

Energy at a Crossroads: The Generational Change of Guard



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The Future?

The twentieth century saw unprecedented growth in population, energy consumption, and food production.

The twenty-first century ushered in an era of declines, in a number of crucial parameters:

- Global oil, natural gas, and coal extraction
- Yearly grain harvests
- Climate stability
- Population
- Economic growth
- Fresh water
- Minerals and ores, such as copper and platinum

A Premise

- ❑ The U.S. is a petroleum based economy dependent on cheap, abundant sources of petroleum products to continue society as we know it today.
- ❑ We place a heavy dependence on technology to provide solutions.
- ❑ Our debt is financed by foreign investors and is used to pay for increasingly expensive imports.
- ❑ Our population is less educated (skill sets, human capital capabilities), therefore, less flexible, less adaptive to rapid change.

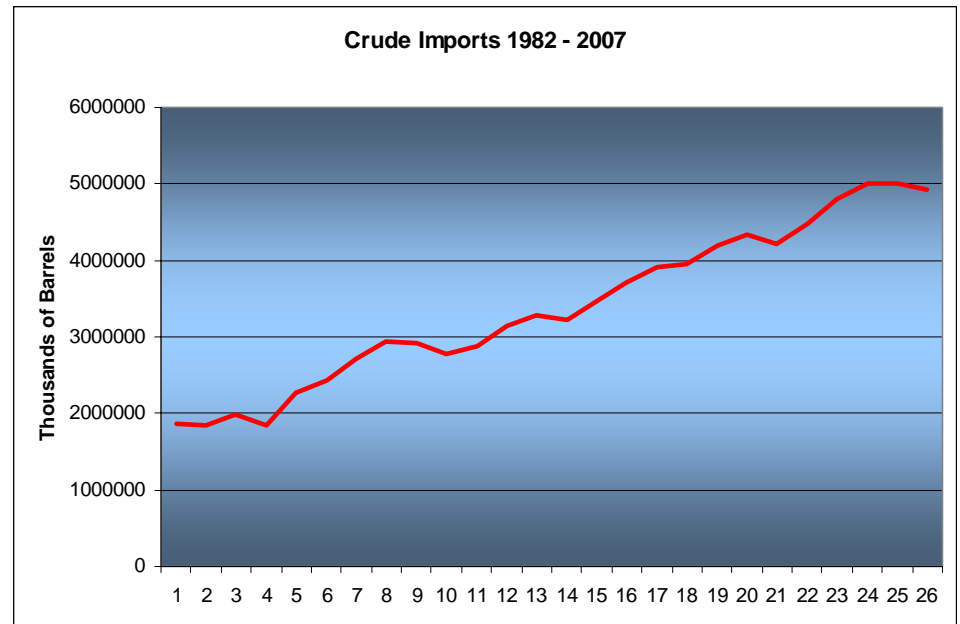
What does the future hold?

We are faced with:

Aging infrastructure – highly dependent on foreign sources of raw materials and finished products;

Aging workforce;

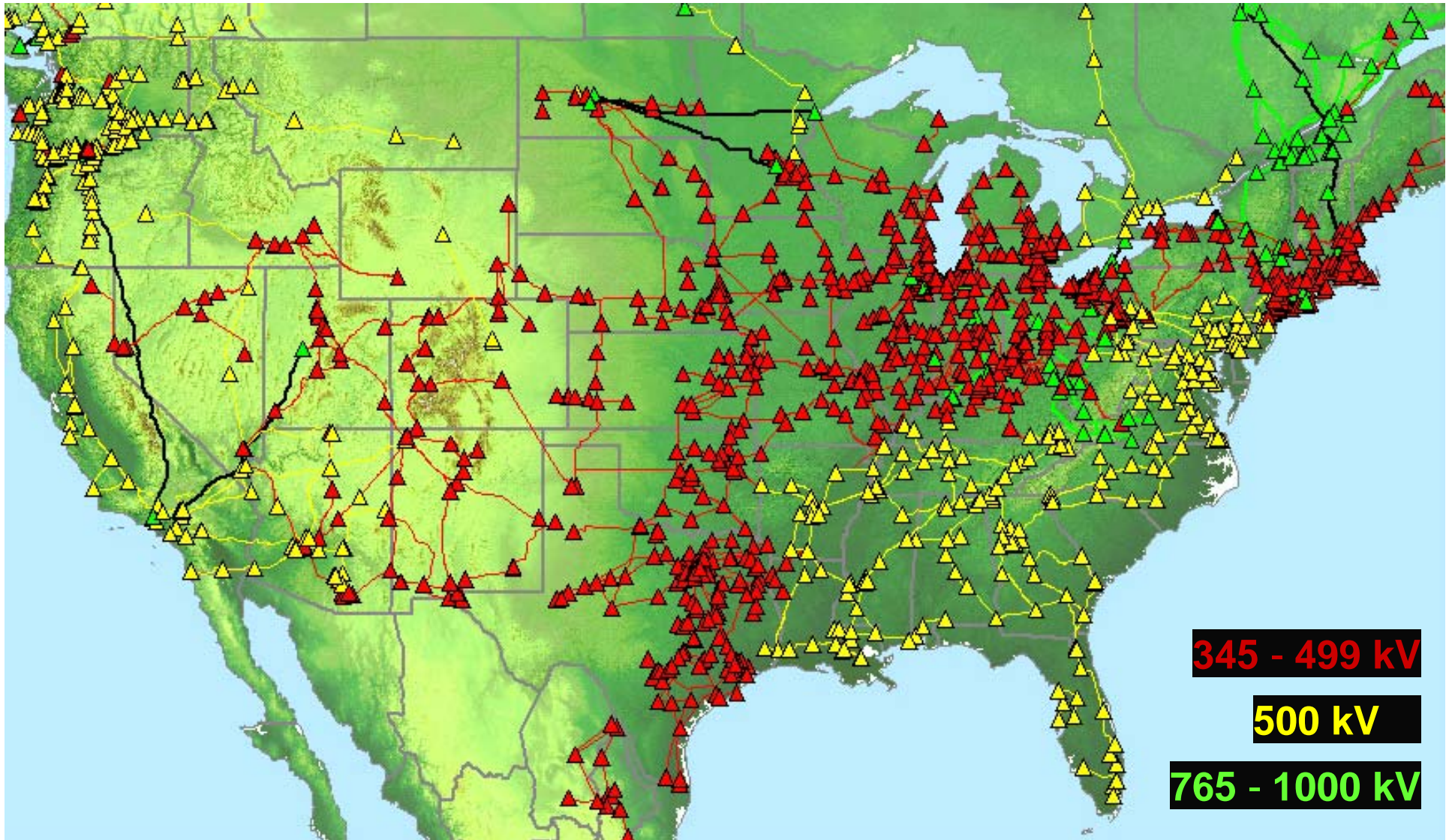
Slow uptake on alternatives;



Increasing demand from growing markets for the resources that we have traditionally viewed as an extension of our domestic supply.

Aging infrastructure

UNCLASSIFIED



UNCLASSIFIED

Aging infrastructure

Once upon a time built in America

Originally built in America it has sustained the United States for over a century:

- ❑ Now we are heavily dependent on foreign manufacturers to produce the products once made domestically in order to keep it running
- ❑ No Nuclear Plants since the 1970's
- ❑ No New Refineries since Garyville, Louisiana, 1976
- ❑ Increasingly “single point of failure” vulnerability
- ❑ Long lead times to repair/replace

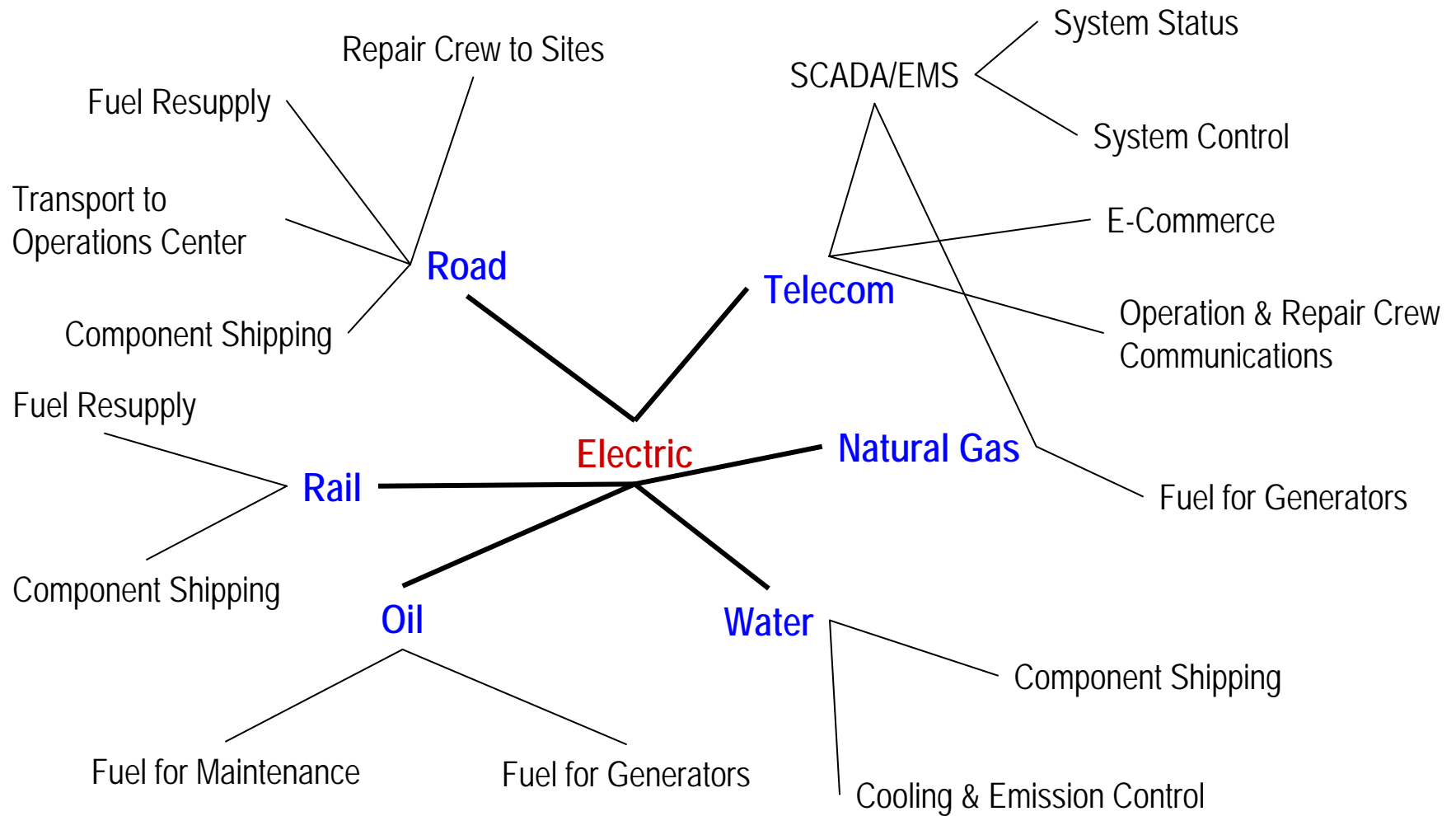
Vulnerabilities of the US Grid Identified

“Structural vulnerability of the North American power grid”

- ❑ 14,000+ ‘nodes’ (generators, transmission substations, distribution substations)
- ❑ 19,000+ ‘edges’ corresponding to the high-voltage transmission lines that carry power between the nodes
- ❑ According to the model a loss of only 4% of the 10,287 transmission substations results in a 60% loss of connectivity
- ❑ During a cascading failure, the loss of only 2% of the nodes causes a catastrophic failure of the entire system

Source: Reka Albert

Critical Infrastructure – Single Point of Failure



Foreign Sources

Once upon a time just augmenting America

America used to export to the world, now it depends on the world for larger and larger percentages of the products it consumes:

- ❑ Net imports of crude oil in 2007 accounted for 58% of U.S. total and steadily increases
- ❑ U.S. production declining since the 1970's
- ❑ Critical components of the electric grid are built overseas (transformers, electronic components, etc.)
- ❑ Increasingly vulnerability to supply disruption

Crude Oil Imports (Top 15 Countries)

CANADA
SAUDI ARABIA
MEXICO
VENEZUELA
NIGERIA

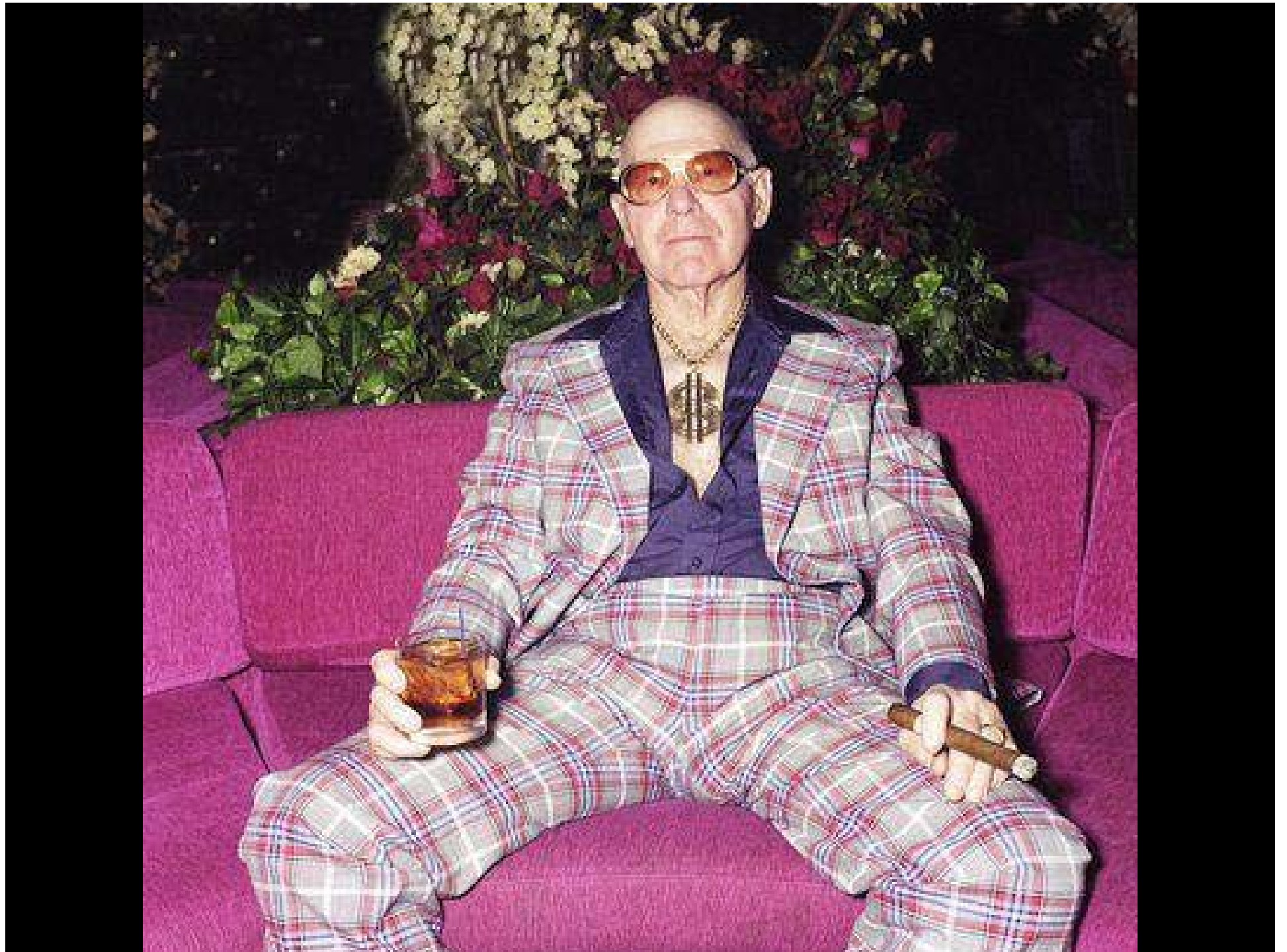
The top five exporting countries accounted for 65% of United States crude oil imports in June 2008.

IRAQ
ANGOLA
BRAZIL
ALGERIA
RUSSIA

The top ten sources accounted for approximately 86% of all U.S. crude oil imports in June 2008.

KUWAIT
ECUADOR
COLOMBIA
CHAD
LIBYA

Total crude oil imports averaged 9.994 million barrels per day in June 2008.



Aging Workforce

Once upon a time the best of class

America used to lead the world in education, now it depends on the world for larger and larger percentages of key skill sets to keep operating:

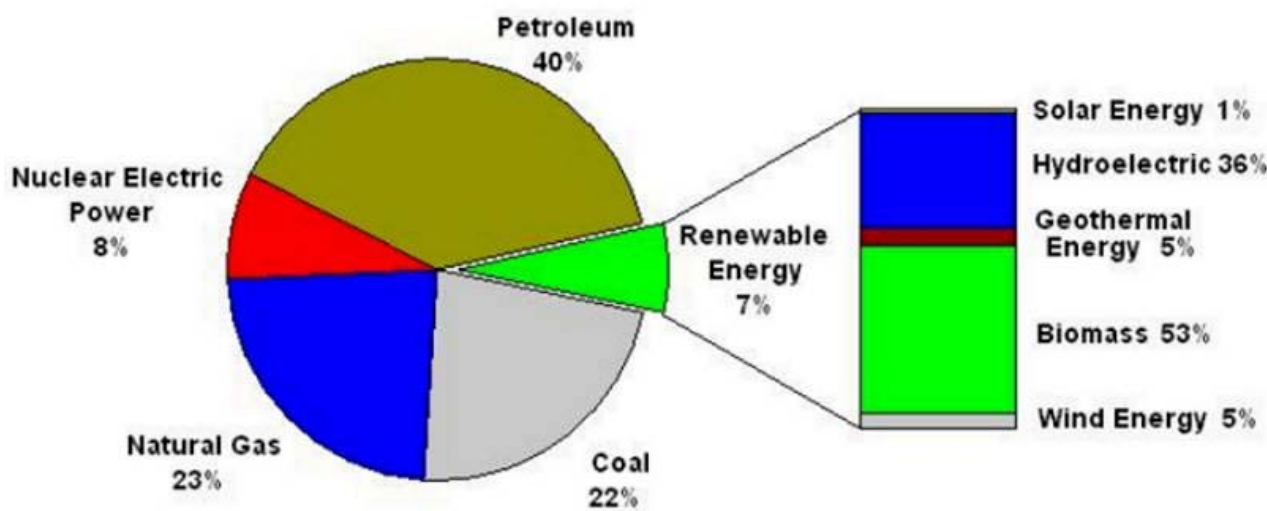
- ❑ In 3 or 4 years, there's expected to be a 30 to 40% shortage of technical and professional oil workers in the U.S., according to Damon Beyer of Katzenbach Partners, a Houston-based management consultancy. As much as 80% of the workforce will be eligible for retirement in the next decade.
- ❑ In the next 5 years, just as the nuclear industry hopes to launch a renaissance, up to 19,600 nuclear workers – 35% of the workforce – will reach retirement age.
- ❑ The top 25 oil companies in the industry have shed more than one million employees since 1982.
- ❑ According to the US Bureau of Labor Statistics, more than 25% of the working population will reach retirement age by 2010, resulting in a potential worker shortage of nearly 10 million.



BIOFUELS POWER CORPORATION

Total = 101.605 Quadrillion

Total = 6.830 Quadrillion Btu



Alternatives

Addicted to what once was?

America has been slow to embrace alternatives to fossil fuels; yet continues to create rhetoric that serves to confuse and mislead:

- ❑ ***Perception*** – Biofuels are not economically viable as a substitute for petroleum.

Reality – Biofuels offer a competitive alternative to petroleum.

- ❑ ***Perception*** – Biofuel crops will crowd out food crops.

Reality – Agricultural productivity – technology & petroleum dependency.

There are alternatives to the use of crops to create Biofuels.

- ❑ ***Perception*** – The ***Pickens Plan*** is a bridge to the future – a blueprint to reduce foreign oil (wind, solar power). Natural gas and biofuels are the only domestic energy sources used for transportation.

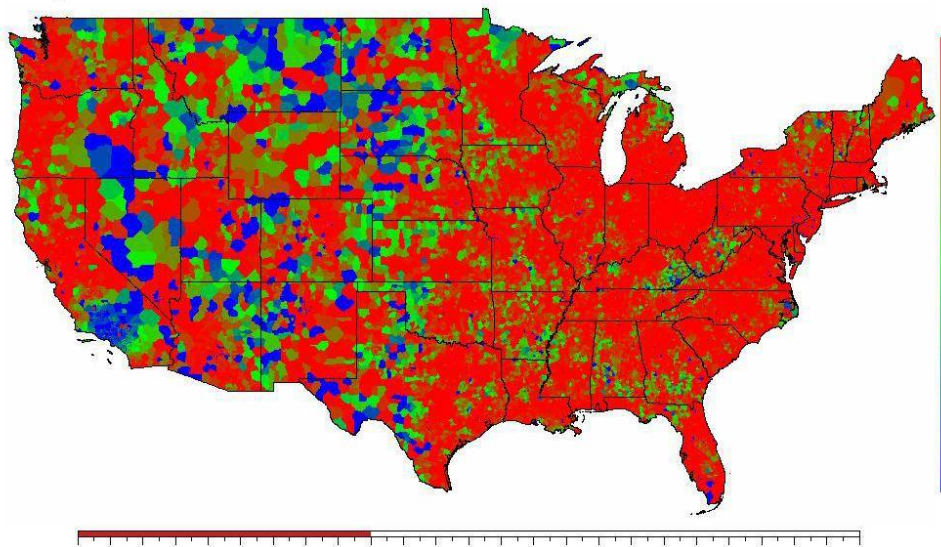
Reality – Predicated on massive investments in technology

- ❑ ***Perception*** – Government mandates and subsidies provide the necessary foundation for the development of the Biofuel industry.

Reality – Unintended consequences of government action.



Day 90



No National Plan

Just too complex and too complicated?

Premise for Collapse:

- ❑ America has no single point for coordination of a national plan to address energy sector needs. Federal, State and Local mandates serve to confuse and mislead.

- ❑ Unintended consequences result from solutions to problems that create more severe problems than those that they attempt to solve.
 - ❑ Economy dependent on cheap, abundant fuel – oil, natural gas, coal.
 - ❑ Production fails to meet maintenance requirements for existing capital.
 - ❑ Heavy dependence on foreign investment to finance the purchase of imported oil.
 - ❑ Denial – failure to address the problem. Long term investment strategy is to invest for the short term.
 - ❑ Technology fails to provide a solution.
 - ❑ Bankruptcy – economic collapse, price bubbles – real estate, stock, etc.
 - ❑ Petroleum based economy – large scale changes may actually require too much energy to accomplish.

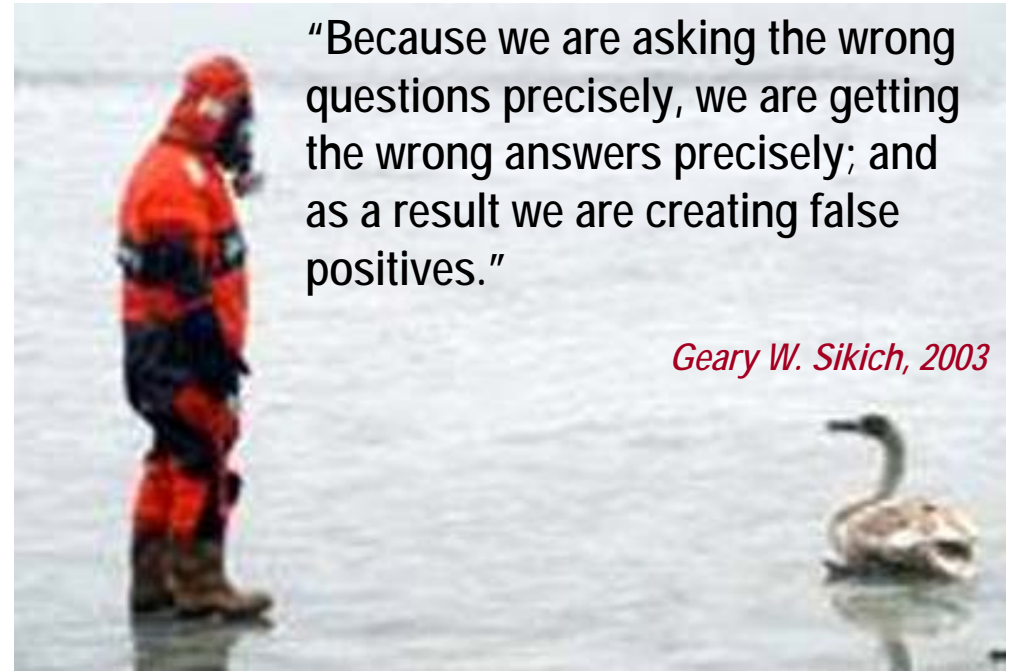
Do Your Research

What We Know
(**Facts**)

What We Think We Know
(**Assumptions**)

What We Do Not Know
(**Speculation**)

What We Do Not Know that We Do Not Know
(**Unknown Unknownables**)



“Because we are asking the wrong questions precisely, we are getting the wrong answers precisely; and as a result we are creating false positives.”

Geary W. Sikich, 2003

Black Swans, Randomness, Preparedness

A black swan is a highly improbable event with three principal characteristics: it is unpredictable; it carries a massive impact; and, after the fact, we concoct an explanation that makes it appear less random, and more predictable, than it was.

Nassim Nicholas Taleb

The Black Swan: The Impact of the Highly Improbable



Stock exchange meltdown foils eager traders – 9/8/2008

A technical glitch brought share trading on the London Stock Exchange to a halt for seven hours yesterday, wiping out most of the trading day on what should have been one of the busiest sessions of the year.

Summary and Conclusions

Aging infrastructure – highly dependent on foreign sources of raw materials and finished products

- ❑ *Some improvement noted as a result of “crisis” events*

Aging workforce

- ❑ *Recognition does not resolve the problem*

Slow uptake on alternatives

- ❑ *No national plan*

Increasing demand – limited supply

- ❑ *Greater competition could result in chaotic markets*

Questions

The biggest single threat to business will be staying with a previously successful business model too long and not being able to adapt to the fluidity of situation.