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Panel
Evolving Industry Opportunities
New Processes - Biorefinery
Bio-Refinery  
And National Forest Policy

- 1] return more forest cover on national park lands to more natural conditions;
- 2] increase multi-use recreation and economic activities on national forests;
- 3] reduce fire hazards on Western public lands; and
- 4] locate forest management and silva-culture practices that reduce carbon emissions.
Innovation Under a Microscope

Regulation Drives Innovation
Innovation
Incentive
Trade-off
Reward true. Break-through
vs.
Race to Hemorrhage Loss
Innovation Drives Policy

Recovered Chemicals

Electric Energy

Pulp

Syn Fuels

SynGas

Alternative Cellulose Products
We are not a Corporatist National Government

- Cannot do what the Europeans do
- Can however be more creative in what solutions as structures can be affected
- Can design contract structures
- Need to work from the inspired national agenda
- *Through* state and local enterprises (extension one good connector, but will have to be engaged).
Management and Internal Organization

Policy Sphere

Larger Economic Context
Management and Internal Organization

Policy Sphere

Larger Economic Context
To: Stewardship

Sustaining Forest Land

Production Resource (Industrial Interests)

Environmental Values (Interests)

Aesthetic Values (Interests)

Logs
Chips/Strands

Fiber

Bio-“Chem” (as in petro-chem)

Energy

Benefits: Jobs that consumers need doing

Society’s Sustainable Resource

Form Conv. Processes Materials Penultimate Products End-Products Mfgs./Mrkts. Consumers & End-Users

Lumber

EWP

Communication

Paper Pkging

Shipping Protecting

Absorbent

Solid Liquid Materials

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Institutes of Paper Science and Technology
**Conventional Kraft Pulp Production**

- **1 t wood logs**
  - **WOOD DEBARKING, CHIPPING**
    - **0.09 t hog fuel**
    - **HOG FUEL BOILER**
      - **steam**
      - **STEAM TURBINE**
        - **Steam extracted for process use**
        - **electricity for process use**
    - **WOOD DIGESTORS**
      - **0.91 tons wood chips**
      - **PULP WASHING**
        - **0.68 t BLS**
        - **BLACK LIQUOR EVAPORATORS**
          - **0.46 t pulp to paper**
          - **0.06 t Na₂S**
          - **0.016 t NaOH**
          - **CaCO₃ (dead load)**
    - **STEAM TURBINE**
      - **steam**
    - **CAUSTICIZER**
      - **0.23 t smelt (Na₂S, Na₂CO₃)**
      - **LIME KILN**
        - **CaCO₃ + heat → CaO + CO₂**
      - **Na₂CO₃ + CaO + H₂O → 2NaOH + CaCO₃**
    - **BLACK LIQUOR RECOVERY BOILER**
      - **0.06 t Na₂S**
      - **0.016 t NaOH**
      - **CaCO₃ (dead load)**

**Mass balance on a dry-matter basis.**

- **1 t wood logs**
- **0.46 t pulp to paper**
- **0.91 tons wood chips**
- **0.09 t hog fuel**
- **0.68 t BLS**
- **0.23 t smelt (Na₂S, Na₂CO₃)**
- **0.06 t Na₂S**
- **0.016 t NaOH**
- **CaCO₃ (dead load)**
Integrated Gasification Combined Cycle
Power Plant / Recovery

Gasifier

Gas Cooling & Cleaning

H₂S Capture & S recovery

Steam Turbine

HRSG (w/duct burner)

Gas Turbine

electricity

steam from hog fuel boiler

natural gas (if needed)

clean syngas (hydrogen-rich gas)

process steam

electricity

black liquor

raw syngas

condensed phase to causticizing

sulfur to pulping liquor preparation

BLGCC
Three Major Problems

- Causticization of residual liquors
- Tar Cracking for Gas Clean-up
- Shortages of both steam for mill and cellulose supply
- Technically complete enough to feed gas turbine or blend to NG in home furnaces
- Already done. Tests on Big Island and New Bern Gasifiers
- Need more trees and added efficiency steam
Forestry Issues

- Helps to solve the cellulose shortage need.

- Demand supporting added cover
  - Especially marginal decision of small holder
  - Especially if larger cellulose harvest per acre
  - Biolistic Transgenic methods less controversial (or less environmentally threatening).
  - Tracking land use changes and sensitivity to different laws
Western Forest Benefits

- Refer to Map
- Fires most serious in Oregon / Washington
- More than $5 billion annually
- Most within 40 miles of a pulp mill
Policy Effects and Implications

- CO$_2$ balance. Transition to new stock and use of fiber output (paper and lumber) might increase net sequestration for half a century.

- Laws make a difference: Property Taxes, Harvesting Rules, ‘corn meal nuisances,’ federal lands objectives, net subsidy balances may disfavor forestry.
Complementary Fuel Stocks

- Two Problems To Gasification on Farm Residuals: Transportation and multiple value streams.
- With an active utility scale gasifier:
  - Make syngas not blendably clean for steam
  - Make syngas blendable / clean-up feasible
  - Make gas and pulp the agricultural material
National Priorities

- Energy Security
  - Distributed production

- Environmental security

- Competitive Workforce
  - Below collegiate level

- Innovation and Rural Economic Development

- Non-Trivial Domestic production source
  - Mills in many places

- Slows CO$_2$ atmospheric accumulation

- Higher tech jobs for this labor force

- High Tech solution to sustain traditional rural industry