

Emerging Markets for Wood Energy In the United States



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Presentation Outline

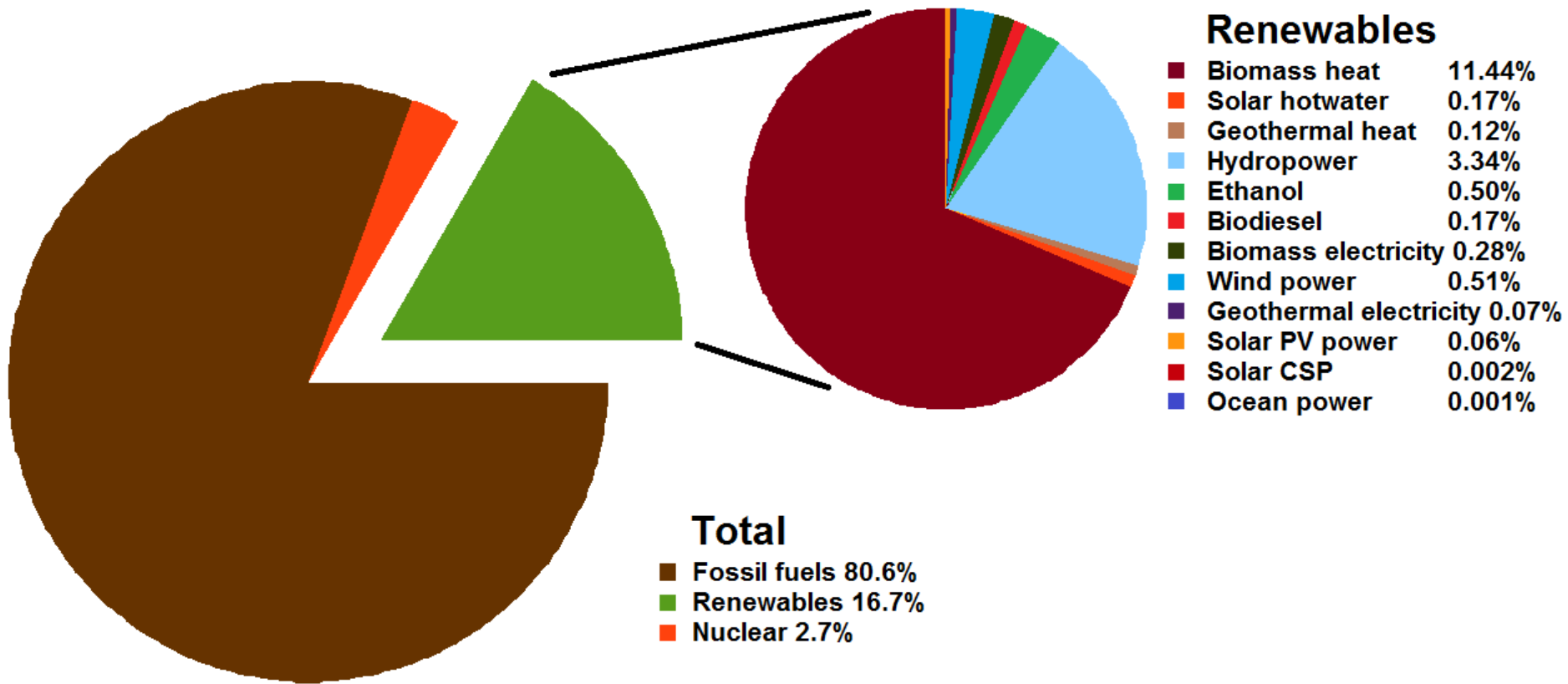
- Renewable Energy
- Wood-to-Energy
- Wood Biomass
- Energy Options
- Current Landscape in the U.S.
- The U.S. South



Today's Energy Paradigm

- Fossil fuel **resources are finite**
- Global energy **consumption is increasing** (nearly 30% by 2030)
- The world **population is growing** (9+ billion by 2050)
- Fast-developing **economies** like India and China **are demanding more resources**
- Greenhouse gas **emissions are increasing** (World carbon dioxide emissions expected to increase by 1.9% annually between 2001 and 2025)

Total World Energy Consumption by Source (2010)



America's Mega Challenges

National Security



Economy



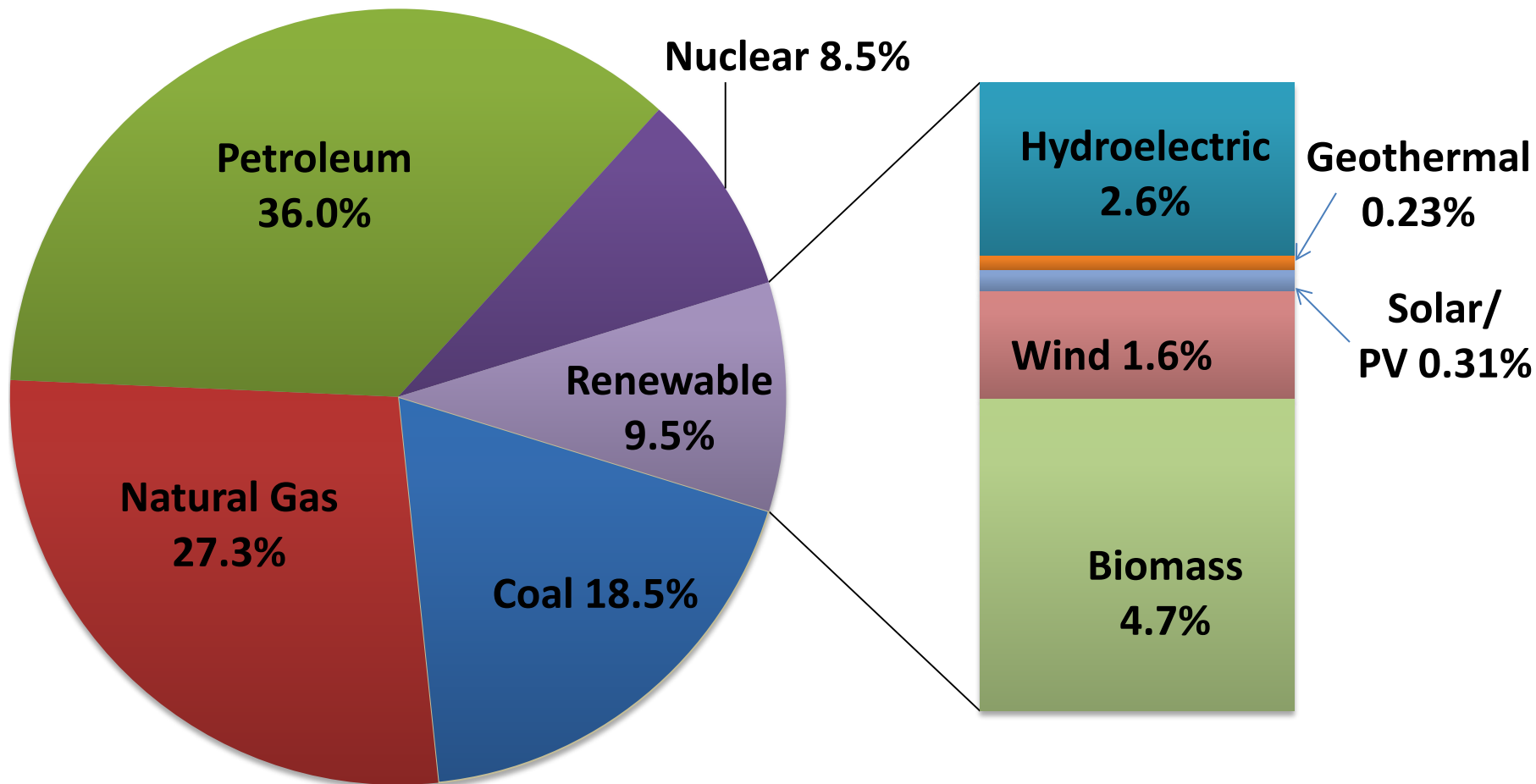
Environmental
Degradation

Where are we now in the U.S.?

2013 Total Energy Consumption: 97.53 Quad BTU

2013 Renewable Energy Consumption: 9.29 Quad BTU

U.S. Primary Energy Consumption by source, 2013



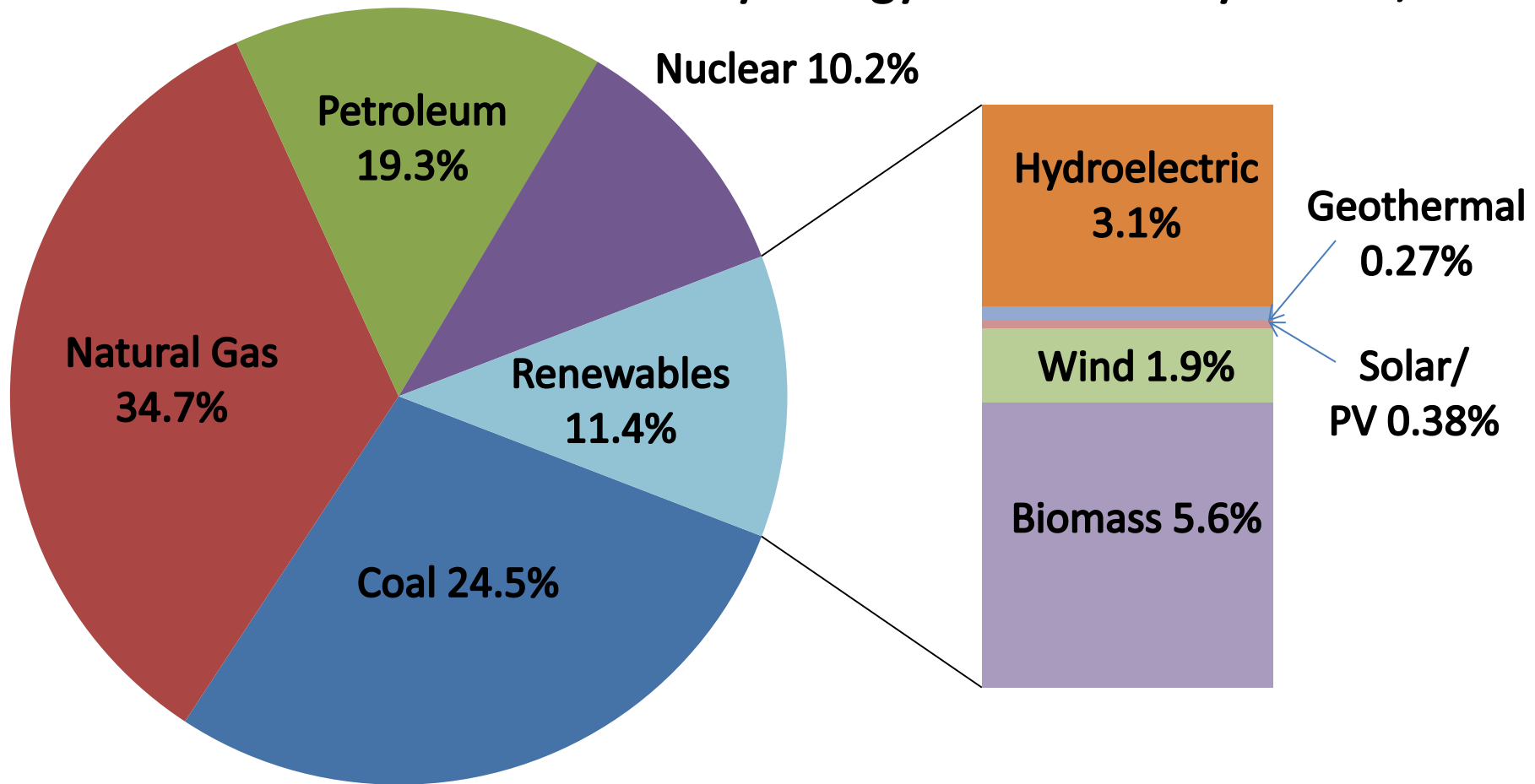
Source: U.S. Energy Information Administration

Where are we now in the U.S. ?

2013 Total Energy Production: 81.66 Quad BTU

2013 Renewable Energy Production: 9.30 Quad BTU

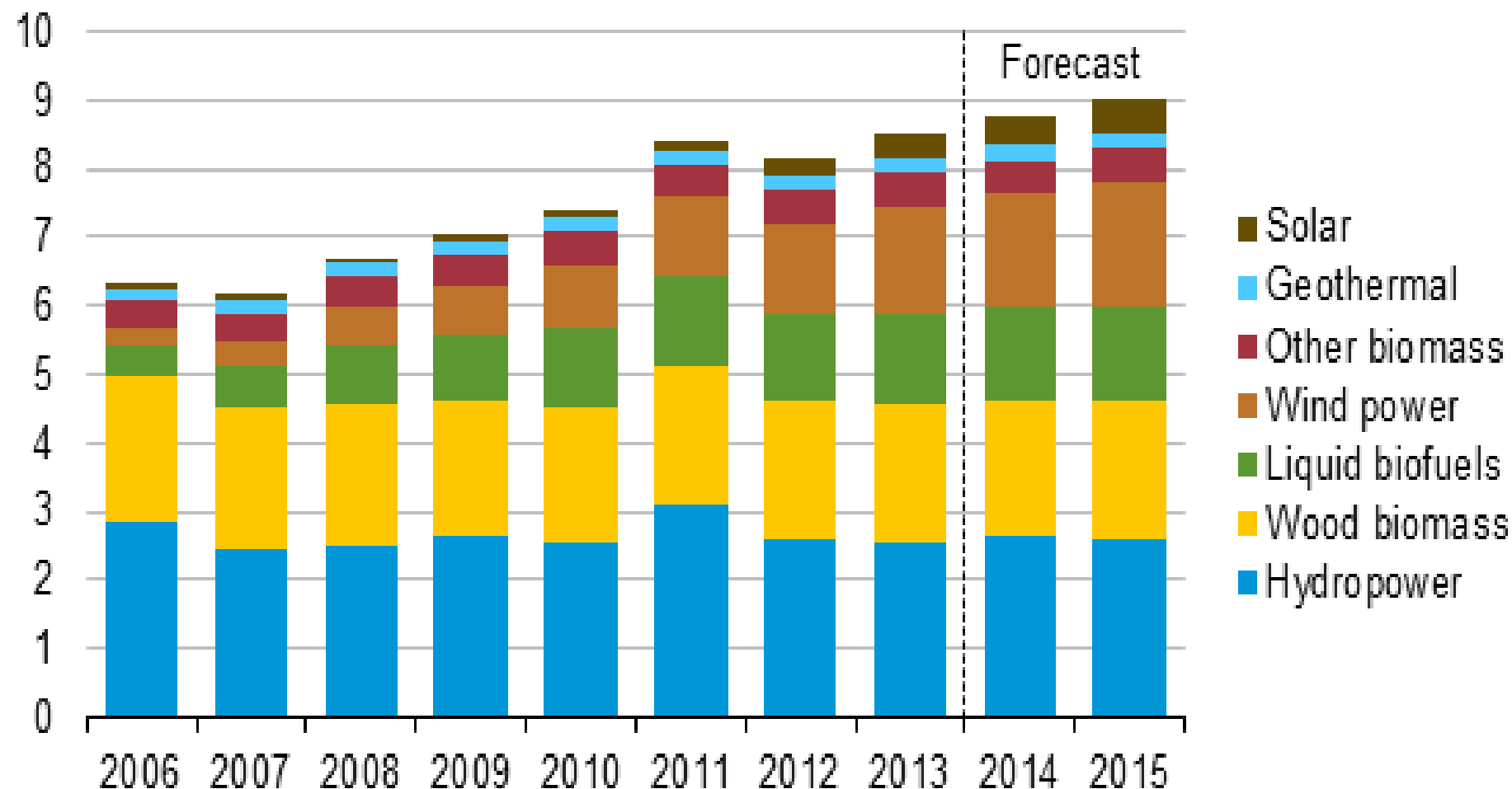
U.S. Primary Energy Production by source, 2013



Source: U.S. Energy Information Administration

U.S. Renewable Energy Supply

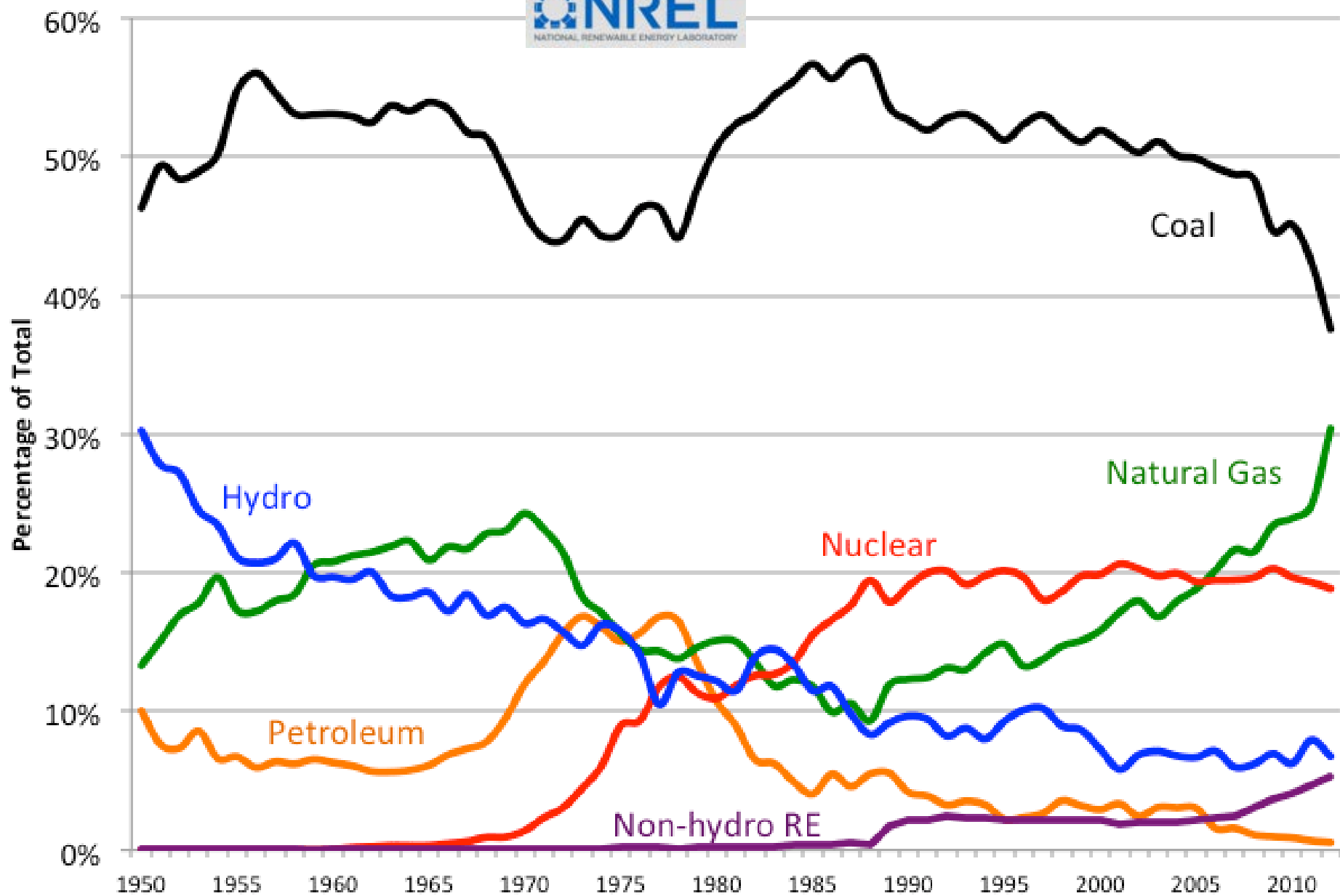
quadrillion British thermal units (Btu)



Note: Hydropower excludes pumped storage generation. Liquid biofuels include ethanol and biodiesel. Other biomass includes municipal waste from biogenic sources, landfill gas, and other non-wood waste.

Source: Short-Term Energy Outlook, April 2014.

Net U.S. Power Generation Share by Source, 1949-2012



Natural Gas Price

3.61 USD/mmbtu

15 Nov '13



InfoMine.com

Wood-based Biomass → Energy



Drivers & Issues

- ◆ Biomass industry drivers: subsidies, natural gas prices, sustainable harvest levels, wood fiber prices, and transportation costs.
- ◆ Harvesting, collecting and transporting cellulosic post-harvest biomass residues can be difficult and expensive.
- ◆ High transportation costs means cellulosic post-harvest biomass plants must source feedstock near plant-typically 75 miles (although up to 150 miles has been reported).

Pre-Summary

- ◇ Biomass demand currently driven by wood-burning power companies---Pellets.
- ◇ Wood-based fuels not economically viable
- ◇ Demand for wood → electricity could also change the landscape.

Wood-based Biomass Types

Primary mill residues

Wood materials from manufacturing plants (primary wood products mills) when residual products are processed from primary wood products.

Slabs, end trimmings, saw veneer trimmings and cores, and pulping shavings.



Wood-based Biomass Types

Secondary mill

Wood scrap and waste from sawing shops, furniture factories, container and pallet manufacturers that use lumber, plywood and other “primary” materials.



Wood-based Biomass Types

Urban wood waste

Discarded wood trimmings, from construction and demolition.



Wood-based Biomass Types

Forest residues/Logging Residues

Logging residue, unutilized volume of wood cut or killed during logging or silvicultural operations.

cut or killed during logging operations; unutilized volume of wood cut or killed during logging operations.



Wood-based Biomass Types

- **Logging slash:**
 - 1.2 to 3.2 tons per hectare generated from needles, branches left on site
 - Potential:
 - Chip tree tops instead of pushing it back into stand



Forests for Biofuel:

Potential forest biofuel products



◎ Logging slash bundled to support power plant

- 100-MW Southern Energy wood-fired power plant in Nacogdoches, Texas (currently idled)
- 20-year power purchase agreement with Austin (Texas) Energy

Management Approaches: Short-rotation woody crops

- Fast-growing plantations that produce large amounts of biomass in short time
- Whole tree chipped in harvest
- Rotation lengths:
 - 3 to 7 years
 - Possibly get 1.5 rotations per planting due to re-sprouting

Short-rotation woody crops

- Species grow along SE coastal region
 - *E. benthamii*, *macarthurii*, *camadulensis*
- Tolerant to temperatures down to 17 degrees F
- Yields:
 - 5-8 tons/ha per year (loblolly pine = 1.2 tons/ha per year)
 - Mature by age 6-9



Short-rotation woody crops

Hybrid Poplar



Paulownia (1 year)
Fastest Growing Species



Eucalyptus globulus
(3 years)
Australia



Eucalyptus sp.
(6 years-rotation age)
Brazil



VERY High volume- short rotation woody crop

Frankensteinus sempervirens

6 years old





Where Does Wood Fit into the Picture?



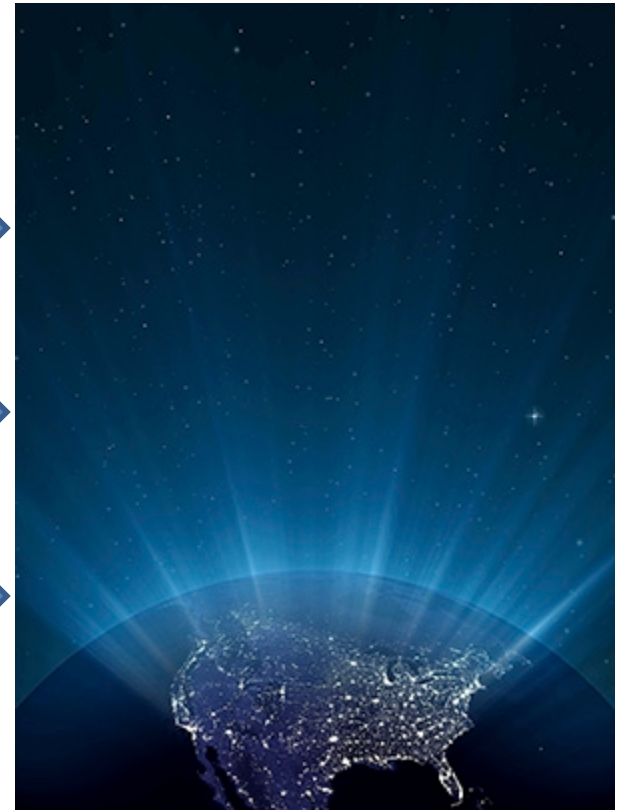
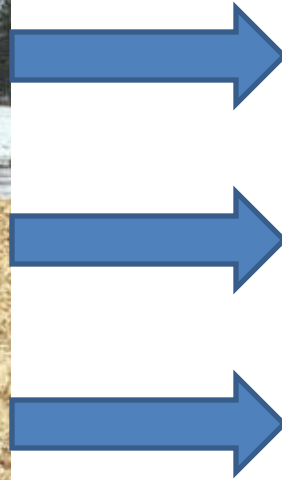
Wood Energy in the U.S.

- Wood is the most commonly used biomass fuel for heat and power in the U.S.
- About 84% of the wood and wood waste fuel used in the U.S. is consumed by industry, electric power producers, and commercial businesses.
- Most of this is used at wood product manufacturing facilities in cogeneration.



Wood to Energy

What are the options?



Gasification

- Converts carbon-based materials, such as coal, petroleum, biofuel, or biomass.....
- into carbon monoxide and hydrogen.....
- by reacting the raw material, at high temperatures controlled with oxygen and/or steam.
- The resulting gas mixture is called synthesis gas or syngas and is itself a fuel.



Pyrolysis

- Chemical decomposition of a condensed substance by heating.
- Does not require oxygen.
- Extreme pyrolysis, which leaves only carbon as the residue, is called *carbonization* and is also related to the chemical process of *charring*.
- Pyrolysis is used in the to produce charcoal, activated carbon, methanol and other chemicals from wood.



Cogeneration

- Simultaneous production of heat and electricity, commonly called combined heat and power (CHP), from a single fuel.
- Traditionally, a steam turbine is used to produce electricity, although a wood gasification/ internal combustion unit can also be a cogeneration unit.
- Most of **U.S.** CHP capacity is in wood products manufacturing industries.

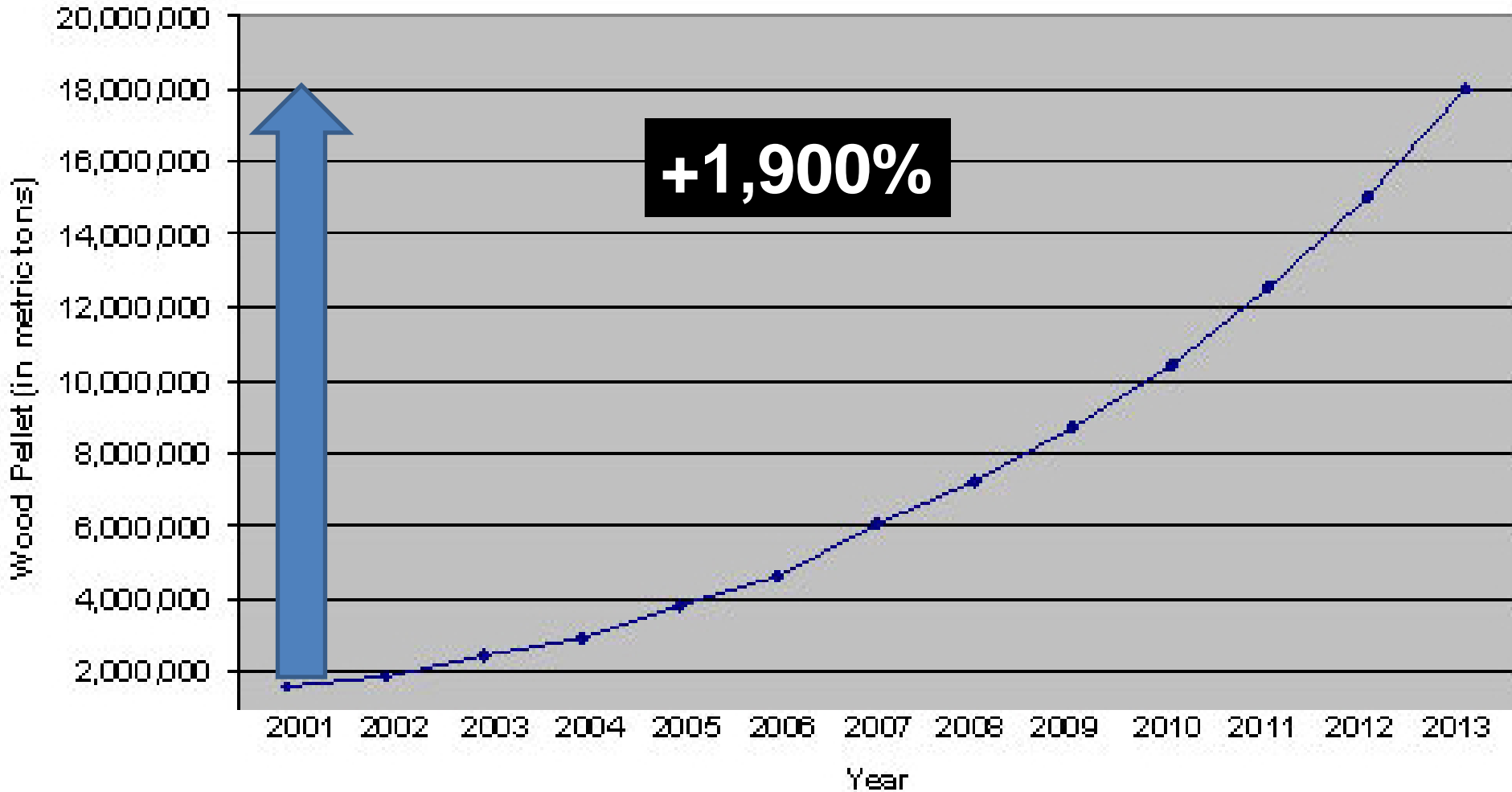


Pellets

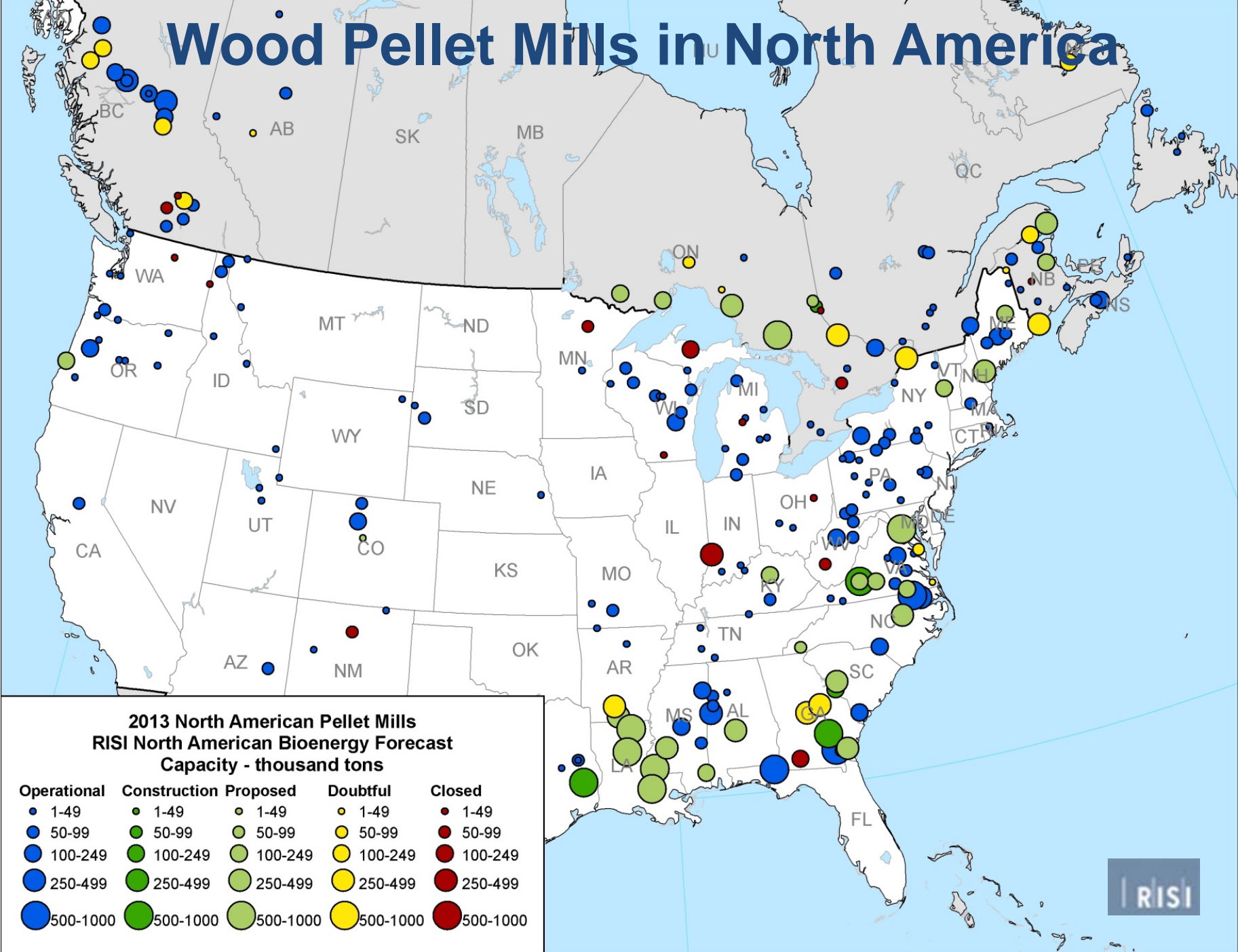
- European Union nations imported some 4.46 million metric tons of wood pellets in 2012 up from 3.2 million in 2011.
- Sweden consumes more than 20% of the world's wood pellets and demand is growing.
- 36% of those pellets came from the United States, the most of any nation.
- Wood pellets have about 70 percent of the calorific value of coal.



Wood Pellet Demand in Europe



Wood Pellet Mills in North America



2013 North American Pellet Mills
RISI North American Bioenergy Forecast
Capacity - thousand tons

Operational	Construction	Proposed	Doubtful	Closed
● 1-49	● 1-49	● 1-49	● 1-49	● 1-49
● 50-99	● 50-99	● 50-99	● 50-99	● 50-99
● 100-249	● 100-249	● 100-249	● 100-249	● 100-249
● 250-499	● 250-499	● 250-499	● 250-499	● 250-499
● 500-1000	● 500-1000	● 500-1000	● 500-1000	● 500-1000

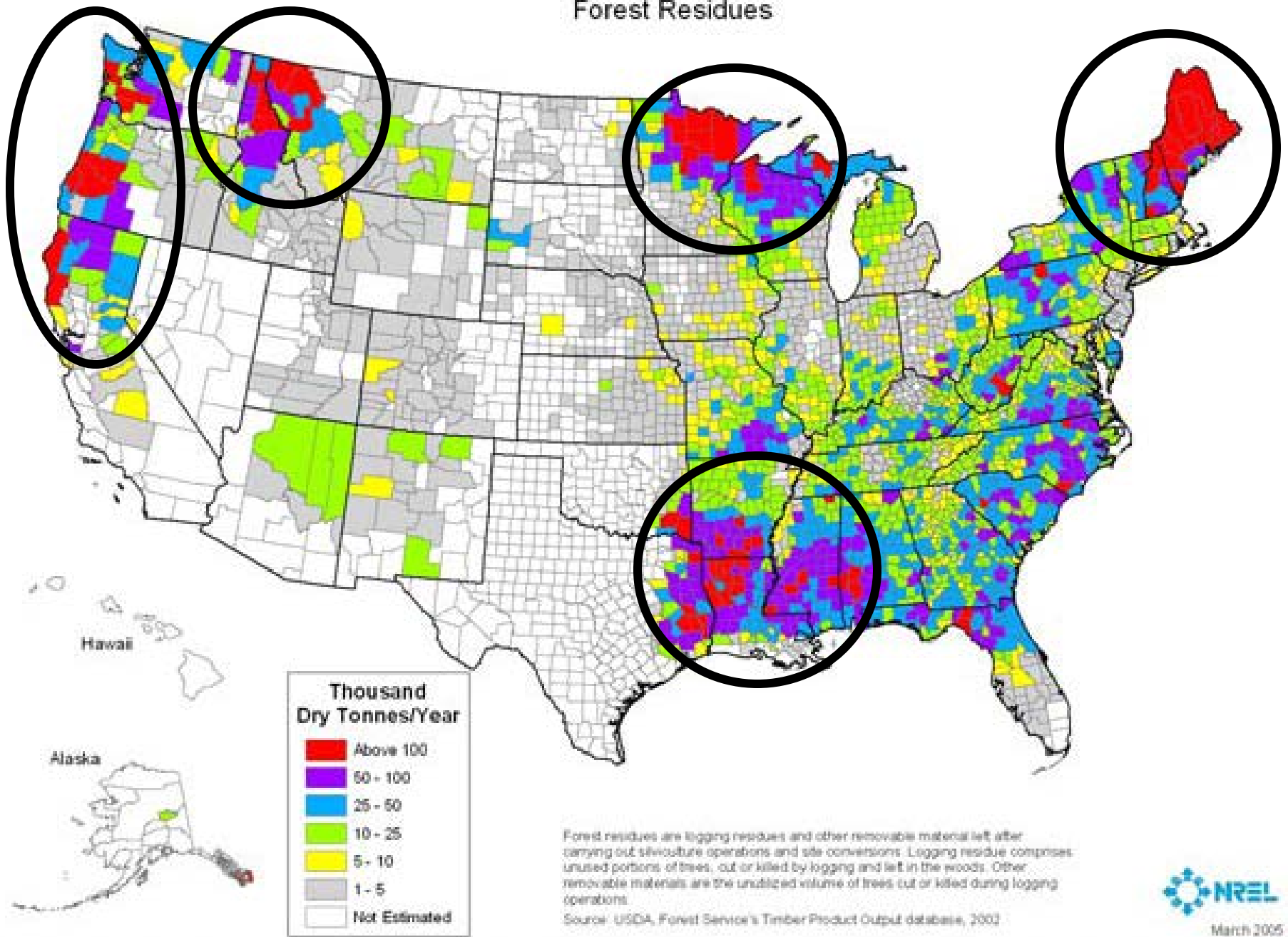
What's Happening Here?



U.S. South



Forest Residues



Southeast Biomass Resources

- 85 million hectares of forestland
- 34 million hectares of traditional cropland
- 48 million hectares of pasture/hay land

- 7.5 billion head of poultry
- 43 million head of livestock
- 151 million tons of municipal solid waste
- Many other unique biomass resources

Forest Landowner Opportunities and Challenges

- ◆ The U.S. South is the “wood basket of the nation.”
- ◆ 85 million hectares or 40% of the 204 million hectares of forestland nation-wide.
- ◆ Significant forestland partly due to its sub-tropical climate, steady supply of rainfall, and favorable topography.

Challenges

- Infrastructure remains one of the biggest challenges in bringing renewable energy online.
 - Transmission lines need to be modernized and expanded to tap into rural sources of electricity, especially wind.
 - Biofuels need expanded pipelines, rail, ports and other shipping facilities to get to urban consumers; expansion of blender pumps and flex fuel vehicles are also needed.
- Significant long term *public and private investment* is needed to achieve a new, renewable energy future.
- Regulatory actions and proposals from EPA, DOE, USDA, states, etc.



Thank You

Questions???

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