comments on Draft Environmental Impact Statement Oregon Passenger Rail: Eugene - Portland

by Mark Robinowitz - PeakTraffic.org - PeakChoice.org - SustainEugene.org - December 18, 2018

PDF Appendices:

- **Peak Traffic and Transportation Triage**
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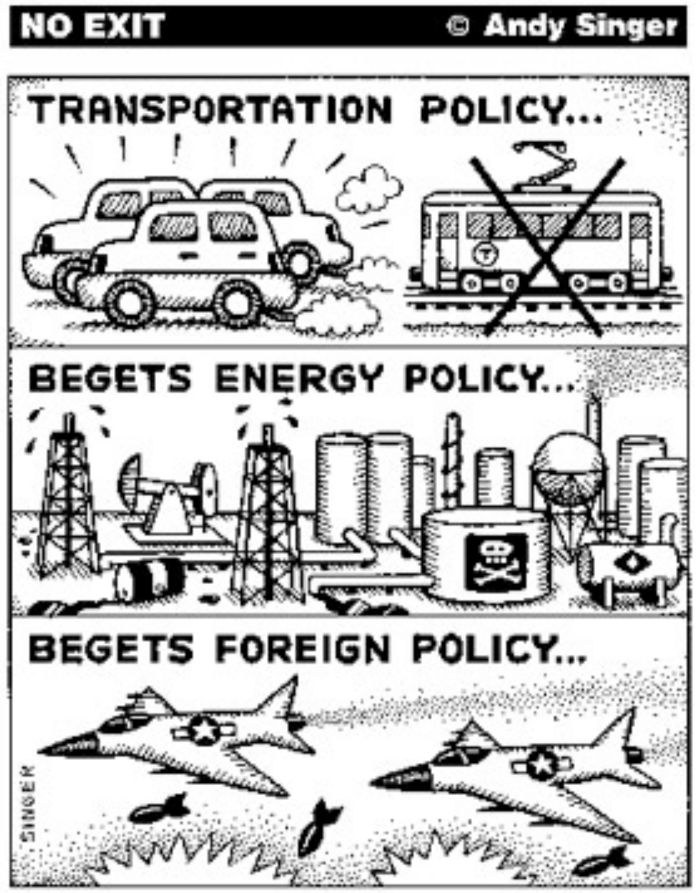
- **Fractal Permaculture: local, bioregional, global**

In the United States, we have a railroad system that the Bulgarians would be ashamed of. We desperately are going to need railroad transport for moving people around, for moving goods around – we don't have that. What we do have is a trucking system that is going to become increasingly dysfunctional, especially as the expense mounts of maintaining the tremendous interstate highway system. It costs so much money every year to maintain what the engineers call a high level of service – which means that the trucks that are delivering things from the central valley of California to Toronto don't break their axles while they're bringing those Caesar salads to Toronto. Once you have a certain number of trucks that are breaking their axles in that 3,000 mile journey, that's the end of transcontinental trucking – which also implies that this is the end of certain economic relationships that we have gotten used to.
-- James Howard Kunstler, from an interview in the film "The End of Suburbia: Oil Depletion and the End of the American Dream" 2004



https://en.wikipedia.org/wiki/Pacific_Northwest_Corridor
... **By 1940, the SP [Southern Pacific Railroad] operated six daily round trips between Portland and Eugene**: five long-distance trains - the Beaver, Cascade, Klamath, Oregonian, and West Coast - that continued to Oakland via the Shasta Route, and the Rogue River local service that ran to Ashland, Oregon on the older Siskiyou Line.[8] Service gradually was decreased; after September 1966, the Cascade was the only remaining SP service running between Portland and Eugene. It was reduced to tri-weekly service in 1970, but lasted until the start of Amtrak.[9]
In 1977, the Oregon Department of Transportation (ODOT) studied the possibility of 100-mile-per-hour (160 km/h) service between Portland and Eugene.

After many years of delay, ODOT has finally released a long overdue Draft EIS on better train service between Eugene and Portland. The proposal would increase Amtrak Cascades frequency to six round trips a day by 2035, which would bring service back to 1940 levels (when there were also six round trips daily).

Six trains a day nearly two decades from now would not be noteworthy in most of the industrialized world, but in Oregon this is an unprecedented initiative.

It would be nice to have choices of departure times from Eugene to Portland beyond 5:30 am, lunch time (when the Coast Starlight is approximately on time) or late afternoon. I have friends who have lived in Eugene and worked at the State Capitol and Salem who regretted they were unable to use Amtrak to commute despite living and working walking distance from each train station.

As every Amtrak frequent rider knows, the train schedule can be unreliable due to freight congestion and the lack of double tracked sections that force trains to wait in sidings. The DEIS would address some of this, but does not detail why some single track sections would be added to and others would not be. Some of the train lines through towns would require substantial community disruption for double tracking, but other segments that would remain single track are in rural locations that would not bulldoze homes or wetlands with endangered species.

There does not seem to be any money appropriated beyond funding this study. Contractors who create NEPA documents are spendy, but laying down rail, buying train sets, installing new crossing gates, rail bridges over waterways, grade separating roads over rail lines are much more expensive.

Meanwhile, the region, the country, global civilization is facing the start of intensifying climate change and the end of the fossil fuel boom due to depletion. Both of these interconnected problems need consideration for future transportation and economic planning.

Revised Purpose and Need

The next stage of the NEPA process needs to consider physically possible scenarios for transportation demand and funding of maintenance and construction. Primary among considerations would be the expected availability of finite concentrated fossil carbon, since expensive oil and/or rationing would make existing projections moot.

"New Circumstances" will require a Supplemental Draft EIS

If a final EIS is prepared and published without consideration of energy descent, an SDEIS would be needed to address the "new circumstances" of energy shifts that will change the assumptions in the study.

The National Environmental Policy Act (NEPA) requires a revision to the Environmental Impact Statement to address the new information about Peak Oil and climate change.

> 40 CFR 1502.9: Draft, final and supplemental statements.
>
> (c) Agencies:
>
> (1) Shall prepare supplements to either draft or final environmental impact statements if:
>
> (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or
>
> (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.23 CFR § 771.130 Supplemental environmental impact statements.
>
> (a) A draft EIS, final EIS, or supplemental EIS may be supplemented at any time. An EIS shall be supplemented whenever the Administration determines that:
>
> (1) Changes to the proposed action would result in significant environmental impacts that were not evaluated in the EIS; or
>
> (2) New information or circumstances relevant to environmental concerns and bearings on the proposed action or its impacts would result in significant environmental impacts not evaluated in the EIS.

The Peak of global petroleum extraction is a "new circumstance" that impacts the purpose and need for any federally funded transportation project.

The global peak of conventional oil is now past, and this reality needs to be a primary consideration for any study of economics, energy, travel demand, financial futures, resource availability and related concerns over the next two decades (the timeline of this study).

Energy limits is not something “outside the scope” of this study, but fundamental to any consideration of energy in 2035. Obviously a precise guess of what will happen on the energy downslope is impossible to quantify, but assuming that it will continue as usual is likely the most erroneous prediction. Availability of concentrated energy is at the core of any transportation demand projection so the SDEIS needs to anticipate how Oregonians will continue to travel as oil becomes scarcer.

The Obama / Biden administration gave more support to Amtrak than any previous administrations. Senator Biden was a frequent Amtrak rider between Delaware and Capitol Hill. The main reason is probably because that administration understood Peak Oil even if they dare not admit it in public. Rebuilding the rails would be required to mitigate Peak Oil's transportation impacts. But the soundbite of "High Speed Rail" distracts from some inconvenient truths - the appropriation of eight billion dollars will only pay for modest fixes to a few lines. Higher speed rail for all of the initial corridors would require hundreds of billions, and a national network of actual high speed rail would be even more expensive -- that would require redirecting funds for more freeways and converting military contractors to build trains. It creates more jobs per dollar to make trains instead of missiles. On the downslope of Peak Energy we need "Transportation Triage" to prioritize systems more likely to be useful during the permanent oil shock, not new highways built on the assumption traffic levels will go up forever.

The money the United States spent to destroy Iraq could have been used for renewable energy systems to power a real national rail network. It would take a lot of fossil fuel inputs to make these systems. Steel and concrete need a lot of energy to produce. It would be wise to prioritize the remaining fossil and mineral resources to anticipate the lower energy future that lies ahead.

Peak energy, limits to growth, depletion

Alaska Pipeline has declined three-fourths, nearing low flow shutdown. It powers Cascadia's motors including food delivery trucks

During the DEIS comment period the Trans Alaska pipeline narrowly escaped disruption or destruction due to a Magnitude 7 earthquake on November 30, 2018. But even without seismic shocks, the pipeline continues to dwindle toward the inevitable low flow shutdown. Cascadia is totally dependent on this source of concentrated energy to run our motors, including cars, trains, planes, container ships and food delivery trucks. It is hard to predict the point when this system will close down, but the potential exists for systemic impacts within the twenty year planning horizon assumed in this NEPA process, even if new drilling is started in northwest or northeast Alaska.

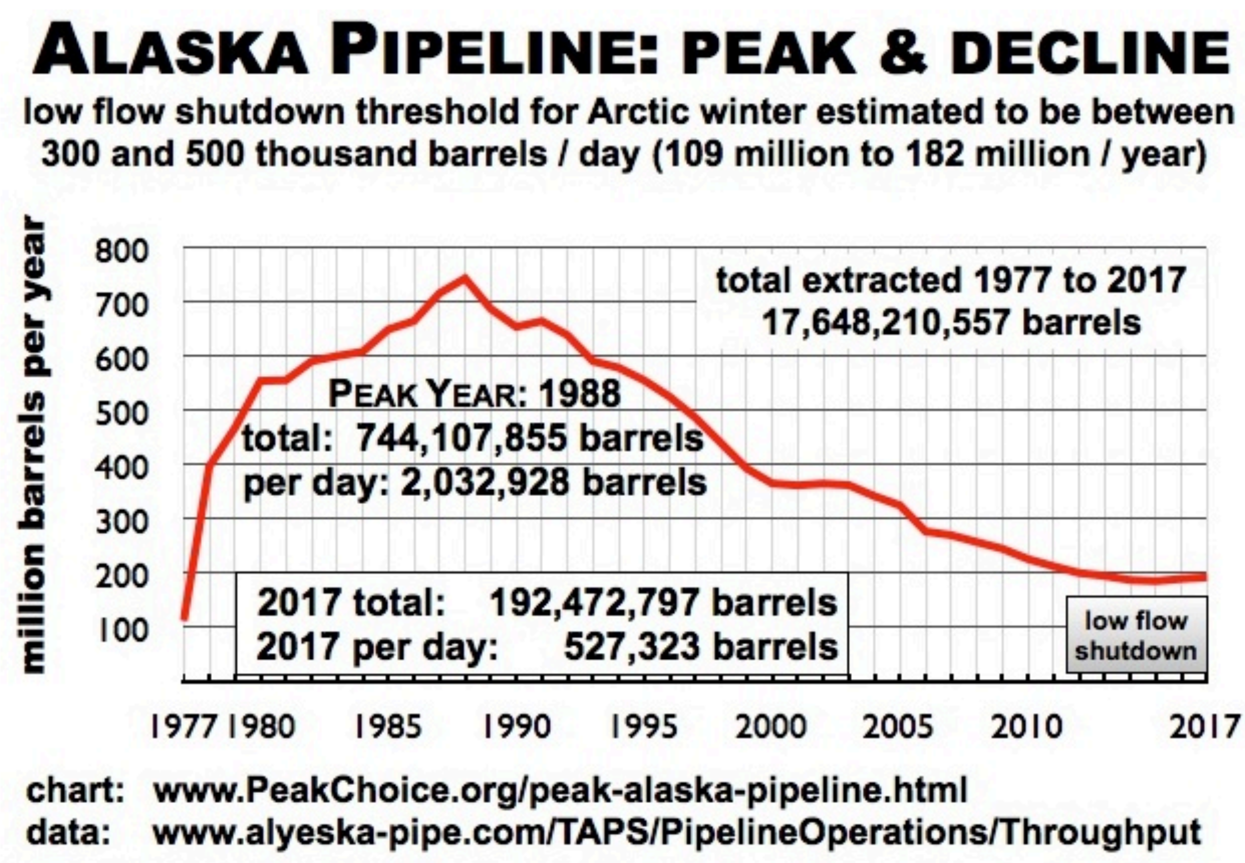
I have had transportation planners from different levels of government quietly admit that this is a real concern and ask me how I think it could be considered. Perhaps a range of alternatives reflecting different scenarios makes sense. There could be the pollyanna "100% renewable green growth" future where techno-fixes save the day at the end of the oil era. I have personally used solar PV since 1990 and enjoy it, although not so much in the wintertime. (I have concluded living on our solar budget might be able to power enough things to stave off the worst case scenarios, but won't power ever increasing exponential growth and therefore our way of life won't be solar powered.) There could also be an "oil rationing" scenario which includes substantially less VMT, a permanent economic recession or depression, and more demand for trains and buses to facilitate travel (but less ability to pay for those services or rail construction to add service). A collapse scenario could also be examined, but in that circumstance railroads might be moot as a consideration.

In 2005, the US Department of Energy (Bush administration) commissioned a study to examine the economic impacts of peak energy. Robert Hirsch was the lead author and the report is popularly known as the Hirsch report. He concluded that we would need two decades of preparations to react to the impacts of Peak Oil, or risk severe economic shocks. I heard Mr. Hirsch speak at the Association for the Study of Peak Oil conferences (ASPO-USA) and asked him if he was subtly suggesting that we blew it when our society ignored President Carter's warnings to pay attention to the energy crises. He just smiled in response ...

Since the Hirsch report, the US has engaged in a massive expansion of unconventional oil and gas to avert the shocks of peaked energy. Fracking has been a steep boom for both fuel sources and has enabled much of the society to go back to sleep - a snooze button. However, fracked wells decline far faster than conventional wells and the early fracked fields have mostly peaked and started their declines. When the fracking boom tips over into bust, the energy crises are likely to return like the passage of the eye of a Category Five hurricane, a scenario we are totally unprepared for either logistically or psychologically.

Here is some relevant background on this limiting, fundamental factor for any economic and transportation planning in Ore-is-gone.

www.peakchoice.org/peak-alaska-pipeline.html

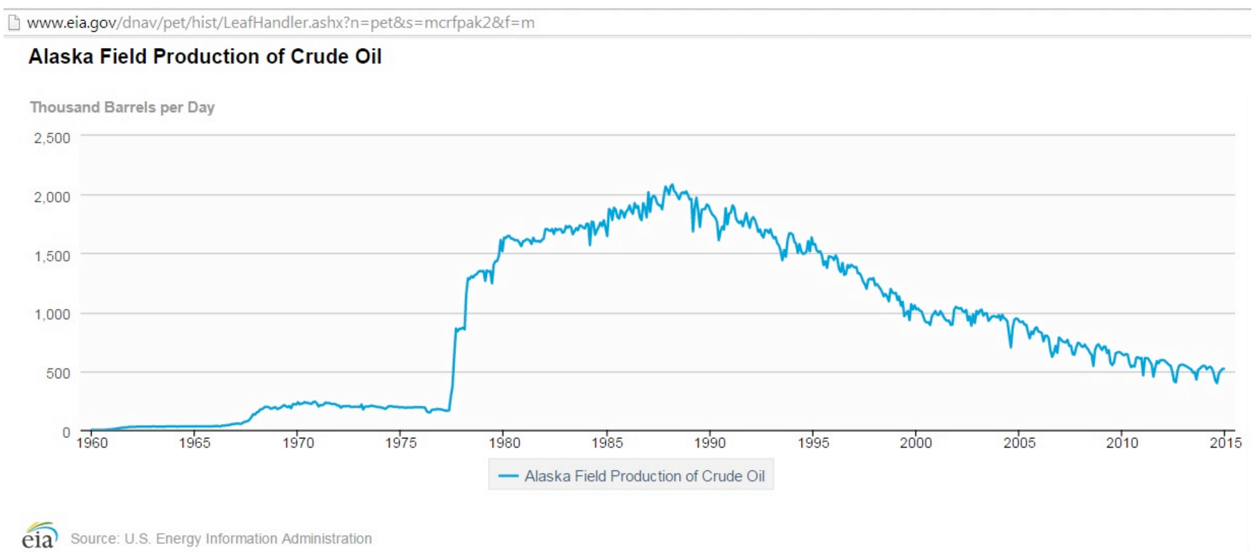


Alaska oil extraction peaked in 1988 at over two million barrels a day. Now, in 2018, it is about a half million barrels a day. The pipeline has a minimum flow level required to keep the contents above freezing so they can be pumped from one side of Alaska to the other in the Arctic winter.

Estimates vary but around three hundred thousand barrels a day is a good guess for the low flow shutdown threshold. The last barrels on the North Slope will not be extracted - some of the remaining reserve will be left in the ground, inaccessible.

The Alaska Pipeline requires a tremendous energy input to pump the oil from Prudhoe Bay (in north Alaska) to the harbor terminal at Valdez. While the energy input into the system is dwarfed by the energy density of the transported oil, it is a factor to consider as the oil fields dwindle further. The pipeline has heaters along the route to keep the contents above freezing, which lowers the "Energy Return on Energy Invested" (EROEI).

The pipeline consortium maintains a web page that discusses some of the energy required to keep the pipeline functioning at www.alyeska-pipe.com/Pipelinefacts/PumpStations.html Drilling for oil in Arctic conditions requires much more energy than oil drilling in warmer climates, especially if the oil is closer to the surface and under higher pressures (ie. most of the Middle East fields).



update: November 30, 2018 - pipeline narrowly escapes earthquake, so oil continues to power West Coast motors

On November 30, 2018 the Anchorage area experienced a magnitude 7 earthquake that destroyed buildings, roads and bridges. Fortunately there were no fatalities or serious injuries, but the region's critical infrastructure suffered damage that will take money, labor, fossil fuels, and minerals to repair.

The pipeline's terminal was not in the maximum shaking zone.

A magnitude 9 earthquake shook that region in 1964, causing far worse damage including a tsunami that wrecked Valdez, where the pipeline terminus is today. This tsunami also killed a few people in Crescent City, California - there was no tsunami warning system then and it arrived there at night, making warning and evacuation impossible.

A rarely reported upcoming problem with the pipeline is low flow shutdown. Its flow peaked in 1988 and is now three fourths less, and barely pumps enough to keep the contents liquid in the Arctic winter. When it's over, there will be major energy disruptions on the west coast that we are totally unprepared for either logistically or psychologically. I assume the Trumpsters will loudly proclaim the shortages are the fault of the "stop drilling" crowd and will have a lot of people believing that. Practical approaches - system wide "Transition Town" and permaculture, cooperatives, etc. would be needed to mitigate this impact. Protests don't get us there.

Prudhoe Bay has pumped over 17 billion barrels since the pipeline opened. The National Petroleum Reserve – Alaska in northwest Alaska, opened to drilling exploration by the Clinton Gore administration in 1998, was originally thought to have ten billion barrels. Current estimates are under a billion. The Arctic National Wildlife Refuge might have a billion barrels, some estimates are higher but could be boosterism.

It's not a secret that the pipeline is declining toward low flow shutdown, but there has been little media coverage and there's almost no public awareness.

Rebuilding roads, power lines and other critical infrastructure in the aftermath of today's quake will require fossil fuels and minerals. It's hard to make steel and concrete and asphalt without these inputs. Same with fighting forest fires or rebuilding damaged communities. If we were smarter as a society we would require the rebuilding to be hyper efficient, passive solar designed, and other practices more appropriate for the lower energy flow future we are entering due to depletion. I've been talking about this for nearly two decades in Ore-is-gone and have not found politicians, newspapers, civic organizations, environmental groups, anyone who is already informed (with the exception of a few insiders with specialized technical knowledge). A native friend who used to live in Anchorage told me a few years ago that it's not a topic he has ever seen discussed there. I hope everyone will accept that there was only so much oil put in the ground by geological processes, Jesus, Allah or the Flying Spaghetti Monster (depending on one's belief systems) and that it was a once time gift of Nature, squandered quickly. Otherwise, we are likely to see scapegoating and anger that would likely make a rational, cooperative response to the downslope impossible to realize.

Damned if we drill. Damned if we stop.

> http://www.npr.org/2017/06/24/533798430/alaskas-40-years-of-oil-riches-almost-never-was
> Now, Alaska's long dependence on oil may be coming to an end.
> "You have a state where oil had paid for almost everything and suddenly the oil revenue – most of it — has evaporated," said economist Gunnar Knapp, former director of Institute of Social and Economic Research at University of Alaska Anchorage.
> After four decades of production, it's getting harder to pump oil out of Prudhoe Bay. The field has been in steady decline since the mid-1990s. The amount of oil flowing through the 800-mile trans-Alaska pipeline each day is now about a quarter of what it carried at its peak in the 1980s. That, coupled with a crash in oil prices, means the state faces an uncertain future. Today, Alaska state

lawmakers are battling over what to do next, and narrowly averted a government shutdown this month.

Alaska's 40 Years Of Oil Riches Almost Never Was
June 24, 2017 7:00 AM ET
Heard on Weekend Edition Sunday
ELIZABETH HARBALL

alyeska-pipe.com/NewsCenter/HeadlineStories

"Cold oil a hot topic during winter"

As oil throughput declines, TAPS faces new and complicated challenges. One of the most complex is maintaining crude oil temperature in the pipeline at around 40 degrees during the winter. This provides a safe operating buffer above 31 degrees, at which point trace amounts of water in the oil can begin to freeze. Heat input along TAPS is critical during cold weather; the hotter the oil, the lesser the chance of ice formation during extreme cold weather events or unplanned pipeline shutdowns. Ice in the pipeline can pose risks to mainline check valves, instruments, mainline pumps and maintenance pigs.

Each winter between October and March, Alyeska's Operations Engineering and the Operations Control Center constantly analyze temperatures along the pipeline and look at weather forecasts to optimize heat input.

"The effort requires a mix of science and intuition to maintain the target temperatures for the pipeline system," explained Mike Malvick, Flow Assurance Advisor with the Flow Assurance Team. "And it's a system that has a lot of thermal mass and a transit time that exceeds two weeks."

TAPS oil temperature is a function of pipeline throughput and the time the oil spends in the pipeline. At its peak in 1988, TAPS throughput was more than 2 million barrels a day. At that rate, oil traveled from Pump Station 1 to Valdez in 4.5 days and was as hot as 120 degrees. Freezing water and wax accumulation weren't concerns.

Oil now leaves Pump Station 1 at approximately 110 degrees and experiences a significant drop in temperature almost immediately upon departing, then continues cooling as it travels to Valdez. Today's throughput is around 530,000 barrels a day, taking 18 days to travel to Valdez. On Monday, January 26, oil departed Pump Station 1 at 106 degrees with an ambient temperature of 17 below zero. By the time the oil traveled 100 miles south to Pump Station 3, the environment had drawn 51 degrees from its natural temperature. Near the Yukon River, temperatures were around 50 below zero. In Fairbanks, temperatures hovered around 40 below. Without heating assistance, the oil would eventually cool below 31 degrees before reaching Valdez.

When will the Alaska pipeline turn into an 800-mile-long Popsicle?

Posted on August 15, 2015 by energyskeptic

http://energyskeptic.com/2015/when-will-the-alaska-pipeline-turn-into-an-800-mile-long-popsicle/

[Below are excerpts on the Alaskan pipeline from Rust: The Longest War by Jonathan Waldman. This is a great book, yet leaves so many possible rust stories uncovered, that I hope Waldman writes Rust II (or any other topic — will certainly read his next book whatever it is). Alice Friedemann www.energyskeptic.com]

Officially, Neogi is the pipeline's integrity manager. He is responsible for keeping the pipeline intact, whole. Most pipeline operators employ integrity managers, but most pipelines are not like the

Trans-Alaska Pipeline System. From Prudhoe Bay to Prince William Sound, TAPS stretches eight hundred miles, which leaves Neogi accountable for one of the heaviest metal things in the Western Hemisphere, through which the vast majority of Alaska's economy flows. Daily, the four-foot steel tube spits out $50 million of oil.

Four technicians from Baker Hughes, the pig's manufacturer, wrapped up a third day of checking and double checking and triple checking its componentry. Among other things, in the front segment of the pig, between two yellow urethane cups, they checked 112 magnetic sensors mounted in between 112 pairs of magnetized brushes. These sensors would detect the magnetic field induced in the pipe as the pig, propelled by the flow of oil, traveled through it. Given any kind of anomaly in the half-inch steel—a pit, a ding, a thin spot—the field would change, and the sensors would capture this and record it on a hard drive. Inch by inch, the sensors would capture this information; Neogi hoped they would capture all seven billion square inches of the pipe. That's 1,200 acres. Using all that data, Neogi would determine the most vulnerable spots on the pipeline, dig them up, and repair them before they became leaks.

No matter how extensively the technicians double checked, even the most advanced pig can't perform its inspection if the wall of the pipe is covered in wax. Wax, a natural component of crude oil, keeps the magnetic brushes and sensors off the steel wall. The consistency of lip balm or mousse, it plugs up caliper arms that measure the shape of the pipe, and snags odometer wheels. Wax renders smart pigs senseless, leaving them blind, dumb, and amnesiac. Nor can a pig survive a violent voyage. Too fast, and sensor heads melt or crack. Too rough, and the magnetizing brushes wear down. Too jarring, and the universal joint between the pig's two segments comes apart, wires snap, and power to the magnetic flux sensors is cut off. Poof goes the data, months of work, and millions of dollars—leaving engineers with a pipeline in indeterminate condition, regulators unhappy, and the public at risk. Wax accumulates when the oil cools below 75 degrees, and long, slack sections, where the pig can barrel down mountain passes at high speed, manifest themselves when there's not much oil flowing through the pipe. Neogi was well aware that it was winter, and that the flow of oil through TAPS was as low as it had been. It was not the best of times to pig.

On account of wax and low flow rates, in the last dozen years, half the smart pig runs have failed.

More recently, a pig was sucked into a relief line at a pump station midway down the line. That the relief line was only sixteen inches in diameter, and guarded with pig bars, was not a sufficient deterrent to the forty-eight-inch pig. This has happened at least a half dozen times. When it happened in 1986, and the pipeline was shut down while the pig was extracted, that meant more than a quarter of the nation's oil wasn't moving toward California. Pigs have made it all the way to Valdez, Alaska, only to be ingested in relief lines there. Other pigs have damaged the pipeline, or gotten stuck in it and been destroyed during their extraction.

They planned to launch the tool at seven in the morning, exactly twelve hours behind a red urethane pig of lesser intelligence. That pig, like a giant squeegee, was scraping the line clean. It was the last of nine such scraper pigs that, by Neogi's design, had been shoved down the pipeline in the previous six weeks. Neogi had kept track of how much wax these pigs had pushed out in Valdez, and graphed it. From 1,200 pounds, the mass had dropped to 400. The line was as clean as it was going to get, primed for inspection. It was ready for the smart

For two decades, the Prudhoe Bay oil fields—Sadlerochit, Northstar, Kuparuk, Endicott, Lisburne—have been declining steadily. Yearly, immutably, they produce 5 percent less oil. The result is that TAPS now carries one quarter of the oil it was designed to carry. It comes out of the ground colder than ever and flows more slowly toward Valdez. Crude used to make it to Valdez in four days, as if running seven-minute miles. Now it walks. Enroute, it cools off even more and, as it does so, deposits more wax on the pipeline. A doctor would call the pipeline arteriosclerotic. While a pipeline waxes, its diameter wanes. Declining throughput makes things difficult for Neogi, but it makes them even more difficult for agencies estimating the pipeline's lifespan.

The pipeline was designed to survive as long as the oil fields. Lest it clog, it must stay warm, which means that it must remain full of flowing oil. In a perverse symbiosis, the pipeline needs the oil as much as the oil needs the pipeline. As a result, while the consortium of agencies that oversees the pipeline has written that it "can be sustained for an unlimited duration," Alyeska figures that it'll survive until 2043, and the state of Alaska figures that it'll expire a bit sooner. Private consultants, hired to estimate the life of TAPS, mention only “the future” and write of “diligent upkeep” in passive sentences. The estimates all couch what nobody wants to say: the pipeline, once the largest privately funded project in America, and one of its greatest engineering achievements, is now an elderly patient in intensive care.

The companies that built the pipeline foresaw such a future and tried to avoid it. In the immediate aftermath of their 1968 oil discovery, they considered every alternative to a pipeline. They considered extending the Alaska Railroad to the North Slope, until they realized that it’d take sixty-three trains, each one hundred cars long, every day, to ship their oil. They considered trucks, calculating that they’d need nearly the entire American fleet in addition to an eight-lane highway. They looked into jumbo jets supplied by Boeing and Lockheed, turning away when it became apparent that their air traffic would exceed the combined air traffic of all the freight in the rest of the country by more than an order of magnitude. They looked into blimps. They commissioned the world’s largest icebreaking cargo ship, and after it got stuck in the Northwest Passage, they seriously considered using a fleet of nuclear submarines to ship the oil, under Arctic ice, to a port in Greenland. Reluctantly, out of alternatives, they settled on a pipeline.

On most other pipelines, “events” or “incidents” or “product releases”—what the rest of us call leaks or spills—are most often caused by third-party damage. By this, the industry means accidents. Heavy equipment is usually to blame; pipeline ruptures are most often caused by collisions with bulldozers and backhoes. On TAPS, since there’s so little construction across the vastness of Alaska, the risk of accidental third-party damage is low. Natural hazards, on the other hand, present threats in abundance. Earthquakes, avalanches, floods, and ice floes all threaten TAPS. But what really keeps Alyeskans up is corrosion. It’s the number one threat to the integrity of the Trans-Alaska Pipeline. On account of that threat, the pipeline was outfitted with the greatest corrosion-protection features of the era. Its principal protection was its coating: paint. As a backup, a zinc strap the size of a wrist (a giant anode) was buried under the pipe. Though TAPS was, boldly, called rustproof, the defense proved insufficient. Like all coatings, the one on TAPS proved vulnerable—but Alyeska didn’t learn quite how vulnerable for a dozen years. When it did, the company beefed up the pipeline’s corrosion protection with 10,000 twenty-five-pound bags of buried magnesium anodes and a cathodic protection system consisting of a hundred-odd rectifiers spitting a low voltage into the pipe.

Because rocks resist current, the cathodic protection system doesn’t work well in rocky areas, leaving corrosion engineers to their final tool: coupons. On the pipeline, a coupon is a one-inch square of steel, connected to it and buried along it, serving as a surrogate. Alyeska has about eight hundred of them. But coupons don’t prevent corrosion; they just help engineers monitor it.

In a way, monitoring is Alyeska’s second line of defense, and Alyeska does a lot of it. Like all major pipelines, TAPS is monitored by leak-detection software, which compares the flow of oil going into the pipeline with the flow coming out the other end, and also scans for sudden pressure drops. But unlike other pipelines, it is also monitored regularly by pilots using infrared cameras to hunt for signals that the hot oil has escaped into the cold Alaskan earth, as well as by “line walkers” who hunt for dark puddles and squishy tundra along the pipeline, and by controllers watching an array of hydrocarbon-detecting and liquid-detecting and noise-detecting sensors shoved into the ground alongside it. And then there are the dozen state and federal agencies looking over the shoulders of the thousand people operating the pipeline, making it the most regulated pipeline in the world.

But because a smart pig is the only way for Alyeska to determine if its pipeline is about to spring a leak before it has actually done so, and because Alyeska operates under more regulatory scrutiny than any other operator, it sends smart pigs down the line nearly twice as often as any other pipeline operator. It employs a smart pig once every three years, and has been doing so since long before federal pipeline laws stipulated it. Thanks largely to smart pigs, TAPS hasn’t suffered a corrosion-induced leak since it began operating in 1977.2 Over its first thirty years, Alyeska reviewed nearly 350 potential threats to the pipeline, including dents, wrinkle bends, weld misalignments, ovalities, gouges, and corrosion pits. The majority of these problems were found with smart pigs.

Keeping the pipe clean has become a priority nearly as great as keeping it whole, because the latter depends on the former. To keep it clean, Alyeska sends cleaning pigs south weekly. The company keeps a fleet of a dozen such pigs at a maintenance yard in Valdez, and in a perpetual relay, these pigs go back and forth: up the haul road, down the line. The managerial pigs—the smart ones—wait patiently while these janitorial pigs stay busy.

Before the last smart pig run, Alyeska sent a janitorial pig south every four days for a month. When these pigs pop out in Valdez, they usually push out ten or twenty barrels of wax. In the pig mobile, they go straight to the pig wash. The wax, a hazardous material, is collected in barrels and shipped out of state. Once, not many years ago, after the pipeline wasn't pigged for six weeks, a pig pushed out forty-seven barrels of wax. Beneath all that wax, on account of corrosion, the one-billion-pound pipeline loses in the vicinity of ten pounds of steel a year: the same as an old Ford. Most of that metal loss is on the outside of the pipe, where it's buried. The inside is, well, nicely oiled. The exception is inside pump stations, where the pipe branches through valves and turbines. In deadlegs—hydraulic culs-de-sac, where oil sits stagnant—microbial-influenced corrosion is a threat. If corrosion struck uniformly, such that the pipeline lost metal evenly and consistently, maintaining it would be vastly easier. After a thousand years, 99.999 percent of the pipe would still be there, sans weak spots. But rust doesn't work like that. It concentrates in relatively few places, begetting more rust. Alyeska responds only to those places that present severe integrity threats. It looks at spots where 35 percent or more of the pipe's wall thickness is gone, and where metal loss leaves the pipe at risk of bursting, which it determines from a formula developed by the American Society of Mechanical Engineers.

To the pipeline, though, ravens pose a greater threat. Ravens pick at the pipe's insulation, and then water gets in. Alyeska spent millions installing bands around the seams of the insulation, and the ravens persisted, outsmarting engineers.

the flow of oil through TAPS decreases, pigging will become drastically more difficult. Below 400,000 barrels per day, it will become impossible to tightline Atigun Pass, because there's only so much oil a controller can store in the tanks at Pump 1 before he runs out of emergency wiggle room. By then, the slack section on Atigun Pass will be over three miles long. Below 350,000 barrels per day, the "slippage factor" of a cleaning pig will prevent it from scraping the line effectively. With the bypass necessary to keep the wax ahead of it in a slurry, there won't be enough force to push the pig forward. Alyeska will also need to run them more frequently—as frequently as during this run's cleaning regimen—and this makes controllers nervous. Meanwhile, by 2015, the small percentage of water entrained in the oil will drop out and begin flowing in a separate layer on the bottom of the line. Collecting at a dozen low spots, it could freeze. In so doing, it could disable check valves or halt pigs. At a flow rate of 400,000 barrels per day (expected by 2020), a pig arriving in Valdez could be pushing a slug of water one third of a mile long. Alyeska may need a new type of pig to push out the water, because water will also corrode the pipeline. Compounding matters, lower throughput will make it harder for controllers to detect leaks.

It was the closest that TAPS had ever been to becoming an eight-hundred-mile-long Popsicle. This is Alyeska's great fear, its "worst-case event." Declining throughput may necessitate frequent cleaning pigs, complex operating procedures, smarter and tougher pigs, and increased maintenance—but these are nothing compared with the seizure of the pipeline. North Slope crude gels at 15 degrees. It gets so thick that pumps can't push it. It becomes thixotropic, like quicksand. For whatever reason—a power outage, say—if the oil sits in the line too long, at the wrong time of year, the threat of the big Popsicle looms. In January 2011, the oil cooled to 25 degrees. The threat is critical.

Alyeska's former president told Congress that at the flow rate expected in 2015, nine winter days of shutdown could spell the ultimate end of the pipeline. If the oil gels, there will be no recovering from it. The threat makes explosions and even leaks seem trivial. It's a game ender. It's because of this conundrum that drilling in the Beaufort and Chukchi Seas is of such importance to Alaska, Alyeska, and Alaskans. Those rigs will tie into the Alaska pipeline, feed it their oil. Sure, residents will get annual dividends, and Alaska will receive billions in royalties and taxes that fund pretty much everything in the state. But it's the long-term future of the state on the table.

The sooner that someone turns around the two-decade saga of declining throughput, keeping the pipeline from turning into a giant Popsicle, the easier those concerned with the integrity of the pipe will sleep. In the meantime, if TAPS leaks for some reason, and the public withholds forgiveness, the resultant delay in offshore drilling could portend the end of the line. That's what Neogi was implying when he mentioned the impact on future drilling. A big spill could delay offshore drilling in the Beaufort or Chukchi Seas for two decades, and this could spell the end of the line. End of the line would be the end of the state of Alaska, and not exactly beneficial to the economy of the other forty-nine states in the union. Precarious is the future of the pipeline, and high are the stakes in which Neogi and the integrity management crew operate.

www.postcarbon.org/blog-post/165463-alaska-and-energy

Alaska and Energy by Richard Heinberg
Posted Oct 26, 2010

During my recent visit to Anchorage, Alaska to speak at that city's Bioneers satellite conference, the friendly locals seemed eager to educate me about their local energy issues. Some of what I learned struck me as important to share with a wider audience.

Alaska is, of course, a huge energy exporter. Crude from the North Slope saved America's energy bacon back in the '80s, helping to lower world oil prices and bankrupt the evil Soviet empire. Production there has declined from a peak of over two million barrels per day to only 600,000 or so today. Once the flow drops below 500,000 barrels, there will be problems with icing in the Trans-Alaska Pipeline system. Not good.

The state's economy is based almost entirely on resource extraction. Everyone gets a check annually from the Alaska Permanent Fund, set up in 1976 primarily by the efforts of then Governor Jay Hammond. High oil prices mean big dividends: in 2008-2009 extra-large payouts made Governor Palin look good to her constituents, though she was in no way responsible.

Alaska has enormous opportunities for renewables—wind, microhydro, geothermal, tidal, even solar. But these are far from being adequately developed, and progress in that direction will take time and lots of investment—a dramatically higher pace of investment than is currently evident.

Anchorage (by far the largest city in the state) faces a particular challenge with natural gas: currently nearly all houses are heated with gas, but supplies from Cook Inlet will run low in two years, even sooner with an abnormally cold winter. Most options to replace current sources (more drilling, LNG, alternative energy) will take longer than two years to develop.There is no serious planning for what to do about this.

Then there is the situation of the native villages. On one hand, the indigenous peoples of the north might seem well placed to weather the changes ahead as industrial society succumbs to peak oil, peak coal, and peak gas: they have cultural traditions of self-sufficiency, small populations relative to land area, and access to lots of wild protein on the hoof (moose, caribou). However, as James van Lanen of Alaska Department of Fish and Game wrote to me in an email just the other day:

"Alaska Native villages are in a very precarious situation. These remote villages are only accessible by motorized travel via air or watercraft. They are entirely dependent upon fossil-fuel systems for goods and services: food, heat, health care. They have no contact with the outside world without fossil fuels.

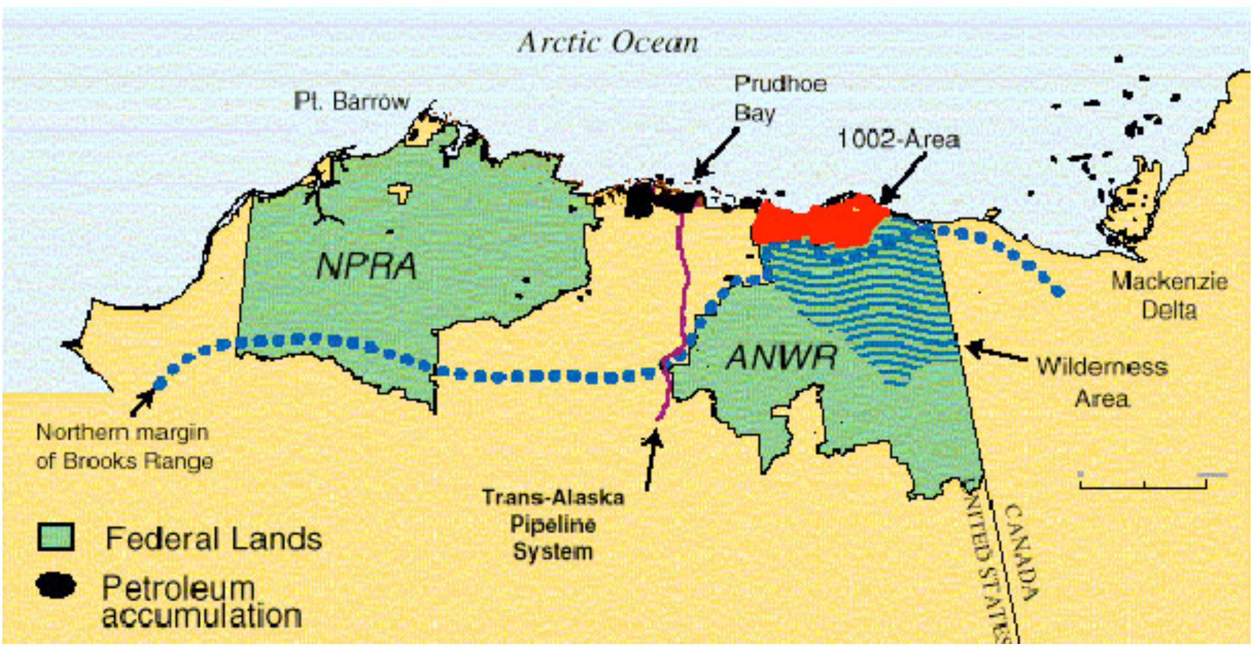
"Some villages obtain more of their food resources from wild sources than others. It would be safe to say that on average 80% of the protein consumption in a village is from wild sources. Berries and Plants supplement some part of the overall diet but this is small. The two important things to consider are (1) much of the food consumed comes from industrial sources and is shipped in via small aircraft and (2) wild food harvests are currently almost entirely fossil-fuel dependent (there is a well-embedded 'machine culture' in native villages; I believe that there is no extant ability to obtain significant amounts of wild foods without the use of machines)..."

"Peak Energy will hit Alaska villages sooner and more intensely than many other places. Fuel is already up to $9 per gallon in some places. As it becomes uneconomical for current supply operations to continue the industrial resources these villages rely on will fizzle out."

"Most village people are aware of their complete dependence upon fossil fuels. Many elders foresee a future collapse due to increasing costs and modern dependence. However, there is no general awareness of the phenomenon of Peak Energy in these communities. There is no awareness that the entire system may break down. Alaska villages desperately need to become educated in what we are facing."

I came away from my too-brief sojourn in Anchorage with both a deep appreciation for this land of great natural beauty, contrasts, and extremes, and an equally deep concern for how Alaskans will deal with their enormous energy challenges. Some of those challenges are going to present themselves forcibly in the very near future.

New drilling for northwest and northeast Alaska to extend the pipeline's life



Several administrations have sought to open northeast Alaska's Arctic National Wildlife Refuge (ANWR) to drilling. So far, environmental groups have successfully prevented this development, using the argument that "refuges" should be protected from industrial development and citing the critical ecological role this area has for caribou and other species. The Trump administration has pushed again for this, perhaps they will succeed, perhaps not.

Less known is the fact that Clinton Gore opened northwest Alaska to exploration in 1998. This was originally thought to have about ten billion barrels, but more recent estimates project perhaps 800 million barrels (a downgrade of over 90%). The opening of this area had barely a peep of protest from the environmental groups, since the policy was pushed by Democrats and the area isn't called a "refuge" even though it has the same ecology as ANWR.

Neither advocates for more drilling regions nor opponents mention the reason additional areas are sought: Prudhoe Bay is in terminal decline and new sources would extend the usability of the pipeline.

There have also been efforts promoting offshore drilling in the Arctic ocean. However, an early test well called "Mukluk" built a gravel island and was an expensive dry hole. Even if climate change reduces the amount of sea ice, it is likely there will still be some winter ice cover that would make permanent offshore oil wells impossible to maintain (hence the reason Mukluk was on an artificial island). Geologist Colin Campbell estimates there may be more natural gas than oil under the Arctic ocean, but without pipeline capacity or Liquid Natural Gas terminals on the north slope this gas is unlikely to be sent to distant users.

http://nixonisinhell.wordpress.com/2007/08/09/an-inconvenient-truth/

> In 1999, Clinton-Gore opened the National Petroleum Reserve – Alaska, (NPR-A), to oil drilling - 24 million acres adjacent to the Arctic National Wildlife Refuge, (ANWR). The NPR-A is an environmentally sensitive area. It contains Teshekpuk Lake, an important nesting ground for many species of migratory bird, including shorebirds and waterfowl. The NPR-A also supports more than half-a million caribou of the Western Arctic and Teshekpuk Caribou Herds. It contains the highest concentration of grizzly bears in Alaska's arctic, as well as wolverines and wolves that prey on the caribou. NPR-A contains the headwaters and much of the Colville River, Alaska's largest river north of the Arctic Circle.

www.aspo-usa.org

> Peak Oil Review
> Association for the Study of Peak Oil - USA
> Vol. 2, No. 41
> October 8, 2007
> The North Slope accounts for about 14 percent of US domestic oil production. Its 740,000 b/d is declining about 6 percent a year. One concern of producers is managing the decline of conventional oil production so that there is enough light oil to mix with increasing volumes of heavy oil suitable for shipping through the pipeline.
> BP will begin a heavy oil production test on the North Slope next summer. They will use a technology called cold heavy oil production with sand, or CHOPS, that is being adapted from techniques used with similar heavy oil deposits in Canada. Heavy oil could provide an additional 2 billion barrels from the North Slope.

I-5 new build option was not realistic

The alternative to build a brand new, higher speed rail line mostly parallel to I-5 was not a reasonable consideration. It would be much more expensive than upgrading the existing route, even if that included an option to extend service to Corvallis.

Technically, building a Shinkansen style rail line next to I-5 would require major reconstruction of the interstate, if it was routed close enough to the road to require rebuilding the interchanges. As ODOT knows, the most expensive component of highway widening is redoing interchanges to accommodate extra lanes, which is underway on selected overcrossings and interchanges south of Eugene (anticipating future lane additions).

It took ODOT many years to find funds to perform this EIS. ODOT also had to scramble several years ago to buy two trains when Washington State decided to reserve their Cascades trains for the Portland-Seattle route (and not extended further south into Oregon).

Studying spending four billion on a new line next to I-5 that would bypass existing stations and then a huge tunnel through Portland seems to have been a distraction.

hold your breath in the tunnel

The longest train tunnel I have gone through on Amtrak is Moffat tunnel in Colorado, west of Denver. On the California Zephyr, the conductor announces that during passage in the six mile long tunnel passengers are not allowed to go from car to car. These seemed odd at first, since the outside darkness is not a problem for the inside of the train. Lighting is not the reason - breathing is the reason. The narrow, single track tunnel does not permit easy flushing of the diesel exhaust. If the doors to the cars are opened, the fumes would flow into the cabins. An Amtrak employee told me that the engineers (for Amtrak and freight trains) are given gas masks in case the train breaks down in this section. Therefore, studying even longer tunnels under Portland for diesel powered trains seemed a waste of funds given to the study's contractors.

If a new route, or segments of a new route legitimately required bypassing existing stations, perhaps that might be acceptable. But given the paltry investments in Oregon passenger rail, the proposal to spend four billion instead of one billion for six round trip trains per day seems ridiculous.

79 miles per hour limit for Talgo trains capable of 120

Talgo trains are capable of going about 120 mph (200 kph). It would be nice for any build option to consider ways that our locomotives could travel closer to their capacity. This would require upgrades to safety gates at crossings plus rebuilt track, perhaps other things.

Double tracking

A major problem with Amtrak service almost everywhere outside the Northeast corridor is the reliance on single track.

In Apple's map program (similar to Google Maps), the satellite image of the rail lines of Oregon currently shows the Coast Starlight headed south of Albany on a single track and an Amtrak Cascades train waiting on a siding for the Starlight to pass.

Salem section

The track through downtown Salem would be difficult to convert to double track without narrowing the parallel road. Fortunately this segment is relatively short and trains are traveling slow there.

It is good that the State Capitol is a short walk from a train station.

Junction City - Willamette River - Harrisburg section

The maps showing where the line would be double tracked do not show any track additions for the Junction City to Harrisburg section. Perhaps the two towns are too landlocked for additional rails (and a bypass would have its own costs and property acquisition problems). However, the route between those towns would be much easier to add capacity, since the route is rural without immediately adjacent homes.

The crossing of the Willamette River south of Harrisburg was on an old wooden bridge. I don't know the age of the structure, but it did not look like it was designed with seismic considerations. Amtrak slowed down to maybe 30 mph (50 kph) when crossing, the opposite of what the train should be doing (going faster between the cities and slowing down when going through town).

Some other sections not considered for double tracks?

- north of Halsey - no improvement / extra track needed?
- to south of Tangent
- Jefferson
- south of Salem to Turner (south of I-5 undercrossing)
- Brooks to Woodburn
- north of Woodburn to Aurora / Canby
- Canby needs
- then to Oregon city
- Portland / Vancouver apparently is slated for a separate project for upgrading this track but it is not detailed in the DEIS. A faster connection could help Vancouver to Portland commute, and provide extra capacity for Portland - Seattle trains, freight trains and the Empire Builder.

Corvallis options need reconsideration

I request reconsideration of Corvallis options between Eugene and Albany.

Oregon State University has many students, faculty, staff, visitors who would be potential riders.

Informally, my friends in Corvallis were all excited when they heard this was being considered.

As the DEIS notes, there is a publicly owned rail right of way between Monroe and Corvallis that could easily be used for Cascades service.

Unfortunately, the old right of way between Monroe and Junction City is no longer in railroad ownership and would be much more difficult to acquire (or a similar route that might have less damage to homes and farms).

However, that would still be less disruptive than some of the Rube Goldberg routes proposed for a new alignment bullet train from I-5 to downtown Portland.

Currently, there is no public transit between Corvallis and Eugene -- only a couple Greyhound buses per day. Service from Corvallis to Portland is also infrequent. Frequent service that is reliable increases ridership.

Perhaps approving the potential of Eugene - Corvallis - Albany train service could be done in the Record of Decision and if funds ever become available then it could be implemented. I have no idea what the Monroe to Junction City segment would cost but it would likely be much less than any of the I-5 parallel options.

The DEIS noted that the existing tracks from Corvallis to Albany bypass the existing Albany train station. One option considered to include the station was a new alignment Highway 34 route. However, this would have considerable private property displacement, probably a reason it was rejected.

So the two options for Corvallis Albany train service either bypass the existing station or tear up properties along Highway 34. While it would not be good to discontinue using the Albany station, adding a new station along the existing route in north Albany would probably be much cheaper than the 34 option. I looked at the satellite maps and found it would be difficult to squeeze in a new station north of the existing station, any option would probably require some private property purchases and perhaps some road work to connect buses and cars to the station’s parking lot.

It’s all moot until Congress, or Phil Knight, or someone finds a lot of money for the simpler upgrades to the existing service route.

Meanwhile, the City of Corvallis has free public bus service, a model to emulate everywhere. Funds are paid for through business taxes and I believe through a local gasoline tax.

At the December 6 public meeting, one of the consultants suggested this option was also inappropriate due to potential 4(f) impact on Finley National Wildlife Refuge. As project manager Jim Cox may remember, I am extremely familiar with Section 4(f), perhaps the strongest environmental law we have. 4(f) states that federal transportation projects (not only roads) may not go through public parks if there are practicable alternatives. In contrast, NEPA merely requires disclosure of the damage that federal projects may have, not avoidance or even mitigation.

I reminded ODOT during their failed West Eugene Porkway effort that 4(f) needed to be considered, and ultimately ODOT and Federal Highway Administration agreed when they selected "No Build" in 2007. Details about 4(f) are at www.PeakTraffic.org/4f.html

I have not examined detailed property maps of the Corvallis - Monroe rail alignment, but my understanding is the former railroad did not go through the Finley preserve, so it would have little if any 4(f) impact. Plus, Congress amended 4(f) a decade ago to remove consideration of minor impacts of 4(f) -- such as if a project clipped the outer edge of a park subject to 4(f) restrictions.

Finley was at one time the only known habitat of Fender's blue butterfly, now a Federally listed endangered species. Several other locations were subsequently documented, including the BLM's West Eugene Wetlands nature park. Fender's was one of the legal obstacles that blocked the WEP from receiving a lasting approval (a Record of Decision signed in 1990 was withdrawn after a notice to file suit against it in 1996, leading to a Supplemental DEIS in 1997 and then a decade of other obstacles that led to No Build).

> Corvallis residents seek passenger rail service
> By The Associated Press
> PUBLISHED: 11:40 A.M., OCT. 22, 2013
> CORVALLIS — Although many say it's a longshot, Corvallis residents say their city should be a stop when passenger rail service is improved between Portland and Eugene.
> The Corvallis Gazette-Times reports that 1,800 people signed a petition, and testimony at a hearing Monday was in favor of the idea. Residents said passenger service would be good for students, business and the environment.
> The Oregon Department of Transportation is studying options for improved service between the Columbia River and the Eugene-Springfield area, a 125-mile segment.
> But current passenger service bypasses Corvallis, and only one of the four alternatives being considered would come through the town.
> The schedule calls for selecting a route in 2015.

A Monroe segment would not have any freight train traffic to cope with, so single track with occasional sidings might be sufficient.

Alternative routes

The DEIS looked at two options for using the parallel existing tracks between Harrisburg and Albany, and also north of Salem. Each of these lines has minimal current traffic and might be reconsidered to include passenger trains, with some modifications.

The Harrisburg to Albany parallel track seems like it might be a relatively easy option, but perhaps there are technical considerations that preclude it as a simple solution. The segment is relatively straight, does not go through Halsey and Shedd, and might be a part of the route where the Talgo train could go faster than it does now.

(A-3)

North of Salem, this line also parallels the Union Pacific line, but does not directly connect back to UP. The DEIS examined an alternate alignment to connect this option to the UP line through "new terrain." Perhaps there are ways to facilitate that without substantial private property acquisition. Perhaps there are not. Meanwhile, ODOT has just built part of the Newberg Dundee Bypass through private property including homes and farms without any discernable public objection. (There was an upset homeowner at the DEIS hearing, but in terms of public controversy it was seemingly non-existent. For the record, I spoke at that hearing in support of No Build, one of five speakers, a small number for a major bypass project!)

Also, at the December 6 public meeting, another citizen asked one of the DEIS preparers who would own the upgraded rails, signals, etc. if public funds were used to upgrade the UP line. He did not have an answer and I request a fuller discussion in the next phase of the NEPA process. For a billion dollars of public money the public should own at least part of the route.

If anything more substantial than upgrading the existing UP line is approved in the final EIS and Record of Decision, it is worth remembering that future funds need to be documented (where they would come from) and also that ODOT and other agencies approved the $4 billion Columbia River Crossing without detailing how they expected to pay for the full project.

Peak Traffic: Vehicle Miles Traveled

The DEIS does not even hint that VMT levels peaked in Oregon as oil prices increased in the 2000s. Since then, the fracking bubble and tar sands have raised oil availability across the country and some locations have had VMT levels slightly above the early - mid 2000s peak. But this new peak of VMT is entirely dependent on how long the fracking bubble lasts. Meanwhile, Amtrak ridership in Oregon has continued to increase and if / when oil prices increase substantially and / or oil availability declines it is likely there will be increased demand for trains.

During the 2008 economic shock, which happened around the time of global peak conventional oil, public transit demand increased across the US. However, transit systems had not anticipated buying fuel at increased prices, so many decreased services and raised fares, which was unfair. LTD and Tri-met both did this. The economic shock also decreased economic activity that lowered business taxes that contribute toward mass transit operations.

The then director of LTD told me that he agreed about the impact of Peak Oil, but he was nearing retirement so it would be someone else's problem to worry about.

www.eugeneweekly.com/20140213/guest-viewpoint/grading-curve

Grading on a Curve

Enviro 'champs' ignoring the biggest issues

ARTICLE | FEBRUARY 13, 2014 - 12:00AM | BY MARK ROBINOWITZ

On Nov. 27, EW's Slant profiled the "Environmental Scorecard" of the Oregon League of Conservation Voters. EW drew attention to "the relatively high scores racked up by state reps and senators in our part of the valley." Unfortunately, OLCV was grading on a curve to make Democrats in Salem look better than they are.

One of the most important votes of the 2013 session, not included in OLCV's scorecard, was to appropriate $450 million toward the Columbia River Crossing (CRC), a $3 billion to $4 billion dollar boondoggle that would widen I-5 to 16 lanes north of the bridge. The Oregon House voted 45-11 in favor and the Senate voted 18-11 in favor. Only two Democrats in the House and one in the Senate voted "no."

EW highlighted Rep. John Lively's 94 percent OLCV rating, but did not mention his vote for the CRC nor his previous promotion of bigger roads while working for ODOT.

OLCV's website cites 10 state reps as environmental champions, but only one of those 10 voted against the CRC. Designating highway expansion supporters as "environmental leaders" suggests political partisanship has become more important than environmental protection.

The only legislator representing Lane County who was against CRC was Rep. Bruce Hanna of Roseburg, a Republican. Some Republicans expressed dislike of the token transit component. Republicans were freer than Democrats to oppose Gov. Kitzhaber's campaign for CRC.

CRC is now bogged down in financial chaos since Washington state legislators did not appropriate anything for it. However, the project is legally approved and an Obama administration priority.

In November 2008, Gov. Kulongoski's Transportation Vision Committee released a report that called for $18 billion in new and expanded state highways, including over $1 billion in Eugene and Springfield. 1000 Friends of Oregon, Oregon Environmental Council and Environment Oregon were part of this committee, but they were window dressing to show that all points of view were supposedly considered. If these groups had a minority report to dissent from the highway promotion, they kept it very quiet.

In 2013, ODOT started building two new highways: the Newberg Dundee Bypass (through farmland) and the Sunrise Freeway in Clackamas County. Both projects only have part of their funding, so ODOT is building segments and hoping for the rest of the money in the future. I attended public hearings for both of these bypasses and did not see any environmental groups at either event.

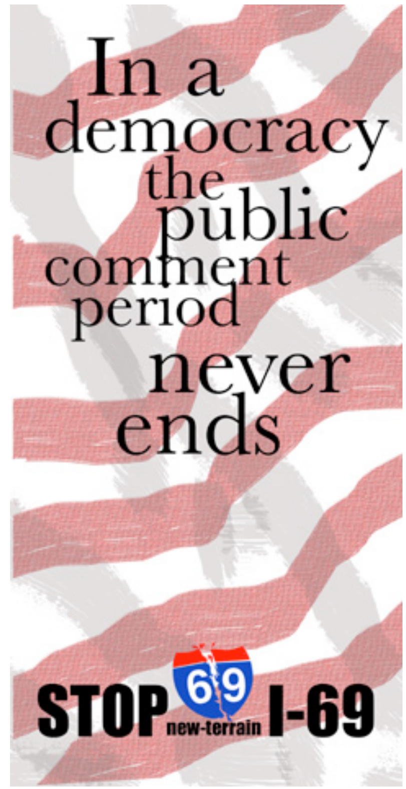
Also in 2013, ODOT approved a new freeway in Medford, the Route 62 bypass. I didn't attend the hearing. The only environmental group that sent comments was Rogue Valley Audubon Society, which complained construction would harm birds.

Federal aid highways such as CRC have to plan for traffic two decades in the future, not current congestion. Our transportation plans ignore the fact that traffic levels peaked in Oregon in 2003 and

Oregon's main fuel source, the Alaska Pipeline, peaked in 1988 and has dropped three quarters since then. It's anyone's guess how much energy will be available for traffic in the 2030s, but it will be much less than the current flow, especially if the Alaska Pipeline closes due to "low flow." Current levels are just above the minimum threshold needed for the pipeline to operate in the Arctic winter.

Here in Eugene from 1999 through 2007, I was the "road scholar" for a proposed lawsuit that prevented the West Eugene Porkway, a bypass of West 11th through the West Eugene Wetlands. WETLANDS vs. Federal Highway Administration was not filed because the feds withdrew the project and selected "no build." Details are at SustainEugene.org.

The lawsuit focused on legal precedents, including Section 4 (f), which prohibits federal aid highways through parks. But it also would have tried to have set a new precedent combining the facts of peak oil and peak traffic as reasons the 20-year planning rule no longer justifies highway expansions.



Since then, I have looked for other freeway fights around the country that could use this legal strategy to create a precedent. A state-by-state list of plans for $1 trillion of highway expansions across the country is at PeakTraffic.org.

The most energetic environmental efforts against new roads are often in places where liberal Democrats are surrounded by conservative Republicans (Bloomington, Ind., and Louisville, Ky., are examples). The professional environmentalists in these places know the state government is not their ally (nor their funder).

While trains and transit could play important roles for post-peak transportation, recognizing we're passing the limits to growth and relocalizing food production are probably the most important responses to peaked traffic and peaked energy.

About the Author

Mark Robinowitz of Eugene is author of "Peak Traffic and Transportation Triage: a Legal Strategy to Cancel Trillion Dollar Highway Plans and Prepare for Post Peak Travel," at PeakTraffic.org.

• 1 Comment

peakchoicedotorg • 17 minutes ago

Sent to me from "a long time environmental activist and former OLCV board member" - I sent him this op-ed and this was his reply:

I hope they print it.

OLCV continues to disappoint me. I wrote them after the special session in which local control over genetic engineering was thrown under the bus and told them they should target on a Democrat architect of that compromise for defeat in the primary, just to show that environmentalists mean business. I received no reply. That they left off the CRC from their list of counted votes doesn't surprise me in the slightest. They are an arm of the Democratic party and deathly afraid of organized labor.

"These forty million [poor] people are invisible because America is so affluent, so rich; because our expressways carry us away from the ghetto, we don't see the poor."

-- Martin Luther King, "Remaining Awake Through a Great Revolution," March 31, 1968 (five days before his assassination)

"It's really hard to come to terms with the number of corporations, government agencies, consultancies, civil service departments and politicians who seem incapable of comprehending a trend break or trend reversal. Collectively they would have been incapable of working out that the wheel may change transport."

-- Euan Mearns, June 11, 2008

http://europe.theoildrum.com/node/4130#comment-359871

www.peaktraffic.org/peakoil.html

2008 Columbia River Crossing Draft Environmental Impact Statement

Interstate 5 Columbia River Crossing
Energy Technical Report
Affected Environment
4-2 May 2008

> Historically, world oil prices have varied considerably and are expected to continue to exhibit high fluctuations as a result of political instability, access restrictions, and a reassessment of OPEC producers' ability to influence prices during periods of volatility. As a result, the 2030 national supply of petroleum could vary substantially depending on world oil prices. Due to global political and economic uncertainties, the USDOE Annual Energy Outlook world oil prices in 2030 were forecasted for three scenarios: "High Price," "Reference Price," and "Low Price" with the cost of oil at 100, 59, and 36 dollars per barrel, respectively (in 2005 dollars). In November 2006 the price of crude oil was about 60 dollars per barrel. One year later it had risen to between 90 and 100 dollars per barrel (2007 dollars). Depending on the world oil prices, the 2030 projections for petroleum imports ranged from 13.4 million barrels per day for the High Price scenario, 17.7 million barrels per day for the Reference Price, and 20.8 million barrels per day for the Low Price scenario.

The 100 dollar a barrel price was reached four months before the publication of the DEIS, not in the year 2030. Therefore, the traffic analysis for the CRC needs to be redone to factor in geological and financial reality - the end of cheap oil is here (regardless of the precise timing of Peak Oil).

The CRC Draft EIS is probably the first to acknowledge the reality of Peak Oil, but unfortunately, the writers of this section failed to describe it accurately. The DEIS suggests that there is a maximum scenario for the year 2030 of $100 a barrel for oil, yet this figure was reached on the first trading day of 2008, four months before the publication of the DEIS. It is astounding that there is no mention in the DEIS of the substantial rise in oil prices during preparation of this report.

One bright spot in the DEIS is the mention of the Department of Energy's Hirsch Report (2005), although the DEIS failed to mention the conclusions of this analysis. The Hirsch Report stated that we would need twenty years to mitigate the impact of Peak Oil, even if we were using toxic technologies such as coal-to-liquids and tar sands. While the Hirsch Report did not specify an opinion on when the Peak would be, oil production worldwide has been essentially flat since 2005 as new oil fields have had a difficult time making up for declining oil fields in the North Sea, Alaska, the Persian Gulf and other areas.

> "fossil fuels are not in short supply at this time, and the use of these resources would not have an adverse effect on their continued availability."
> -- Newberg Dundee Bypass, Oregon, Draft Environmental Impact Statement, (2008), p. 4-3

> EN: Energy
> One commenter provided comments regarding peak oil, climate change, and the relationship between the cost of fuel and the demand for driving. The FHWA has been actively engaged in preparing for transportation changes that may result from larger-scale issues such as peak oil, climate change, and other externally caused actions. Although formal policies are still emerging for many of these issues, planning for such changes is occurring. This planning takes many forms including alternative fuels, new modes of travel (mass transit, bicycle/pedestrian), sustainable design, and other measures. Many new infrastructure projects are allowing for increased use of transit (buses, light rail, trains) and bicycle/pedestrian travel to reduce oil and gas consumption while maintaining the public's mobility. Peak oil is not identified as an issue in which analysis can provide meaningful information to the public or decision makers regarding which alternative to select for the Sunrise Project. Government agencies are considering future conditions in planning for public infrastructure projects. It is also important to note that, while fuel types and supplies may change, transportation agencies are still planning to provide needed infrastructure and improvements to ensure continued movement of goods and people in the future. The Sunrise Project contributes to these efforts.
> -- Sunrise Project, I-205 to Rock Creek Junction, Final Environmental Impact Statement, December 2010, Chapter 5 - Comments and Responses, pp. 350-351

Peak Oil Plateau: Growth is Over

Peak Oil does not mean that civilization is about to run out of oil. Instead, we are near (or at) the point where continued growth of petroleum combustion no longer can be maintained, which will have profound consequences for the global economy that is dependent on exponential growth of nearly everything (especially of money supplies). Energy creates the economy, a physical limitation rarely acknowledged by economists. Peak Oil is also the point where the maximum amount of economic "growth" is reached -- and ideally a turning point where we can decide to use the remaining half of the oil as a bridge toward a more sustainable way of living. It would require enormous energy, money and people power to reorient away from NAFTA Superhighways toward investing in bullet trains, away from dirty fossil fuel technologies toward efficiency and renewable energy systems, away from resource wars and toward global cooperative efforts to reduce our collective impact on the planetary biosphere.

Alternative fuels and plug-in hybrids won't reverse Peak Traffic

Renewable energy systems are largely focused on generating electricity. Transportation systems are almost entirely based on burning liquid fuels, which are not generated by solar PV power or wind turbines.

A bigger problem is that in the coming decades natural gas supplies in the US are likely to have dropped so low that they will no longer be able to be used to generate electricity -- the remaining gas will be needed to heat buildings, especially in the colder climates where the gas is extracted from. Whatever renewable energy systems are installed between now and then will need to replace the substantial inputs that natural gas has for the electric power grid at the same time that there is less available energy to manufacture solar panels and wind turbines.

All of the major car companies have developed much more efficient vehicles (Greenpeace, "The Environmental Impact of the Car," 1992), with many models around 100 mpg. VW even has a small model that is highway rated that gets about 250 mpg -- the VW CEO drove it to their annual stockholder meeting a few years ago. While technological shifts may help mitigate the energy crisis after Peak Oil, it cannot eliminate the problem. There are few factories to make these vehicles. There are few capital investments to fund the conversion of existing factories to make hyper-efficient cars. The existing fleet of vehicles are not going to be instantly eliminated in favor of efficient cars, as the owners have invested heavily in their current models -- someone who bought a $50,000 SUV is not easily going to be able to absorb the loss by purchasing a new car that is more efficient. At best, the investment in more efficient vehicles may slow the decline of VMTs on the Peak Oil downslope -- but it cannot prevent that decline. There is also the problem of substantial use of oil and mineral ores to manufacture new cars, even efficient ones. Carpooling would be a far faster, cheaper solution but that is a social shift, not a technological change.

Electric cars, even if a hundred million were instantly produced and distributed (in factories that don't exist), could not substitute for food delivery trucks, tractors, freight trains, most Amtrak trains, container ships that bring us cheap crap from Chinese slave labor factories, passenger planes, cargo planes, war planes, petrochemicals for non-transport purposes, fossil fuels used to heat homes and run factories, depleting natural gas used to power part of the electric power grid, oil use at mines and many other uses that show we are not addicted to oil -- we are extremely dependent upon it and the "alternatives" are less concentrated and therefore unable to substitute completely.

www.registerguard.com/news/2005/12/14/ed.letters.1214.p1.php?section=opinion

Don't underestimate peak oil

The profile of the new Oregon Transportation Plan, "Road map: How to get there from here," (Register-Guard, Dec. 5) mentions the concept of "peak oil" as a transportation planning issue, but then downplays its significance, claiming that the peak of production might happen in the next two decades.

In April, Oregon Secretary of State Bill Bradbury told an audience in Eugene that we are at peak oil. Most petroleum geologists agree that the peak is either here or will be here soon, and that the megafields discovered more than four decades ago are showing signs of depletion. A good scientific introduction to these issues can be found on the Web site of the Association for the Study of Peak Oil, www.peakoil.net

Peak oil will require us to conserve energy and to live more locally. The promise of hydrogen-powered cars is a distraction from practical solutions to reduce consumption, since hydrogen is a means to store energy, not an energy source (you still need energy to make it). The Oregon Transportation Plan should recommend improved train service in the Willamette Valley and coordinate with economic planners to relocalize production of goods to reduce demand for delivery trucks.

At 7 p.m. on Jan. 10 [2006], the Eugene Permaculture Guild is sponsoring a lecture by Richard Heinberg at the Eugene Hilton. Heinberg is author of "The Party's Over" and "Powerdown: Options and Actions for a Post Carbon World," which describe how communities can cooperate to mitigate the impacts of energy decline.

MARK ROBINOWITZ
Eugene

www.kunstler.com/mags_diary16.html

James Howard Kunstler

February 6, 2006

By now, President Bush's wildly irresponsible remarks on energy in his state of the union speech may have already vanished down the memory hole, but the damage will linger on. "America is addicted to oil," Mr. Bush began, failing to mention that underlying this addiction was a living arrangement that required people to drive their cars incessantly. A clueless public will continue to believe that "the best way to break this addiction is through technology. . ." and that "we must also change how we power our automobiles."

Mr. Bush recommended ethanol. As one wag put it after the speech: "America's heroin is oil, and ethanol will be our methadone." The expectation will still be that everybody must drive incessantly.

It is hard to believe that Mr. Bush does not know the truth of the situation, or that some of the clever people around him who run his brain do not know it, namely that ethanol and all other bio-fuels are net energy losers, that they require more energy to grow and process them than they produce in the end, and that the energy "inputs" required to do this are none other than oil and natural gas, the same fuels we already run engines on.

The president also said that "breakthroughs on this and other new technologies will help us reach another great goal, to replace more than 75 percent of our oil imports from the Middle East by 2025."

In point of fact, our oil imports from anywhere on the planet will be reduced by more than 75 percent because by that time worldwide oil depletion will be advanced to its terminal stage, and nobody will have any oil left to export -- assuming that the industrial nations have not ravaged each other by then in a war to control the diminishing supply of oil.

The key to the stupidity evinced by Mr. Bush's speech is the assumption that we ought to keep living the way we do in America, that we can keep running the interstate highway system, WalMart, and Walt Disney World on some other basis besides fossil fuels. The public probably wishes that this were so, but it isn't a service to pander to their wishes instead of addressing the mandates of reality. And reality is telling us something very different. Reality is saying that the life of incessant motoring is a suicidal fiasco, and if we don't learn to inhabit the terrain of North America differently, a lot of us are going die, either in war, or by starvation when oil-and-gas-based farming craps out, or in civil violence proceeding from failed economic expectations.

I hate to keep harping on this, but Mr. Bush could have announced a major effort to restore the American railroad system. It would have been a major political coup. It would have a huge impact on our oil use. The public would benefit from it tremendously. And it would have put thousands of people to work on something really meaningful. Unlike trips to Mars and experiments in cold fusion, railroads are something we already know how to do, and the tracks are lying out there waiting to be fixed. But the reigning delusions of Hollywood and Las Vegas prevent us from thinking realistically about these things. We're only into wishing for grand slam home runs and five-hundred-million-dollar lottery jackpots. Anything less than that makes us feel like losers.

Meanwhile, the official Democratic Party response to Mr. Bush's nonsense was the stupendous fatuousness of newly-elected Virginia Governor Tim Kaine's rebuttal, a saccharine gruel of platitudes and panderings ...

History will look back in wonder and nausea at the twitterings of these idiots as the world they pretended to run lurched into darkness.

"In conjunction with the Oregon Department of Energy, Metro will develop a contingency plan for dealing with short term gasoline shortages. Initially, this will involve adoption of a framework plan which will establish the need for refinement of the key elements."

– Metro Regional Transportation Plan (Portland), updated October 6, 1983

[Metro in Portland has still not done this preparation work on a serious level.]

www.peakoil.net/Newsletter/NL39/Newsletter39.html [Association for the Study of Peak Oil]

334. New roads and a tunnel in Switzerland (March 2004 issue)

Switzerland operates a devolved form of government seeking to involve its citizens in major issues rather than impose decisions by parliamentarians under the iron grip of party machines, as practised in many so-called democracies. The decision now facing the Swiss people is whether or not to modernise the highway system and build a new tunnel under the Alps. Linear extrapolation of past trends of traffic and goods transport has no doubt been used to justify the mammoth undertaking, but it is meeting strong opposition, partly built on recognition of oil depletion. A cartoon has appeared depicting a future scene of a cyclist and an old man looking down on an empty highway with trees growing through the cracks. The old man comments "In my day we believed in all that" to which the cyclist replies "You still had petrol"

The Swiss Federal Office of Energy is holding a Workshop on oil and gas resources on February 27th which will be open to the public. ASPO will be represented by Campbell and Bauquis in a discussion with representatives of the IEA, IHS, Schlumberger and Chevron-Texaco. It remains to be seen if it will have any positive outcome, as the accompanying report commissioned by the Federal Office simply contrasts the views of so called "optimists" and "pessimists" to reach a neutral position, absolving the government from the need to take any firm action. The likely outcome is that the investments in roads and tunnels will be neither approved nor rejected but simply delayed – it might indeed be a good political response, given that impact of peak oil will soon be self-evident.

Published on 4 Apr 2005 by New Zealand Herald. www.energybulletin.net/5112.html

New Zealand: No easy solutions in sight to keep oil prices in check

by Cameron Pitches

... New Zealand's transport agencies need a contingency plan for the rising price of oil. At US$70 a barrel, the Auckland Regional Transport Authority should be looking to secure options on electric rolling stock for our rail network.

At US$100, the Government should be suspending all new roading projects. At US$200, Auckland International Airport's proposals for a second runway should be shelved in favour of a container wharf for shipping.

Reliance on emerging new energy technologies such as hydrogen won't help us in the short term, either. The so-called hydrogen economy is a net energy-loss proposition - more energy is put in to the extraction, compression and storage of hydrogen than comes out of it.

In addition, more than 90 per cent of hydrogen is obtained from fossil fuels, which defeats the purpose of an alternative fuel.

www.sevenoaksmag.com/commentary/63_comm2.html

A bridge too far: Big men and their little toys

May 24, 2005

Am Johal

Building our way out of congestion through highway expansion seems incredibly short-sighted, especially in the context of oil reaching $100 a barrel by 2010 and a public transportation sadly in need of a billion dollar overhaul.

www.fcnp.com/511/story3.htm

The Peak Oil Crisis: Part 4, A Sudden Shortage

Tom Whipple May 19 - 25, 2005

A few weeks ago, the International Energy Agency (IEA) in Paris released a study called "Saving Oil in a Hurry" in which they examined what the oil importing countries could do should there be an interruption in supply. This 165-page document looks at previous oil shortages — the two in the 1970's and some recent ones in Europe — to develop recommendations as to what governments should do when there is more demand at the pumps than there is gasoline available.

They conclude that the overriding concern during a government intervention is to hurt the economy as little as possible. The study emphasizes that there are important differences between measures simply restricting travel, such as a Sunday driving ban, and those that assist or encourage motorists to cut fuel use such as car-pooling or the concept, unknown here in America, of "ecodriving" (light foot on gas).

The major cost associated with fuel storage is lost mobility and the reduced economic activity that results.

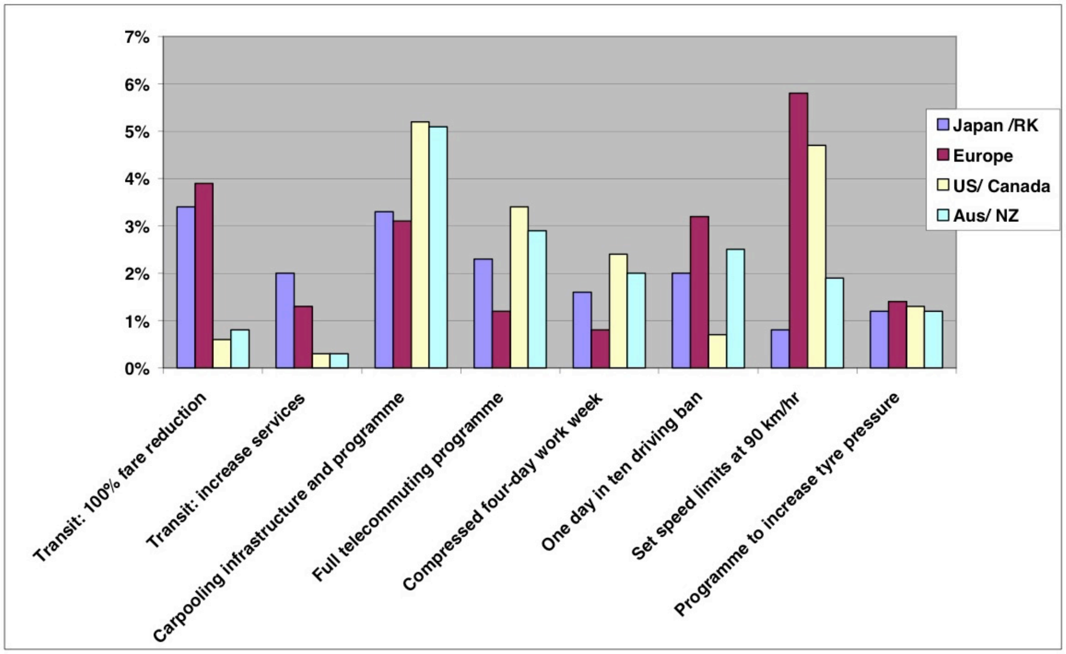
After much thought, the IEA came up with seven general approaches that would produce savings of energy (in a hurry):

• Increases in public transit usage.
• Increases in car-pooling
• Telecommuting (working from home)
• Changes in work schedules
• Driving bans and restrictions
• Speed limit reductions.
• "Ecodriving"

There can, of course, be endless details to these general approaches to saving transportation energy and the savings garnered by each of these approaches will depend on how they are implemented. There is a big difference between a car-pool publicity campaign and expansion of strictly enforced HOV to all lanes of all major arteries and the denial of parking to single occupant vehicles.

The publication of internationally agreed set of approaches to saving transportation energy at least gives us a basis for discussion on the day when the real shortage arrives.

Percent reduction in total fuel use by IEA region, selected measures



Imperial College London

www.bloomingtonalternative.com
Confronting the new transportation paradigm
May 2, 2004
by David Coyte

While Indiana's Gubernatorial candidates are jockeying for positions on the I-69 proposal and Citizens' group are working up lawsuits on the project, events are transpiring in Indiana and around the world which will render this debate obsolete.

In spite of the recent gas tax increase, Indiana's Department of Transportation has some serious fiscal problems. Rather than scale back new construction projects, INDOT has changed its revenue projection methods to make them look affordable. The new revenue projection formula uses the historical trends of the 1990's to predict revenues for 2002 – 2011.

The significant trend during that period was an incredible increase in miles driven. With the higher gas tax and assuming the same growth in travel INDOT expects an increase in revenue for road "preservation" and new construction of about $100 million per year – most of which will go to new construction. This is a 15% increase in annual funding for these areas as opposed to the traditional 2%.

There are problems with these numbers both in their likely accuracy and in how they are slated to be spent. Most of the assumed $100 million in additional annual revenues are targeted towards new construction leaving an approximate $25 million increase per year for maintaining our existing roads. Since the cost of maintaining a mile of interstate during the late 1990's was rising at over 25% a year, this formula sacrifices our existing road system for new construction – which then becomes an additional maintenance burden. The assumption in these forecasts that the driving trends of the 1990's will continue is highly suspect. Road funds dropped by well over 100 million between 2001 and 2002 – primarily because of the economic downturn which is still with us. This situation, coupled with rising fuel prices, makes the likelihood of continuing 1990's travel growth most unlikely. INDOT's Long Range Plan Fiscal Forecast ends with this warning: "Again, it is important to note that the fiscal forecast assumes additional funding from some source will occur in the future. The time and amount of the additional funds are not forecasted." This statement should trouble economic planners.

The Global picture is even more troubling. There is substantial evidence that world petroleum prices will begin rising sharply within the next 10 years. While there is plenty of oil resources left on the planet, the cheap and easy "conventional oil" resources are about gone. What's left will be much more costly and slower to produce creating "real", as opposed to the "political" shortages we experienced in 1973.

Some experts believe that the current fuel price increases represent the beginning of this situation, and events are occurring which support that belief. In February it was announced that refineries are beginning to ration supplies to independent retailers. OPEC has announced it will cut production in April. This could be due to the reduced ability to produce rather, than as claimed, an effort to support prices which are already well above price targets.

Oil is to our economy what water is to agriculture. Because of this you would expect the planning agencies and the business community to be sensitive to its availability. This is not the case. Much of the blame lies with the Energy Information Administration (EIA), a division of the Dept. of Energy. The EIA is dominated by economists who believe that petroleum will be "created by demand" over the protests of the petroleum geologists who are responsible for finding and producing it. Furthermore, the EIA has accepted huge increases in the oil reserve estimates that came out of the Middle East in 1988 and ,89 - which most geologist find highly suspect. In 1999 the EIA predicted that oil prices would stay under $23 per barrel through 2020 (1997 dollars)*. In January of 2004 the EIA predicted that the price of oil would stay below $29.00 a barrel in the high price forecast. Today oil is over $36 per barrel – yet current EIA predictions are just as optimistic. Presidents from both parties, despite the scientific evidence, have supported the EIA fantasies. No president wants to anger the powerful highway and trucking lobbies, or suggest to us citizens that we may have to curb our energy consumption.

If, as events suggest, oil prices continue to rise, then INDOT's revenue projections are more than just optimistic – they are a destructive delusion which will delay us in addressing the very serious issue of developing and maintaining affordable and effective transportation alternatives. As fuel prices rise, miles traveled (read highway revenues) will drop as people conserve, carpool, and use transit. The need for additional highway capacity will disappear. The need for alternate urban and inter-city transportation services will grow.

There are reasonable responses to this situation: First, stop all new road construction – the cheap gas world has come to an end and we will be lucky to maintain our existing road system. Second, take the money slated for new road construction and put it into rail-based transportation. Two big reasons for this: Freight rail uses 1/10th as much energy as trucks, and maintaining rail lines costs about 1/50th as much as maintaining an equal capacity highway. Because of those efficiencies freight has been moving onto rail over the last decade and we are now facing a shortage in rail capacity.

On the passenger side the solution lies with implementing the Midwest Regional Rail Initiative, of which Indiana is a member. This nine-state plan proposes a high-speed (100 MPH) passenger rail system throughout the Midwest. Indiana's cost to implement this plan would be less than the 7 mile long upgrade of I-65 in southeast Indiana. The US Department of Transportation studies have shown that this system will require no public subsidy after the initial few years of implementation. This regional system, coupled with rail based transit systems for our metropolitan areas, will address the transportation needs and energy realities of this century.

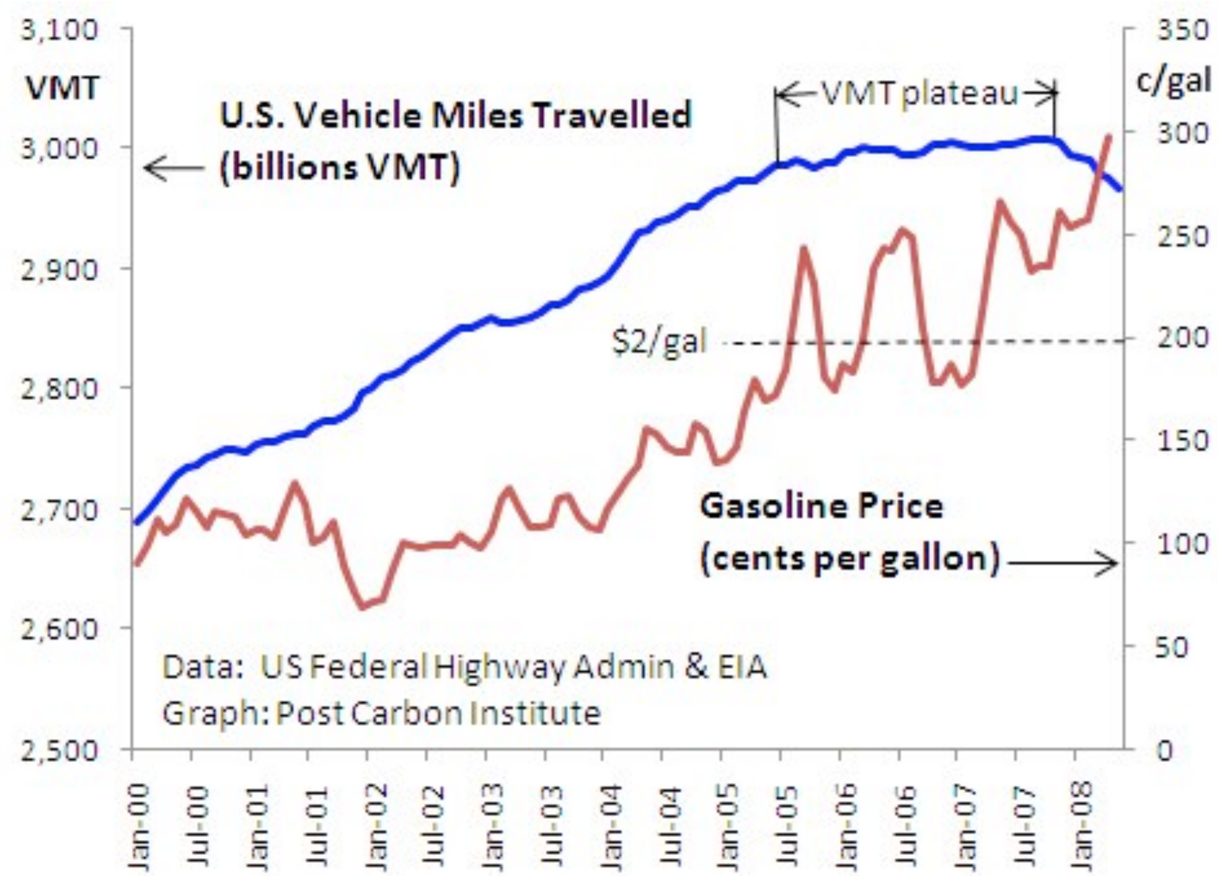
Creating additional rail capacity is the investment strategy that makes sense. A bonus for moving freight onto rail is greatly reduced highway maintenance costs. A bonus for investing in rail transit is better access for our growing elderly and working poor populations. Both efforts improve our air quality and positively impact the issues of sprawl and loss of farmland. Regional farmland becomes ever more precious as distant food sources become more expensive to access.

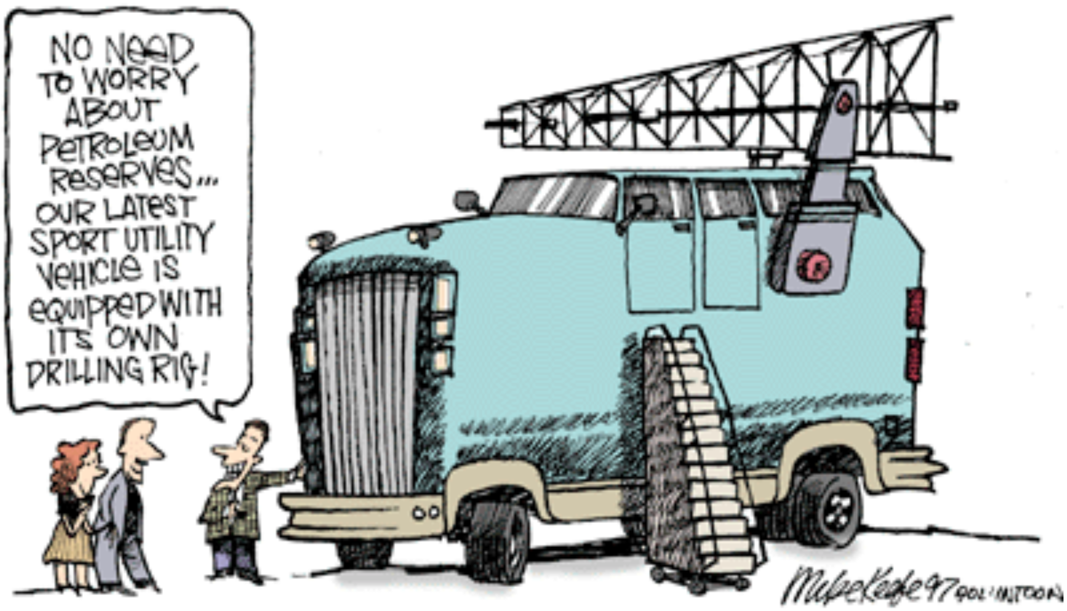
More of us will become transit dependent as oil prices reverberate through our economy. To remain economically and socially viable we need to focus on the new transportation paradigm while we have the time and resources to implement it. That paradigm demands that we maintain the roads we have while aggressively investing in freight rail and passenger rail infrastructure. . It will take political guts to confront this situation. We best find some soon.

There are excellent books and articles on the subject of oil resource depletion: Hubbert's Peak: the Impending World Oil Shortage, by Kenneth Deffeyes, Princeton University Press, 2001; Out of Gas: End of the Age of Oil, by David Goodstein, WW Norton and Co, NY, 2003; and the The Hydrogen Economy: Creation of the World-Wide Energy Web and the Redistribution of Power on Earth, by Jeremy Rifkin. These are all respected scientists. Searching "Hubbert’s Peak" will bring up numerous articles on the Web.

* Annual Energy Outlook 1999, Table A12, page 129, EIA, December 1998

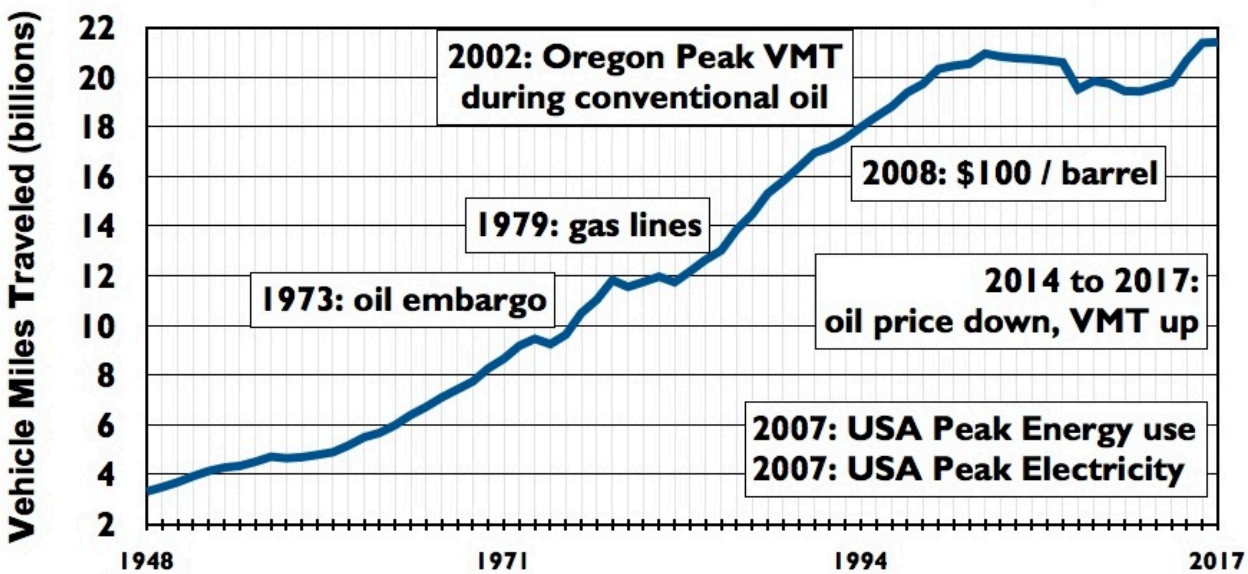
David Coyte is President of CART, the Coalition for the Advancement of Regional Transportation, which is headquartered in Louisville and has been working on transportation planning issues for over a decade. Coyte has contributed articles to planning magazines, newspapers, and non-profit newsletters. A version of this piece will appear in Louisville's Business First Magazine in May.

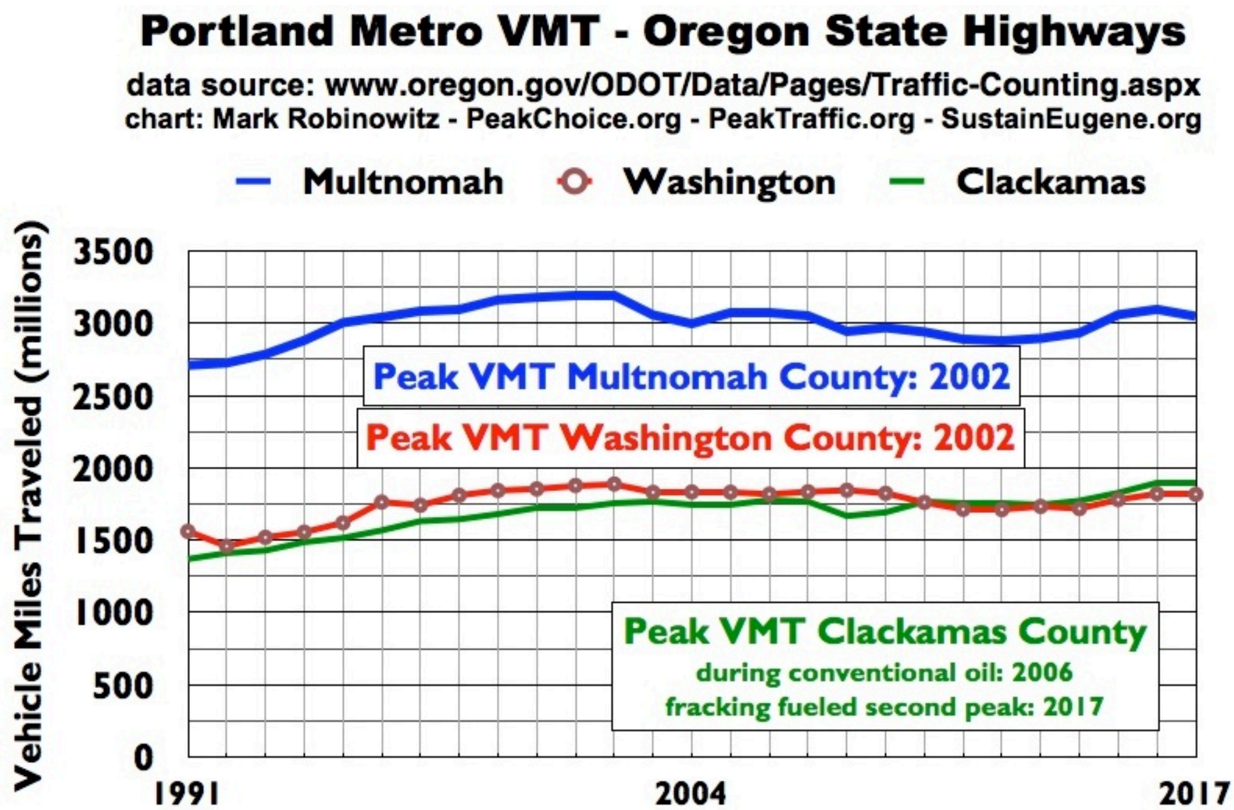


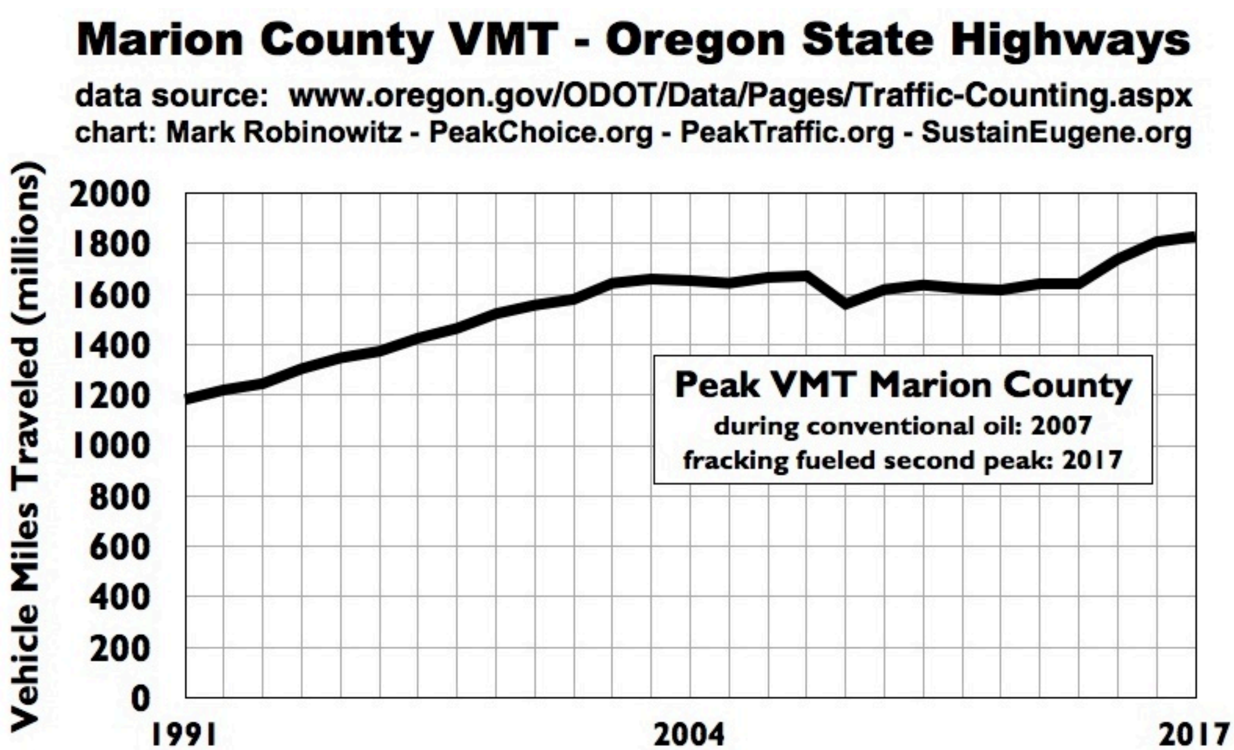


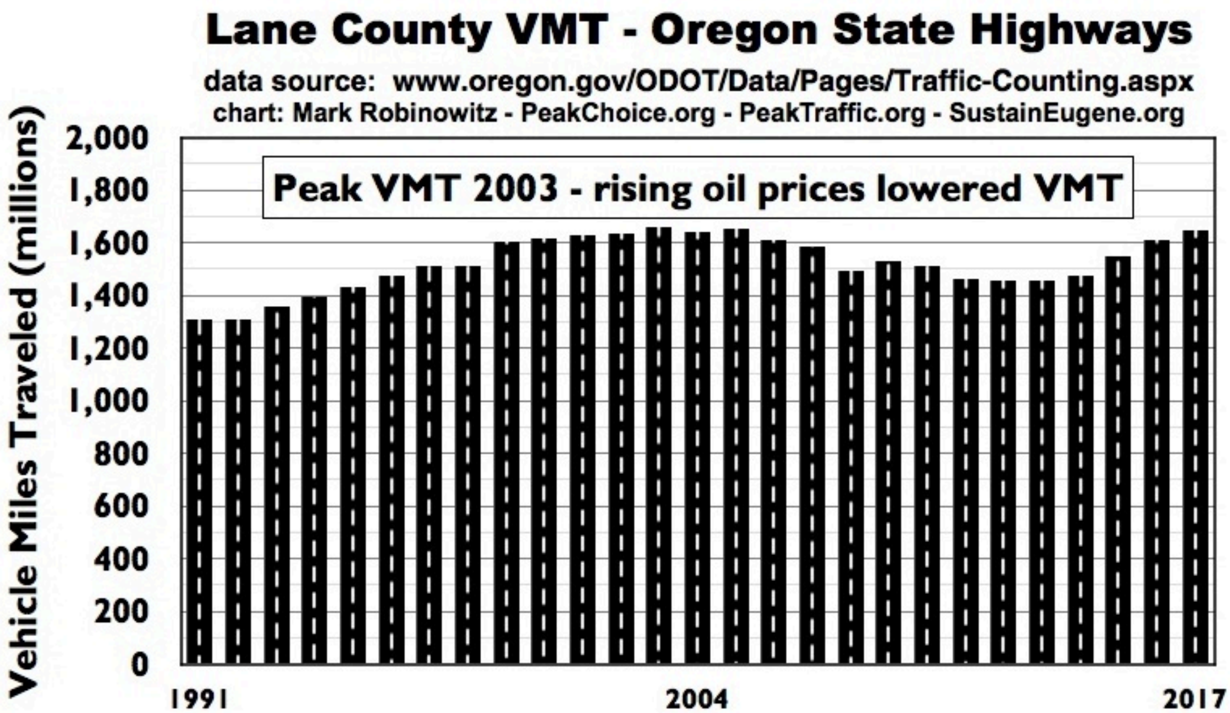
Oregon State Highways VMT 1948 to 2017

data source: www.oregon.gov/ODOT/Data/Pages/Traffic-Counting.aspx
chart: Mark Robinowitz - Peak Choice.org - PeakTraffic.org - SustainEugene.org




Portland Metro VMT - Oregon State Highways
data source: www.oregon.gov/ODOT/Data/Pages/Traffic-Counting.aspx
chart: Mark Robinowitz - PeakChoice.org - PeakTraffic.org - SustainEugene.org
Multnomah
Washington
Clackamas
Vehicle Miles Traveled (millions)
3500
3000
2500
2000
1500
1000
500
0
1991
2004
2017
Peak VMT Multnomah County: 2002
Peak VMT Washington County: 2002
Peak VMT Clackamas County
during conventional oil: 2006
fracking fueled second peak: 2017


Marion County VMT - Oregon State Highways
data source: www.oregon.gov/ODOT/Data/Pages/Traffic-Counting.aspx
chart: Mark Robinowitz - PeakChoice.org - PeakTraffic.org - SustainEugene.org
Vehicle Miles Traveled (millions)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1991
2004
2017
Peak VMT Marion County
during conventional oil: 2007
fracking fueled second peak: 2017



train service connected to the study area

If ODOT really anticipates $4 billion being available for expanded passenger rail service, it could consider increased service on connected routes in addition to the Eugene- Albany - Salem - Oregon City - Portland route.

Coast Starlight

Perhaps most important long distance train is Coast Starlight. It requires substantial improvements to on-time reliability to be more functional as a transportation system. The trains are also several decades old and often show their age. In the short term, having more than one train a day seems unrealistic, but if we will ever have a substantive train network this would be a minimal requirement. Whatever upgrades to the Portland Eugene line are done should consider how to include expanded Starlight service.

Oakridge stop for Coast Starlight

Downtown Oakridge is the main city between Eugene and Chemault, and is a larger community than Chemault. (Bend has a bus connection, but Bend is not that close to the stop.) Oakridge could make a logical location for a flag stop for the Starlight

Empire Builder

Empire Builder is similar to the Starlight, daily service to distant locations. It too, would benefit from consideration of more than daily service.

Passenger trains to the coast and short line routes might not be practical, but we could use better intercity buses

Occasionally there have been public requests for intercity train service to the Oregon coast, sometimes via letters to the editor.

Coos Bay line

The freight line from Eugene to Coos Bay was built to haul lumber for timber companies. Much of the route is very twisting, steep and slow. It would be far slower than intercity buses. Perhaps most limiting is the fact it goes near Florence, not to it. I have heard this route has been used a few times for an entertainment oriented train but it would be a poor service for a transportation oriented train. Perhaps if we suffer an economic depression people will be grateful for whatever service remains, but in that circumstance keeping the valley train service functional might be enough of a challenge.

Better bus service between the valley and coastal communities is probably a more realistic goal.

Corvallis line

There is also a train line from Corvallis to the Newport area, but this route is almost as curvy and steep as the Coos Bay route. Perhaps as gasoline becomes less affordable and less available this service will gain in popularity, at least until the Cascadia Subduction Zone earthquake.

Bus service in the valley

Currently, bus service between Eugene and Portland is faster than Amtrak Cascades. This is the case for Amtrak's contracted buses as well as Bolt Bus / Greyhound. The goal of the ODOT train study will be met if the rail system facilitates Eugene to Portland train travel faster than driving the speed limit on I-5.

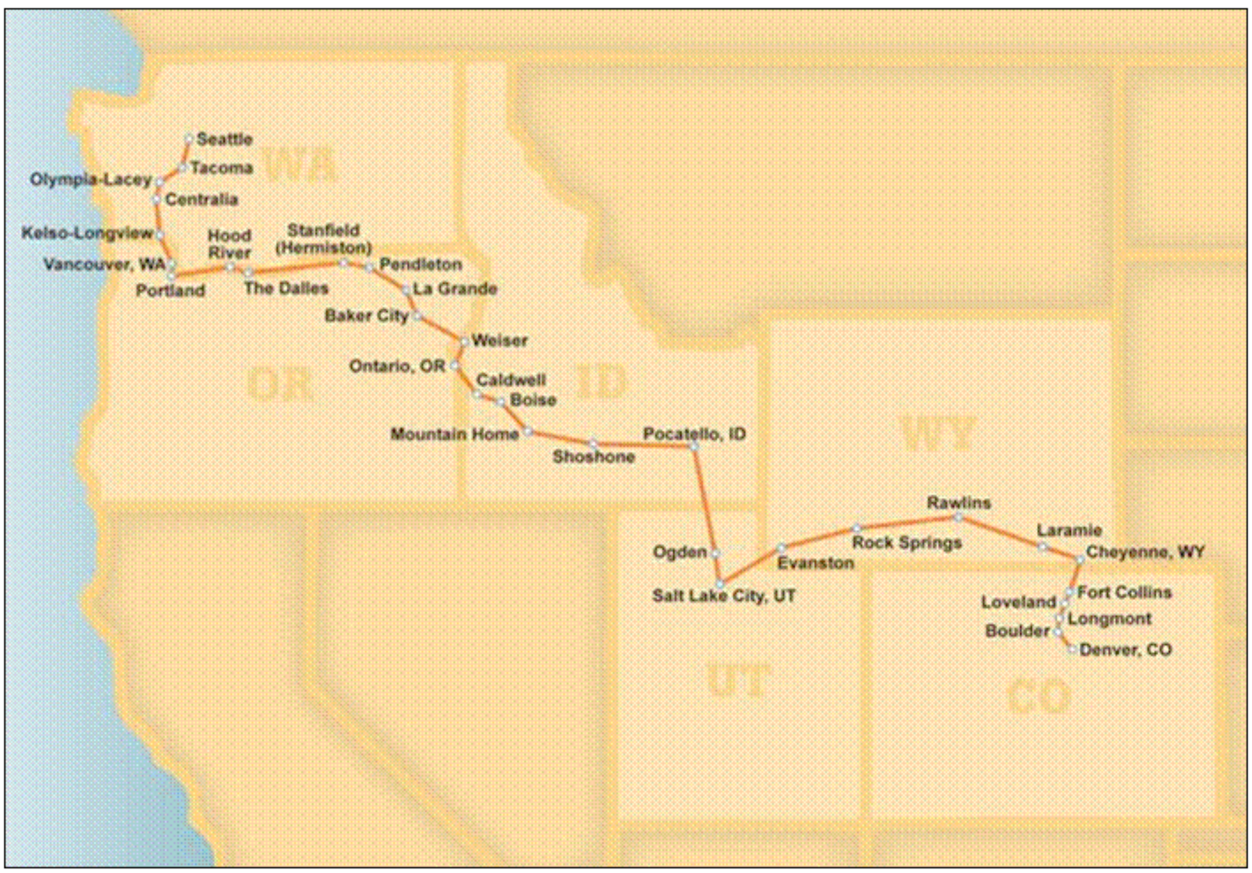
Pioneer Train

The discontinued Pioneer Train is also mostly outside the study area but it included a Portland stop. Efforts to revive this deserve a token mention in the Final EIS or SDEIS.

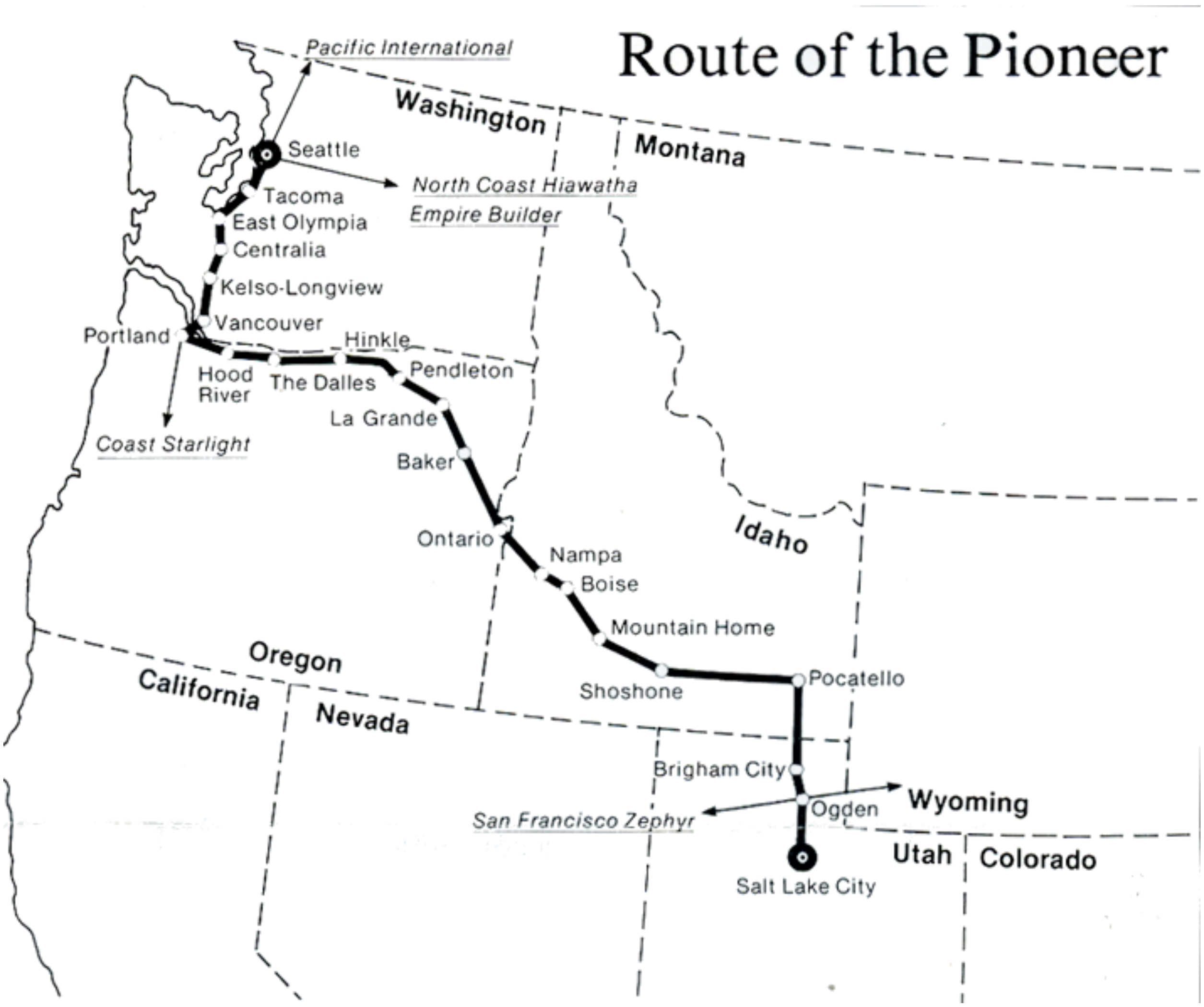
This route was canceled by the Clinton Gore administration in 1997.

It served a lower population region but was also a critical connection to the outside world, especially in winter. As oil declines renewed train service could become even more important to those communities.

Advocates for Pioneer restoration note that every city along the route has endorsed its revival, even those that would only have trains stop at inconvenient times in the middle of the night.



Amtrak Pioneer 1977 map



https://pioneertrain.org/

Eastern Oregon Passenger Rail Summit
La Grande, Oregon
March 16, 2019

Working to bring the same scene to Portland, Boise and intermediate points!

The Eastern Oregon Rail Summit will be held in La Grande, Oregon on Saturday, March 16, 2019 in the David E. Gilbert Center in Ackerman Hall at Eastern Oregon University from 1000 AM to 200 PM. Discussed will be rail transportation in the Pacific Northwest, with a focus on returning rail passenger service between Portland and Boise via Hood River, The Dalles, Hermiston, Pendleton, La Grande, Baker City, Ontario, and Nampa. All are welcome to participate. The exact time of the summit will be announced later.

HISTORY

Pioneer at Rowena, OR, 1991. Copyright Joe Blackwell. Used by permission.

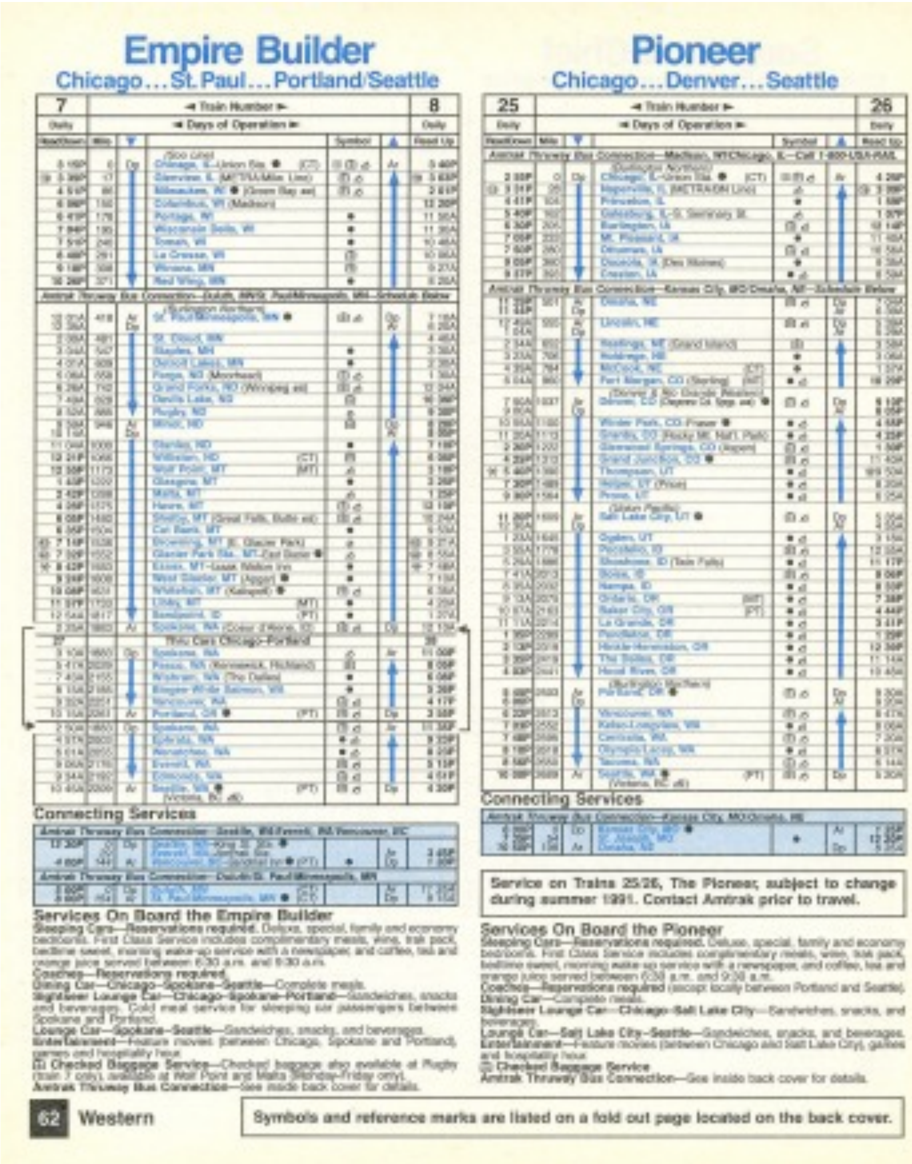
The Pioneer was not part of the original Amtrak system, which replaced the nation's private passenger railroads on May 1, 1971. In the late 1960s, proposals to eliminate one of the two trains on the Union Pacific's Pacific Northwest mainline through southern Idaho met strong regional resistance, but when Amtrak was formed, all of the Union Pacific passenger service in the Pacific Northwest was abruptly discontinued.

The first Pioneer timetable, May 1977. Courtesy The Museum of Railway Timetables. http://www.timetables.org/

The absence of Amtrak service running east from Portland in eastern Oregon and southern Idaho motivated state and federal officials to push for a train to bridge that gap. Their efforts reached fruition on June 7, 1977, when the Pioneer was born as a Salt Lake City-Seattle train.

At that time, Amtrak's San Francisco Zephyr train ran from Chicago across southern Wyoming on the Union Pacific mainline to Ogden, Utah, from which it continued on to California. It crossed the Pioneer's path in Ogden, giving the new train a connection with Chicago and the East. On October 28, 1979, another train, the Desert Wind, began operating between Los Angeles and Ogden; between Ogden and Chicago it operated as a section of the San Francisco Zephyr. The Denver and Rio Grande Western Railroad meanwhile continued to run its Rio Grande Zephyr, a remnant of America's once-proud fleet of private trains, on the route from Denver through the spectacular canyon of the upper Colorado River, to Utah and Salt Lake.

Things would soon change. In the spring of 1983, the Rio Grande Zephyr ceased operations and the San Francisco Zephyr – renamed the California Zephyr – shifted south, taking over service on the Rio Grande Zephyr's route between Denver and Salt Lake. From there it turned north to Ogden, then west towards California. The Desert Wind's northern terminus simultaneously moved to Salt Lake. That city's Rio Grande Station thus became the junction point for all three trains, which exchanged through-cars there as a coordinated service. On October 27, 1985, the California Zephyr stopped calling at Ogden, heading west directly from Salt Lake instead, and eliminating the overlap between its route and thePioneer's between the two Utah cities.



Empire Builder
Chicago…St. Paul…Portland/Seattle

Pioneer
Chicago…Denver…Seattle

Connecting Services

Service on Trains 25/26, The Pioneer, subject to change during summer 1991. Contact Amtrak prior to travel.

Services On Board the Empire Builder

Services On Board the Pioneer

62 Western

Symbols and reference marks are listed on a fold out page located on the back cover.

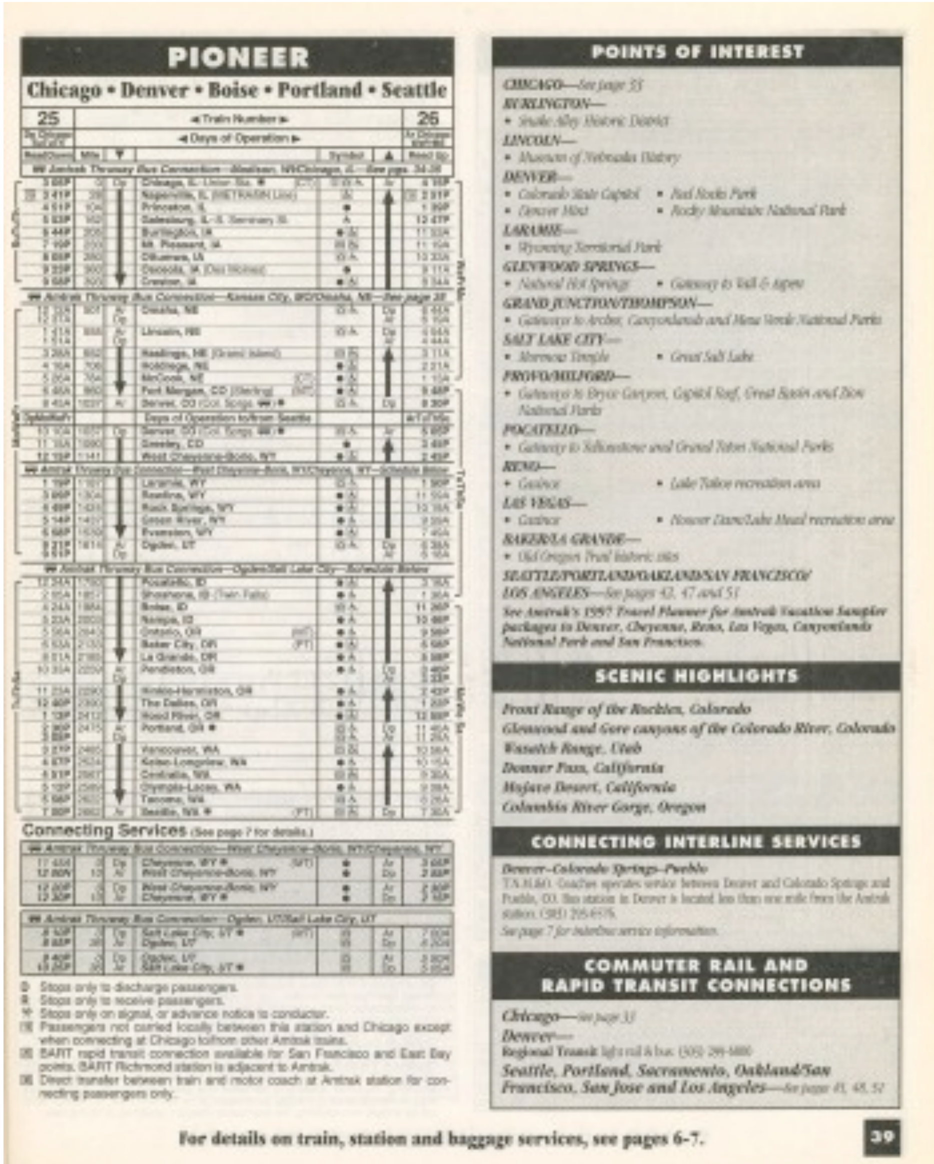
Amtrak Pioneer timetable, April 1991. Courtesy The Museum of Railway Timetables. http://www.timetables.org/

That situation prevailed until June, 1991, when Amtrak shifted the Pioneer's routing in order to restore service to Wyoming. Now the train ran as a section of the California Zephyr only between Chicago and Denver. There, the westbound train split off from the Zephyr as its own train and proceeded north to Wyoming, then west to Ogden, then along its established route north and west to Portland and Seattle. The Desert Wind continued to ply the Salt Lake-Los Angeles route.

Pioneer at Cascade Locks, OR, 1993. Copyright Richard Sugg. Used by permission.

As part of an attempt to reduce costs, Amtrak reduced service on all three routes in the autumn of 1993, reducing the Pioneer to a thrice-weekly service at all points west of Denver. Amtrak supposed that travellers would simply concentrate their travel on the days when the Pioneer still ran, but such was not to be the case: in eastern Oregon towns, the reduction of service by 4/7, or 57%, led to a 58% drop in ridership compared with the late 1980s. Efforts were made to continue funding for the train, but the long-threatened end came on May 10, 1997, when the last Pioneer pulled out of Seattle for the return to Chicago. The Desert Wind disappeared along with its sister train to the north, and today Amtrak's service through the heart of the West consists of but one train, the California Zephyr.

In the late 1990s, the Association of Oregon Rail and Transit Advocates spearheaded a drive to restore the Pioneer as a train that would carry mail and express – expedited freight – as well as passengers, since Amtrak at that time was incorporating express into many of its other trains. At the same time, Ron Wyden, Democratic senator from Oregon, and Mike Crapo, Republican senator from Idaho, launched a bipartisan effort to initiate a train on part of the Pioneer route, between Portland and Boise. As late as 2004, Amtrak's strategic plan made a passing reference to the Portland-Boise route as being "under discussion," but, given the Bush Administration's skepticism towards Amtrak, the mention meant little. To many onlookers, the Pioneer was history.



PIONEER

Chicago • Denver • Boise • Portland • Seattle

Connecting Services

POINTS OF INTEREST

SCENIC HIGHLIGHTS

Front Range of the Rockies, Colorado

Glenwood and Gore canyons of the Colorado River, Colorado

Wasatch Range, Utah

Donner Pass, California

Mojave Desert, California

Columbia River Gorge, Oregon

CONNECTING INTERLINE SERVICES

COMMUTER RAIL AND RAPID TRANSIT CONNECTIONS

For details on train, station and baggage services, see pages 6-7.

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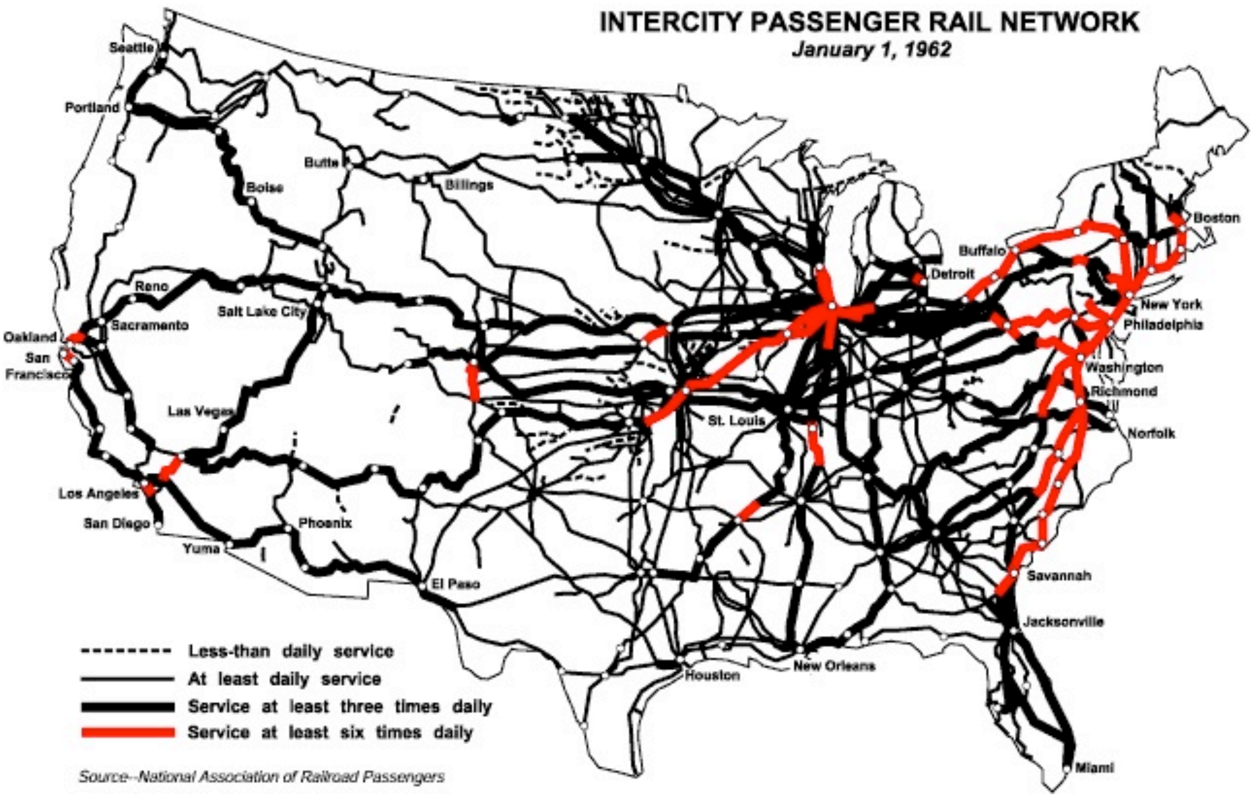
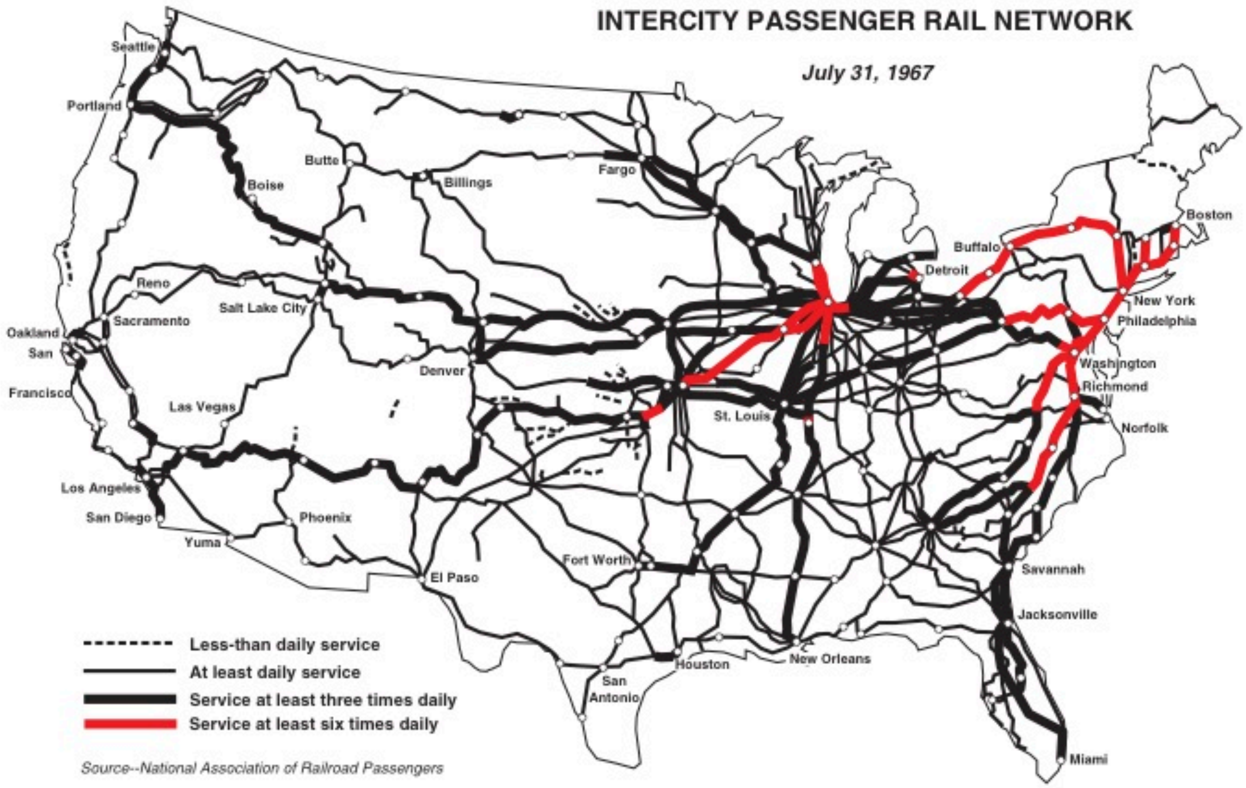
The last Pioneer timetable, November 1996. Courtesy The Museum of Railway Timetables. http://www.timetables.org/

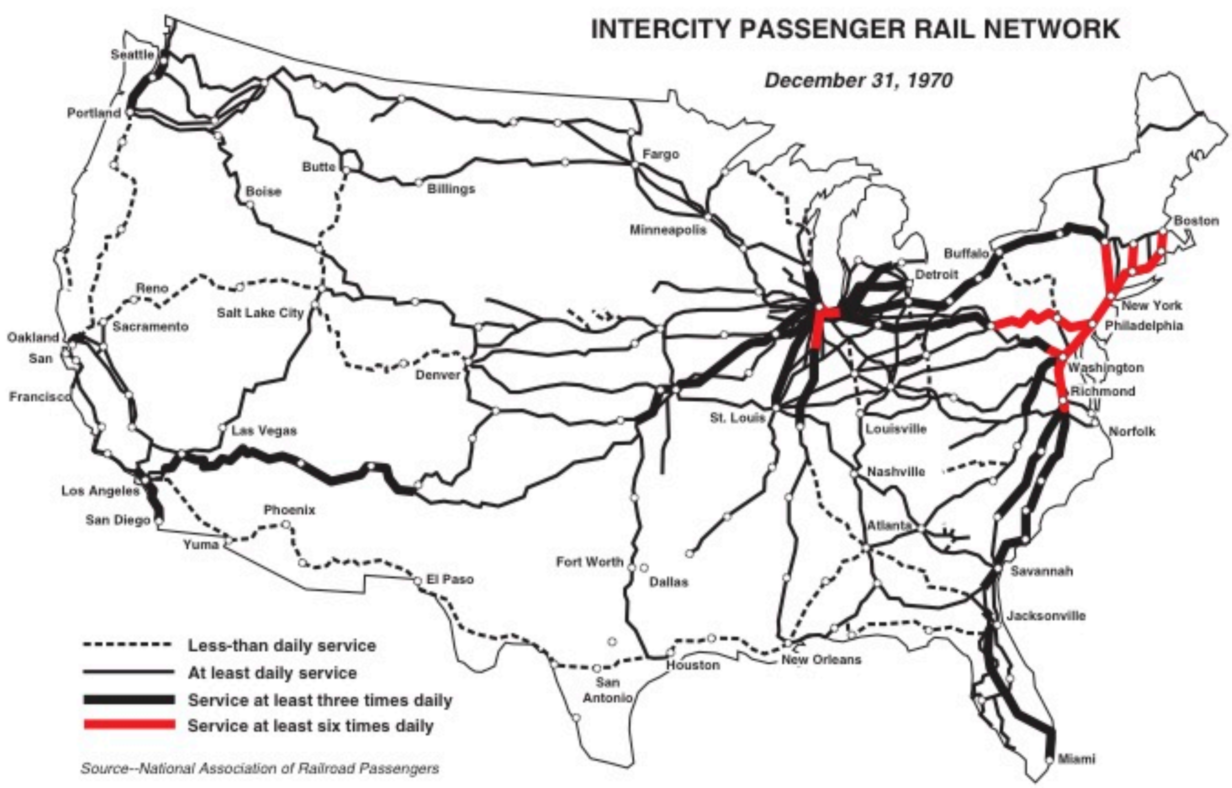
Wyden and Crapo didn't give up the fight, however. In legislation aimed at providing new congressional authorization for Amtrak's operation, they inserted language requiring Amtrak to study the possible restoration of the Pioneer from the Pacific Northwest across Idaho and on to Chicago. Idaho congressman Mike Simpson and Oregon congressmen Greg Walden and Earl Blumenauer joined the effort, and the provision entered the law as part of the Passenger Rail Improvement Act in October, 2008. Amtrak then began the feasibility study process. Today, that statute and the recent economic stimulus legislation are providing both political impetus and funding possibilities that make the return of the Pioneer more likely than it has ever been since it was terminated in 1997. The Pioneer Restoration Organization has come together to bring local communities behind the initiative, and before too long eager passengers may once again see that train coming round the bend…

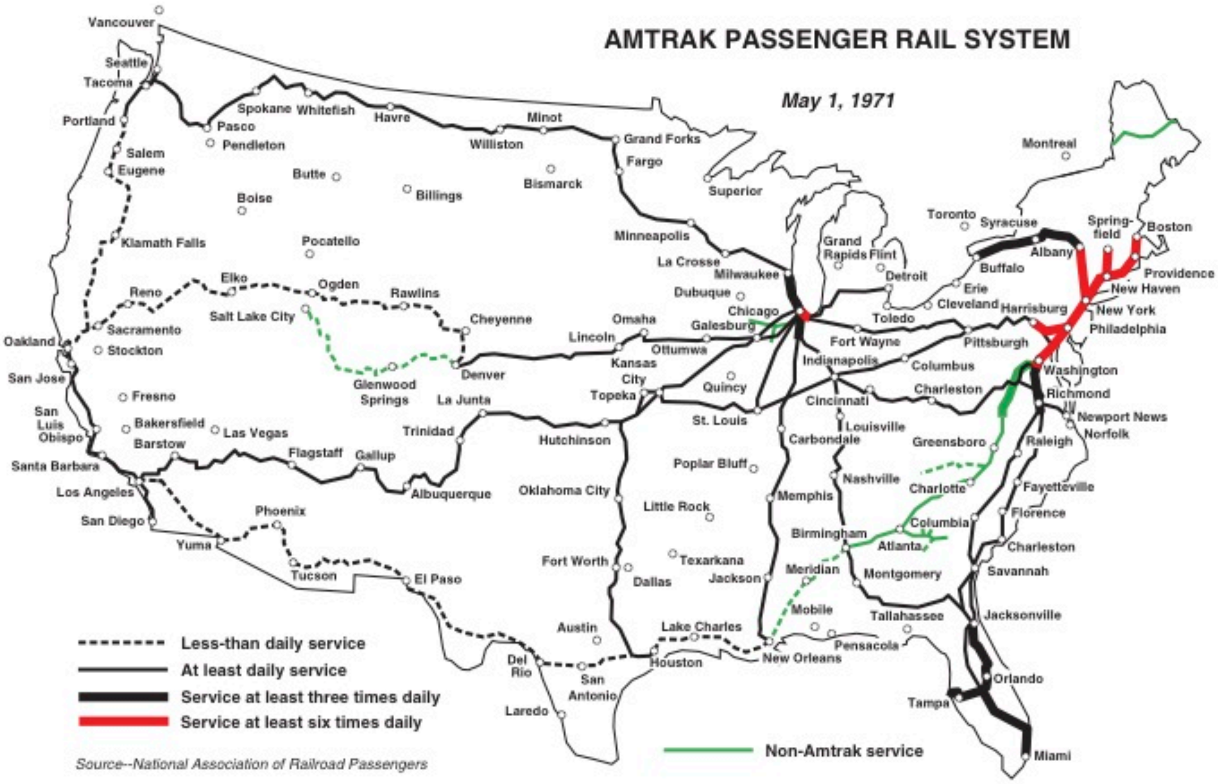
Decline of train service over the decades

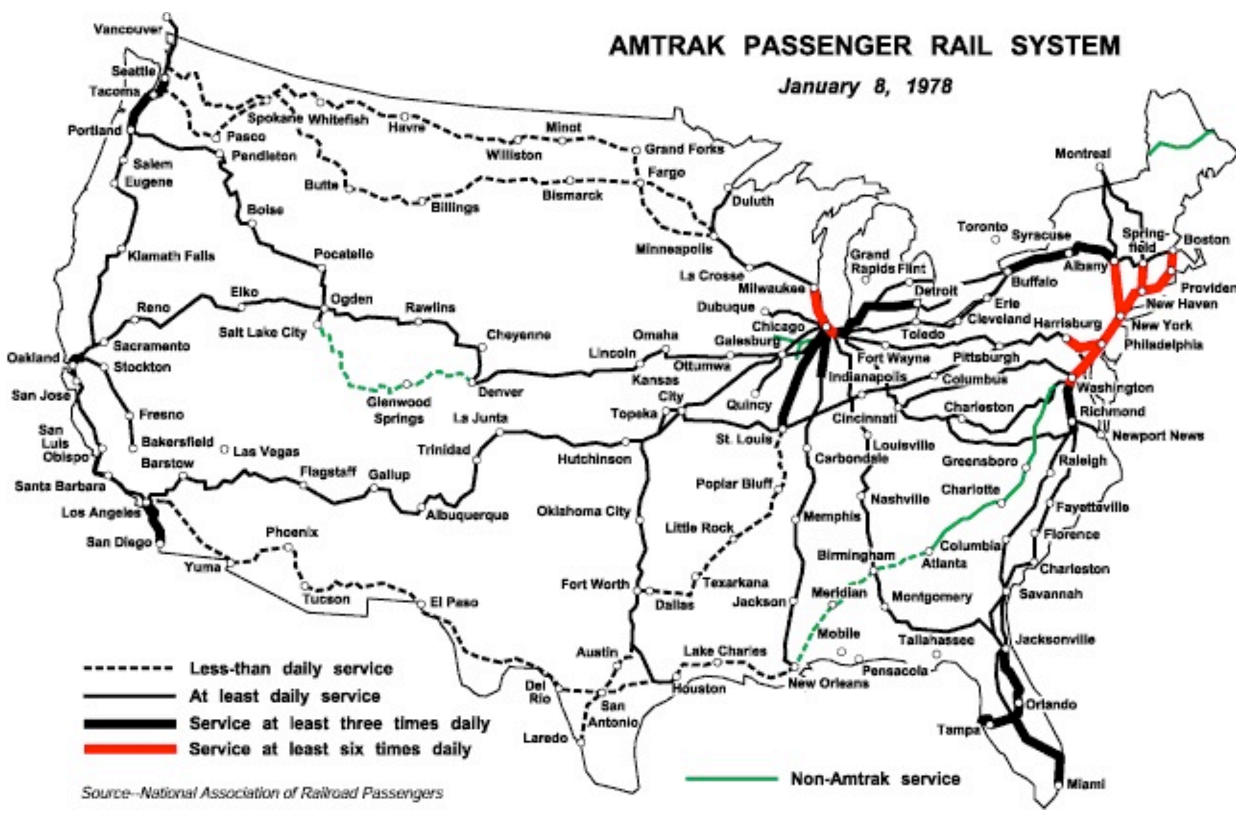
National rail maps from [National Assocation of Rail Passengers]

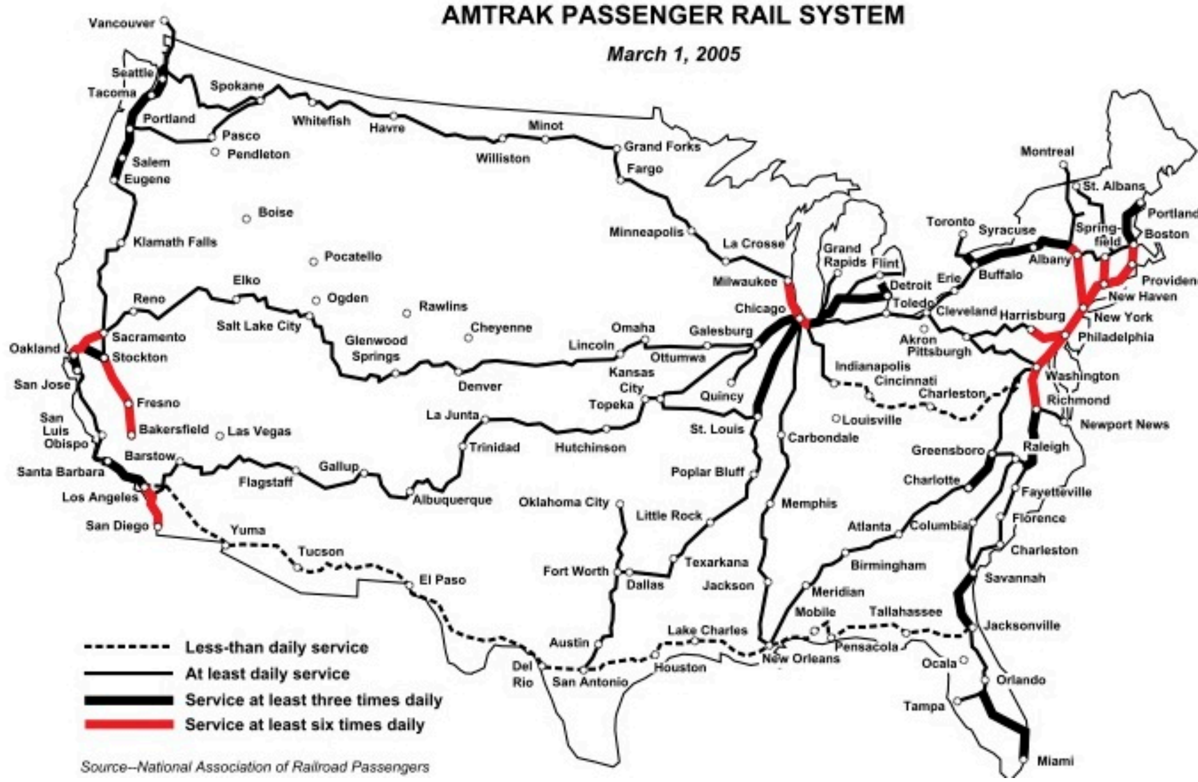



INTERCITY PASSENGER RAIL NETWORK
July 31, 1967
Seattle
Portland
Butte
Boise
Billings
Fargo
Boston
Buffalo
Detroit
Reno
Salt Lake City
Sacramento
Oakland
San Francisco
New York
Philadelphia
Denver
Washington
Richmond
Las Vegas
St. Louis
Norfolk
Los Angeles
San Diego
Phoenix
Yuma
Fort Worth
El Paso
Savannah
Jacksonville
Houston
New Orleans
San Antonio
Miami
Less-than daily service
At least daily service
Service at least three times daily
Service at least six times daily
Source--National Association of Railroad Passengers


INTERCITY PASSENGER RAIL NETWORK
December 31, 1970
Seattle
Portland
Fargo
Butte
Boise
Billings
Minneapolis
Boston
Buffalo
Detroit
Reno
Salt Lake City
Sacramento
Oakland
San Francisco
New York
Philadelphia
Denver
Washington
Richmond
St. Louis
Norfolk
Louisville
Las Vegas
Nashville
Los Angeles
San Diego
Phoenix
Atlanta
Yuma
El Paso
Fort Worth
Dallas
Savannah
Jacksonville
Houston
New Orleans
San Antonio
Miami
Less-than daily service
At least daily service
Service at least three times daily
Service at least six times daily
Source--National Association of Railroad Passengers


AMTRAK PASSENGER RAIL SYSTEM
May 1, 1971
Vancouver
Seattle
Tacoma
Portland
Pasco
Spokane
Whitefish
Havre
Minot
Williston
Grand Forks
Fargo
Pendleton
Salem
Eugene
Butte
Billings
Bismarck
Superior
Montreal
Boise
Klamath Falls
Pocatello
Minneapolis
La Crosse
Milwaukee
Grand Rapids
Flint
Detroit
Toronto
Syracuse
Spring-field
Boston
Albany
Buffalo
Providence
New Haven
New York
Philadelphia
Erie
Cleveland
Harrisburg
Pittsburgh
Reno
Elko
Ogden
Rawlins
Cheyenne
Salt Lake City
Sacramento
Stockton
Oakland
San Jose
Dubuque
Chicago
Galesburg
Omaha
Lincoln
Ottumwa
Toledo
Fort Wayne
Indianapolis
Columbus
Washington
Richmond
Glenwood Springs
Denver
La Junta
Kansas City
Topeka
Quincy
Cincinnati
Charleston
Fresno
Bakersfield
Las Vegas
San Luis Obispo
Barstow
Santa Barbara
Flagstaff
Gallup
Trinidad
Hutchinson
St. Louis
Louisville
Carbondale
Newport News
Norfolk
Greensboro
Raleigh
Los Angeles
San Diego
Albuquerque
Oklahoma City
Poplar Bluff
Nashville
Charlotte
Fayetteville
Phoenix
Little Rock
Memphis
Columbia
Florence
Yuma
Tucson
El Paso
Fort Worth
Dallas
Texarkana
Jackson
Birmingham
Atlanta
Meridian
Montgomery
Charleston
Savannah
Mobile
Tallahassee
Jacksonville
Austin
Lake Charles
Pensacola
New Orleans
Del Rio
San Antonio
Houston
Orlando
Laredo
Tampa
Miami
Less-than daily service
At least daily service
Service at least three times daily
Service at least six times daily
Non-Amtrak service
Source--National Association of Railroad Passengers


AMTRAK PASSENGER RAIL SYSTEM
January 8, 1978
Vancouver
Seattle
Tacoma
Portland
Spokane
Whitefish
Havre
Minot
Pasco
Pendleton
Williston
Grand Forks
Fargo
Salem
Eugene
Butte
Billings
Bismarck
Duluth
Montreal
Boise
Klamath Falls
Pocatello
Minneapolis
La Crosse
Milwaukee
Grand Rapids
Flint
Detroit
Toronto
Syracuse
Spring-field
Boston
Albany
Buffalo
Providence
New Haven
Erie
Cleveland
Harrisburg
New York
Philadelphia
Reno
Elko
Ogden
Rawlins
Salt Lake City
Cheyenne
Sacramento
Stockton
Oakland
San Jose
Dubuque
Chicago
Galesburg
Omaha
Lincoln
Ottumwa
Toledo
Fort Wayne
Pittsburgh
Indianapolis
Columbus
Washington
Glenwood Springs
Denver
La Junta
Kansas City
Topeka
Quincy
Cincinnati
Charleston
Richmond
Fresno
Bakersfield
Las Vegas
San Luis Obispo
Barstow
Trinidad
Hutchinson
St. Louis
Louisville
Carbondale
Newport News
Greensboro
Raleigh
Santa Barbara
Flagstaff
Gallup
Poplar Bluff
Charlotte
Los Angeles
San Diego
Albuquerque
Oklahoma City
Nashville
Fayetteville
Phoenix
Little Rock
Memphis
Columbia
Florence
Yuma
Birmingham
Atlanta
Charleston
Tucson
El Paso
Fort Worth
Dallas
Texarkana
Jackson
Meridian
Montgomery
Savannah
Mobile
Tallahassee
Jacksonville
Austin
Lake Charles
Pensacola
New Orleans
Del Rio
San Antonio
Houston
Orlando
Laredo
Tampa
Miami
Less-than daily service
At least daily service
Service at least three times daily
Service at least six times daily
Non-Amtrak service
Source--National Association of Railroad Passengers



Potemkin Party by James Howard Kunstler

kunstler.com/clusterfuck-nation/potemkin-party/

July 27, 2015

How many of you brooding on the dreadful prospect of Hillary have chanced to survey what remains of Democratic Party (cough cough) leadership in the background of Her Royal Inevitableness? Nothing is the answer. Zip. Nobody. A vacuum. There is no Democratic Party anymore. There are no figures of gravitas anywhere to be found, no ideas really suited to the American prospect, nothing with the will to oppose the lumbering parasitic corporatocracy that is doing little more than cluttering up this moment in history while it sucks the last dregs of value from our society.

I say this as a lifelong registered Democrat but a completely disaffected one — who regards the Republican opposition as the mere errand boy of the above-named lumbering parasitic corporatocracy. Readers are surely chafing to insert that the Democrats have been no less errand boys (and girls) for the same disgusting zeitgeist, and they are surely correct in the case of Hillary, and indeed of the current President.

Readers are surely also chafing to insert that there is Bernie Sanders, climbing in the opinion polls, disdaining Wall Street money, denouncing the current disposition of things with the old union hall surliness we've grown to know and love. I'm grateful that Bernie is in the race, that he's framing an argument against Ms. It's My Turn. **I just don't happen to think that Bernie gets what the country — indeed what all of techno-industrial society — is really up against, namely a long emergency of economic contraction and collapse.**

These circumstances require a very different agenda than just an I Dreamed I Saw Joe Hill redistributionist scheme. Lively as Bernie is, I don't think he offers much beyond that, as if cadging a little more tax money out of WalMart, General Mills, and Exxon-Mobil will fix what is ailing this sad-ass polity. The heart of the matter is that our way of life has shot its wad and now we have to live very differently. Almost nobody wants to even try to think about this.

I hugely resent the fact that the Democratic Party puts its time and energy into the stupid sexual politics of the day when it should be working on issues such as re-localizing commercial economies (rebuilding Main Streets), reforming agriculture to avoid the total collapse of corporate-industrial farming, and fixing the passenger rail system so people will have some way to get around the country when happy Motoring dies (along with commercial aviation).

The "to do" list for rearranging the basic systems of daily life in America is long and loaded with opportunity. Every system that is retooled contains jobs and social roles for people who have been shut out of the economy for two generations. If we do everything we can to promote smaller-scaled local farming, there will be plenty of work for lesser-skilled people to do and get paid for. Saying goodbye to the tyranny of Big Box commerce would open up vast vocational opportunities in reconstructed local and regional networks of commerce, especially for young people interested in running their own business. We need to prepare for localized clinic-style medicine (in opposition to the continuing amalgamation and gigantization of hospitals, with its handmaidens of Big Pharma and the insurance rackets). **The train system has got to be reborn as a true public utility. Just about every other civilized country is already demonstrating how that is done — it's not that difficult and it would employ a lot of people at every level.** That is what the agenda of a truly progressive political party should be at this moment in history.

That Democrats even tolerate the existence of evil entities like WalMart is an argument for ideological bankruptcy of the party. Democratic Presidents from Carter to Clinton to Obama could have used the Department of Justice and the existing anti-trust statutes to at least discourage the pernicious monopolization of commerce that Big Boxes represented. By the same token, President Obama could have used existing federal law to break up the banking oligarchy starting in 2009, not to mention backing legislation to more crisply define alleged corporate "personhood" in the wake of the ruinous "Citizens United" Supreme Court decision of 2010. They don't even talk about it because Wall Street owns them.

So, you fellow disaffected Democrats — those of you who can't go over to the other side, but feel you have no place in your country's politics — look around and tell me who you see casting a shadow on the Democratic landscape. Nobody. Just tired, corrupt, devious old Hillary and her nemesis Bernie the Union Hall Champion out of a Pete Seeger marching song.

I've been saying for a while that this period of history resembles the 1850s in America in two big ways: 1) our society faces a crisis, and 2) **the existing political parties are not up to the task of comprehending what society faces.** In the 1850s it was the Whigs that dried up and blew away (virtually overnight), while the old Democratic party just entered a 75-year wilderness of irrelevancy. God help us if Trump-o-mania turns out to be the only alternative.

Oh, by the way, notice that the lead editorial in Monday's New York Times is a plea for transgender bathrooms in schools. What could be more important? For Transgender Americans, Legal Battles Over Restrooms

High Speed Rail

Japanese bullet train passing by Mt. Fuji.

Amtrak Acela - the fastest train in the US. It can reach top speed of 150 mph / 250 kph -- on short sections of track in Rhode Island and Massachusetts. Most of the route has track and overhead wires designed for slower speeds.

http://prorevnews.blogspot.com/2010/12/morning-line-why-infatuation-with-high.html
December 29, 2010
Morning line: Why the infatuation with high speed rail?
Sam Smith, The Progressive Review

> For some time I've been trying to figure out why the Obama admnistration has placed so much emphasis on high speed rail and so little on the ordinary kind, which would serve a far broader and less wealthy segment of the country. Was it just another example of class theft? Was it the companies behind the contracts?
>
> Such factors play a role, but it has recently occurred to me that the real reason may not have anything to do with passenger service at all. It may be that Obama wanted to appear to be doing something grand in the transportation field while at the same time doing nothing that would offend the

trucking lobby. High speed rail would be perfect as it minimizes any advantage to conventional and badly needed freight rail service.

There is absolutely no transportation or environmental reason not to improve conventional frieght and rail service but if you can find an alternative that makes the yuppies and the truckers happy at the same time, why bother?

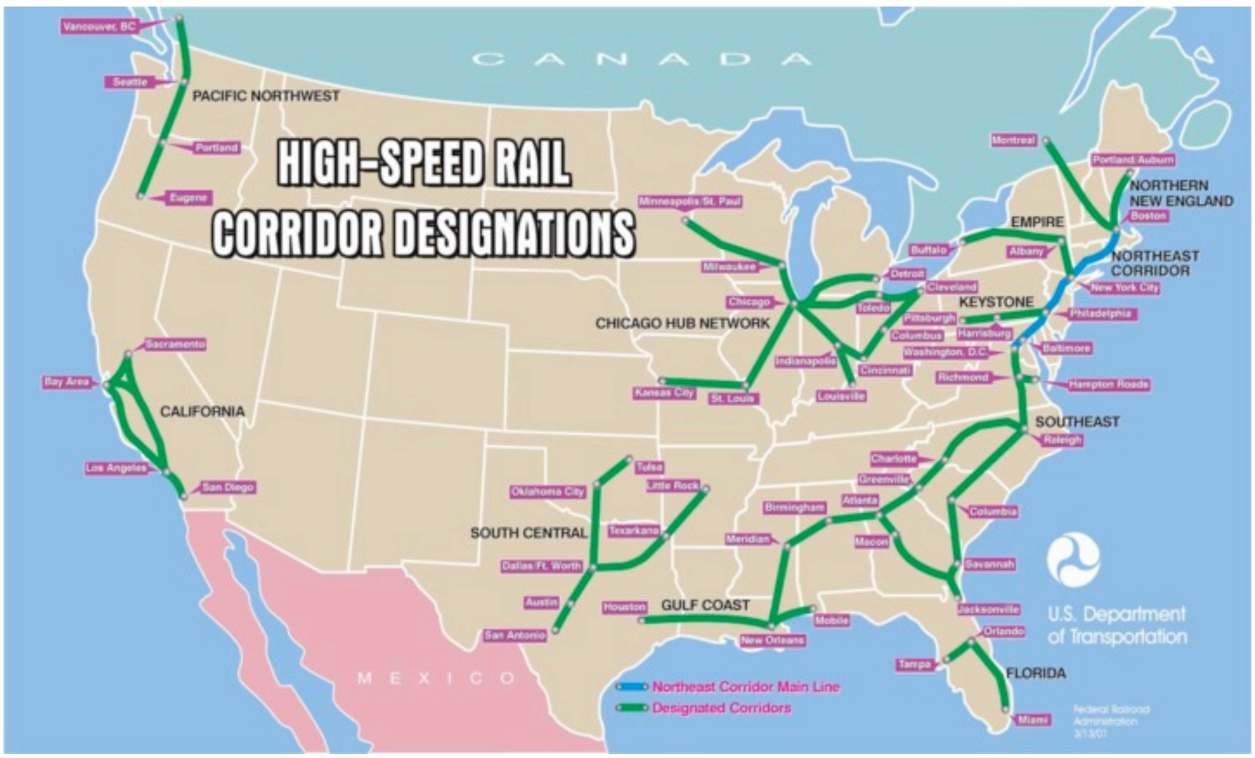
http://prorevnews.blogspot.com/2011/02/high-speed-rail-for-high-incomes.html

FEBRUARY 10, 2011

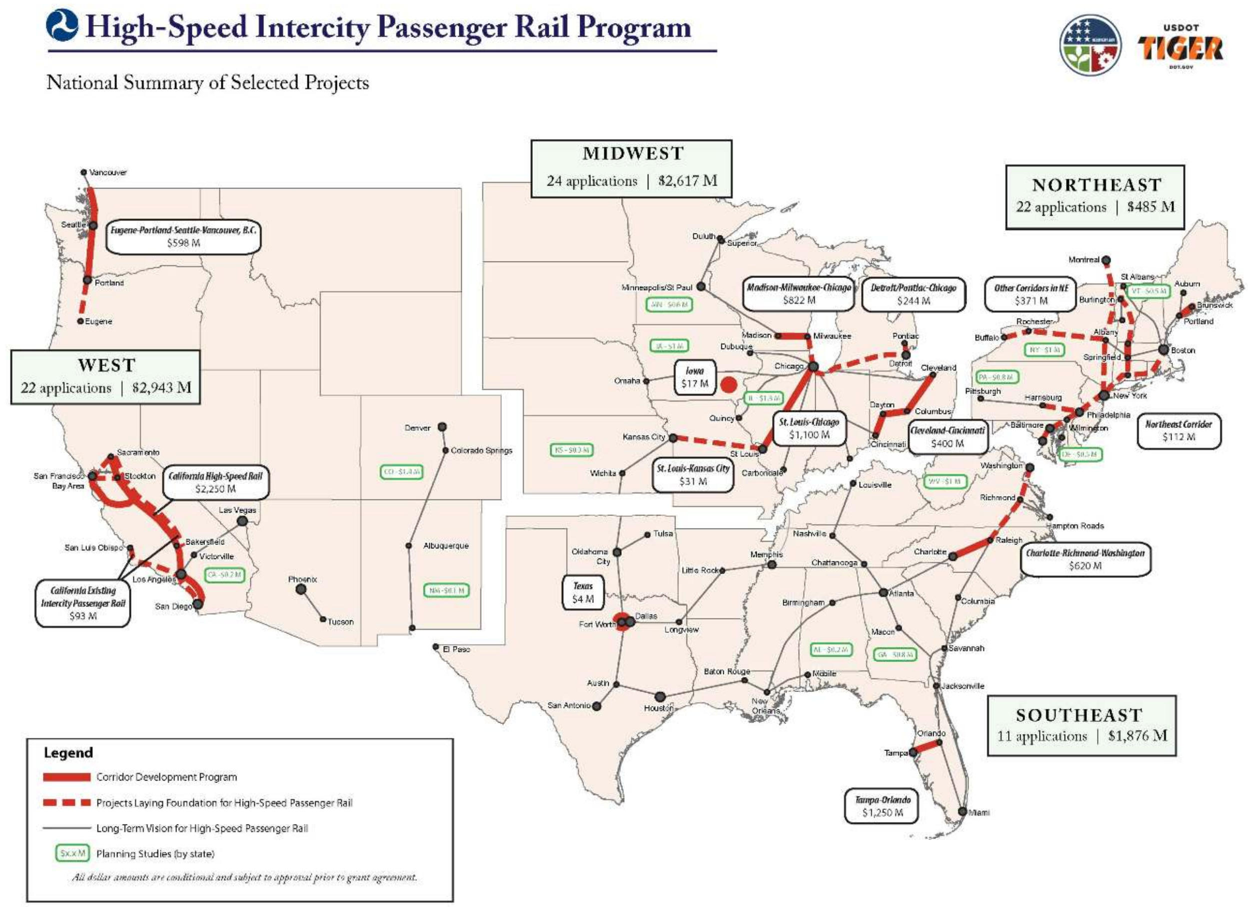
High speed rail for high incomes
Sam Smith

The only serious analysis of high speed rail we've seen in the archaic media has come from economist Robert Samuelson. Why so little? Because basically, high speed rail is basically an earmark for the business class, for reporters whose travel is reimbursed and for other upscale riders.

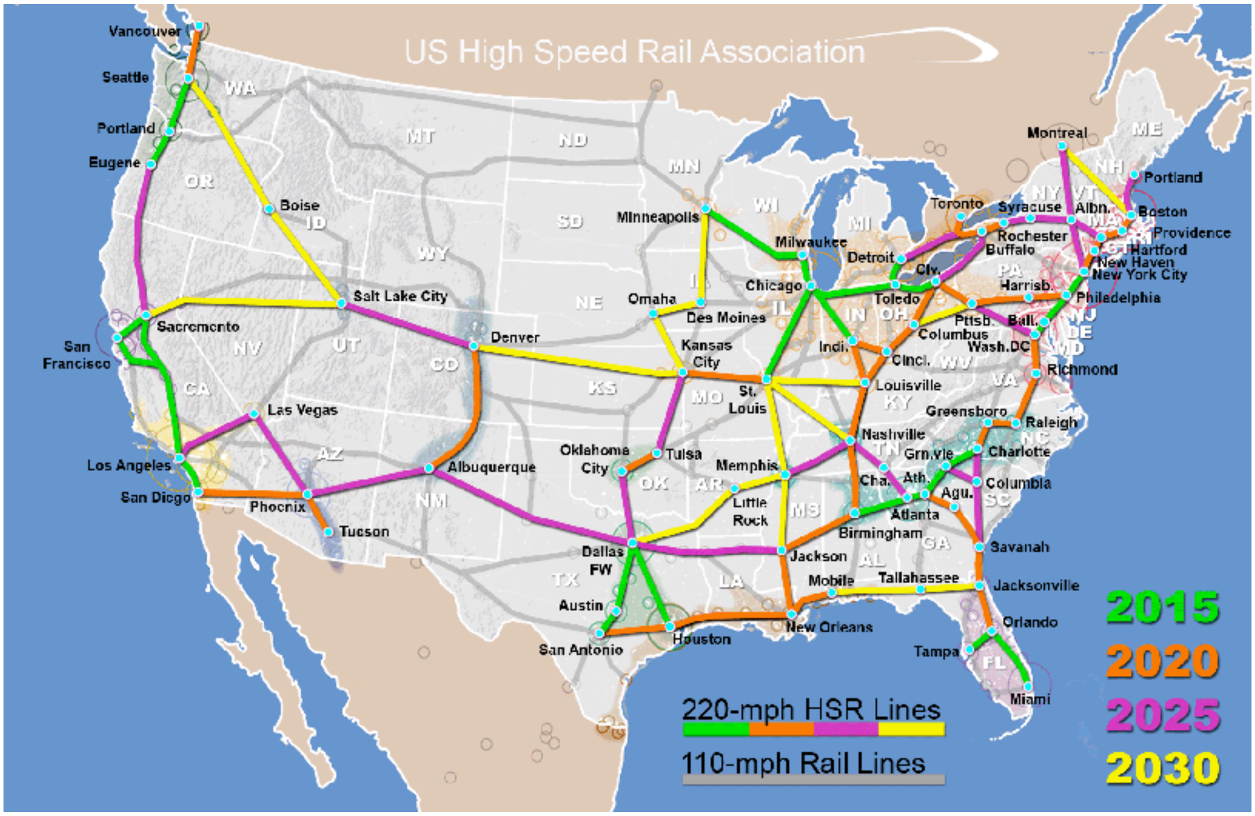
Looked at from an economic perspective, it is the class equivalent of ethnic segregation: the elite get to go high speed rail, the rest sit in the back of the bus. There's billions in funding for the former and little for the latter or for conventional rail.



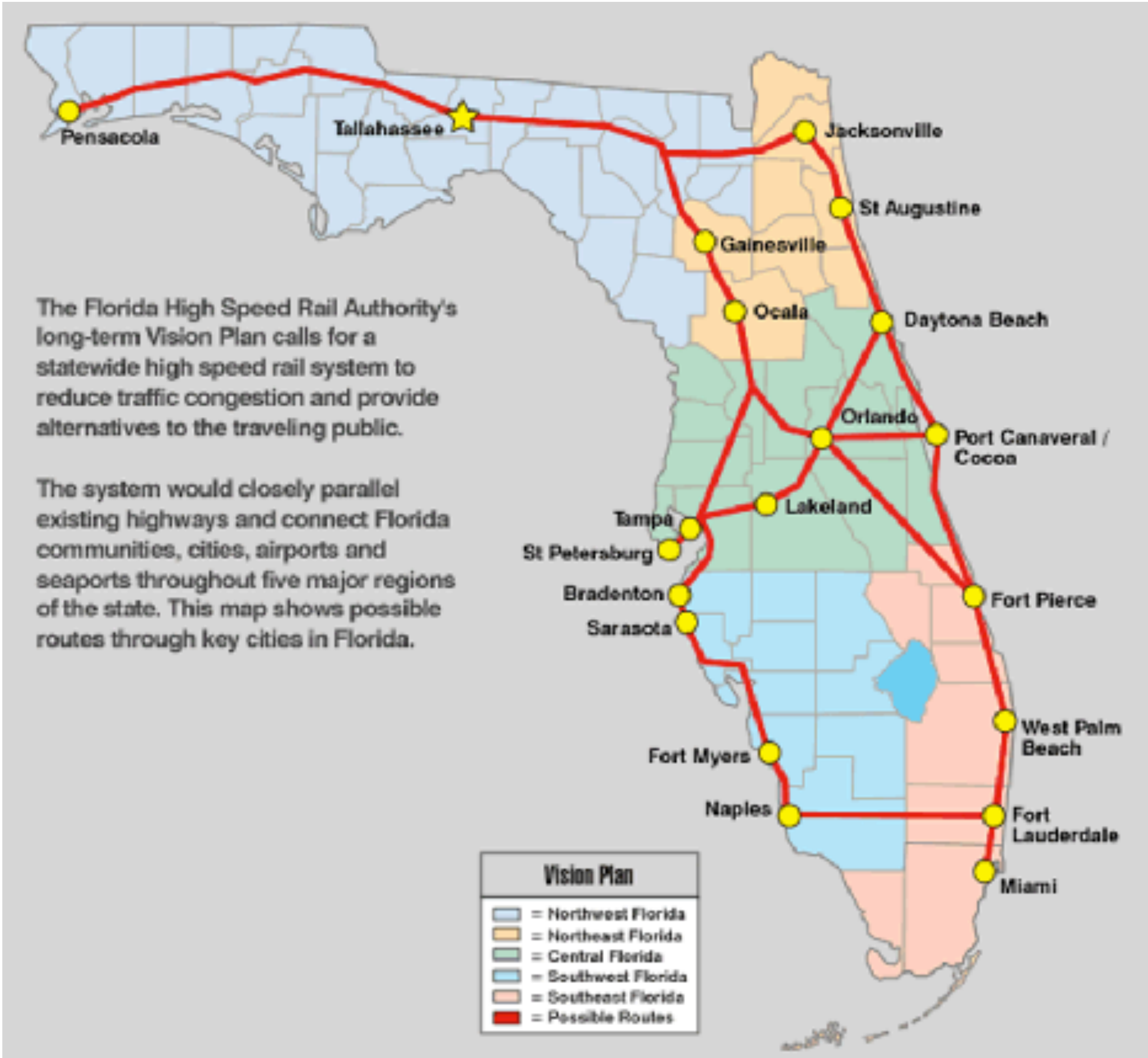
High speed rail proposal made during the George W. Bush administration.



Subsequent high speed rail proposal by the Obama administration.

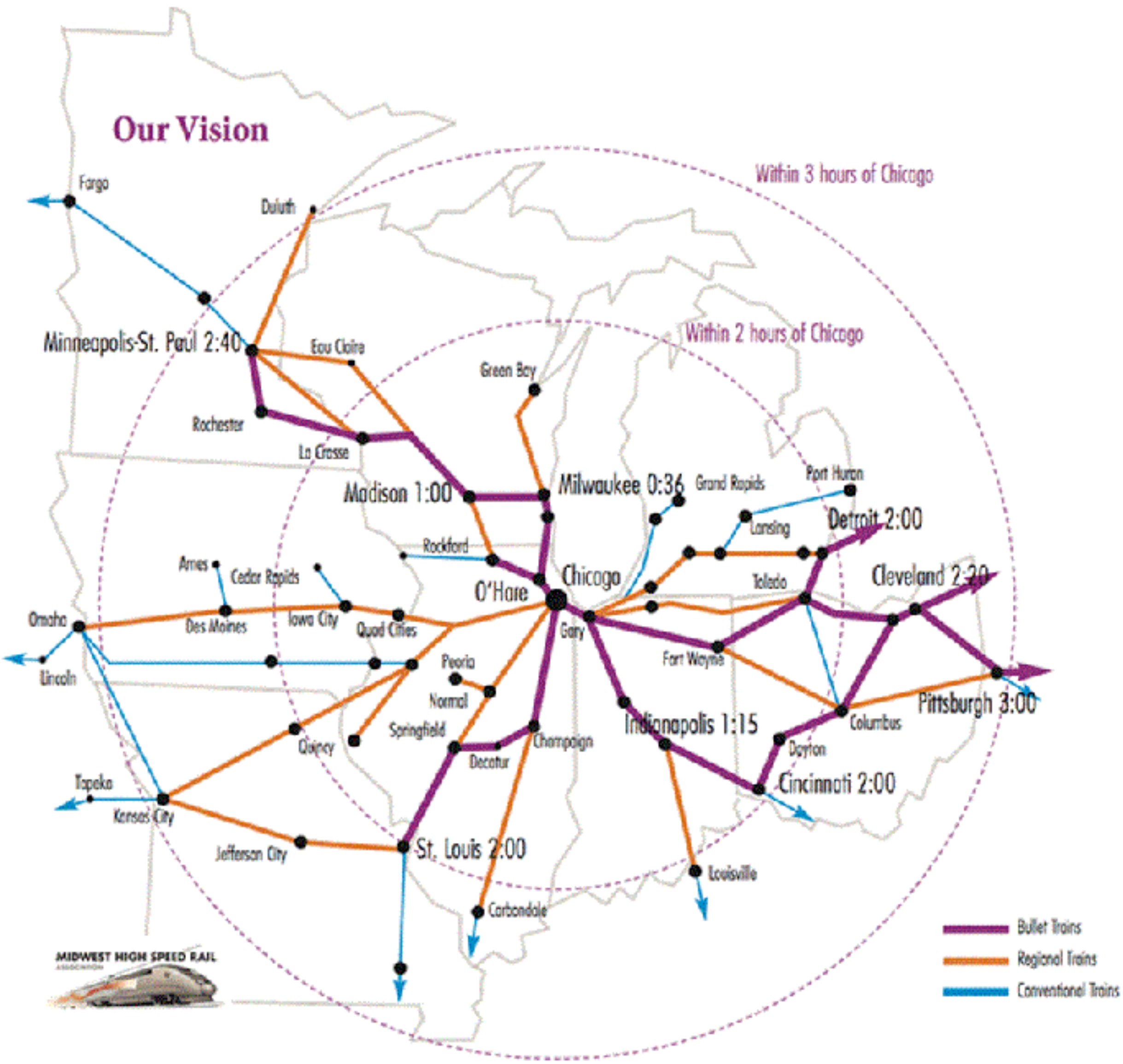


Non-governmental proposal for national high speed rail network. The "2015" deadline wasn't met anywhere with super high speed rail -- or even modest upgrades to existing Amtrak intercity service. Meanwhile, construction of new fighter planes and aircraft carriers continue to soak up hundreds of billions of dollars.



Florida high speed rail concept rejected by the Republican controlled state government due to partisan politics. Oil depletion poses risks to the influx of tourists who visit Florida (and use transportation systems), so perhaps a modern train network will not be needed in the Sunshine state. Florida is famous for having lots of elderly people, many of whom no longer drive, but most of the state has little or no public transportation.

It is likely climate change caused sea level rise will interfere with coastal cities before Florida high speed rail is built.



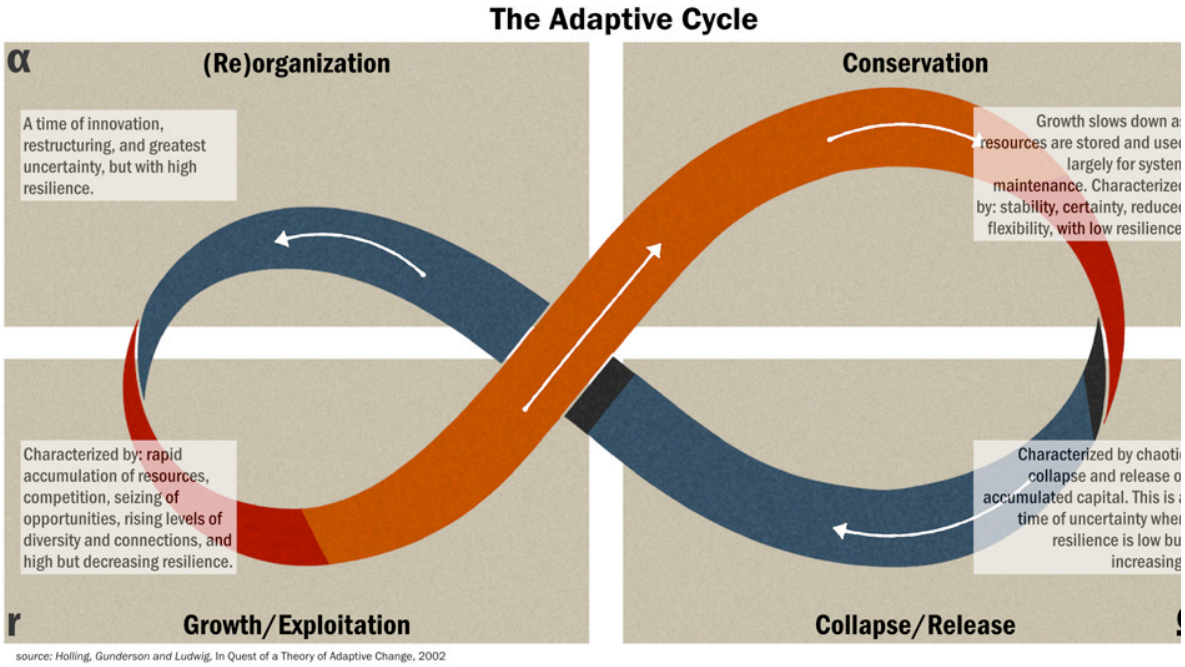
Midwest high speed and higher speed train network proposed by Midwest High Speed Rail Association. Chicago is the second largest rail hub in the US, after New York City.

The Big Picture: By Richard Heinberg, originally published by Resilience.org December 17, 2018

https://www.resilience.org/stories/2018-12-17/the-big-picture/

Humanity has a lot of problems these days. Climate change, increasing economic inequality, crashing biodiversity, political polarization, and a global debt bubble are just a few of our worries. None of these trends can continue indefinitely without leading to a serious failure of our civilization's ability to maintain itself. Taken together, these metastasizing problems suggest we are headed toward some kind of historic discontinuity.

Serious discontinuities tend to disrupt the timelines of all complex societies (another name for civilizations—that is, societies with cities, writing, money, and full-time division of labor). The ancient Roman, Egyptian, and Mayan civilizations all collapsed. Archaeologists, historians, and systems thinkers have spent decades seeking an explanation for this pattern of failure—a general unified theory of civilizational collapse, if you will. One of the most promising concepts that could serve as the basis for such a theory comes from resilience science, a branch of ecology (the study of the relationship between organisms and their environments).



Why Civilizations Collapse: The Adaptive Cycle

Ecosystems have been observed almost universally to repeatedly pass through four phases of the adaptive cycle: exploitation, conservation, release, and reorganization. Imagine, for example, a Ponderosa pine forest. Following a disturbance such as a fire (in which stored carbon is *released* into the environment), hardy and adaptable "pioneer" species of plants and small animals fill in open niches and reproduce rapidly.

This *reorganization* phase of the cycle soon transitions to an *exploitation* phase, in which those species that can take advantage of relationships with other species start to dominate. These relationships make the system more stable, but at the expense of diversity.

During the *conservation* phase, resources like nutrients, water, and sunlight are so taken up by the dominant species that the system as a whole eventually loses its flexibility to deal with changing conditions. These trends lead to a point where the system is susceptible to a crash—a *release* phase. Many trees die, dispersing their nutrients, opening the forest canopy to let more light in, and providing habitat for shrubs and small animals. The cycle starts over.

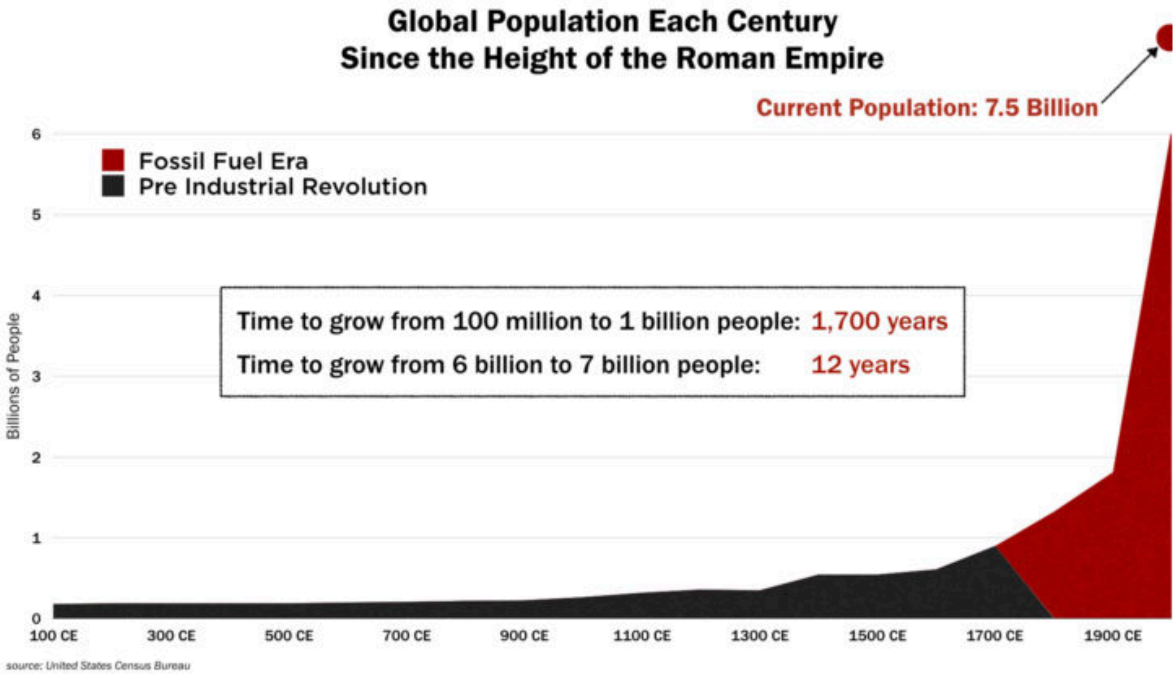
Civilizations do roughly the same thing. In their early days, complex societies are populated with generalist pioneers (people who do lots of things reasonably well) living in an environment with abundant resources ready to be exploited. These people develop tools to enable them to exploit their resources more effectively. Division of labor and trade with increasingly distant regions also aids in more thorough resource exploitation. Trading and administrative centers, i.e., cities, appear and grow. Money is increasingly used to facilitate trade, while debt enables a transfer of consumption from the future to the present. Specialists in violence, armed with improved weaponry, conquer surrounding peoples.

Complexity (more kinds of tools, more social classes, more specialization) solves problems and enables accumulation of wealth, leading to a conservation phase during which an empire is built and great achievements are made in the arts and sciences. However, as time goes on, the costs of complexity accumulate and the resilience of the society declines. Tax burdens become unbearable, natural resources become depleted, environments become polluted, and conquered peoples become restless. At its height, each civilization appears stable and invincible. Yet it is just at this moment of triumph that it is vulnerable to external enemies and internal discord. Debt can no longer be repaid. Conquered peoples revolt. A natural disaster breaks open the façade of stability and control.

Collapse often comes swiftly, leaving ruin in its wake. But at least some of the components that made the civilization great (including tools and elements of practical knowledge) persist, and the natural environment has opportunity to regenerate and recover, eventually enabling reorganization and a new exploitation phase—that is, the rise of yet another civilization.

Energy Is Everything

Global industrial civilization shows significant signs of being in its conservation phase. Our accomplishments are mind-boggling, but our systems are overstretched, and problems (including climate change, inequality, and political dysfunction) are accumulating and worsening. However, our civilization is different from any of its predecessors. Unlike the ancient Romans, Greeks, Egyptians, Shang Dynasty Chinese, Incas, Aztecs, and Mayans, we have built a civilization that is global in scope. We have invented modes of transportation and communication previously unimaginable. Thanks to advances in public health and agriculture, the total human population has grown to many times its size when Roman armies marched across North Africa, Europe, and Britain. Have we perhaps outgrown the adaptive cycle and escaped natural checks to perpetual expansion?



In order to answer the question, we must first inquire *why* modern civilization has been so successful. The rise of technology, including advances in metallurgy and engineering, certainly played a part. These provided better ways of obtaining and harnessing energy. But it's the rapid shift in *qualities* and *quantities* of energy available to us that really made the difference.

Previously, people derived their energy from annual plant growth (food and firewood), and manipulated their environment using human and animal muscle power. These energy sources were inherently limited. But, starting in the 19th century, new technologies enabled us to access and harness the energy of fossil fuels. And fossil fuels—coal, oil, and natural gas—were able to provide energy in amounts far surpassing previous energy sources.

Energy is everything. All terrestrial ecosystems and all human societies are essentially machines for using (and dissipating) solar energy that has been collected and concentrated through photosynthesis. We like to think that money makes the world go 'round, but it is actually energy that enables us to do anything at all—from merely getting up in the morning to launching a space station. And having lots of energy available cheaply can enable us to do a great deal.

Fossil fuels represent tens of millions of years' worth of stored ancient sunlight. They are energy-dense, portable, and storable sources of power. Accessing them changed nearly everything about human existence. They were uniquely transformative in that they enabled higher rates of harvesting and using all other resources—via tractors, bulldozers, powered mining equipment, chainsaws, motorized fishing trawlers, and more.

Take just one example. In all previous agrarian civilizations, roughly three-quarters of the population had to farm in order to supply a food surplus to support the other 25 percent—who lived as aristocrats, traders, soldiers, artisans, and so on. Fossil fuels enabled the industrialization and automation of agriculture, as well as longer-distance distribution chains.

Harvesting corn by hand (left) versus harvesting by machine (right). Image sources: The Harvest Cradle by John Linnell, Public Domain (left). Deer Harvester by Wesley Hetrick, Creative Commons Non-Commercial 2.0 Generic License (right).

Today only one or two percent of the U.S. population need to farm full-time in order to supply everyone else with food. The industrialization of food systems has freed up nearly all of the former peasant class to move to cities and take up jobs in manufacturing, marketing, finance, advertising, management, sales, and so on. Thus urbanization and the dramatic expansion of the middle class during the 20th century were almost entirely attributable to fossil fuels.

But fossil fuels have been a bargain with the devil: these are depleting, non-renewable resources, and burning them produces carbon dioxide and other greenhouse gases, changing the climate and the chemistry of the world's oceans. These are not small problems. Climate change by itself is far and away the most serious pollution dilemma any human society has ever faced, and could lead to crashing ecosystems, failing food systems, and widespread forced human migration.

Replacing fossil fuels with other energy sources is possible in principle, but doing so fully would require massive investment, not just for building solar panels, wind turbines, or nuclear reactors (there are some other serious problems with this latter option), but also for the retooling of manufacturing, transportation, buildings, and food systems to run on electricity instead of solid, liquid, or gaseous fuels. An energy transition is needed, but it's not happening at even nearly the pace that would be required in order to forestall catastrophic climate change or to prevent economic decline resulting from the depletion of the world's highest quality oil, coal, and gas resources. Industrial society's failure to make this energy transition is no doubt due not just to well-funded opposition by the fossil fuel industry, but also to the enormous technical challenge posed, and to the failure of policy makers to champion and implement the carbon taxes and alternative energy subsidies that would be needed.

And so we accelerate toward ecological and economic ruin.

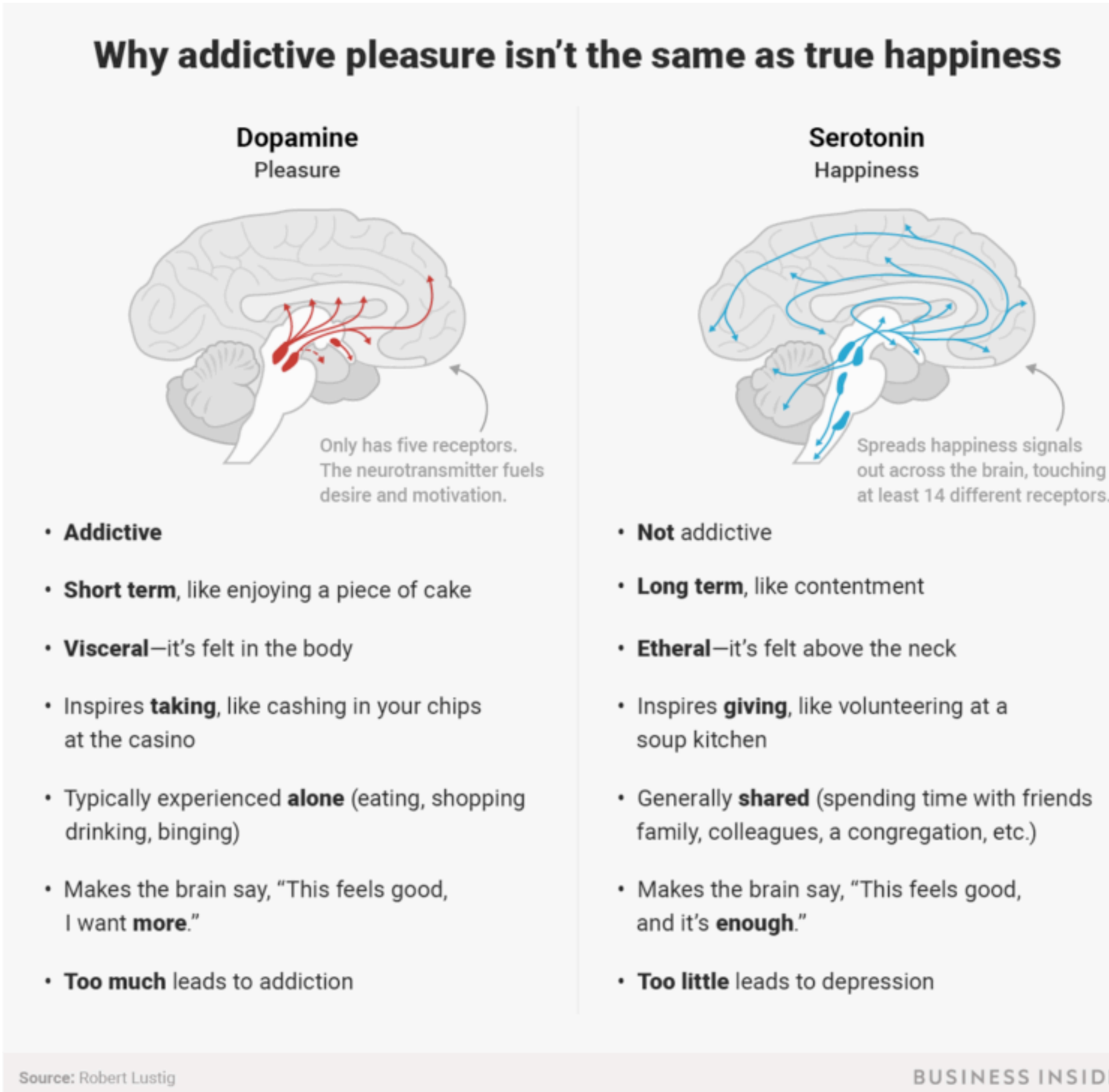
Why It's So Hard to See that We're Headed for the Biggest Crash Ever

This is fairly typical of what happens toward the end of the conservation phase of every civilization's adaptive cycle. Each problem that arises, taken by itself, is usually solvable—at least in principle. But, as problems accumulate, leaders who are accustomed to (and benefit from) the status quo grow increasingly reluctant to undertake the changes to systems and procedures that would be required in order to address worrisome trends. And as those trends are ignored, the level of effort and discomfort needed to reverse them soars. Once solving problems requires too much perceived sacrifice, the only realistic ways to deal with them are to deny their existence or to blame others for them. Blame has the advantages of enabling leaders to look as though they're actually doing something, and of winning loyalty from their followers. But it does nothing to actually stave off snowballing crises.

It's easy enough to see how elites could lose touch with reality and miss signals of impending collapse. But why would everyone else follow suit? Recent discoveries in neuroscience help explain why it's hard for most of us to grasp that we're on an unsustainable path.

We humans have an understandable innate tendency, when making decisions, to give more weight to *present* threats and opportunities than to *future* ones. This is called discounting the future—and it makes it hard to sacrifice now to overcome an enormous future risk such as climate change. The immediate reward of vacationing in another country, for example, is likely to overwhelm our concern about the greenhouse gas footprint of our airline flight. Multiply that future-discounting tendency in one instance by the billions of individual decisions with climate repercussions and you can see why it's difficult to actually reduce our total greenhouse gas emissions.

We humans are also wired to respond to novelty—to notice anything in our environment that is out of place or unexpected and that might signal a potential threat or reward. Most types of reward increase the level of the neurotransmitter dopamine within the brain. Experiments have found that if an animal's dopamine receptor genes are removed, it explores less and takes fewer risks—and without some exploration and risk taking, individuals have reduced chances of survival. But the human brain's dopamine reward system, which evolved to serve this practical function, can be hijacked by addictive substances and behaviors. This is especially problematic in a culture full of novel stimuli specifically designed to attract our interest—such as the hundreds of advertising messages the average child sees each day. We have become addicted to stimuli that our culture has multiplied and refined specifically for the purpose of grabbing our attention (for fun and profit) to such a degree that we barely notice long-term trends that are as threatening as a charging rhino.



The power holders in society incentivize smart people below them in rank and wealth to normalize the unsustainable, deny impending consequences, and distract one and all from worsening contradictions. Economists who claim that economic growth can continue forever on a finite planet win Nobel Prizes. Politicians who argue that climate change is a hoax attract big campaign contributions. Pundits and entrepreneurs advance along their career paths by asserting that society can grow its way out of climate change and resource depletion traps through "decoupling" (service economies, it is claimed, can expand in perpetuity without requiring additional energy or physical resources). Technology mavens win fame and glory by informing us that artificial intelligence, 3D printing, or Blockchain will usher in the "singularity," at which point no one will have to work and all human needs and desires can be satisfied by self-reproducing machines.

Denial comes in shades, some of them quite benign. Many thoughtful and informed people acknowledge the threats of climate change, species extinctions, soil depletion, and so on, and insist that we can overcome these threats if we just try harder. They are often on the right track when they propose changes. Elect different, more responsible politicians. Donate to environmental nonprofit organizations. Drive an electric car. Put solar panels on our roofs. Start solar co-ops or regional non-profit utility companies that aim to source all electricity from renewable sources. Eat organic food. Shop at local farmers markets. These are all actions that move society in the right direction (that is, away from the brink of failure)—but in small increments. Perhaps people can be motivated to undertake such efforts through the belief that a smooth transition and a happy future are possible, and that renewable energy will create plentiful jobs and lead to a perpetually growing green economy. There is no point in discouraging such beliefs and their related actions; quite the contrary: they should, if anything, be encouraged. Such practical efforts, however motivated or rationalized, could help moderate collapse, even if they can't prevent it (a point we'll return to below). But an element of denial persists nonetheless—denial, that is, of the reality that the overall trajectory of modern industrial society is beyond our control, and that it leads inexorably toward overshoot and collapse.

What to Do?

All of the above may help us better understand why the world seems to be running off the rails. But the implications are horrific. If all this is true, then we now face more-or-less inevitable economic, social, political, and ecological calamity. And since industrial civilization is now global, and human population levels are multiples higher than in any previous century, this calamity could occur on a scale never seen before. Although no one can possibly predict at this point just how complete and awful collapse might actually be, even human extinction is conceivable (though no one can say with any confidence that it is likely, much less inevitable).

This is more than a fragile human psyche can bear. One's own mortality is hard enough to contemplate. A school of psychology ("terror management theory") proposes that many of our cultural institutions and practices (religion, values of national identity) exist at least in part to help us deal with the intolerable knowledge of our inevitable personal demise. How much harder must it be to acknowledge signs of the imminent passing of one's entire way of life, and the extreme disruption of familiar ecosystems? It is therefore no wonder that so many of us opt for denial and distraction.

There's no question that *collapse* is a scary word. When we hear it, we tend to think immediately of images from movies like *Mad Max* and *The Road*. We assume collapse means a sudden and complete dissolution of everything meaningful. Our reasoning shuts down. But this is just when we need it most.

In reality, there are degrees of collapse, and history shows that the process has usually taken decades and sometimes centuries to unfold, often in stair-steps punctuated by periods of partial recovery. Further, it may be possible to intervene in collapse to improve outcomes—for ourselves, our communities, our species, and thousands of other species. After the collapse of the Roman Empire, medieval Irish monks may have "saved civilization" by memorizing and transcribing ancient texts. Could we, with planning and motivation, do as much and more?

"Desolation" by Thomas Cole (1836), the fourth of a five-part series called The Course of Empire. Public Domain.

Many of the things we could do toward this end are already being done in order to avert climate change and other converging crises. Again, people who voluntarily reduce energy usage, eat locally grown organic food, make the effort to get to know their neighbors, get off the consumer treadmill, reduce their debt, help protect local biodiversity by planting species that feed or shelter native pollinators, use biochar in their gardens, support political candidates who prioritize addressing the sustainability crisis, and contribute to environmental, population, and human rights organizations are all helping moderate the impending collapse and ensure that there will be more survivors. We could do more. Acting together, we could start to re-green the planet; begin to incorporate captured carbon not only in soils, but in nearly everything we make, including concrete, paper, and plastics; and design a new economic system based on mutual aid rather than competition, debt, and perpetual growth. All of these efforts make sense with or without the knowledge that civilization is nearing its sell-by date. How we describe the goals of these efforts—whether as ways of improving people's lives, as ways to save the planet, as fulfilling the evolutionary potential of our species, as contributing to a general spiritual awakening, or as ways of moderating an inevitable civilizational crash—is relatively unimportant.

However, the Big Picture (an understanding of the adaptive cycle, the role of energy, and our overshoot predicament) adds both a sense of urgency, and also a new set of priorities that are currently being neglected. For example, when civilizations collapse, culturally significant knowledge is typically lost. It's probably inevitable that we will lose a great deal of our shared knowledge during the coming centuries. Much of this information is trivial anyway (will our distant descendants really suffer from not having the ability to watch archived episodes of *Let's Make a Deal* or *Storage Wars*?). Yet people across the globe now use fragile storage media—computer and server hard drives—to store everything from music to books to instruction manuals. In the event that the world's electricity grids could no longer be maintained, we would miss more than comfort and convenience; we could lose science, higher mathematics, and history.

It's not only the dominant industrial culture that is vulnerable to information loss. Indigenous cultures that have survived for millennia are being rapidly eroded by the forces of globalization, resulting in the extinction of region-specific knowledge that could help future humans live sustainably.

Upon whom does the responsibility fall to curate, safeguard, and reproduce all this knowledge, if not those who understand its peril?

Act Where You Are: Community Resilience

We at Post Carbon Institute (PCI) have been aware of the Big Picture since the founding of the organization 15 years ago. We've been privileged to meet, and draw upon the insights of, some of the pioneering ecologists of the 1960s, '70s, and '80s who laid the basis of our current understanding of resilience science, systems thinking, climate change, resource depletion, and much more. And we've strived to convey that understanding to a younger generation of thinkers and activists.

Throughout this time, we have continually grappled with the question, "What plan for action makes the most sense in the context of the Big Picture, given our meager organizational resources?"

After protracted discussion, we've hit upon a four-fold strategy.

Encourage resilience building at the community level.

Resilience is the capacity of a system to encounter disruption and still maintain its basic structure and functions. When it is in its conservation phase, a system's resilience is typically at its lowest level throughout the entire adaptive cycle. If it is possible at this point to build resilience into the human social system, and ecological systems, then the approaching release phase of the cycle may be more moderate and less intense.

Why undertake resilience building in communities, rather than attempting to do so at the national or international level? It's because the community is the most available and effective level of scale at which to intervene in human systems. National action is difficult these days, and not only in the United States: discussions about nearly everything quickly become politicized, polarized, and contested. It's at the community level where we most directly interact with the people and institutions that make up our society. It's where we're most affected by the decisions society makes: what jobs are available to us, what infrastructure is available for our use, and what policies exist that limit or empower us. And critically, it's where the majority of us who do *not* wield major political or economic power can most directly affect society, as voters, neighbors, entrepreneurs, volunteers, shoppers, activists, and elected officials.

PCI has supported Transition Initiatives since its inception as one useful, locally replicable, and adaptable model for community resilience building.

Leave good ideas lying around.

Naomi Klein, in her book *The Shock Doctrine*, quotes economist Milton Friedman, who wrote:

"Only a crisis—actual or perceived—produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around. That, I believe, is our basic function: to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes the politically inevitable."

Friedman and other neoliberal economists have used this "shock doctrine" for decades to undermine regional economies, national governments, and indigenous cultures in order to further the project of corporate-led economic globalization. Klein's point is that the key to taking advantage of crises is having effective system-changing plans waiting in the wings for the ripe moment. And that's a strategy that makes sense as society as a whole teeters on the brink of an immensely disruptive shift.

What ideas and skills need to be lying around as industrial civilization crumbles? One collection of ideas and skills that's already handily packaged and awaiting adoption is permaculture—a set of design tools for living created by ecologists back in the 1970s who understood that industrial civilization would eventually reach its limits. Another set consists of consensus group decision-making skills. The list could go on at some length.

Target innovators and early adopters.

Back in the 1960s, Everett Rogers, a professor of communications, contributed the theory of the Diffusion of Innovations, which describes how, why, and at what rate new ideas, social innovations, and technology spread throughout culture. The key to the theory is his identification of different types of individuals in the population, in terms of how they relate to the development and adoption of something new: *innovators, early adopters, early majority, late majority*, and *laggards*.

Innovators are important, but the success of their efforts depends on diffusion of the innovation among early adopters, who tend to be few in number but exceptionally influential in the general population.

At PCI, we have decided to focus our communications on early adopters.

Help people grasp the Big Picture.

Discussions about the vulnerability of civilization to collapse are not for everyone. Some of us are too psychologically fragile. All of us need a break occasionally, and time to feel and process the emotions that contemplating the Big Picture inevitably evokes. But for those able to take in the information and still function, the Big Picture offers helpful perspective. It confirms what many of us already intuitively know. And it provides a context for strategic action.

Pro-Social, Nonpartisan

I'm frequently asked if I have hope for the future. My usual reply is along these lines: hope is not just an expectation of better times ahead; it is an active attitude, a determination to achieve the best possible outcome regardless of the challenges one is facing. PCI Fellow David Orr summed this up best when he wrote, "Hope is a verb with its sleeves rolled up."

However, if that's as far as the discussion goes, merely redefining "hope" may seem facile and unsatisfying. The questioner wants and needs reasonable grounds for believing that an outcome is possible that is something other than horrific. There is indeed evidence along these lines, and it should not be ignored.

Steven Pinker, in his book *The Better Angels of Our Nature,* argues that we humans are becoming more peaceful and cooperative. Now, it could be argued that any decline in violence during the past few decades can be seen as yet another indication that civilization is in a conservation phase of the adaptive cycle: we have attained a balance of power, facilitated by the wealth flowing ultimately from fossil fuels; perhaps violence is simply being held in abeyance until the dam breaks and we head into the release phase of the cycle. Nevertheless, evolution is real, and for humans it occurs more rapidly via culture than through genes. It is entirely possible, therefore, that we humans are rapidly evolving to live more peacefully in larger groups.

Earlier I explained how the findings of neuroscience help us understand why so many of us turn to denial and distraction in the face of terrible threats to civilization's survival. Neuroscience also offers good news: it teaches us that *cooperative* impulses are rooted deep in our evolutionary past, just like competitive ones. Self-restraint and empathy for others are partly learned behaviors, acquired and developed in the same way as our capacity for language. We inherit both selfishness and the capacity for altruism, but culture generally nudges us more in the direction of the latter, as parents are traditionally encouraged to teach their children to share and not to be wasteful or arrogant.

Disaster research informs us that, in the early phases of crisis, people typically respond with extraordinary degrees of cooperation and self-sacrifice (I witnessed this in the immediate aftermath of wildfires in my community of Santa Rosa, California). But if privation persists, they may turn toward blame and competition for scarce resources.

All of this suggests that the one thing that is most likely to influence how our communities get through the coming meta-crisis is the quality of relationships among members. A great deal depends on whether we exhibit pro-social attitudes and responses, while discouraging blame and panic. Those of us working to build community resilience need to avoid partisan frames and loaded words, and appeal to shared values. Everyone must understand that we're all in this together. The Big Picture can help here, if it aids people in grasping that the collapse of civilization is not any one group's fault. It is only by pulling together that we can hope to salvage and protect what is most intrinsically valuable about our world, and perhaps even improve lives over the long term.

Hard times are in store. But that doesn't mean there's nothing we can do. Each day of relative normalcy that remains is an occasion for thankfulness and an opportunity for action.

http://www.theenergyreport.com/pub/na/14705

US Shale Gas Won't Last Ten Years: Bill Powers

Source: Peter Byrne of The Energy Report
Nov 8. 2012

Los Angeles Times, May 20 2014: US Department of Energy admits Post Carbon Institute is right about exaggerated estimates of frackable oil reserves in California, downsizes estimate for Monterrey Shale by 96%

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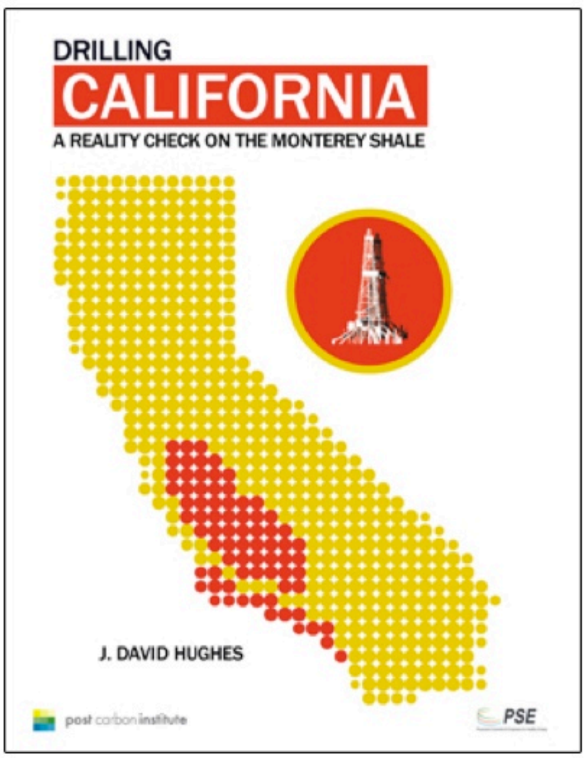

Drilling California: A Reality Check on the Monterey Shale

David Hughes

December 2, 2013

Drilling California: A Reality Check on the Monterey Shale

David Hughes

December 2, 2013

Written by PCI Fellow J. David Hughes and published in partnership by Post Carbon Institute and Physicians, Scientists & Engineers for Healthy Energy, this report provides the first publicly available empirical analysis of actual oil production data from the Monterey Formation, including from wells that have undergone hydraulic fracturing and acidization. It lays out some of the play's fundamental characteristics compared to other tight oil plays, including geological properties, current production, production potential, and associated environmental issues.

Unlike previous studies looking at potential production and economic impacts, this report is based on analysis of real production data (compiled in the most comprehensive oil and gas production database publicly available) and should therefore help ensure that public policy decisions on the development of the Monterey are grounded in data, not assumptions.

Visit montereyoil.org for more resources, including key maps and figures.

Los Angeles Times

July 11, 2014

U.S. officials cut estimate of recoverable Monterey Shale oil by 96%

BY LOUIS SAHAGUN

May 20, 2014, 9:00 p.m.

Federal energy authorities have slashed by 96% the estimated amount of recoverable oil buried in California's vast Monterey Shale deposits, deflating its potential as a national "black gold mine" of petroleum.

Just 600 million barrels of oil can be extracted with existing technology, far below the 13.7 billion barrels once thought recoverable from the jumbled layers of subterranean rock spread across much of Central California, the U.S. Energy Information Administration said.

AL SEIB, LOS ANGELES TIMES

Aaron Kent, a wireline operator for Canary, works on a slick line at an oil rig pump jack site in the oil fields near Bakersfield. Kern County has seen a flurry of activity because of the potential for development of the Monterey Shale formation.

Related Content

Oil and gas industry generates thousands of jobs in California, report finds

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FOR THE RECORD:

Monterey Shale: In the May 21 Section A, an article about federal energy authorities slashing by 96% the estimated amount of recoverable oil in California's Monterey Shale deposits described the rock formation as a 1,750-mile area. The Monterey Shale is a 1,750-square-mile area.

The new estimate, expected to be released publicly next month, is a blow to the nation's oil future and to projections that an oil boom would bring as many as 2.8 million new jobs to California and boost tax revenue by $24.6 billion annually.

The Monterey Shale formation contains about two-thirds of the nation's shale oil reserves. It had been seen as an enormous bonanza, reducing the nation's need for foreign oil imports through the use of the latest in extraction techniques, including acid treatments, horizontal drilling and fracking.

The energy agency said the earlier estimate of recoverable oil, issued in 2011 by an independent firm under contract with the government, broadly assumed that deposits in the Monterey Shale formation were as easily recoverable as those found in shale formations elsewhere.

The estimate touched off a speculation boom among oil companies. The new findings seem certain to dampen that enthusiasm.

Kern County in particular has seen a flurry of oil activity since 2011, with most of the test wells drilled by independent exploratory companies. Major oil companies have expressed doubts for years about recovering much of the oil.

The problem lies with the geology of the Monterey Shale, a 1,750-mile formation running down the center of California roughly from Sacramento to the Los Angeles basin and including some coastal regions.

Unlike heavily fracked shale deposits in North Dakota and Texas, which are relatively even and layered like a cake, Monterey Shale has been folded and shattered by seismic activity, with the oil found at deeper strata.

Geologists have long known that the rich deposits existed but they were not thought recoverable until the price of oil rose and the industry developed acidization, which eats away rocks, and fracking, the process of injecting millions of gallons of water laced with sand and chemicals deep underground to crack shale formations.

The new analysis from the Energy Information Administration was based, in part, on a review of the output from wells where the new techniques were used.

"From the information we've been able to gather, we've not seen evidence that oil extraction in this area is very productive using techniques like fracking," said John Staub, a petroleum exploration and production analyst who led the energy agency's research.

"Our oil production estimates combined with a dearth of knowledge about geological differences among the oil fields led to erroneous predictions and estimates," Staub said.

Compared with oil production from the Bakken Shale in North Dakota and the Eagle Ford Shale in Texas, "the Monterey formation is stagnant," Staub said. He added that the potential for recovering the oil could rise if new technology is developed.

A spokesman for the oil industry expressed optimism that new techniques will eventually open up the Monterey formation.

"We have a lot of confidence in the intelligence and skill of our engineers and geologists to find ways to adapt," said Tupper Hull, spokesman for the Western States Petroleum Assn. "As the technologies change, the production rates could also change dramatically."

Rock Zierman, chief executive of the trade group California Independent Petroleum Assn., which represents many independent exploration companies, also sounded hopeful.

"The smart money is still investing in California oil and gas," Zierman said.

"The oil is there," Zierman said. "But this is a tough business."

Environmental organizations welcomed the news as a turning point in what had been a rush to frack for oil in the Monterey formation.

"The narrative of fracking in the Monterey Shale as necessary for energy independence just had a big hole blown in it," said Seth B. Shonkoff, executive director of the nonprofit Physicians Scientists & Engineers for Healthy Energy.

J. David Hughes, a geoscientist and spokesman for the nonprofit Post Carbon Institute, said the Monterey formation "was always mythical mother lode puffed up by the oil industry — it never existed."

Hughes wrote in a report last year that "California should consider its economic and energy future in the absence of an oil production boom from the Monterey Shale."

The 2011 estimate was done by the Virginia engineering firm Intek Inc.

Christopher Dean, senior associate at Intek, said Tuesday that the firm's work "was very broad, giving the federal government its first shot at an estimate of recoverable oil in the Monterey Shale. They got more data over time and refined the estimate."

For California, the analysis throws cold water on economic projections built upon Intek's projections.

In 2013, a USC analysis, funded in part by the Western States Petroleum Assn., predicted that the Monterey Shale formation could, by 2020, boost California's gross domestic product by 14%, add $24.6 billion per year in tax revenue and generate 2.8 million new jobs.

louis.sahagun@latimes.com

Earth, energy and money

Whether you focus on Peak Energy, Climate Chaos or what is euphemistically called the "Great Recession," each of these are aspects of reaching the limits to growth on a round, finite planet. The transition from cheap, abundant fuels to expensive, hard to get fuels is reducing the amount that people drive and damaging the economic system that requires endless growth to function. Peak Energy is starting to reduce the physical ability to grow traffic levels, regardless of economic circumstances. Burning fossil fuels pollutes the thin film of the atmosphere, with health consequences and environmental impacts, including global warming. **Ecology, energy and money are interconnected and inseparable, and each require a holistic integration with the others to address any of them.**

Energy depletion is not only about personal transportation or carbon footprints. Driving less will be uncomfortable, but eating less would be far more difficult. Most food eaten in the US crosses time zones, some travels across international borders. As fossil fuels decline we need to grow food where it is eaten. Relocalizing food production, growing food in cities, community gardens, suburban "food not lawn" efforts, and protection of farmland from asphalt and concrete are all needed to cope with oil depletion.

It's anyone's guess what energy levels will be in the 2030s, but under any physically possible scenario the flow rates of fossil fuels will be considerably less than they are today, since conventional fossil fuels have peaked globally. There will still be oil extraction in the 2030s but at levels less than current rates, and the future fuels will be the dirtier, more expensive, difficult to extract "bottom of the barrel" supplies. Hyper efficient cars, public transit, car sharing, relocalizing production of food and other goods could mitigate these impacts but not prevent them. Transportation planning needs to focus on maintaining the enormous road networks already built, not expanding them further for travel demand that will not materialize on the energy downslope.

The category of investment euphemistically called "modernization" should be dedicated toward quality train service, not super wide superhighways.

The reason we use fossil fuels is not that Dick Cheney is evil or the oil companies are greedy but that fossil fuels are more energy dense than living on our solar budget. Fossil fuels enabled us to zoom from under a billion to over seven billion today, and climbing down gracefully from peak energy will be more challenging than descending an icy Cascadian peak during a blizzard.

Connected Dots: Earth • energy • money
by Mark Robinowitz • PeakChoice.org

first printed in Heartbeat, heartwood.org, Spring 2014

We are not addicted to fossil fuels, it's much worse than that. Oil, coal, unnatural gas, mineral ores and using "renewable" resources faster than they regenerate fueled our population growth from under a billion (before fossil fuels) to seven billion today. Our industrial agriculture system is totally dependent on massive energy consumption to grow and distribute food.

We are in a paradox: burning these fuels is wrecking the biosphere, but if we stopped burning them our society would crash, which could accelerate ecological damage. There are many worthy efforts to relocalize food production and prepare for living with less fossil energy, but at the rate they are being implemented the fossil fuels will be gone before we are prepared to live without them.

Many environmental groups say we need to reduce our use of fossil fuels in the coming decades to mitigate climate chaos. However, energy use has peaked due to physical constraints, and on the energy downslope our use will continue to decline whether we plan for it or not.

In the United States, energy use from all sources peaked in 2007 at about 101 quads. A quad is a quadrillion BTUs. One BTU is roughly the energy released by a match. In 2012, energy use had dropped to about 95 quads.

2007 was also the year of Peak Electricity in the US. Since then, electricity usage has dropped about ten percent.

Traffic also peaked in the US in 2007, in terms of Vehicle Miles Traveled (VMT). The rising cost of gasoline and economic "recession" ended the increase of car traffic. Roads are still busy, but most are not getting any more congested.

Federal transportation law requires highway expansion plans to consider traffic levels two decades in the future. It's anyone's guess how much fossil energy will be available in the 2030s, but it's clear it will be considerably less than today's flow. This negates the "purpose and need" for new bypasses and highway widenings, but Peak Traffic has not yet been included in any official transportation plan anywhere in the country.

Domestic aviation also peaked in 2007, again due to rising oil prices that raised the cost of tickets. The leveling off of aviation growth is a bigger shift than the reduction after 9/11.

US oil production peaked in 1970 at about ten million barrels a day. In the past couple years, there has been a propaganda campaign to persuade the public that fracking is going to lead to energy independence. However, while fracking has received lots of scrutiny due to the toxic impacts on aquifers, the fact that fracking is a very short term activity is not as well known. Fracked wells deplete far faster than conventional wells, and the production data shows fracking cannot bring US oil extraction back to the 1970 peak, even if environmental and public health problems were ignored. Fracking and tar sands are “scraping the bottom of the barrel” and have delayed the onset of gasoline rationing.

Coal production peaked in the US in 1999, in terms of energy content. The tonnage of coal mining continues to increase, but the industry is going after lower quality coal, part of the motive for mountaintop removal. In Pennsylvania, where coal mining began, extraction peaked in 1920.

Peak Natural Gas in the US was in 1973. The recent boom in gas extraction is from fracking, but that is starting to peak, just as fracking for oil is peaking. When the fracking bubble bursts, we will have to choose whether to use the remaining natural gas to heat cities in the winter or to burn it for electricity.

Nuclear power has also peaked. Peak uranium mining in the US was 1980. The number of operating power reactors has peaked. Old, worn out reactors are being shut down faster than replacement plans for new nukes.

We are also using “renewable” resources faster than they regenerate. Forests, fish, soil, and fresh water are being depleted everywhere. Part of the needed response to our civilization’s “going out of business sale” would be to implement permaculture strategies everywhere. It would be nice to see environmental initiatives focus more on “Transition Towns” than lobbying politicians. The more we can create practical responses, the more likely we will see broader adoption of ecological policies on the energy downslope.

Using solar energy for twenty years (and wind power for ten) taught me that renewable energy could only run a smaller, steady state economy. Our exponential growth economy requires ever increasing consumption of concentrated resources (fossil fuels are more energy dense than renewables). A solar energy society would require moving beyond growth-and-debt based money.

After fossil fuel we will only have solar power, but that won't replace what we use now. Living on our current solar budget could not be a seamless substitute for digging up a hundred million years of sunlight. We need to abandon the myth of endless growth on a round, and therefore, finite planet to have a planet on which to live. Will we use the remaining fossil fuels to make lots of solar panels and relocalize food production instead of waging Peak Oil Wars?

June 27th, 2012
www.peakchoice.org/peak-blame.html
316: Peak Blame
KMO welcomes Mark Robinowitz of OilEmpire.us back to the C-Realm Podcast to discuss why both the mainstream political left as well as the right in the United States cannot address the demands of Peak Oil in a realistic way. Republicans have rebuked Navy Secretary Ray Mabus for attempting to ween the Navy off of fossil fuels because they see finding alternatives to petroleum as a Democratic partisan issue. Established environmental and social justice organizations are still holding onto unrealistic Green Technology and Green Capitalism paradigms and have yet to come to terms with the fact that the project of the 21st Century will be figuring out how to equitably distribute a shrinking pie. One thing unlikely to be in short supply as the realities of diminishing fossil fuel reserves make themselves unmistakable: blame. Mark hopes that we can achieve Peak Blame sooner rather than later and get on with the grown-up work of figuring out how best to deploy our remaining energy resources.

M. King Hubbert on energy and money

excerpt from Richard Heinberg, "The Party's Over," (New Society Books: 2003) pp. 91-92, discussing M. King Hubbert, the geologist who first figured out the math behind Peak Oil. Hubbert predicted in 1956 that the USA would peak around 1970, he was pilloried for this but the USA did peak in 1970. Hubbert later predicted that the world would peak in the mid 1990s, but then cautioned this might get pushed back a decade due to the oil shock of 1973, which is what happened. Hubbert initially thought nuclear power would be the post-fossil fuel solution but changed his mind and said solar energy was the answer, but this would require giving up exponential growth and learning to live within natural limits on a finite planet.
-- Mark

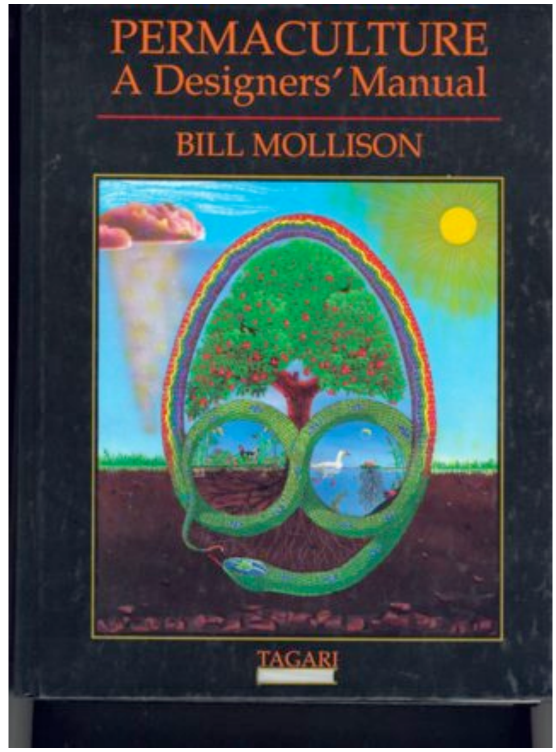
Hubbert immediately grasped the vast economic and social implications of this information [Peak Oil]. He understood the role of fossil fuels in the creation of the *modern industrial world, and thus foresaw the wrenching transition that would likely occur following the peak in global extraction rates. ...*

> *The world's present industrial civilization is handicapped by the coexistence of two universal, overlapping, and incompatible intellectual systems: the accumulated knowledge of the last four centuries of the properties and interrelationships of matter and energy; and the associated monetary culture which has evolved from folkways of prehistoric origin.*
> *The first of these two systems has been responsible for the spectacular rise, principally during the last two centuries, of the present industrial system and is essentially for its continuance. The second, an inheritance from the prescientific past, operates by rules of its own having little in common with those of the matter-energy system. Nevertheless, the monetary system, by means of a loose coupling, exercises a general control over the matter-energy system upon which it is superimposed.*
> *Despite their inherent incompatibilities, these two systems during the last two centuries have had one fundamental characteristic in common, namely exponential growth, which has made a reasonably stable coexistence possible. But, for various reasons, it is impossible for the matter-energy system to sustain exponential growh for more than a few tens of doublings, and this phase is by now almost over. The monetary system has no such constraints, and, according to one of its most fundamental rules, it must continue to grow by compound interest.*

Hubbert thus believed that society, if it is to avoid chaos during the energy decline, must give up its antiquated, debt-and-interest-based monetary system and adopt a system of accounts based on matter-energy -- an inherently ecological system that would acknowledge the finite nature of essential resources.
Hubbert was quoted as saying we are in a "crisis in the evolution of human society. It's unique to both human and geologic history. It has never happened before and it can't possibly happen again. You can only use oil once. You can only use metals once. Soon all the oil is going to be burned and all the metals mined and scattered."
Statements like this one gave Hubbert the popular image of a doomsayer. Yet he was not a pessimist, indeed, on occasion he could assume the role of utopian seer. We have, he believed, the necessary know-how, all we need do is overhaul our culture and find an alternative to money. If society were to develop solar-energy technologies, reduce its population and its demands on resources, and develop a steady-state economy to replace the present one based on unending growth, our species' future could be rosy indeed. "We are not starting from zero," he emphasized. "We have an

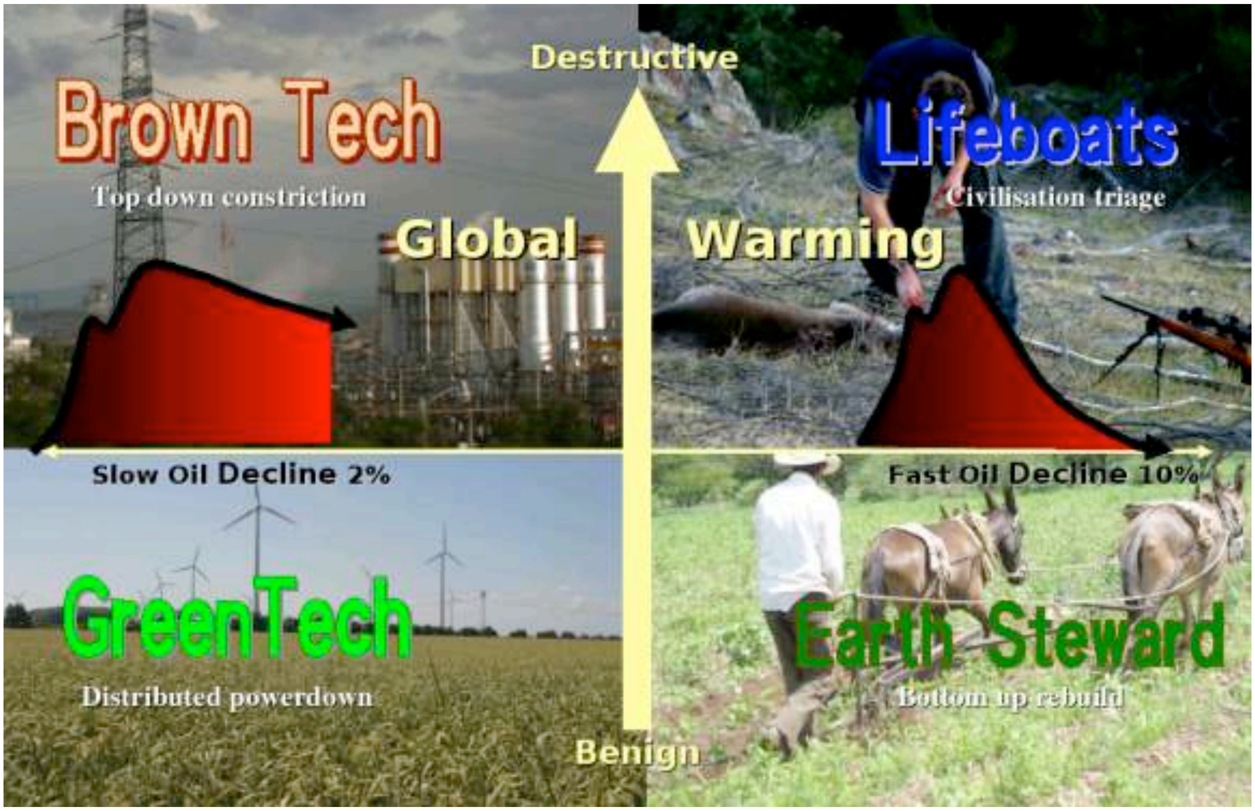
enormous amount of existing technical knowledge. It's just a matter of putting it all together. We still have great flexibility but our maneuverability will diminish with time."

David Holmgren, permaculture co-originator

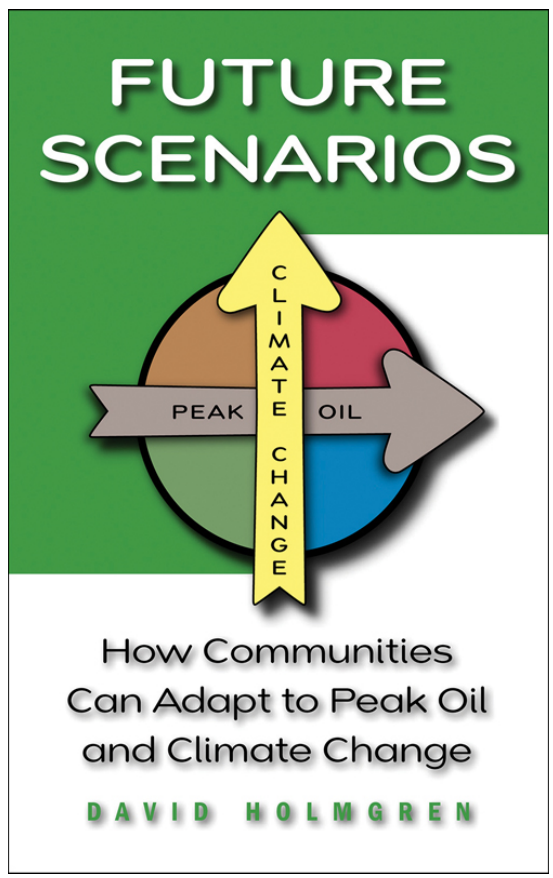


"Awareness of Climate Change by the media and general public is obviously running well ahead of awareness about Peak Oil, but there are interesting differences in this general pattern when we look more closely at those involved in the money and energy industries. Many of those involved in money and markets have begun to rally around Climate Change as an urgent problem that can be turned into another opportunity for economic growth (of a green economy). These same people have tended to resist even using the term Peak Oil, let alone acknowledging its imminent occurrence. Perhaps this denial comes from an intuitive understanding that once markets understand that future growth is not possible, then it's game over for our fiat system of debt-based money."

-- David Holmgren, co-originator of permaculture, "
Money vs. Fossil energy: the battle to control the world,"
http://www.holmgren.com.au/DLFiles/PDFs/Money_vs_Fossil_Energy.pdf

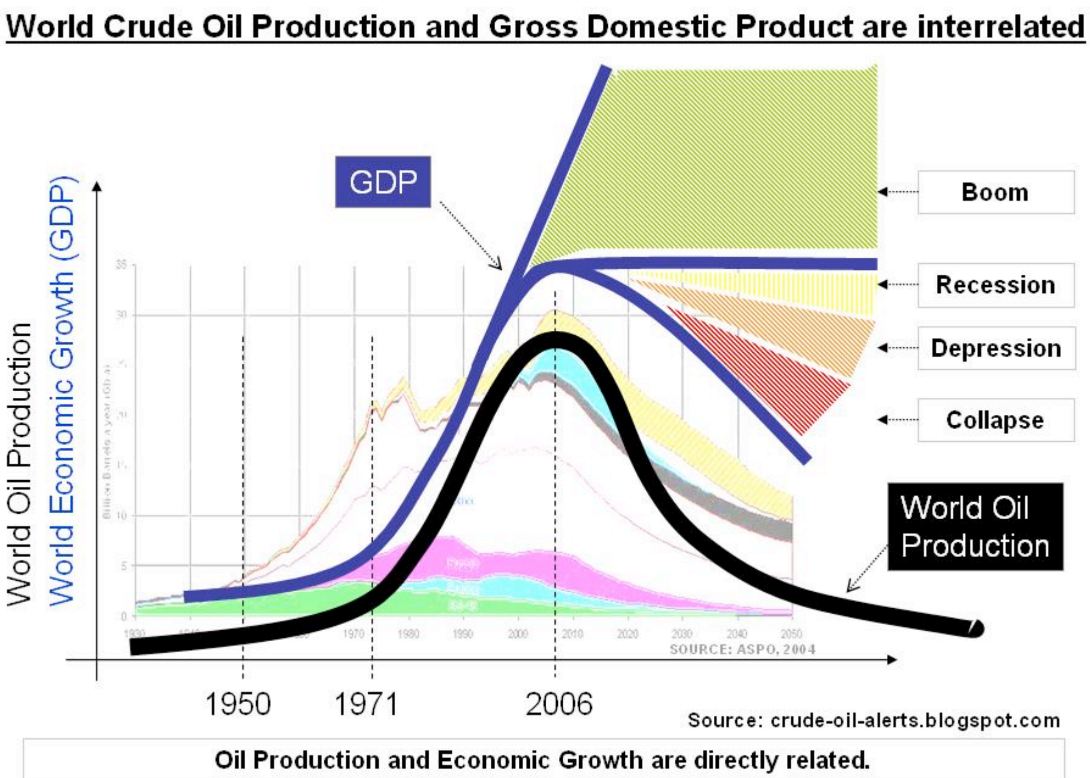


David Holmgren, the co-orginator of permaculture, is author of Future Scenarios: How Communities can adapt to Peak Oil and Climate Change. "Economic recession is the only proven mechanism for a rapid reduction of greenhouse gas emissions ... most of the proposals for mitigation from Kyoto to the feverish efforts to construct post Kyoto solutions have been framed in ignorance of Peak Oil. As Richard Heinberg has argued recently, proposals to cap carbon emissions annually, and allowing them to be traded, rely on the rights to pollute being scarce relative to the availability of the fuel. Actual scarcity of fuel may make such schemes irrelevant." -- www.futurescenarios.org



"The dip in global emissions created by the 2008 global financial crisis was ignored by the climate activist community as an inconvenient truth." "Crash on Demand: Welcome to the Brown Tech Future," by David Holmgren (co-originator of permaculture) http://holmgren.com.au/wp-content/uploads/2014/01/Crash-on-demand.pdf

podcast February 12, 2014
http://c-realm.com/podcasts/crealm/401-psycho-social-debt-jubilee/
401: Psycho-social Debt Jubilee
Podcast: Play in new window | Download
KMO welcomes permaculture co-originator David Holmgren to the C-Realm Podcast to discuss two of his essays: Money Vs Fossil Energy: the Battle for Control of the World and Crash on Demand: Welcome to the Brown Tech Future. David has been tracking the onset of climate change and peak oil for many years, but he says that in recent years, largely due to the work of Steve Keen and Nicole Foss, he has come to see financial systems as the fastest moving and most volatile element in emerging global crisis. He describes why he considers the Bush administration to have been guided by a certain energy realism lacking in too many social and climate activists. Finally, he describes why he thinks that multiple generations of mass affluence has left us saddled with a psycho-social debt that will be very difficult for us to discharge.



"I realized that one of the best use of the US Energy Policy History work may be to convince environmentalists and others that think peak oil is a scare tactic or financial manipulation, that it is in fact a real problem - not something that just popped up, it has been recognized as a problem for decades, and that access to the energy resources of other countries is the main reason that we have been able to ignore it for so long. The intention would be of course to connect the movements so that all can see the elephant for what it is."
-- David Room, Local Clean Energy Alliance

from Extraenvironmentalist.com
interview conducted at Northwest Permaculture gathering, October 2012
permaculture design, steady state economics, peak money, solar energy, limits to growth
www.peakchoice.org/audio/interview-mark-robinowitz.mp3
15 minutes, 33 megabytes

www.transitionvoice.com/2011/01/global-warming-worst-advocacy-campaign-ever/
Interesting essay that suggests the environmental movement's myopia about energy limits is part of the reason public support for climate change / global warming / greenhouse effect is in decline.

This is a good discussion of interconnections:

www.darkoptimism.org/2008/06/14/focus-on-climate-change-and-ignore-peak-oil-not-good-enough/

It is a deep pleasure for me to be again in Stockholm and to gratefully accept the Right Livelihood Award for 1986 on behalf of myself and those who have worked with me at the International Institute of Concern for Public Health. Sweden is gaining an international reputation for its extraordinary efforts on behalf of global justice and peace, and for its yearly search of the global community for creative and concerned persons and organizations which could use some encouragement and financial assistance. This is a much valued service to the forming global village. In the long run it will, I think, be more humanly productive than increased airport security, military exercises, nuclear threats, and development of crowd-control technology. This contrast between a system of encouragement and cooperation, on the one hand, and a system of threats and forceable control, on the other, lies at the centre of the global crisis. It poses a clear choice for the future, on which will depend the survival or disintegration of civilization.
-- Rosalie Bertell, THE RIGHT LIVELIHOOD AWARDS 1986
Acceptance Speech by Rosalie Bertell
December 8th, 1986
www.rightlivelihood.org/bertell_speech.html
"alternative Nobel Prize"

Most people do not enjoy having their entire worldview discredited; it sets them uncomfortably adrift. Scientists are no exception. A paradigm tends to be so greatly cherished that, as new knowledge or evidence turns up that contradicts it or calls it into question, the paradigm is embroidered with qualifications and exceptions, along with labored pseudo-explanations--anything, no matter how intellectually disreputable or craven, to av oid losing the paradigm. If a paradigm is truly obsolete, it must finally give way, discredited by the testing of the real world. But outworn paradigms ordinarily stand staunchly until somebody within the field makes a leap of insight, imagination, and courage sufficient to dislodge the obsolete paradigm and replace it.
-- Jane Jacobs, "Dark Age Ahead"

http://culturechange.org/cms/content/view/926/1/

Questionable Renewable Energy Dreams: Where Do We Go from Here by Jan Lundberg

24 November 2014

A Tale of Three Studies • Oil Grows in Instability and Danger As It Goes Away Geologically • Cars Are Renewable?

It was the summer that Al Gore had NASA's James Hansen testify in the Senate that human-caused global warming had begun: in August 1988 I founded Fossil Fuels Policy Action, a nonprofit institute, in Washington. We would be a clearing house for energy data & policy, with an eye to replacing fossil energy with renewable energy. Two all-consuming questions became our focus: why is the U.S. not conserving energy, and what can make it happen? This immediately morphed us from more passive "assessment" to more active advocacy, within our basic mission.

In a matter of months our solution became our *raison-d'être*: a Conservation Revolution. Our conclusion about the dire state of the world was seemingly affirmed by Worldwatch's 1992 initiative which followed our public announcement and publications with their very similar Environmental Revolution. It all seemed like a very big deal then, for activists and dreamers can get a bit carried away. Funding and competition for funds can come into play as well. None of us would have anticipated that nearly a quarter of a century later, now with grey hair and somewhat tired voices, we are still fighting for such a revolution or at least some meaningful, trend-altering reforms.

Prior to forming Fossil Fuels Policy Action, I had scoured the inside-the-beltway environmental establishment for a job, to put my well-known oil industry analytical skills to use for Mother Earth. It was early 1988. The only job I got was a temporary post at Renew America, formerly the Solar Lobby. What I learned from the many greenies I met around town was that they were positioning themselves for green business, in both senses of the word. Their intentions were good, but I felt somewhat repulsed by a mere industry shift. The greener establishment I glimpsed would not bring about much of a change in the nation's overall direction. Yet, I was happy enough to form a group that fit in with them, because I found some reforms exciting, and I had to create my own job under a new banner in order to participate.

Photo courtesy Truthout/Richard Brand - Flickr

My misgivings about the value and promise of a green industrial class sprang mostly from my innate, radical nature-loving. Soon after starting Fossil Fuels Policy Action, I became aware that major environmental groups were taking donations from the natural gas lobby, the American Gas Association. I had known the AGA, so I paid a visit and went out for drinks with my key contacts from my days at Lundberg Survey where I had published alternative fuels price reports for gas utilities. I left the bar knowing that Fossil Fuels Policy Action was now in line for a convenient donation: to trumpet natural gas as a "bridge fuel" for a renewable energy future. I wanted that future and was working for it, but I began to suspect it was purely utopian if the renewable energy were imagined to be on a scale to substitute for fossil fuels. I had just been sent the book *Beyond Oil: The Threat to Food and Fuel in the Coming Decades* to review, so I learned about the net-energy issues with alternative energy.

Instead of taking the AGA's money, I decided it was more fun to reject the donation publicly by publishing a newsletter on the competition between natural gas and heating oil, exposing the environmental groups' taking fossil fuel money. My corporate friend Nelson Hay of the AGA called me up after seeing our newsletter, and bellowed, "Are you on acid, Jan?!" And a prominent D.C. environmentalist chided me in a letter that said only, "It's all dirty money anyway."

Renewable energy should be the real deal, and not something to justify dependence on slightly cleaner fossil fuels. Today, the question has become, "How can renewable energy systems be seen for what they are and are not?" Where do we go from here, when the consumer economy with its cheap-oil built infrastructure has little future after conventional oil extraction peaked globally in 2005? One clue is that Fossil Fuels Policy Action eventually became Culture Change.

A Tale of Three Studies: Bursting Renewable Energy's Mental Bubble

Renewable energy is great, right? But what if it is mostly misused, and appears increasingly to be a false promise for preventing more oil spills like BP's in the Gulf of Mexico and for saving the Earth's unravelling climate? After a thorough and dispassionate look, at the end of this section we nail the "double Achilles Heel" of large-scale renewable energy: storage of energy during intermittency, and low net-energy return on energy invested.

Just as some of us question the wonders of "clean" natural gas -- increasingly derived from toxic fracking -- some go further, beyond embracing renewable energy, to promote and practice energy-consumption curtailment as the best form of conservation.

But this usually falls on deaf ears. One reason is that there is no sexy, high-tech, start-up, dollar-signs-in-the-eyes attraction to cutting back on energy use in general. Rather, "clean tech," which is often not about cutting energy consumption, is the hot buzz word for investors and careerists -- even though curtailing energy use is the fastest way to reduce greenhouse gas emissions, mercury, smog, acid rain, and nuke-energy risks.

A near spate of exposés on "renewable" energy appeared recently. We first put out the word on two of them via Facebook and emails: **What's Wrong with Renewable Energy?** by Kim Hill, drawn partly from Ozzie Zehner's book *Green Illusions*, and **Abundant Clean Renewables? Think Again!**in Truthout.org, November 16, 2014, by Almuth Ernsting of Biofuelwatch.

In these studies, as in many an article on Resilience.org (formerly EnergyBulletin.net) and CultureChange.org, the widely ignored but fatal issues involving the renewable energy technofix for peak oil and overpopulation are presented in disturbing, documented detail. The discussion is not about decentralized, small-scale energy systems for a home or farm. Passive solar and mills for grinding grain, powered with the wind or flowing water, are especially benign. Rather, the issue is large-scale systems designed to be part of the electric grid.

Ernsting asks, "Can we really put our hopes for stabilizing the climate into trying to simply replace the energy sources in a growth-focused economic and social model that was built on fossil fuels? Or do we need a far more fundamental transition towards a low-energy economy and society?" She sees the rise of wind power and solar power as serving the corporate agenda rather than human needs. She examines Germany's real energy mix, which puts solar and wind in perspective. Most "renewable" energy in Germany is from biofuels, biogas and wood pellets, none of which are innocent of causing serious environmental impacts. These three prime renewable energy supplies, and dependency on them, means that the "24,000 wind turbines and 1.4 million solar panels have scarcely made a dent in Germany's fossil fuel burning and carbon emissions."

Same for Denmark, Ernsting reports: "wind energy in Denmark accounted for just 3.8 percent of Denmark's total energy use in 2010" because electricity generation is only one aspect of energy. Again, in Denmark it is bioenergy generating far more energy than wind. Norway is a similar situation, except hydroelectric dams are the favored alternative energy. This means a set of problems for Norway that Norwegian companies are exporting, to the detriment of foreign lands.

What if the windy UK put wind turbines all over its coasts? Fifteen offshore wind turbines installed *on every kilometer of the UK coastline* would supply just 13 percent of the country's average daily energy use. "Generating that 13 percent of UK energy... would require wind turbines made of 20 million tons of steel and concrete - more than all the steel that went into U.S. shipbuilding during World War II. Steel manufacturing is heavily dependent on coal, not just as a fuel for the furnaces but because it is needed to enrich the raw material, iron ore, with carbon to make it stable. And concrete is hardly 'carbon neutral' either - cement (a key component) accounts for 5 percent of global carbon dioxide emissions."

Almuth Ernsting

Then there's solar PV panels. They are up to four times as energy- and carbon-intensive to produce as wind turbines: "Aluminum - used to mount and construct solar panels - is about as carbon and energy-intensive as steel. Silicon needs to be smelted at 2,000 degrees Celsius and materials used to replace silicon have an even higher environmental footprint. Then there's an array of highly toxic and corrosive chemicals used during manufacturing. Yet with regards to pollution, building wind and marine turbines is likely worse than making solar panels, because efficient and lasting turbine magnets rely on rare earth mining and refining. One 5-megawatt turbine requires a ton of rare earths, the mining and refining of which will leave behind 75 cubic meters of toxic acidic waste water and one ton of radioactive sludge." (Ernsting, Truthout)

Zehner gives environmentalists 10 reasons to question "renewable" energy:

(1) Solar panels and wind turbines aren't made out of nothing. They are made out of metals, plastics, chemicals. These products have been mined out of the ground, transported, processed, manufactured. Each stage leaves behind a trail of devastation...

(2) The majority of electricity that is generated by renewables is used in manufacturing, mining, and other industries that are destroying the planet. Even if the generation of electricity were harmless, the consumption certainly isn't.

(3) The aim of converting from conventional power generation to renewables is to maintain the very system that is killing the living world, killing us all, at a rate of 200 species per day. Taking carbon emissions out of the equation doesn't make it sustainable. This system needs to not be sustained, but stopped.

(4) Humans, and all living beings, get our energy from plants and animals. There is no living creature that needs electricity for survival. Only the industrial system needs electricity to survive, and food and habitat for everyone are being sacrificed to feed it.

(5) Wind turbines and solar panels generate little, if any, net energy (energy returned on energy invested). The amount of energy used in the mining, manufacturing, research and development, transport, installation, maintenance and disposal of these technologies is almost as much—or in some cases more than—they ever produce.

(6) Renewable energy subsidies take taxpayer money and give it directly to corporations. Investing in renewables is highly profitable. General Electric, BP, Samsung, and Mitsubishi all profit from renewables, and invest these profits in their other business activities.

(7) More renewables doesn't mean less conventional power, or less carbon emissions. The amount of energy being generated by renewables has been increasing, but so has the amount of energy generated by fossil fuels. No coal or gas plants have been taken off line as a result of renewables.

(8) Only 20% of energy used globally is in the form of electricity.

(9) Solar panels and wind turbines last around 20-30 years, then need to be replaced. The production process, of extracting, polluting, and exploiting, is not something that happens once, but is continuous and expanding.

(10) The emissions reductions that renewables intend to achieve could be easily accomplished by improving the efficiency of existing coal plants, at a much lower cost. This shows that the whole renewables industry is nothing but an exercise in profiteering with no benefits for anyone other than the investors.

Ernsting's and Zehner's articles are hard-hitting, short pieces and easy to read. They throw ice water on professional technofixers in the environmental movement (i.e., almost anyone getting significant funding), and dash the hopes of "progressive consumers" looking for greener ways to maintain their First World, privileged lifestyles -- if they will pay attention.

My own brief "elevator speech" on the renewable-energy technofix is that

• renewable energy systems depend on the larger fossil fuels infrastructure

• they have much lower net-energy yield than cheaply produced oil always had

• they offer electrical power only (save biofuels) and not any chemicals or materials that fossil fuels give

• renewable energy systems for replacing fossil fuels are not scalable to meet the alleged needs for energy consumption now or projected

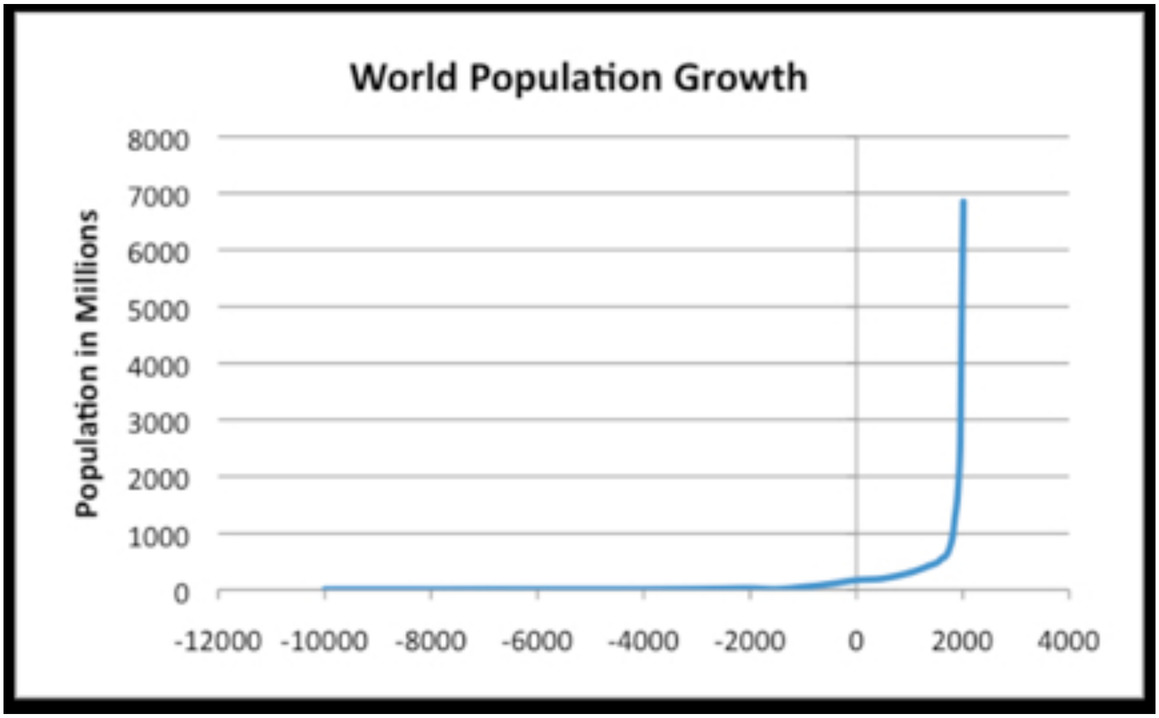
• large renewable energy systems eat up agricultural land -- as does the soil-depleting, heavily subsidized, energy-inefficient biofuels industry. Hydroelectric power poses problems too, concerning ecologically damaging dams with their siltation that shortens the lifetime of the dams' water supply for power as well as irrigation.

These concerns have been voiced by the few for many years. The facts are obscured and suppressed, as a deluded nation and entire civilization jumped on the runaway oil train to economic collapse, following the peak of cheaply extracted oil in 2005. The virtuous belief in renewable energy for a greener future justified the delusion. Collapse-denial is perhaps more pervasive than denial of anthropogenic global warming, in part because the environmental establishment and mainstream media shrink from open discussion on the shortcomings of renewable energy as a viable substitute for the volume of oil and its many products in the consumer economy.

Hence, collapse and the eventual adjusting of the population size to ecological carrying capacity -- over-shot several decades ago -- also belong off the typical enviro group's table and off the reporter's beat. Politicians refuse to touch any of this. The almost palpable silver bullet for technological avoidance of resource-limits keeps most of us going as relatively comfortable or willing players in the struggling consumer economy.

When one questions "renewable" energy, it can appear he or she is singing the praises of the petroleum industries. No; deep-green environmentalists and proponents of simple living are not shills for the oil, gas or coal industries. Yes; it is unfair that subsidies for fossil fuels are so huge, and it is a tragedy for the climate. But this does not mean that subsidies for centralized renewable-energy systems will solve the energy crisis or prevent climate collapse.

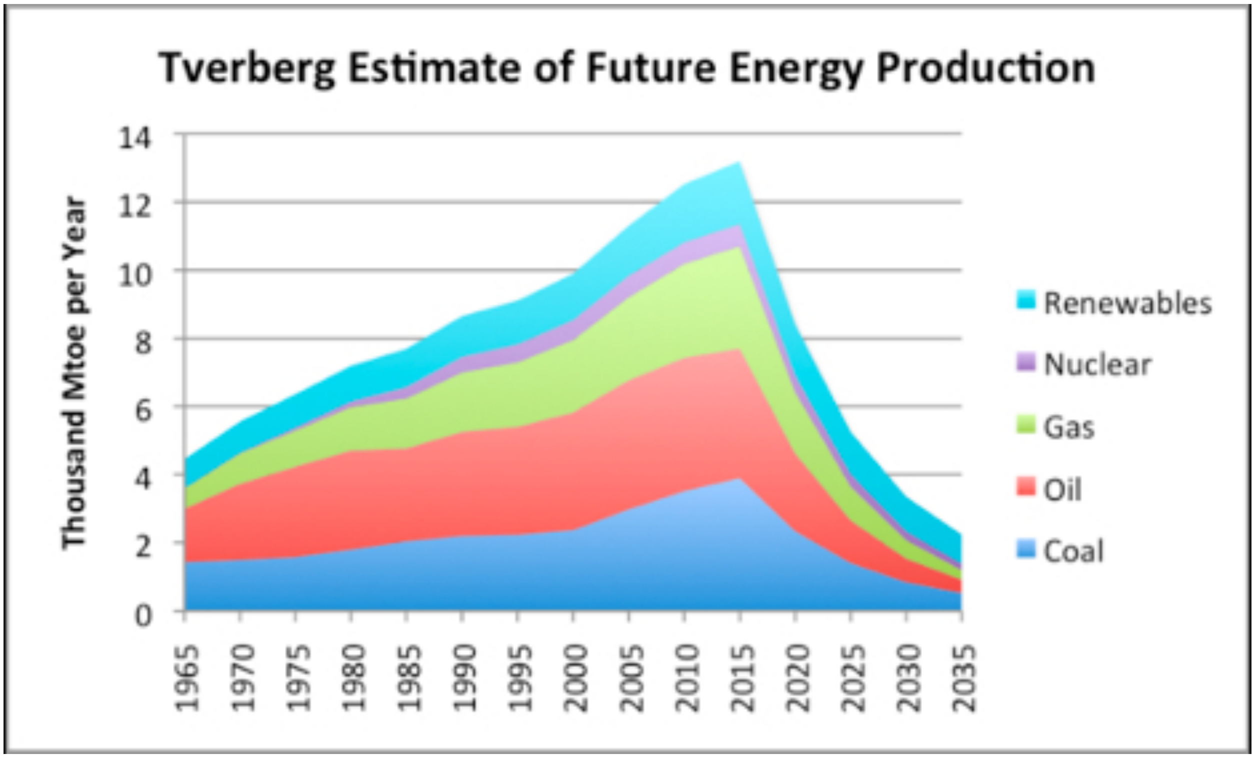
In 2005 the U.S. Department of Energy commissioned a report on peak oil. Known informally as the Hirsch Report, it found that two decades' infrastructure-transformation completion are needed before peak oil hits, to avoid major disruption to the nation. The report found, "the economic, social, and political costs will be unprecedented." Maximized renewable energy efforts cannot change this, and would have had to come on like gangbusters by 1985 along with other major shifts. [1]



based on U.S. Bureau of Census data

Make no mistake, renewable energy systems have almost entirely been put into place to perpetuate endless growth on a finite planet.

Also worthwhile reading for understanding the true and limited potential of "renewable" energy technology systems on a large scale is **Eight Pitfalls in Evaluating Green Energy Solutions** by Gail Tverberg. She gets into her subject with:
"Does the recent climate accord between US and China mean that many countries will now forge ahead with renewables and other green solutions? I think that there are more pitfalls than many realize." She concluded,



Historical based on BP 2013 Statistical Review of World Energy, IEA groupings

"Expectations for wind and solar PV need to be reduced. Solar PV and offshore wind are both likely net energy sinks because of storage and balancing needs, if they are added to the electric grid in more than very small amounts. Onshore wind is less bad, but it needs to be evaluated closely in each particular location. The need for large subsidies should be a red flag that costs are likely to be high, both short and long term. Another consideration is that wind is likely to have a short lifespan if oil supplies are interrupted, because of its frequent need for replacement parts from around the world."

Tverberg's eight pitfalls are:

(1) Green solutions tend to push us from one set of resources that are a problem today (fossil fuels) to other resources that are likely to be problems in the longer term.

(2) Green solutions that use rare minerals are likely not very scalable because of quantity limits and low recycling rates.

Gail Tverberg, photo from ExtraEnvironmentalist.com

(3) High-cost energy sources are the opposite of the "gift that keeps on giving." Instead, they often represent the "subsidy that keeps on taking."

(4) Green technology (including renewables) can only be add-ons to the fossil fuel system.

(5) We can't expect oil prices to keep rising because of affordability issues.

(6) It is often difficult to get the finances for an electrical system that uses intermittent renewables to work out well.

(7) Adding intermittent renewables to the electric grid makes the operation of the grid more complex and more difficult to manage. We run the risk of more blackouts and eventual failure of the grid.

(8) A person needs to be very careful in looking at studies that claim to show favorable performance for intermittent renewables.

Solar and wind power share a twin Achilles Heel: storage of energy during intermittency, and low net-energy return on energy invested. In **The Catch-22 of Energy Storage** by John Morgan of the Energy Collective, his research found

Several recent analyses of the inputs to our energy systems indicate that, against expectations, energy storage cannot solve the problem of intermittency of wind or solar power. Not for reasons of technical performance, cost, or storage capacity, but for something more intractable: there is not enough surplus energy left over after construction of the generators and the storage system to power our present civilization.

The problem is analysed in an important paper by Weißbach *et al* in terms of energy returned on energy invested, or EROEI – the ratio of the energy produced over the life of a power plant to the energy that was required to build it. It takes energy to make a power plant – to manufacture its components, mine the fuel, and so on. The power plant needs to make at least this much energy to break even. A break-even powerplant has an EROEI of 1. But such a plant would pointless, as there is no energy surplus to do the useful things we use energy for.

There is a minimum EROEI, greater than 1, that is required for an energy source to be able to run society. An energy system must produce a surplus large enough to sustain things like food production, hospitals, and universities to train the engineers to build the plant, transport, construction, and all the elements of the civilization in which it is embedded...

Although renewable energy doesn't live off sun alone -- it needs metals, semiconductors, ceramics and more -- Resilience.org standby Ugo Bardi's recent investigation in**Renewable energy: does it need critically rare materials?** did not find a major problem with rare-metals supply for solar or other renewable energy systems.

By now a more alert consumer of energy news can keep renewable energy developments in a big-picture perspective. We hear how Germany can be a solar success, so why can't the U.S.; we hear Denmark has built more windmills, and that renewable energy is getting cheaper and more efficient. These claims bypass or hide so much of the whole story that we miss the fact that we are witnessing a bubble created for the purpose of stoking investment and more subsidies.

An example of trumpeting solar power's slow triumph over petroleum -- despite the disparate kinds of energy involved, and total absence of discussion on the need to immediately slash energy use in general -- is Bloomberg's Oct. 29, 2014 report **While You Were Getting Worked Up Over Oil Prices, This Just Happened to Solar**, by Tom Randall:

After years of struggling against cheap natural gas prices and variable subsidies, solar electricity is on track to be as cheap or cheaper than average electricity-bill prices in 47 U.S. states -- in 2016, according to a Deutsche Bank report published this week.

That's assuming the U.S. maintains its 30 percent tax credit on system costs, which is set to expire that same year...

Yet, the report reveals the amazing expectations of major analysts: "Solar will be the world's biggest single source of electricity by 2050, according to a recent estimate by the International Energy Agency. Currently, it's responsible for*just a fraction of one percent*." [emphasis added.] It's as if petroleum's role in solar panels and the grid is negligible, or that solar panels can magically supply farm chemicals to grow the food that petroleum has been doing.

Oil Grows in Instability and Danger As It Goes Away Geologically

Falling oil prices of late, to four-year lows, are not only bad news: these are deceptively low prices. Because of direct and hidden subsidies, the real cost of oil to consumers is a few times the nominal price, i.e., a few hundred dollars per barrel. This true high price has for several years pinched off growth of the economy, and made people struggle when buying not just oil products but anything with a significant imbedded-energy cost such as food and manufactured products. Still, low oil prices are bad news for the environment, such as enabling more transport-sector pollution. If it mattered more, low oil prices that hurt renewable energy investment would be tragic. This report with its Tale of Three Studies, and further information below, puts the matter into perspective.

It is precisely because the most desirable crude oil fields are rapidly depleting and new discoveries have trended downward for decades, it is alarming that oil dependence is at its height. More accurately it is at a brief plateau, from a long-range historical perspective. Renewable energy systems and conservation have not emancipated modern society from oil, and are not on track to do so except in conditional scenarios that ignore far too much, such as population size. The dwindling supply of oil with no equivalent energy-substitution means that the rising vulnerability to oil shock and the end of plentiful supplies extends to a breaking point on the relatively near horizon. There are "Things to Know As Collapse Becomes Hip" [2]

Exuberance for continued profligate energy consumption flows not only from knee-jerk faith in technology for "renewable" energy. Claims that the U.S. has regained the role of top producer of oil worldwide obscure energy reality for the unsuspecting public, even though the U.S. is not a significant petroleum exporter and is still a gross importer of oil. To help discredit the hoopla, Matt Mushalik recently showed in Crude Oil Peak and Resilience.org that **US Oil Dependency on Middle East has Hardly Changed Since 2007**. Obviously, renewable energy did not manage to enable a different trend.

Although unconventional forms of petroleum in the Americas do not offer a ride up Consumerland Peak, they are extremely dangerous. The chart here on Fossil Fuels Emissions shows the relative potential for tar sands emissions, described as conservative by the makers of the chart.

A new Huffington Post article republished on Resilence.org is myth-busting: in **Challenging (Crude) Convention**, three researchers found that "US shale-oil production is likely to peak in 2017-18." The article warns, "It is imperative, then, that American policy makers and people recognize that the fracking-enabled spike in US crude oil production most likely represents only a temporary reprieve from the declining production levels experienced from 1970 to 2005."

The authors' findings and warnings about the very capital-intensive, short-lived U.S. oil bonanza lead us to a cautionary pronouncement on "renewable" energy as well: without the continuously greased oil infrastructure for the entire corporate global economy, "renewable" energy for the grid is similarly constrained, for the reasons explained above, as it fails to deliver the wide-eyed dreams held by many environmentalists and investors.

The article's authors Daniel Davis, David Hughes, and Mark Lewis seemed to miss that point, mentioning that "The quality and efficiency of solar power and wind turbines continues to improve and we should encourage further development." Primarily for climate concerns, the authors support those technologies to get industrial society beyond the internal combustion engine. The authors invoke the Paris UN climate conference in 2015 for the "need to accelerate investment and research into alternative means of energy creation."

This stance made the most sense decades ago when inefficiency reinged, but without the older stance of curtailing energy use for simple living, climate protection and resilience for modern society are extremely doubtful. The authors say, "it would be prudent to begin more aggressively investing in creative new means of powering the economy." But, considering what we know about energy-alternatives, would it not be more responsible (and cheaper) to anticipate oil-related collapse and pursue rapid curtailment of energy consumption? To set sails, ride more bicycles, go car-free, depave, grow food locally, and share appliances between families? Shower with a friend to save water?

The large renewable energy systems cannot be a realistic centerpiece of climate protection. Nor do they offer a way out of petrocollapse. People are happy to embrace a silver bullet to solve the energy and climate dilemmas, but changing their lifestyles is too inconvenient and psychologically threatening. What would fellow yuppie colleagues at the office say if one showed up on a bicycle and had downsized the home? This poses no social-acceptance problem in most of the world, but for the U.S. -- land of Happy

Motoring and the American Dream of the two-car garage -- consumers cling to technological progress to further insulate them from Mother Nature and her terrifying animals and storms.

Meanwhile in bike-friendly northern Europe, "the Crisis" (post 2008 meltdown) is, with hoped-for able leadership and non-austerity compassion, supposed to abate. It is fervently wished for, so that middle class consumer equality -- cars, jet vacations, restaurant bliss and the like -- can get back on track. But even without the petroleum-rich Russian Bear's being upset over Ukraine, and even without wars in the Middle East, growth as we know it is history. Stability as we know it is also history. It does not help that simple living -- closer to nature and one's local economy, brought about by energy curtailment -- is so equated with "doom and gloom."

Cars Are Renewable?

courtesy Sheerness Imports for Dealers

A key article related to addressing the notion of "clean, renewable" energy's saving the consumer lifestyle is the recent **Tesla, Leaf: Unclean at Any Speed?** by Ozzie Zehner, author of *Green Illusions*. Zehner was a car buff, an electric one at that, but he has found that "clean cars" and therefore cars in general have no long-term future.

The title harkens back to Ralph Nader's seminal consumerist study published in 1965: *Unsafe at Any Speed*: *The Designed-In Dangers of the American Automobile*. The two cars Nader gained fame for attacking were the Volkswagon Bug and General Motors' Corvair compact. The book was shocking at the time. The world had only begun to suspect the post-World War II corporate world of major fraud, thanks to the earlier book in 1960 by Vance Packard, *The Waste Makers* which introduced us to manufacturers' hidden strategy of planned obsolescence for products.

The "Tesla, Leaf" study's author, Ozzie Zehner, deflects car lovers' emotional wrath against his non-technofix position by opening with "I was once an electric car enthusiast. I even built one! But in my new IEEE cover feature, I ask, 'Are electric among the cleanest transportation options, or among the dirtiest?' Unclean at Any Speed considers the entire life cycle of electric cars, especially their manufacturing impacts..." (Zehner is a University of California at Berkeley visiting scholar.)

Additional points we frequently make to car enthusiasts who think electric or some non-petroleum propulsion will save the day:

• The approximate one million animals a day slaughtered on U.S. roads have no reason to cheer. The animals are forgotten consistently.

• In the U.S. the human death toll from crashes is 25,000 a year. Injuries are much higher, as is the death & injury toll from the sedentary lifestyle of driving.

• A car company exemplifies the opposite of local economic self-reliance because almost all the money for a new car purchase leaves the community.

• Why contribute to urban sprawl, as cars require space needed for growing food and leaving some room for wildlife? Pavement, tarmac and asphalt rooftops add to the urban heat island effect.

• Roads fragment wildlife habitat and drive away top predators. Roads allow access for clear-cutters of forests, and contribute to population growth through migration. Roads cause much erosion resulting in siltation of salmon-spawning streams.

• Ultimately the car is an entropy heap. Toxic, unsightly waste, slightly recyclable.

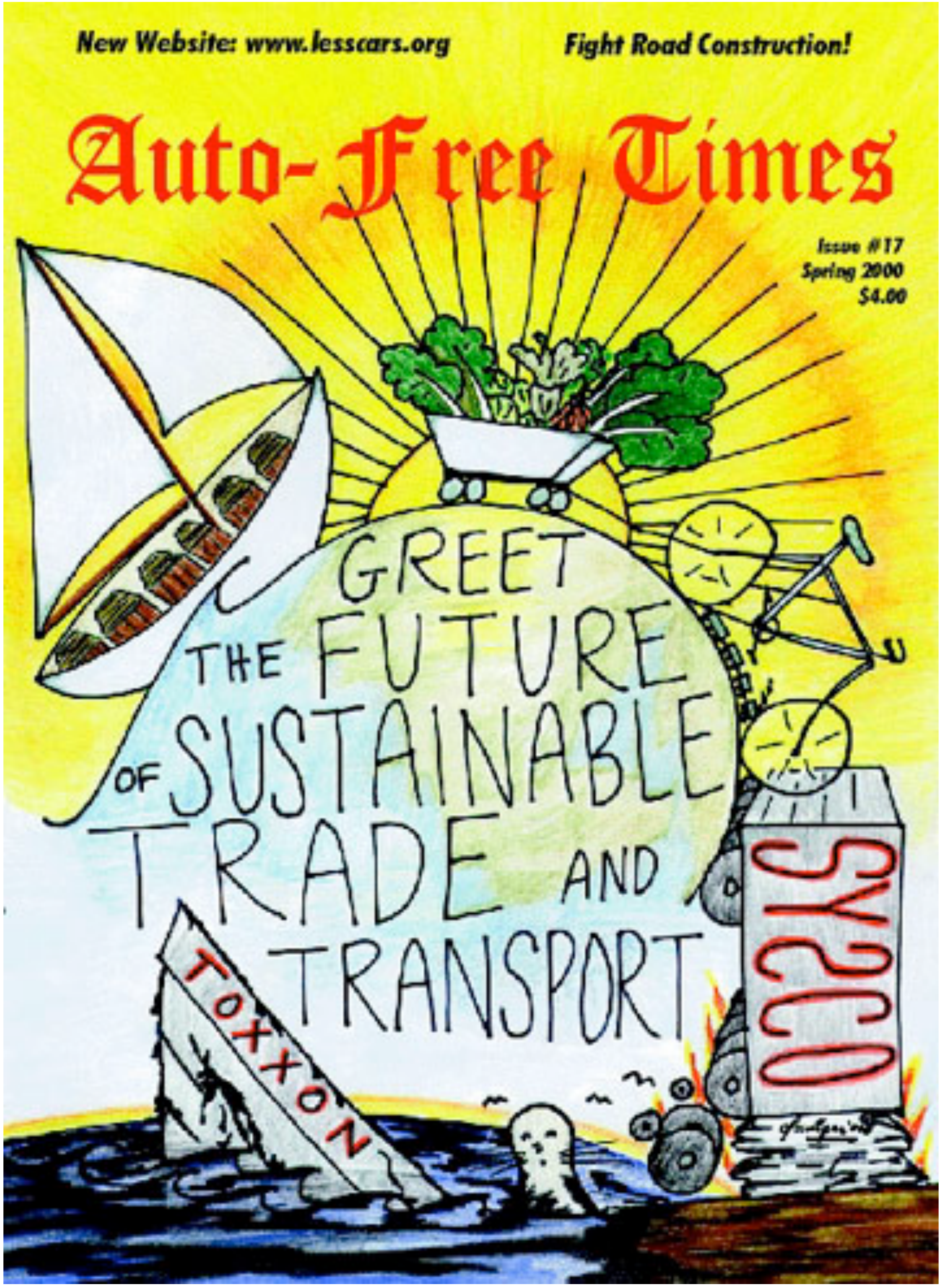
by Andy Singer

• The actual speed of the American motorist is approximately 5 (five) miles per hour, when all the time associated with the vehicle's purchase cost and upkeep is considered. (source: Ivan Illich's book *Energy and Equity*, 1974, part of his series on alternatives to industrial society)

• Think also of the billions of tires and tons of plastic from Big Oil. And are brake dust, tire dust what children and animals deserve to breathe?

• Get your exercise on a bicycle and don't threaten others with a killing machine.

Conclusion



Launch of the Sail Transport Network, reported by our organization in 2000

Apart from passive solar installations -- e.g., black-painted water tanks on roofs for warming water -- and **sail power** for truly clean transport on the water, renewable energy systems on an industrial scale for the grid have delivered neither the quantity of energy nor done so in a truly clean-source fashion to significantly cut fossil fuel consumption. Instead, renewable energy output has, in effect, been used to shore up growth of the corporate global economy's precarious petroleum infrastructure. Renewable energy systems have gotten almost nowhere without massive imbedded energy from the petroleum industry. Given the actual carbon footprint of renewable energy systems, it is not surprising there has been no decrease in overall carbon emissions with the advent of solar panels, wind turbines, and other "renewables."

Alternatives to industrial society have been in the making from Day One, when Luddites destroyed factory machines over two centuries ago in England, to protect their village way of life for their survival. The 1960s saw a rejection of Plastic Society, the War Machine, and a move to go Back to the Land. The "Appropriate Tech" movement of the 1970s followed, exemplified by The Farm in Tennessee that was the nation's biggest commune. Today there are remnants of the Back to the Land movement, along with a sail transport movement back to the sea.

Appropriate Tech has gone out of style, as renewable energy was forced to "grow up," cut the long hair, put on a suit and tie, and try to power the global corporate economy. When Appropriate Tech was twisted and betrayed to "mature" into large-scale "renewable" energy systems, it was a lot like organic food gardens and homesteads giving way to agribusiness "organic" large-scale farms that deplete topsoil and ship product very long distances with oil. But as long as there is ample oil -- subsidized so as to look affordable, during the peak-oil plateau -- little will change in the corporate global economy. This is despite renewable energy systems which have become part of business-as-usual for the totally unsustainable consumer economy.

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1. Peak oil study by Robert Hirsch, et al, for the U.S. Dept. of Energy: **Peaking of World Oil Production: Impacts, Mitigation and Risk Management**, early 2005.

2. **Things to Know as Collapse Becomes Hip** August 24, 2013, by Jan Lundberg, Truthout.org Op-Ed

In "Six Myths About Climate Change that Liberals Rarely Question," Erik Lindberg looks at renewable energy's hopeless but hoped-for role for saving the climate and the consumer economy. Scroll down to **Myth #3: Renewable Energy Can Replace Fossil Fuels**. Nov. 26, 2014

Peak Frack, Hydraulic fracturing of petroleum, in a nutshell.

Why Wind Farms Can Be Relied On For Almost Zero Power, The Energy Collective, November 17, 2014: "In every country aggregate wind farm output often goes close to zero...[so] Wind farms can reliably supply less than 1% of installed capacity"

Beyond Oil: The Threat to Food and Fuel in the Coming Decades, a 1986 book and econometric model about peak oil, reviewed by Jan Lundberg in 1988 originally for *Population and Environment* quarterly journal.

Culture Change operated the Alliance for a Paving Moratorium against new road construction from 1990-2001, publishing the **Auto-Free Times** magazine and Road Fighters' Alerts.

A conference on energy- and resource-consumption curtailment and simple living was held November 7-9, 2014, by **Community Solutions** Yellow Springs, Ohio.

***Publisher's note*:**

Although I have publicly switched my work emphasis to sail transport, I have practical reason for continuing to concern myself with industrial/consumer renewable energy systems. Apart from an abiding interest in helping people understand the workings of oil industry supply dynamics, and understand how the entire energy sector is affected, I need to be current on the realities of both "the technofix" for oil dependence and the ballyhooed oil bonanza in the U.S. oil patch, because:

When my colleagues and I are promoting sail transport as truly renewable, clean energy, this almost unique advantage is not enough for some. This is because the consumer economy gets more patience and assumed longevity with every new "optimistic" news report on petroleum or renewables. Oil-intensive consuming will thereby confidently chug along, supposedly, with no end of oil-guzzling conventional shipping. Either oil is mistakenly seen as plentiful for the foreseeable future, or renewable energy is "certainly" stepping in to allow for sustainable consuming and polluting. Yet, some of us see the inevitability of local economics and ocean protection becoming the norm, sooner than many think likely, enabled by a growing global sailing fleet for essential travel and exchange of goods. - *Jan Lundberg, independent oil industry analyst and founder,* **Sail Transport Network**

Acknowledgment: the green plug graphic is courtesy **greenretaildecisions.com** in its coverage of "EPA Launches Green Power Resource Library," or **4liberty.eu**.

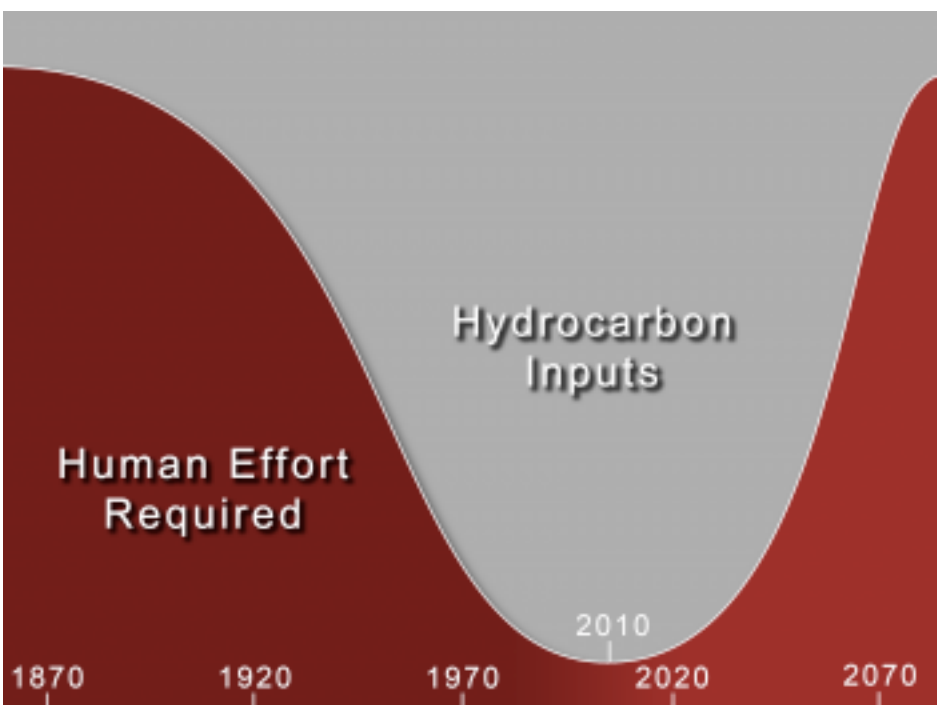
Andrew Nikiforuk's latest book, The Energy of Slaves

http://www.dmpibooks.com/book/the-energy-of-slaves

Excerpt:

Ancient civilizations routinely relied on shackled human muscle. It took the energy of slaves to plant crops, clothe emperors, and build cities. In the early nineteenth century, the slave trade became one of the most profitable enterprises on the planet, and slaveholders viewed religious critics as hostilely as oil companies now regard environmentalists. Yet when the abolition movement finally triumphed in the 1850s, it had an invisible ally: coal and oil. As the world's most portable and versatile workers, fossil fuels dramatically replenished slavery's ranks with combustion engines and other labour-saving tools. Since then, oil has transformed politics, economics, science, agriculture, gender, and even our concept of happiness. But as Andrew Nikiforuk argues in this provocative new book, we still behave like slaveholders in the way we use energy, and that urgently needs to change.

Many North Americans and Europeans today enjoy lifestyles as extravagant as those of Caribbean plantation owners. Like slaveholders, we feel entitled to surplus energy and rationalize inequality, even barbarity, to get it. But endless growth is an illusion, and now that half of the world's oil has been burned, our energy slaves are becoming more expensive by the day. What we need, Nikiforuk argues, is a radical new emancipation movement.



www.mbendi.co.za/indy/oilg/p0070.htm

geologist Colin Campbell on peak of oil production (2000)

Peak oil is a turning point for Mankind. The economic prosperity of the 20th Century was driven by cheap, oil-based energy. Everyone had the equivalent of several unpaid and unfed slaves to do his work for him, but now these slaves are getting old and won't work much longer. We have an urgent need to find how to live without them.

It is stressed that we are not facing a re-run of the Oil Shocks of the 1970s. They were like the tremors before an earthquake, although serious enough, tipping the World into recession. Now, we face the earthquake itself. This shock is very different. It is driven by resource constraints, not politics - although of course politics do enter into it. It is not a temporary interruption but the onset of a permanent new condition.

http://www.greens.org/s-r/60/60-09.html

Synthesis/Regeneration 60 (Winter 2013)

greens.org: A Critique of Jacobson and Delucchi's Proposals for a World Renewable Energy Supply

by Ted Trainer

Mark Jacobson and Mark Delucchi published a claim that all the world's energy needs in 2030, allowing for projected economic growth, can be met with wind, water and solar power. They assume that energy efficiency can reduce demand for energy by 5–15% by 2030. —Editors

Advocates of renewable energy technologies frequently refer to the many available and potential ways of reducing the effect of variability of renew able energy. However they usually do not show that these could be combined to enable constant energy delivery to the grid despite the magnitude of the shortfalls that typically occur in supply from renewable sources. Jacobson and Delucchi (2011a, 2011b) list possible strategies but do not show that these can provide the necessary quantities of energy to plug gaps in supply.

http://www.greens.org/s-r/48/48-11.html

greens.org: Renewable Energy Cannot Sustain a Consumer Society

by Ted Trainer

Sustainable Solutions?

... a problem calls for a solution; the only question is whether a solution can be found and made to work and, once this is done, the problem is solved.
A predicament, by contrast, has no solution. Faced with a predicament, people come up with responses. Those responses may succeed, they may fail, or they may fall somewhere in between, but none of them "solves" the predicament, in the sense that none of them makes it go away.
-- John Michael Greer, "The Long Descent" thearchdruidreport.blogspot.com

http://www.postcarbon.org/why-should-we-even-bother/
Why should we even bother?
Asher Miller
December 29, 2014

Let's be honest, if you're aware — at any meaningful level — of the full nature of the human (un)sustainability crisis, you've probably asked:

Why bother? After all, the problems are so big and intractable–a climate march, Keystone XL Pipeline blockade, or Transition Town can't possibly do much. And Post Carbon Institute wants me to not only take action, but also donate money?!?!

Yes. I want you take action. We all need to take action. And, yes, donate money (even if you don't believe in the US dollar!). Because it's not hopeless.

Trust me, I get it. Given the long odds — exacerbated by the human propensity to optimism and discounting the future in favor of the present, the power and reach of entrenched interests, and the sheer inertia behind the consumer- and growth-dependent economy — it's hard to believe in solutions.

I'm going to give it to you straight: *there are no solutions*, at least not ones that will allow the society we've created to continue on its "business as usual" trajectory. (No, not even with a massive deployment of renewable energy.)

But that doesn't mean it's hopeless, that we (and you) shouldn't even bother to try. Here's our best thinking for why and how to intervene in the system — and why your role is absolutely critical.

If you're reading this, we count you among the small but growing number of innovators and early adopters who play an absolutely critical role in developing alternatives to existing policies and practices, to keep them alive and available for the moment they're needed. Here's why.

Change Strategy

In our view, the nature of the predicament we face is such that proactive efforts at mitigating its impacts — while still highly valuable — are insufficient to prevent severe crises. In fact, it will be unfolding crises in our economic, energy, ecological, and socio-political systems that create the greatest opportunity for change.

Therefore, the question before us is this: How can we anticipate these crises, build resilience to withstand them, and begin efforts that create change so that society can be ready to take decisive and appropriate action when they arise?

Our strategy responds to this question in three ways:

Support communities as they build resilience to withstand existing and coming challenges;

Help prevent the worst kinds of shocks or changes—those to which we simply cannot adapt; and

Transform cultural norms and economic, energy, food, built environment, population, and socio-political systems to help to steer humanity down a truly sustainable path.

In this effort we are guided by two theories—summarized as "Crisis = Opportunity" and "The Diffusion of Innovation."

Crisis = Opportunity

In *The Shock Doctrine*: *The Rise of Disaster Capitalism*, Naomi Klein detailed how "free market" advocates and corporations have taken advantage of crises to further their aims. The following quote from Milton Friedman, the guru of free market economics, best outlines their strategy:

Only a crisis — actual or perceived — produces real change. When the crisis occurs, the actions that are taken depend on the ideas that are lying around. That, I believe, is our basic function: to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes politically inevitable.

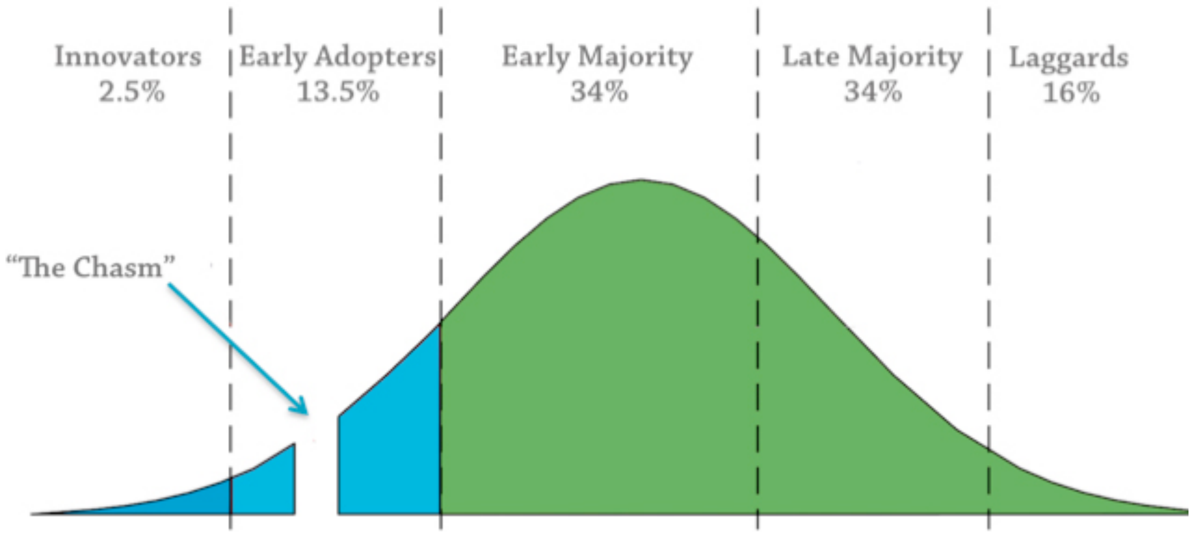
Although the philosophical views and values of the neoclassicists are in many ways antithetical to our own, this framework is very applicable to our mission. What this means in tactical terms is a change strategy focused on two main levers:

Building awareness of the true nature of the predicament at hand. Although key decision makers and society at large may not adopt the right policies and behavioral changes in advance of crises, communication and education strategies are vital in ensuring that the right ideas and models are "picked up" when the right moments arise.

Developing, replicating, and scaling the right ideas and models. Although these alternative ideas and models (which can include everything from alternative indicators of progress to replicable local food enterprises) may exist initially at the margins, current events and coming crises will present opportunities for them to be broadly adopted and quickly built out. Therefore, it is vital to use the time and resources available now to experiment and create best practices—to build alternatives that have the greatest chance of both being "picked up" and succeeding.

Diffusion of Innovations

The Diffusion of Innovations theory describes how, why, and at what rate new ideas, social innovations, and technology spread throughout our culture. Key to the theory is the identification of different types of individuals in the population, in terms of how they relate to the development and adoption of a new innovation: innovators, early adopters, early majority, late majority, and laggards.



The Innovation Adoption Lifecycle

Although they make up only a small percentage of the total population, innovators and early adopters build the foundation upon which all social innovations take place. The role of innovators is obvious. The equally critical role of early adopters is to embrace a new innovation when it is not easy to do so, and in turn spread that innovation to the early majority. Studies of hundreds of innovations (both successful and those that failed to catch on) have shown the critical role both groups play and what happens when innovations don't cross "the chasm" by failing to attract enough early adopters.

In the context of PCI's work, innovators are those developing new insights, messages, or models (e.g., a local food system enterprise) that raise understanding of one or more specific sustainability crisis and/or build resilience in response. Likewise, early adopters are those people most likely to embrace our message of limits and resilience, help spread that awareness, and take action. They may already be engaged with one specific sustainability issue (e.g., climate) or are amongst a group we call "the walking worried"—those who feel that things are amiss, but don't know what or why (and thus initiate their own process of exploration, or are exposed through their networks to innovators or early adopters).

Diffusion + Crisis

We see the greatest opportunity for significant change where diffusion and crises meet. Knowing that many crises cannot be solved or averted, Post Carbon Institute aims to develop and spread the right understanding, ideas, and responses (by supporting innovators). We also work to increase the odds that these are then embraced when these crisis hit (by increasing the number of early adopters).

We Need You. Seriously.

The focus on supporting innovators and early adopters, along with the spreading of a systemic understanding of the sustainability crisis, is why we at PCI have been so focused on building energy literacy and community resilience. Over the next year, we aim to expand these efforts by:

Exploring what kinds of societal and behavioral changes a ~100% renewable energy future will require.

Continuing to bust the hype that shale gas and oil will solve our energy woes.

Investigating with geoscientists how climate change and peak oil interact.

Developing a whole suite of new community resilience programs that provide a systemic framework for building resilience, educate and support young people for the world they've inherited, and connect and inspire thousands of community resilience groups and innovators.

This is where you come in. As a follower of PCI, we count among the small but growing number of innovators and early adopters who play an absolutely critical role in "*developing alternatives to existing policies, to keep them alive and available until the politically impossible becomes politically inevitable.*" It's **you** who PCI works so tirelessly to support. *We need you.*

When we are honest with ourselves, it seems clear that climate, energy, environmental, economic, and political crises are inevitable. What form they take we can't rightly predict. But in those moments of crisis new possibilities will emerge. On our shoulders — those of us who understand the predicament and what is required for true sustainability — lies the responsibility and privilege of ensuring that the right ideas are picked up. We sincerely believe there's tremendous potential for the "right" understanding and models to scale non-linearly, if we make the "right" efforts now.

So, we hope you'll continue to roll up your shirt sleeves by spreading knowledge and developing alternatives. And, yes, we ask that you also support PCI directly. Thank you.

http://www.theoildrum.com/node/5939

Scientific American's Path to Sustainability: Let's Think about the Details

Posted by Gail the Actuary on November 9, 2009 - 10:10am
Topic: Alternative energy
Tags: hydroelectric, scientific american, solar photovoltaic, solar power, sustainability, wind [list all tags]

Scientific American presents "A Path to Sustainable Energy by 2030" in its November issue. In many ways, it sounds good. But let's think about the details: What would the end result look like? Would it really be sustainable? What would the costs really be? Is there any way we could afford to do what is proposed?

The authors of the article, Mark Jacobson and Mark Delucchi, propose substituting wind, water, and solar (WWS) energy for all other forms of energy by 2030, not for just the US, but for the world. The types of energy sources that would be eliminated include the following:

- Petroleum (including gasoline, diesel, propane, heating oil, etc.)
- Natural gas
- Coal
- Liquid biofuels, such as ethanol
- Wood and other biomass
- Nuclear

All that would remain would be wind, wave power, tidal energy, hydroelectric, geothermal, and solar. Because of the ambitious timeframe, the only techniques that can be used are ones that work at large scale today, or are very close to working.

What would we end up with?

Essentially, we would need to change all of the world's infrastructure to use either electricity or solar or water power directly--by 2030. What might this mean?

- Airplanes. The authors propose that airplanes be powered by hydrogen powered fuel cells (with the hydrogen be made by hydrolysis using WWS energy sources). I understand that hydrogen is three times as bulky as gasoline, explodes easily, and escapes fairly quickly from its holding tanks, making it difficult to store for very long. It seems like airplanes and helicopters would need to look more like blimps, to hold the necessary fuel. Unless the explosion issue is solved, the popularity of hydrogen fuel cells would likely be pretty low.

- Ships. The authors don't tell us how ships would be powered. Clearly sailing ships would meet the criteria, but would be quite slow. Because of their slow time for passage, we would need a lot more sailing ships than the types of ships we use now, because so many would be in transit at a given time. Barges could float down rivers, and if the current isn't too strong, could perhaps be towed back in some way (boat with fuel cell?). Ships powered by hydrogen fuel cells might also work, but they would have the same issues as for airplanes. Because of their long trips, leakage would be more of an issue than on airplanes.
- Automobiles and Trucks. According to the authors, these would be powered by batteries or hydrogen powered fuel cells. There are several issues--the technology is only barely there for automobiles and trucks--for example, I don't know of anyone working on battery-powered technology for long distance trucking. Fuel cell technology is very expensive. David Strahan in The Last Oil Shock says that the current cost is about $1 million dollars per car. He quotes the chief engineer at Honda as saying it would take 10 years to get the cost down to $100,000 a car.

Minerals shortages are also likely to be a problem for converting autos and trucks to batteries or to hydrogen fuel cells. The Scientific American article mentions following materials as being in short supply: rare-earth metals for electric motors, lithium for lithium-ion batteries and platinum for fuel cells. The article mentions recycling as a partial solution. Analyses published at The Oil Drum, such as this one, indicate that we would likely run out of rare materials fairly quickly, even with recycling.

- Farm equipment; bulldozers; cement mixers; and other heavy equipment. Would need to be converted to electric. It is not clear that the technology (or rare materials needed for the technology) exist to do so.
- Heating of buildings; heating for cooking and baking; hot water heating; commercial heating; heating of grains to remove excess moisture. Would need to be converted to electric, or in some cases solar. This would be true, even where heating is now done over wood or charcoal fires, such as in Africa or China.
- Mining and manufacturing. Would need to be converted to all electric. Presumably oil and natural gas extraction would continue, but at possibly lower rates, because of their uses for non-energy uses, such as textiles, asphalt, plastics and lubrication. Drilling for oil and gas would be converted to electric as well.

What steps would be needed to build all of these things?

It seems like we would first need to figure out what the end point would look like, and then work backwards.

We are told that the authors of the Scientific American article think we would need the following:

- 3.8 million large wind turbines
- 90,000 solar electricity generating plants
- "Numerous geothermal, tidal, and rooftop photovoltaic installations"

Besides these, we would need to build all of the new airplanes, ships, cars, trucks, heavy equipment, and new appliances that would be needed under the new regime. Individual homeowners would need to get their homes rewired for the larger amount of electricity they would use--especially if they are converting to electric home heating.

One thing we need to plan for is a greatly expanded and improved electrical grid. The Scientific American article indicates that the variability in generation would be mostly smoothed out by combining electrical transmission of many different types--wind, hydroelectric, solar, geothermal, and wave--over a wide geographical area. To do this will require considerable long distance transmission, often between different countries--including some that may not be friendly with each other. The grid will also need to be upgraded to be "smart," so automobiles can draw electric power at the times of day when it is not needed elsewhere.

Once we have figured out what the new system will look like, we will need to figure out what kind of factories are needed to build all of the devices for the new system, and what raw materials the factories will need. Some of the raw materials can perhaps be obtained by recycling, and some factories can perhaps be obtained by converting other factories, but this won't always be the case. It is likely that new factories will need to be built, and new mines opened, especially for the rare minerals.

By the time we start seeing many finished good produced, it is likely that we will be at least half way through the 20 year period. In part, this is because we are still working out technology details (for example, how to efficiently build a hydrogen fuel cell powered airplane). Also, once we get those details worked out, we need to build mines for raw materials and build the factories to make the new devices. It is only when we get those steps taken care of that we can build what we really want--the airplanes, the new ships, the wind turbines, the solar PV, and all of the rest.

When sizing the factories, we will need to size them not for "normal" production levels, but for converting the economy quickly to use the new power sources. For example, under normal circumstances, if earth-moving equipment is expected to last for 40 years, we would expect to need factories to make 1/40 of the world's needed earth-moving equipment in a given year. But if we need to ramp up to replacement in 10 years, we will need 4 times as many factories. (What do we do with the excess factories at the end?)

How much would this all cost?

The authors tell us that they expect the cost of the new WWS energy generation equipment would be $100 trillion over 20 years. But that doesn't include the cost of all the new infrastructure to go with it--the new airplanes and ships and cars and trucks, or the electrical transmission lines. In total, the cost will be far higher than $100 trillion--lets guess $200 trillion--to be paid for over the next 20 years.

The Scientific American article gives the impression that the costs will be low, because it looks only at the cost the new electricity generation, and assumes that cost of generation will go down with volume and with additional research. It also implicitly assumes that debt financing over a long period, such as 40 years, will be used, so we don't have to pay for the cost of the new system before we start using it. But how realistic is that?

The cars, trucks, boats, airplanes, coal fired power plants, etc. we are currently using won't have much trade-in value once power is generated by WWS, and the new equipment will likely be fairly expensive. So we will be faced with buying new high priced equipment, with little trade-in value from what we used previously. In many cases, businesses would not normally be replacing equipment this soon. The debt that was taken on to pay for all of our current equipment won't magically go away either--it will still need to be paid.

So how will we pay for all of the new equipment? The governments of the world are pretty much maxed out for borrowing. Companies are not going to be able to take on a project of this magnitude either, especially since they already have debt to service. It seems to me that the only way a program such as the program of WWS fuels replacing other fuels can be financed is through increased taxes that would cover each year's expenditures, as they are made.

So let's think about how much this would cost. $200 trillion over 20 years amounts to $10 trillion a year, spread over world economies. The US share of this would be something around 21%, based on the ratio of US GDP to world GDP. So let's say that the US would need to fund $2.1 trillion a year. Let's compare this to current taxes. In 2008, US Federal, State, and Local taxes combined amounted to $4.1 trillion according to the US Bureau of Economic Analysis. In order to collect $2.1 trillion more, a tax increase equal to slightly more than 50% of all taxes currently paid would be required. If the additional tax were collected as a percentage of "personal income" (which includes wages, social security income, rents, dividends, etc.), it would amount to 17% of personal income. It seems unlikely that a tax of this magnitude, or even half of this magnitude, would be agreed to by tax payers.

If such a tax were passed, after a few years there would be benefits that would start offsetting its cost, and might lead to a lower tax, and after 2030, perhaps lower costs overall, because it is no longer necessary to purchase fossil fuels. The benefits that would start offsetting costs would be sales of electricity and other energy, and sales or leasing of vehicles and other goods produced. Many of the sales of goods would be going to replace automobiles that had worn out, factories beyond their useful life, and ships that no longer had value to the owners.

But there is a remaining issue. There will be a lot of assets which would still have considerable value in 2030, if it weren't for the new law. For example, a new car with an internal combustion engine that was manufactured in 2028 will still have considerable value, and a gas fired stove a homeowner owns will still have value, even though he needs to replace it with an electric one. A coal fired power plant built in 1980 is likely to still have value, apart from this law, and so will all of the tankers used for international transport of oil, and all of the natural gas pipelines. Should the owners of these assets be compensated for value of their otherwise-useful assets? There is nothing built into the tax to do so.

It would seem to me that these owners should be compensated, even if it takes a higher tax to do so. In part, this compensation could come in the form of "trade in" value, if a new automobile or electric stove or other item is purchased. But suppose the assets that lose value belong to businesses, and aren't easily traded in for corresponding asset--such as a coal fired power plant, or natural gas pipelines. I would argue that compensation for the remaining value of these is really needed as well.

The assets that will lose value because of the new law are typically owned by a company. The stocks and bonds of these companies will generally have a wide variety of owners--very often pension plans, insurance companies, endowment funds, and individuals saving for their retirements. If the otherwise-useful assets of these companies are taken without compensation, the companies are likely to default on their bonds, and the stocks of these companies will lose value. This will mean that some pension funds will not be able to pay their promised payments, and some life insurance policies will not pay as promised. If there is no compensation to these companies by a tax or some sort, the loss will flow through the system and hit others--with retirees likely hit the hardest. So there will be a loss to the system, one way or another.

How sustainable would this system be?

There are a number of weak areas in this system:

- There are not likely to be enough rare minerals (and even not-so-rare minerals), to make all of the desired high-tech end products. Recycling will help, but it is likely that the system will run into a bottleneck in not very many years.

- The system will use a huge number of electrical transmission lines. These transmission lines are subject to all kinds of disturbances--hurricane or other windstorm destruction, forest fires, land or snow slide, malicious destruction by those not happy for some reason (perhaps those unhappy by wealth disparities). Fixing lines that need repair will be challenging. We currently use helicopters and specialized equipment. These would need to be adequately adapted to a system without fossil fuels.
- If electricity is out in an area, pretty much all activity in an area will stop (except that powered by local PV), and there will be no back-up generators. Residents will not be able to recharge vehicles, so they will quickly become useless. Even vehicles coming into an area may get stranded for lack of recharge capability. Food deliveries and water may be a problem. The current system at least offers some options--back-up generators, and cars and trucks powered by petroleum that one can drive away.
- Operating the system will require a huge amount of international co-operation, because the transmission system will cross country lines. If one country becomes unable to pay its share, or fails to make repairs, it could be a problem.
- All of the high tech manufacturing will require considerable international co-operation and trade. This could be interrupted by debt defaults by major players, or by countries hoarding raw materials, or by difficulty in producing enough ships and airplanes to handle international trade.
- The system clearly can't continue forever. It could be stopped by a lack of rare minerals, or international disputes, or lack of adequate international trade. The system doesn't provide any natural transition to a truly sustainable future. For example, food production is likely to still be done using industrial agriculture, with the food that is produced shipped to consumers a long distance away. It will be difficult to transition to a system which is truly sustainable at the point the system stops working.

What would a reasonable timeframe for transition be?

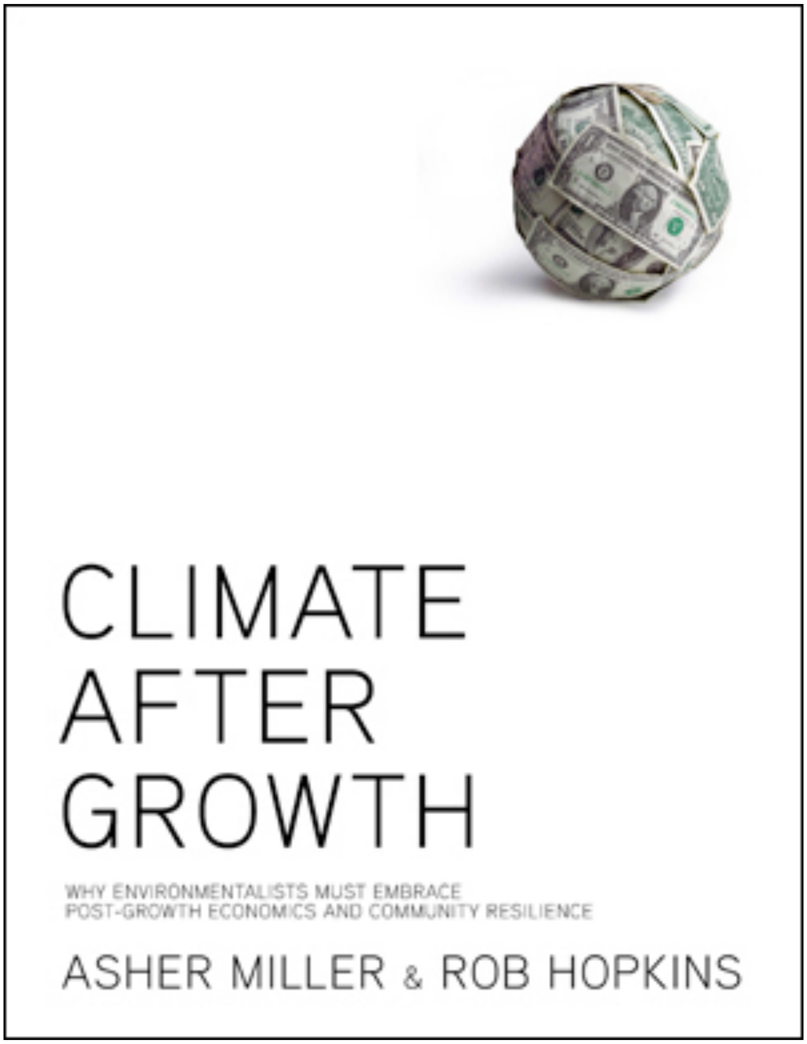
It seems to me that a reasonable timeframe for a transition such as that discussed in the Scientific American article would be 50 years, rather than 20 years suggested in the Scientific American article. With such a timeframe, there will be a little more time to fine tune technology, so as to find cost-efficient solutions that scale well. We also have more time to use the factories that are built, so that we don't have to overbuild, just to meet a deadline. Costs are likely to much easier to handle, since there will not be as much of an overlap issue. In addition, there will be much less problem of having to dispose of other-wise useful assets.

The problem is that we really don't have 50 years to make a transition. We already are on the downslope. We should have started back in the 1960s with a project like this.

It seems to me that all we can do is a very much reduced version of an approach such as the one described in the Scientific American article. Given the timing, we may not even want to do an approach such as described in the article. The approach described assumes a high level of international trade continuing long-term. This is a fairly optimistic assumption, given the difficulty of air and ship transportation without fossil fuels.

Instead of the high tech approach advocated by Scientific American, we may want to find solutions that can be done locally, with local materials. For example, we may want to encourage local agriculture. For industry, we may want to look at solutions that have worked in the past, such as wind powered factories, as discussed in this recent post. These were built with local materials, and were used to power factories directly, without conversion to electricity. With such solutions, a transition to a truly sustainable future will be much more of a possibility.

http://www.postcarbon.org/publications/climate-after-growth/



Climate After Growth: Why Environmentalists Must Embrace Post-Growth Economics and Community Resilience

Rob Hopkins, Asher Miller
September 30, 2013

In this provocative paper, PCI Executive Director Asher Miller and Transition Movement Founder (and PCI Fellow) Rob Hopkins make a convincing case for why the environmental community must embrace post-growth economics and community resilience in their efforts to address the climate crisis.

Executive Summary

The nearly ubiquitous belief of our elected officials is that addressing the climate crisis must come second to ensuring economic growth. This is wrongheaded—both because it underestimates the severity of the climate crisis, and because it presupposes that the old economic "normal" of robust growth can be revived. It can't.

In fact, we have entered an era of "new normals"—not only in our economy, but in our energy and climate systems, as well. The implications are profound:

The New Energy Normal. The era of cheap and easy fossil fuels is over, leading the industry to resort to extreme fossil fuel resources (tar sands, mountaintop removal coal mining, shale gas, tight oil, and deepwater oil) to meet demand. Unfortunately, these resources come with enormous environmental and economic costs, and in most instances provide far less net energy to the rest of society. They also require much higher prices to make production worthwhile, creating a drag effect on the economy. As a result, high energy prices and economic contraction are likely to continue a back-and-forth dance in the coming years.

The New Climate Normal. Climate stability is now a thing of the past. As extreme weather events grow in severity, communities are increasingly adopting strategies that build resilience against the effect of these and other climate shocks. At the same time, we must take dramatic steps if we hope to avoid raising global temperatures more than 2°C above pre-industrial levels. According to Kevin Anderson of the Tyndall Centre, this would require a 10% reduction in CO2 emissions per year, starting now—a rate so significant that it can only be achieved through dramatic reductions in energy use.

The New Economic Normal. We've reached the end of economic growth as we've known it in the US. Despite unprecedented interventions on the part of central banks and governments, the so-called economic recovery in the US and Europe has been anemic and has failed to benefit the majority of citizens. The debate between stimulus and austerity is a distraction, as neither can fully address the factors that spell the end of economic growth—the end of the age of cheap oil, the vast mountains of debt that we have incurred, the diminishing economic impacts of new technologies, and the snowballing costs of climate change impacts.

These fundamental changes in our energy, climate, and economic systems require unprecedented (and previously politically untenable) strategies. Yet this new reality is still largely unrecognized. As long as our leaders' predominant focus remains on getting back to the days of robust economic growth, no national or international climate policies will be enacted to do what is required: cut fossil fuel use dramatically.

Instead of focusing on achieving climate policy within the economic growth paradigm, the US environmental community must embrace strategies that are appropriate to these "new normals."

Responding to each of these new energy, climate, and economic "normals" will require one common strategy: building community resilience. Efforts that build community resilience enhance our ability to navigate the energy, climate, and economic crises of the 21st century. Done right, they can also serve as the foundation of a whole new economy—an economy comprised of people and communities that thrive within the real limits of our beautiful but finite planet.

Thankfully, innovations that build community resilience are cropping up everywhere, and in many forms: community-owned, distributed, renewable energy production; sustainable local food systems; new cooperative business models; sharing economies, re-skilling, and more. While relatively small and inherently local, these projects are spreading rapidly and creating tangible impacts.

Growing the community resilience movement to the national and global scale that's needed will require the full support and participation of the US environmental community. Specifically we need to:

build the capacity of groups—large and small—who are leading these efforts;
support the growth of a global learning network; and
enable local investments to flow into community resilience enterprises.

By making community resilience a top priority, environmentalists can offer an alternative to the "growth at all costs" story, one in which taking control of our basic needs locally has multiple benefits. Community resilience-building can create new enterprises and meaningful work, and increase well-being even as GDP inevitably falters. It can reduce greenhouse gas emissions and dependence on fossil fuels, while addressing social and economic inequities. And it can strengthen the social cohesion necessary to withstand periods of crisis.

On their own, community resilience projects can't overcome all the environmental, energy, economic, and social equity challenges facing us. That will require coordinated global, national, regional, community, business, neighborhood, household and individual efforts. But the community resilience movement can help create the conditions in which what is now "politically impossible becomes politically inevitable."

How the environmental community responds to the risks and opportunities of the new energy, climate, and economic "normals" will make an enormous difference in its success, and in the fate of humankind.

http://www.postcarbon.org/the-oil-price-crash-of-2014/

The Oil Price Crash of 2014, Richard Heinberg, December 19, 2014

Oil prices have fallen by half since late June. This is a significant development for the oil industry and for the global economy, though no one knows exactly how either the industry or the economy will respond in the long run. Since it's almost the end of the year, perhaps this is a good time to stop and ask: (1) Why is this happening? (2) Who wins and who loses over the short term?, and (3) What will be the impacts on oil production in 2015?

1. Why is this happening?

Euan Mearns does a good job of explaining the oil price crash here. Briefly, demand for oil is softening (notably in China, Japan, and Europe) because economic growth is faltering. Meanwhile, the US is importing less petroleum because domestic supplies are increasing—almost entirely due to the frantic pace of drilling in "tight" oil fields in North Dakota and Texas, using hydrofracturing and horizontal drilling technologies—while demand has leveled off.

Usually when there is a mismatch between supply and demand in the global crude market, it is up to Saudi Arabia—the world's top exporter—to ramp production up or down in order to stabilize prices. But this time the Saudis have refused to cut back on production and have instead unilaterally cut prices to customers in Asia, evidently because the Arabian royals *want* prices low. There is speculation that the Saudis wish to punish Russia and Iran for their involvement in Syria and Iraq. Low prices have the added benefit (to Riyadh) of shaking at least some high-cost tight oil, deepwater, and tar sands producers in North America out of the market, thus enhancing Saudi market share.

The media frame this situation as an oil "glut," but it's important to recall the bigger picture: world production of conventional oil (excluding natural gas liquids, tar sands, deepwater, and tight oil) stopped growing in 2005, and has actually declined a bit since then. Nearly all supply growth has come from more costly (and more environmentally ruinous) resources such as tight oil and tar sands. Consequently, oil prices have been very high during this period (with the exception of the deepest, darkest months of the Great Recession). Even at their current depressed level of $55 to $60, petroleum prices are still above the International Energy Agency's high-price scenario for this period contained in forecasts issued a decade ago.

Part of the reason has to do with the fact that costs of exploration and production within the industry have risen dramatically (early this year Steve Kopits of the energy market analytic firm Douglas-Westwood estimated that costs were rising at nearly 11 percent annually).

In short, during this past decade the oil industry has entered a new regime of steeper production costs, slower supply growth, declining resource quality, and higher prices. That all-important context is largely absent from most news stories about the price plunge, but without it recent events are unintelligible. If the current oil market can be characterized as being in a state of "glut," that simply means that at this moment, and at this price, there are more willing sellers than buyers; it shouldn't be taken as a fundamental or long-term indication of resource abundance.

2. Who wins and loses, short-term?

Gail Tverberg does a great job of teasing apart the likely consequences of the oil price slump here. For the US, there will be some tangible benefits from falling gasoline prices: motorists now have more money in their pockets to spend on Christmas gifts. However, there are also perils to the price plunge, and the longer prices remain low, the higher the risk. For the past five years, tight oil and shale gas have been significant drivers of growth in the American economy, adding $300 to 400 billion annually to GDP. States with active shale plays have seen a significant increase of jobs while the rest of the nation has merely sputtered along.

The shale boom seems to have resulted from a combination of high petroleum prices and easy financing: with the Fed keeping interest rates near zero, scores of small oil and gas companies were able to take on enormous amounts of debt so as to pay for the purchase of drilling leases, the rental of rigs, and the expensive process of fracking. This was a tenuous business even in good times, with many companies subsisting on re-sale of leases and creative financing, while failing to show a clear profit on sales of product. Now, if prices remain low, most of these companies will cut back on drilling and some will disappear altogether.

The price rout is hitting Russia quicker and harder than perhaps any other nation. That country is (in most months) the world's biggest producer, and oil and gas provide its main sources of income. As a result of the price crash and US-imposed economic sanctions, the ruble has cratered. Over the short term, Russia's oil and gas companies are somewhat cushioned from impact: they earn high-value US dollars from sales of their products while paying their expenses in rubles that have lost roughly half their value (compared to the dollar) in the past five months. But for the average Russian and for the national government, these are tough times.

There is at least a possibility that the oil price crash has important geopolitical significance. The US and Russia are engaged in what can only be called low-level warfare over Ukraine: Moscow resents what it sees as efforts to wrest that country from its orbit and to surround Russia with NATO bases; Washington, meanwhile, would like to alienate Europe from Russia, thereby heading off long-term economic integration across Eurasia (which, if it were to transpire, would undermine America's "sole superpower" status; see discussion here); Washington also sees Russia's annexation of Crimea as violating international accords. Some argue that the oil price rout resulted from Washington talking Saudi Arabia into flooding the market so as to hammer Russia's economy, thereby neutralizing Moscow's resistance to NATO encirclement (albeit at the price of short-term losses for the US tight oil industry). Russia has recently cemented closer energy and economic ties with China, perhaps partly in response; in view of this latter development, the Saudis' decision to sell oil to China at a discount could be explained as yet another attempt by Washington (via its OPEC proxy) to avert Eurasian economic integration.

Other oil exporting nations with a high-price break-even point—notably Venezuela and Iran, also on Washington's enemies list—are likewise experiencing the price crash as economic catastrophe. But the pain is widely spread: Nigeria has had to redraw its government budget for next year, and North Sea oil production is nearing a point of collapse.

Events are unfolding very quickly, and economic and geopolitical pressures are building. Historically, circumstances like these have sometimes led to major open conflicts, though all-out war between the US and Russia remains unthinkable due to the nuclear deterrents that both nations possess.

If there are indeed elements of US-led geopolitical intrigue at work here (and admittedly this is largely speculation), they carry a serious risk of economic blowback: the oil price plunge appears to be bursting the bubble in high-yield, energy-related junk bonds that, along with rising oil production, helped fuel the American economic "recovery," and it could result not just in layoffs throughout the energy industry but a contagion of fear in the banking sector. Thus the ultimate consequences of the price crash could include a global financial panic (John Michael Greer makes that case persuasively and, as always, quite entertainingly), though it is too soon to consider this as anything more than a possibility.

3. What will be the impacts for oil production?

There's actually some good news for the oil industry in all of this: costs of production will almost certainly decline during the next few months. Companies will cut expenses wherever they can (watch out, middle-level managers!). As drilling rigs are idled, rental costs for rigs will fall. Since the price of oil is an ingredient in the price of just about everything else, cheaper oil will reduce the costs of logistics and oil transport by rail and tanker. Producers will defer investments. Companies will focus only on the most productive, lowest-cost drilling locations, and this will again lower averaged industry costs. In short order, the industry will be advertising itself to investors as newly lean and mean. But the main underlying reason production costs were rising during the past decade—declining resource quality as older conventional oil reservoirs dry up—hasn't gone away. And those most productive, lowest-cost drilling locations (also known as "sweet spots") are limited in size and number.

The industry is putting on a brave face, and for good reason. Companies in the shale patch need to look profitable in order to keep the value of their bonds from evaporating. Major oil companies largely stayed clear of involvement in the tight oil boom; nevertheless, low prices will force them to cut back on upstream investment as well. Drilling will not cease; it will merely contract (the number of new US oil and gas well permits issued in November fell by 40 percent from the previous month). Many companies have no choice but to continue pursuing projects to which they are already financially committed, so we won't see substantial production declines for several months. Production from Canada's tar sands will probably continue at its current pace, but will not expand since new projects will require an oil price at or higher than the current level in order to break even.

As analysis by David Hughes of Post Carbon Institute shows, even without the price crash production in the Bakken and Eagle Ford plays would have been expected to peak and begin a sharp decline within the next two or three years. The price crash can only hasten that inevitable inflection point.

How much and how fast will world oil production fall? Euan Mearns offers three scenarios; in the most likely of these (in his opinion) world production capacity will contract by about two million barrels per day over the next two years as a result of the price collapse.

We may be witnessing one of history's little ironies: the historic commencement of an inevitable, overall, persistent decline of world liquid fuels production may be ushered in not by skyrocketing oil prices such as we saw in the 1970s or in 2008, but by a price crash that at least some pundits are spinning as the death of "peak oil." Meanwhile, the economic and geopolitical perils of the unfolding oil price rout make expectations of business-as-usual for 2015 ring rather hollow.

Strange Planet • 22 days ago
Isn't this the roller-coaster ride that some people predicted would characterise the peak of oil production? With the remaining oil supplies in the hands of the "market" instead of controlled by government as a bridge to a sustainable society, then I suppose we can expect dramatic rises and falls in price and supply right up until we drop off the resource cliff. I have never expected that there would be a steady decline without government intervention.

Bazz12 Strange Planet • **10 days ago**
Spot on Strange Planet.
This exactly what Kenneth Deffreyes predicted in his book Beyond Oil. He predicted very volatile prices going in a number of cycles, before finally sagging into collapse. This is the second cycle.
How many cycles is the real trick, but those of a mathematical bent who can calculate integral proportional and derivative functions, if they can get the data, might be able to enlighten us all. Any control systems engineers here ?
It is all there, in the figures if your maths is good enough.

peakchoicedotorg Strange Planet • **11 days ago**
The 2005 "Hirsch Report" from US Department of Energy made this prediction. (Increasing volatility of prices at Peak Oil.)
I think Colin Campbell made similar predictions in the 1990s.

www.postcarbon.org/our-renewable-future-essay/

Our Renewable Future, Richard Heinberg

January 21, 2015

Or, What I've Learned in 12 Years Writing about Energy
(7000 words, about 25 minutes reading time)

Folks who pay attention to energy and climate issues are regularly treated to two competing depictions of society's energy options.* On one hand, the fossil fuel industry claims that its products deliver unique economic benefits, and that giving up coal, oil, and natural gas in favor of renewable energy sources like solar and wind will entail sacrifice and suffering (this gives a flavor of their argument). Saving the climate may not be worth the trouble, they say, unless we can find affordable ways to capture and sequester carbon as we continue burning fossil fuels.

On the other hand, at least some renewable energy proponents tell us there is plenty of wind and sun, the fuel is free, and the only thing standing between us and a climate-protected world of plentiful, sustainable, "green" energy, jobs, and economic growth is the political clout of the coal, oil, and gas industries (here is a taste of that line of thought).

Which message is right? Will our energy future be fueled by fossils (with or without carbon capture technology), or powered by abundant, renewable wind and sunlight? Does the truth lie somewhere between these extremes—that is, does an "all of the above" energy future await us? Or is our energy destiny located in a Terra Incognita that neither fossil fuel promoters nor renewable energy advocates talk much about? As maddening as it may be, the latter conclusion may be the one best supported by the facts.

If that uncharted land had a motto, it might be, "How we use energy is as important as how we get it."

1. Unburnable Fossils and Intermittent Electricity

Let's start with the claim that giving up coal, oil, and gas will hurl us back to the Stone Age. It's true that fossil fuels have offered extraordinary economic benefits. The cheap, concentrated, and portable energy stored in these remarkable substances opened the way, during the past couple of centuries, for industrial expansion on a scale previously inconceivable. Why not just continue burning fossil fuels, then? Over the long term that is simply not an option, for two decisive reasons.

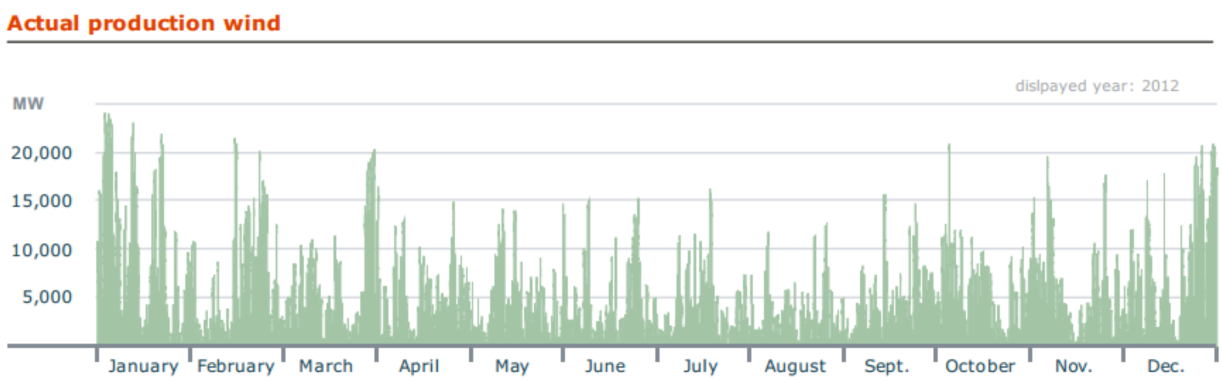
First, burning fossil fuels is changing the climate to such a degree, and at such a pace, that economic as well as ecological ruin may ensue within the lifetimes of today's schoolchildren.

The science is in: either we go cold turkey on our coal, oil, and gas addictions, or we risk raising the planet's temperature to a level incompatible with the continued existence of civilization.

Second, these are depleting, non-renewable sources of energy. We have harvested them using the low-hanging fruit principle, which means that further increments of extraction will entail rising costs (for example, the oil industry's costs for exploration and production have recently been soaring at nearly 11 percent per year) as well as worsening environmental risks. This problem has been sneaking up on us over the last ten years, as sputtering conventional oil and natural gas production set the stage for the Great Recession and the expensive (and environmentally destructive) practices of "fracking" and tar sands mining. Despite the recent plunge in oil prices the fossil fuel party is indeed over. Sooner or later the stark reality of declining fossil energy availability will rivet everyone's attention: we are overwhelmingly dependent on these fuels for nearly everything we eat, consume, use, and trade, and—as Americans started to learn in the 1970s as a result of a couple nasty oil shocks—the withdrawal symptoms are killer.

So while fossil fuel promoters are right in saying that coal, oil, and gas are essential to our current economy, what they omit mentioning is actually more crucial if we care how our world will look more than a few years into the future.

Well then, are the most enthusiastic of the solar and wind boosters correct in claiming that renewable energy sources are ready to substitute for coal, oil, and gas quickly enough and in sufficient quantity to keep the global economy growing? There's a hitch here, which critics are only too quick to point out. We've designed our energy consumption patterns to take advantage of controllable inputs. Need more power? If you're relying on coal for energy, just shovel more fuel into the boiler. But solar and wind are different: they are available on Nature's terms, not ours. Sometimes the sun is shining or the wind is blowing, sometimes not. Energy geeks have a vocabulary to describe this—they say solar and wind power are intermittent, variable, stochastic, or chaotic.



Variability of wind generation in Germany for 2012 (source: European Energy Exchange)

There are ways of buffering this variability: we can store energy from renewable sources with batteries or flywheels, or pump water uphill so as to recapture its potential energy later when it flows back downstream; or we can build a massive super-grid with robustly redundant generating capacity so that, when sun and wind aren't available in one region, another region can cover demand throughout the entire interconnected system. But these strategies cost money and energy, and add layers of complexity and vulnerability to what is already the largest machine ever built (i.e., the power grid).

Crucially, a recent study by Weissbach *et al.* compared the full-lifecycle energy economics of various types of power plants and found that once the intermittency of solar and wind energy is buffered by storage technologies, these sources become far less efficient than coal, natural gas, or nuclear plants; indeed, once storage is added, solar and wind fall "below the economical threshold" of long-term viability, regardless of the falling dollar price of panels and turbines themselves. The problem lies in the fact that the amount of energy embodied in the full generation-storage system cannot be repaid, with a substantial energy profit, by that system over its lifetime. Recent operational studies of solar PV systems in Spain and Australia have come to similar conclusions.

Another way to deal with variability is *demand management,* which can take a variety of forms (I'll be discussing some of those later in a fair amount of detail). These all, by definition, mean changing the ways we *use* energy. But for the moment let's stay with the subject of energy *supply*.

Early increments of solar and wind power are easy and cheap to integrate into the existing electricity distribution system because power from gas-fired peaking plants can quickly (literally, by the minute) be ramped up or down to accommodate these new, small, variable inputs while also matching changing overall demand levels. In this case, the price of wind and solar energy gets counted as just the immediate cost of building, installing, and maintaining turbines and panels. And, as the *New York Times* recently noted, the price of electricity from renewables (counted this way) is now often competitive with electricity from fossil fuels. On this basis, solar and wind are disruptive technologies: they're getting cheaper while fossil fuels can only grow costlier. This one clear economic advantage of renewable energy—free "fuel" in the forms of sunlight and wind—is decisive, as Germany is now seeing with falling wholesale electricity prices (though retail prices are rising due to feed-in tariffs that require the utility industry to pay above-market prices for renewable electricity).

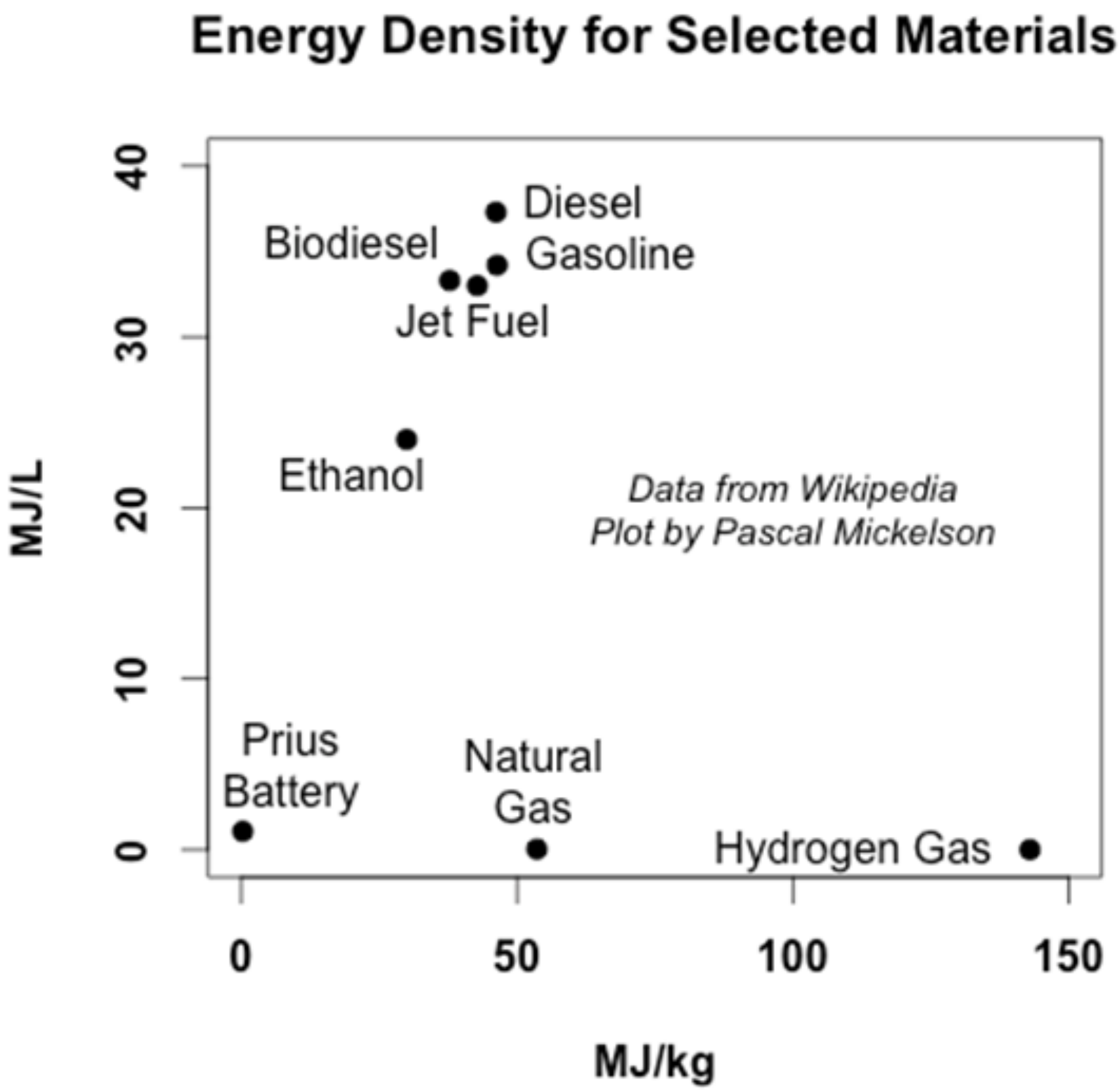
But as electricity from variable renewables makes up a larger and larger proportion of all power generated, the requirements for energy storage technologies, capacity redundancy, and grid upgrades will inevitably climb; indeed, beyond a certain point, the scale of needed investment is likely to explode. Grid managers tend to say that the inflection point arrives when solar and wind power provide about 30 percent of total electricity demand, though one computer model suggests it could be put off until 80 percent market penetration is achieved. (For two contrasting views on the question of how expensive and difficult intermittency makes the renewables transition—from renewable energy optimists Jacobson and Delucchi on one hand, and from "The Simpler Way" advocate Ted Trainer on the other—see a highly informative peer-reviewed exchange here, here, and here.) The looming need for investment in storage and grid upgrades is part of the reason some electric utility companies are starting to wage war against renewables (another part is that net metering puts utilities at a disadvantage relative to solar homeowners; still another is simply that fossil fuel interests hate competition from solar and wind on general principle). As solar panels get cheaper, more homes and businesses install them; this imposes intermittency-smoothing costs on utility companies, which then raise retail prices to ratepayers. The latter then have even more of an incentive to install self-contained, battery-backed solar and abandon the grid altogether, leading to a utility "death spiral."

Yet renewable energy technologies currently require fossil fuels for their construction and deployment, so in effect they are functioning as a parasite on the back of the older energy infrastructure. The question is, can they survive the death of their host?

2. The Liquid Fuels Substitution Quandary

So far, we've talked only about electricity. The power generation sector arguably represents the easiest phase of the overall energy transition (since alternative technologies do exist, even if they're problematic)—but only about 22 percent of global energy is consumed in the form of electrical power; in the US the figure is 33 percent. Our biggest single energy source is oil, which fuels nearly all transportation. Transport is central to trade, which in turn is the beating heart of the global market economy. Oil also fuels the agricultural sector, and eating is fairly important to most of us. Of the three main fossil fuels, oil is showing the most immediate signs of depletion, and renewable options for replacing it are fairly dismal.

It is possible to electrify much of our transportation, and electric cars are now decorating showrooms. But they have a minuscule market share and, at the current growth rate, will take many decades to oust conventional gasoline-fueled automobiles (some analysts believe that growth rate will soon increase dramatically). In any case, batteries do not do well in large, heavy vehicles. The reason has to do with energy density: an electric battery typically is able to store and deliver only about 0.1 to 0.5 megajoules of energy per kilogram; thus, compared to gasoline or diesel (at 44 to 48 MJ/kg), it is very heavy in relation to its energy output. Some breakthroughs in battery storage density and price appear to be on the horizon, but even with these improvements the problem remains: the theoretical maximum energy storage for batteries (about 5 MJ/kg) is still far below the energy density of oil. Neither long-haul trucking nor container shipping is ever likely to be electrified on any significant scale, and electric airliners are simply a non-starter.



Energy storage density by weight (horizontal axis) and volume (vertical axis) for selected media. A hypothetical ideal energy storage medium would appear in the upper right-hand corner of the graph. (Source: Pascal Mickelson)

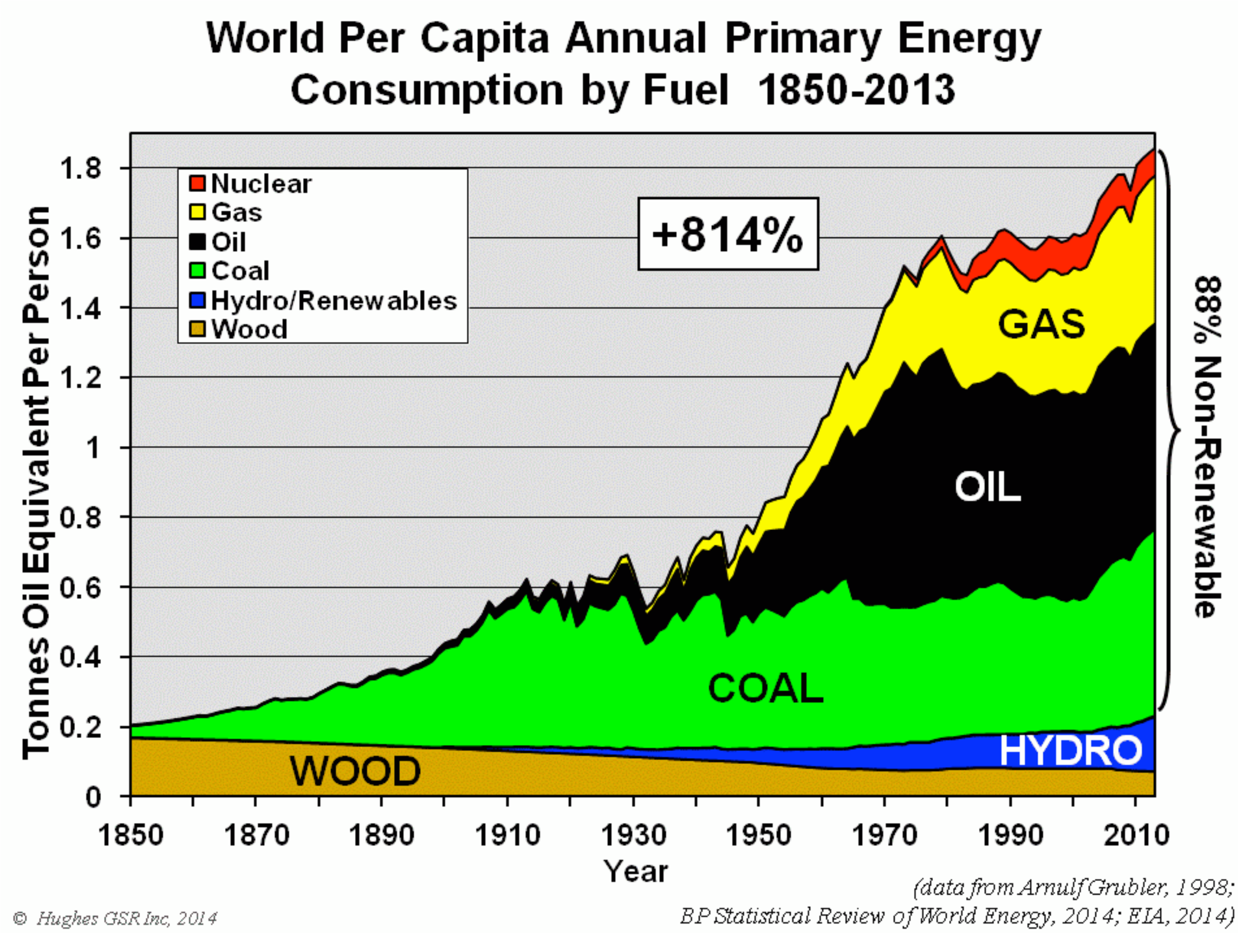
The promise of biofuels as a direct substitute for petroleum was widely touted a decade ago, but we hear much less on that score these days. It turns out that enormous subsidies are needed because the processes for producing these fuels are highly energy intensive. This goes for second-generation cellulosic ethanol and biodiesel from algae as well. Research into synthetic biology pathways to biofuel production remains in its infancy.

Hydrogen offers a medium for storing energy in a way that can be used to power vehicles (among other things), and Toyota is about to release its first commercial hydrogen-powered car. But if we produce hydrogen with renewable energy, that means making H2 from water using solar or wind-based electricity; unfortunately, this is an expensive way to go about it (most commercially produced hydrogen is currently made from natural gas, because the gas-reforming process is inherently more efficient and therefore almost always cheaper than electrolysis, regardless of the electricity source).

These problems lead some energy analysts to propose a cheaper alternative to oil: why not transition the transport fleet to burn compressed natural gas, which government and industry tell us is abundant and climate-friendly? Unfortunately this is no solution at all over the long term. Globally, natural gas may be available in quantity for several more decades, but optimistic forecasts of "100 years" of abundant US domestic gas supplies are proving to be unfounded, and methane leakage from production and transmission infrastructure may end up making gas even worse for the climate than oil.

3. How much energy will we have?

The question is inescapable: will our renewable future offer less mobility? If so, this in itself would have enormous implications for the economy and for daily life. Another question arising from all of the above: will the *quantity* of energy available in our renewable-energy future match energy demand forecasts based on consumption trends in recent decades? There are too many variables to permit a remotely accurate estimate of *how much* less energy we might have to work with (we simply don't know how quickly renewable energy technology will evolve, or how much capital investment will materialize). However, it's good to keep in mind the fact that the energy transition of the 19th and 20th centuries was additive: we just kept piling new energy sources on top of existing ones (we started with firewood, then added coal, oil, hydropower, natural gas, and nuclear); further, it was driven by economic opportunity. In contrast, the energy transition of the 21st century will entail the *replacement* of our existing primary energy sources, and it may largely be driven either by government policy or by crisis (fuel scarcity, climate-induced weather disasters, or economic decline).



The additive history of energy sources (source: David Hughes)

Even supply forecasts from renewable energy optimists who tell us that intermittency is affordably solvable typically assume we will have *less* available electrical energy, once the shift away from fossil fuels is complete, than the International Energy Agency estimates that we would otherwise want (for example, analysis by Lund and Mathieson projects energy consumption levels in 2030 in Denmark to be only 11 percent higher than 2004 demand, with no further increase between 2030 and 2050, whereas IEA forecasts assume continued demand growth through mid-century). However, if (as the Weissbach study suggests) intermittency is in fact a serious economic burden for solar and wind power over the long term, then we need to entertain the likelihood that energy supplies available at the end of the century may be smaller—maybe considerably smaller—than they are now.

At the same time, the *qualities* of our energy supply will differ from what we are used to. As explained earlier, solar and wind are intermittent, unlike fossil energy supplies. Further, while planet Earth is blessed with lots of wind and sunlight, these are diffuse energy sources that need collecting and concentrating if they're to operate heavy machinery. During the coming energy transition, we will be shifting from energy sources with a small geographic footprint (e.g., a natural gas well) toward ones with larger footprints (wind and solar farms collecting ambient sources of energy). True, we can cut the effective footprint of solar by using existing rooftops, and wind turbines can share space with food crops. Nevertheless, there will be unavoidable costs, inefficiencies, and environmental impacts resulting from the increasing geographical extent of energy collection activities.

The potency of fossil fuels derives from the fact that Nature did all the prior work of taking energy from sunlight, storing it in chemical bonds within plants, then gathering those ancient plants and transforming and concentrating their chemical energy, using enormous heat and pressure, over millions of years. Renewable energy technologies represent attempts to gather and concentrate ambient energy in present time, substituting built capital for Nature's free gifts.

Moreover, while electrical power is easily transported via the grid, this doesn't change the fact that sunlight, hydropower, biomass, and wind are more available in some places than others. Long-distance electricity transmission entails infrastructure costs and energy losses, while transporting biomass more than a hundred miles or so typically erases the crucial energy profitability of its use.

4. A Possible Outcome of Current Energy Trends

The price of renewable energy is falling while the cost of producing fossil fuels is rising. The crossover point, where fossil fuels cease to be cost competitive, could come soon—perhaps in the next decade.

What happens then? As batteries get cheaper, electric cars could become the industry standard; reduced gasoline demand would likely force the price of oil below its marginal production cost. If falling demand periodically outpaced declining supply (and vice versa), the result would be increasingly volatile petroleum prices, which would be bad for everyone. Meanwhile as more businesses and homes installed cost-competitive solar-and-battery systems, conventional utilities could go bankrupt.

The result: we would have green energy technology, but not the energy means to maintain and reproduce it over the long run (since every aspect of the renewable energy deployment process currently relies on fossil fuels —particularly oil— because of their unique energy density characteristics).

During the transition, what proportion of the world's people would be able to afford the up-front investment required for entry into the renewable energy club? It's likely that many (including poor people in rich countries) would not, especially given current trends toward increasing economic inequality; for these folks, conventional fossil-based grid power would likewise become unaffordable, or simply unavailable.

What if renewable energy optimists are right in saying that solar and wind are disruptive technologies against which fossil fuels cannot ultimately compete, but renewables critics are correct in arguing that solar and wind are inherently incapable of powering industrial societies as currently configured, absent a support infrastructure (mines, smelters, forges, ships, trucks, and so on) running on fossil fuels?

5. Googling Questions

The combined quantity and quality issues of our renewable energy future are sufficiently daunting that Google engineers who, in 2007, embarked on an ambitious, well-funded project to solve the world's climate and energy problems, effectively gave up. It seems that money, brainpower, and a willingness to think outside the box weren't enough. "We felt that with steady improvements to today's renewable energy technologies, our society could stave off catastrophic climate change," write Ross Koningstein and David Fork, key members of the RE<C project team. "We now know that to be a false hope."

The Google team defined "success" as identifying a renewable energy system that could compete economically with coal and could also be deployed fast enough to stave off the worst climate change impacts. The team concluded that renewable energy isn't up to that job. In their article, Koningstein and Fork put on a brave face, hoping that some currently unknown energy source will appear at the last minute to save the day. But putting one's faith in a currently non-existent energy source seems less realistic than working for dramatic improvements to solar and wind technologies. A completely new source would require decades for development, testing, and deployment. Realistically, our choice of replacements for fossil fuels is limited to energy sources that can be harnessed with current technology, even if they can't keep the industrial growth engine humming.

In inquiring whether renewable energy can solve the climate crisis at essentially no net economic cost, Koningstein and Fork may have been posing the wrong question. They were, in effect, asking whether renewables can support our current growth-based industrial economy while saving the environment. They might more profitably have inquired what kind of economy renewable energy *can* support. We humans got by on renewable sources of energy for millennia, achieving high levels of civilization and culture using wind, sun, water, wood, and animal power alone (though earlier civilizations often faced depletion dilemmas with regard to resources other than fossil fuels). The depletion/climate drawbacks of fossil fuels ensure that, as the century progresses, we will indeed return to a renewables-based economy of some sort, running on hydropower, solar, wind, and a suite of other, more marginal renewable sources including biomass, geothermal, wave, microhydro, and tidal power.

We always adapt our energy sources, as much as we can, to suit the ways we want to use energy. It is therefore understandable that most people would like somehow to make solar and wind act just like fossil fuels, which have shaped our current consumption patterns. But that leads us back to the problems of energy storage, capacity redundancy, grid redesign, transport electrification, and so on. Weissbach's study suggests that the costs of enabling solar and wind to act like fossil fuels are so great as to virtually cancel out these renewables' very real benefits. Reluctantly but increasingly, we may have to *adapt the ways we use energy* to suit the quantities and inherent qualities of the energy available to us.

Fossil fuels shaped our current infrastructure of mines, smelters, forges, factories, pipelines, grids, farms, highways, airports, pumps, shopping malls, suburbs, warehouses, furnaces, office buildings, houses, and more. We built the modern world with the assumption that we would always have more energy with similar characteristics to maintain, operate, and replace this staggering and still-growing array of machines, structures, and support systems. Where it is absolutely essential to maintain these systems in their current form, we will certainly make every effort to adapt our new energy sources to the job (using batteries, for example); where systems can themselves be adapted to using less energy or energy that is intermittently available, we will adapt those systems. But in many instances it may be unaffordable to adapt either the energy source or the usage system; in those cases, we will simply do without services we had become accustomed to.

This may be the renewable future that awaits us. To prepare for that likelihood, we need to build large numbers of solar panels and wind turbines while also beginning a process of industrial-economic triage.

Reconfiguring civilization to operate on less energy and on energy with different characteristics is a big job—one that, paradoxically, may itself require a substantial amount of energy. If the necessity of expending energy on a civilization rebuild coincides with a reduction in available energy, that would again mean that our renewable future will *not* be an extension of the expansive economic thrust of the 20th century. We may be headed into lean times.

Granted, there is a lot of uncertainty here. Some countries are better placed to harvest ambient natural energy sources than others. Some academic studies paint an over-optimistic picture of renewables, because they focus only on electricity and ignore or understate the costs of variability mitigation; other studies arrive at unfairly pessimistic assessments of renewables because they use obsolete price data. It's hard to portray our renewable future in a way that one analyst or another will not dispute, at least in terms of detail. Nevertheless, *most* energy experts would probably agree with the *general* outline of renewable energy's potential that I've traced here.

I consider myself a renewable energy advocate: after all, I work for an organization called Post Carbon Institute. I have no interest in discouraging the energy transition—quite the contrary. But I've concluded that many of us, like Koningstein and Fork, have been asking the wrong questions of renewables. We've been demanding that they continue to power a growth-based consumer economy that is inherently unsustainable for a variety of reasons (the most obvious one being that we live on a small planet with finite resources). The fact that renewables can't do that shouldn't actually be surprising.

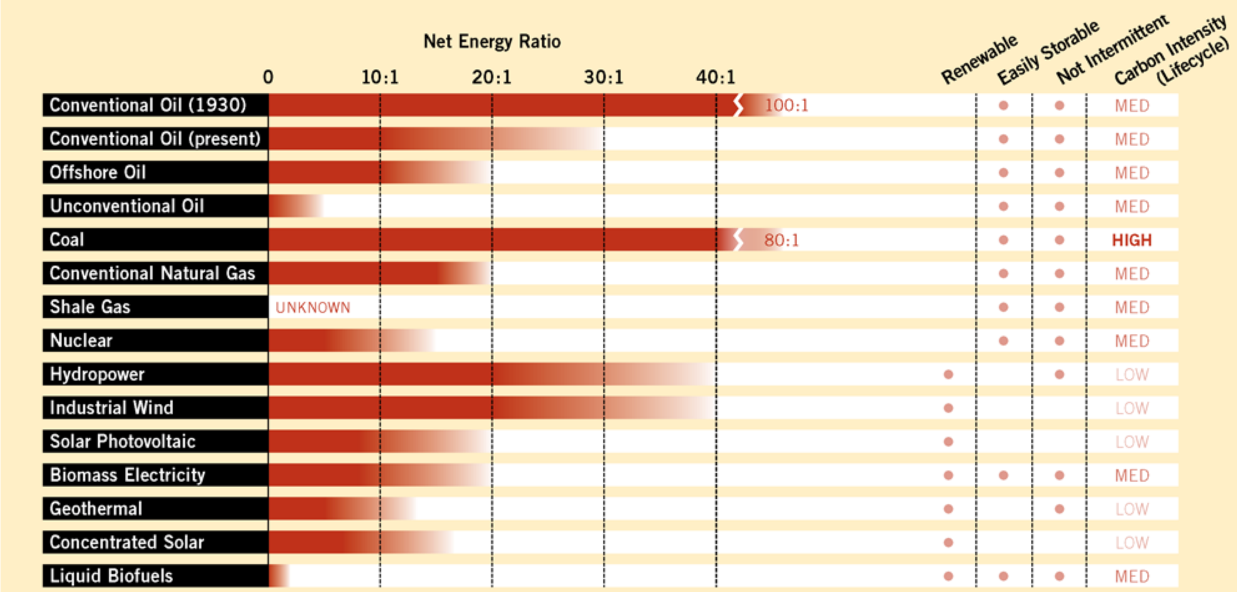
What are the right questions? The first, already noted, is: What kind of society *can* up-to-date renewable energy sources power? The second, which is just as important: How do we go about becoming that sort of society?

As we'll see, once we begin to frame the picture this way, it turns out to be anything but bleak.

6. A Couple of Key Concepts

Our degree of success in this all-encompassing transition will partly depend on our ability to master a couple of simple energy concepts. The first is *energy returned on energy invested* (EROI or EROEI). It takes energy to get energy: for example, energy is needed to drill an oil well or build a solar panel. The historic economic bonanza resulting from society's use of fossil fuels partly ensued from the fact that, in the 20th century, only trivial amounts of energy were required for drilling or mining as compared to the gush of energy yielded. High EROEI ratios (in the range of 20:1 to 50:1 or more) for society's energy-obtaining efforts meant that relatively little capital and labor were needed in order to supply all the energy that society could use. As a result, many people could be freed up from basic energy-producing activities (like farming), their labor being substituted by fuel-fed machines. Channeled into manufacturing and managerial jobs, these people found ways to use abundant, cheap energy to produce more goods and services. The middle class mushroomed, as did cities and suburbs. In the process, we discovered an unintended consequence of having an abundance of cheap "energy slaves" in the forms of tons of coal, barrels of oil, and cubic feet of natural gas: as manufacturing and other sectors of the economy became mechanized, many pre-industrial professions disappeared.

The EROEI ratios for fossil fuels are declining because the best-quality resources are being used up; meanwhile, the energy return figures of most renewable energy sources are relatively low compared to fossil fuels in their heyday (and this is especially true when buffering technologies—such as storage equipment, redundant capacity, and grid expansions—are accounted for).



CHARACTERISTICS OF ENERGY RESOURCES

An energy resource is unhelpful if it requires nearly as much energy to produce as it provides to society. The net energy ratio gives us an approximate indication of this relationship. Similarly, an energy resource is worthless if we can't use it the way we need it. The world's infrastructure for transportation and commerce was built for oil and coal power in large part because these resources are relatively easy to store and transport, and can be used at will. Most renewables lack these attributes. The environmental impact of a resource—including but not limited to its carbon intensity—is key to its long-term utility, and the main argument against coal as a baseload power source. DATA: D. MURPHY

Characteristics of energy resources (source: David Murphy). "Net Energy Ratio" in this chart is essentially the same as EROEI.

The practical result of *declining overall societal EROEI will be the need to devote proportionally more capital and labor to energy production processes*. This is likely to translate, for example, to the requirement for more farm labor, and to fewer opportunities in professions not centered on directly productive activities: we'll need more people making or growing things, and fewer people marketing, advertising, financing, regulating, and litigating them. For folks who think we have way too much marketing, advertising, financialization, regulation, and litigation in our current society, this may not seem like such a bad thing; prospects are likewise favorable for those who desire more control over their time, labor, and sources of sustenance (food and energy).

A second essential energy concept has to do with the difference between embodied and operational energy. When we contemplate the energy required by an automobile, for example, we are likely to think only of the gasoline in its tank. However, a substantial amount of energy was expended in the car's construction, in the mining of ores from which its metal components were made, in the making of the mining equipment, and so on. Further, enormous amounts of energy were spent in building the infrastructure that enables us to use the car—the systems of roads and highways, the networks of service stations, refineries, pipelines, and oil wells. The car's gasoline supplies operational energy, but much more energy is embodied in the car itself and its support systems. This latter energy expenditure is easily overlooked.

The energy glut of the 20th century enabled us to embody energy in a mind-numbing array of buildings, infrastructure, machines, gadgets, and packaging. Middle-class families got used to buying and discarding enormous quantities of manufactured goods representing generous portions of previously expended energy. If we have less energy available to us in our renewable future, this will impact more than the operation of our machines and the lighting and heating of our buildings. It will also translate to a shrinking flow of manufactured goods that embody past energy expenditure, and a reduced ability to construct high energy-input structures. We might find we need to purchase fewer items of clothing and furniture, and fewer electronic devices, and inhabit smaller spaces. We might also use old goods longer, and re-use and re-purpose whatever can be repaired. We might need to get used to buying more basic foods again, rather than highly processed and excessively packaged food products. Exactly how far these trends might proceed is impossible to say: we are almost surely headed toward a simpler society, but no one knows ultimately how simple. Nevertheless, it's fair to assume that this overall shift would constitute the end of consumerism (i.e., our current economic model that depends on ever-increasing consumption of consumer goods and services). Here again, there are more than a few people who believe that advanced industrial nations consume excessively, and that some simplification of rich- and middle-class lifestyles would be a good thing.

7. Transitioning Nine Sectors

When we start applying these energy principles to the systems that surround us and support our daily existence, the implications really start to get interesting. Let's take a quick tour:

Food: Fossil fuels are currently used at every stage of growing, transporting, processing, packaging, preparing, and storing food. As those inputs are removed from food systems, it will be necessary to bring growers and consumers closer together, and to replace petrochemical-based fertilizers, herbicides, and pesticides with agro-ecological farming methods that rely on crop rotation, intercropping, companion planting, mulching, composting, beneficial insects, and promotion of microbial activity in soils. As mentioned earlier, we will need many more farmers, especially ones with extensive practical, local ecological knowledge.

Water: Enormous amounts of energy are used in extracting, moving, and treating water; conversely, water is used in most energy production processes. We face converging water crises arising from aging infrastructure and climate change-related droughts and floods. All this suggests we must become far more water thrifty, find ways to reduce the energy used in water management, use intermittent energy sources for pumping water, and use water reservoirs for storing energy.

Resource extraction (mining, forestry, fishing): Currently, extractive industries rely almost entirely on petroleum-based fuels. Since, as we have seen, there are no good and comprehensive substitutes for these fuels, we will have to reduce resource extraction rates, reuse and recycle materials wherever possible, and employ more muscle power where possible in those extractive processes that must continue (such as forestry).

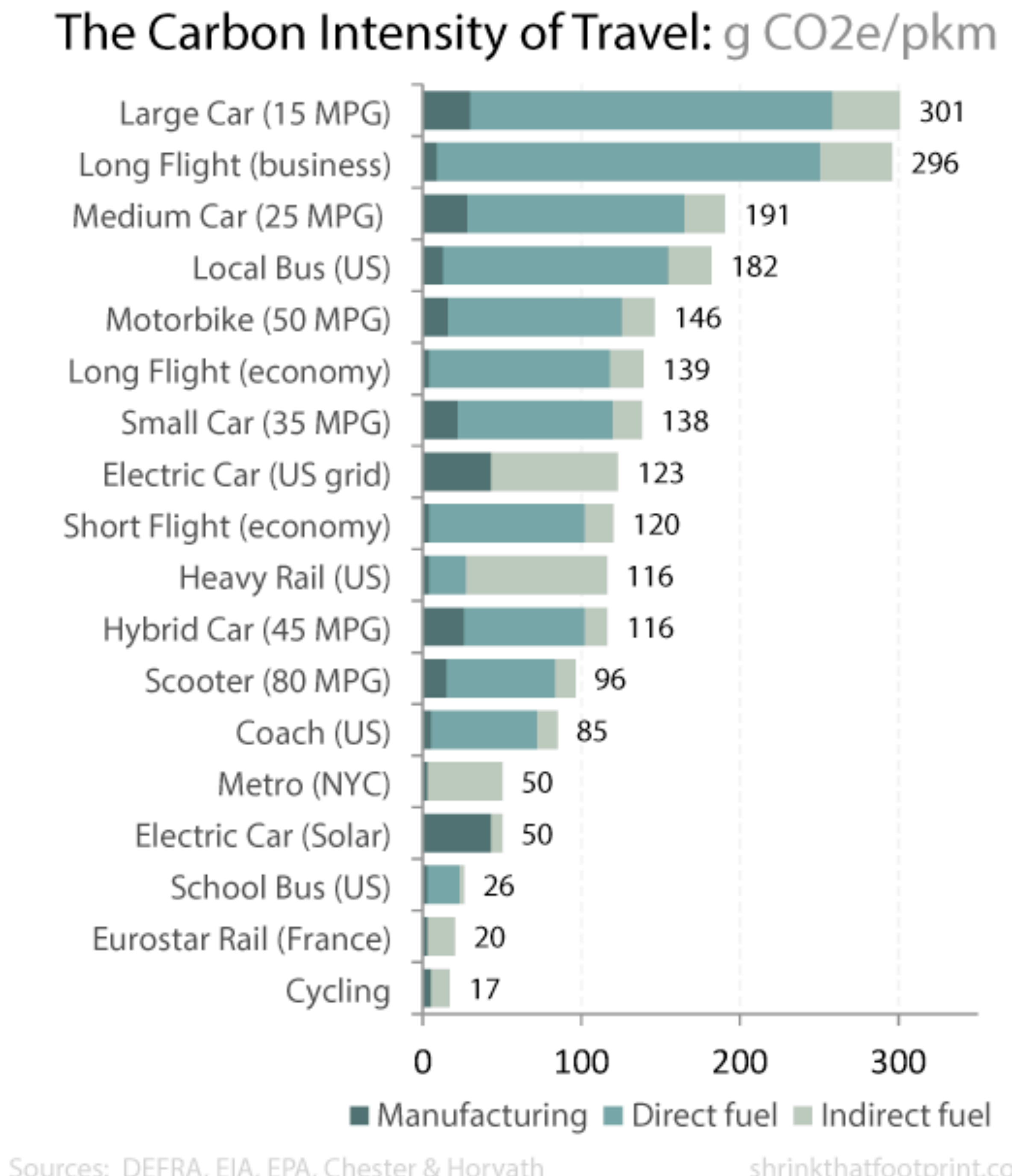
Building construction: Cement, iron, and road-building materials embody substantial amounts of energy, while large construction equipment (cranes, booms, bulldozers) requires concentrated energy for its operation. We must shift to using natural, locally available building materials, and more labor-intensive construction methods, while dramatically reducing the rate of new construction. The amount of enclosed space per person (home, work, shopping) will shrink.

Building operations: We've gotten used to actively heating, cooling, ventilating, and lighting our buildings with cheap, on-demand energy. We will need to maximize our passive capture of ambient, variable, solar energy using south-facing glazing, superinsulation, and thermal mass. Whatever active energy use is still required will employ efficient heat pumps and low-energy LED lighting, powered mostly by solar cells and wind turbines with minimal storage and redundancy (so as to maximize EROEI).

Manufacturing: Our current system is globalized (relying on oil-based transport systems); consumes natural gas, electricity, and oil in manufacturing processes; and uses materials that embody large amounts of energy and that are often made from fossil fuels (i.e., plastics). Lots of energy is used also in dealing with substantial flows of waste in the forms of packaging and discarded products. The economy has been fine-tuned to maximize consumption. We must shift to shortened supply chains, more localized manufacture of goods (shipping information, not products), materials with low embodied energy, and minimal packaging, while increasing our products' reuse and repair potential. This will be, in effect, an economy fine-tuned to minimize consumption.

Health care: The high dollar cost of modern health care is a rough indication of its energy intensity. As the energy transition gains momentum, it will be necessary to identify low-energy sanitation and care options, and prioritize prevention and local disaster response preparedness. Eventually, high-energy diagnostics and extreme end-of-life interventions may simply become unaffordable. Treatment of chronic conditions may rely increasingly on herbs and other traditional therapies (in instances where their efficacy can be verified) as the pharmaceutical industry gradually loses its capability to mobilize billions of dollars to develop new, targeted drugs.

Transportation: The energy transition will require us to prioritize transport modes according to operational and embodied energy efficiency: whereas automobile and truck traffic have been richly subsidized through road building in the last seven decades, governments should instead devote funds toward electrified rail networks for both freight and passenger travel. We must also design economic and urban systems so as to reduce the need for motorized transportation—for example, by planning communities so that most essential services are within walking distance.



Source: Shrinkthatfootprint.com (data from DEFRA, EIA, EPA, Chester & Horvath)

Finance: It would appear that comparatively little energy is needed to run financial systems, as a few taps on a computer keyboard can create millions of dollars instantly and move them around the globe. Nevertheless, the energy transition has enormous implications for finance:

heightened debt levels imply an increased ability to consume now with the requirement to pay later. In effect, a high-finance society stimulates consumption, whereas we need to reduce consumption. Transition strategies should therefore include goals such as the cancelation of much existing debt and reduction of the size and role of the financial system. Increasingly, we must direct investment capital toward projects that will tangibly benefit communities, rather than leaving capital investment primarily in the hands of profit-seeking individuals and corporations.

You may have noticed that suggestions in each of these categories are far from new. Organized efforts to reduce both operational and embodied energy consumption throughout society started in the 1970s, at the time of the first oil price shocks. Today there are many NGOs and university programs devoted to research on energy efficiency, and to life cycle analysis (which seeks to identify and quantify energy consumption and environmental impacts of products and industrial processes, from "cradle to grave"). Industrial ecology, biomimicry, "cradle-to-cradle" manufacturing, local food, voluntary simplicity, permaculture, and green building are just a few of the strategies have emerged in the last few decades to guide us toward a more energy-thrifty future. Most major cities now have bicycle advocacy groups, farmers markets, and energy efficiency programs. These all represent steps in the right direction.

Yet what is being done so far barely scratches the surface of what's needed. There could be only one meaningful indication of success in all these efforts, and that would be a decline in society's overall energy use. So far, we have seen energy declines primarily in times of severe economic recession—hardly ever purely as a result efficiency programs. What we need is not just to trim energy use here and there so as to save money, but to reconfigure entire systems to dramatically slash consumption while making much of the remaining energy consumption amenable to intermittent inputs.

Another insight that comes from scanning energy reduction strategies in various societal sectors is that efforts already underway along these lines often have side benefits. There are tangible psychological, social, and cultural payoffs associated with local food and voluntary simplicity programs, and health improvements can follow from natural, energy-efficient dwellings, walking, bicycling, and gardening. A successful energy transition will require that we find ways to maximize and celebrate these benefits, while honestly acknowledging the full human and environmental costs of our decades-long, fossil-fueled joyride.

In the march toward our energy future, the PR war between the fossil fuel industry and renewables advocates gets much of the attention. But it will be our effectiveness in the hard work of dramatically reducing and reconfiguring energy consumption—sector by sector, farm by farm, building by building, household by household, community by community—that will largely determine our overall success in what is likely to be history's most difficult and crucially important economic shift.

8. Neither Utopia Nor Extinction

This is all politically charged. Some renewable energy advocates (particularly in the US) soft-pedal the "use less" message because we still inhabit an economy in which jobs and profits depend on stoking consumption, not cutting it. "Less" also implies "fewer": if the amount of energy available contracts but human population continues growing, that will translate to an even sharper *per capita* hit. This suggests we need to start reducing population, and doing so quickly—but economists hate population decline because it compromises GDP and results in smaller generational cohorts of young workers supporting larger cohorts of retirees. Here is yet another message that just doesn't sell. A contraction of energy, population, and the economy has only two things going for it: necessity and inevitability.

From a political standpoint, some solar and wind advocates apparently believe it makes good strategic sense to claim that a renewable future will deliver comfort, convenience, jobs, and growth—an extension of the oil-fueled 20th century, but now energized by wind and solar electrons. Regardless of whether it's true, it is a message that appeals to a broad swath of the public. Yet most serious renewable energy scientists and analysts acknowledge that the energy transition will require changes throughout society. This latter attitude is especially prevalent in Europe, which now has practical experience integrating larger percentages of solar and wind power into electricity markets. Here in the US, though, it is common to find passionate but poorly informed climate activists who loudly proclaim that the transition can be easily and fully accomplished at no net cost. Again, this may be an effective message for rallying troops, but it ends up denying oxygen to energy conservation efforts, which are just as important.

I have good friends in the renewable energy industry who say that emphasizing the intermittency challenges of solar and wind amounts to giving more ammunition to the fossil fuel lobby. Barry Goldwater famously proclaimed that "Extremism in the defense of liberty is no vice"; in a similar spirit, some solar and wind boosters might say that a little exaggeration of renewable energy's potential, uttered in defense of the Earth, is no sin. After all, fossil fuel interests are not bound by the need for strict veracity: they continually make absurd claims that the world has centuries' worth of coal and gas, and decades of oil. It's not a fair or equal fight: the size and resources of the fossil fuel industry vastly outweigh those of the renewables camp. And there could hardly be more at stake: this is war for the survival of our current civilization-supporting climate regime. Nevertheless, we will ultimately have to deal with the reality of what solar and wind can actually provide, and we will do so far more successfully if we plan and prepare ahead of time.

There are a lot of smart, dedicated people working hard to solve the problems with renewables—that is, to make it cheaper and easier for these energy sources to mimic the 24/7 reliability of fossil fuels through improvements in energy storage and related technologies. None of what I have said in this essay is meant to discourage them from that important work. The more progress they make, the better for all of us. But they'll have more chance of success in the long run if society starts investing significant effort into adapting its energy usage to lower consumption levels, more variable sources, and more localized, distributed inputs.

The problem is, the gap between our current way of life and one that can be sustained with future energy supplies is likely to be significant. If energy declines, so will economic activity, and that will create severe political and geopolitical strains; arguably some of those are already becoming apparent. We may be headed into a crucial bottleneck; if so, our decisions now will have enormous repercussions. We therefore need an honest view of the constraints and opportunities ahead.

At this point I must address a few words to "collapsitarians" or "doomers," who say that only utter ruin, perhaps extinction, awaits us, and that renewables won't work at all. They may be correct in thinking that the trajectory of society this century will be comparable to the collapse of historic civilizations. However, even if that is the case, there is still a wide range of possible futures. The prospects for humanity, and the fates of many other species, hang on our actions.

What's needed now is neither fatalism nor utopianism, but a suite of practical pathways for families and communities that lead to a real and sustainable renewable future—parachutes that will get us from a 17,000-watt society to a 2,000-watt society. We need public messages that emphasize the personal and community benefits of energy conservation, and visions of an attractive future where human needs are met with a fraction of the operational and embodied energy that industrial nations currently use. We need detailed transition plans for each major sector of the economy. We need inspiring examples, engaging stories, and opportunities for learning in depth. The transition to our real renewable future deserves a prominent, persistent place at the center of public conversation.

The Transition Network, The Arthur Morgan Institute for Community Solutions, The Simplicity Institute, and many other organizations have already begun pioneering this work, and deserve support and attention. However, more framing and analysis of the issues, along the lines of this essay but in much greater depth, could also help. My organization, Post Carbon Institute, is embarking on a collaborative project to provide this. If you don't hear much from me for a while, it's because I'm working on it. Stay tuned.

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*For the sake of simplicity, I have omitted discussion of nuclear power from this essay. There are those who say that nuclear power will, or should, play a prominent role in our energy future. I disagree with this view. Globally, nuclear power—unlike solar and wind—is contracting, not growing (China provides one of only a few exceptions to this observation). Nations are turning away from nuclear power due to the high levels of required investment—which, in virtually every case, must be underwritten by government. They are doing so also because of the high perceived risk of accidents—especially since the commencement of the ongoing catastrophe at the Fukushima nuclear facility in Japan. Nuclear boosters advocate new fuels (thorium) or technologies (fast breeder reactors) to address these concerns. But many years of trials will be needed before these alternatives are ready to be deployed at scale; and it is unclear, even then, whether they will live up to claims and expectations.

Energy experts expose export error

www.postcarbon.org/the-purposely-confusing-world-of-energy-politics/

The Purposely Confusing World of Energy Politics, by Richard Heinberg

Posted Feb 11, 2014

Life often presents us with paradoxes, but seldom so blatant or consequential as the following. Read this sentence slowly: Today it is especially difficult for most people to understand our perilous global energy situation, precisely *because* it has never been more important to do so. Got that? No? Okay, let me explain. I must begin by briefly retracing developments in a seemingly unrelated field—climate science.

Once upon a time, the idea that Earth's climate could be changing due to human-caused carbon dioxide emissions was just a lonely, unpopular scientific hypothesis. Through years that stretched to decades, researchers patiently gathered troves of evidence to test that hypothesis. The great majority of evidence collected tended to confirm the notion that rising atmospheric carbon dioxide (and other greenhouse gas) levels raise average global temperatures and provoke an increase in extreme weather events. Nearly all climate scientists were gradually persuaded of the correctness of the global warming hypothesis.

But a funny thing happened along the way. Clearly, if the climate is changing rapidly and dramatically as a result of human action, and if climate change (of the scale and speed that's anticipated) is likely to undermine ecosystems and economies, then it stands to reason that humans should stop emitting so much CO2. In practical effect, this would mean dramatically reducing our burning of fossil fuels—the main drivers of economic growth since the beginning of the Industrial Revolution.

Some business-friendly folks with political connections soon became alarmed at both the policy implications of—and the likely short-term economic fallout from—the way climate science was developing, and decided to do everything they could to question, denigrate, and deny the climate change hypothesis. Their effort succeeded: belief in climate change now aligns fairly closely with political affiliation. Most Democratic elected officials agree that the issue is real and important, and most of their Republican counterparts are skeptical. Lacking bipartisan support, legislative climate policy languished.

From a policy standpoint, climate change is effectively an energy issue, since reducing carbon emissions will require a nearly complete revamping of our energy systems. Energy is, by definition, humanity's most basic source of power, and since politics is a contest over power (albeit *social* power), it should not be surprising that energy is politically contested. A politician's most basic tools are power and persuasion, and the ability to frame issues. And the tactics of political argument inevitably range well beyond logic and critical thinking. Therefore politicians can and often do make it harder for people to understand energy issues than would be the case if accurate, unbiased information were freely available.

So here is the reason for the paradox stated in the first paragraph: As energy issues become more critically important to society's economic and ecological survival, they become more politically contested; and as a result, they tend to become obscured by a fog of exaggeration, half-truth, omission, and outright prevarication.

How does one cut through this fog to gain a more accurate view of what's happening in our society's vital energy supply-and-support systems? It's helpful to start by understanding the positions and motives of the political actors. For the sake of argument, I will caricature two political positions. Let's personify them as Politician A and Politician B.

Politician A has for many years sided with big business, and specifically with the fossil fuel industry in all energy disputes. She sees coal, oil, and natural gas as gifts of nature to be used by humanity to produce as much wealth as possible, as quickly as possible. She asserts there are sufficient supplies of these fuels to meet the needs of future generations, even if we use them at rapidly increasing rates. When coal, oil, and gas do eventually start to run out, Politician A says we can always turn to nuclear energy. In her view, the harvesting and burning of fossil fuels can be accomplished with few incidental environmental problems, and fossil fuel companies can be trusted to use the safest methods available. And if Earth's climate is indeed changing, she says, this is not due to the burning of fossil fuels; therefore, policies meant to cut fossil fuel consumption are unnecessary and economically damaging. Finally, she says renewable energy sources should not be subsidized by government, but should stand or fall according to their own economic merits.

Politician B regards oil, coal, and natural gas as polluting substances, and society's addiction to them is shameful. He thinks oil prices are high because petroleum companies gouge their customers; nuclear energy is too dangerous to contemplate; and renewable energy sources are benign (with supplies of sunlight and wind vastly exceeding our energy needs). To hear him tell it, the only reason solar and wind still supply such a small percentage of our total energy is that fossil fuel companies are politically powerful, benefiting from generous, often hidden, government subsidies. Government should cut those subsidies and support renewable energy instead. He believes climate change is a serious problem, and to mitigate it we should put a price on carbon emissions. If we do, Politician B says, renewable energy industries will grow rapidly, creating jobs and boosting the economy.

Who is right? Well, this should be easy to determine. Just ignore the foaming rhetoric and focus on research findings. But in reality that's not easy at all, because research is itself often politicized. Studies can be designed from the outset to give results that are friendly to the preconceptions and prejudices of one partisan group or another.

For example, there are studies that appear to show that the oil and natural gas production technique known as hydrofracturing (or "fracking") is safe for the environment. With research in hand, industry representatives calmly inform us that there have been *no* confirmed instances of fracking fluids contaminating water tables. The implication: environmentalists who complain about the dangers of fracking simply don't know what they're talking about. However, there are indeed many documented instances of water pollution associated with fracking, though technically most of these have resulted from the improper disposal of wastewater produced once fracking *per se* is finished, rather than from the hydrofracturing process itself. Further, industry-funded studies of fracking typically focus on sites where best practices are in place and equipment is working as designed—the ideal scenario. In the messy real world, well casings sometimes fail, operators cut corners, and equipment occasionally malfunctions.

For their part, environmentalists point to peer-reviewed studies showing air, water, and human health problems associated with actual (far from ideal) fracking operations.

So, depending on your prior beliefs, you can often choose research findings to support them—even if the studies you are citing are actually highly misleading.

Renewable energy is just as contentious. Mark Jacobson, professor of environmental engineering at Stanford University, has co-authored a series of reports and scientific papers arguing that solar, wind, and hydropower could provide 100 percent of world energy by 2030. Clearly, Jacobson's work supports Politician B's political narrative by showing that the climate problem can be solved with little or no economic sacrifice. If Jacobson is right, then it is only the fossil fuel companies and their supporters that stand in the way of a solution to our environmental (and economic) problems. The Sierra Club and prominent Hollywood stars have latched onto Jacobson's work and promote it enthusiastically.

However, Jacobson's publications have provoked thoughtful criticism, some of it from supporters of renewable energy, who argue that his "100 percent renewables by 2030" scenario ignores hidden costs, land use and environmental problems, and grid limits (see here, here, and here. Jacobson has replied to his critics, well, energetically (here and here).

At the other end of the opinion spectrum on renewable energy is Gail Tverberg, an actuary by training and profession (and no shill for the fossil fuel industry), whose analysis suggests that the more solar and wind generating capacity we build, the worse off we are from an economic point of view. Her conclusion flatly contradicts that of this report, which aims to show that the more renewables we build, the more money we'll save. Ecologist Charles Hall has determined that the ratio of energy returned to energy invested in capturing solar energy with photovoltaic (PV) panels is too low to support an industrial economy. Meanwhile the solar industry claims that PV can provide *all* of society's power needs. Global wind capacity may have been seriously over-estimated. But then again, maybe not.

In sum, if you're looking for quick and simple answers to questions about how much renewables can do for us, at what price, and over what time frame, forget it! These questions are far from being settled.

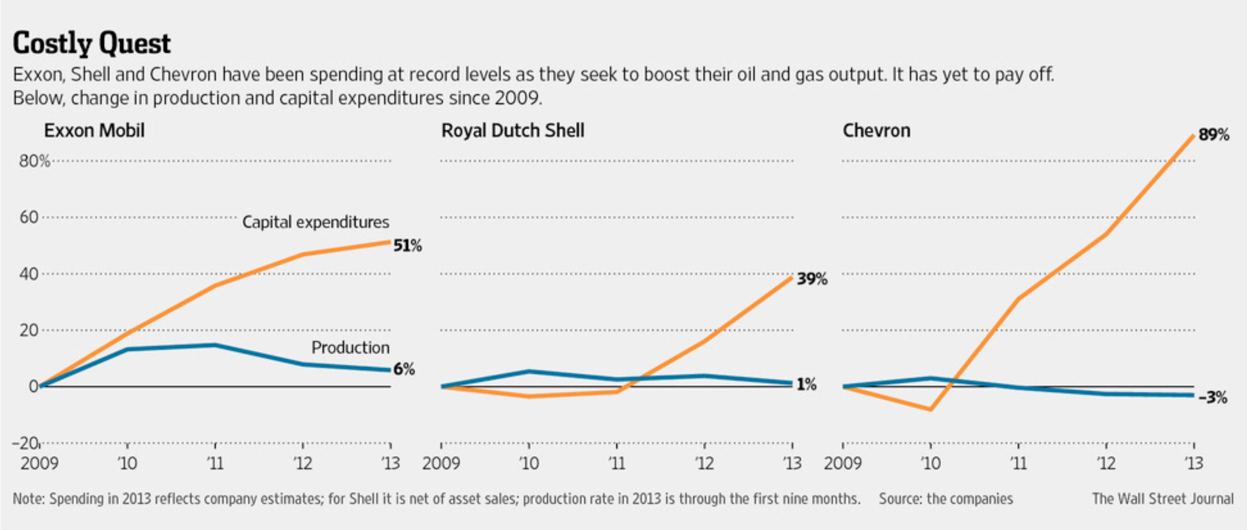
There's a saying: For every Ph.D., there is an equal and opposite Ph.D. Does this mean science is useless, and objective reality is whatever you want it to be? Of course not. However, politics and cultural bias can and do muddy the process and results of scientific research.

All of this is inevitable; it's human nature. We'll sort through the confusion, given time and the hard knocks that inevitably come when preconceptions veer too far from the facts. However, if the more worrisome implications of climate science are right, we may not have a lot of time for sorting, and our knocks may be very hard indeed.

* * *

Here's a corollary to my thesis: *Political prejudices tend to blind us to facts that fail to fit any conventional political agendas.* All political narratives need a villain and a (potential) happy ending. While Politicians B and A might point to different villains (oil companies on one hand, government bureaucrats and regulators on the other), they both envision the same happy ending: economic growth, though it is to be achieved by contrasting means. If a fact doesn't fit one of these two narratives, the offended politician tends to ignore it (or attempt to deny it). If it doesn't fit either narrative, nearly everyone ignores it.

Here's a fact that apparently fails to comfortably fit into either political narrative: *The energy and financial returns on fossil fuel extraction are declining—fast.* The top five oil majors (ExxonMobil, BP, Shell, Chevron, and Total) have seen their aggregate production fall by over 25 percent over the past 12 years—but it's not for lack of effort. Drilling rates have doubled. Rates of capital investment in exploration and production have likewise doubled. Oil prices have quadrupled. Yet actual global rates of production for regular crude oil have flattened, and all new production has come from expensive unconventional sources such as tar sands, tight oil, and deepwater oil. The fossil fuel industry hates to admit to facts that investors find scary—especially now, as the industry needs investors to pony up ever-larger bets to pay for ever-more-extreme production projects.



In the past few years, high oil prices have provided the incentive for small, highly leveraged, and risk-friendly companies to go after some of the last, worst oil and gas production prospects in North America—formations known to geologists as "source rocks," which require operators to use horizontal drilling and fracking technology to free up trapped hydrocarbons. The energy returned on energy invested in producing shale gas and tight oil from these formations is minimal. While US oil and gas production rates have temporarily spiked, all signs indicate that this will be a brief boom that will not change the overall situation significantly: society is reaching the point of diminishing returns with regard to the economic benefits of fossil fuel extraction.

And what about our imaginary politicians? Politician A wouldn't want to talk about any of this for fairly obvious reasons. But, strangely, Politician B likely would avoid the subject too: while he might portray the petroleum industry as an ogre, his narrative requires it to be a powerful one. Also, he probably doesn't like to think that gasoline prices might be high due to oil depletion rather than simply the greed of the petroleum barons. Motives can be complicated; perhaps both feel the patriotic urge to cheer domestic energy production, regardless of its source and in spite of evidence of declining returns on investment. Perhaps both understand that declining energy returns imply really bad news for the economy, regardless which party is in power. In any case, mum's the word.

Some facts seem to fit one narrative or the other but, when combined, point to a reality that undermines both narratives. *What if climate change is an even worse problem than most of us assume, and there is no realistic way to deal seriously with it and still have economic growth?*

In the real world of US politics, many Democrats would agree with the first part of the sentence, many Republicans with the second. Yet both parties would flee from endorsing the statement as a whole. Nevertheless, this seems to be where the data are driving us. Actual climate impacts have consistently outpaced the worst-case forecasts that the UN's International Panel on Climate Change (IPCC) has issued during the past two decades. That means curbing carbon emissions is even more urgent than almost anyone previously thought. The math has changed. At this point, the rate of reduction in fossil fuel consumption required in order to avert catastrophic climate change may be higher, possibly much higher, than the realistically possible rate of replacement with energy from alternative sources. Climatologist Kevin Anderson of the UK-based Tyndall Centre figures that industrial nations need to cut carbon emissions by up to 10 percent per year to avert catastrophe, and that such a rapid reduction would be "incompatible with economic growth." What if Anderson is right?

The problem of transitioning quickly away from fossil fuels while maintaining economic growth is exacerbated by the unique characteristics of different energy sources.

Here's just one example of the difficulty of replacing oil while maintaining economic growth. Oil just happens to be the perfect transport fuel: it stores a lot of energy per unit of weight and volume. Electric batteries can't match its performance. Plug-in cars exist, of course (less than one percent of new cars sold this year in the US will be plug-in electrics), but batteries cannot propel airliners or long-haul, 18-wheel truck rigs. Yet the trucking and airline industries just happen to be significant components of our economy; can we abandon or significantly downsize them and grow the economy as we do so?

What about non-transport replacements for fossil fuels? Well, both nuclear power stations and renewable energy systems have high up-front investment costs. If you factor in *all* the financial and energy costs (something the solar, wind, and nuclear industries are reluctant to do), their payback time is often measured in decades. Thus there seems to be no realistic way to bootstrap the energy transition (for example, by using the power from solar panels to build more solar panels) while continuing to provide enough energy to keep the rest of the economy expanding. In effect, to maintain growth, the energy transition would have to be subsidized by fossil fuels—which would largely defeat the purpose of the exercise.

Business-friendly politicians seem to intuitively get much of this, and this knowledge helps fuel their continued infatuation with oil, coal, and natural gas—despite the increasing *economic* problems (even if we disregard the environmental problems) with these fuels. But these folks' way of dealing with this conundrum is simply to deny that climate change is a real issue. That strategy may work for their supporters in the fossil fuel industries, but it does nothing to avert the worsening real-world crises of extreme temperature events, droughts, floods, and storms—and their knock-on impacts on agriculture, economies, and governments.

So those on the left may be correct in saying that climate change is the equivalent of a civilization-killing asteroid, while those on the right may be correct in thinking that policies designed to shrink carbon emissions will shrink the economy as well. Everybody gets to be correct—but nobody gets a happy ending (at least as currently envisioned).

That's because nearly every politician wants growth, or at least recognizes the need to clamor for growth in order to be electable. Because growth, after all, is how we currently define our collective, national happy ending. So whenever facts lead toward the conclusion that more growth may not be possible *even if our party gets its way*, those facts quickly get swept under the nearest carpet.

Masking reality with political rhetoric leads to delays in doing what is necessary– making the best of the choices actually available to us. We and our political "leaders" continue to deny and pretend, walking blindly toward environmental and economic peril.

* * *

We humans are political animals—always have been, always will be. Our interests inevitably diverge in countless ways. Further, much of the emotional drive fueling politics comes from ethical impulses: perhaps for genetic reasons, different people assign different ethical principles a higher priority. Thus one politician's concern for fairness and another's passion for national loyalty can glide right past each other without ever shaking hands. Religion can also play a role in partisanship, along with the legacies of economic and social exclusion, historic rivalries, disputes, and atrocities. None of this can be dispelled with the wave of a magic wand.

Moreover, political engagement often leads to welcome outcomes. When people organize themselves to effect change, the result can be expansions of civil rights, women's suffrage, and environmental protection. On the other hand, when people fail to speak up, social power tends to become monopolized by a small minority–and that never ends well. So, let's not withdraw from politics.

But how to work effectively in a politically polarized environment? Hyper-partisanship is a problem in approving judicial appointees and passing budgets, and failure to do these things can have serious consequences. But when it comes to energy and climate, the scale of what is at stake runs straight off the charts. The decisions that need to be made, and soon (ideally 20 years ago!), on energy and climate may well determine whether civilization survives. The absence of decisive action will imperil literally everything we care about.

Energy is complicated, and there can be legitimate disagreements about our options and how vigorously to pursue them. But the status quo is not working.

I've struggled to find a hopeful takeaway message with which to end this essay.

Should I appeal to colleagues who write about energy, pleading with them to frame discussions in ways that aren't merely feeding red meat to their already far too polarized audiences, encouraging them to tell readers uncomfortable truths that don't fit partisan narratives? I could, but how many energy writers will actually read this essay, and how many of those are willing to examine their preconceptions?

Perhaps the best I can do is point out the existence of a small but enthusiastic subculture that actually understands these issues. This subculture is exemplified by Transition Initiatives promoting "small-scale local responses to the global challenges of climate change, economic hardship, and shrinking supplies of cheap energy" and the premise that life can be better without fossil fuels. For better or worse, this subculture is practically invisible to political elites and the mainstream media (except perhaps in parts of the UK).

Perhaps it's fitting that this essay leaves both author and readers unsettled and uncomfortable. Discomfort can sometimes be conducive to creativity and action. There may be no solutions to the political problems I've outlined. But even in the absence of solutions there can still be better adaptive behaviors, and judo-like strategies that achieve desired outcomes—ones that could conceivably turn the tide on intractable global problems such as climate change—without directly confronting existing societal power structures. These behaviors and strategies can be undertaken even at the household scale, but we're likely to achieve much more if we collaborate, doing what we can locally while using global communications to compare notes and share our successes and challenges.

Originally published as Richard Heinberg's February 2014 Museletter.

www.postcarbon.org/new-site-files/Reports/Searching_for_a_Miracle_web10nov09.pdf

SEARCHING FOR A MIRACLE: Net Energy Limits and the Fate of Industrial Society, by Richard Heinberg

Foreword by Jerry Mander

A Joint Project of the International Forum on Globalization and the Post Carbon Institute. [False Solution Series #4]

September 2009

www.resilience.org/stories/2012-10-22/gas-bubble-leaking-about-to-burst

Gas Bubble Leaking, About to Burst, by Richard Heinberg, Post Carbon Institute, October 22, 2012

For the past three or four years media sources in the U.S. trumpeted the "game-changing" new stream of natural gas coming from tight shale deposits produced with the technologies of horizontal drilling and hydrofracturing. So much gas surged from wells in Texas, Oklahoma, Louisiana, Arkansas, and Pennsylvania that the U.S. Department of Energy, presidential candidates, and the companies working in these plays all agreed: America can look forward to a hundred years of cheap, abundant gas!

Some environmental organizations declared this means utilities can now stop using polluting coal—and indeed coal consumption has plummeted as power plants switch to cheaper gas. Energy pundits even promised that Americans will soon be running their cars and trucks on natural gas, and the U.S. will be exporting the fuel to Europe via LNG tankers.

Early on in the fracking boom, oil and gas geologist Art Berman began sounding an alarm (see example). Soon geologist David Hughes joined him, authoring an extensive critical report for Post Carbon Institute ("Will Natural Gas Fuel America in the 21st Century?"), whose Foreword I was happy to contribute.

Here, one more time, is the contrarian story Berman and Hughes have been telling: The glut of recent gas production was initially driven not by new technologies or discoveries, but by high prices. In the years from 2005 through 2008, as conventional gas supplies dried up due to depletion, prices for natural gas soared to $13 per million BTU (prices had been in $2 range during the 1990s). It was these high prices that provided an incentive for using expensive technology to drill problematic reservoirs. Companies flocked to the Haynesville shale formation in Texas, bought up mineral rights, and drilled thousands of wells in short order. High per-well decline rates and high production costs were hidden behind a torrent of production—and hype. With new supplies coming on line quickly, gas prices fell below $3 MBTU, less than the actual cost of production in most cases. From this point on, gas producers had to attract ever more investment capital in order to maintain their cash flow. It was, in effect, a Ponzi scheme.

In those early days almost no one wanted to hear about problems with the shale gas boom—the need for enormous amounts of water for fracking, the high climate impacts from fugitive methane, the threats to groundwater from bad well casings or leaking containment ponds, as well as the unrealistic supply and price forecasts being issued by the industry. I recall attempting to describe the situation at the 2010 Aspen Environment Forum, in a session on the future of natural gas. I might as well have been claiming that Martians speak to me via my tooth fillings. After all, the Authorities were all in agreement: The game has changed! Natural gas will be cheap and abundant from now on! Gas is better than coal! End of story!

These truisms were echoed in numberless press articles—none more emblematic than Clifford Krauss's New York Times piece, "There Will Be Fuel," published November 16, 2010.

Now Krauss and the Times are singing a somewhat different tune. "After the Boom in Natural Gas," co-authored with Eric Lipton and published October 21, notes that ". . . the gas rush has . . . been a money loser so far for many of the gas exploration companies and their tens of thousands of investors." Krauss and Lipton go on to quote Rex Tillerson, CEO of ExxonMobil: "We are all losing our shirts today. . . . We're making no money. It's all in the red." It seems gas producers drilled too many wells too quickly, causing gas prices to fall below the actual cost of production. Sound familiar?

The obvious implication is that one way or another the market will balance itself out. Drilling and production will decline (drilling rates have already started doing so) and prices will rise until production is once again profitable. So we will have less gas than we currently do, and gas will be more expensive. Gosh, whoda thunk?

The current Times article doesn't drill very far into the data that make Berman and Hughes pessimistic about future unconventional gas production prospects—the high per-well decline rates, and the tendency of the drillers to go after "sweet spots" first so that future production will come from ever-lower quality sites. For recent analysis that does look beyond the cash flow problems of Chesapeake and the other frackers, see "Gas Boom Goes Bust" by Jonathan Callahan, and Gail Tverberg's latest essay, "Why Natural Gas isn't Likely to be the World's Energy Savior".

David Hughes is working on a follow-up report, due to be published in January 2013, which looks at unconventional oil and gas of all types in North America. As part of this effort, he has undertaken an exhaustive analysis of 30 different shale gas plays and 21 shale/tight oil plays—over 65,000 wells altogether. It appears that the pattern of rapid declines and the over-stated ability of shale to radically grow production is true across the U.S., for both gas and oil. In the effort to maintain and grow oil and gas supply, Americans will effectively be chained to drilling rigs to offset production declines and meet demand growth, and will have to endure collateral environmental impacts of escalating drilling and fracking.

No, shale gas won't entirely go away anytime soon. But expectations of continuing low prices (which drive business plans in the power generation industry and climate strategies in mainstream environmental organizations) are about to be dashed. And notions that the U.S. will become a major gas exporter, or that we will convert millions of cars and trucks to run on gas, now ring hollow.

One matter remains unclear: what's the energy return on the energy invested (EROEI) in producing "fracked" shale gas? There's still no reliable study. If the figure turns out to be anything like that of tight "fracked" oil from the North Dakota Bakken (6:1 or less, according to one estimate), then shale gas production will continue only as long as it can be subsidized by higher-EROEI conventional gas and oil.

In any case, it's already plain that the "resource pessimists" have once again gotten the big picture just about right. And once again we suffer the curse of Cassandra—though we're correct, no one listens. I keep hoping that if we're right often enough the curse will lift. We'll see.

www.postcarbon.org/person/36208-david-hughes
www.postcarbon.org/reports/PCI-report-nat-gas-future.pdf
www.postcarbon.org/report/331901-will-natural-gas-fuel-america-in

Post Carbon Institute: Will Natural Gas Fuel America in the 21st Century?

David Hughes
Published May 29, 2011

In this groundbreaking report, David Hughes shatters the myth (advanced by industry, government, and many environmental organizations) that domestic natural gas can be a "bridge fuel" from high-carbon sources of energy like coal and oil to a renewable energy future.

“Snake Oil: how fracking’s false promise of plenty imperils our future” by Richard Heinberg

Snake Oil: how fracking's false promise of plenty imperils our future - Reviews - The Ecologist

www.theecologist.org/reviews/2315910/snake_oil_how_frackings_false_promise_of_

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Snake Oil: how fracking's false promise of plenty imperils our future

Paul Mobbs

20th March 2014

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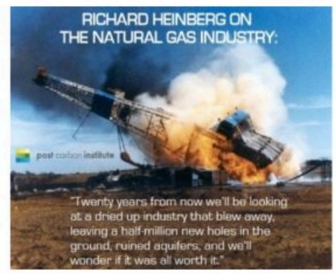
Fracking is just another step on the fossil fuel treadmill, according to 'Snake Oil' by Richard Heinberg. High costs, diminishing returns and growing pollution will ultimately nail its future. Paul Mobbs urges readers - give a copy to your MP before it's too late!



Twenty years from now we'll be looking at a dried up industry that blew away, leaving half a million new holes in the ground, ruined aquifers, and we'll wonder if it was all worth it. Image: Post Carbon Institute.

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> “Unlike the USA, where the damage to states such as Texas and Pennsylvania is largely done, we in the UK still have the time to stop this mad policy before it's too late.”

For those who thought the 'fracking' issue was just about water pollution and earthquakes, Richard Heinberg's *Snake Oil* might be a little perplexing.

You don't get to the parts about environmental pollution until about two thirds of the way through the book. But it's for that very same reason that those who are unaware of these larger dimensions to the shale gas issue will get the greatest benefit from reading the book.

Like myself, Richard Heinberg began to look at the issue of energy and the environment in the early 2000s, and in particular the growing geophysical restrictions on conventional oil and gas supplies.

As 'conventional' resources reach their physical limits of production - the point known as 'peak oil' and 'peak gas' - the energy industry has looked to other 'unconventional' energy sources to keep their business models working.

The many faces of a single problem

In Canada that's been tar sands; in Australia it's coal seam gas; in Russian that's drilling in the Arctic Circle; in the USA, and perhaps soon Britain, that's shale gas and oil.

The first two thirds of 'Snake Oil' described the history of how this transition has taken place:

- how Western oil companies and their home economies have become challenged by high energy prices;
- how energy agencies and companies have selectively quoted and managed the statistics on energy supply to downplay any talk of a crisis;
- and as a result, how shale gas was promoted as an energy solution when in fact it was, in that greatest of American traditions, a 'Snake Oil' remedy - a toxic cocktail that tricks the unsuspecting consumer into buying it, and which often makes the underlying problems worse.

The book outlines how interest groups have used partial data to talk-up the promise of shale gas in order to gain political support and financial investment; and then how they used that political and financial capital to relax environmental controls and buy publicity for their technology.

It's just another treadmill

It reveals how the drilling boom sparked by this large-scale investment has been used to promote the economic benefits of shale gas - whilst at the same time hiding the fact that it's the poor production and fast depletion rates of shale gas well which force this continuous 'treadmill' of drilling.

And it uses the oil and gas industry's own proprietary data sources to demonstrate how, like the resource booms of American history, the current boom of US shale gas is likely to go bust very soon - as investment dries up and the available sites are quickly worked out.

And yes, there's a chapter on pollution too!

'Snake Oil' is an American book, largely based on American data. However, from that wealth of experience we can draw parallels with how the industry has been manipulating public opinion in Britain and Europe, to buy political influence and talk-up their false solution.

In advance of the widespread damage seen in the USA, we can hopefully learn the lessons and stop that same corrupt process happening over here.

Stop this mad policy while we still can!

And unlike the USA, where the damage to states such as Texas and Pennsylvania is largely done, we in the UK still have the time to stop this mad policy before it's too late.

'Snake Oil' shouldn't just be a book for anti-fracking activists. It has value to the general public, and I would hope that many journalists and policy-makers would read it too.

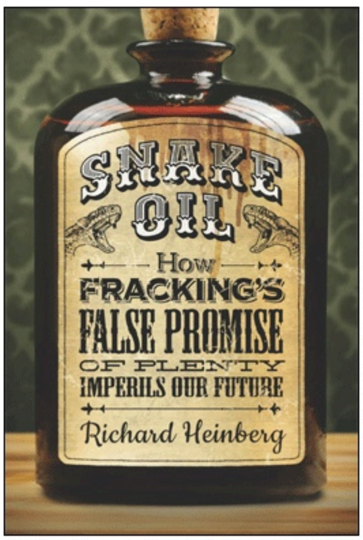
To that end we should all consider buying a copy and sending it to our pro-fracking Members of Parliament and Council leaders - and demanding that they respond to the information the book contains in order to justify their support to develop this technology in Britain.

The book: *Snake Oil: How Fracking's False Promise of Plenty Imperils Our Future* is written by Richard Heinberg and published by Clairview Books, February 2014. ISBN 9781 9055 7072 0. £10.99.

Paul Mobbs *is an independent environmental consultant, researcher and author.*

He is also the creator and editor of the Free Range Activism Website.

Books + Reports



Snake Oil: How Fracking's False Promise of Plenty Imperils Our Future

Richard Heinberg

July 25, 2013

The rapid spread of hydraulic fracturing ("fracking") has temporarily boosted US natural gas and oil production… and sparked a massive environmental backlash in communities across the country. The fossil fuel industry is trying to sell fracking as the biggest energy development of the century, with slick promises of American energy independence and benefits to local economies.

Snake Oil casts a critical eye on the oil-industry hype that has hijacked America's energy conversation. This is the first book to look at fracking from both economic and environmental perspectives, informed by the most thorough analysis of shale gas and oil drilling data ever undertaken. Is fracking the miracle cure-all to our energy ills, or a costly distraction from the necessary work of reducing our fossil fuel dependence?

Published by Post Carbon Institute. Distributed by Chelsea Green Publishing. 2013. 162 pages. ISBN 9780976751090.

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Gas Bubble Leaking, About to Burst

by Richard Heinberg, originally published by Post Carbon Institute | OCT 22, 2012

For the past three or four years media sources in the U.S. trumpeted the "game-changing" new stream of natural gas coming from tight shale deposits produced with the technologies of horizontal drilling and hydrofracturing. So much gas surged from wells in Texas, Oklahoma, Louisiana, Arkansas, and Pennsylvania that the U.S. Department of Energy, presidential candidates, and the companies working in these plays all agreed: America can look forward to a hundred years of cheap, abundant gas!

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ExxonMobil: “We are all losing our shirts today. . . . We’re making no money. It’s all in the red.” It seems gas producers drilled too many wells too quickly, causing gas prices to fall below the actual cost of production. Sound familiar?

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www.resilience.org/stories/2014-12-24/fracking-fracas-the-trouble-with-optimistic-shale-gas-projections-by-the-u-s-department-of-energy

Fracking Fracas: The Trouble with Optimistic Shale Gas Projections by the U.S. Department of Energy, David Hughes

December 23, 2014

On December 3, 2014, *Nature* published "Natural Gas: The Fracking Fallacy", which suggested that the forecasts of the Energy Information Administration (EIA) for four major U.S. shale gas plays were wildly optimistic, based on a comparison to forecasts for the same plays by the University of Texas Bureau of Economic Geology (UT/BEG). This was followed by a formal denunciation of the article both by the EIA and UT/BEG, despite the fact that the substance of the article was correct. Arthur Berman provided an excellent overview of the merits—or in this case the lack thereof—of the attack by both of these agencies on what is essentially the reality behind the shale revolution.

The *Nature* piece steered clear of any discussion of my recent *Drilling Deeper* report (published by Post Carbon Institute), which looked at twelve major shale gas and tight oil plays accounting for most of U.S. shale production, and which also came to the conclusion that the EIA's projections were extremely optimistic. *Nature* focused instead on the four plays described in two published and two unpublished studies by UT/BEG. The *Nature* article sparked a lot of media attention, which prompted the EIA and UT/BEG to issue rebuttals.

The argument of the EIA and UT/BEG that their projections of shale gas production from the plays mentioned in the *Nature* article are fundamentally similar is untrue, given the publicly available data. The implications of the EIA being wrong on its projections of cheap and abundant gas for decades are considerable, given that investment decisions are now being made based on these projections— including construction of infrastructure for LNG exports, gas-fired generation and even crude oil exports. Hence it is worthwhile to examine the EIA's optimistic projections in more detail in light of the projections available from UT/BEG and the *Drilling Deeper* report (DD).

www.postcarbon.org/the-shocking-data-behind-shale-oil/

The Shocking Data Behind Shale Oil, Chris Martenson, David Hughes, December 16, 2014

Hooray, oil is suddenly much cheaper than it used to be. That's great news, right?

Not so fast. For certain it's not good news for those counting on a continued rise in US oil production from the "shale miracle". Many drillers were challenged to operate profitably when oil was above $70 per barrel. Very few will remain solvent with oil in the $50s (as it is as of this writing).

So, expect US oil production to suffer from these lower prices if they persist. But even if oil prices rise and rise soon, there's new data that indicates the total amount of extractable oil from America's shale plays is less –*much* less — than what we're being told (or better put, "sold").

On today's podcast, Chris Martenson talks with oil analyst David Hughes, who has analyzed the major shale plays utilizing a massive database of well production results from America's shale basins. The data show that declines tend to be hyperbolic in all shale fields. The average first-year decline is 70%; down to 85% by year three. And we're drilling the best parts of these plays first: meaning that future wells will yield less even under the best results.

We're pinning our hopes of "oil independence" on faulty assumptions. Worse, we're using it to dismiss the Peak Oil theme at exactly the time we should be using this extra oil to construct the infrastructure for our next energy age (whatever that may look like), while we still have the net energy available to us:

> *Let's just take a play like the Bakken.: 45% annual field decline, sweet spots are getting to be drilled out. We know that they need to drill 1,500 wells a year just to keep production flat. But as you go into lower quality rock, the well quality in most of the play's extent is only about half of what it is in the sweet spot. If you have to rely on the lower quality part of the play you need 3,000 wells per year instead of 1,500 to offset the field decline. But the wells aren't any cheaper. They cost the same amount to drill. To be profitable for producers, it's going to take a lot higher prices in order to make that happen. And you can go through play after play and see the same thing. We are drilling the best parts of the plays now and it is just going to get worse down the road. We are going to need higher and higher prices.*
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> *The EIA has not only made what I consider really optimistic estimates on production, they have also made optimistic estimates on price. A lot of the infrastructure that is being built today is based on the assumption of cheap prices for the foreseeable future. That is not in the cards. With these recent cheap prices we are going to see production go down a lot faster than my estimates. My estimates are best case: I assume that the capital will always be there to drill the wells and that there will be no environmental concerns that restrict access to drilling locations. So in that way I am the best case. But even if you take my best case, the medium and long-term supply picture from shale is disturbing.*
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> *Sadly, corporations tend to think about the next couple of quarters. Politicians may think about the next election, but an energy sustainability plan has to have a vision of decades we certainly don't see that in all the hype read every day. If you look at the mainstream media, I don't think there is a lot of original research that is done there. I think people tend to repeat what other people said and it kind of takes on a momentum of its own, which is why I was so*

interested in trying to lay out as much of the basic data on these shale plays as I could. It's dangerous.

I mean, if you look at the infrastructure going forward in an era of declining oil and gas the number one way to promote energy sustainability in my view is figuring out ways to use less. And some of the infrastructure that needs to be built in order to give people an alternative to high energy throughput lifestyles takes a lot of oil and gas to build. And you know, this short term bounty that we are looking at should in fact be used to do that not to maintain business as usual to the bitter end and then face the consequences.

TRANSCRIPT

Chris Martenson: Welcome to this Peak Prosperity podcast. I am your host Chris Martenson. Today there really is no more important story than what is happening to the price of oil. Now just like in 2008 oil has been plummeting catching everyone including this analyst by surprise. West Texas intermediate crude, the WTIC blend I am looking at right now at $58 and a few pennies here. Right here on the 12th of December. And the airwaves are packed with commentary. And the print media are churning out copy to explain all of this to us. Mostly with the spin that the price plunge is due to US shale oil flooding the world markets. And most are going out of their way to even find Wall Street analysts who make the claim that shale oil is profitable at $70, no $60, no $50. In fact, I even read last week one analyst claim that $25 a barrel was profitable in the shale plays.

Now why does all of this matter so much? Isn't lower oil prices, aren't those good for consumers and should we see all of this maybe as a gift? Well, yes for now. But unfortunately not in the sense that in the near term a lot of shale oil and shale gas companies are going to go out of business because they were not profitable when oil was 40% higher. And they are therefore even more unprofitable today. And over the longer term we see oil projects getting pulled left and right today. Deep water plans have been shelved. Capital cut backs have happened in the oil sands and this means that future production will be lower than if oil prices had remained elevated. So a little consumer happiness today potentially followed by damaging oil shortfalls in the future.

The shale story, however, is weighing on this and it is not a simple story as the media likes to portray. It is more than plucky American can-do ingenuity turning straw into gold. To really understand the shale oil future we need to understand that not all shale plays are created equally. And that within each play some regions are sweet spots and others are relative duds. We need to know that these wells deplete horribly quickly. And that the very process of drilling these wells creates all sorts of above ground troubles, including road and bridge damage and airborne fracking aerosols that drift about harming humans and animals alike.

Now possibly, worst of all, is that the nation if not the world has latched onto the shale story as if it were some permanent savior from the unpleasant task of facing up to the idea that oil is a finite substance. To help us understand all of this we could not have a better guess today than David Hughes, a geo-scientist who has studied the energy resources of Canada for nearly four decades including 32 years with The Geological Survey of Canada as a scientist and research manager. Now it is his work with The Post Carbon Institute that has really caught my eye. That includes "Drill Baby Drill," a 2013 report. Probably the most comprehensive, publicly available analysis to date of the prospects for shale gas and tight oil, as shale oil is usually called in the United States. "Drilling California," which was the first, first publicly available empirical analysis of actual oil production data from California's much promoted Monterey formation and the subject of today's discussion, "Drilling Deeper," which is a reality check on the Department of Energy's expectation of long-term domestic oil and natural gas abundance. Welcome, David.

David Hughes: My pleasure, Chris.

Chris Martenson: Well, David I want to – really, I am very excited to have this conversation with you. And I want to help our listeners understand what is truly possibly in the shale plays. Obviously there is oil there. There is gas there. We are getting both out of the ground, that's true. But I need to cut through the marketing copy and even outright industry propaganda that has muddied the waters so that our listeners can make some informed decisions. Now let's focus on "Drilling Deeper," your most recent study. Tell us about this study. I want to know what it included, how it was conducted and for example, what sorts of data did you use to perform the analysis? What can you tell us about how you put this report together?

David Hughes: Well, we had access for the first time really to the EIA's play by play forecast which was published in the "Annual Energy Outlook 2014." And what I wanted to do is look at those forecasts and basically do a reality check on them. So what we did is we looked at the top 12 shale plays that basically account for 88% of shale gas production. In the EIA's forecast 82% of tight oil production. We went through that play by play. The data source was Drilling Info, which is a commercial database out of Austin, Texas, that is used by the EIA and it is also used by most multinationals. And it contains basically all of the well production data on a play by play basis. So one can take it apart at the play level and one can also take it apart at the county level within plays. So I was interested in looking at the – as you referred to, all plays are not created equal. And even within plays all counties are not created equal. So we wanted to do things like you know, characterize well quality, what is the average productivity by county, by play. What are the decline rates? Both well decline rates which are very steep if you look at a tight oil play like the Bakken for example. The average three year decline is about 85% in production. The average first year decline is about 70%. Declines tend to be hyperbolic in all shale fields. The first year is the greatest, the second year is a bit less. Third year a bit less. So if you look at the decline of the field, which is really a combination of new wells declining quickly and older wells declining slowly, you can compute a field decline.

And so for a field like the Bakken the decline is about 45% per year, which means that 45% of production has to be replaced by more drilling in order to keep production flat. So if you know the average rate of production for the first year of wells in a play it is quite easy to calculate the number of wells you need to drill in order to keep production flat. And for a play like the Bakken that is about 1500 wells per year are needed just to keep production flat. So in round numbers at $10 million a well you need to put in about $15 billion a year to keep production flat on the Bakken. Production is growing in the Bakken and that is because they are drilling 2,000 wells a year. They are 500 wells to the good in terms of growing production. However, the higher production grows the larger the chunk that 45% drill decline takes. So you need more and more wells in order to offset decline. So basically, what we did for each of those plays is put all of that information into a spreadsheet. So we know what the well quality is in the sweet spots and we know what the well quality is in all the rest of the play. And typically sweet spots may be 15 to maybe 20% at the outside of the total play area.

So we know that fundamental law of oil and gas companies is they drill their best locations first. So the wells are going into the sweet spots today, but as drilling locations are used up in sweet spots they are going to have to go more and more into lower quality rocks. We can put all of that into a spreadsheet and come up with production forecasts going forward.

Chris Martenson: So this spreadsheet then, this is at the individual well level? So like well has a code that is associated, some alpha numeric code and says this is well XJ55 or whatever and you had each of those in a spreadsheet so they were sorted I guess by time so that you would have – I mean there are thousands and thousands of wells drilled in the Bakken and some of them get started to be drilled in what 2007? And then there is a vintage in 2008, 9, 10 so did you have all that data available?

David Hughes: Yes. So for a play like the Bakken we had all of the producing wells up until about July of 2014. "Drilling Deeper" was published in late October. We tried to keep it current to mid 2014. So we had every well that was drilled from year 0 in all of those different plays.

In terms of making the forecast, basically we used the average production over the first year which allowed us to determine the number of wells that you need to offset that 45% decline. And you know, in the spreadsheet you start off assuming—in the case of the Bakken you know, engineering companies are telling us that well technology is getting better and we are making those wells more productive. I actually was doing a check on that for every play. I looked at the average productivity by year from 2009 until 2013. So you can see if in fact, it is going up or if it is not going up.

Chris Martenson: This is per well productivity, right? So that is what we really care about is productivity of the wells and just at this point I need to interject. I think that the EIA has muddied the water to turning to what they call "per rig" productivity and saying people have thrown this at me a lot lately "oh 300% productivity improvement." No, no, no that is a process improvement because what they have done is they managed to figure out ways to drill multiple wells off a single pad. And they have these things called walking rigs which allows each rig to spend less time in transit and more time drilling. So we are drilling more wells, but what you are talking about is the per well productivity, which is what we really should care about, right? Because if we are getting more oil out of each well then yes, there is more oil coming out of the play. But if we are drilling more wells faster that is not the same thing. So you are talking about per well productivity, right?

David Hughes: Absolutely.

Chris Martenson: So what do you see there?

David Hughes: You know, the other thing is how many wells could you drill in a play? That was another fundamental parameter that we looked at for every play. If you look at investor's presentations there is a lot of talk about down spacing. How close can you space these wells before you get interference. There is a – what I thought was a really good paper published by an engineer at Drilling Info who looked at the Bakken in terms of down spacing. In essence if you drill two wells 300 feet apart, initially the productivity will likely be very high. It would likely be comparable between the two wells. But if you look at it over 12 months or 24 months you can start to measure the interference so one well is cannibalizing another well's oil. And the drilling info paper basically said below about 2,000 feet spacing you are starting to see interference if you look at a 12 to 24 month timeframe.

We made assumptions about how many wells you can drill in a play. For a play like the Bakken we assumed when the play is said and done you can drill about 32,000 wells. There is

8,500 producing wells right now. We felt you could drill four times as many wells as are there right now. That is a key fundamental parameter in making the forecast. So if rigs are more productive, sure you can drill those locations out quicker, but you don't necessarily get any more oil at the end of the day. It is per well productivity that counts at the end of the day.

Chris Martenson: Let me talk about that per well productivity then. This is a central part to the story that is out there. So I want to make sure we get this right. So a typical Bakken well they drill down whatever 10,000 feet, slant it sideways. And then they go sideways in this big horizontal stage and I guess how much we get out of a well is going to be a function of a number of things. One, the underlying geology that is just true for that rock. Two, how long of that lateral we drilled? Is it 5,000 feet? Is it 10,000 feet? That makes a big difference in the collection area. Then I guess are we doing a five stage frack or a 30 stage frack? So how much we shatter that rock up. All of that sort of plays in and I assume that are playing with all of those parameters over time. But you have got data that showed these wells by year. And if we really were — I don't know how you would factor out the longer drilling and the more fracking, but how much additional oil are we seeing coming out of the wells because we have made improvements to the drilling techniques and the fracking techniques? How much is that?

David Hughes: Well, it depends on the play. And it depends on the region within the play. So if you look at the Bakken the average well that was drilled in the Bakken went up about 7% from 2011 to 2013. That is a combination of better technology, as you say longer horizontal laterals, more frack stages, higher water volumes, more propping and it is also a function of people drilling in the sweet spots. It is hard to differentiate the two. I think it is a combination of both; better technology and drilling in the sweet spots.

So for a play like the Bakken we say okay, we are looking at a slight improvement in well productivity. So I'm going to assume that is going to continue for another year or two before people start to have to drill in lower quality parts of the reservoir. And from peak well productivity, well productivity will decline as you go into the lower quality rock. The technology is never going to make up for bad reservoir rock. The Bakken is still quite a young play. As I said, they have only drilled about 25% of the total potential locations. So there are still locations in the sweet spots. Well, those are running out fairly quickly.

If you look at an older play like the Barnett which is a shale gas play in Texas and that is where fracking really got its start. Well quality peaked in 2011. So they drilled about 20,000 wells in the Barnett now. 4,000 of those are no longer productive. Well quality peaked in 2011 and it is now down 17% from peak. So if you look at the top counties in the Barnett they are finished .There is already eight wells per square mile and drilling has to move into lower quality rock. Production of the Barnett is now down 18%. In a mature play like the Barnett you are really seeing the fact that geology wins out every time against technology, despite what Halliburton and some of these companies will tell you.

Chris Martenson: Now one quick thing on the Barnett. Somebody said to me once, "well that's because natural gas prices are at say \$3 to \$4.00 per NCF. But if natural gas prices went back up to \$10 or \$12.00 from its current \$3 to \$4 that people would start punching more holes into the Barnett." That is the slow down in the drill program accounts for that decline, but they could ramp it back up again if prices were higher. We know price is always a function in this story that is lurking out there. How much do you think the Barnett would be sensitive to additional price improvements and people drilling more, and how much do you think it is past its prime, it is already done?

David Hughes: Well, I looked at that. And that is true to a certain extent – the drilling rate in the Barnett is down. It is only about 400 wells per year right now. So in every play drilling rate is the key parameter. How fast you drill determines what the production profile looks like. So in every play I get at least three and sometimes four different scenarios of drilling rate. And the Barnett I – my low scenario is we just keep drilling 400 wells per year. What does that look like in terms of future production? My most likely scenario is the price of gas is going to go up a bit and drilling will be bumped from 400 to 600 wells per year. And then it will gradually decline to 500 wells per year to move into the lower quality parts of the play, which they are already moving into.

But I also did another study, another projection that said okay what if quintuple drilling rates in the Barnett? If we go from 400 to 2,000, which is what it was at its max back in about 2008. And if you do that you can certainly stop the decline and reverse it to a new peak. That new peak would happen in about 2016. You know, if we instantaneously increased the drilling rate by five times. However, when you look at the total production out to 2040, it doesn't change the cumulative production that much. All you do, if you drill faster, you get it quicker. So if you look out through say 2020-2025 in that quintuple drilling rate scenario, all of a sudden production falls below what you would have got if you follow my most likely scenario. So there is no free lunch. You can drill fast and get it quick and then suffer the consequences later. Or you can drill at what I consider the most likely rate.

I went through that scenario for all the plays and then stacked them all up and compared my most likely scenario to what the EIA projected.

Chris Martenson: Okay. I am going to assume given the current prices that we are going to fall below your most likely scenario for a while just because prices aren't supportive of a real robust drilling program right now.

To get back to drilling deeper—among the major conclusions of your report were that shale oil would peak in output before 2020. I think the EIA is roughly in agreement with that. But where you disagree with the Energy Information Agency, the EIA, is that you feel they have overstated the amount of oil that the US would produce by 2040 by a really very wide margin. I want to understand those conclusions. So let's break them down.

First, talk about the peak in shale oil happening before 2020. How did you arrive at that conclusion? I understand that you've modeled this. You have ran a variety of scenarios. When I say "shale oil peaks before 2020," I assume that is under your most likely scenario. Let's talk about that scenario and what the implications of that are. So do you still see a peak before 2020?

David Hughes: Yeah. The actual peak before 2020 was for the two top plays, which are the Bakken and the Eagle Ford. The Bakken and Eagle Ford make up 62% of current tight oil production. So those are really the two biggies. I also went through Permian Basin plays. But the Permian Basin is unlike the Bakken and Eagle Ford; the Permian Basin is really a very old place. They have been around for 40 to 60 years. Other plays like the Niobrara and the *Austin* Chalk would fall into that category too. So these are really old plays that we have known about for a long time and they are redeveloping them with better technology. With fracking.

The Bakken and Eagle Ford are unique in that they kind of rose from nothing. They're true tight oil shale oil plays. I was able to do forecasts for those two for tight oil and for the Permian basically I just looked at all of the historical data. I didn't actually make projections. But if you look at the Bakken and Eagle Ford, the two most important tight oil plays in the US, I went through those and did the same scenario based on drilling rate and looked at the most likely scenario. So for example, for the Bakken, not withstanding the current low oil prices, I assume that the drilling will continue at 2,000 wells per year and then gradually fall to 1,000 wells per year as they move into the outlying, low quality parts of the play.

And if you do that, Bakken production rises to about 1.2 barrels a day. In or around 2015, 2016 you get a peak followed by a long decline. Same thing for the Eagle Ford. The Eagle Ford is actually the number one tight oil play in the US right now. They are plowing 3,500 wells per year into Eagle Ford. Yeah, its just incredible, it's 10 wells per day. And I assumed that drilling was going to continue at that rate and gradually decline to about 2,000 wells per year as they move into the outlying parts of the play. If you do that, it peaks considerably higher. I am just trying to think right off hand… I think my most likely scenario was around 1.4 to 1.5 million barrels a day and that will happen around 2016, 2017. If they ramped up drilling in Eagle Ford they could go much higher. They can probably top out at 1.8 million barrels a day. Also the Eagle Ford produces a lot of associated gas. So there is a lot of value in those wells. You look at the trajectory, peaking in 2016, 2017 and declining. When you add up the production in 2040 in the Bakken and the Eagle Ford compared to the EIA forecast for the Bakken and Eagle Ford, mine are less than a tenth of the production in 2040.

Chris Martenson: Less than a tenth.

David Hughes: Less than a tenth. The other interesting thing is the EIA seems to have underestimated short term production. So my projections are actually for higher production early on and a higher peak than the EIA. But you know, much worse scenario down the road. Much lower productivity by the time you get to 2040.

Chris Martenson: This is interesting. I assume you have read or heard of the University of Texas at Austin study on shale gas that concluded that US government estimates of the amount of natural gas that can be extracted by fracking are far too optimistic and that shale gas production will peak in 2020, I think they put it, and decline rapidly. As I understood it what they did is they didn't look at county level resolution. They broke down all the plays into square mile resolution, which some counties are thousands of square miles. So this resolution is much higher and that helps them identify sweet spots or not sweet spots more accurately, I assume. So I am wondering, did you read that? And how did their study conclusions differ from yours or do your conclusions match? Then given your answer to that, what is the EIA doing wrong, or what should they consider amending in their approach to be more realistic. So first on the study – did you see it and how do your conclusions match?

David Hughes: Oh yeah, I've got a detailed comparison in "Drilling Deeper" between my work and UT's work and they are very comparable. You know, if you look at the section by a square mile by square mile resolution, you can do that but in fact the critical parameters — one of the key parameters you get for every well is IP, right? That is the highest one month production or the highest six month production of every well, which I mapped, which gives you a pretty good idea of where the sweet spots are. There is a lot of other parameters you can look at for shale gas, thermal maturity, organic matter content, porosity, natural fracture density, things like that, but those parameters are not measured at a square mile resolution. They are measured generally at a much broader scale. So I think that you can do a pretty good job at the county level, which is the level that I took it — and parts of counties. When I looked at the total play area, I looked at the boundaries between productive wells and non productive wells so we could put a limit. I only used that portion of the county that was productive in determining the productive play area. When I did the comparison I talked to Scott Tinker at UT. Basically their base case and my most likely case are very close. There are only two studies that they published so far – the Barnet and the Fayetteville — so I did a detailed comparison. In fact, they may be a little more pessimistic than me in some cases. But you know, we are in broad agreement that the EIA is wildly optimistic.

Chris Martenson: What would the EIA need to do to become more realistic? Where are they – we know that the – so I mean we know the EIA in the case of the Monterey shale they turned to a private firm and just did some back of the envelope calculations and then had to downgrade the Monterey estimates of what that reserve was going to be at by 96%. Something that you had come to a conclusion a long time before. Obviously the EIA had some methodological issues or they relied on the wrong parties in the case of the Monterey. But more generally, what is the EIA doing that is giving them these inflated estimates do you think?

David Hughes: I scratch my head about that. If you go through "Drilling Deeper," — it's a free download for your guests or audience — I've done a comparison. The Barnett, my most likely case, compared to the EIA; it is really kind of bizarre. The EIA agrees that the Barnett peaked in 2012 and it is going to decline but then they have a ramp up to nearly the equivalent of the 2012 peak in 2040. So it doesn't fit with the fundamentals of the play. The only thing I can think of is they have a phenomenal faith in technology. That somehow someone is going to pull a technological rabbit out of his hat. Same thing if you go through play by play I have done the comparison. One of them I think the Bone Spring in the Permian I think the EIA is too conservative, but every other one they are way too optimistic.

Chris Martenson: Well this is really important because as I look at it I see chemical companies and power utilities, all of them investing tens, hundreds of billions of dollars in new property, plant, and equipment. Investments with 40, 50 year life cycle horizons. Because they are taking advantage of, I am quoting here, "100 years of cheap, natural gas," mostly from the shale plays. If you were going to advise these companies, what would you – would you tell them that you think the EIA's assessments are not the ones they should be using?

David Hughes: Absolutely. And that is one of the reasons I was so interested in doing "Drilling Deeper." And I have laid out, if you go through it, there is 20 pages a play and a lot of the basic fundamental data that has never been available is there in charts and graphs. Let's just take a play like the Bakken. 45% field decline, sweet spots are getting to be drilled out. We know that they need to drill 1,500 wells a year just to keep production flat. But as you go into lower quality rock and the well quality in most of the plays is only about half of what it is in the sweet spot. If you have to rely on the lower quality price of the play you need 3,000 wells per year instead of 1,500 to offset the field decline. But the wells aren't any cheaper. They cost the same amount to drill. Obviously you need a lot higher prices in order to make that happen. And you can go through play after play and see the same thing. We are drilling the best parts of the plays now and it is just going to get worse down the road. We are going to need higher and higher prices.

The EIA has not only made what I consider really optimistic estimates on production, they have also made optimistic estimates on price. A lot of the infrastructure that is being built as you say is based on the assumption of cheap prices for the foreseeable future. That is not in the cards. With cheap prices, we are going to see production go down a lot faster than my estimates. My estimates are best case, so I assume that the capital will always be there to drill the wells and that there will be no environmental concerns that restrict access to drilling locations. So in that way I am best case. Even if you look at my best case, that will be rather disturbing to me if I was a petro chemical company or somebody that was investing a lot in gas fired generation.

Chris Martenson: Alright. Let me test one of the assumptions then. There are a couple of key assumptions that are really driving the overall scenario then. First is going to be the decline rates of each wells and that leads you to say here is why we need to replace 1,500 wells. Let's start there with that decline rate. I was reading this Bloomberg article yesterday and I am quoting here, "Shale production will keep growing because the rate of decline from wells has been overstated, Ed Morris, head of commodities research at Citigroup said." So I am already reading things where they are tossing out that decline rates have been over estimated, but when I read your report what I saw is that you didn't estimate these decline rates; you measured them, right? So what is the difference between these? Did you estimate them? It looked to me like a measurement. Like you just said "let's sum up all of these wells by vintage and see how fast they decline." That's not an estimate. That is more of a measurement. What do you think the disagreement here is?

David Hughes: Well, if you want an optimist, Ed Morris makes the EIA look like the most conservative organization on the planet. He has always been wildly optimistic. If you look at his latest forecast for tight oil, we're going up to 7 million barrels a day and it is just going to stay there forever. I am not sure what Ed uses to make those kind of statements, but what I used is every well. My decline curve for the play in every play is all the wells in the play. I looked at the most current five years worth of drilling. I also looked at well decline curves in every county. You know, all of the top counties at any rate in every place. That is data. It is just nothing imaginary about that.

Chris Martenson: Alright. So you feel like the well decline rate is something we have a handle on, we can model that. We have enough data out of the big plays, the Barnetts, the Fayettevilles, the Eagle Fords, Permian, Bakken — we've got enough. Maybe even Marsalis. We have enough data now to say, "Hey this is kind of how this plays out." Is this a fair statement?

David Hughes: That is a very fair statement.

Chris Martenson: Cool alright. So second big piece – the second big factor I have some confusion around is how much oil is ultimately going to flow from a well, which goes by the acronym EUR, the ultimate recoverable amount of oil. I've got to tell you David, the typical EURs that I am still reading in the newspapers from the Bakken wells, they just toss around this 500,000 barrel amount; it is a lot of oil. And looking in "Drilling Deeper" I found a table you had your EURs that averaged 378,000 barrels a well. That is a big discrepancy. How do you explain that one?

David Hughes: I think if you look at — was it the Bakken you are looking at?

Chris Martenson: Yeah.

David Hughes: I think if you look at counties like Montrail and McKenzie they are higher than that. And if you look at the outlying counties like Divide and Richland they are much lower than that. I can't recall — I think the Montrail and the McKenzie are about 400 and the Richland and Divide and some of those are down sort of in the low 200s. So overall they may average 378 like you say.

Chris Martenson: Yeah. That was your total. So how did you derive your EURs? Was that by taking the decline rates and extrapolating them out and coming up with some idea of how long these wells will persist?

David Hughes: Yeah. The bottom line is nobody knows how much oil is going to come out of those wells until the last barrel gets pumped. So it is an assumption, right? You fit a curve – most companies fit a hyperbolic curve or some combination of hyperbolic/exponential. What I did is I used the actual data for the first four years. So the decline curve for the first four years in a play like the Bakken is pretty solid, you know, it is not much doubt about that. So I took the data for the first four years — how much oil is that cumulatively? And then I fit a 13% exponential decline after that, assuming the well would live to be 30 years old, which is a totally unproven assumption. But for the sake of comparison so I could at least compare the EUR between counties. I used a 13% exponential decline. That number is certainly arguable. If you look at the decline in year four in the Bakken it is probably about 20%. So using 13% as a terminal decline is maybe optimistic. The other thing that if you look at those EUR diagrams in "Drilling Deeper," you will see I have denoted the amount of oil that is produced in the first four years versus the next 26 years, and typically 50 to 60% or more of a well's total oil will be produced in the first four years. So you know, if you are in a sweet spot you can make your money back pretty quickly. That is one of the beauties for oil companies about shale wells. The downer is we don't know if it will only last for 12 years, and that assumption of total EUR is just that, an assumption. I looked at the Barnet and 4,000 wells are no longer producing and their maximum life is only about 10 years. Their average life is something like four years. So you know, anybody that tells you a well is going to produce this much oil is really kidding you. It is only an assumption at this point in time.

Chris Martenson: The Barnett is mostly, it is all gas right? So maybe the gas plays will be different, but this is astonishing to me, David, the astonishing thing is that the Barnett really started getting drilled hard in what, 2007-ish maybe, 2008?

David Hughes: Or the Bakken, you meant?

Chris Martenson: No, I was thinking of the Barnet. When did that start getting drilled?

David Hughes: Oh okay. It really got started in the late '90s for the Barnet. I mean it really ramped up after about 2003, 2004.

Chris Martenson: Right, but that's just like 10 years ago that is when the ramp up started and the peak happened on that gas play within a 10 year window, let's just say, and so obviously the Bakken is going to be different because there is still what 24,000 well sites that can be drilled. That will just take time. At 2,000 wells a year we still got 12 years of drilling. So it is going to take some time for that to really — there is plenty of room to continue that drill program, but it is not forever. And so this is the part I really want to get to is this idea that somewhere before or around 2020 even these shale plays now are in decline from a total production standpoint. And as far as I'm concerned, because I am 52 now, that is like tomorrow. Time seems to go faster as I get older. So this is really soon as far as I am concerned and my concern in trying to publicize all this is we got the data, you have done this incredible work, there it is. There is really nothing to argue about with decline rates. We can quibble a little about the EURs. We can talk about how close the wells might be spaced, but really we are sort of wiggling a little. We are not going to get 100 years of gas. We are not going to get 100 years of increasing oil production out of this whole thing, Ed Morris' weird graphs not withstanding. So my concern is that this is really, really important because so many decisions are being built in this country around this idea that we have solved this energy crisis and it is now in the rear view mirror, but it is really not is it?

David Hughes: Absolutely not. I have been on that same theme there Chris for many years. Corporations tend to think about the next couple of quarters. Politicians may think about the next election, but this is an energy plan, an energy sustainability plan has to have a vision of decades and we certainly don't see that in all the hype we read every day.

Chris Martenson: If I had my magic policy wand I would say "great, we can pretty much add up how many trillions of cubic feet of gas we think we are very likely to get at a certain price and here is how many billions of barrels of oil are left and these are two finite numbers." And then we would take those and we would go "where would we like to be when those finally run out" — or nothing every fully runs out, but we are going to have a blob of energy that we get to use over this next period of time, let's call it 10 or 20 years, and then it is largely gone at that point in time. Dregs remaining. That is what I would love to have a conversation. Where do we want to be in 10 or 20 years? Because business as usual will get us to a place where we have a lot of infrastructure that can't be supported any longer because we don't have the goods for it. This is the part where I get in arguments all the time, people go "oh but we are so swamped with natural gas that look it drove prices down. It just proves that technology will always find a way." My response to that is: "Did you know that we still in the United States are a net importer of natural gas?" And most people don't know that part because they hear we are making LNG terminal decisions because we have so much that we better just export it. It is just astonishing to me that the data that you have and the public perception it is still pretty far apart.

David Hughes: Yeah, it is. You know, I think that if you look at the mainstream media, I don't think there is a lot of original research that is done there. I think people tend to repeat what other people have said and it kind of takes on a momentum of its own. Which is why I was so interested in trying to lay out as much of that data as I could. It is dangerous. I mean if you look at the infrastructure going forward in an era of declining oil and gas, the number one way to promote energy sustainability in my view is figuring out ways to use less. And some of the infrastructure that needs to be built in order to give people an alternative to high energy throughput lifestyles takes a lot of oil and gas to build. And you know, this short term bounty that we are looking at should in fact be used to do that, not to maintain business as usual to the bitter end and then face the consequences.

Chris Martenson: I agree. I agree. Final question – and thank you for your time, so generous. Final question is: What is the reception to the report? Has the EIA reached out? Have any government people talked to you? Is industry wanting to know more? Tell me about how it has been received so far.

David Hughes: Well, I sent a copy of the report the day it was published to John Staub at the EIA who is the head of the oil and gas team and I didn't hear anything back. I sent it to Scott Tinker at UT and he was pretty enthused and sent it around to his team. So they are certainly looking at it. In terms of the mainstream media, they really didn't have a lot of major coverage of it unfortunately. In terms of the industry, if you look at the industry lobby group, Energy in Depth is a lobby arm of the Independent Petroleum Association of America. They took special pains to write an attack article on it. They didn't really criticize any of the data in it. They sort of had to resort to ad homonym adjectives that apply to me, which wasn't appreciated. I think if you look at the second tier of media, we did get an awful lot of coverage and none of it really negative that I can see. I think the data that is in Drilling Info is data that is not available anywhere else. This is data that industry uses, but it has not been widely made available. I am hoping that "Drilling Deeper" will have a long shelf life and people will be able to refer back to it again and again. Hopefully it will promote a bit of saner thinking in terms of our energy future going forward.

Chris Martenson: At a minimum I would hope that the good people who are running the state of North Dakota would take a look and plot a strategy based on the likely arc of their industry because it is completely calculable. As long as they have a long-term view of that and understand where they are going I think that would be great. Listen, thank you so much for your excellent and data driven work and for your time today. I will note that we will have a link to "Drilling Deeper" at the bottom of this podcast. People if you look at the bottom of this page you will see it right there and that will take you over to the Post Carbon website and a download. And you should read it. You should check it out. If you like your data and you love it done well and analyzed well and with good writing around it, this is an absolutely essential report because everything depends on the energy story as we go forward and boy the disinformation out there is just magnificent right now and "Drilling Deeper" and other work by David Hughes is state of the art. It is great stuff. So please everybody take a look at that and David thank you so much for your time today.

David Hughes: It's been my pleasure, Chris.

Links

Drilling Deeper report

Drilling California report

This interview was originally published at Peak Prosperity.org

Drilling Deeper Post Carbon Institute

Drilling Deeper

David Hughes

October 27, 2014

Abstract

Drilling Deeper reviews the twelve shale plays that account for 82% of the tight oil production and 88% of the shale gas production in the U.S. Department of Energy's Energy Information Administration (EIA) reference case forecasts through 2040. It utilizes all available production data for the plays analyzed, and assesses historical production, well- and field-decline rates, available drilling locations, and well-quality trends for each play, as well as counties within plays. Projections of future production rates are then made based on forecast drilling rates (and, by implication, capital expenditures). Tight oil (shale oil) and shale gas production is found to be unsustainable in the medium- and longer-term at the rates forecast by the EIA, which are extremely optimistic.

This report finds that tight oil production from major plays will peak before 2020. Barring major new discoveries on the scale of the Bakken or Eagle Ford, production will be far below the EIA's forecast by 2040. Tight oil production from the two top plays, the Bakken and Eagle Ford, will underperform the EIA's reference case oil recovery by 28% from 2013 to 2040, and more of this production will be front-loaded than the EIA estimates. By 2040, production rates from the Bakken and Eagle Ford will be less than a tenth of that projected by the EIA. Tight oil production forecast by the EIA from plays other than the Bakken and Eagle Ford is in most cases highly optimistic and unlikely to be realized at the medium- and long-term rates projected.

Shale gas production from the top seven plays will also likely peak before 2020. Barring major new discoveries on the scale of the Marcellus, production will be far below the EIA's forecast by 2040. Shale gas production from the top seven plays will underperform the EIA's reference case forecast by 39% from 2014 to 2040, and more of this production will be front-loaded than the EIA estimates. By 2040, production rates from these plays will be about one-third that of the EIA forecast. Production from shale gas plays other than the top seven will need to be four times that estimated by the EIA in order to meet its reference case forecast.

Over the short term, U.S. production of both shale gas and tight oil is projected to be robust-but a thorough review of production data from the major plays indicates that this will not be sustainable in the long term. These findings have clear implications for medium and long term supply, and hence current domestic and foreign policy discussions, which generally assume decades of U.S. oil and gas abundance.

Drill, Baby, Drill: Can Unconventional Fuels Usher in a New Era of Energy Abundance? Post Carbon Institute

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Drill, Baby, Drill: Can Unconventional Fuels Usher in a New Era of Energy Abundance?

David Hughes

February 19, 2013

In this landmark report, PCI Fossil Fuel Fellow David Hughes takes a far-ranging and painstakingly researched look at the prospects for various unconventional fuels to provide energy abundance for the United States in the 21st Century. While the report examines a range of energy sources, the centerpiece of "Drill, Baby, Drill" is a critical analysis of shale gas and shale oil (tight oil) and the potential of a shale "revolution."

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Abstract

It's now assumed that recent advances in fossil fuel production – particularly for shale gas and shale oil – herald a new age of energy abundance, even "energy independence," for the United States. Nevertheless, the most thorough public analysis to date of the production history and the economic, environmental, and geological constraints of these resources in North America shows that they will inevitably fall short of such expectations, for two main reasons: First, shale gas and shale oil wells have proven to deplete quickly, the best fields have already been tapped, and no major new field discoveries are expected; thus with average per-well productivity declining and ever-more wells (and fields) required simply to maintain production, an "exploration treadmill" limits the long-term potential of shale resources. Second, although tar sands, deepwater oil, oil shales, coalbed methane, and other non-conventional fossil fuel resources exist in vast deposits, their exploitation continues to require such enormous expenditures of resources and logistical effort that rapid scaling up of production to market-transforming levels is all but impossible; the big "tanks" of these resources are inherently constrained by small "taps."

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From the Blog

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www.aspousa.org/index.php/2010/07/interview-with-art-berman-part-1/

Interview with Art Berman - Part 1 - July 19, 2010

Art Berman is a geological consultant whose specialties are subsurface petroleum geology, seismic interpretation, and database design and management. He is currently consulting with a wide range of industry clients such as PetroChina, Total, and Schlumberger. Mr. Berman has an MS in geology from the Colorado School of Mines and is active with the American Assoc. of Petroleum Geologists. Art spoke with us last Thursday after a presentation in Canada at the CIBC Technical Conference.

POR: Can you give us your latest updated perspective on the shale gas story?Art Berman is a geological consultant whose specialties are subsurface petroleum geology, seismic interpretation, and database design and management. He is currently consulting with a wide range of industry clients such as PetroChina, Total, and Schlumberger. Mr. Berman has an MS in geology from the Colorado School of Mines and is active with the American Assoc. of Petroleum Geologists. Art spoke with us last Thursday after a presentation in Canada at the CIBC Technical Conference.

Art Berman: You have to acknowledge that shale gas is a relatively new and significant contribution to North American supply. But I don't believe it's anywhere near the magnitude that is commonly discussed and cited in the press. There are a couple of key points here. First the reserves have been substantially overstated. In fact I think the resource number has been overstated.

If you investigate the origin of this supposed 100-year supply of natural gas…where does this come from? If you go back to the Potential Gas Committee's [PGC] report, which is where I believe it comes from, and if you look at the magnitude of the technically recoverable resource they describe and you divide it by annual US consumption, you come up with 90 years, not 100. Some would say that's splitting hairs, yet 10% is 10%. But if you go on and you actually read the report, they say that the probable number-I think they call it the P-2 number-is closer to 450 Tcf as opposed to roughly 1800 Tcf. What they're saying is that if you pin this thing down where there have actually been some wells drilled that have actually produced some gas, the technically recoverable resource is closer to 450. And if you divide that by three, which is the component that is shale gas, you get about 150 Tcf and that's about 7 year's worth of US supply from shale. I happen to think that that's a pretty darn realistic estimate. And remember that that's a resource number, not a reserve number; it has nothing to do with commercial extractability. So the gross resource from shale is probably about 7 years worth of supply.

For a project that a colleague and I did for a client, I actually went in and looked at all the shale plays and assigned some kind of a resource number to them. I also used some work that was done by Wendell Medlock at Rice University's Baker Institute. He did an absolutely brilliant job of independently determining what the size of the resource plays in Canada and the US might be.

The resource hasn't been misrepresented but the probable component has not been properly explained as a much smaller component of the total resource; I guess they just didn't read the PGC's report carefully enough. If you take the proved reserves plus the report's probable technically recoverable number, we have something like 25 years of natural gas supply in North America, which is quite a bit. It's a lot. I don't say any of this to give shale gas a bad name.

The other interesting thing about the PGC's report that nobody seems to pay attention is this: they said there is something like 650 Tcf of potential shale gas. Well, there's 1000 Tcf of something else. What's the something else? It's conventional reservoirs plus non-shale/non-coalbed-methane unconventional reservoirs. So there's 70 percent more resource in better quality rocks than shale. It just astonishes me that nobody has paid any attention to that.

So that's the simple view. And then the other thing that we see empirically is that if you look at any of these individual shale-gas plays-whether it's the Haynesville or the Barnett or the Fayetteville-they all contract to a core area that has the potential to be commercial that is on the order of 10 to 20 percent of the geographic area that was originally represented as all being the same. So if you take the resource size that's advertized-say for the Haynesville shale, something like 250 Tcf-and you look at the area that's emerging as the core area, it's less than 10 percent of the total. So is 25 Tcf a reasonable number for the Haynesville shale? Yeah, it probably is. And it's a huge number. But the number sure is not 250 Tcf, and that's the way all of these plays seem to be going. They remain significant. It hasn't been proved to me yet that any of it is commercial, but they're drilling it like mad, there's no doubt about it.

Those are sort of the basic conclusions. And when you look at it probabilistically, which I think is the only intelligent way to look at anything which you have any uncertainty about, what you realize is that the numbers that are being represented by all of these companies as "truth" are probably like the P-5 case, having a 5 percent probability of being true. So they say, "well, our average well in the Haynesville is going to be 7 Bcf," and I say there will certainly will be wells that make 7 Bcf but there's no way that the average is that high. My take is that there will probably be 5 percent of wells that will make 7 Bcf.

I just think everybody is caught up in this. I have a slide where I say, you guys need to get over the love affair and get on with the relationship. You keep talking about how big it is and how great it is, but at some point you have to live together and that's hard work. You have to be honest with yourself and with each other and you have to do some work. I just don't think we've moved past the love affair.

One other important thing is the Barnett shale. We keep coming back to it because it's the only play that has much more than 24 months worth of history. I recently grouped all the Barnett wells by their year of first production. Then I asked, of all the wells that were drilled in each one of those years, how many of them are already at or below their economic limit? It was a stunning exercise because what it showed is that 25-35% of wells drilled during 2004-2006-wells drilled during the early rush and that are on average 5 years old-are already sub-commercial. So if you take the position that we're going to get all these great reserves because these wells are going to last 40-plus years, then you need to explain why one-third of wells drilled 4 and 5 and 6 years ago are already dead.

POR: When you say one-third of the wells are already sub-commercial, do you mean they have been shut in, or that they are part of a large pool where no one has sharpened the pencil?

Berman: Some of them never produced to begin with. No one talks about dry holes in shale plays, but there are bona fide dry holes-maybe 5 or 6 or 7 percent that are operational failures for some reason. So that's included. There are wells that, let's just call them inactive; they produced, and now they're inactive, which means they are no longer producing to sales. They are effectively either shut-in or plugged. Combined, that's probably less than 10 percent of the total wells. But then there are all the wells that are producing a preposterously low amount of gas; my cut-off is 1 million cubic feet a month, which is only 30,000 cubic feet per day. Yet those volumes, at today's gas prices, don't even cover your lease/operating expenses. I say that from personal experience. I work in a little tiny company that has nowhere near the overhead of Chesapeake Energy or a Devon Energy. I do all the geology and all the geophysics and there's four or five other people, and if we've got a well that's making a million a month, we're going to plug it because we're losing money; it's costing us more to run it than we're getting in revenue.

So why do they keep producing these things? Well, that's part of the whole syndrome. It's all about production numbers. They call these things asset plays or resource plays; that reflects where many are coming from, because they're not profit plays. The interest is more in how big are the reserves, how much are we growing production, and that's what the market rewards. If you're growing production, that's good-the market likes that. The fact that you're growing production and creating a monstrous surplus that's causing the price of gas to go through the floor, which makes everybody effectively lose money….apparently the market doesn't care about that. So that's the goal: to show that they have this huge level of production, and that production is growing.

But are you making any money? The answer to that is…no. Most of these companies are operating at 200 to 300 to 400 percent of cash flow; capital expenditures are significantly higher than their cash flows. So they're not making money. Why the market supports those kinds of activities…we can have all sorts of philosophical discussions about it but we know that's the way it works sometimes. And if you look at the shareholder value in some of these companies, there is either very little, none, or negative. If you take the companies' asset values and you subtract their huge debts, many companies have negative shareholder value. So that's the bottom line on my story. I'm not wishing that shale plays go away, I'm not against them, I'm not disputing their importance. I'm just saying that they haven't demonstrated any sustainable value yet.

Commentary: Interview with Art Berman—Part 2

By the Peak Oil Review team

(Note: Commentaries do not necessarily represent the ASPO-USA position.)

Art Berman is a geological consultant whose specialties are subsurface petroleum geology, seismic interpretation, and database design and management. He is currently consulting with a wide range of industry clients such as PetroChina, Total, and Schlumberger. Mr. Berman has an MS in geology from the Colorado School of Mines and is active with the American Assoc. of Petroleum Geologists. He spoke with us about 10 days ago, after a presentation in Canada at the CIBC Technical Conference. (Part 1 appeared last week, in the July 19th issue of the POR.)

POR: How have analysts and investors responded to your studies and your viewpoints?

Berman: My biggest clients, for this kind of talk and work, are investment bankers and investment advisory companies. I gave two talks in Calgary over the last week—one to CIBC and the other to Middlefield Capital. I've given multiple talks to energy investment companies. They're the peoplewho are really paying attention to this. The answer is that a significant portion of the investment banking sector takes what I'm saying quite seriously, but what they do with that I can't tell you.

POR: How has the gas-producing industry responded to your studies and views?

Berman: The U.S. companies have pretty much chosen to ignore me. Or they've made public statements that I'm a kook or I don't understand or I'm hopelessly wrong. Some them—especially the Canadian companies for some reason—want me to advise them even though my message is not a message that they prefer.

It's a fascinating process. My sense of it is that the level of interest, and whatever notoriety I have, has only increased. I credit the ASPO 2009 peak oil conference in Denver with really kicking that off. That presentation was a tipping point in awareness about the truth of shale gas reserves and economics. After my presentation, I had almost five hours of discussions with analysts that had attended the talk. Associated Press reporter Judith Kohler published an article — Analyst: Gas shale may be next bubble to burst that was distributed to hundreds of outlets in the national press and that brought this topic into the mainstream. U.S. E&P executives responded with a series of ad hominem opinion editorials and earnings meeting statements that minimized the fact-based positions that were presented at the ASPO 2009 meeting.

Before that, I spent months making presentations to professional societies of geologists, geophysicists and engineers throughout the Gulf Coast. These are colleagues who do the work of the petroleum industry that gave me what amounted to a peer review. I know that there were silent people in those audiences who disagreed with me, but the overall response was supportive and enthusiastic. I also got hundreds of e-mails responding to my World Oil articles that included testimonials about companies' experience with shale gas wells in the real world.

E&P executives don't have any such base, nor do they know about this experience. In all of my presentations, I acknowledge people that include some of the most respected E&P CEOs, opinion leaders, and experts on oil and gas price formation, reservoir engineering, economic evaluation and risk analysis. In addition, there are also many industry analysts in research companies, financial advisory and fund management firms, and reporters in the energy press that consult and publish opinions about my position on shale gas.

The point is that I am not alone. I have a large community of supporters with impeccable credentials. I am a cautious and somewhat conservative person in my professional work because I advise clients on high-risk and very large bets on wells and investments. My reputation and future income depends on the credibility of my evaluations and the quality of my research. I do not believe that the same can be said for the CEOs of the U.S. public companies that dispute my findings.

I'm a fairly busy guy, and a lot of people want to hear the story; I talk to Bloomberg and Platts and others all the time. If anything, I feel as if I'm sort of slipping into the mainstream, in a weird way. It's a scary thought. I'm now asked to participate in august panel discussions, albeit representing the radical fringe; but a year ago nobody even wanted to talk to me.

I don't know where it's going. It seems inevitable to me that it is sort of a bubble phenomenon; but bubbles can go on for 25 years or so, even though everyone knows that's what's happening. As long a capital markets continue to fund these things it's going to keep on going. I'm not saying that's even a bad thing, though I wouldn't put any money in it, that's for darned sure.

POR: Back in the 1960's the phrase "too cheap to meter" was introduced, by some promoters, as being the future of nuclear energy. Over time, the reality obviously didn't match the hype. It feels to us that there could be a parallel with the recent 100-year-supply statement...

Art Berman: It could be a big denial issue....

POR: Like that early era for atomic power, the shale gas story still seems so new that there are a lot of uncertainties about the shale gas bucking bronco, if you will. How will the industry respond to the uncertainties? How are they responding to the current tough price signals?

Berman: Not at all right now. I had a whole series of talks that I gave last spring called, ―North American Natural Gas: Acknowledging the Uncertainty.‖ That's all I want people to do. Not that they shouldn't drill for it or that I'm right; all I'm saying is acknowledge the uncertainty.

POR: How do you think the Macondo well fiasco will impact US gas and oil production? We're particularly thinking in the mid- to long-term scenarios.

Berman: Just what's happened already has had a pretty negative effect on the US economy. The moratorium has caused some rigs to move to other countries. So it seems to me that the inevitable outcome, at some point, is that we'll have even more dependence on imported crude oil. I just don't see any other way around it. The intangible piece of that really is how it will affect the planning of companies that want to continue exploring in the Gulf of Mexico. Do they immediately de- emphasize all of that because we just don't know what the government is going to do to them? And I think the answer to that, despite what they say, is —yah, sure.

The deepwater Gulf of Mexico is really it. That's the only substantial source of new reserves of crude oil that the United States has. For now, the whole area has a big question mark on it.

POR: How about the impact on offshore oil and gas production elsewhere in the world? There is already talk of modifying standards and rules in some other offshore basins.

Berman: That's another unknown. It can't be good for the energy industry. There are some countries that's couldn't care less; they're just happy to have the rigs come into their waters. But there are certainly countries—like Canada and the UK and Norway—that will certainly put more regulations on it. It will likely have the net effect of slowing offshore operations down and making things cost more. I'm not here to say that that's wrong.

I personally think the current administration is milking this thing for all the political capital they can. Nobody who's handling this for them really knows much about the oil and gas business. You have a theoretical physicist running the Department of Energy and I'm sure he's a very intelligent and high- integrity guy but he didn't really know anything about drilling or petroleum and I don't think Salazar is particularly schooled in it. President Obama doesn't know anything about it. So you have a bunch of amateurs dealing with something that needs a bunch of professionals. Even on the networks and cable news shows, I haven't seen anybody they've brought on who knows anything about it. A lot of interesting people get in front of the cameras and talk: college professors and oceanographers and image analysis specialists and the director of a center for biodiversity—he seems like a real smart guy—but they don't know anything about drilling operations or petroleum. I don't say that hyper- critically; it's just a fact.

POR: Switching over to oil...A number of oil industry CEOs—Christophe de Margerie, James Mulva, etc.—have said world oil production is likely to top out in the

90-95 million barrels/day level, probably during this decade. Where do you see world oil production going in the future?

Berman: That's not an area where I've done a lot of current research. I'm really just answering from the standpoint of what I've read others say. I agree with the comments of the CEOs that you named. It just seems like such a stretch to me that we could ever get to the kinds of levels of production that some groups like CERA [Cambridge Energy Research Associates] say we can. It just makes huge sense to me that the big oil exporting countries will continue using more and more of their own petroleum for their own internal uses. How does anybody think that they are going to actually increase the amount of exported oil to get to 95 million or 100 million barrels a day or whatever the forecast number is? From what I read, it looks like the odds are stacked against getting production much higher than it is right now. And we're in kind of a good place now because demand is way down. US demand has been down nearly 2 million barrels a day below what it was in 2008; that's huge. How long will that last? We don't know, but assuming we're in a recovery— and it kind of looks that way from a natural gas consumption perspective—if and when oil demand ramps up I think we're going to know the answer very quickly. And the answer's going to be, we'll struggle to maintain...that's my belief.

http://kunstler.com/blog/2010/11/sixty-lame-minutes.html

Sixty Lame Minutes by James Howard Kunstler

on November 15, 2010 9:13 AM

So, last night CBS hauled Aubrey McClendon, CEO of Chesapeake Energy, on board their flagship Sunday infotainment vehicle, 60 Minutes, to blow a mighty wind up America's ass (as they say in professional PR circles). America is lately addicted to lying to itself, and 60 Minutes has become the "go-to" patsy for funneling disinformation into an already hopelessly confused, wishful, delusional, US public.

McClendon told the credulous Leslie Stahl and the huge viewing audience that America "has two Saudi Arabia's of gas." Now, you know immediately that at least half the viewers misconstrued this statement to mean that we have two Saudi Arabia's of gasoline. Translation: don't worry none about driving anywhere you like, or having to get some tiny little pansy-ass hybrid whatchamacallit car to do it in, and especially don't pay no attention to them "green" sumbitches on the sidelines trying to sell you some kind of peak oil story.... It also prepared the public to support whatever Mr. McClendon's company wants to do, because he says his company will free America from its slavery to OPEC. By the way, CBS never clarified these parts of the story by the end of the show.

First of all, they are talking about methane gas, not liquid gasoline or oil. There are large deposits of methane gas locked into shale deposits roughly following the Appalachian mountain chain from New York State through Pennsylvania, West Virginia, into Ohio, but also hot spots out west. It's hard to get at. You have to basically blow up the shale rock deep underground with high pressure water that is loaded up with chemicals and sand particles to keep the rock fragments separated once they are blown apart. Chesapeake Energy specializes in this rock fracturing (or "fracking") method for drilling. You can get gas out of the ground this way. The question is how much, over what time period, at what cost.

At the present time, with America anxious about any kind of future energy, shale gas sounds like a dream-come-true. Mostly what the public saw on 60 Minutes last night was a sell-job for Chesapeake Energy to boost its stock price. Here are some facts:

Over a 50 year period ahead, all the shale gas drilling of the Marcellus fields in New York State will produce the equivalent of three years US consumption at 2008 levels.

A price of $8 per unit is required to make shale gas fracking economically viable in theory even for a short time. Gas is currently around $4. Expect to pay at least twice as much for gas.

Even at higher costs, shale gas fracking is arguably uneconomical. It requires huge numbers of rigs, generally 8 wells per "pad," meaning very high capital investments. The wells produce nicely for a year, average, and then deplete very steeply - meaning you get a lot of money up front and very soon all that capital investment is a wash. Translation: Chesapeake can make a lot quick money over the next few years of intense drilling and they don't care what happens after that.

Chesapeake itself estimates that 5.5 million gallons of fresh water are needed per well, often delivered in trucks, which require fuel.

It takes three years, average to prepare a drilling "pad" and the up to 12 wells on it, working 24/7 in rural areas with significant noise and electric lighting

The fracking fluid is a secret proprietary cocktail formula amounting to 5 percent of the liquid injected into the earth. It's composed of: sand; a jelling agent to suspend the sand because water is not "thick" enough; biocides to kill bacteria that thrive in jelling agent; "breakers" to thin out jell-thickened water after fracking to get the fluid out of the way of released gas and improve "flowback;" fluid-loss additives to decrease "leak-off" of fracking fluid into rock; anti-corrosives to protect metal in wells; and friction reducers to promote high pressures and high flow rates. Of the 5.5 million gallons of fluid injected into each well, 27,500 gallons is the chemical cocktail.

Mr. McClendon said on 60 Minutes that it couldn't possibly harm the public's water supply because they were drilling so far below the 1000-foot-deep maximum of most water wells. He left out the fact that they have to drill through those drinking water layers to get down to the shale gas, and pump the fracking fluid through it, and then get the gas up through it. He also left out the fact that the concrete casings of drill holes sometimes crack and leak at any depth.

The fracking fluid cannot be re-used. You have to mix new cocktail fluid for each injection.

"Flowback" fluid inevitably comes back up with the gas, sometimes spilling over the ground. In any case, the stuff that does come back up is stored on the surface in lagoons. Often it contains heavy metals, salts, and radioactive material from drilling through strata of radon-bearing granite and other layers. Liners of flowback fluid lagoons have been known to fail.

Gas well failures in Pennsylvania, where production was ramped up quickest in recent years, have ended up polluting well water to the degree that residents can no longer use their wells.

Little is known about the migration of fracking fluids underground.

It seems to me that the chief mass delusion associated with this touted "bonanza" is that Americans would supposedly be able to shift to driving cars that run on natural gas. I believe they will be hugely disappointed. Between the cost of fracking production (and its poor economics), gearing up the manufacture of a new type universal car engine, and installing the infrastructure for methane gas fill-ups - not to mention the supply operation by either new pipelines or trucks carrying liquefied methane gas, we will discover that a.) America lacks the capital, and b.) that households will be too broke to change out the entire US car fleet.

What this disgusting episode really shows is how eager the USA is to mount a campaign to sustain the unsustainable at all costs, including massive collective self-deception. The lying starts at the very top, not just in Aubrey McClendon's office at Chespeake, but in every executive suite throughout the land - including the Oval Office - where any lie is automatically swallowed and then upchucked for public consumption in the interest of keeping a nation based on addictive rackets stumbling on without having to change our behavior.

note from Mark: CBS is the most honest television network, if you want to “see BS” http://kunstler.com/blog/2012/11/epic-disappointment.html

Epic Disappointment by James Howard Kunstler

November 19, 2012

Those inhabiting the economic wish-space got a case of the vapors last week when the Paris-based International Energy Agency (IEA) published an annual report stating that the USA would overtake Saudi Arabia as the world's leading oil producer and reach the long-touted nirvana of "energy independence." The news was greeted in this country with jubilation. Thus, peak credulity meets peak bullshit.

It's been clear for a while that authorities in many realms of endeavor - politics, economics, business, media - are very eager to sustain the illusion that we can keep our way of life chugging along. But under the management of these elites, the divorce between truth and reality is nearly complete. The financial system now runs entirely on accounting fraud. Government runs on the fumes of statistical fraud. The business of oil and gas runs on public relations fraud. And the media runs on the understandable wish of the masses to believe that all the foregoing illusions still work to maintain the familiar comforts of modern life (minus Hostess Ho-Hos and Twinkies, alas).

And so the story has developed that the shale oil plays of North Dakota and Texas, which started ramping up around 2005 - the same year the world hit the wall of peak conventional oil - and the shale gas plays in Texas, Louisiana, Pennsylvania, New York, and Ohio would enable American "consumers" to drive to WalMart effectively forever.

Now, it happens that the particulars of oil and gas production are so abstruse that the editors of The New York Times, The Bloomberg News Service, CNN, and a score of other mass media giants swallowed the IEA report whole, with fanfares and fireworks, and a nation afflicted with doubt about its future swooned into the first week of the holidays in celebration mode - we're soon to be number 1 again, and the future is secure! Have a nice Thanksgiving and Christmas and prepare to sober up in 2013. When the truth finally emerges from this morass of dissimulation, the disappointment will be epic.

Here's why the shale oil story is not the "game changer" that the wishful claim it is: the price required to get it out of the ground (between $80-90 a barrel) will crush the US economy. Since prices are already in that range, the economy is already being crushed. The result is an economy in more-or-less permanent contraction. As demand for oil falls with declining economic activity the price of oil falls - below the level that makes it worthwhile to conduct expensive shale oil drilling and fracking operations.

Meanwhile, in the background, as economies contract and economic "growth" of the type our system requires no longer happens, the problems in finance and banking get a lot worse. This is largely because interest on borrowed money can no longer be paid back. Loans are defaulted on. As this happens, banks become insolvent. Governments play games with public money - including "money" they "create" out of thin air - to prop up the banks. None of it alters the sad fact that there is not enough real money in the system. The result of all these desperate monkeyshines is the impairment of capital formation. That is, the failure to accumulate new wealth. The lack of new wealth, along with declining prospects for the repayment of loans, leads to a shortage of credit, especially to businesses that require large supplies of it to keep gigantic complex operations like shale oil and gas going

Shale oil (and shale gas) share some problematical properties. The cost of drilling each well is a big number, $6-8 million. The wells deplete very rapidly, over 40 percent after one year in the Bakken formation of North Dakota. The oil is not distributed equally over the whole play but exists in "sweet spots." The sweetest sweet spots were drilled the earliest and the quality of the remaining potential drill sites is already in decline. The current trend shows declining first-year productivity in new wells drilled since 2010 running at 25 percent.

There are over 4300 shale oil wells in the Bakken formation of North Dakota producing about 610,000 barrels a day. In order to keep production up, the number of wells will have to continue increasing at a faster rate than previously. This is referred to as "the Red Queen syndrome" which alludes to the character in Alice in Wonderland who famously declared that she had to run faster and faster just to stay where she is. The catch to all this is that the impairments of capital formation are working insidiously in the background to guarantee that the money will not be there to set up the necessary wells to keep production at current levels. In other words, shale oil (and shale gas) are Ponzi schemes. The story in the Eagle Ford play in Texas is very similar.

I haven't even mentioned the concerns about fracking and its effect on ground water, and won't go into it here, except to acknowledge that it presents an additional range of concerns.

The current price situation in shale gas is different than shale oil. The drilling frenzy in shale gas produced a glut, which drove down prices from a $13 a unit (thousand cubic feet or mcf) to around $2 at its low point earlier this year. That's way below the price that is economically rational to drill and frack for it. The price collapse has played havoc among the companies engaged in shale gas, though it has been a boon to customers. A lot of the drilling equipment has moved to the North Dakota oil fields. There will be less shale gas in the period ahead and the price will go up. It has got to go above about $8 a unit or there will be no reason for any company to be in the shale gas business. But as is always the case in such a correction, the price will surely overshoot $8, at which point it will become unaffordable to its customers. The volatility alone will make the business of shale gas drilling impossible to maintain. Forget about the USA becoming a major gas exporter.

You probably get the point by now, so I will only add a couple of out-of-the-box considerations vis-à-vis the prospect of the USA becoming energy independent.

-- Production is getting so low in the Prudhoe Bay fields of Alaska that the famous pipeline may not be able to operate. If the flow of oil reaches a certain low volume, it takes longer to make the long journey. The oil cools down and gets sludgy and some of the water that travels with it will freeze. This could destroy the pipeline. The capital is not there to retrofit the pipeline for a depleting oil field in a region that is difficult and expensive to work in.

-- Exporting countries (the ones that send us oil) are depleting their reserves and using more of their own oil, resulting in annually declining export rates. China, India, and other still-modernizing nations compete for a growing share of that declining export flow.

-- I have barely hinted at the geopolitical forces roiling behind the sheer business dynamics. But here's an interesting one: the time will come when the US will invoke the Monroe Doctrine to prevent Canada from sending its oil and tar-sand byproducts to nations other than ourselves. Just wait.

Finally, I have one flat-out prediction, one I have made before but deserves repeating: Japan will be the first society to consciously opt out of being an advanced industrial economy. They have no other apparent choice really, having next-to-zero oil, gas, or coal reserves of their own, and having lost faith in nuclear power. They will be the first country to enter a world made by hand. They were very good at it before about 1850 and had a pre-industrial culture of high artistry and grace - though, granted, all the defects of human psychology.

I don't think the US can make that transition in an orderly way. We're too stricken with techno-narcissism and grandiosity. What troubles me is how we will greet the epic disappointment that waits for us when we discover that the journey to WalMart is over. My guess is that being predisposed to superstition and religious fanaticism, the American public will violently reject science and rationality and retreat into a world of shadows. We're already well on our way. The IEA report will just accelerate things.

from ASPO USA's Peak Oil Review, January 3, 2010
Association for the Study of Peak Oil and Gas - USA
www.aspo-usa.org

Shale Gas: Panacea or Chimera?

The hype surrounding shale gas continued to build during 2010 with many saying that the gas will prove to be so plentiful that it will be the solution to our energy problems for many decades ahead. It has become conventional wisdom in many circles that the US has 100 years' worth of shale gas ready for exploitation. The hysteria reached its zenith in March at the Cambridge Energy Research Associates annual conference where speaker after speaker spoke ecstatically about the prospects for the natural-gas industry. In Pennsylvania over 1000 shale gas wells have now been drilled. Even India, China, the French and Shell have started investing in the US shale gas bonanza as have the major US oil companies.

During the past year the prices for natural gas fell from $6 per million cubic feet to less than $4 as the quantity of gas in storage continued to build. Outside analysts continue to say that at these prices the industry is losing money and that it will require at least $6 or $7 gas to pay for the drilling and hydraulic fracturing of the expensive horizontal wells.

Concerns over contamination of groundwater by the fracking process continue to grow. Over strident industry objections, the state of New York has put a temporary hold on new shale-gas drilling permits until the EPA can investigate the dangers to groundwater supplies more carefully.

As was the case last year, skeptics point out that while shale-gas wells can initially be very productive they quickly fall to below economic levels. The 100 years' worth figure comes from the most optimistic possible reading of the Potential Gas Committee report; in reality the amount of gas available at modest prices may ultimately be only a fraction of the touted amount. When one factors in the talk about moving a substantial portion of US electricity generation to natural gas or perhaps replacing the diesels in long-haul trucking with natural gas engines, exponential growth kicks in so that natural gas reserves would be drawn-down much more quickly than imagined.

While large quantities of shale gas are likely to be produced over the next few decades, behind-the- scenes evidence that the resource is not a long-term solution to our energy problems and certainly not to our liquid-fuels problem continues to mount.

getting a little closer to the truth ... but still says gas exports will increase into the 2020s

www.bloomberg.com/news/2012-01-23/u-s-reduces-marcellus-shale-gas-reserve-estimate-by-66-on-revised-data.html

Bloomberg: U.S. Cuts Estimate for Marcellus Shale Gas Reserves by 66%

by Christine Buurma - Jan 23, 2012 9:04 AM PT

The U.S. Energy Department cut its estimate for natural gas reserves in the Marcellus shale formation by 66 percent, citing improved data on drilling and production.

About 141 trillion cubic feet of gas can be recovered from the Marcellus shale using current technology, down from the previous estimate of 410 trillion, the department said today in its Annual Energy Outlook. About 482 trillion cubic feet can be produced from shale basins across the U.S., down 42 percent from 827 trillion in last year's outlook.

"Drilling in the Marcellus accelerated rapidly in 2010 and 2011, so that there is far more information available today than a year ago," the department said. The estimates represent unproved technically recoverable gas. The daily rate of Marcellus production doubled during 2011.

The estimated Marcellus reserves would meet U.S. gas demand for about six years, using 2010 consumption data, according to the Energy Department, down from 17 years in the previous outlook.

The Marcellus Shale is a rock formation stretching across the U.S. Northeast, including Pennsylvania and New York. Shale producers use a technique known as hydraulic fracturing, which involves pumping water, sand and chemicals underground to extract gas embedded in the rock.

Geological Data

The U.S. Geological Survey said in August that it would reduce its estimate of undiscovered Marcellus Shale natural gas by as much as 80 percent after an updated assessment by government geologists.

Shale gas will probably account for 49 percent of total U.S. dry gas production in 2035, up from 23 percent in 2010, the Energy Department said today.

Gas's share of electric power generation will increase to 27 percent in 2035 from 24 percent in 2010, the report showed.

The department also said the U.S. may become a net exporter of liquefied natural gas in 2016 and a net exporter of natural gas in 2021. U.S. LNG exports may start with a capacity of 1.1 billion cubic feet a day in 2016 and increase by an additional 1.1 billion cubic feet per day in 2019, the department said.

http://energyskeptic.com/2014/methane-hydrate-not-gonna-happen/

Why we aren't mining methane hydrates now. Or ever. Peak Energy & Resources, Climate Change, and the Preservation of Knowledge by Alice Friedemann

Methane hydrates are methane gas and water that exist where pressures are high or temperatures low enough.

The United States Geological Survey estimates the total energy content of natural gas in methane hydrates is greater than all of the known oil, coal, and gas deposits in the world.

But that's a wild ass guess since we can't measure this resource, for reasons such as coring equipment that can't handle the expansion of the gas hydrate as it's brought to the surface. And if you do work around this problem, there's tremendous variability within the same area (Riedel). Since less than 1% of is potentially extractable, there's no point in throwing around large numbers and getting the energy illiterate excited.

According to petroleum engineer Jean Laherrère, no way do methane hydrates dwarf fossil fuels. "Most hydrates are located in the first 600 meters of recent oceanic sediments at an average water depth of 500 meters or more, which represents just a few million years. Fossil fuel sediments were formed over a billion years and are much thicker — typically over 6,000 meters (Laherrère).

So here it is 2014, with no commercially produced gas hydrate, despite 30 years of research at hundreds of universities, government agencies, and energy companies in the United States, Japan, Brazil, Canada, Germany, India, Norway, South Korea, China, and Russia.

Japan alone has spent about $700 million on methane-hydrate R&D over the past decade (Mann) and gotten $16,000 worth of natural gas out of it (Nelder). I think this reflects the likely EROI of methane hydrates — .0000228 (16000/700,000,000, and yes, I know money and EROI aren't the same). But EROI doesn't capture the insanity as understandably as money does. Basically, **for every $43,750 you spend, you get $1 back** ($700,000,000 / $16,000).

Of course, it's all ***theoretical***. Maybe you get $500 or $5,000 back. Who knows? There is no commercial production now or in the foreseeable future. And we've tried all kinds of thermal techniques to unleash it — hot brine injection, steam injection, cyclic steam, fire flooding, and electromagnetic heating — all of them too inefficient and expensive to scale up to a commercial project (DOE 2009).

1) Gas hydrates are cotton candy crystals mainly found in dispersed, deeply buried impermeable marine shale.

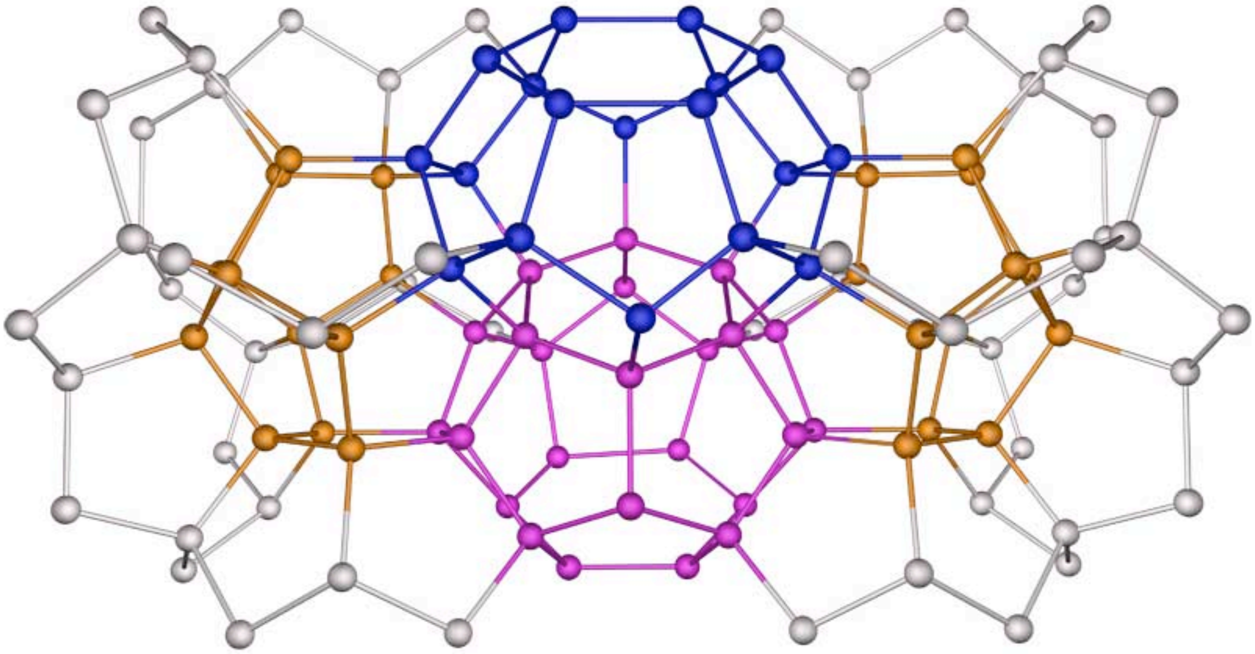
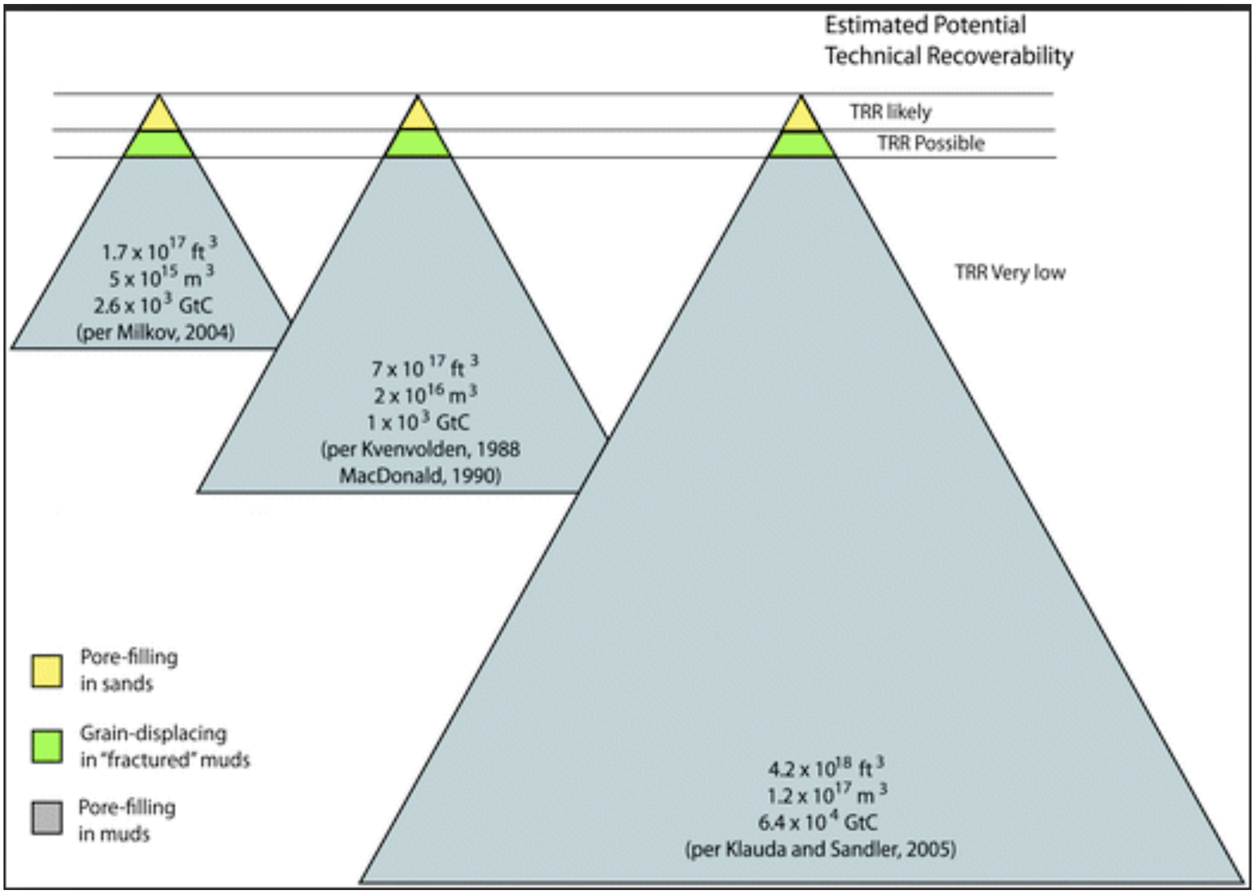


Figure 1. methane hydrate crystals form from dodecahedral clusters of water which create a cage around a single methane molecule. Source: Ken Jordan. 2005. Water Water Everywhere. Projects in Scientific computing.

In Figure 2 below, methane hydrates (yellow) in porous sands are the only resource with any chance of being exploited — a very small fraction of the overall methane hydrate resource. Most methane hydrates are locked up in marine shales (gray) where they'll probably remain forever because:

- The average concentrations are extremely low, about .9 to 1.5% by volume, even in the less than 1% of highly porous sediments where there's any chance of extracting them
- Marine shales are impermeable, very deep, widely dispersed, with very low concentrations of methane hydrate (Moridis et al., 2008).
- Clathrates are far from oil and gas infrastructure, which you must use to get the methane hydrates stored and delivered
- The infrastructure, technology, and equipment to extract gas hydrates hasn't been invented yet
- The energy required to get the methane hydrate out has negative Energy Returned on Energy Invested (EROEI). It takes too much energy to heat them in order to release them plus break the bonds between the hydrates' water molecules.
- Inhibitor injection requires significant quantities of fairly expensive chemicals



Source: Boswell, Ray, et al. 14 Sep 2010. Current perspectives on gas hydrate resources. Energy Environ. Sci., 2011,4, 1206-1215

2) Methane Hydrates are Explosive Cotton Candy

Because as temperature rises or pressure goes down when you bring these ice cubes to the surface, the gas hydrates expand to 164 times their original size. Though most are the size of sugar grains mixed in with other sediments.

Methane hydrates bubbling up to the surface

3) How do you store and get these giant gas bubbles to market?

If you could keep the gas hydrates small, crystalline, and pacified, there would still be that niggling worry you might offend them into their 164-fold fury. So it's best to let that happen — but now where are you going to store all this gas and how will you deliver it?

You'd have to use oil and gas infrastructure in the Arctic and other questionable places where ownership isn't settled and potentially create geopolitical tensions.

And imagine how Exxon will feel about that! Their oil rigs are already dodging icebergs. Oil companies avoid drilling through methane hydrates because they can fracture and disrupt bottom sediments, wrecking the wellbore, pipelines, rig supports, and potentially take out a billion dollar offshore platform as well as other oil and gas production equipment and undersea communication cables.

4) The Mining of Gas Hydrates can cause Landslides…

Eastman states that normally, the pressure of hundreds of meters of water above keeps the frozen methane stable. But heat flowing from oil drilling and pipelines has the potential to slowly destabilize it, with possibly disastrous results: melting hydrate might trigger underwater landslides as it decomposes and the substrate becomes lubricated…

5) Which can Trigger Tsunamis

Landslides can create tsunamis that migh result in fatalities, long term health effects, and destruction of property and infrastructure.

6) Methane Hydrates are a greenhouse gas 23 times more potent than carbon dioxide

Climate scientists like James E. Hansen worry that methane hydrates in permafrost may be released due to global warming, unleashing powerful feedback loops that could cause uncontrollable runaway climate change.

Scientists believe that sudden, massive releases of methane hydrates may have led to mass extinction events in the past.

Considering that the amount of methane onshore and offshore could be 3,000 times as much as in the atmosphere, it ought to be studied a bit more before proceeding, don't you think? (Whiteman 2013, Kvenvolden 1999).

7) Ecological Destruction

They're dispersed across vast areas at considerable depths, which makes them very ecologically destructive to mine, since you have to sift through millions of cubic yards of silt to get a few chunks of hydrate.

8) Toxic Waste

The current state of technology uses existing oil drilling techniques, which generate wastes including produced formation water (PFW), drilling fluid chemicals, oil and water-based drilling muds and cuttings, crude oil from extraction processes and fuel/diesel from ships and equipment (Holdway 2002).

9) EROI

There are only two studies on EROI, both by Callarotti, and he looks ***only*** at the heat energy used to free the clathrates up, and it's published in a journal called Sustainability that would better be named Gullibility when it comes to the topic of energy which is not their specialty. He comes up with an EROI of 4/3 to 5/3 using just that ***one*** parameter. Callarotti knows this is a dishonest figure because he says "If one were to consider the energy required for the construction of the heaters, the pipes, and the pipe and the installation process, the total EROI would be even less."

Is he kidding? What about the energy used to mine and crush the ore to get the metals to build the pipelines, drilling, dredging and sifting through the sediment equipment, methane hydrate processing plant, the vessel and the diesel burned to get to the remote (arctic) location, and so on.

Conclusion

You don't have to be a scientist to see how difficult the problem is:

- Somehow you've got to capture the energy in thousands of square miles of exploding grains of sugar that erupt into a gas 164 times their size.
- There are huge deposits of natural gas that are easier to get at and far more valuable that aren't being exploited because they're stranded (not near pipeline infrastructure), so who's going to invest in a resource of much lower quality at the bottom of the pyramid with such dismal prospects?
- We can't even drill for oil in most of the Arctic (Patzek) which is where a lot of the methane hydrates are, and that infrastructure has to be there to even think of trying to get at the methane hydrates.
- Most of the hydrates are in a thin film on the deep ocean floor. Are you going to build a thousand square mile blanket to trap the bubbles like a school of fish? Or use expensive fracking & coalbed methane techniques?
- Permafrost gas hydrate is so shallow there's not enough pressure to get it to flow fast enough to be worth mining

Despite all the happy talk that says we can meet these challenges by 2025 if only there were more funding, we're out of time.

It's highly unlikely that Methane Hydrates will ever fuel the diesel engines that do the actual work of civilization, all of them screaming "Feed Me!" as oil declines in the future.

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a link to the BBC documentary referenced above:
http://www.youtube.com/watch?v=wn62AjIpWMw

BBC: "The Day the Earth Nearly Died" about Permian mass extinction 252 million years ago caused by methane

These EIS comments have stressed Peak Energy more than Climate, mostly because energy limits impact the potential for an "export" terminal far more than concerns about pollution. However, I think the popular focus on climate is actually understated, the crisis is not only worse than official predictions from the Intergovernmental Panel on Climate Change, it is worse than the environmental groups suggest.

The Permian mass extinction is a way to consider the risk that is posed to all life. This extinction is thought to be the worst of the five big mass extinction in Earth's history, worse than the impact that wiped out the dinosaurs 65 million years ago.   It is thought that volcanism warmed the world and then this warming caused the melting of frozen methane in the oceans to further heat the planet.

Some who warn about climate suggest that we've used most of our "carbon budget" for keeping the Earth's temperature increase below 2 degrees C, and only could use a little more before reaching these limits, and therefore most of what remains has to be left in the ground. However, if current theories about the Permian extinction are correct, then we would have to leave ALL of the remaining fossil fuels in the ground, since the warming we have already set in motion could accelerate thawing of permafrost and frozen methane in the sea floor.

www.crudeoilpeak.info/peak-affordable-oil

Peak Affordable Oil

BY MATT – FEBRUARY 2, 2015

POSTED IN: CRUDE OIL ANALYSIS, GLOBAL

It is quite obvious that high oil prices in the last 3-4 years

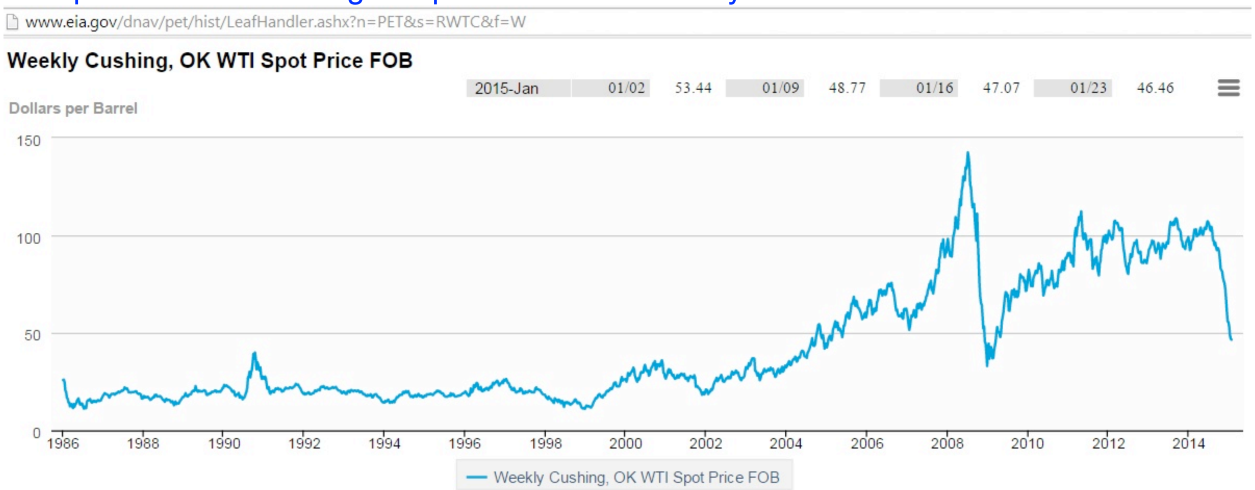


Fig 1: WTI spot prices to 23/1/2015

http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=rwtc&f=w

have reduced demand for oil, as shown in this IEA graph for OECD countries:

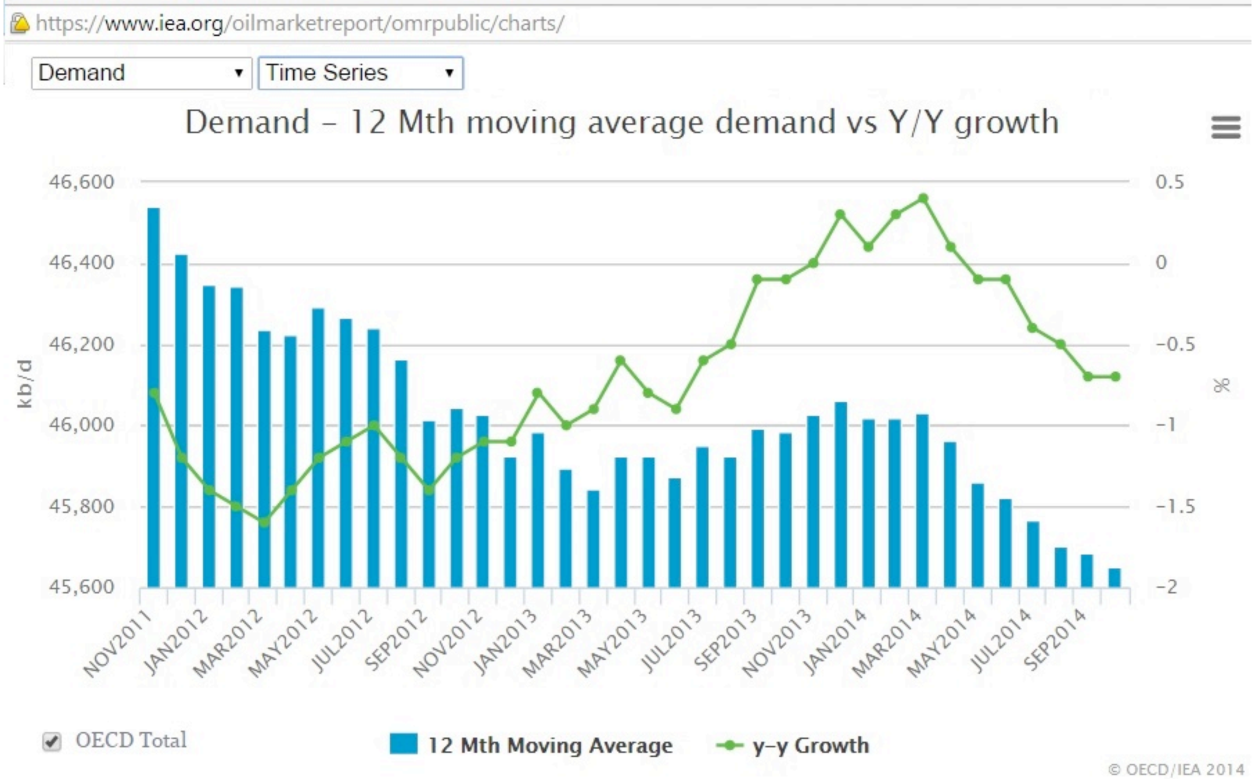


Fig 2: Oil demand in OECD countries Oct 2011 – Sep 2014
https://www.iea.org/oilmarketreport/omrpublic/charts/

So which oil is affordable? Let's use a graph of the Monetary Policy Report (January 2015) of the Bank of Canada (which would be favourable to Canadian tar sands)

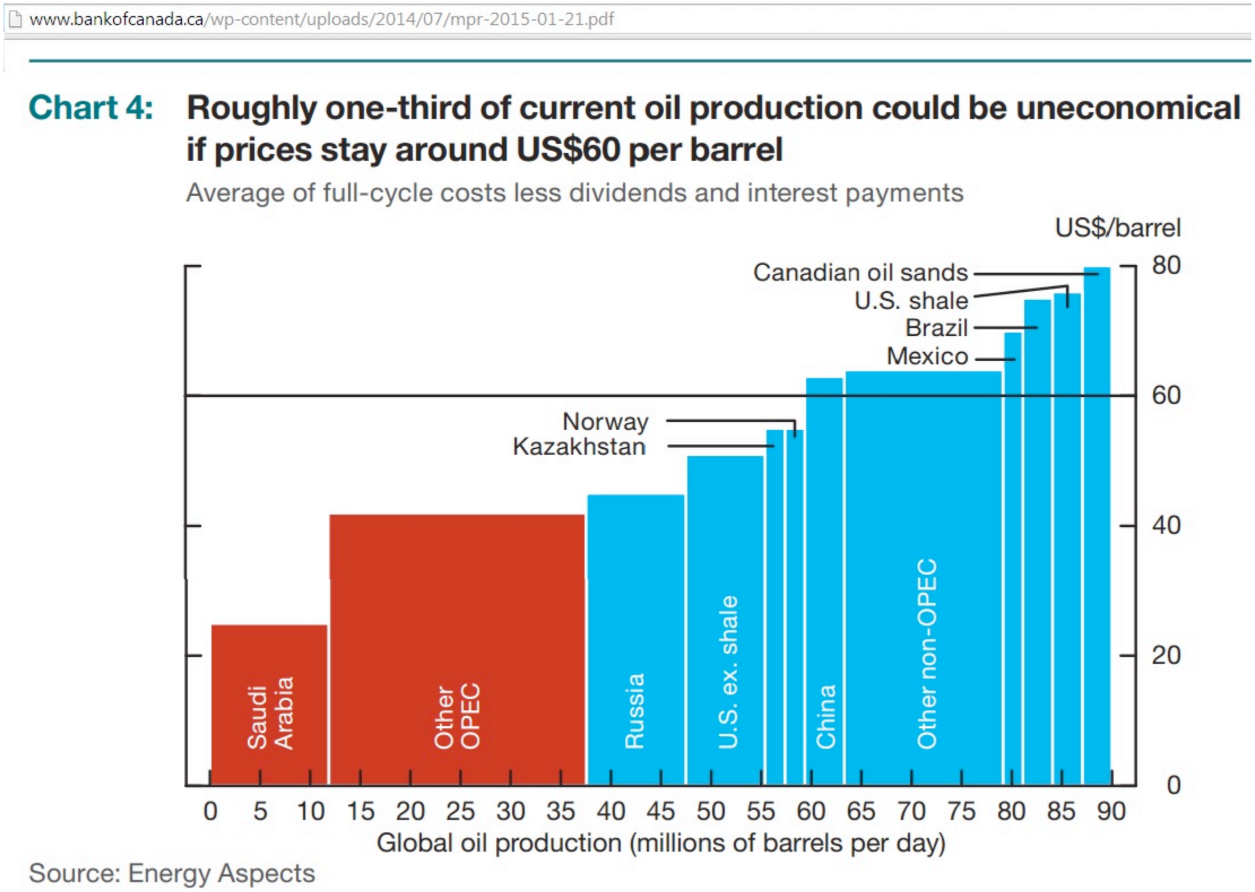


Fig 3: Oil production by area and full-cycle costs

The Bank of Canada report reads: "Based on recent estimates of production costs, roughly one-third of current production could be uneconomical if prices stay around US $60, notably high-cost production in the United States, Canada, Brazil and Mexico (Chart 4). More than two-thirds of the expected increase in the world oil supply would similarly be uneconomical. A decline in private and public investment in high-cost projects could significantly reduce future growth in the oil supply, and the members of the Organization of the Petroleum Exporting Countries (OPEC) would have limited spare capacity to replace a significant decrease in the non-OPEC supply."
http://www.bankofcanada.ca/wp-content/uploads/2014/07/mpr-2015-01-21.pdf
Let's put these costs into oil production graphs:

(1) Total Oil Supply

Fig 3 refers to 90 mb/d (x-axis) which was the world's total oil supply for 2013, according to EIA's stats available here: http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=53&aid=1

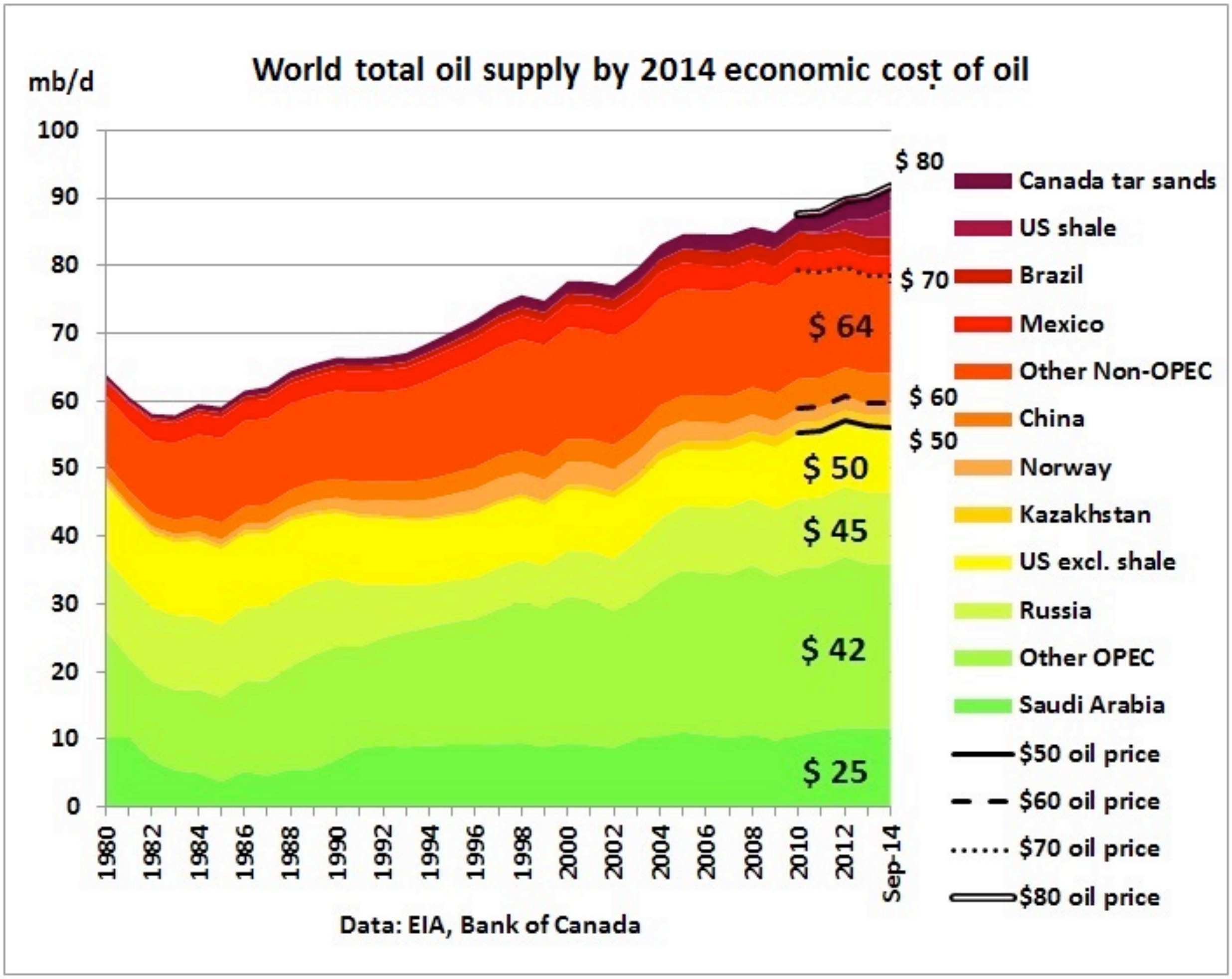


Fig 4: Oil supply by country/area and economic cost of oil

In Fig 4, oil supplies are stacked by 2014 economic cost of oil, starting with Saudi Arabia ($25/barrel, green) and going up to Canadian tar sands ($80/barrel, dark red). The colors have been extended over the whole period to 1980 so that the production history can be seen. Lines in various styles show 4 different cost levels, whereby their lengths are indicative only to show corresponding production levels for the last years.

It seems that oil supplies up to around $75 have peaked (all countries up to Brazil). In other words, if the world is willing (or able) to pay only $75 a barrel, corresponding oil production declined since 2012 – at around 1.6% over 2 years. $50 oil was up and down, but at only 56 mb/d or 60% of current demand. What is important here is that affordable oil does not appear to increase in volume. That has serious implications for economic and transport planning

In Fig 4, oil supply includes: crude oil, natural gas plant liquids, refinery processing gains and other liquids (including bio fuels). The EIA definitions are here: http://www.eia.gov/cfapps/ipdbproject/docs/IPMNotes.html#p1

Let’s check how that graph would look like if we used just crude oil and condensate.

(2) Crude oil and condensate

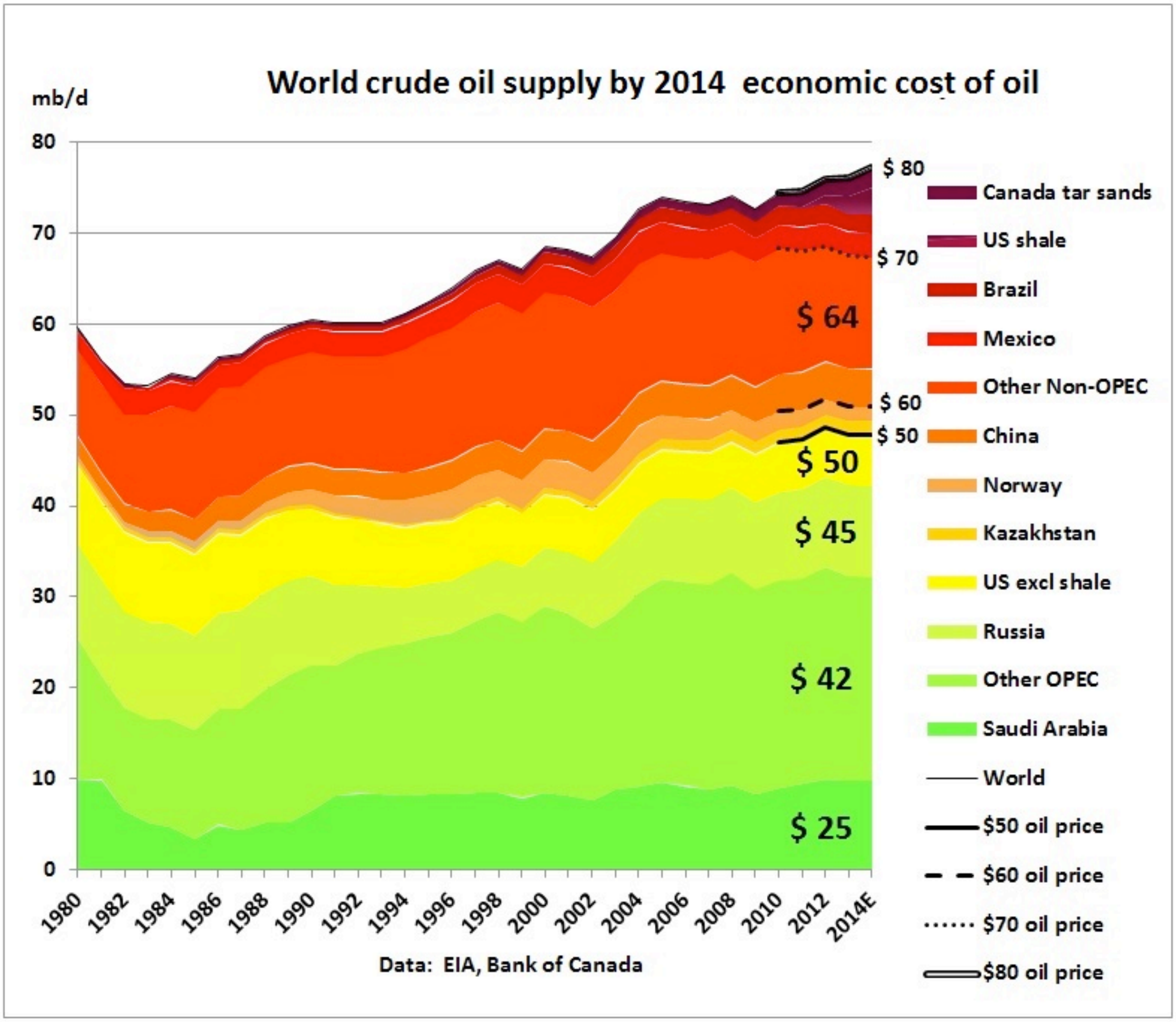


Fig 5: Same as Fig 4, but for crude oil only

All crude oil up to $75 is basically flat since 2005. Expensive unconventional oil has covered up this indisputable trend.

(3) Canadian tar sand costs

So how did the Bank of Canada arrive at $90 for tar sands? The following table is from a July 2014 report of the Canadian Energy Research Institute (http://ceri.ca/) CANADIAN OIL SANDS SUPPLY COSTS AND DEVELOPMENT PROJECTS (2014-2048) ceri.ca/images/stories/2014-07-17_CERI_Study_141_Oil_Sands_Supply_Cost_Update_2014-2048.pdf

Table 3.4: Supply Costs Summary

Project	SC at Field Gate (C$2013/bbl)	WTI Equivalent SC (US$2013/bbl)
SAGD	**50.89**	**84.99**
Stand-Alone Mine	**71.81**	**105.54**
Integrated Mining and Upgrading	**107.57**	**109.50**
Standalone Upgrader	**40.82**	**44.13**

Source: CERI

Fig 6: Cost of Canadian tar sands

SAGD stands for steam assisted gravity drainage for in-situ tar sand projects as described here: http://www.connacheroil.com/index.php?page=great_divide_oil_sands

So the Bank of Canada has taken $90 as a WTI equivalent average. The above prices assume a light/heavy differential of $18 a barrel between West Texas Intermediate and West Canadian Select, even after the reversal of the Seaway pipeline and the construction of the southern leg of the Keystone XL in 2013 to connect Cushing to the Gulf of Mexico. This increased WTI, thereby narrowing the differential to Brent, but not to historical levels of $2-5/barrel "potentially indicating two things: either the two markets are no longer correlated and prices are representative of regional markets only or the market to market connectivity is not sufficient to increase WTI prices to Brent levels (sans transportation costs) or a combination of both….. Over time as more blended bitumen and SCO (syncrude oil) continue to penetrate the existing markets as well as new markets, such as the US Gulf Coast and markets outside of North America, the light heavy differential might narrow in the future."
http://ceri.ca/images/stories/2014-07-17_CERI_Study_141_Oil_Sands_Supply_Cost_Update_2014-2048.pdf

Conclusion:

Using the assessment of the Bank of Canada, production of affordable oil at price levels up to $75 has peaked or is at peak since the turning point of 2005. This means that the global economy cannot grow "normally" again.

Why The Promise Of American LNG Exports Is Gassy Hype by Wolf Richter • May 29, 2014

Natural gas production has been on a tear in the US. The fracking boom caused coal use to go into remission, broadsided the solar-panel industry, and motivated energy-intensive industries or those that use natural gas as feedstock to build new plants in the US. It has changed the energy equation. It created tens of thousands of good jobs. It created a whole industry of lobbyists and activists, battling each other and greasing politicians along the way.

And it caused earthquakes, not just in Oklahoma, but also in the minds of speculators, hype artists, and Wall Street hope mongers, funded by a tsunami of nearly free money that was drilled into the ground for years while the price of natural gas remained stubbornly below the cost of production.

That money is gone for good. And the price? After some tumultuous gyrations earlier this year, it's up 140% from the April 2012 low. But it's *still* below the cost of production, and the industry has shown no eagerness whatsoever to drill for dry natural gas. Wells that also produce enough oil and natural gas liquids, which fetch a much higher price, are better deals.

So production last year rose a scant 1% to a new record of 24.3 trillion cubic feet, not nearly enough to meet demand. In 2013, gas in underground storage was drawn down by 700 billion cubic feet and ended the year 20% below where it had started the year. After some additional nasty winter weather, natural gas in storage is now at 1,266 Bcf. That's 786 Bcf, or 38%, below where it had been at this time last year, and last year's storage levels were already running below average, which caused the price gyrations this winter.

And current levels are 1,478 Bcf, or 54%, below those of the same period in 2012. In other words, demand has exceeded supply for two years in a row by over 700 Bcf each. But now there isn't enough gas in storage to keep the system operational if a similar drawdown occurs again.

Questions are percolating if the US is going to have enough natural gas in storage by end of October to last through the winter. People are crunching all sorts of numbers to get a handle on it. But the Energy Department's EIA remains sanguine. Its predictions concerning natural gas are almost always far off target, and its predictions of a super-low price over the last two years have become – with hindsight – a silly joke.

Much depends on the weather. A cool summer and a warm winter will get us through it. But if a long heat spell hits densely populated areas and AC units are maxed out for weeks at a time, and if major cold waves roll over the land in the winter, the US would have to import Liquefied Natural Gas from the international markets, in competition with Korea and Japan which pay nearly four times the current price at the Henry Hub. It's going to be mayhem.

While all these questions are being kicked around and visions of shortages hover over every calculation, billions of dollars are thrown at LNG export terminals and deals are made to ship US LNG to other parts of the world. The idea is to take this dirt-cheap natural gas that would be produced in the US in maniacal bouts of over-drilling and arbitrage the price differential. And when Russia annexed the Crimea, voices clamored for the US to start selling LNG to Europe to lessen Europe's dependence on Gazprom and save it from Russia.

But where the heck is all this natural gas supposed to come from?

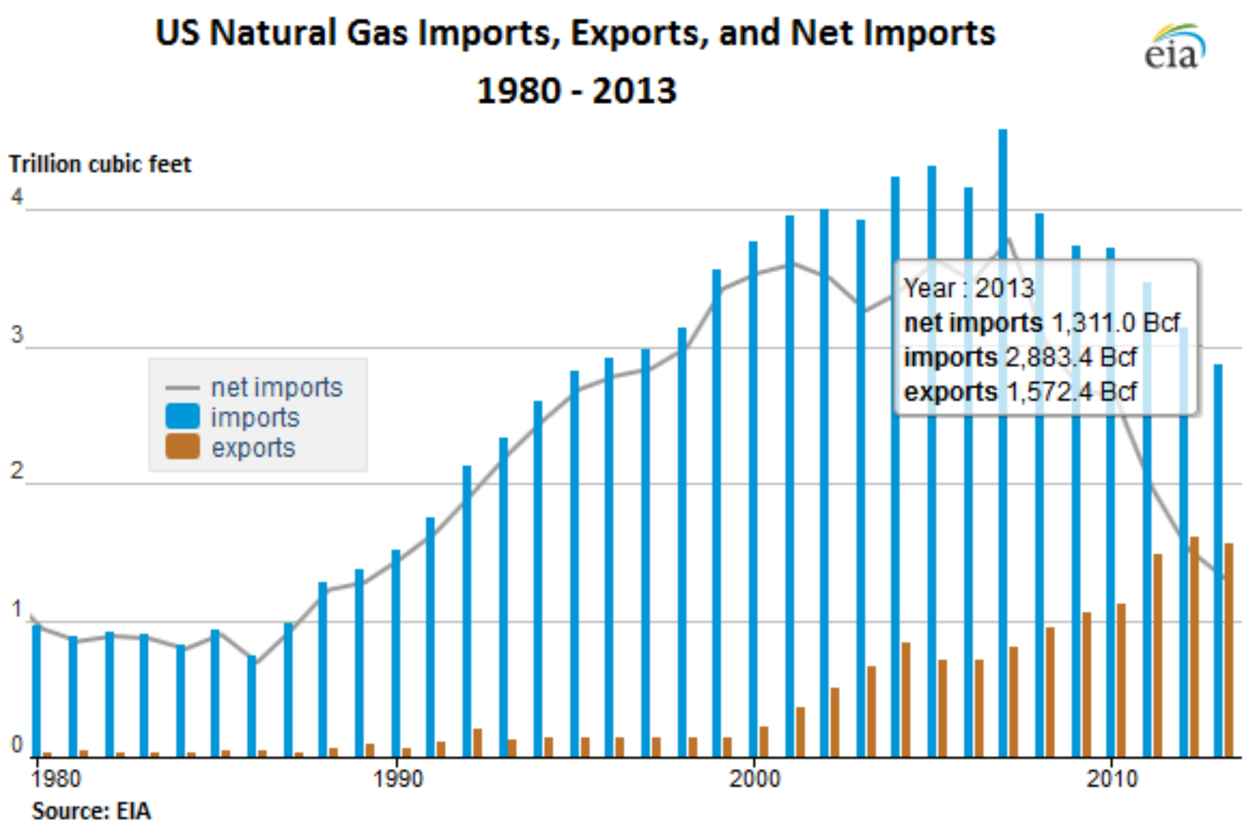
The US is a net importer of natural gas. OK, exports via pipeline to Mexico and Canada have steadily risen over the last ten years, except in 2013 when they edged down 1% as the US was running a little short. And imports, which ballooned from the mid-1980s to max out when the fracking boom kicked off in earnest in 2007, have since dropped every year. Last year, imports – mostly by pipeline from Canada and some LNG – were down 8%. The difference – net imports – dropped to 1,311 Bcf, the lowest since 1989.

If these trends were to continue, the US *could possibly* reach natural-gas independence over the next four or five years and might become a net exporter after that. But consumption has exceeded production over the last 24 months – largely due to the damage the persistent low price has done to the drilling industry. Demand has been met by drawing storage levels down 54%! But that resource has now been used up.

For the US to perform the super-feat of becoming a major net-exporter of natural gas, a new mega-drilling boom for dry gas would have to burst on the scene, *like right now*, and resources, equipment, and people would have to be moved from drilling for oil to drilling for dry natural gas. But that isn't going to happen with high oil prices and still dirt-cheap natural gas prices. Production goes where the profits are – and they aren't in natural gas. Not yet. Not at the current price.

And so the promise that American LNG could relieve Japan's thirst for natural gas and lower its dependence on the price gougers in the Middle East, and that the *very same* LNG could also calm Europe's angst about Russia's reliability as a supplier, the promise that easy billions could be made exporting that LNG has turned out to be just gassy hype.

The US has its hands full dealing with its own demand – at least until a dizzying increase in the price of natural gas triggers another drilling boom. Then all bets are off. *But wait* … once the price spikes enough to trigger that drilling boom, the promise of big profits from exporting cheap natural gas as high-priced LNG would turn into even more gassy hype.



Peak Coal and Peak Oil: declining prospects

Coal Export through Oregon and Washington?
coal peaked in USA in 1999, in Pennsylvania in 1920

www.peakchoice.org/peak-coal.html

link and comment courtesy of RiceFarmer.blogspot.com
www.platts.com/latest-news/coal/washington/power-river-basin-producers-finding-it-more-costly-21402408
Powder River Basin producers finding it more costly to get to coal reserves

"'There's very little low ratio coal out there anymore,' said Al Elser, BLM's assistant district manager for solid minerals in Casper, Wyoming."

Powder River Basin coal is some of the cheapest in the world. But as this article shows, the "easy coal" is pretty much gone. That of course means rising prices, and declining net energy. As with oil, coal is not going to literally "run out," but price increases will create an increasing drag on the economy. It's all downhill from here.

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www.cleanenergyaction.org
COAL: Cheap and Abundant: Or Is It?
Version 1.1. Released February 2009
Comments and Questions to Leslie Glustrom lglustrom at gmail.com

ABSTRACT
Coal-fired power plants provide approximately 50% of the electricity in the United States. It has often been stated that coal is "cheap and abundant" and it is assumed that it will stay that way for at least the next century. A careful analysis of existing information on coal supplies suggests that United States coal supplies are much more constrained than is widely understood. Indeed, it appears that with existing mines playing out over the next 10-20 years and future mine expansions highly uncertain, the planning horizon for building alternative power production infrastructure is likely to be much shorter than previously thought.

A careful review of existing information on U.S. coal supplies demonstrates that:

1) The U.S. Energy Information Administration has repeatedly published data on coal "reserves" as though they include an assessment of economic recoverability when in actuality they did not. As a result, the often touted "200 year supply of U.S. coal" is not based on a realistic assessment of how much coal will actually be accessible.

2) The United States Geological Survey has developed a tool for assessing economic recoverability and published a series of reports showing that the amount of economically recoverable coal is a small fraction (e.g. less than 20%) of the original resource. The most recent USGS assessment of coal in the Gillette coal field of the Powder River Basin of Wyoming, the source of about 40% of U.S. coal, found that only 6% of the coal was economically accessible under the economic conditions at the time.

Between 2002 and 2008, while coal costs were rising dramatically, the USGS reduced the amount of economically accessible coal in the Gillette coal field of the Powder River Basin from 23 billion tons to 10 billion tons.

3) The major mines in the Powder River Basin of Wyoming (e.g. the "Fort Knox" of U.S. coal) have less than a 20 year life span, and coal mines in other parts of the United States are also likely to be playing out in the next 20 years. Future coal mine expansions are highly uncertain as these expansions will face very serious geologic, economic, legal and transportation constraints. Importantly, the federal government owns essentially all of the coal in the western United States, and future coal mineexpansions in western states will have to comply with a host of federal laws.

IN CONCLUSION,

It appears that rather than having a "200 year supply of coal," the United States has a much shorter planning horizon for moving beyond coalfired power plants. Depending on the resolution of geologic, economic, legal and transportation constraints facing future coal mine expansion, the planning horizon for moving beyond coal could be as short as 20-30 years.
http://cleanenergyaction.files.wordpress.com/2011/10/coal_supply_constraints_cea_0212091.pdf

"We can't print coal the way we've been printing money so we need to take a very sober look at long-term coal supplies and begin to plan accordingly."
-- "Coal Supply Constraints: Long-Term American Coal Supplies Questioned," Leslie Glustrom, Boulder, CO, February 12, 2009
www.cleanenergyaction.org/documents/press/our%20news/coal_supply_constraints_021209.html

"Geology and Markets, not EPA, Waging War on Coal"
http://cleanenergyaction.org/2014/06/04/geology-and-markets-not-epa-waging-war-on-coal/
Clean Energy Action shows that it's the peaking of coal production, not Obama policies, causing coal's decline by driving up the cost of extracting coal (June 2014)

The EPA is not waging a war on coal. This isn't to say that a war on coal would be a bad idea, but rather that it's mostly unnecessary. Coal in the US is dying off on its own, and at most what we're doing is equivalent to taking it off life support. Our task is to manage the graceful transition to a much lower carbon energy system.

The proposed EPA carbon regulations are just the first baby steps we need to take down the path of avoiding catastrophic warming. The EPA, the state legislatures and regulatory bodies, and (someday) the US Congress are all going to have do do a whole lot more work in the years to come, working together to transform our energy system much faster and much more profoundly than these regulations alone can.

Because there's so much more work to do, it is important that we do not allow the EPA and the Obama administration to be made into scapegoats for the decline of the coal industry. We must not allow this kind of work to remain politically poisonous, or we'll never build the kind of momentum we need to finish the job.

"Warning: Faulty Reporting on U.S. Coal Reserves"
http://cleanenergyaction.org/research-reports/faulty-reporting-us-coal-reserves/
2013 Clean Energy Action report on peaking of coal reserves

www.scitizen.com/future-energies/global-coal-supplies-it-might-be-worse-than-anyone-thinks_a-14-3558.html

Global Coal Supplies: It Might Be Worse Than Anyone Thinks
by Kurt Cobb
10 Aug, 2010
A new study on global coal supplies suggests a worldwide peak in production from existing fields in 2011.

Claims that the world has 200 to 400 years of coal left at current rates of consumption have blinded policymakers and the public. The claims are based on two questionable notions: 1) That official coal reserve estimates are accurate and 2) that the world will experience no growth in the rate of consumption of coal over the period cited.

In a new study published in the international journal Energy researchers Tadeusz W. Patzek and Gregory D. Croft suggest that actual historical coal production is a better indicator of the future trend of worldwide coal output than stated reserves which are notoriously unreliable. They note, for example, that the state of Illinois, despite its rank as second in reserves in the United States, has seen its production decline by half over the last 20 years. In the meantime Illinois' estimated recoverable reserves have actually increased from 32 billion tons to 34 billion tons between 1987 and 2006.

They mention the work of David Rutledge at the California Institute of Technology who has detailed the sharp downward revisions in the official reserve estimates in recent decades and who believes ultimate production will fall far short of the current reserve estimates. The trajectory for reserves, Rutledge shows, has largely been down as planners include constraints both technical and practical such as coal in seams too thin to mine economically or the presence of a large city over a shallow coalfield. Rutledge also applies Hubbert Linearization to the production data to obtain a truly startling picture of ultimate future recoveries: 50 percent less than current forecasts.

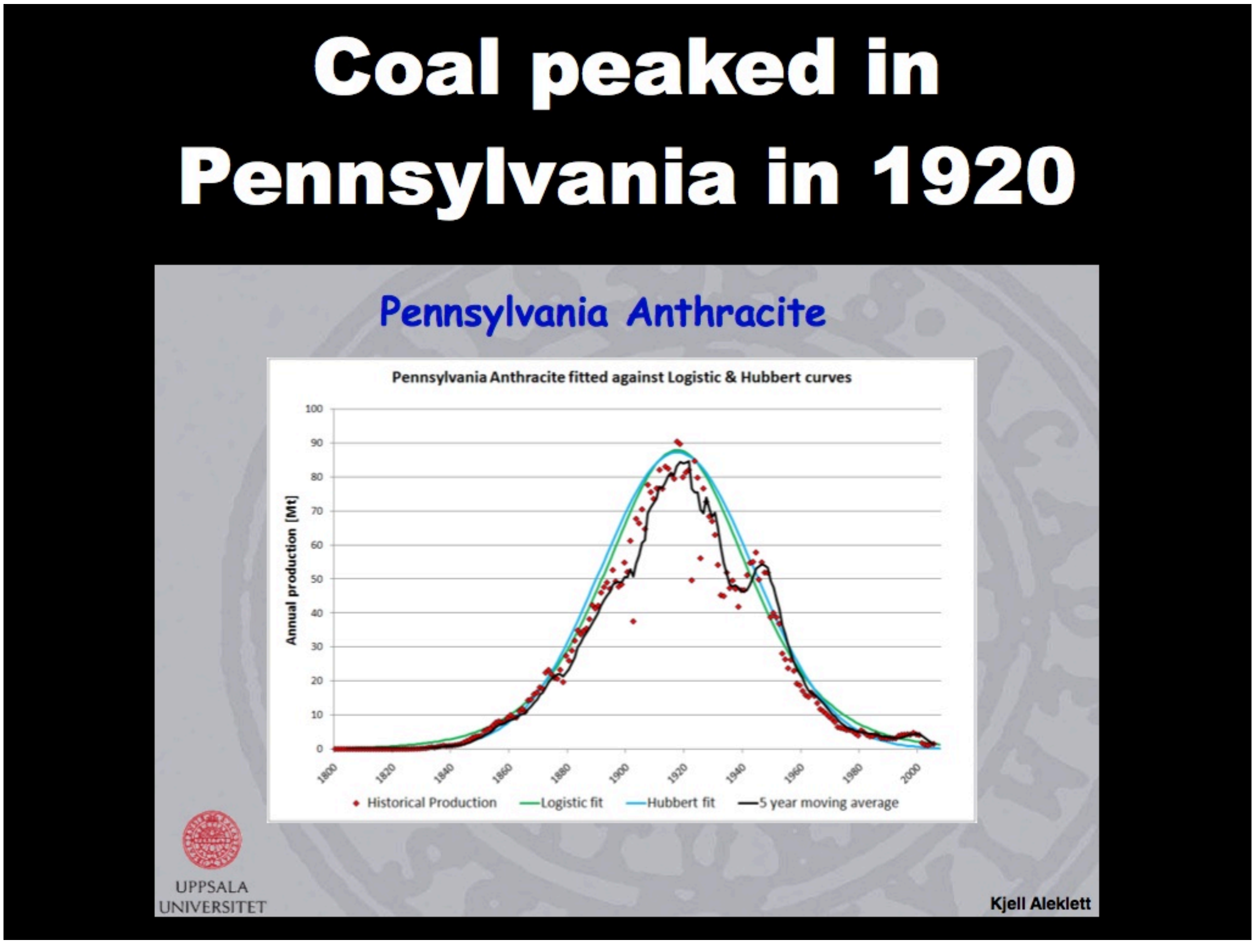
As for the second assumption, the idea that coal demand would stay the same even as the population and the world economy presumably grow is an absurd notion without any historical basis. So even if stated reserves are correct, exponentially rising rates of production would quickly whittle the supply down to perhaps 75 years with a peak coming much sooner than that.

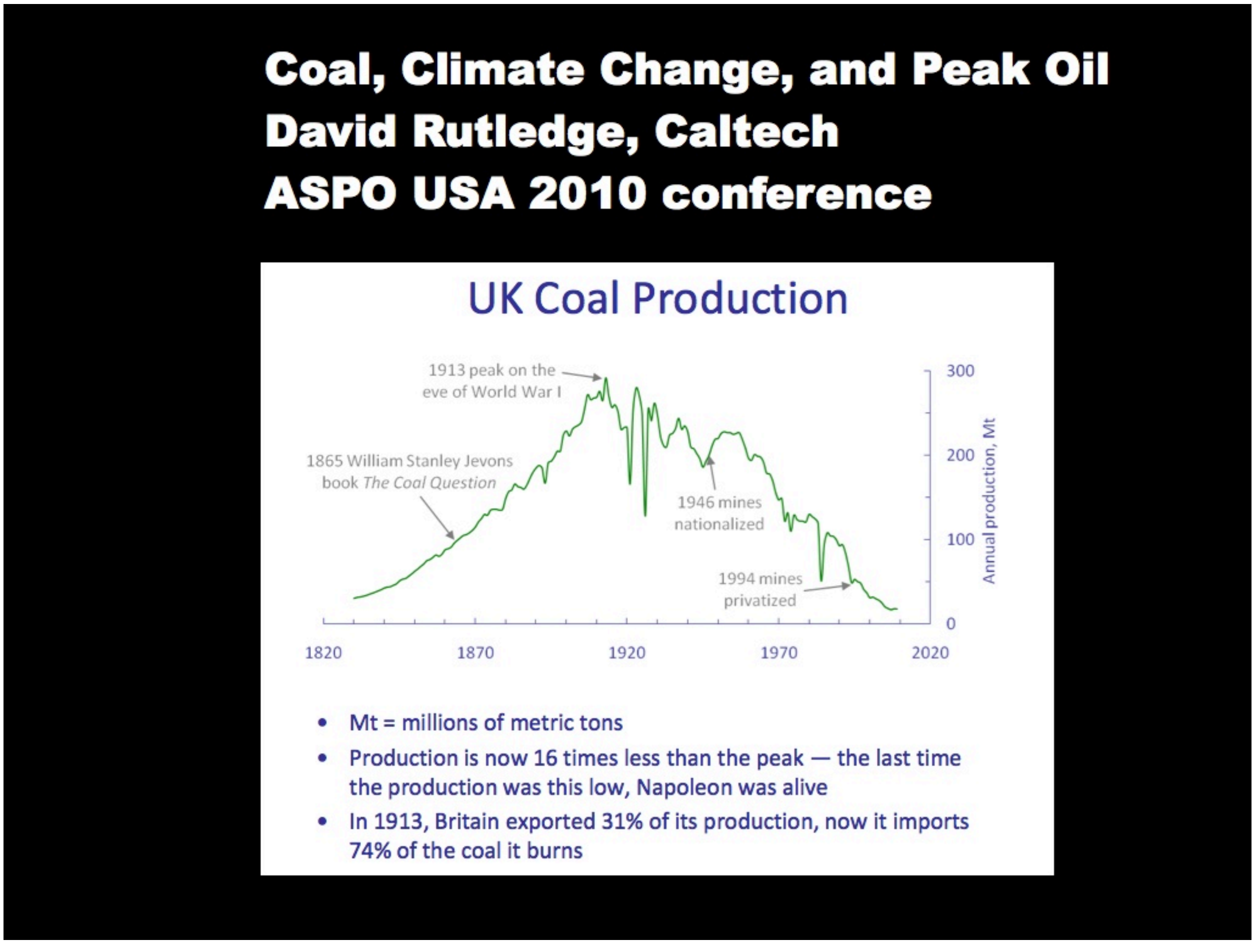
But the authors believe such a path of growth is out of the question because of the near term production peak they expect in coal and oil as well. They calculate a peak in worldwide coal production from existing coalfields in 2011. They argue that nearly all of the world's major coalfields have been known for a long time, and that only one major field has been discovered in the last 50 years. They recognize major untapped sources in Alaska and Siberia, but believe that the difficulties and long lead times involved in developing them will mean that the date of peak production will not be affected. Rather these areas might lessen somewhat the pace of decline. Perhaps the most shocking projection in the report is that coal production from existing coalfields is expected to fall by 50 percent over the next 40 years.

www.george-orwell.org/Down_The_Mine/0.html
George Orwell
Down The Mine

Our civilization, pace Chesterton, is founded on coal, more completely than one realizes until one stops to think about it. The machines that keep us alive, and the machines that make machines, are all directly or indirectly dependent upon coal. In the metabolism of the Western world the coal-miner is second in importance only to the man who ploughs the soil. He is a sort of caryatid upon whose shoulders nearly everything that is not grimy is supported. For this reason the actual process by which coal is extracted is well worth watching, if you get the chance and are willing to take the trouble. ....

But-most of the time, of course, we should prefer to forget that they were doing it. It is so with all types of manual work; it keeps us alive, and we are oblivious of its existence. More than anyone else, perhaps, the miner can stand as the type of the manual worker, not only because his work is so exaggeratedly awful, but also because it is so vitally necessary and yet so remote from our experience, so invisible, as it were, that we are capable of forgetting it as we forget the blood in our veins. In a way it is even humiliating to watch coal-miners working. It raises in you a momentary doubt about your own status as an 'intellectual' and a superior person generally. For it is brought home to you, at least while you are watching, that it is only because miners sweat their guts out that superior persons can remain superior. You and I and the editor of the Times Lit. Supp., and the poets and the Archbishop of Canterbury and Comrade X, author of Marxism for Infants--all of us really owe the comparative decency of our lives to poor drudges underground, blackened to the eyes, with their throats full of coal dust, driving their shovels forward with arms and belly muscles of steel.


Coal peaked in Pennsylvania in 1920
Pennsylvania Anthracite
Pennsylvania Anthracite fitted against Logistic & Hubbert curves
Annual production [Mt]
Historical Production
Logistic fit
Hubbert fit
5 year moving average
UPPSALA UNIVERSITET
Kjell Aleklett


Coal, Climate Change, and Peak Oil
David Rutledge, Caltech
ASPO USA 2010 conference
UK Coal Production
1913 peak on the eve of World War I
1865 William Stanley Jevons book The Coal Question
1946 mines nationalized
1994 mines privatized
300
200
100
0
Annual production, Mt
1820
1870
1920
1970
2020
Mt = millions of metric tons
Production is now 16 times less than the peak — the last time the production was this low, Napoleon was alive
In 1913, Britain exported 31% of its production, now it imports 74% of the coal it burns

PEAK TRAFFIC AND TRANSPORTATION TRIAGE

Mark Robinowitz • PeakTraffic.org

Whether you focus on Peak Energy, Climate Chaos or what is euphemistically called the "Great Recession," each of these aspects of reaching the limits to growth mandate an end to highway expansion. We cannot afford to build more roads when we cannot maintain what we already have. The transition from cheap, abundant oil to expensive, hard to get oil is reducing the amount that people drive and damaging the economic system that requires endless growth to function. Peak Energy is starting to reduce the physical ability to grow traffic levels, regardless of economic circumstances. Burning fossil fuels pollutes the thin film of the atmosphere, with health consequences and environmental impacts, including global warming. Ecology, energy and money are interconnected and inseparable, and each require a holistic integration with the others to address any of them.

Energy depletion is not merely about personal transportation. Driving less will be uncomfortable, but eating less would be far more difficult. Most food eaten in the US crosses time zones, some travels across international borders. As fossil fuels decline we need to grow food where it is eaten. Relocalizing food production, growing food in cities, community gardens, suburban "food not lawn" efforts, and protection of farmland from asphalt and concrete are all needed to cope with oil depletion.

George H.W. Bush's highway law - the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) - requires Federal aid highway plans to be designed for traffic conditions two decades in the future, not current traffic congestion. It's anyone's guess what energy (and therefore, traffic) levels will be in the 2030s, but under any physically possible scenario the flow rates of petroleum will be lower, since conventional fossil fuels have peaked globally. There will be oil extraction in the 2030s but less than current flow rates. Future fuels will be the dirtier, more expensive, difficult to extract "bottom of the barrel" supplies. Electric cars, public transit, car sharing, and relocalization could mitigate these impacts but not prevent them. It takes fossil fuels and minerals to make electric cars and repave roads.

Transportation planning needs to focus on maintaining the enormous road networks already built, not expanding them further for travel demand that will not materialize on the energy downslope. The investments euphemistically called "modernization" should be dedicated toward quality train service, not super wide superhighways.

The National Environmental Policy Act (NEPA) mandates a "Supplemental" Environmental Impact Statement must be prepared if there are "new circumstances" not anticipated when the scoping process was conducted. Surely reaching the global peak of petroleum production is relevant for a transportation project allegedly designed for travel long past the peak.

If the Federal Highway Administration included Peak Energy in environmental analyses, this would be a seismic shift in transportation planning across the United States. Plans need to consider energy depletion and the limits to growth on a finite planet.

There are several ways this shift could happen: a successful Federal lawsuit forces FHWA to include Peak Energy, the start of gasoline rationing (delayed by fracking and tar sands mining) forces transportation planners to consider alternatives, or a change in national policies.

Peak Energy and Peak Vehicle Miles Traveled are "new circumstances" relevant for proposed transportation projects.

Council on Environmental Quality regulations
40 CFR 1502.9:
Draft, final and supplemental statements.
(c) Agencies:
- (1) Shall prepare supplements to either draft or final environmental impact statements if:
  - (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or
  - (ii) **There are significant new circumstances or information** relevant to environmental concerns and bearing on the proposed action or its impacts.

Federal Highway Administration regulations
23 CFR 771.130:
Supplemental environmental impact statements.
(a) A draft EIS, final EIS, or supplemental EIS may be supplemented at any time. An EIS shall be supplemented whenever the Administration determines that:
- (1) Changes to the proposed action would result in significant environmental impacts that were not evaluated in the EIS; or
- (2) **New information or circumstances relevant** to environmental concerns and bearings on the proposed action or its impacts would result in significant environmental impacts not evaluated in the EIS.

> **"These forty million [poor] people are invisible because America is so affluent, so rich; because our expressways carry us away from the ghetto, we don't see the poor."**
> **— Martin Luther King**, "Remaining Awake Through a Great Revolution"
> March 31, 1968 (five days before his assassination)

Oregon Highway Plans

www.PeakTraffic.org/oregon.html

In 2008, Governor Kulongoski's Transportation Vision Committee report called for $18 billion in new and widened Oregon state highways. An updated estimate might be over $20 billion.
1000 Friends of Oregon, Oregon Environmental Council, and Environment Oregon were part of this committee, but they were window dressing to show all points of view were supposedly considered.
If these groups had a minority report to dissent from the highway promotion, they kept it very quiet.

National highway plans include over a trillion dollars in expansions. Details at PeakTraffic.org

"Transportation Vision Report" - no longer on line
archived: www.sustaineugene.org/tvreport_final.pdf
a few highlights:

$4.2 billion: Columbia River Crossing, wider I-5, up to 16 lanes on Vancouver, WA side
approved December 2011, not under construction
Oregon legislature appropriated $450 million 2013

$1 billion: Sunrise freeway, Clackamas County
approved December 2010, $130 million available to build a segment, construction began 2013, now open

$1.3 billion: I-5 / I-84 reconstruction, Portland

$2.1 billion: I-5 to Hwy 99, Tualatin-Sherwood
part of stopped Portland Western Bypass in 1990s

$2 billion: I-5 widening south of Portland

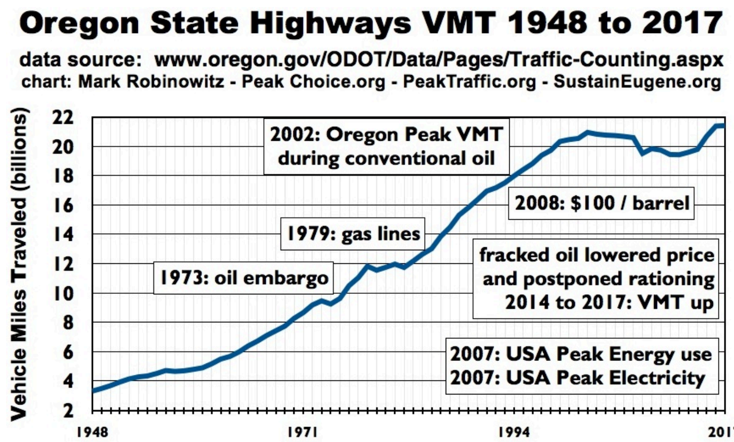
$600 million: I-5 widening, Salem to OR 34
Albany-Jefferson widening now slated at $500 m.

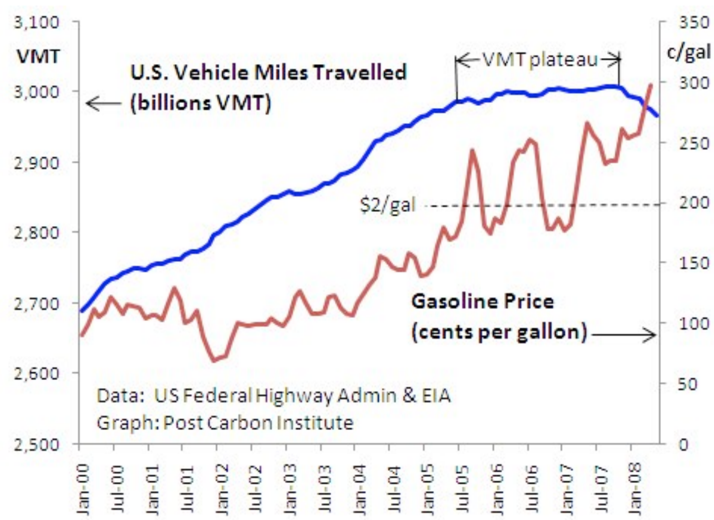
$670 million: Salem Willamette River bridge

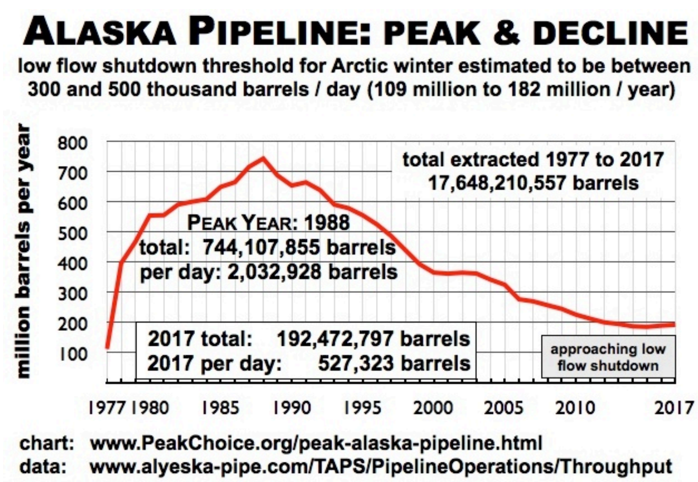
$550 million: Newberg Dundee bypass
paves farmland, approved June 2010
construction of $262 million segment started 2013

$100 million: North Corvallis Bypass
OR 34 to north Corvallis, including new river bridge

$200 million: Route 126 upgrade, Springfield
wider mainline, interchanges at 52nd & Main Street)







$250 million plus: Beltline widening, Eugene
widen Beltline up to 11 lanes at the Willamette river

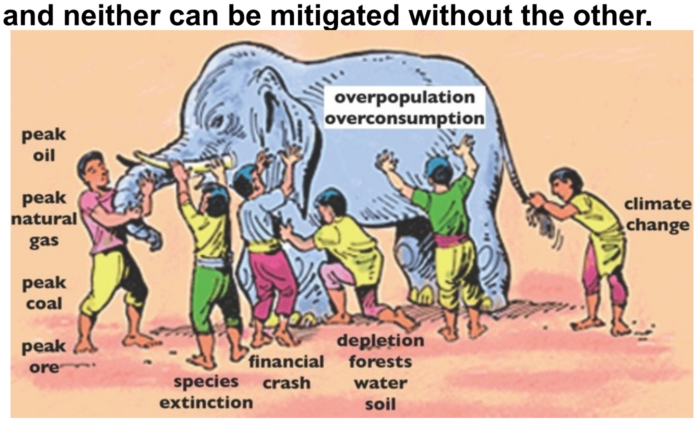
$375 million: Route 62 freeway bypass, Medford
approved May 2013, $450 million, only about $100 million appropriated to build a segment

$870 million: US 97 upgrades, Bend-Redmond

PEAKED ENERGY and CLIMATE CHAOS

The most important question facing humanity is how we respond to the interconnected crises of Peaked Energy, Climate Chaos, overpopulation, overconsumption and resource conflicts as we pass the limits to growth on a round, finite planet.

These crises resemble the parable of the blind men touching an elephant. Each observer correctly describes a part of the elephant, but none have a holistic understanding. **Peaked Energy and Climate Change are two facets of ecological overshoot, and neither can be mitigated without the other.**



The global crises of the end of cheap fossil fuels and the start of climate change require global levels of solutions — we need to relocalize everywhere. We are not merely at peak energy, we are at peak technology, peak money, peak communication, and peak everything else. Real solutions would require us to redirect the energy, talents and resources of global capitalism, the military industrial complex, media, universities, and other societal institutions.

We have enough resources and talent to shift civilization to create a peaceful world that might be able to gracefully cope with the end of concentrated fossil fuels, or to create a global police state to control populations as the resources decline. The "War on Terror" is actually a long planned World War to control finite fossil fuels as we pass their peaks.

Understanding why civilization did not respond to the warnings of resource depletion decades ago is needed if a shift toward sanity is still possible at this late date. This is a simple question that has a complex answer — and these decisions were not made democratically. Mitigating Peaked and Climate would require world peace instead of peak oil wars.

We are not "addicted" to oil — the modern world is completely dependent upon fossil fuels for industrial agriculture, transportation networks, and the growth based monetary system. Addictions are things you can give up — but oil runs our civilization.

Peaked and Climate are interconnected

Focusing on energy shortage while ignoring ecology led to the false solutions of offshore drilling, fracking, tar sands, liquid natural gas, biomass electricity, mountaintop removal, and nuclear power.

Focusing only on "carbon" while ignoring energy limits is one of the reasons for the political backlash against climate change awareness. Environmental groups frame these concerns as we *should* reduce energy consumption instead of we *will* reduce use because we cannot burn fuel that does not exist.

Framing the question as how we will use the remaining fossil fuels could bypass climate denial. We will reduce our "carbon footprint" whether we want to or not, since the oil, coal and unnatural gas will be mostly depleted before 2050, when our footprints are supposed to be much smaller. Reducing use by 2050 is code for depletion by 2050.

Our exponential growth economy has hit the end of growth of resource consumption, imposed by nature. Building lots of wind turbines, railroads and relocalizing agriculture would require reallocating resources used for endless warfare and wasteful consumerism. After Peak Everything there will be fewer resources available for "transition." We need triage on a planetary scale for the remaining fossil fuels and minerals.

David Holmgren, co-originator of permaculture, is author of "*Future Scenarios: How Communities can adapt to Peak Oil and Climate Change*." www.futurescenarios.org

> *"Economic recession is the only proven mechanism for a rapid reduction of greenhouse gas emissions ... most of the proposals for mitigation from Kyoto to the feverish efforts to construct post Kyoto solutions have been framed in ignorance of Peak Oil. As Richard Heinberg has argued recently, proposals to cap carbon emissions annually, and allowing them to be traded, rely on the rights to pollute being scarce relative to the availability of the fuel. Actual scarcity of fuel may make such schemes irrelevant."*

Living on our current solar budget would power a smaller, steady state economy. We will live on our solar budget as the oil, unnatural gas and coal deplete. Future generations need us to choose wisely and use remaining fossil fuels for relocalization and power down.

Fracking Postponed Rationing

Hydraulic fracturing — "fracking" — permanently pollutes groundwater, causes earthquakes and is ultrahazardous for nearby communities. The motive for fracking is not profiteering (many fracked wells lose money) but to replace declining flows of conventional oil and gas due to depletion.

Fracking provided a "stay of execution" for Peak Energy in America. It postponed energy rationing — which we are totally unprepared for, logistically and psychologically.

The disruptions caused by the 1973 / 1974 oil embargo and gas lines in 1979 were merely warnings (mostly ignored). The economic shocks of oil rationing after the fracking boom goes bust could trigger the biggest onslaught of scapegoating in US history, especially since this may be permanent.

How will "stop drilling" groups respond to being blamed for the shortfalls? Will groups create cooperatives to insulate homes to reduce energy use, create car sharing networks, repair bicycles, revitalize community interdependence? Practicalities could be much more important than protests. Energy literacy about finite fuels might mitigate anger about the impacts of depletion.

The five stages of Peak Acceptance

Peak Denial and Plausible Deniability
Peak Blame: Pique and Scapegoating
Peak Bargaining: techno-fixes and the promised land after oil
Peak Trauma Social Disaster (PTSD)
Peak Acceptance: Nature is abundant and finite

What the Frack?
www.peakchoice.org/peak-frack.html

Peak Energy and Climate Chaos
www.peakchoice.org/peak-climate.html

Peak Money: a permanent change
www.peakchoice.org/peak-money.html

Peak Electricity was 2007 in USA
www.peakchoice.org/peak-electricity.html

100% renewable energy after finite concentrated fossil carbon: solar power will run a smaller, steady state society

Directly using solar electricity since 1990 taught me it is wonderful but not a replacement for fossil fuels. Living on our solar budget after oil, coal and unnatural gas deplete will force us to relocalize production.

It takes fossil fuels and mineral ores to make, move, and install solar panels and wind turbines. We should use some of what is left for the "transition" instead of more consumerism and militarism. Here are resources on how "sustainable" energy will power a smaller, steady state society not based on endless growth on a round, abundant, finite planet. We all need to wean ourselves away from the American Way of Life (AWOL).

Richard Heinberg and David Fridley
Our Renewable Future: Laying the Path for One Hundred Percent Clean Energy
Post Carbon Institute www.postcarbon.org www.ourrenewablefuture.org www.shalebubble.org

www.greens.org/s-r/60/60-09.html
A Critique of Jacobson and Delucchi's Proposals for a World Renewable Energy Supply by Ted Trainer

www.greens.org/s-r/48/48-11.html
Renewable Energy Cannot Sustain a Consumer Society by Ted Trainer

www.resilience.org/stories/2009-11-09/scientific-americans-path-sustainability-lets-think-about-details/
Scientific American's Path to Sustainability: Let's Think about the Details by Gail Tverberg

www.resilience.org/stories/2017-09-19/100-percent-wishful-thinking-green-energy-cornucopia/
100 Percent Wishful Thinking: The Green-Energy Cornucopia
by Stan Cox, author, Any Way You Slice It: The Past, Present, and Future of Rationing

PEAK MONEY: a permanent change

we are past limits to growth, this is not a cyclical recession

Some of the media, government elites, and the financial world knew the financial crash was imminent but feigned surprise in public while planning their exit strategies and wargaming how to manage and manipulate the crisis to protect their power (not just more profits). The financial meltdown is not a cyclical recession, it is a permanent economic shift. The End of Growth transcends ideologies and partisan politics.

Now that we are at Peak Everything we need to move beyond Peak Denial and Peak Blame to equitably share the shrinking economic pie.

Even if transnational corporations were converted into democratic, locally owned cooperatives, we have still overshot Earth's carrying capacity.

"This is not so much financial bad weather as financial climate change" — James Howard Kunstler

"Communism forgets that life is individual. Capitalism forgets that life is social, and the kingdom of brotherhood is found neither in the thesis of communism nor the antithesis of capitalism but in a higher synthesis that combines the truths of both. Now, when I say question the whole society, it means ultimately coming to see that the problems of racism, the problem of economic exploitation, and the problem of war are all tied together."
— Martin Luther King, "Where do we go from here?" August 16, 1967

energy and money

- "the recession that will not end in our lifetime" www.PeakChoice.org/peak-money.html
- Richard Heinberg, Post Carbon Institute "The End of Growth" www.postcarbon.org
- Chris Martsenson, "The Crash Course" www.peakprosperity.com/crashcourse
- Center for the Advancement of the Steady State Economy www.steadystate.org
- Gail Tverberg, OurFiniteWorld.com

steady state economics for an ecological society

The dominant paradigm teaches money is the most important value, energy conservation and ecological sanity are nice if we can afford them.

Most of the environmental movement has embraced the concept of the Triple Bottom Line, which suggests that the economy needs to consider ecology and social justice issues. While it is good to factor these into economic decisions, the deeper truth is the environment makes the economy possible. Energy creates money, not the other way around. No jobs on a dead planet.

It is probably not a coincidence that many of the political voices calling attention to the problems of fiat currency, the Federal Reserve and other structural problems rarely mention the underlying ecological limits - and worse, some of them seem fixated on Jewish bankers who allegedly run the world.

We need to weave together social justice advocates with understanding of how fiat money is created and that we have reached the limits to infinite growth on a finite planet.

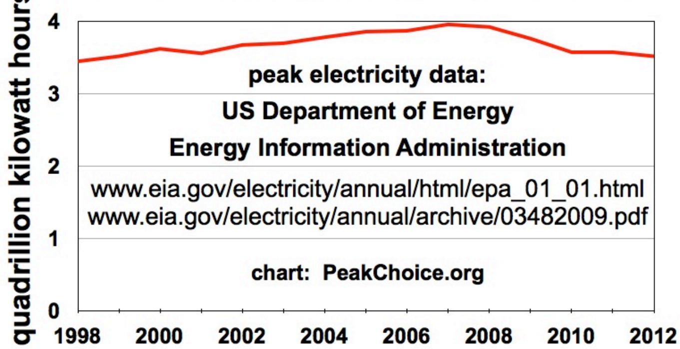
"Awareness of Climate Change by the media and general public is obviously running well ahead of awareness about Peak Oil, but there are interesting differences in this general pattern when we look more closely at those involved in the money and energy industries. Many of those involved in money and markets have begun to rally around Climate Change as an urgent problem that can be turned into another opportunity for economic growth (of a green economy). These same people have tended to resist even using the term Peak Oil, let alone acknowledging its imminent occurrence. Perhaps this denial comes from an intuitive understanding that **once markets understand that future growth is not possible, then it's game over for our fiat system of debt-based money**."
— David Holmgren, co-originator of permaculture "Money vs. Fossil energy: the battle to control the world" www.holmgren.com.au

PEAKED ELECTRICITY

by Mark Robinowitz - www.PeakChoice.org

Oil is not the only critical resource that is "peaking." The amount of electricity is also approaching a peak of production due to finite supplies of the fuels used to make electricity (coal, uranium, natural gas). Renewable energies are ideal generation sources, but they are a small amount of the electric grid and cannot be expanded fast enough to maintain current levels.

USA electricity use peaked in 2007



Coal: Dirtiest and Biggest (but finite)

Half of the electricity in the US comes from burning coal to spin steam turbines. Coal is the dirtiest type of fossil fuel in terms of mining damage and greenhouse gas production. Estimates of the amount of remaining coal have been exaggerated and "peak coal" globally is likely in the next decade or two. There's not enough coal to fuel endless growth projections, but there is enough to further foul our air.

Coal peaked in the US in 1999, in terms of energy content. In Pennsylvania, where coal mining started, it peaked in 1920. In Britain, coal peaked in 1913 and Germany had Peak Coal during World War II.

For more info: www.oilempire.us/peak-coal.html
the best book: Richard Heinberg "Blackout: Coal, Climate and the Last Energy Crisis."

Nukes: Just a Fancy Way to Boil Water

The richest uranium deposits in the US were in the Colorado plateau, the best were extracted decades ago (with severe health and ecological impacts). Globally, uranium deposits are mostly in a few countries and are nearing their peak.

As of 2010, about half of the nuclear fuel in US power reactors comes from the "Megatons to Megawatts" program, which has diverted uranium from dismantled Russian nuclear bombs to civilian fuel production. Using weapons materials for power generation reduces weapons stockpiles, but still creates more high level nuclear wastes. This program will run out in 2013.

Some nuclear boosters want to revive plans for "reprocessing" of irradiated fuel rods, the most toxic technology ever invented. Reprocessing dissolves extremely radioactive "spent" nuclear fuel rods into acids, and uses solvents to extract the unfissioned uranium for reuse. The byproducts include the myriad "fission products" left over from the reactor's operation ("high level waste"), dissolved into a nasty mix of toxic solvents and acids. It is thermally hot, lethally radioactive and extremely difficult to contain.

In 1975, the Nuclear Regulatory Commission published "The Impact of Intensified Nuclear Safeguards on Civil Liberties," also known as the "Barton Report." It predicted that an economy based on nuclear reprocessing would require the suspension of civil liberties to safeguard the nuclear fuel since it would create commerce in nuclear weapons ingredients. Reprocessing also separates out plutonium from irradiated fuel rods. President Ford blocked US plans for reprocessing since it would fuel nuclear proliferation by commercializing weapons materials.

Unnatural Gas: Overcommitted, In Decline

Natural gas is the cleanest burning fossil fuel and it is also the most versatile, which has led to increased variety of uses of it. In recent years, its role in the electric grid has increased and now powers about one sixth of US electrical demand.

US natural gas production peaked in 1973 and has been on a bumpy plateau ever since. About a quarter of US oil and gas production is from offshore wells in the Gulf of Mexico (since most on shore fields are in terminal decline).

Natural gas is the most difficult fossil fuel to transport, requiring pipelines between the well head and the ultimate user.

Since 9/11, US imports of Liquid Natural Gas via special ships have doubled (from one to two percent of US gas usage). LNG cools natural gas to about 260 degrees below zero (F) to compress it for transoceanic transit. LNG boats and terminals have the energy potential of a small nuclear bomb if they explode.

A new technology called fracking has created a surge of US gas production. Fracking blasts underground rock with toxic solvents to liberate embedded natural gas. Industry groups claim shale gas is a “100 year” supply but wells in the Barnett shale gas field near Dallas, Texas have sharp decline rates. Shale gas will probably be a short term boom followed by sharp bust. A good summary is Richard Heinberg’s book “Snake Oil: How Fracking’s False Promise of Plenty Imperils Our Future” – postcarbon.org and shalebubble.org

Dams Damn Rivers

Hydropower was one of the earliest forms of large scale electrical production and is the easiest to operate. The fuel is essentially free and renewable (once the dam is built). It is easy to vary the flow rates up and down to match shifts in the load demand. But in the US, most sites with hydroelectric potential have already been dammed, so even if society ignored the ecological impacts on rivers and fish habitat, there are few places left in North America for more dams.

Grid Stability and Baseload

The electric grid requires balancing generation with load demands to keep it stable. Solar and wind power are reliable yet intermittent, it’s not always sunny or windy. Running more than a small portion of the grid with renewables would require major changes to the way the grid runs since it’s hard to store solar and wind power.

The Department of Homeland Security has run planning exercises on how to power “critical infrastructure” if the national grids break down and result in “islands” of fragmented grid sections. It will be harder to keep everything powered all of the time as fossil fuels decline, the economy contracts and components age.

Solar Power: Good for Billions of Years

Passive solar heating of buildings, solar hot water, and solar electricity are ultimately the best way to power our society. But there is a huge gap between where we are and where we would like to be. Current solar electric technology requires a global electronics infrastructure, rare mineral ores, copper and other materials that are energy intensive to process. Most solar technologies are ways to use fossil fuels, not substitutes for them.

Solar thermal energy — to heat water and buildings — is much simpler and cheaper than photovoltaic panels. Solar thermal can also make utility scale electricity that stores heat for the evening. It is better for grid baseload than PV.

The Answer is Blowing in the Wind

Wind turbines are also a way to use solar power, since sunlight creates wind. Commercial wind turbines require rare earth mineral ores for the magnets, which are mostly found in China. While there has been a big boom in wind farms, they cannot be built fast enough to replace depleting natural gas or the need to stop mining coal due to its ecological devastation.

Renewables for a Steady State Economy

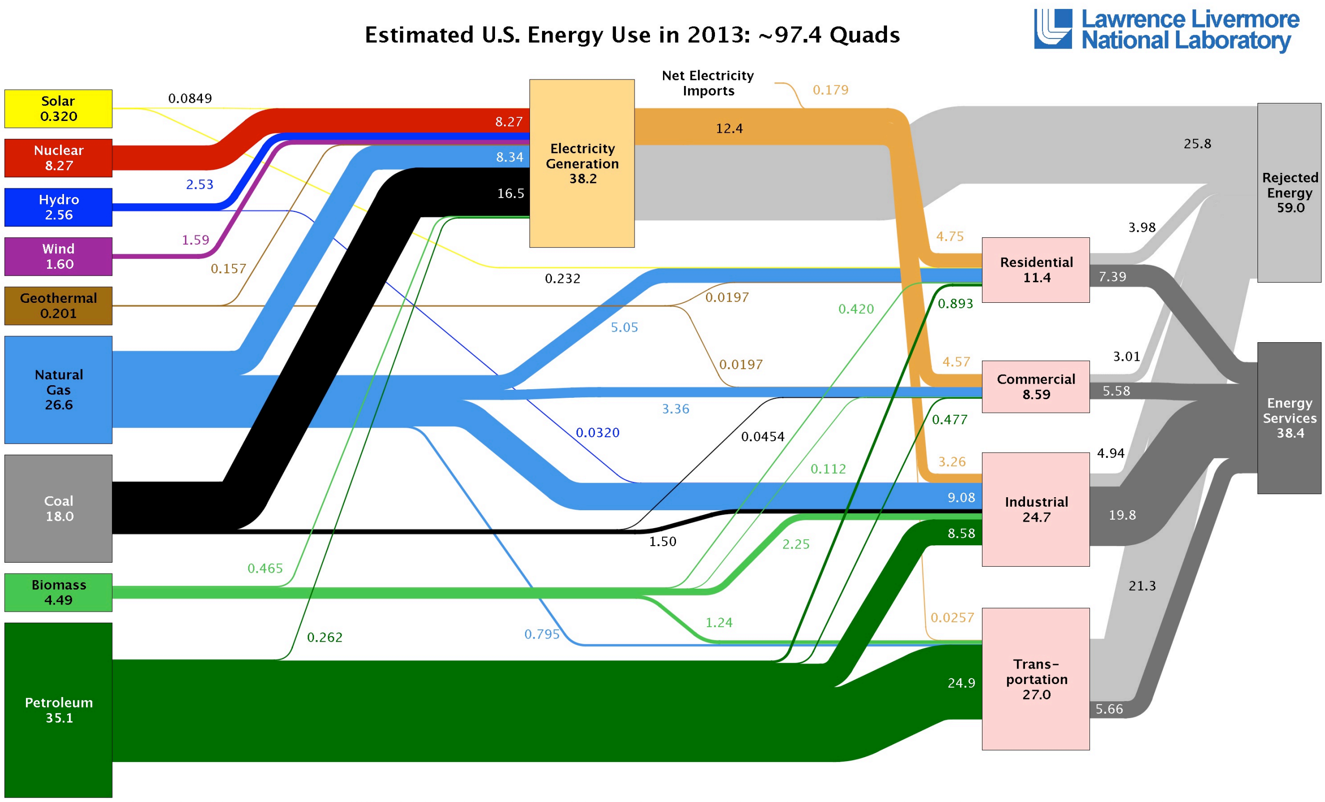
Using solar power for two decades (and wind power for one) taught me that renewable energy could only run a smaller, steady state economy. Our exponential growth economy needs ever increasing consumption of concentrated resources (fossil fuels are more energy dense than renewables). A solar energy society would require moving beyond growth-and-debt based money

After fossil fuel we will only have solar power, but that won’t replace what we use now. We need to abandon the myth of endless growth on a round, and therefore, finite planet to have a planet on which to live. Will we use the remaining fossil fuels to make lots of solar panels and relocalize food production instead of waging Peak Oil Wars?

additional resources on energy descent

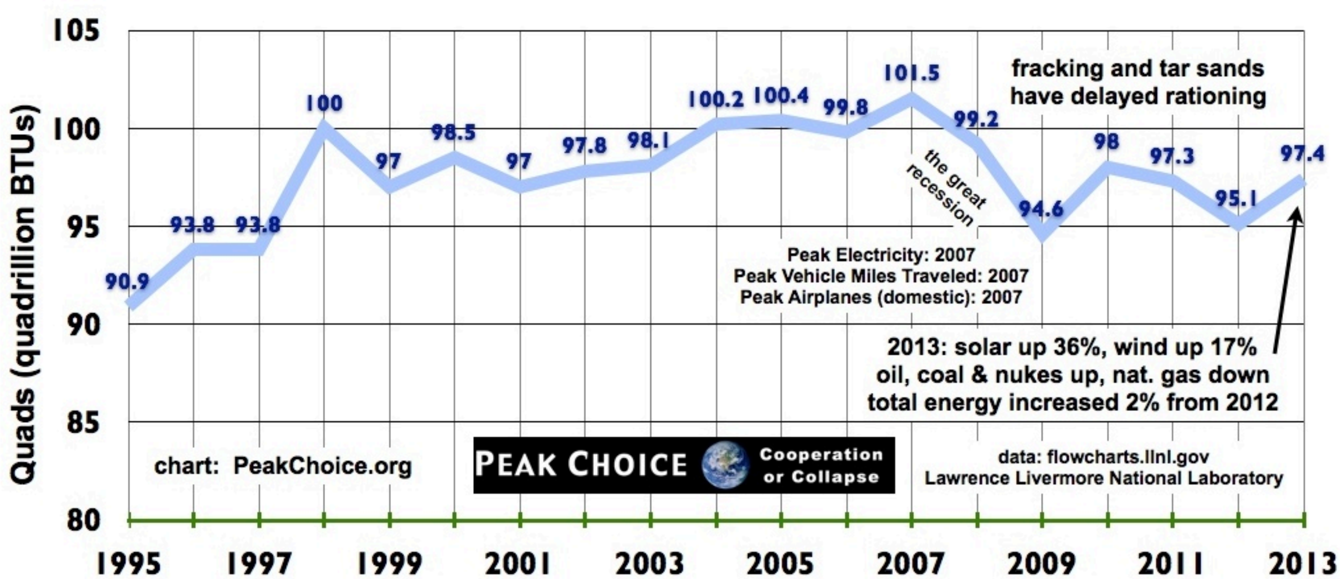
Searching for a Miracle: Net Energy Limits and the Fate of Industrial Society
by Richard Heinberg
www.postcarbon.org/new-site-files/Reports/Searching_for_a_Miracle_web10nov09.pdf

Future Scenarios: How Communities can adapt to Peak Oil and Climate Change
by David Holmgren (co-originator of permaculture) www.futurescenarios.org

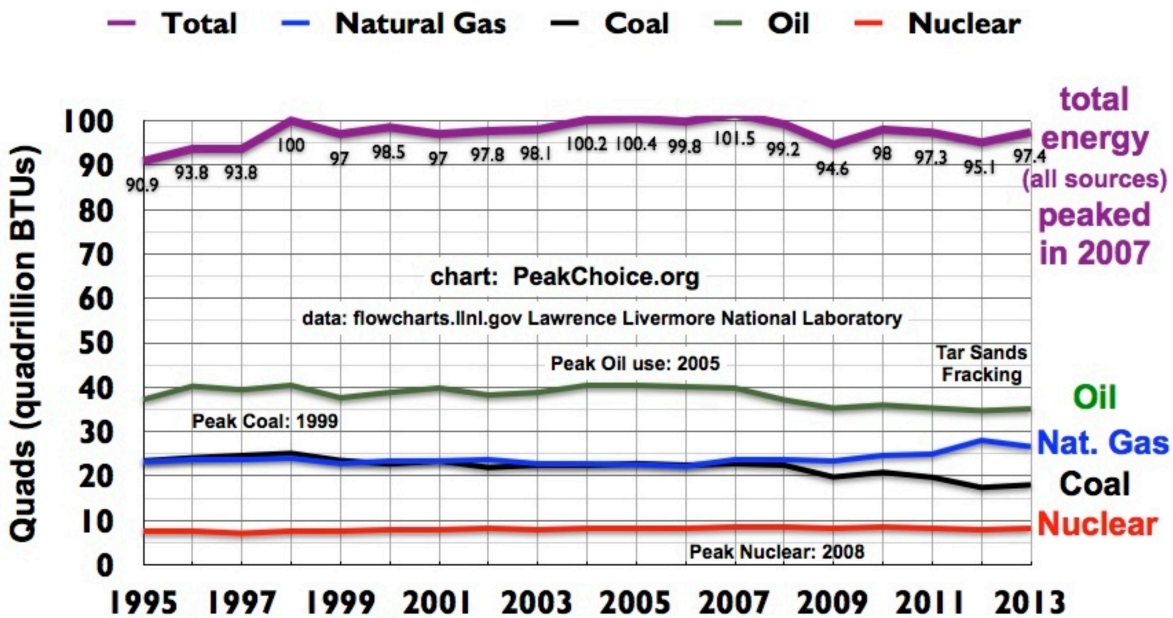


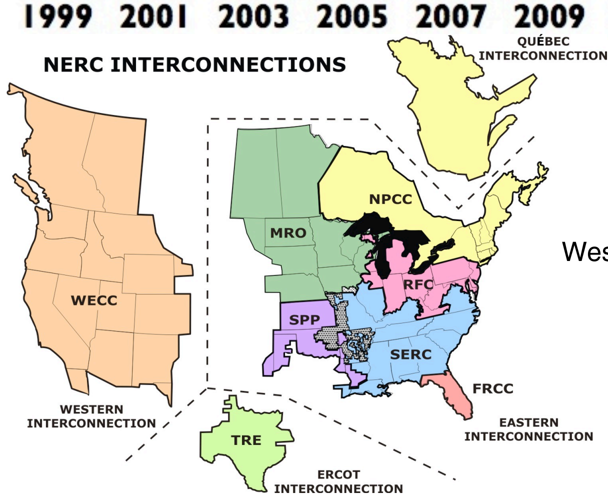
Source: LLNL 2014. Data is based on DOE/EIA-0035(2014-03), March, 2014. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

USA: all energy use peaked in 2007



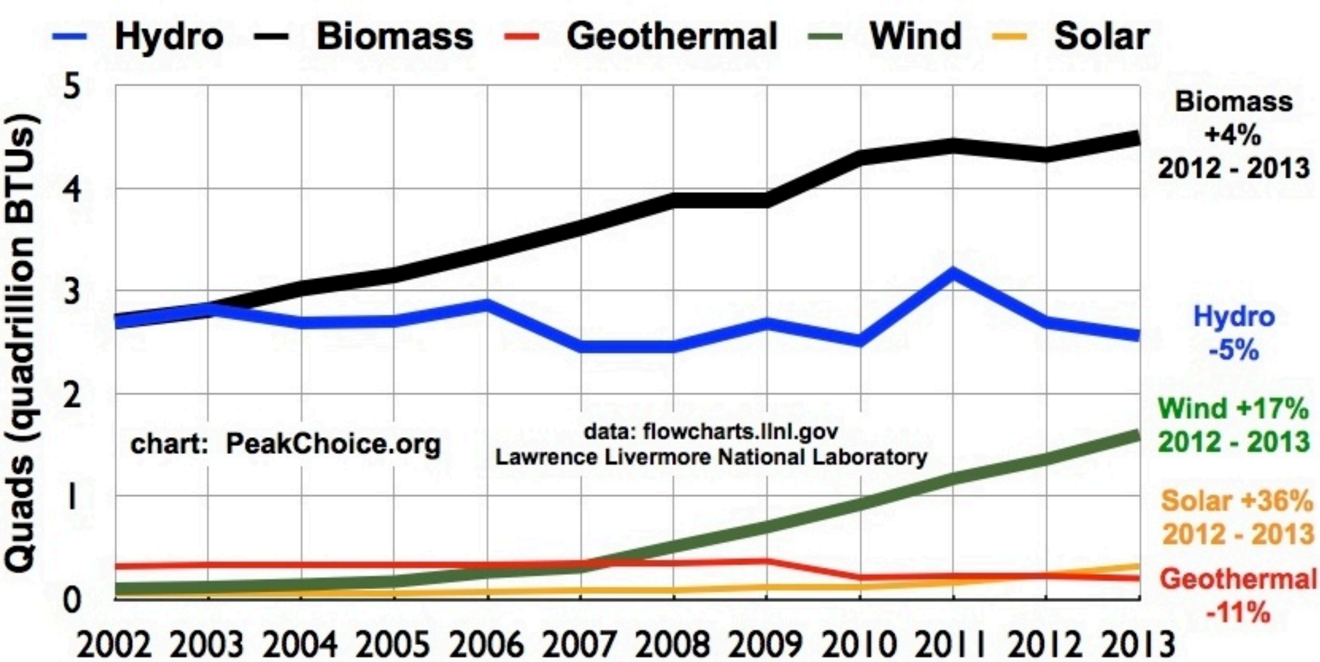
USA: fossil fuels and nuclear





power grids:
West, Texas, East, Quebec

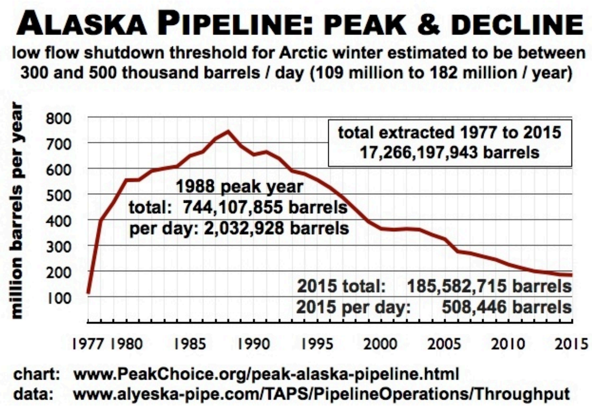
USA: “renewables”



OREGON OIL TRAINS AND THE END OF THE ALASKA PIPELINE

Oil trains into Oregon and Washington are supposedly to export oil to Asia. But a different motive is more likely in the long run: Cascadia's oil supply mostly comes from the Alaska Pipeline, which had two million barrels a day in 1988 and in 2016 has dropped below a half million a day.

Oil trains are likely our "Plan B" when the Alaska Pipeline shuts down due to low flow.



"Approximately 90 percent of Washington's current supply of crude oil comes from Alaska's North Slope oil fields. Five refineries in the Puget Sound area distribute refined petroleum products to Washington and adjacent states. Oregon imports 100 percent of its petroleum, approximately 90 percent of it from Washington refineries. Both states' future supply of petroleum is largely dependent on domestic production and reserves. Oil production from the North Slope peaked in 1988 and is projected to continue declining."

— Columbia River Crossing Final Environmental Impact Statement, September 2011

Boom and Bust

The oil fracking boom in Texas and North Dakota was impressive (and toxic). It boosted US production almost back to the levels of the 1970 domestic oil peak. This led to delusional claims the US would become energy independent and a net exporter of petroleum. In reality, fracked wells deplete faster than conventional wells, are much more expensive, and require huge energy inputs. **We are scraping the bottom of the oil barrel.**

The 1972 Limits to Growth study predicted peak pollution would follow peak resources. Tar sands and fracking confirm this.

What the Frack?

Texas oil peaked in 1972 and a decade ago had declined to a quarter of that. Fracking has pushed it back up to 1972 levels but fracking is peaking and production levels are dropping again.

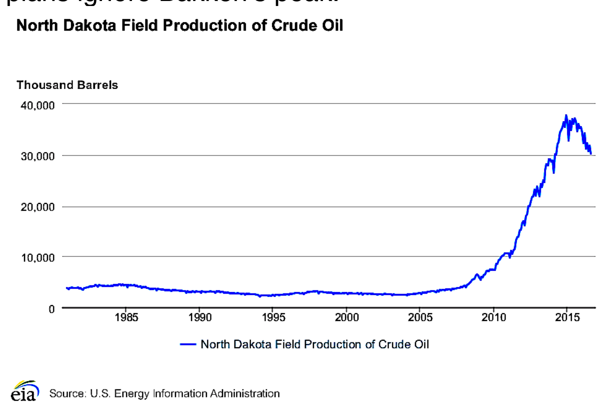
Half of USA "natural" gas is now from fracking, which heats cold cities and fuels part of the electric power grids. Without fracking, Obama would only have lasted one term, since **tar sands and fracking for gas and oil delayed rationing.**

As depletion becomes more obvious, the economic impacts are likely to be extremely profound. Our society is unprepared for the downslope in terms of logistics or psychology.

Fracking should be banned but this would have an enormous cost, which is why a ban probably won't happen before depletion.

Fracken' Bakken

North Dakota is now the second largest oil state, after Texas, and double Alaska's production. That increase has also reversed. Oil train export plans ignore Bakken's peak.



December 2014: 37,845 thousand barrels (peak)
August 2016: 30,216 thousand barrels

THE FIVE STAGES OF PEAK ACCEPTANCE

- **Peak Denial and Plausible Deniability**
- **Pique: Anger and Peak Blame**
- **Peak Bargaining: techno-fixes and the promised land after oil**
- **PTSD: Peak Trauma Stress Disorder**
- **Peak Acceptance: Nature's limits**

www.postcarbon.org/bakken-reality-check/
Post Carbon Institute report:
North Dakota fracked oil has peaked

Exaggerated estimates: fracked oil in California downsized more than 99%

The oil industry claimed fracking California's "Monterey Shale" could extract **15 billion barrels**, two years of US combustion. This could pose severe threats to water quality in drought zones, but the other half of the story is the oil is not there.

Post Carbon Institute looked at the geological evidence — these estimates were exaggerated.

In 2014, the Energy Information Administration conceded the estimates were wrong and downsized estimates to **600 million barrels.**

In 2015, the US Geological Survey further downsized the estimate to 21 million barrels.

Our Solar Budget on a Finite Planet

The main thing this writer has learned from using solar panels since 1990 is they are great but cannot replace our overuse of concentrated fossil fuels. Living on our solar budget will power a smaller, steady state economy — not one based on endless growth on a finite planet. This limitation is due to physics, not politics.

We use fossil fuels because they are more concentrated and easier to use than sunlight and wind. It would be nice to have simple replacements for this stored energy, but our growth based economy requires ever increasing use of stuff.

Now that the easy to extract fossil fuels are in decline, replaced by difficult to extract energy, our economy is having increased difficulty sustaining continued growth. Economic impacts of energy decline are leading to increased instability, with social chaos on top of ecological damage.

Moving beyond fossil fuels is not about electric cars, but relocalizing food production. Solar panels do not power long distance food shipments.

Breeding plant varieties for changing climates will probably be the most important adaptation. A potential antidote to climate denial is under-standing peak energy, since our choice is not to use less fossil fuel but how we cope with having less of it, whether wanted or not. This would require moving beyond peak denial, which is more popular than climate denial.

Nature is abundant but not infinite. Solar panels cannot power endless growth of consumerism. As resources deplete, relocalizing food production and community cooperation will be more important than failed political strategies.

Peak Energy and Peak Blame

Financial hardships lead to demagogues — the classic example is 1930s Germany. Trump's alleged electoral win suggests the blaming likely to happen as energy depletion contracts the economy.

My guess is the elites letting Team Trump rig the election with faith based voting machines and blocking minorities from voting means the fracking crash is going to happen faster than our rulers expected, he will be able to implement nastiness in response and take the blame for the economic impact. Never Trumpers may be hoping to say they were against what the new President did, while continuing to keep the new policies after he leaves the White House to go back to Trump Tower, just as the two parties kept the surveillance state Bush the Lesser presided over after he left office less popular than Richard Nixon after Watergate.

I fear the "stop drilling" environmentalists will get the blame for the oil shortages. **Energy literacy about depletion and widespread permaculture relocation / transition town logistics could be the antidote to denial and scapegoating, but that would require recognizing limits to growth on a finite planet, which conflicts with a monetary system based on the cancer-like paradigm of endless growth.**

— Mark Robinowitz, PeakChoice.org

PEAK CHOICE
Cooperation or Collapse
An Uncensored Guide: Earth • Energy • Money

FRACTAL PERMACULTURE

local ❄ bioregional ⊕ global