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Biomass Energy Opportunities and Our Local Forests

Future Forests II

February 11, 2009

Ferndale, CA

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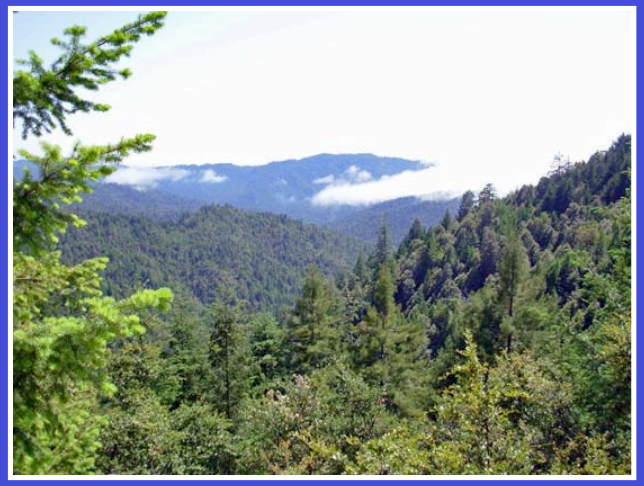
Outline

- Schatz Energy Research Center
- Forest Biomass to Energy Pathways
- Biomass Energy Technologies - Description and Status
- Biomass Energy and Our Local Forests – Near Term Opportunities and Long Term Vision



DOE/NREL

Schatz Energy Research Center

Humboldt State University, Arcata, California

Promoting the use of clean and renewable energy

SERC Biomass Energy Projects

- Biomass Gasification Project with UC Berkeley
- Biomass Heating Feasibility Study for SRNF Orleans Ranger District Office
- Biomass Energy Assessment for Yurok Tribe (part of Tribal Utility Feasibility Study)
- Biomass Energy Assessment for Humboldt County (part of Energy Element for the General Plan Update)

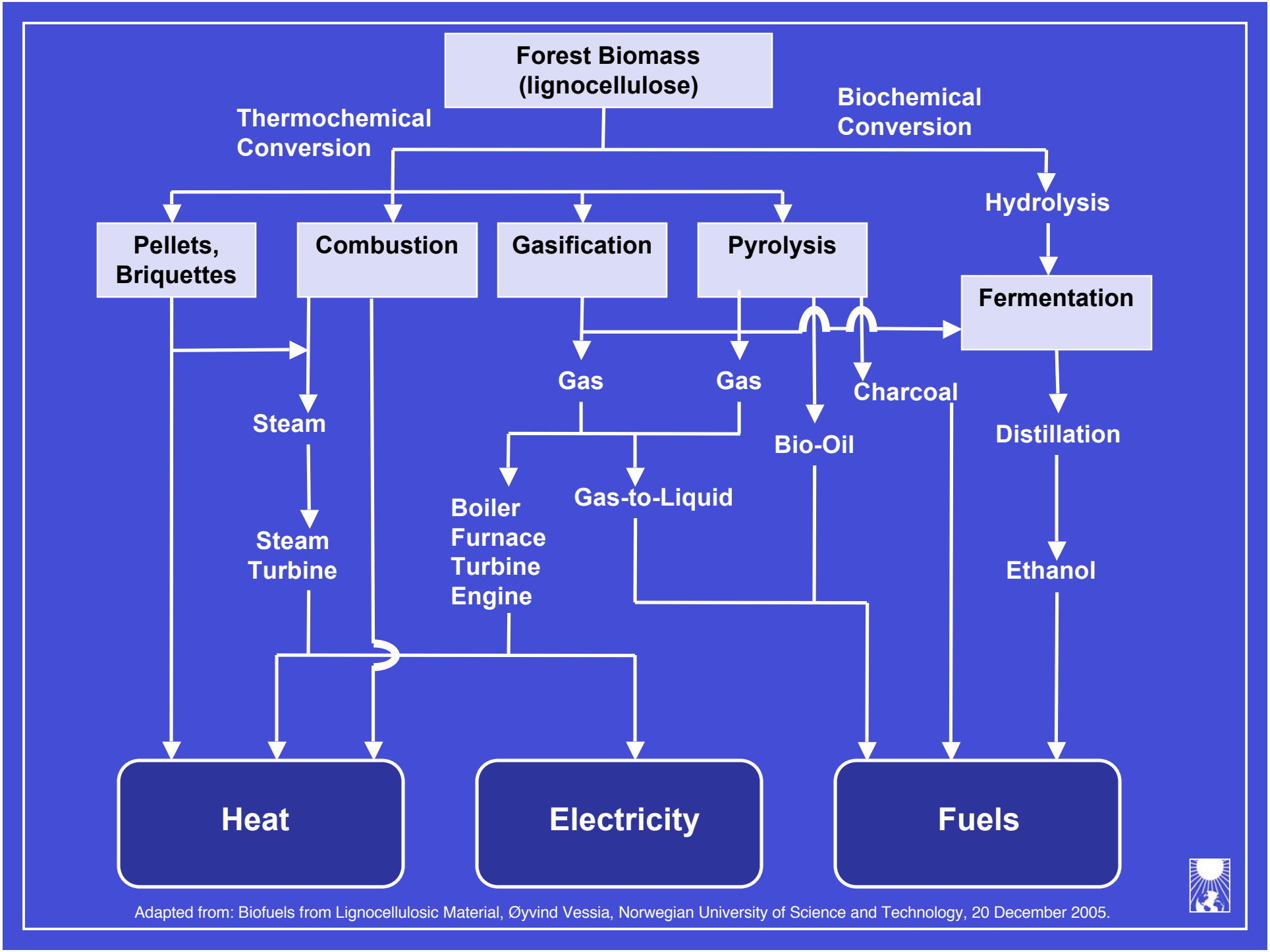
Forest Biomass to Energy Pathways

Biomass Inputs

- Logging Slash
- Thinning / Management
- Fuel Reduction
- Mill Wastes

Energy Products

- Electricity
- Heat
- Liquid Biofuels
- Biogas
- Pellets, Briquettes, Charcoal



Adapted from: Biofuels from Lignocellulosic Material, Øyvind Vessia, Norwegian University of Science and Technology, 20 December 2005.

Solid Fuels

- Conventional pellets are made from sawdust
- Whole tree pellets pose challenges
  - No existing market
  - Pellets fall apart
  - Need clean source, primarily bole wood
  - Ash content too high – slag, clinkers
- Economies of scale require larger production facilities

Generate Electricity at Central Plants

- Send waste to large, local, wood-fired steam power plants (Fairhaven, Scotia, Ultrapower)
- Challenges:
  - Transport costs limit allowable distance traveled (highway miles and logging roads)
  - Difficulty getting chip vans to landing
  - Roll-off containers, efficient collection and transport practices can help (Han-Sup Han, HSU)
  - Scale of operation needs to be large enough

Craig Rawlings, et al. Dec. 2004

Heat and Electricity for Distributed Power Plants

- Locate smaller, distributed power plants in rural communities
- Steam-fired turbine, gasifier + IC engine or combustion turbine
- Challenges:
  - Minimum economies of scale (fuel handling, pollution control, etc. are too great for small projects)
  - Need secure fuel supply and competitive pricing
  - Lack of equipment availability in smaller sizes

MSEI Fairhaven Biomass Power Plant

Wood Chip Fired Boilers

- "Fuels for Schools" model has worked in VT, MT etc.
- Equipment is proven and can be economical
- Challenges:
  - Min. facility/equipment size (1-2 MMBtu, 50,000 sq.ft.)
  - Air quality regulations and cost of pollution control
  - Need secure quality fuel supply
  - Very small facilities can use cordwood fire boilers
- What's needed?
  - Market analysis – how many boilers, size, location
  - Resource assessment – availability, quality, cost
  - Prove concept with pilot projects
  - Develop needed support infrastructure

Cellulosic Biofuels

- Cellulosic ethanol, synthetic diesel, bio-oil
- There is great demand for sustainable transportation fuels (renewable, local, carbon neutral, doesn't compete with food crops, minimal environmental impact, cost effective, energy efficient)
- Technologies are not yet commercially available
- May offer significant opportunity in next 5, 10, 20 years

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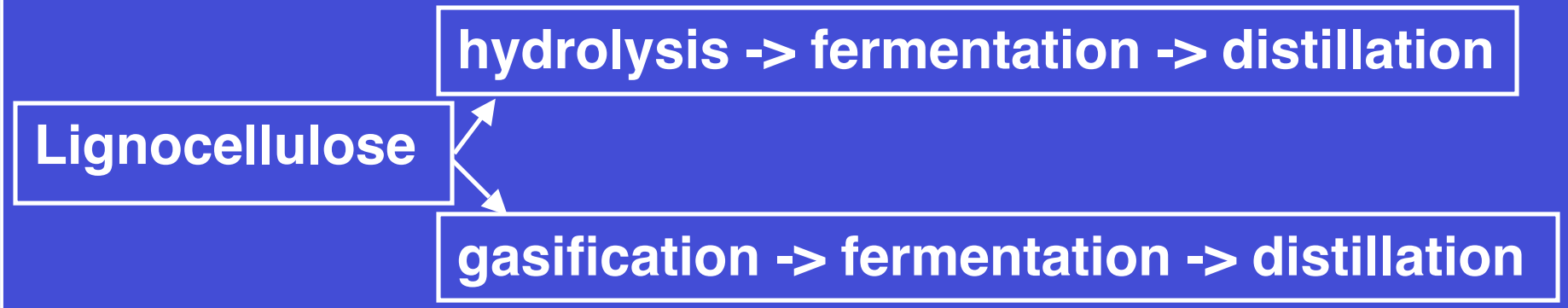
Cellulosic Ethanol



- Ethanol from sugars and grains is proven and commercial
- Ethanol from cellulosic materials is advancing, not yet commercial
- Lots of R&D $$$ being invested

Gas-to-Liquid Fuels

Lignocellulose -> gasification -> Fisher Tropsch

- **Fischer Tropsch process produces long chain hydrocarbons, well proven route from syngas to liquid fuels, several commercial plants internationally that use coal, crude oil or natural gas as the feedstock**
- **Can be “upgraded” to diesel fuel or gasoline**
- **Not commercial for lignocellulosic feedstock**

Fast Pyrolysis

Lignocellulose -> fast pyrolysis -> bio-oil

- Bio-oil can be used directly as substitute for fuel oil in boilers and turbines
- Can be refined into gasoline or diesel fuel
- Issues with stability, acidity, corrosiveness
- Two main companies have commercial operations (Ensyn, Dynamotive), small facilities, small amount used for fuel, most used for flavorings or other products
- Renewable Oil International - project announced for Douglas County, OR, wood waste to bio-oil, modular – can be loaded on flatbed

Be Cautious

- "If it sounds to good it probably is."
- Many of these technologies are still in development. It may take years or they may never make it.
- Small, portable systems are the most challenging.

Renewable Oil International

Bench scale unit (photo from ROI presentation)

Final Thoughts

- Energy prices are critical to the success of alternative energy projects. Current energy prices:
  Oil = $40 / barrel
  Gasoline = $2 / gal
  Natural = $1.20 / therm
- How much impact could these technologies have?
  Bio-fuel for transportation (20% of Humboldt County gasoline demand): ~ 254,000 green tons/yr
  New biomass fired steam-electric plant (14 MW): ~ 266,000 green tons/yr
  "Fuels-for-Schools" biomass heating (50 facilities): ~ 25,000 green tons/yr

Thank You

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Questions?