

# Value-Added Uses of Hardwood Sawmill Residues in Bioenergy



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Forth Worth, TX  
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# Quick bio

- ▶ **Partner, Innovative Natural Resource Solutions LLC and Innovative Wood Fuels LLC**
- ▶ **Former Genl Mgr, New England Wood Pellet LLC**
  - Supervised wood procurement
- ▶ **Former Executive Director, NH Timberland Owners Assn (forest industry trade group)**
- ▶ **Founding Chair, Biomass Thermal Energy Council, Washington DC**



Jaffrey, NH



Schuyler, NY



Deposit, NY



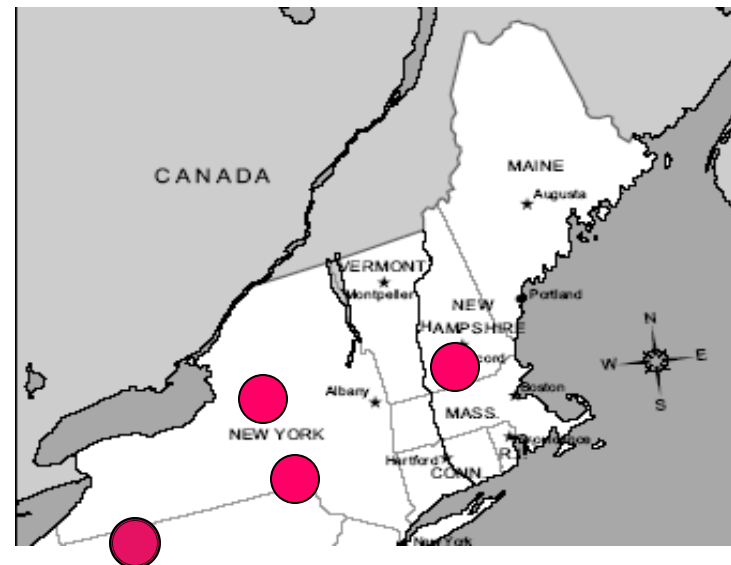
Youngsville, PA



## New England Wood Pellet *at a glance*



- 105 employees
- 500 jobs supported  
(wood supply, transport, sales)
- 300,000 tons annual production
- Heat 85,000 homes and businesses
- 200 bulk accounts
- Displace 34 MM gallons of heating oil
- Reduce GHG emissions 379K tons/yr
- \$20 MM/yr in wood purchases



# Wood Bioenergy 101

## ▶ Electricity

- 7,400 MW – hydro, wind, solar exceed
- Growth slowing: cheap NG, carbon accounting debate (Clean Power Plan)
- Federal/state incentives: ITC/PTC

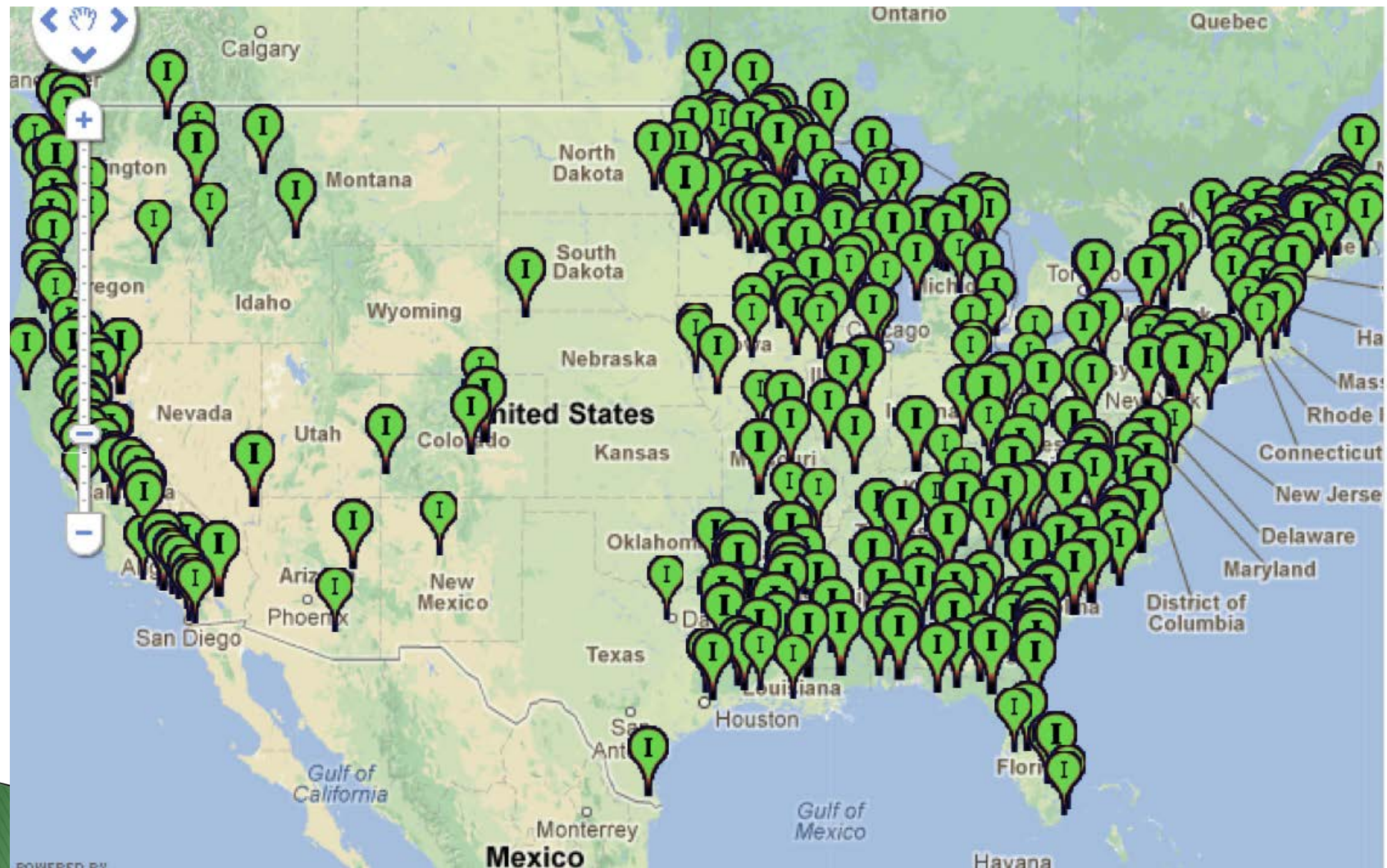
## ▶ Transportation

- Cellulosic ethanol – no commercial US plants
- Renewable fuel oil, DME – no commercial US plants
- Federal incentives: RFS, ITC/PTC

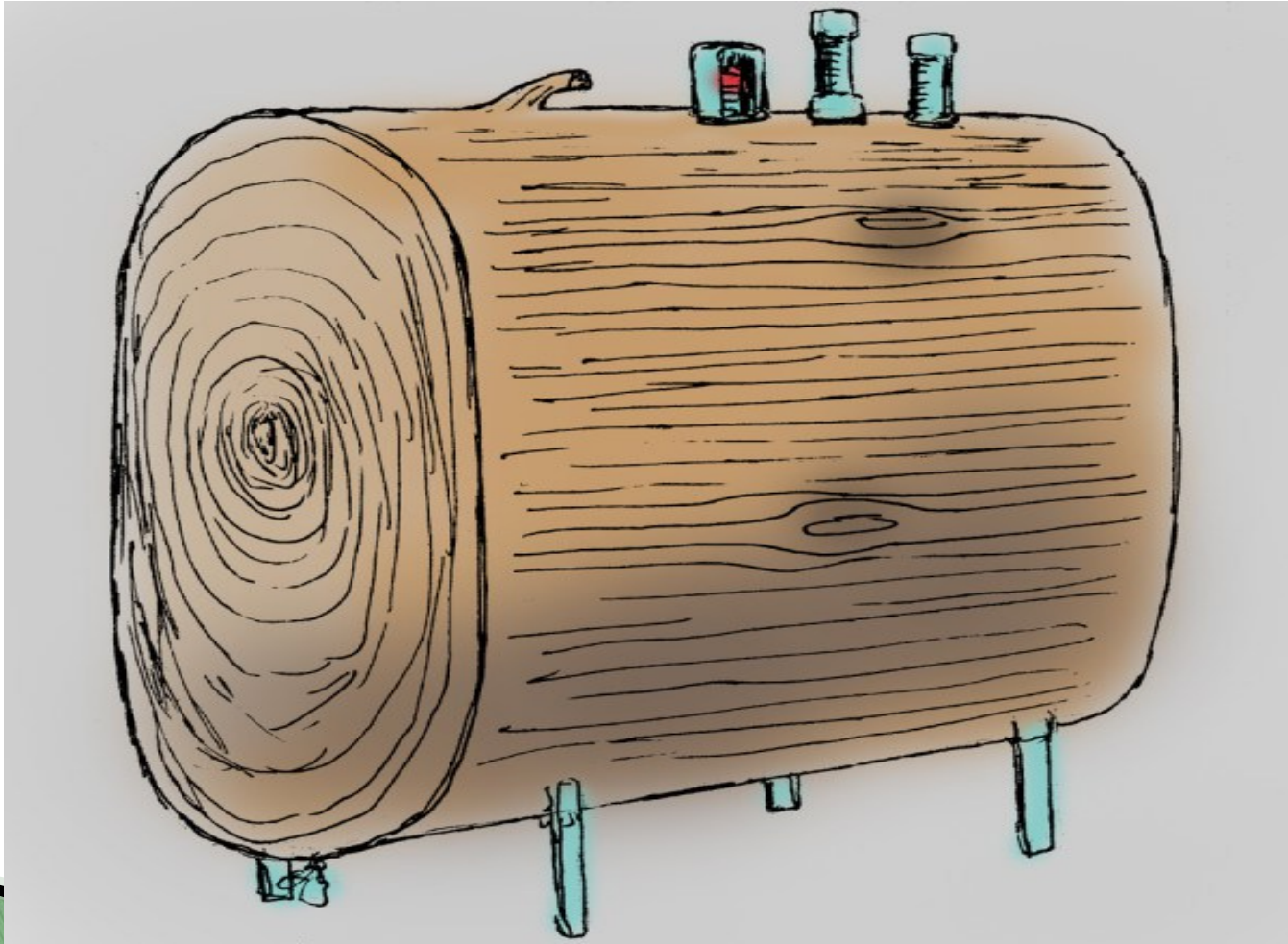
## ▶ Heat

- Residential
- Commercial/Institutional
- Industrial
- Some state incentives, esp. northeast

# Operating Biomass Electric Plants



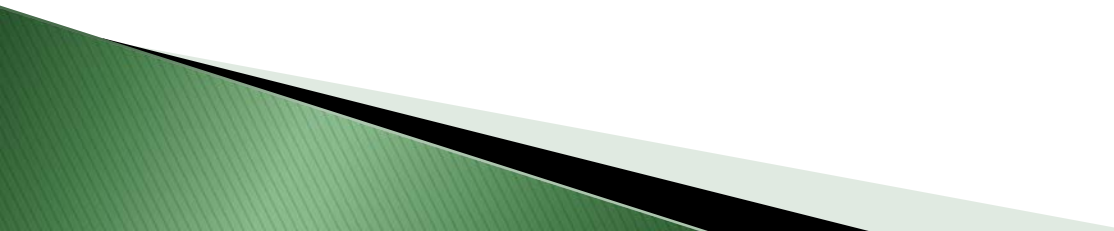
# Heat – Real promise for large scale use of sawmill residues



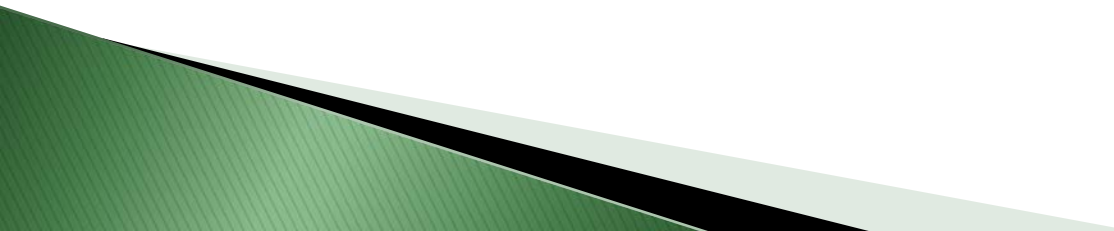
# Bioenergy Markets for Hardwood Residues

- ▶ **Bark**
  - Industrial boiler fuel for heat/electricity, e.g. dry kilns
- ▶ **Green Chips / Green sawdust / Kiln-dried sawdust, chips, shavings, grindings**
  - Industrial boiler fuel for heat/electricity
  - Commercial/institutional heating and process heat
  - Wood pellets: different grades for different markets
  - Briquettes and bricks for residential heating (small market)

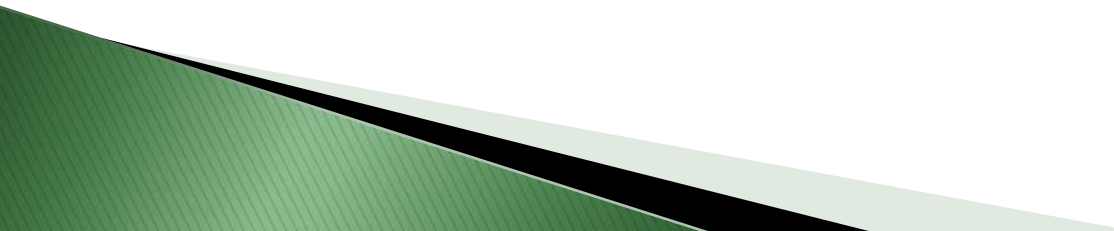
# Benefits of Wood Bioenergy for Heating

- ▶ Historically much less expensive vs. heating oil, propane, natural gas, electric heat
  - ▶ Keeps fuel dollars local
  - ▶ Energy independence
  - ▶ New boiler technology = low emissions
  - ▶ Renewable fuel
  - ▶ Supports good forestry and forest industry through markets for residues and low grade roundwood
- 

# “Engineered” Wood Fuels

- ▶ Clean, Efficient Combustion
  - ▶ Fully automated fuel storage and conveying
  - ▶ Green Chips
  - ▶ Semi-Dry Chips (“Refined” Chips)
  - ▶ Pellets
- 

# Green Hardwood Chips

- ▶ 35–50% moisture content
  - ▶ <1% ash if bark free
  - ▶ Must be clean!
  - ▶ About 5,000 btu/lb
  - ▶ Boilers generally over 3 MMBTU
  - ▶ Hospitals, schools, larger buildings, campuses (district heating)
  - ▶ Live floor delivery
  - ▶ Delivered price – \$50–65/green ton
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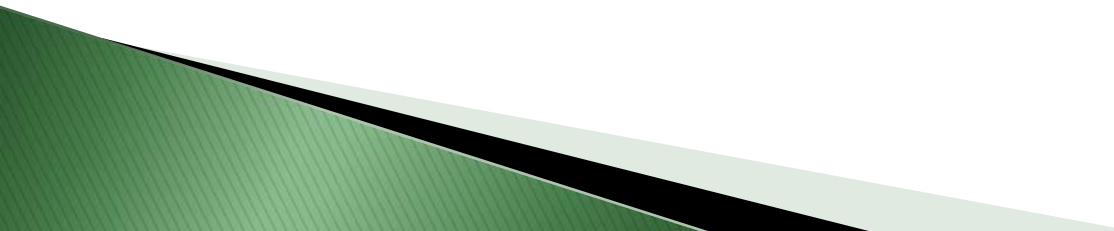
# Merrimack Valley Schools Wood – 5 MMBTU Chip District Heating Plant, Penacook NH



# EMD Millipore, Jaffrey NH – 20 MMBTU heat and process steam



# Semi-Dry “Refined” Chips

- ▶ Strong in Europe, market just starting in U.S.
  - ▶ Air, solar or active drying to  $<25-30\%$  MC
  - ▶ About 6,500 btu/lb
  - ▶ For boilers generally  $<1$  MMBTU
  - ▶ Multi-fuel boilers – pellets or chips
  - ▶ Pneumatic or live floor delivery
  - ▶ Delivered price – \$90–125/green ton (hardwood)
- 

# Whelen Engineering, Charlestown NH - 2 MMBTU/4 stacked boilers



# Solar hot air drying of wood chips for fuel



# Wood Pellets



- ▶ Primary feedstock:
  - Chips or sawdust, green or kiln-dry
- ▶ Dried to 6–9% MC before pelletizing
- ▶ 8,300 btu/lb.
- ▶ Bark-free, clean fiber = low ash
- ▶ Most species desirable
- ▶ Domestic heating markets (bagged and bulk), export co-firing markets (EU & UK), potential domestic co-firing and industrial markets

# Carroll County Nursing Home Complex, Ossipee NH

## 1.6 MMBTU



# Greenfield Community College, Greenfield MA

## Installation by: Sandri Energy



# White Mountain National Forest Admin. Complex, Campton NH – 1 MMBTU cogen system



KOB Pellet  
Boiler



Pellet-fueled 100 kw  
Cogeneration Unit



Bulk delivery to  
external silo

# Typical Installation External to Existing Building



# Wood Pellets Now Seeing Large-Scale Users

Jackson Laboratory, Bar Harbor, Maine, 12,000 TPY  
“powder burner”



# Pneumatic bulk delivery trucks (Sandri Energy and Maine Energy Systems)



# Growth opportunities for use of sawmill residues in heating and CHP

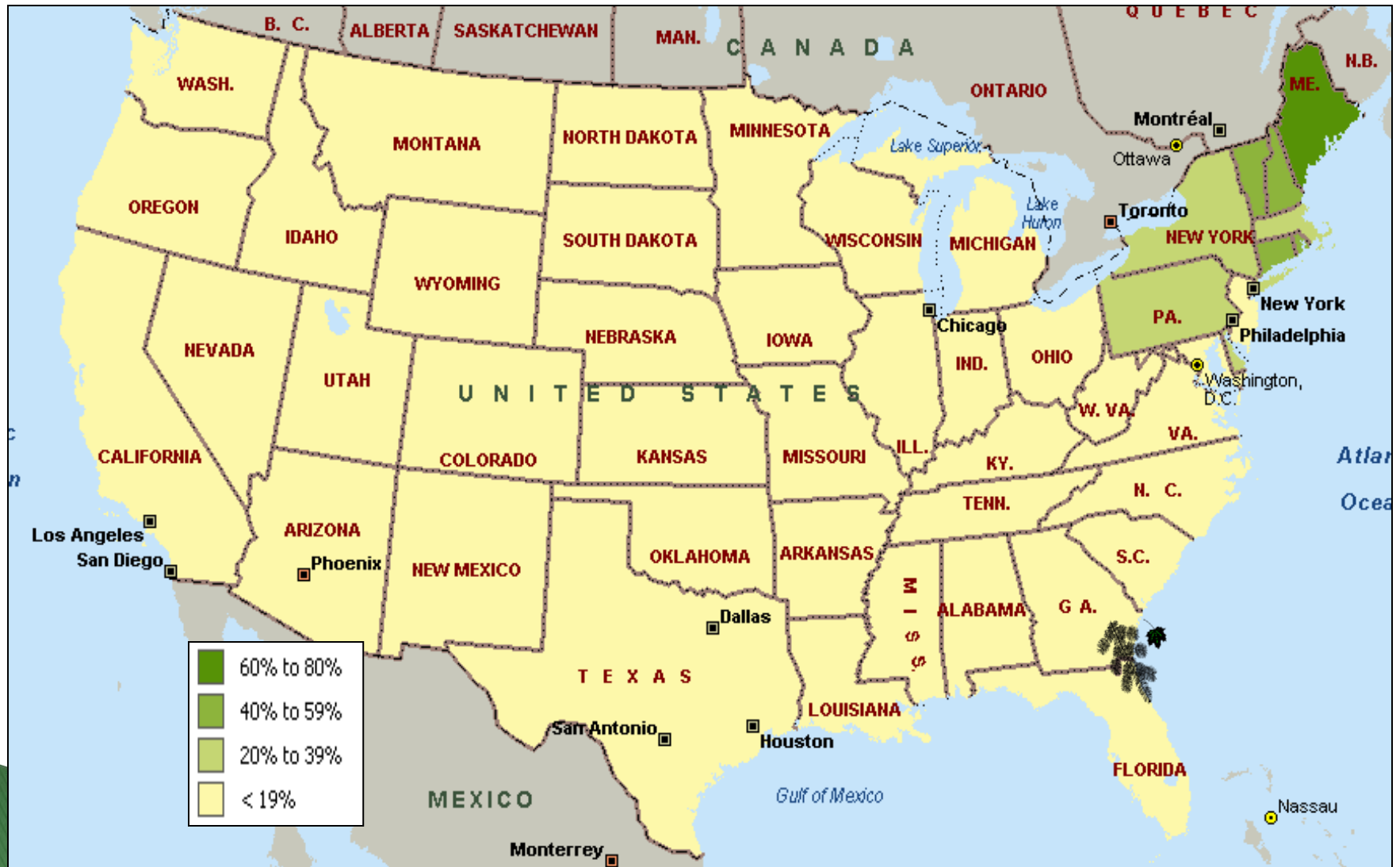
## ► **Regions with:**

- Limited natural gas distribution (rural, mountainous)
- Expensive electricity
- Cold winters
- High dependence on heating oil
- Healthy forest products industry
- Culture of wood burning, rural economies

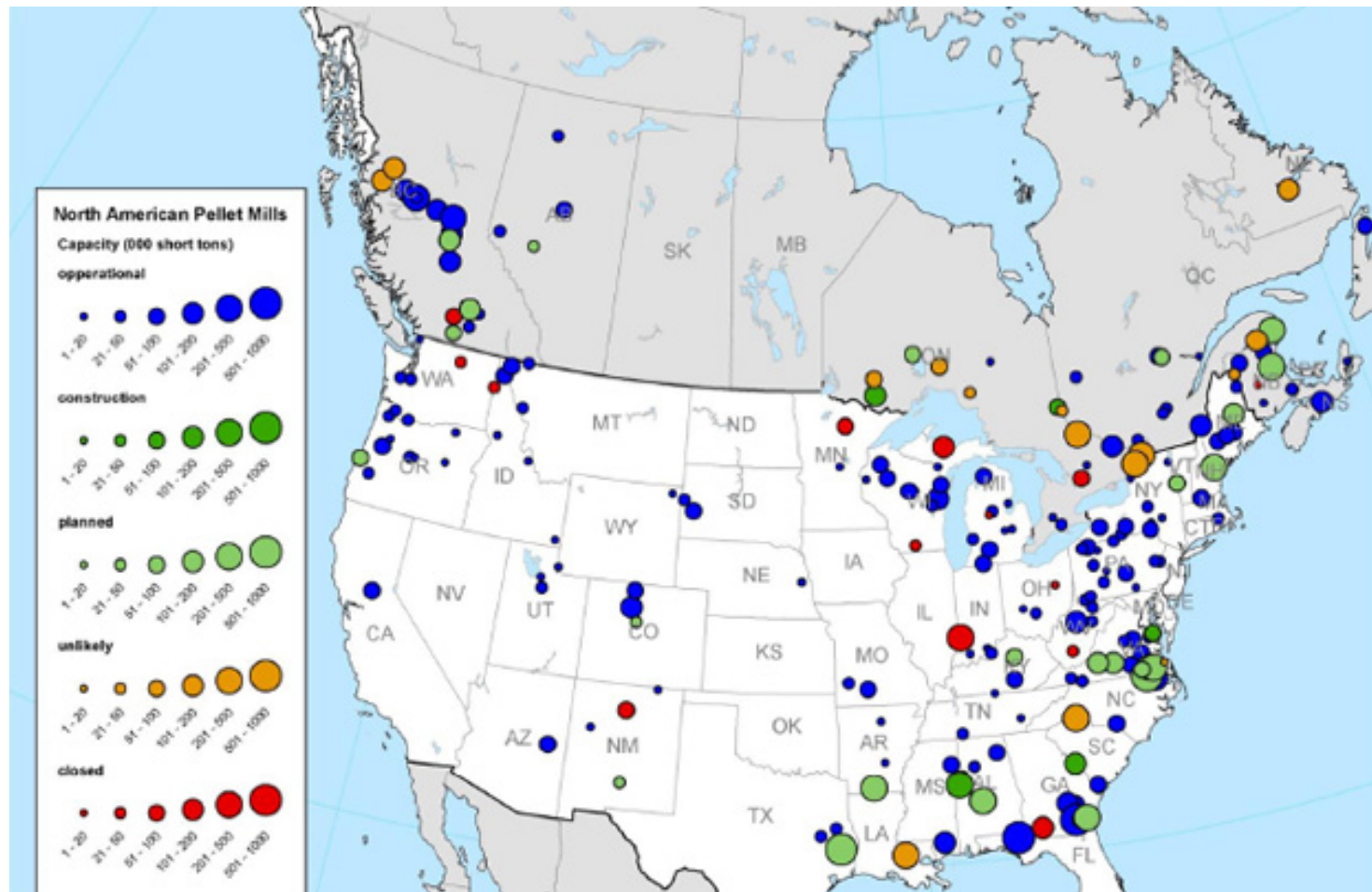
## ► **Northeast, but also North–Central, Pacific Northwest**

## ► **Elsewhere: process heat for big thermal loads, pellet manufacturing**

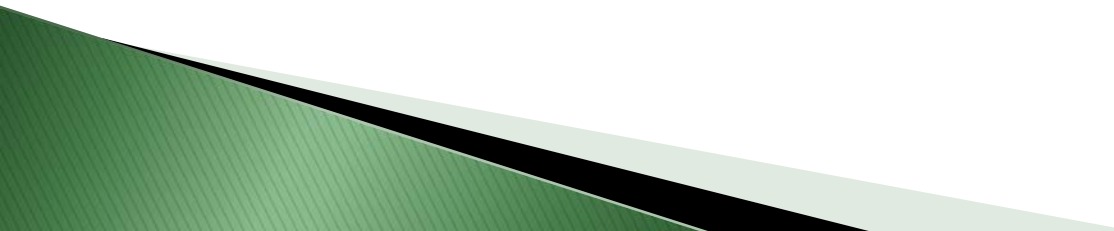
# Percent of Homes Using Oil as a Primary Heat Source



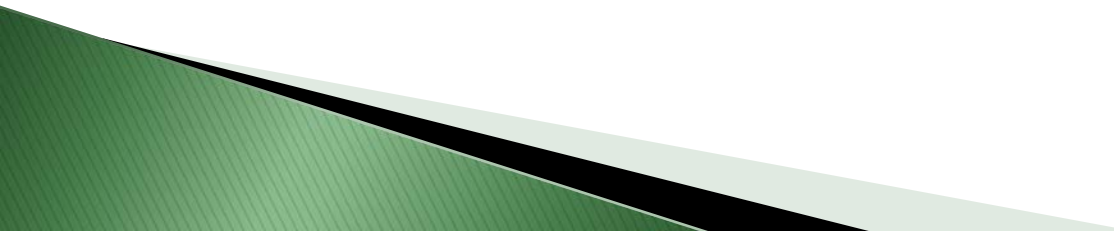
# North American Pellet Manufacturers



# Domestic U.S. Pellet Heating Industry

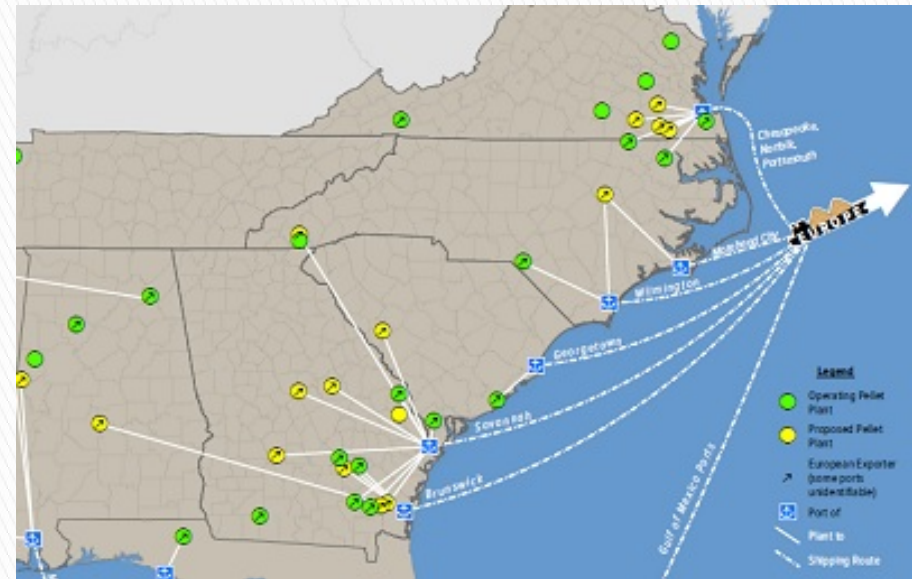
- ▶ About 80 manufacturers
  - ▶ Most small; only 15 above 100K TPY
  - ▶ Produce and ship about 3 MM TPY
  - ▶ Markets centered in northeast, north-central, northwest, and mid-Atlantic regions
  - ▶ Relatively slow growth – about 5% YOY last 10 years
  - ▶ Consolidation in recent years
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# Domestic pellet wood procurement

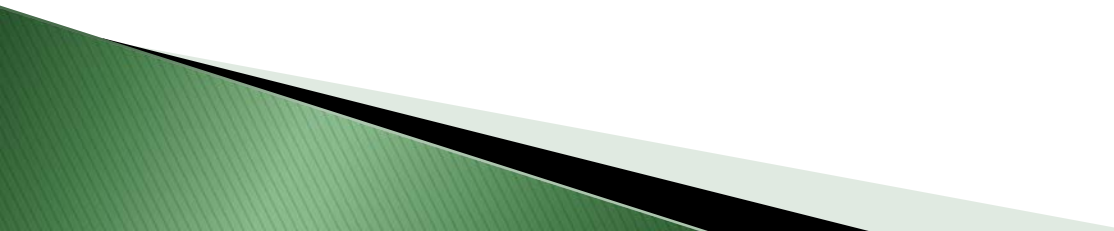
- ▶ Premium grade requires high quality, clean wood fiber
  - ▶ “Garbage in, garbage out”
  - ▶ Clean, bark-free sawmill and secondary manufacturing residues: chips and dust
  - ▶ Debarked roundwood chips: from chip mill or in-woods with flail debarker
  - ▶ Some tolerance for bark-on roundwood chips, but must limit
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# U.S. Export Pellet Industry

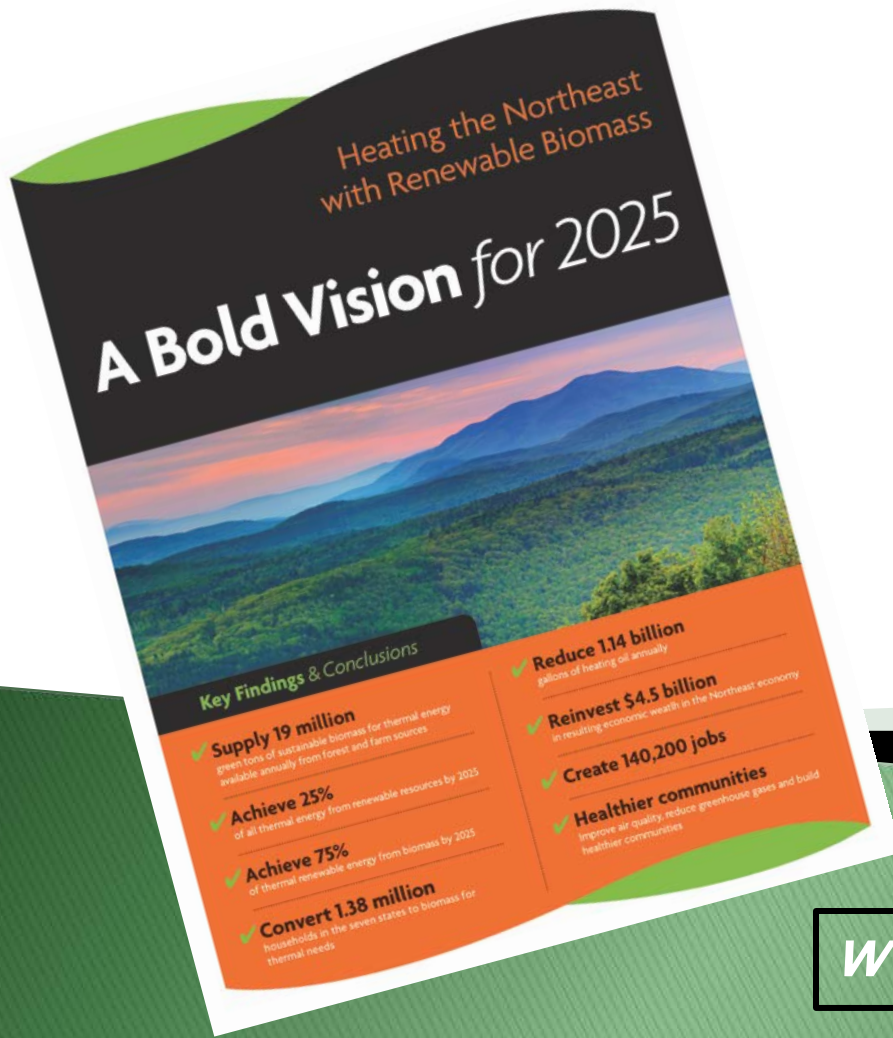
- ▶ Centered in U.S. south – Atlantic and Gulf states
- ▶ Significant growth in recent years, but slowing
- ▶ Nearly all export volume used in co-firing with coal to produce electricity and some CHP
- ▶ Current U.S. capacity now exceeds 4 MM TPY
- ▶ Carbon accounting under scrutiny
- ▶ Driven by EU and UK renewable energy/GHG emission reduction mandates



# Export Pellet Wood Procurement

- ▶ Industrial pellet can tolerate higher ash content
  - ▶ Low grade roundwood, mostly SYP
  - ▶ Tops and limbs
  - ▶ In-woods chips from roundwood, logging residues
  - ▶ Commercial thinnings, SYP
  - ▶ Sawmill residues, mostly softwood
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# Heating the Northeast with Renewable Biomass: *A Bold Vision for 2025*

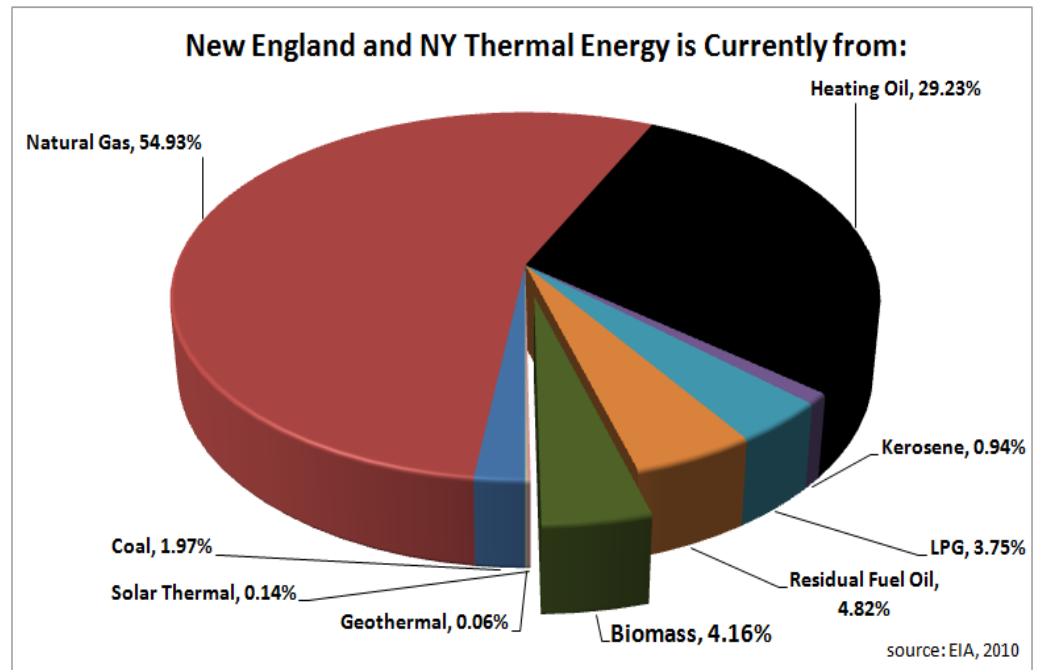


- An American Revolution in thermal renewable energy, to start in the Northeast
- 25% of all thermal energy in Northeast from renewable energy by 2025
- 75% of renewable thermal energy from sustainably-sourced forest and agricultural biomass by 2025 (balance from solar thermal and geothermal)

[www.nebioheat.org/vision](http://www.nebioheat.org/vision)

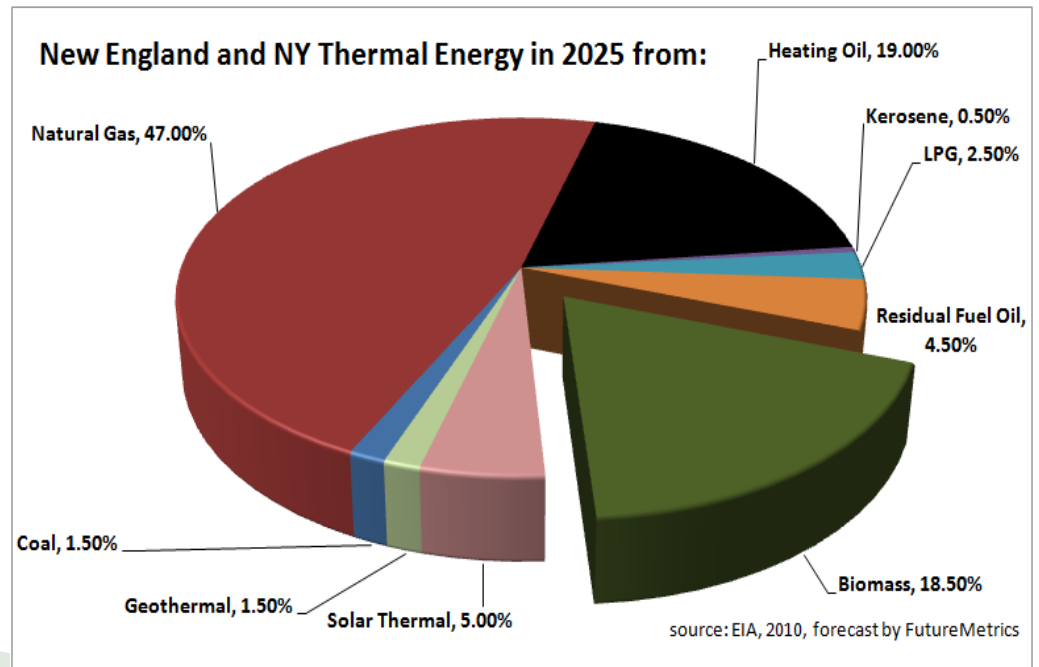
# 2010

Biomass = 4.16%  
of thermal energy




# 2025

Biomass = 18.50%  
of thermal energy



# Policy Support for Biomass Heating

- ▶ USDA – REAP Grants (25% capital cost)
  - ▶ States – Grants and rebates for boilers
  - ▶ States – RECs for heat generated by biomass in some states with RPS programs (NH, MA)
  - ▶ Federal – BTU Act – up to 30% ITC for boilers
  - ▶ Federal – Bioenergy Program for Advanced Biofuel payments
  - ▶ Federal – Renewable energy procurement requirements for federal agencies now credits heat in addition to electricity
- 

# A Primer in Wood Pellet Manufacturing





Truck  
Dump



**We have  
also  
procured  
and utilized  
hardwood  
roundwood,  
with on-  
site flail  
debarking  
and  
chipping in  
winter 2007**



The material is stored in piles until a front end loader transfers it into the in-feed system. “Green” material averages about 45% moisture content.



At this point, the chips pass through a 350 hp pre-grinder and are mixed with the sawdust.



The material then fills a silo which meters wood into the dryer.



**The 12-foot diameter, 60-foot long rotary kiln dryer dries the material to 10–12% moisture content.**



The dryer is heated by a 45 MMBTU biomass burner.



**Air is then blown into a series of cyclones which separate water vapor and gases from the dried sawdust. Moist air is then exhausted.**



Now the coarse sawdust goes through another 300 hp grinding to be reduced in size.



The material is now conveyed to a silo where about 15% goes back to fuel the burner.



The material in the silo is then metered into one of three 300 hp mills where the pellets are formed under high heat and pressure. Pellets are about 4% moisture content.



The pellets travel through a cooling system.



Pellets are separated into 40-pound bags and stacked by our robotic packaging system. Some product is diverted to our bulk delivery truck for delivery to central heating customers.

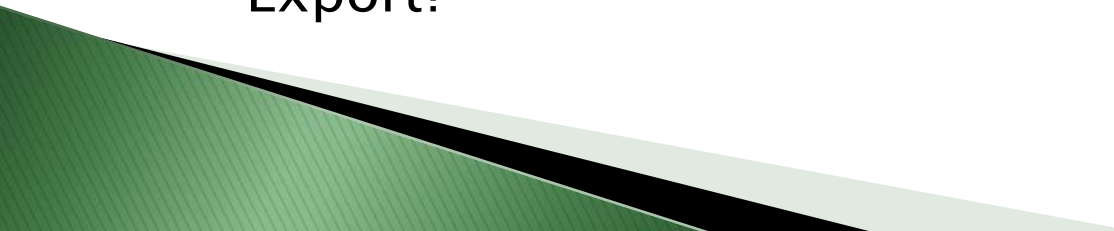


Stacked pellets are then prepared for shipping.



Or shipped in bulk to over 200 bulk accounts

# Words of Wisdom

- ▶ Know and secure your wood supply
  - ▶ Optimize siting and size of plant – proximity to wood supply, proximity to market
  - ▶ Don't scrimp on capital – build it right
  - ▶ Plan on 1 + years of shakedown
  - ▶ Take combustible dust seriously
  - ▶ Prepare for three years of market development to get plant to capacity
  - ▶ Diversify your market channels
    - Bagged and bulk
    - Specialty retailer and mass merchant
    - Export?
- 

# Thank you

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