

An Overview of Wood Energy In North America



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Presentation Outline

- Renewable Energy
- Wood-to-Energy
- Wood Biomass
- Energy Options
- Current Landscape
- Challenges & Issues

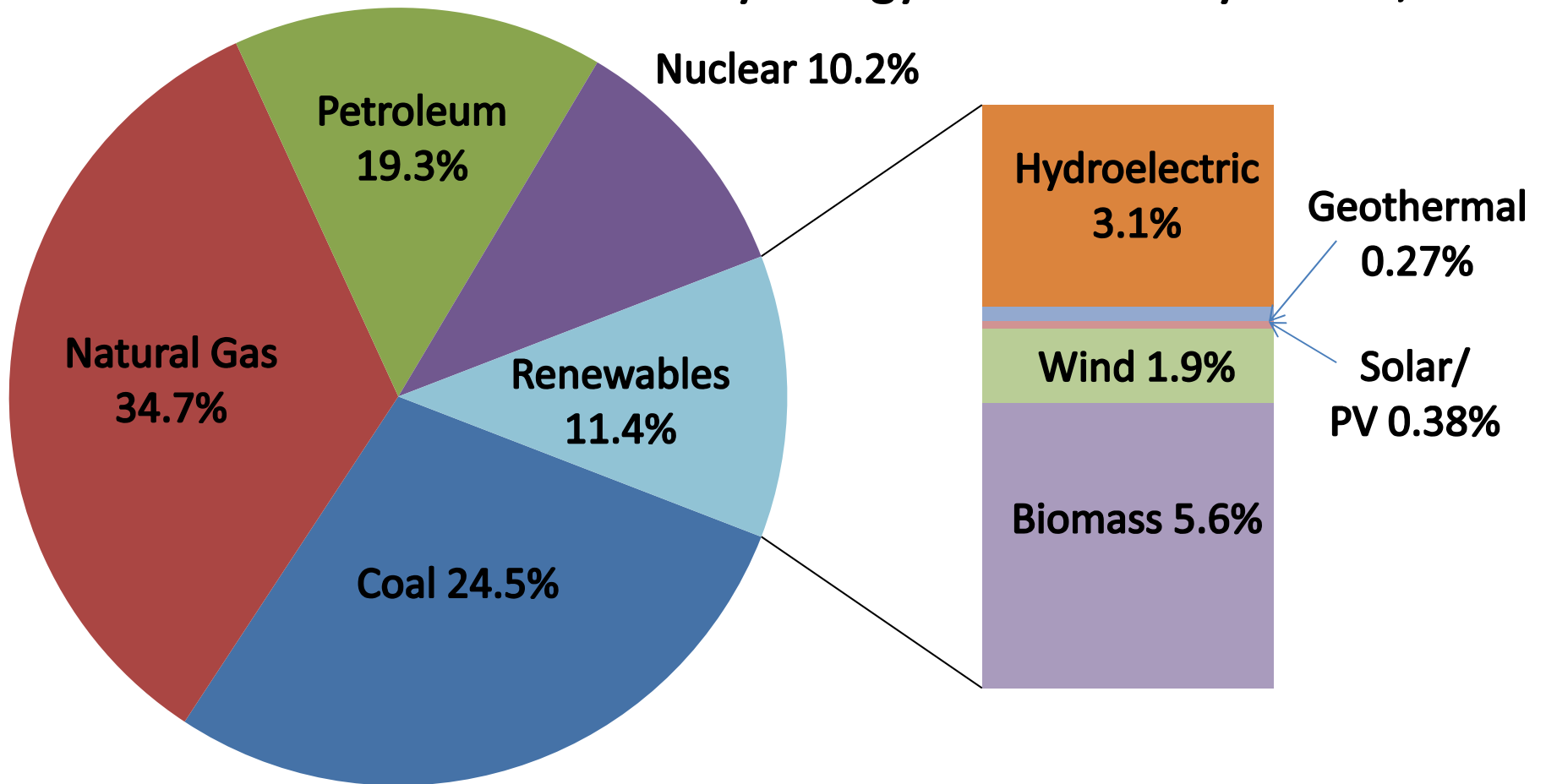


Where are we now in the U.S. ?

2013 Total Energy Production: 81.66 Quad BTU

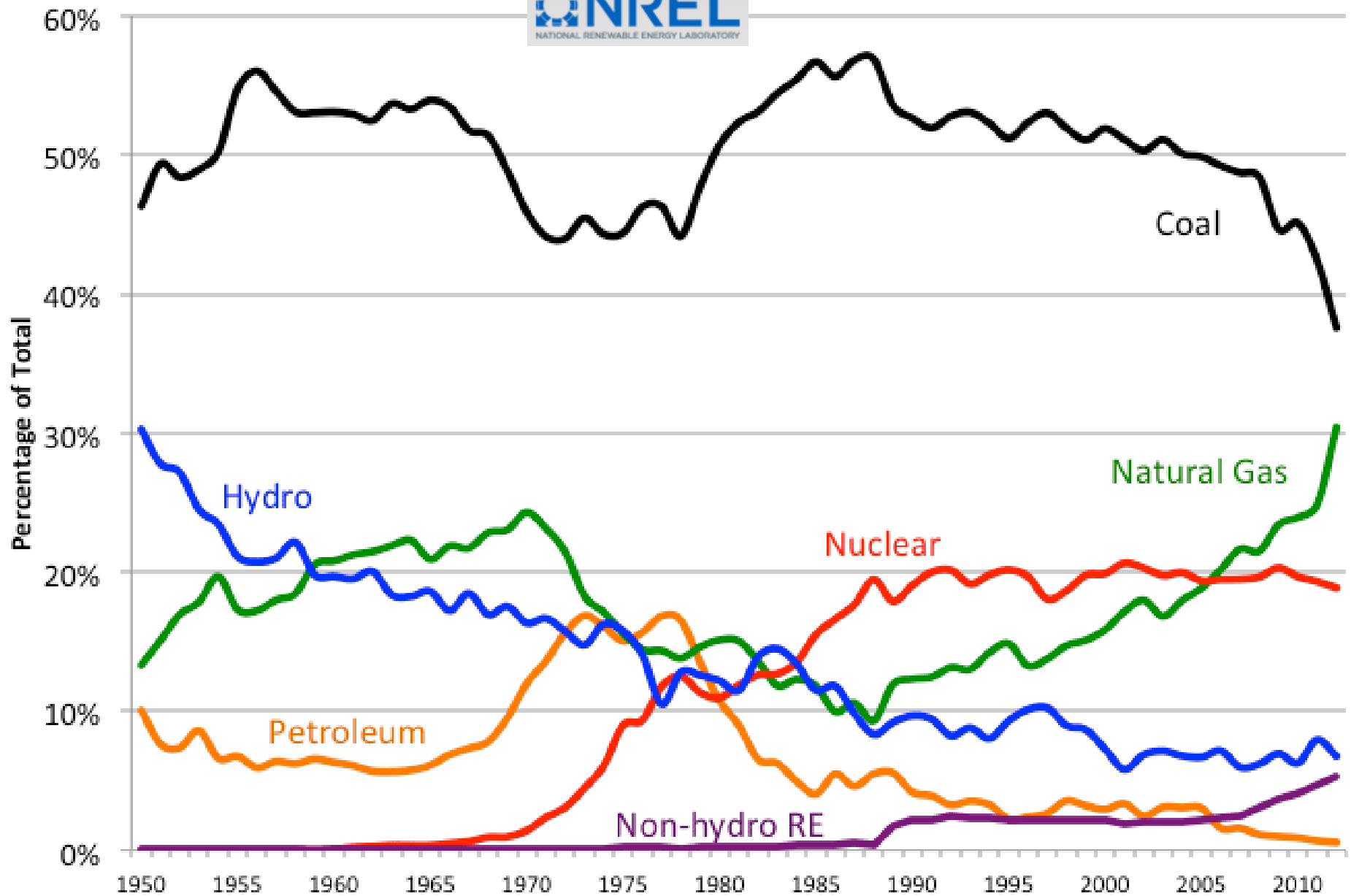
2013 Renewable Energy Production: 9.30 Quad BTU

U.S. Primary Energy Production by source, 2013



Source: U.S. Energy Information Administration

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



Natural Gas Price

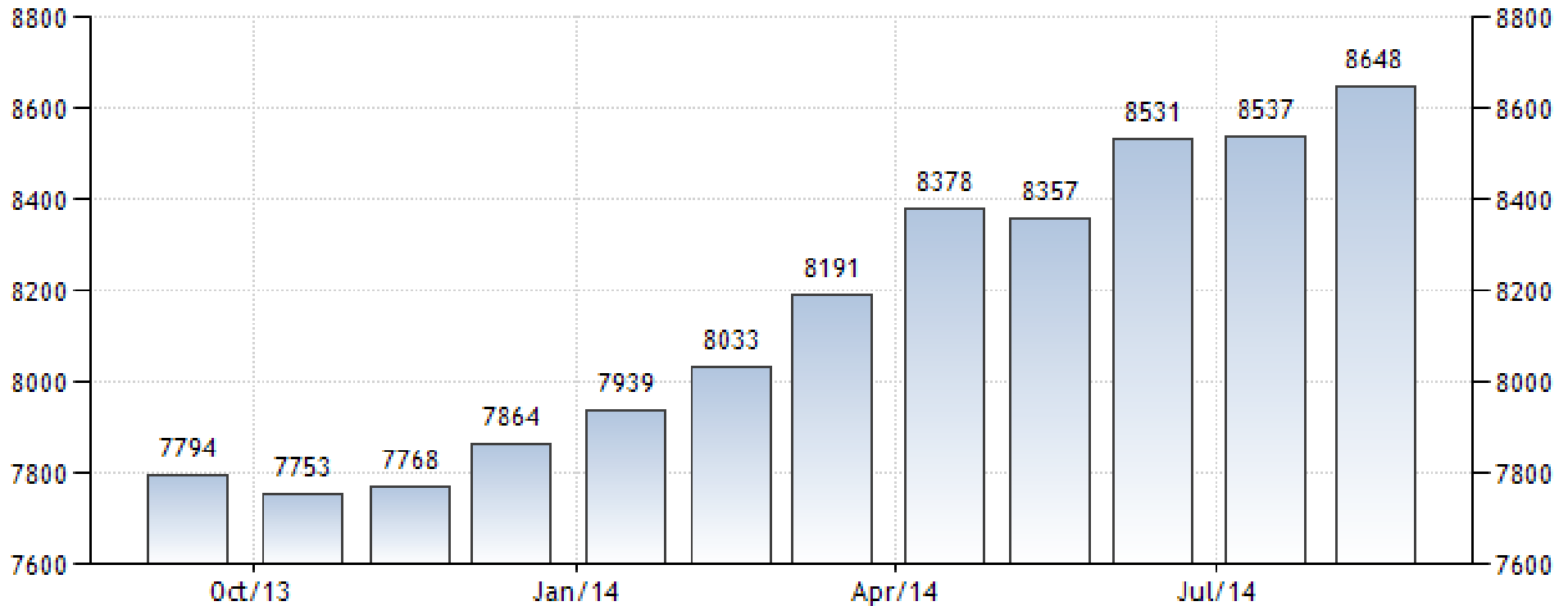
3.61 USD/mmbtu

15 Nov '13



InfoMine.com

U.S. Crude Oil Production



SOURCE: WWW.TRADINGECONOMICS.COM | U.S. ENERGY INFORMATION ADMINISTRATION



Where Does Wood Fit into the Picture?



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

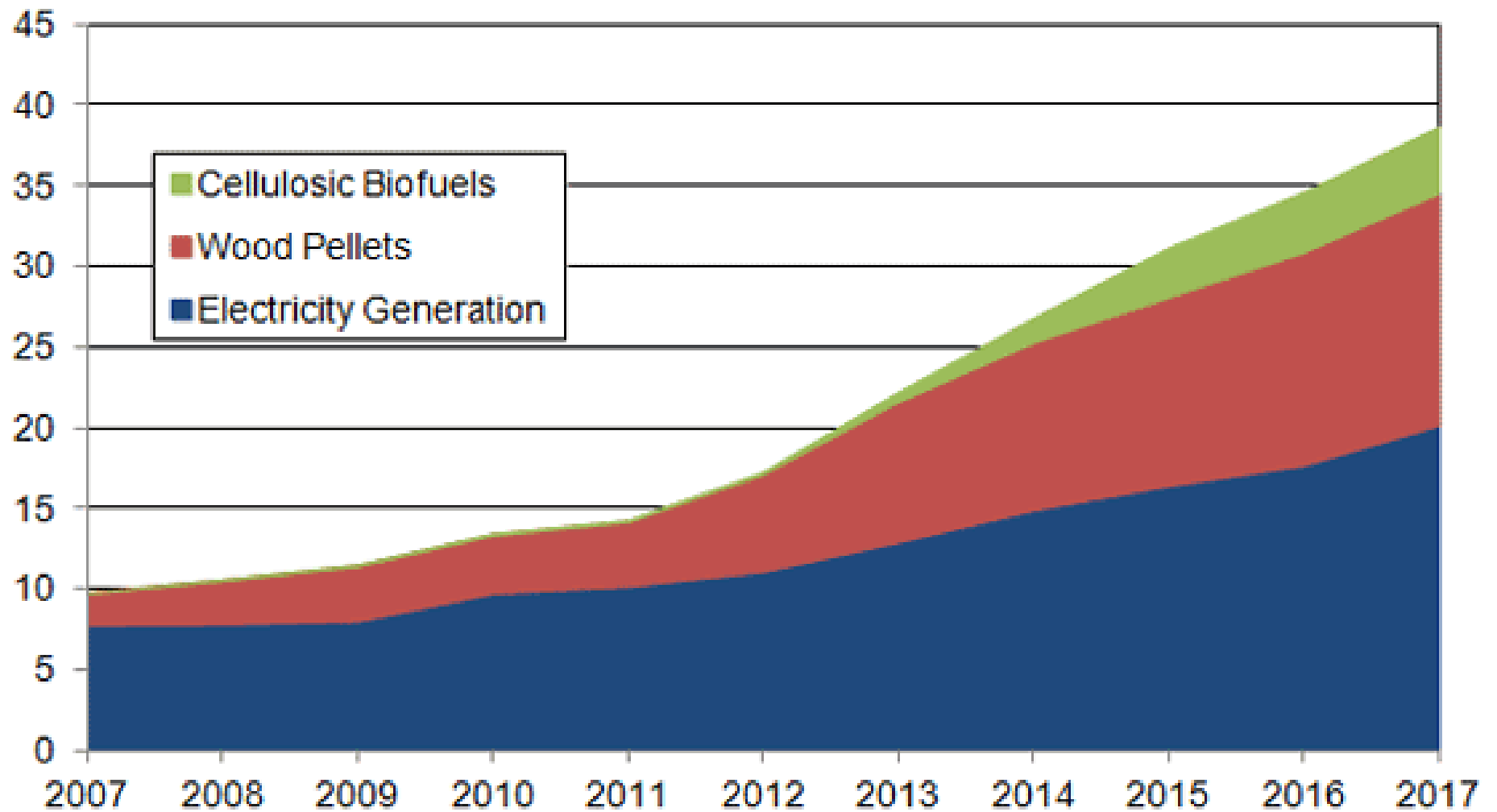
- ◇ Biomass demand currently driven by wood-burning power companies---Pellets.
- ◇ Demand for wood→electricity could also change the landscape (beyond CHP).
- ◇ Wood-based fuels not economically viable.

Wood Energy in North America

- Wood is the most commonly used biomass fuel for heat and power.
- 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 Fiber Consumption by Bioenergy Market
(2007-2017) - North America**
Million dry tons



Source-RISI

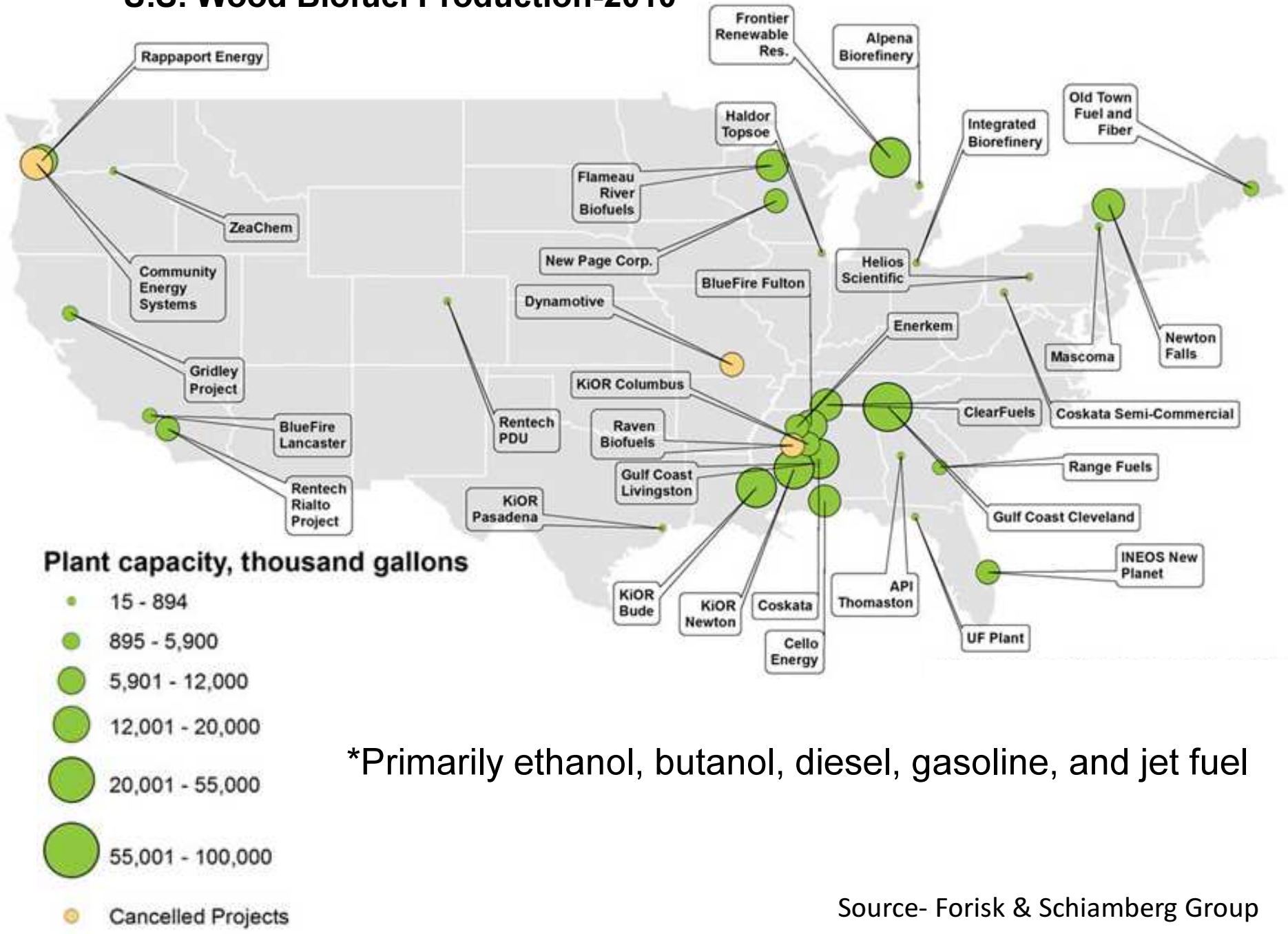
North American Wood Biomass Projects

Announcements-2007 to Present – October 2014

Wood Demand (000 green tons/year)

Wood Energy	36,944
Wood Pellets	45,475
<u>Liquid Biofuels</u>	<u>2,185</u>
Total	84,604

U.S. Wood Biofuel Production-2010



*Primarily ethanol, butanol, diesel, gasoline, and jet fuel

Source- Forisk & Schiamberg Group

Wood-based Biomass Types

Primary mill residues

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

Slabs, end trimmings, sawdust, veneer scraps and cores, and pulping sludges.



Wood-based Biomass Types

Secondary mill

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



Wood-based Biomass Types

Urban wood waste

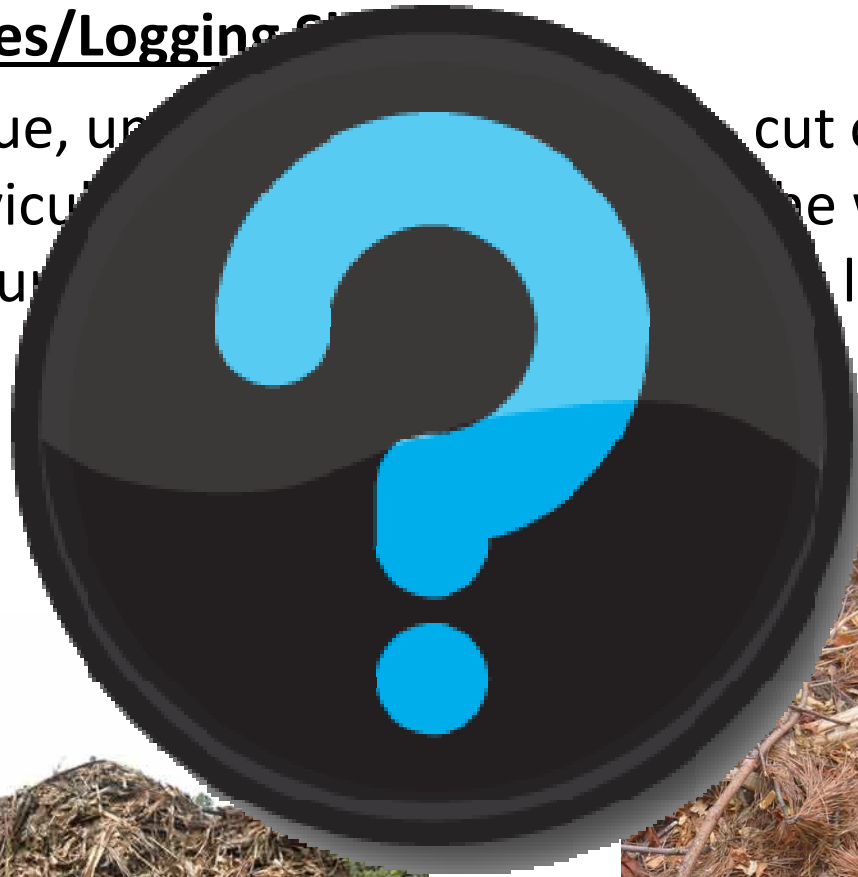
Discarded wood trimmings, from construction and demolition.



Wood-based Biomass Types

Forest residues/Logging slash

Logging residue, unutilized wood cut or killed during logging or silvicultural operations in the woods; unutilized volume of wood cut during logging operations.

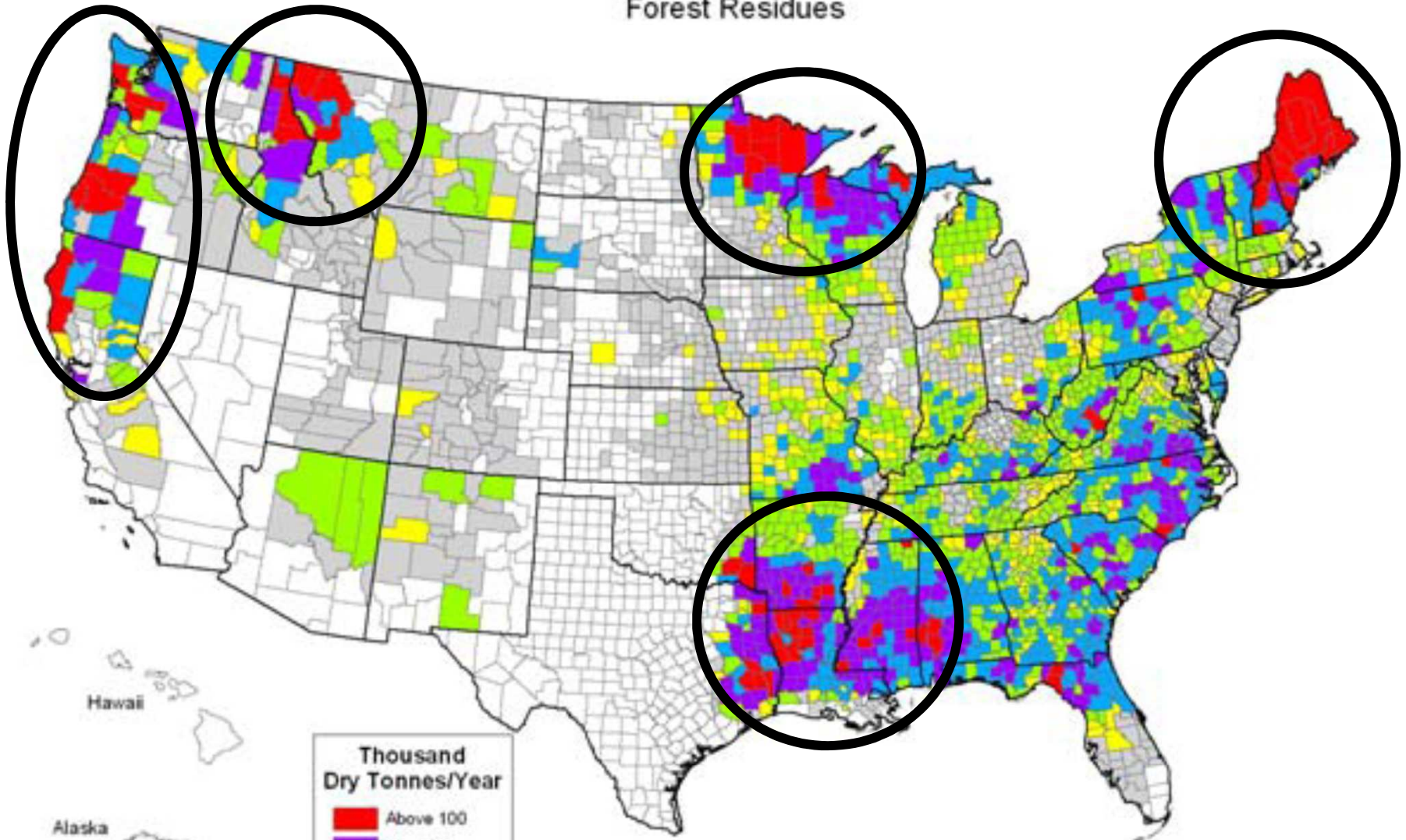


Wood-based Biomass Types

- **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



Forest Residues



Forest residues are logging residues and other removable material left after carrying out silviculture operations and site conversions. Logging residue comprises unused portions of trees, cut or killed by logging and left in the woods. Other removable materials are the unutilized volume of trees cut or killed during logging operations.

Source: USDA, Forest Service's Timber Product Output database, 2002



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

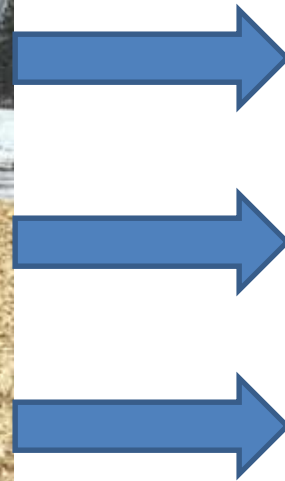
Frankensteinus sempervirens

6 years old



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



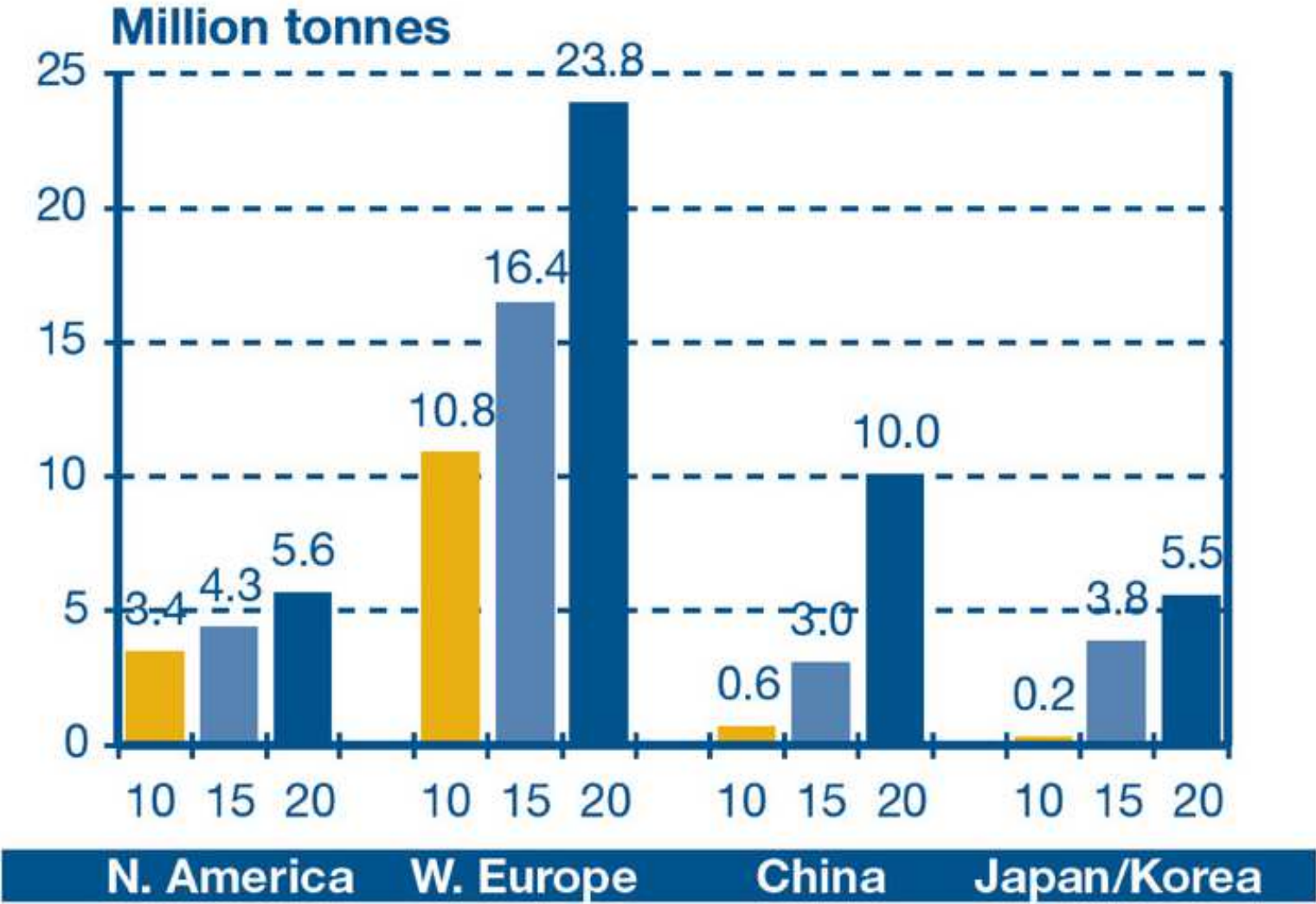
Pellets

- 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.



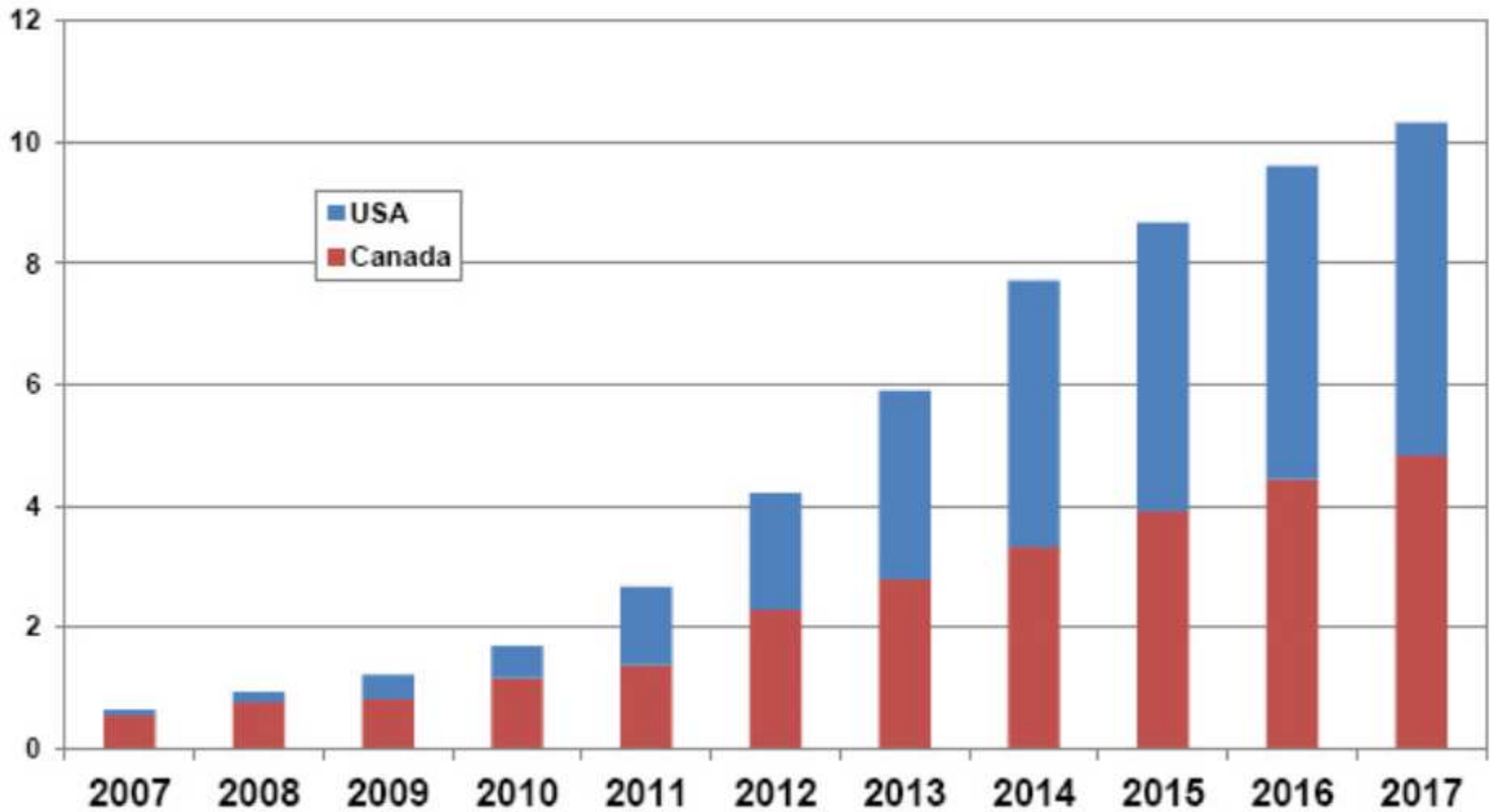
Source: Baton Rouge Business Report, June 26, 2013

Global Wood Pellet consumption Outlook to 2020



Source: Wood Markets, February 2013, Wood Pellet Association of Canada

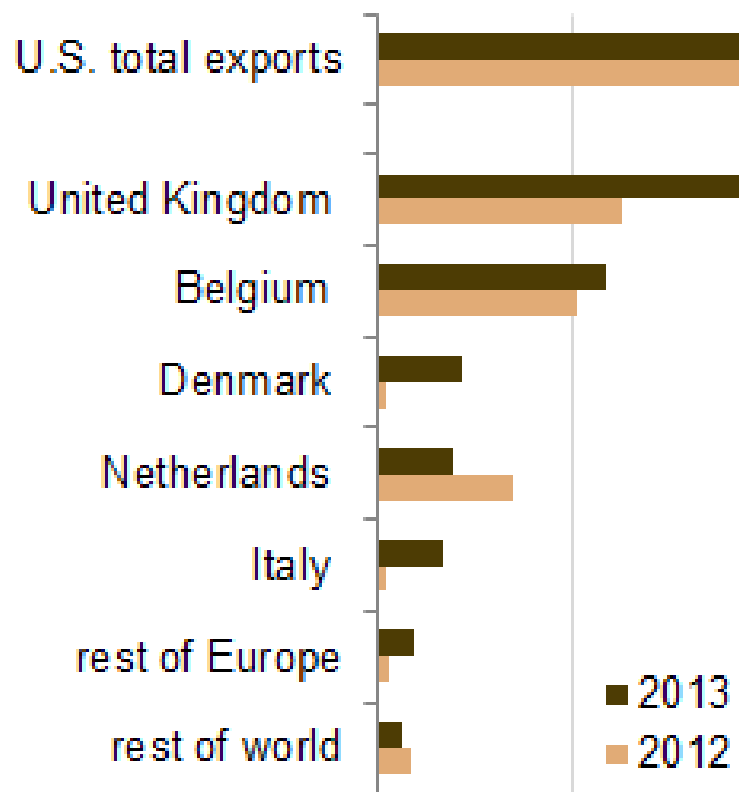
Forecast of wood pellet exports from North America 2007-2017, in million tonnes.



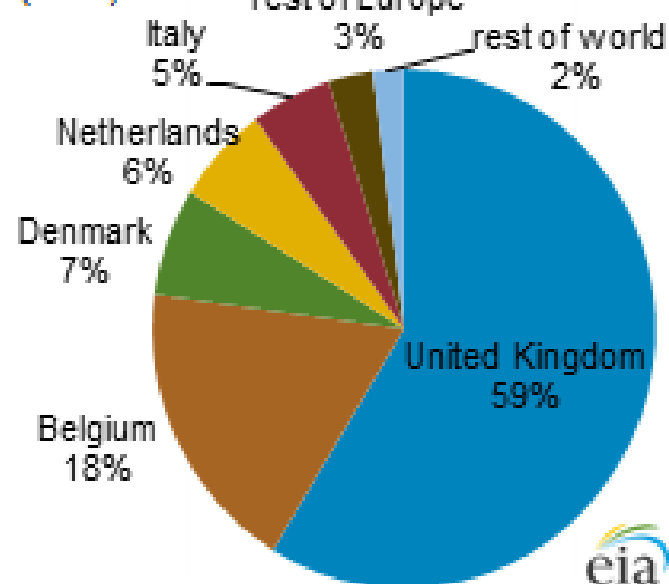
Sources – Seth Walker-RISI

U.S. wood pellet exports by destination (2012 and 2013)

thousand short tons 0 500 1,000 1,500 2,000 2,500 3,000 3,500



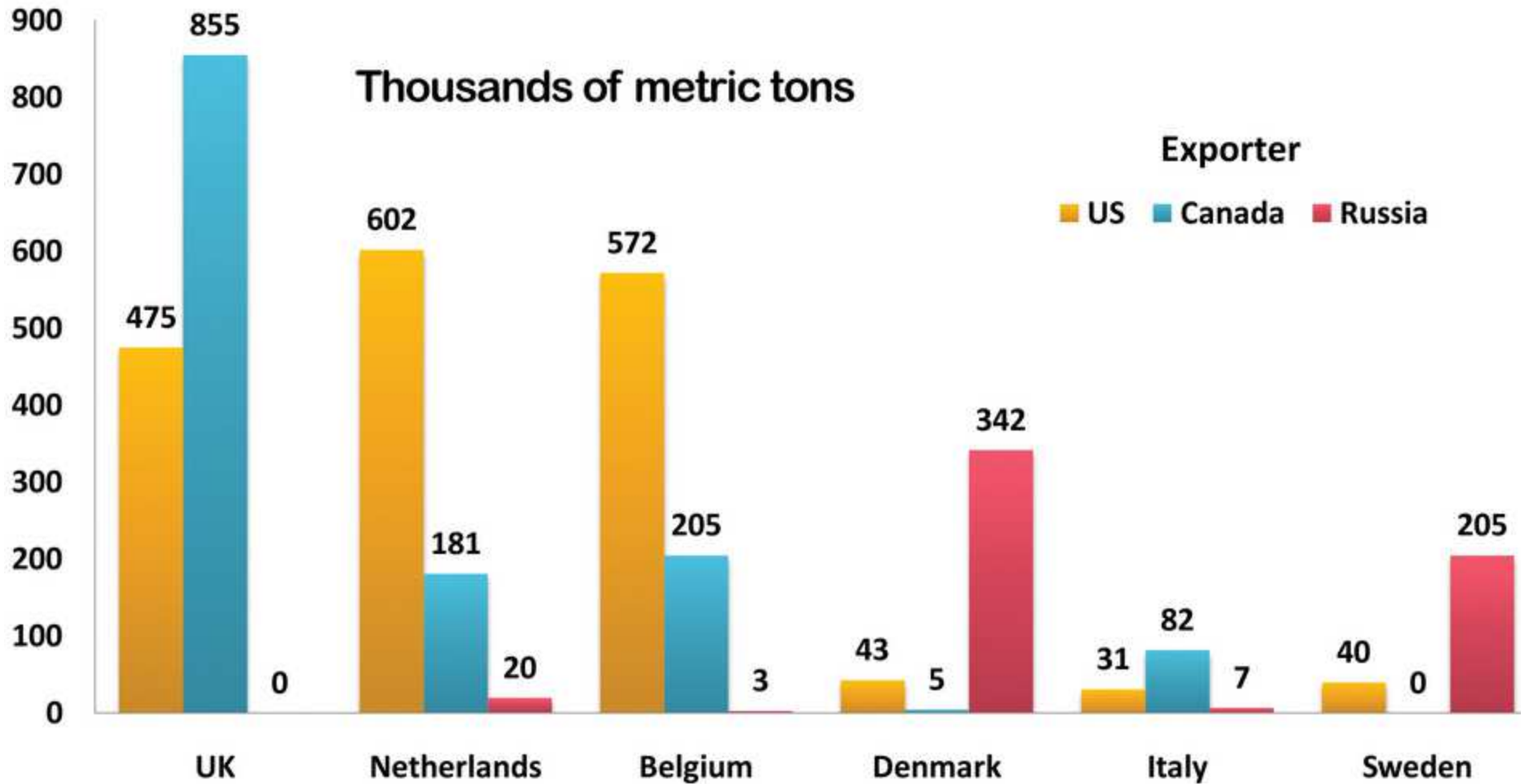
Imports of U.S. wood pellets by country (2013)



Source: U.S. Energy Information Administration, based on U.S. International Trade Commission data

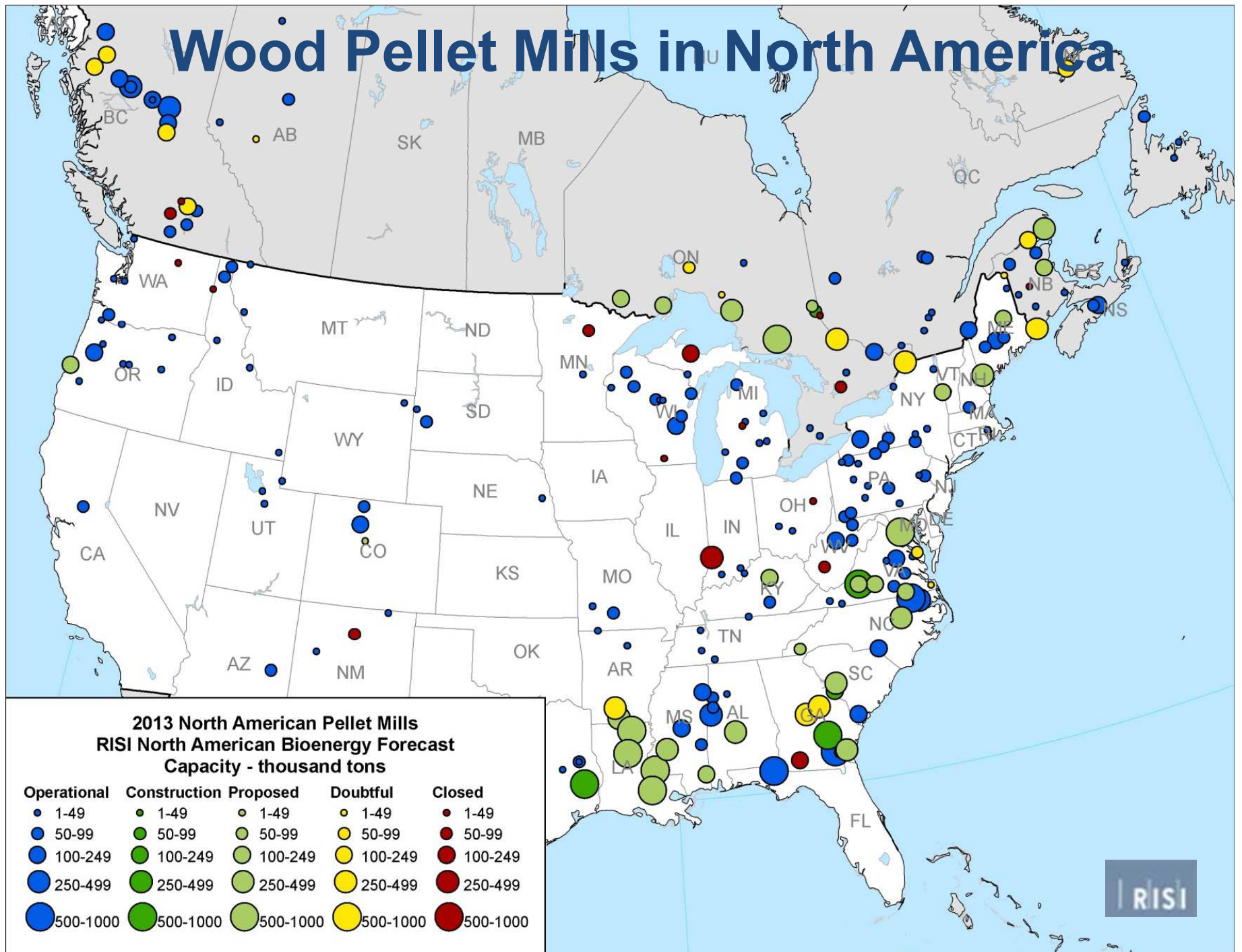


Wood Pellet Imports by Selected Countries (2012)



Sources: Biomass Magazine 9/23/13

Wood Pellet Mills in North America



Mega Challenges

National Security



Economy



Environmental
Degradation

Challenges/Issues

- 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 government agencies.

Challenges/Issues

- Competition for raw materials-chips.
 - Pulp/Paper
 - Composite Panels (OSB, Particleboard, Chipboard)
 - Upward price pressure for all sectors utilizing same raw material.
- Limited facility location options.
- Policy changes in demand markets.
- Relative prices of alternative fuel sources.



Thank You Questions???

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