



Renewable Energy – where to from here?

Aerospace Industry Committee
Museum of Aviation
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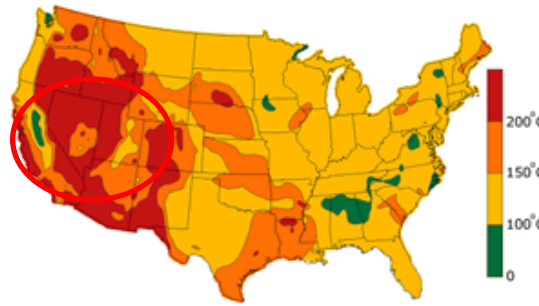
Overview

- A change in President a change in focus
- Military leads the way
- From liquid fuels to power and back again
- Where does solar fit in
- Quality of Life
- Opportunities and Challenges

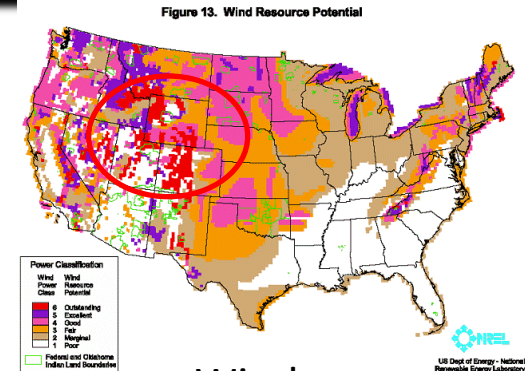
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Solar

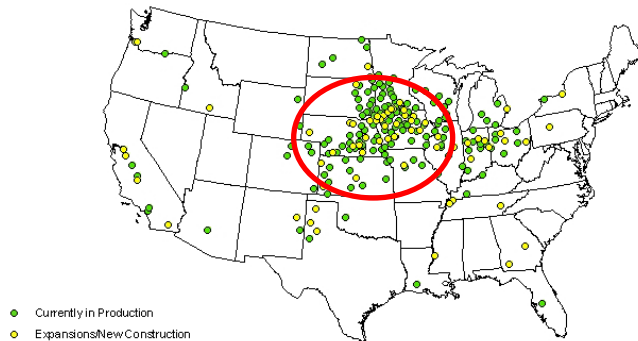


Geothermal

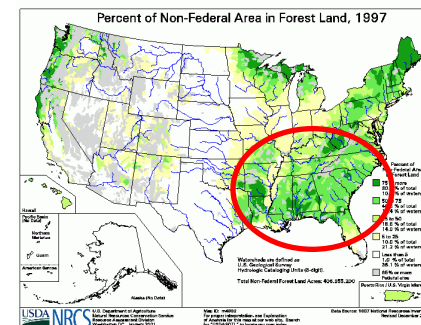


Wind

Not one market – but several each focused on a primary renewable energy source.
 Georgia has strategic advantages in biomass and abundant solar resource
 Biomass alone can produce heat, power, electricity and liquid fuels



Corn Ethanol



Biomass

- POP QUIZ
 - Q: Largest Energy User in the world
 - A: USA
 - Q: Largest Energy User in the USA
 - A: Military
 - Q: Largest Energy User in the Military
 - A: Air Force
 - Q: Largest Energy User in the Air Force
 - A: JP8 fuel for the aircraft

Military Leading the way – aggressive programs to reduce energy by 30% by 2015, consume 25% electricity from renewables reduce foreign oil reliance by 50% - all in existing laws and policies

Warner Robins – developing a 25-50 MW Biomass tri generation



- Successful Renewable Energy (Any) Industries require
 - Abundant, reliable feedstock with predictable future cost that you can control
 - Technology that works and is scalable
 - Bankers finance projects not scientists/engineers.
 - Do bankers understand the concept?
 - Cost effective end product that can eventually work unsubsidized
 - Established path to market

LESSON - Do not try and solve more than 2 issues at once



- A change in focus
 - Bush
 - National security
 - Develop Ethanol (and local oil and nuclear) to reduce reliance on imported oil
 - Obama
 - Efficiency and Jobs
 - Reduce consumption through weatherization and develop renewable electricity
 - Next President
 - Competitiveness
 - Energy for quality of life and global competitiveness

- Shifting Focus – one fuel

- 2007 Ethanol

- 2008 Electricity

- 2009 Export Pellets

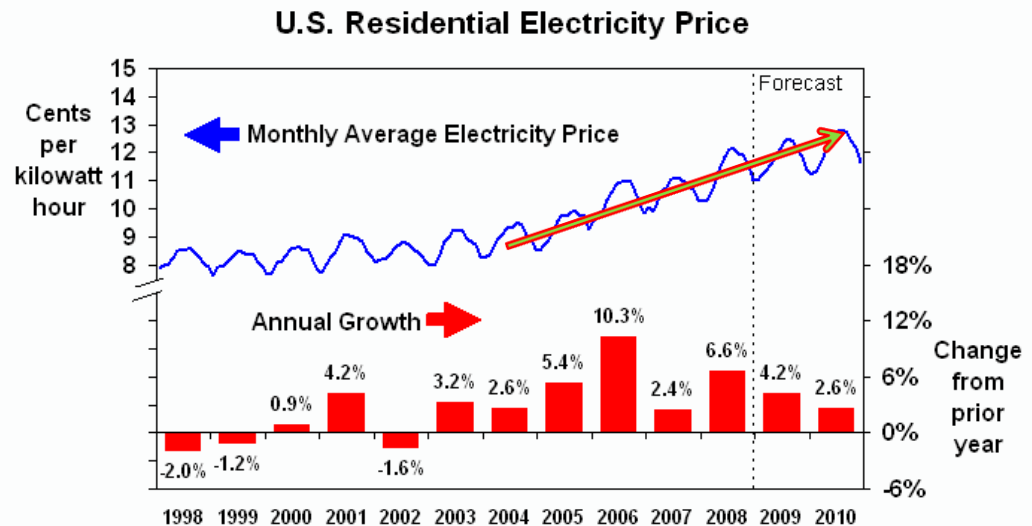
- 2010 Synthetic Diesel, DME other liquids

From liquid fuels to
power and back
again

Technology developments, (success/failures) , changing oil prices, shifting federal focus all driving change.

Solar PV Economics are being driven by:

- Predictable installed costs and yields
- 3% to 5% annual REDUCTIONS in installed costs
- 6% to 12% annual INCREASES in fossil/nuclear alternatives
- Incentives



Short-Term Energy Outlook, August 2009

Public policy driving renewables and increasing demand will continue to push traditional power costs upwards.



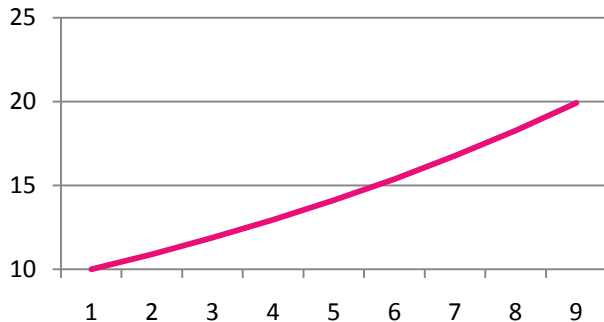
It all depends on the predicated escalation rate of traditional generation and the next best cost alternative in that region.

When will it work unsubsidized?

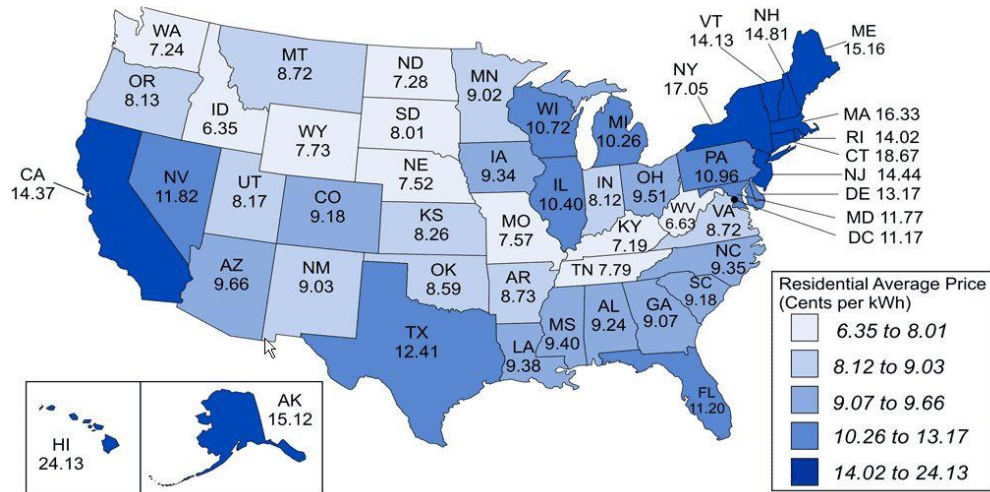
• Non Subsidized Production Costs in Sunny Regions

- 2 KW residential 36 - 79 cents kWh
- 50 kW commercial 26 - 57 cents kWh
- 500 kW Industrial 20 – 44 cents kWh

www.solarbuzz.com



The U.S. average residential retail price of electricity was 10.64 cents per kilowattour in 2007.



Source: Energy Information Administration, Form EIA-826, "Monthly Electric Sales and Revenue with State Distributions Report."

At 9% increase Industrial Solar will compete without subsidies with traditional generation in 9 years



- Incentives

- A complex patch work of Federal and State incentives, rebates, grants, accelerated depreciation, feed in tariffs and renewable portfolio standards for industrial, commercial and residential applications
 - Jobs, Environment, National Security, votes....
- In general Federal capital incentives of 30%
- Many State capital incentives of 30%
- Premium Purchase agreements

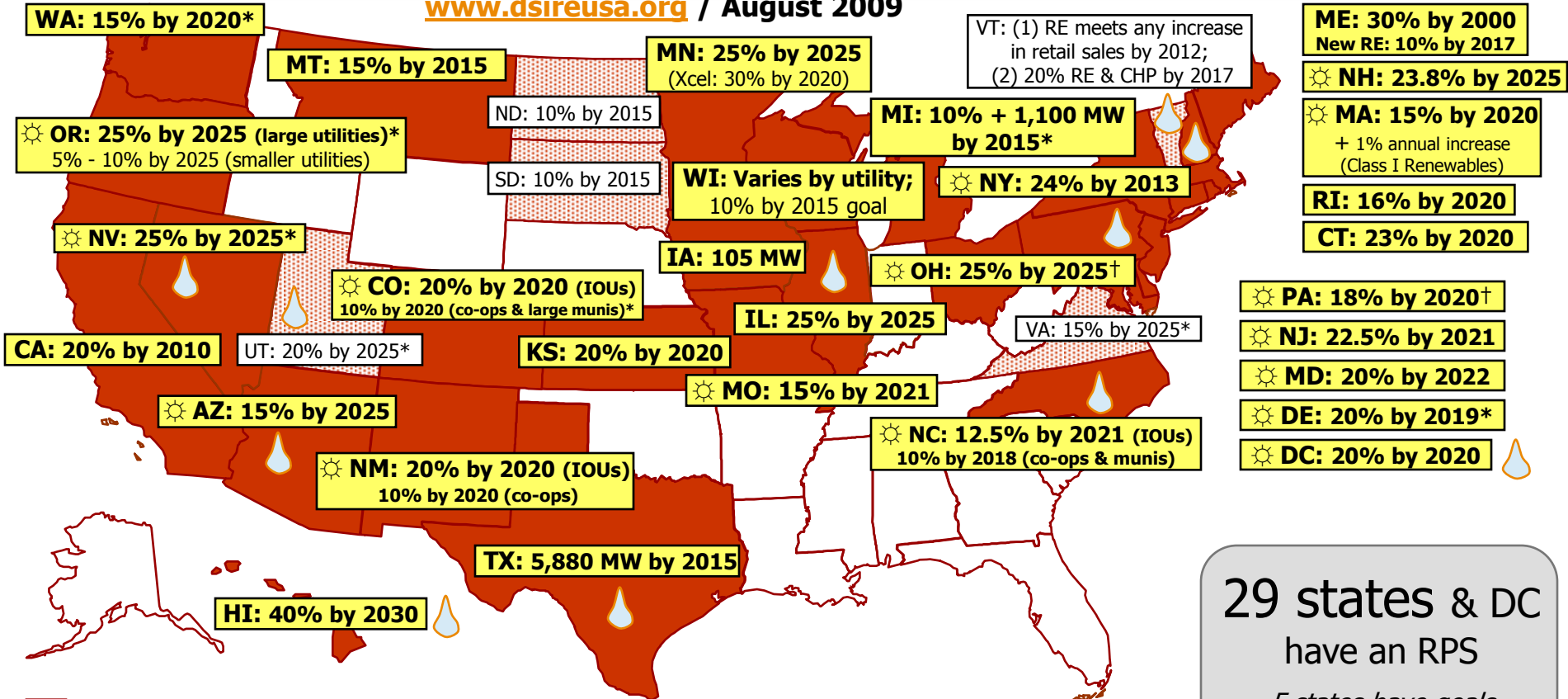
In aggregate they reduce actual costs produced that meet or are lower than current traditional generation and yields positive NPV's with IRR's of +10%

Renewable Portfolio Standards

Standards

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www.dsireusa.org / August 2009



29 states & DC
have an RPS
5 states have goals

- State renewable portfolio standard
- State renewable portfolio goal
- Solar water heating eligible

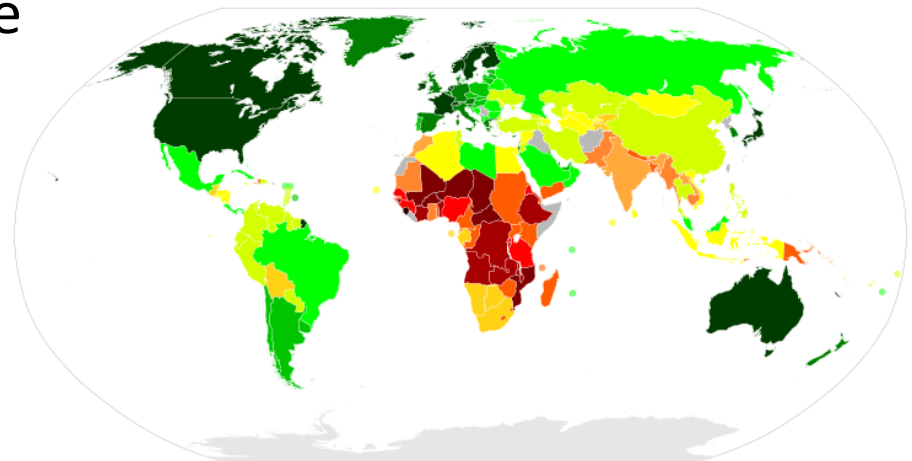
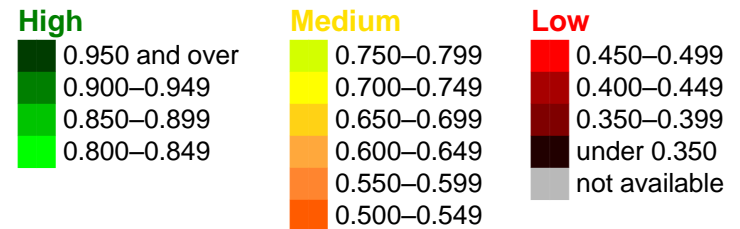
- ☀ Minimum solar or customer-sited requirement
- ✳ Extra credit for solar or customer-sited renewables
- † Includes separate tier of non-renewable alternative resources



- Quality of Life – different things to different people
 - Healthy, Wealthy and Happy?
 - 35 Hour Work week?
 - Able to shop at Wal-Mart at 3am on a Tuesday?
 - Based on house size?
 - Based on political system?

What could you give up and NOT have an impact on your quality of life?

- All Measures more or less information
 - The Economist – Quality of Life Index
 - 9 measures of economic, comfort, political, longevity, infant mortality..
 - Yale/London School of Economics – Human Development Index
 - Life Expectancy, Literacy, GDP
 - The Issue is not “who has the best quality of life” but rather “why do they vary?”

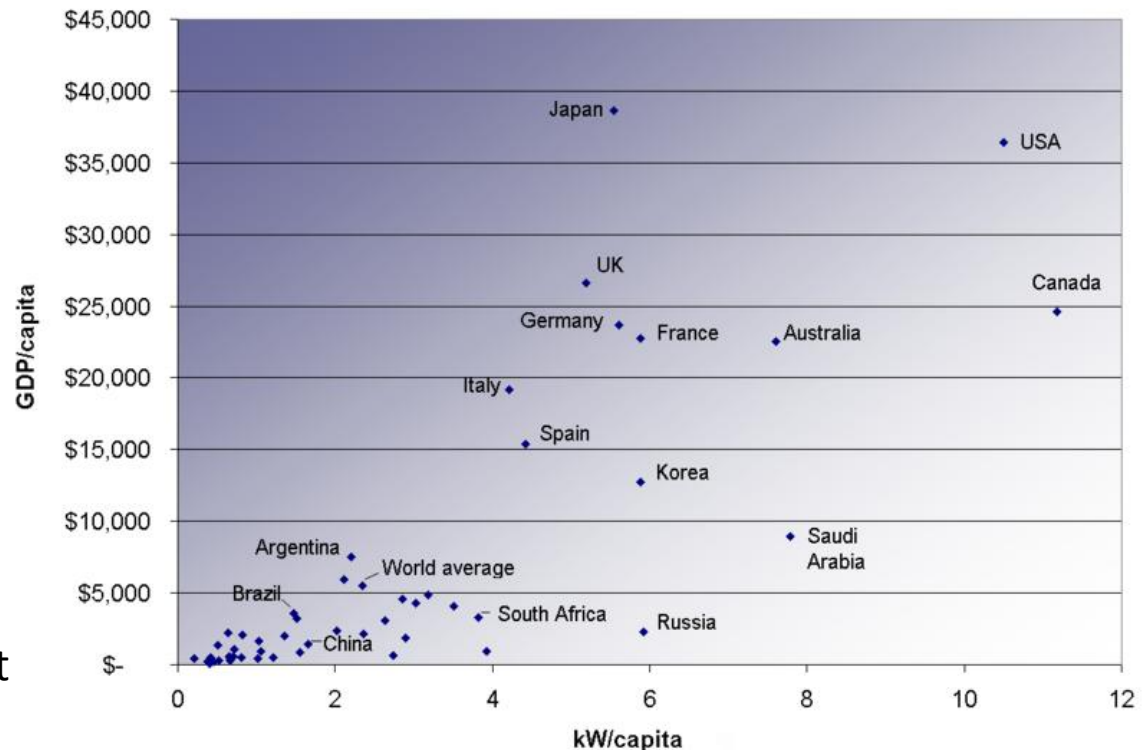


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- Quality of Life and Energy are inexorably linked.
- Perhaps no other single issue than Energy has more of an impact.
- Look at the components – first Energy and GDP. Cheap Energy has made us a Global Power

Two messages

1. The US has leveraged cheap energy to be a global economic power.
2. Even a small change in global per capita energy use in emerging countries has a dramatic impact on global demand



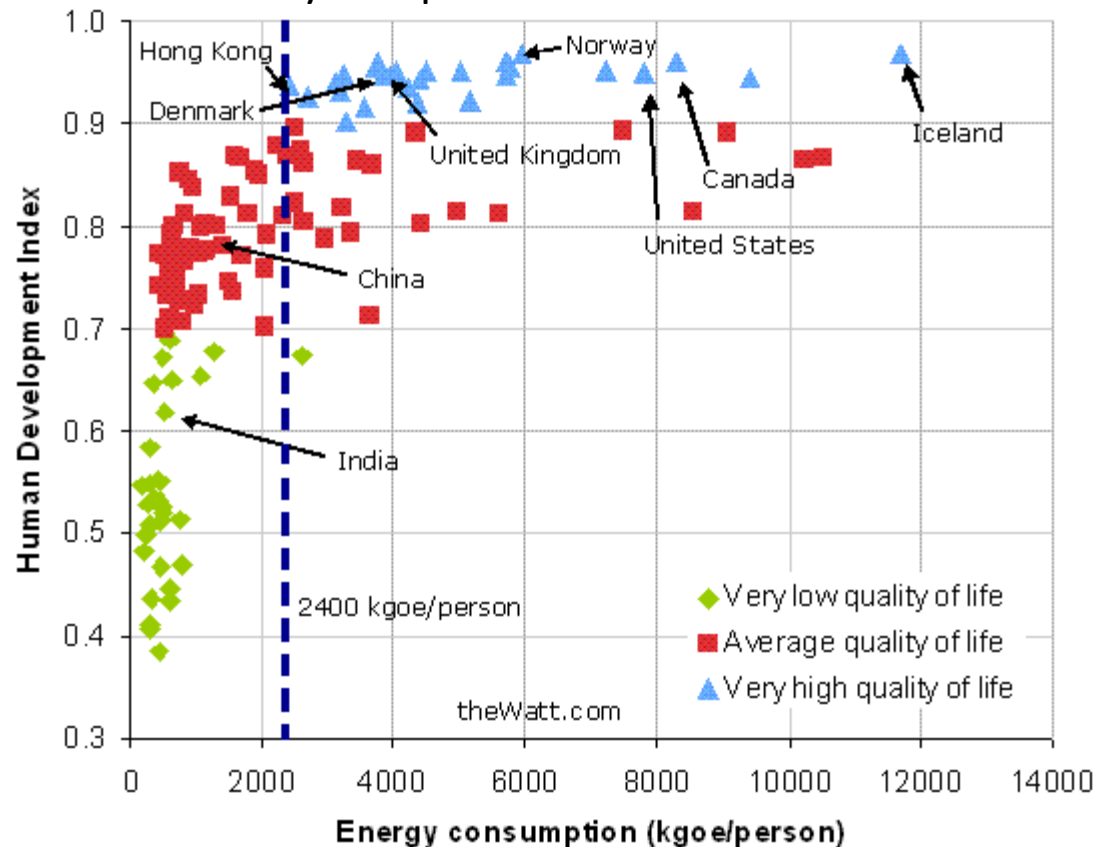
If all the world used energy as we do, there would only be enough for 1.4 of the 6.6 Billion worlds people

Energy Efficiency

Many developed countries have a similar or better HDI than we do but use 50% less energy per capita

It's all about choices – where we live, how we commute, what we eat....

A small change in energy use can make a large improvement in HDI – but only to a point



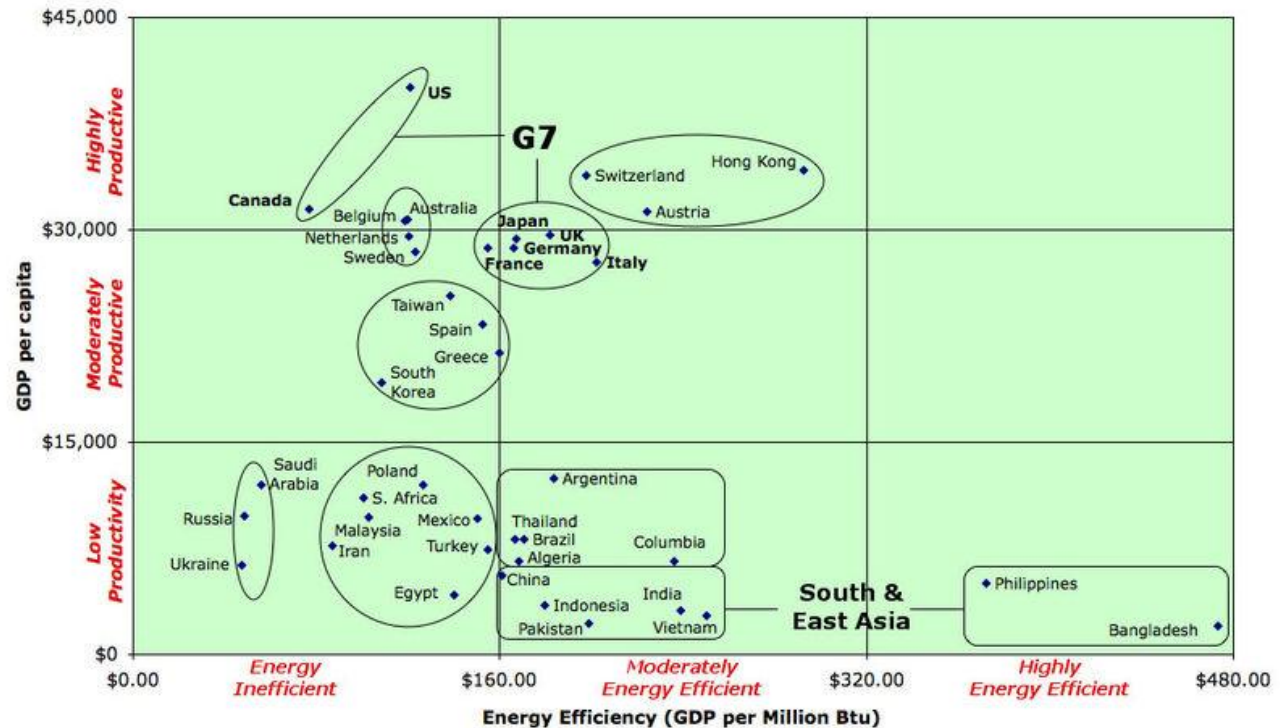
Energy Intensity



Ultimately it will be about competitiveness – our major trading nations use much less energy than we do for each dollar of GDP produced.

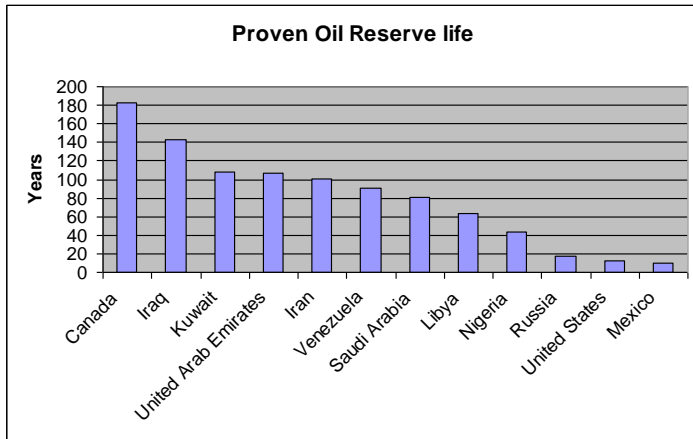
When energy was cheap we used it as a free resource – much like developing countries use labor

**GDP vs. Energy Efficiency
(Top 40 Economies by GDP)**



When energy gets very expensive we will be at a significant disadvantage – what is your personal balance between quality of life and energy? What about your customers, your employees?

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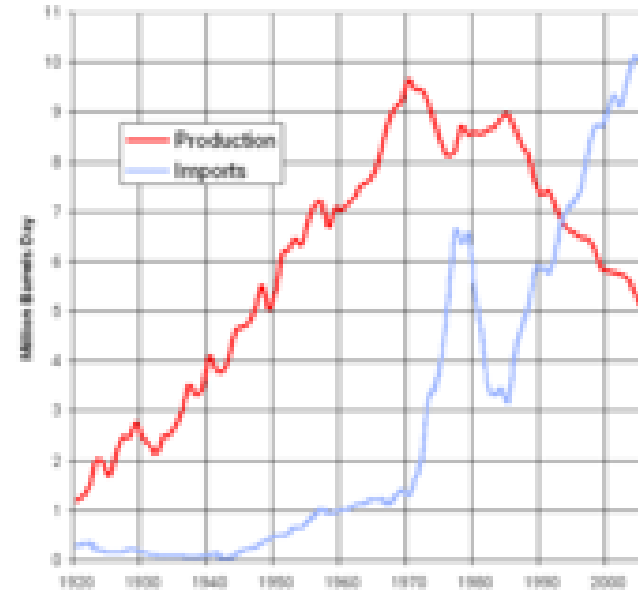
The US runs out first!

We need short term fixes

AND

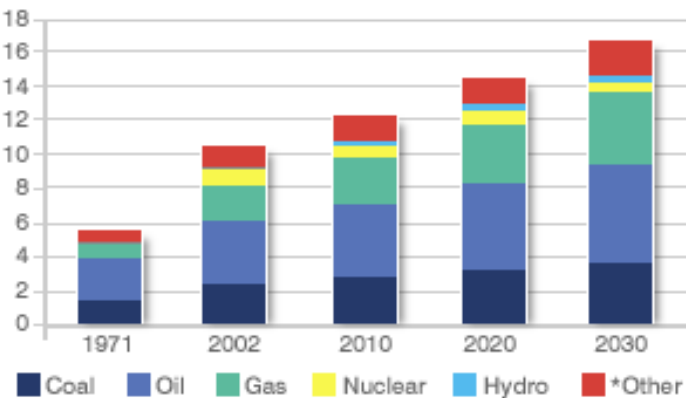
We need long term solutions

US Oil Production and Imports



PROJECTED FUTURE DEMAND

Billion tonne oil equivalent



*Includes geothermal, solar, wind, heat, etc. Source: IEA 2005

REMEMBER – the cheapest energy is the energy you never used! The best ROI is conservation, the only long term answer is efficiency.

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2008 look forward

The State has sufficient biomass to support the development of over 40 major biomass investments of greater than \$100 Million each.

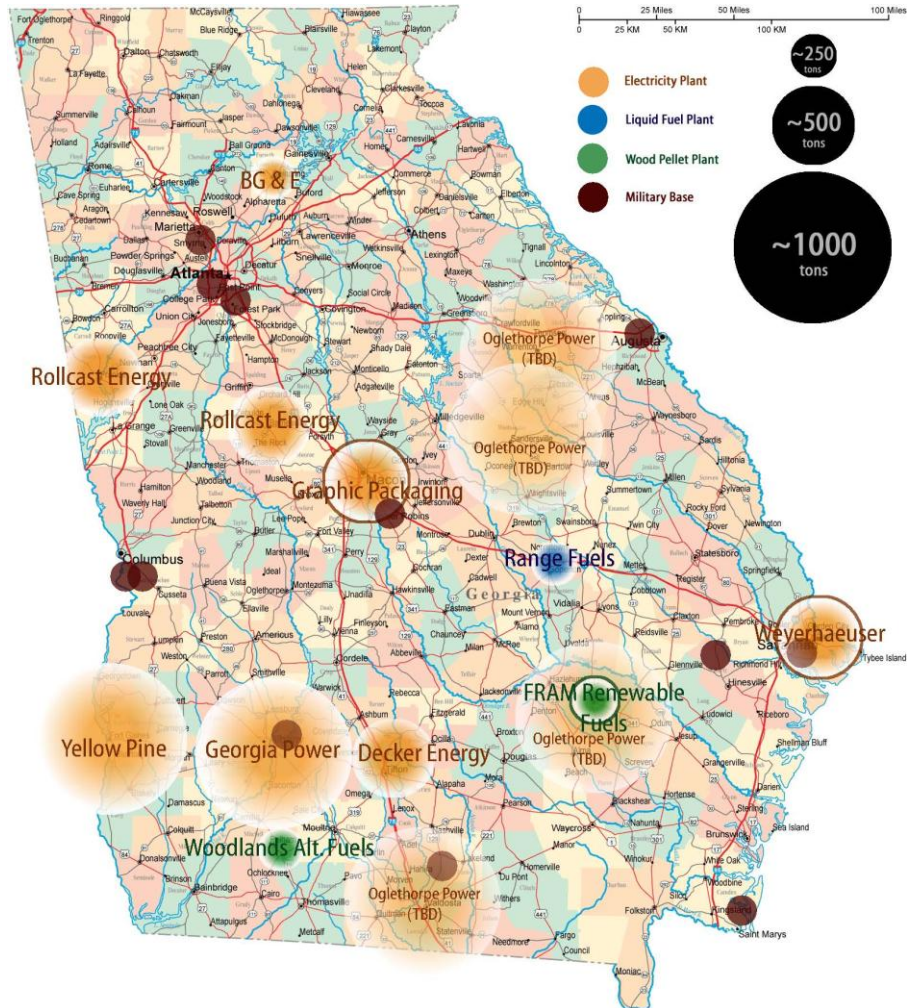
Bio based fuels could change the face of rural Georgia



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2009 - In the past year over \$1.5 Billion of announced projects. Electric Power production is the leader.

Unlike fossil energy – renewable fuel is dispersed. The new model is distributed production.



- When your business is energy then it's all about the fuel!
 - And when the fuel is biomass its => Details, details. Details....
 - What to grow
 - How to harvest
 - Delivered cost of residuals v's round wood
 - Traceability
 - Moisture or BTU's
 - Guaranteed supply for 20 years
 - Escalations
 - Storms, fires
 - Collection circles
 - Rail v's road
 - Competition
 - Cap and trade.....

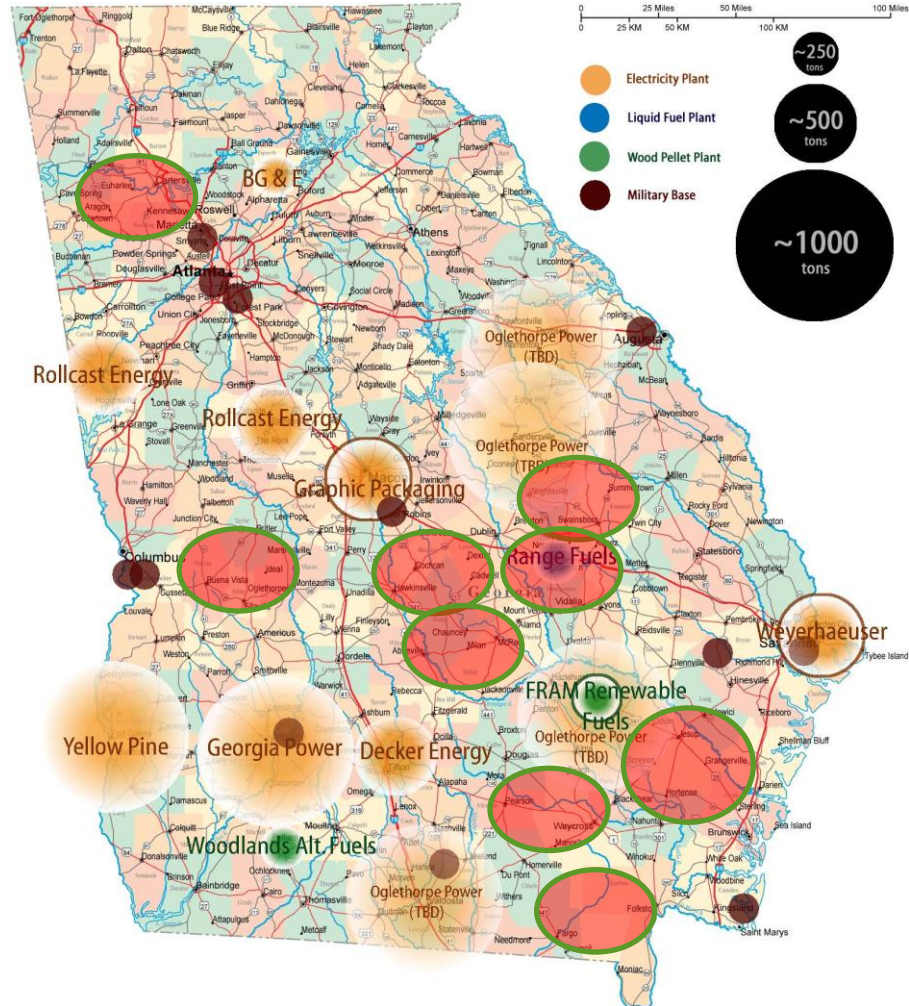
The devil's in the
detail

- Lessons
 - Communities need to be ready
 - The jobs and economic opportunities are not in the energy plants they are in the supply chain, construction and service
 - Education and training
 - Communication infrastructure
 - Policy and support focused on the cost effective biomass fuels and commercialization that make projects cost effective over their entire life will attract business
- Economic Opportunities

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2015 ?

Unlike fossil energy – renewable fuel is dispersed. The new model is distributed production.





Questions ???

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