

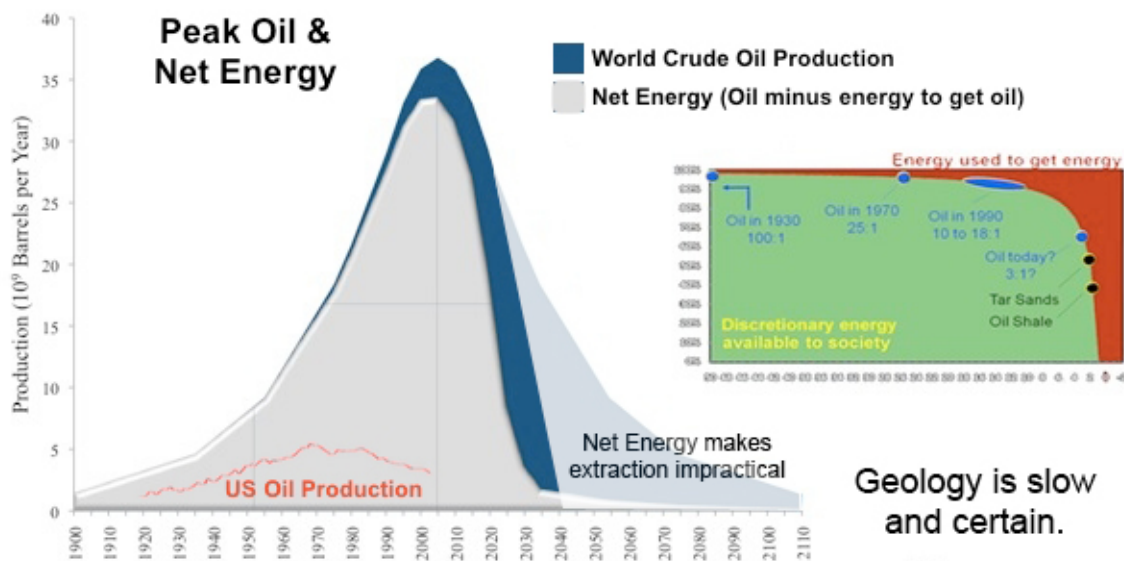
## 10x: A Transportation and Power Infrastructure Economic Boom

CSX Railroad commercials note “Our trains [move a ton of freight 423 miles on one gallon of fuel.](#)” Yet, in cities, we move a person and light cargo about 97 times less efficiently. 10x, ten times better efficiency in urban transportation is practical if government returns transportation and power infrastructures to free markets governed by performance standards.

Railroads are commercial networks governed by performance standards, managed for profits. Highway networks are centrally planned by governments and made oil the lifeblood of our economy; created civilization killers of Peak Oil, Climate Change, debt, wars and oil's Potato Famine potential (monolithic dependence on an energy source 65% outside our ability to control). [Joint Forces Commands' JOE-2010](#) warning to all US military commands:

*"By 2012, surplus oil production capacity could entirely disappear, and as early as 2015, the shortfall in output could reach nearly 10 million barrels per day."*

A two hundred year view of oil shows oil is a finite resource; life based on oil is finite.



Oil is finite, ingenuity is unlimited. Performance standards can change the lifeblood of our economy from oil to ingenuity in real time. In 1984 communications networks switched from centrally planned to free markets. In 15 years, analog networks, protected from competition for a century, were displaced by digital networks. Returning power and transport networks to free markets, granting rights of way based on performance standards, will change the lifeblood of our economy from oil to ingenuity, creating millions of jobs and providing better service at lower costs as competitors strive to convert 97 times less efficient into profits.

This paper outlines:

- 10x, the target of performance standards.
- 10x example.
- Proposed performance standards for achieving 10x.
- History of stagnation, central planning.
- List metrics for achieving 10x.
- Self-reliance, changing the lifeblood of our economy from oil to ingenuity

### **10x, the threshold for a paradigm shift**

In 1865 it cost \$1,000 to travel from New York to San Francisco. Just 5 years later, in 1869, the cost dropped to \$67, a greater than 10x cost reduction. Between 1850 and 1950 railroads were the catalyst for building of America's manufacturing base and the shift in energy systems from biofuels to fossil fuels.

Millions of jobs, vast innovation, better service at lower costs resulted from 10x shifts in communications since 1984. In 1984 communications infrastructure management shifted from centrally planned under government managed monopoly to free markets governed by Performance Standards.

### **10x example**

In [1975 a Personal Rapid Transit](#) (PRT) network opened in Morgantown, WV as a solution to the 1973 Oil Embargo. It has since delivered 110 million injury-free, oil-free passenger miles. In that same period of time centrally planned highway networks have killed 1.3 million Americans with about 5 million injuries per year. This greater than 10x improvement in safety can extend to all costs. Using JPods version of PRT, people and cargo are chauffeured non-stop from origin to destination at about 4 cents per vehicle-mile. Cars cost about 56 cents per vehicle mile.

Efficiency is sufficient that solar collectors mounted over the rails gather 5,000 to 30,000 vehicle-miles of power per mile of rail per day. Electricity can be used as a transportation fuel. In the urban niche, the distributed nature of the transportation network can be used to gather distributed solar resources.

[Between 1850 and 1950](#) railroads were the catalyst for changing energy systems. Once transportation and power infrastructures are returned to free markets governed by performance standards, once



customers make the choice of network, there will be an economic boom, American manufacturing will re-tool to fill demand and the energy system will shift from fossil fuels to solar for at least the urban market.

### **Performance Standards**

The re-tooling of communications infrastructure since 1984 has been dramatic. Millions of jobs were created, innovations inconceivable in 1984 continue to unfold, manufacturing of electronics has boomed.

Companies competing for customers in free markets must differentiate themselves from their competitors. Innovation, quality, service, speed and other factors aid in defining differences between competitors. By adopting performance standards, competitors and customers have a loose framework where resources from diverse companies combine and customers can quantify value. When a better "know-what" emerges to fit changing needs, customers want change and competitors scramble to find a fit within new performance standards.

Institutions in free and centrally planned markets strive for consistency, to improve "know-how", to get better at what they do above all other objectives. In free markets, companies that are too locked into improving their "know-how" and fail to adapt to changes in customer wants fail and are displaced. Society benefits from this "creative destruction" as performance standards define options so people can choose what best meets their needs and wants. Markets nimbly adapt.

Specific Performance Standards recommended for re-tooling transportation and power are:

- Privately fund innovation. This drives the hunt for 10x benefits. Customers will not re-tool their buying patterns unless there are 10x benefits. The railroads were built with private capital, then supported with government backed bonds once they went into profitable service that achieved public policy objectives. The same is true for the Internet.
- As appropriate, use the government's balance sheet back bonds that refinance profitably operating infrastructure that achieves public policy objectives. This allows private risk capital to be recycled to build more infrastructure.
- Set Performance Standards so they can be incrementally displaced by the next leap in performance standards.
- As a starting point, granting access to rights of way for alternative transportation networks that exceed 112 passenger miles per gallon.
- Regulate alternative transportation networks using the ASTMs and associated theme park regulations. Government Departments of Transportation are institutions that strive for consistency; innovation is a consistency aberration. Since 1950, DOT's caused the loss of thousands of miles of railroads by subsidizing highways and oil, removing efficiency as a market force. The theme park industry has a strong record of safety and innovation. The theme park insurance industry is well established to enforce safety that exceeds that of highways by about 12,000 times.

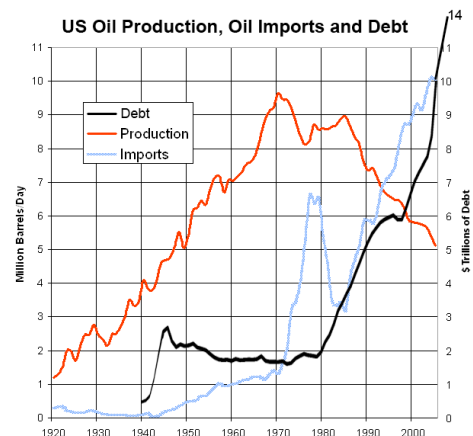
### ***History of stagnation, central planning***

The US Constitution limits government institutions ([Article X, Bill of Rights](#)) so they insure liberty floats outside the "know-how," the "creative destruction" of religions, free speech and free markets. Government institutions are to be limited to regulating commerce so all costs are capitalized, so those benefiting from an activity, fully pay for that activity; preventing socialized costs that benefit an elite and the expense of the general welfare.

It was very fortunate that the Bill of Rights was not part of the Constitution. The [Federalist](#) and [Anti-Federalist](#) Papers provide deep insight into balancing the need for government while usually limiting it abuse by malace and/or misplaced good intent. The Articles of Confederation proved to week. The Civil War was required constrain the power of states. This paper is about the problems created by the Federal Government encroaching, applying its institutions ever more deeply into commerce. As a metric,

Unfortunately, mobilizing to fight World War I the Federal government initiated a process that expanded control of the means of production, monopolizing/socializing communications, power and transportation infrastructures as "natural monopolies." The great innovations of Ford, Edison, Bell and the Wright Brothers were institutionalized resulting in a century of improved "know-how" while stifling improved "know-what:"

- A century of rotary telephones and analog telephone lines (until 1984).
- Climate Change: Socializing the cost of disposing of fossil fuel waste.
- War: Socializing the cost of defending oil supply lines.
- Debt: Socializing many of the costs of using oil. Expanding size of government to manage transportation and power, taking away free market jobs and obligate debt and unfunded liabilities to the taxpayers.



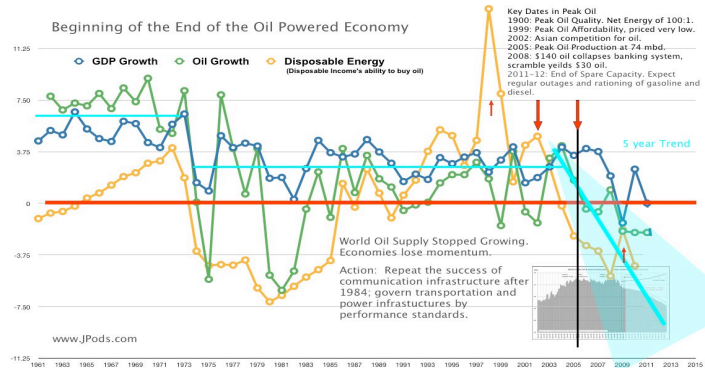
- Oil's Potato Famine potential: socializing the cost of weakening American self-reliance with oil addiction:
  - Monolithic dependence on a source of energy 65% outside our control.
  - Depriving future generations of potential energy and critical materials.
  - [Net Energy. economically affordable oil will decrease about 80% in the next 20 years.](#)

### Metrics for achieving 10x

What gets measured, gets done. Metrics that structure performance standards are:

- Disposable Energy: Life requires energy. Less affordable energy, less life. More efficient use of energy, more life. Disposable Energy is peoples disposable income's ability to buy energy.

The following graph is a 50 year comparison of [Economic Growth](#) (blue) to [Oil Supply Growth](#) (green) to [Disposable Energy](#) (gold). Housing foreclosures, \$13 trillion in falling property values, collapse of the banking system in 2008 are highly correlated with decreasing Disposable Energy.



- Economic Work: Economic work is what is accomplished per unit energy consumed. The following [chart is DOT's comparison of passenger miles per gallon](#) with Performance Standard and JPods networks added. Multiple units are added. FTR is a ratio relative to the efficiency of a freight train moving a ton of cargo:

Mode	Energy Use per passenger mile			Mileage by Mode by Fuel Type			
	Load	Whr/km	FTR	Gas mpg	km/liter	Diesel m	km/liter
Demand response, taxi	1	2613	396	8	4	10	4
Bus, Transit	8.8	774	117	27	14	33	14
Personal trucks	1.72	721	109	29	15	35	15
Cars	1.57	642	97	33	17	40	17
Air, domestic	96.2	596	90	35	18	43	18
Rail, Commuter	31.3	547	83	38	20	46	20
Rail, Transit (light & heavy)	22.5	509	77	41	21	50	21
Rail, Amtrak	20.5	484	73	43	22	52	22
Motorcycles	1.2	339	51	62	32	75	32
Vanpool	6.1	242	37	87	45	105	45
Performance Standard 1	1.57	186	28	112	48	136	58
JPods	1.57	79	12	264	112	321	136

- [Net Energy](#): Ratio of economically useful energy relative to the energy required to get energy. The higher the ratio, the more potent the energy source. Net Energy is like take-home pay, you can earn \$50 an hour but if you have to pay \$40 an hour in taxes it is not worth as much as at \$20 an hour job with \$5 an hour in taxes. Happiness is not about how much you make, it is about how much you keep:
  - Oil in 1910 was about 100:1 and has depleted to about 10:1. We get about 10 useful barrels of oil for every barrel consumed to get those 10 barrels.
  - Wind is about 25:1. All costs are up front, but great take-home pay.

- Solar is about 20:1. All costs are up front, but great take-home pay.
- Oil sand is about 3:1.
- Oil shale is less than 3:1
- Biofuels are about 1.2:1
- Electricity is about .3:1 (electricity is a carrier, about 70% of energy required to produce electricity is lost before being useful).
- Hydrogen is about .3:1 (hydrogen is a carrier, that consumes about 70% of the round trip from primary energy source, to hydrogen to useful power).

Despite that it is easy to measure Net Energy, emotions, not logic dominates the treatment of energy sources.

- Biofuels receive billions of dollars in subsidies even though it takes about a gallon of fossil fuels to make a gallon of ethanol. Without government mandates, no customers would buy ethanol. Biofuel is like trying to make the sun useful by shoving it through a corn cob.
- Oil sands and oil shale are grouped with conventional oil despite the fact they have radically less Net Energy.
- Solar and wind are discounted as unusable by energy experts. Solar does not support central planners notions of energy. Solar is like the Internet, cell phones, Google and Facebook, a distributed system. The sun has a long history of supporting life on Earth. American liberty and self-reliance were founded under a solar budget. The US economy was absolutely solar powered until 1850 and fundamentally solar powered until about 1950. About 90% of the oil used in all human history has been used since 1950. The Net Energy of solar and wind underscore Thomas Edison's 1910 and 1934 observations:

- 1910 ([full quote](#)): *"Sunshine is spread out thin and so is electricity. Perhaps they are the same, Sunshine is a form of energy, and the winds and the tides are manifestations of energy."*

*"Do we use them? Oh, no! We burn up wood and coal, as renters burn up the front fence for fuel. We live like squatters, not as if we owned the property."*

*"There must surely come a time when heat and power will be stored in unlimited quantities in every community, all gathered by natural forces. Electricity ought to be as cheap as oxygen...."*

- 1934: *"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait 'til oil and coal run out before we tackle that."*

### ***Self-reliance, changing the lifeblood of our economy from oil to ingenuity***

Self-reliance is the solution. Oil's limitations cannot be fixed by conserving, electric cars, high speed trains or the use of any of the artifacts of the oil-powered economy. [Electric cars have a larger carbon-footprint than diesel cars; electric trains use more energy per passenger mile than airplanes.](#) Biofuels burn food in cars at less than 1% efficiency. Government management of the means of production directs billions of dollars to produce without solving the problem. They mandate products that few customers would buy.

To innovators waste is potential profits that can be recovered by delighting customers by preempting waste. As waste is recovered as profits, the causes of civilization killers are preempted. There are amazing profits in powering transportation within a solar budget.

It normally requires 100 years to transition a major infrastructure, we have to make the transition by 2020 to something unknown. We have faced this challenge before. Here is a quote from Thomas Paine's [Common Sense](#) with oil being substituted for Great Britain:

*The authority of Great Britain (oil) over this continent, is a form of government (energy), which sooner or later must have an end: And a serious mind can draw no true pleasure by looking forward, under the painful and positive conviction that what he calls "the present constitution" is merely temporary. As parents, we can have no joy, knowing that this government (oil) is not sufficiently lasting to ensure any thing which we may bequeath to posterity: And by a plain method of argument, as we are running the next generation into debt, we ought to do the work of it, otherwise we use them meanly and pitifully.*

[A child born today has a \\$46,000+ share of the National Debt](#) and a million dollar obligation to unfunded liabilities. Continued dependence on oil passes the burden of innovating to our children as we deplete the energy to make the transition.

[Performance Standards](#), granting rights of way to privately funded transportation networks that exceed 112 passenger miles per gallon does not solve our current problem. Performance Standards simply permit innovators to innovate.

Unleashed, innovators will create choices and people to choose from those choices what meets their needs, driving innovators to refine, and extend choices. Adapting becomes nimble. Like communications since 1984, the reality of the change will far exceed what was planned. We can be self-reliant, change the lifeblood of our economy from oil to ingenuity.