Biomass Energy:

learn before we earn

Research to Receptor

OFA

November 2009

Research is not just answering questions:
it's also figuring out which questions to ask.

This is the second kind. Not the best of its kind, but that kind.

What's up for grabs

- 2 MT of biomass a year @ $ 175/T delivered
- $ 350 M / year for 25 years
- Or $ 8.75 Billion (NPV of $ 5 B ?)
- 5% waste = $ 437.5 million
- If waste cut to 2%, Ontario saves $ 350 million
- And if a 5% better value, Ontario up by $ 887.5 M
- $ 5 to 15 million to get it right, is OK

What else is on the line

- Is biomass needed to avoid stranding Nanticoke and connecting lines – $ 8 billion to $ 13 billion
- A timely start on Ontario's alternative to GHG's

7 Questions: *Working back from the stack*

1) What goes up the stack
2) What happens in the boiler
3) How to store
4) Where can we ship from
5) Si, N, P, K recovery, needed, how
6) How do we ‘pellet’ better
7) What are the agronomics

What is skipped

- Easy on economics, so not much about
  - Gov't., OPA, OPG power purchase terms
  - Raising funds to build pellet plants
  - Negotiations with CN/CP to do rails
  - Ditto with port authorities
  - Risk avoidance and management via design

What goes up the stack
What happens in the boilers

2 questions, same tests

Program to test farm biomass (alone and mixes) for

1) Heat value
2) Dry weight composition
3) Flu gas composition at different temps
4) Uses for ash
5) Boiler ‘slagging’ at different temps/air flows

Fuel tests

- **10+ kinds of biomass**
- **And likely blends**
- **5 tests per biomass or blend**
  - **heat, emissions, slagging, dry composition, ash**
- **Cost in 2007 North Dakota, $ 50,000 per round**
- **$ 2 M + in 2010 for 30 + test rounds**
- **Find blends that work for Nanticoke type boilers**

How do you study storage

- Outdoor storage cheaper, does it work
- Can boats be storage
- Pellet weathering tests
- Does small store better than large or medium
- Product modifications – do they help - Wax, Glaze, Torrify
- Which work/are cost effective
  - Tarps, hoop houses, silos, on farm, JIT from processor, trench silos
- Low damage handling – augers, belts, scrapers
- Dust control

What does storage research look like

- **Freeze – thaw cycles, exposure to weather**
- **Running material in and out of bins**
- **Measuring dust and losses**
- **Minimize lifts,**
- **Assess trenches, silos, structures**
- **Find out how Swedes, Danes, Brits do it**

Some transport

2 million tonnes =

- 65 trips by lakers
- 27,000 rail cars
- 100,000 truckloads

Where can we ship from

Ontario's secondary rail lines iffy to bad

Few lakeside elevators with good rail

Lakeside elevator capacity low given the volume

Nanticoke has no rail/tip facility

So – a transportation study is needed and follow through action

Transport study

- **How and where does the volume fit**
- **Which rail lines/ports can be upgraded at best cost**
- **Which would give Ontario greatest overall benefits**
- **Minimize truck travel, farm to plant**
- **Which roads to upgrade**

Study can guide pellet plant location

iS Si, NPK recovery needed

- Cost of pelletizing $ 35+/ ton
- With Si, NPK recovery, $ 50 plus
- From fuel tests – must silica be removed
- From emissions tests – better without NPK
- From agronomics – enuff better to recover NPK
- Value and what comes air, from soil

Si recovery

- Why – reduce material that can form slag
  - And amorphous Si is valued for chips etc.
  - Fewer lung problems
- How - Pulp and paper uses alkali bath
  - Others use electric precipitation
  - Alberta Research Council has a third patented approach

Which is better, best?

N P K

Why Recover: Loss from farms costly/Cleaner emissions

- In a wet pellet process recovery is from process water
- In dry – recovery by charge attraction or
- By ‘tea leaf’ approach or
- Over wintering on farm – what does it work for

Choice of methods undetermined at this time

Better Pelleting/Better Pellets

- **Cost reductions**
  - Safety +++
  - Energy use
  - Machinery needs
  - Handling
  - Heat re-use
  - Speed
  - Source ID/grading
- **Quality Improvements**
  - Low dust
  - Wear/weather resist
  - Easy store
  - ***Hi-density***
  - Cleaner emissions
  - Useful ash
  - Full Si, NPK recovery

On farms

CROP RESIDUES

- **Soil maintenance**
  - **Return of nutrients,**
  - **Limits on removal**
  - **Changes to crop cycle**
  - **No food for fuel**
  - **How to ensure the above**
- **What can be pelleted on farm**
- **Single pass harvests**
  - **Chaff, stover, cobs, straw all in one go**
- **More Residue/More Crop**
  - **Back to long stem grains**
  - **On to 2 ear corn**

PURPOSE GROWN

- Culture, seed, processes
- Harvest, equipment, processes
- On farm processing
- Varieties North – Willow
  - Farm model
  - Sudbury to Matawa
- Varieties South
  - Hemp, switch, miscanthus
  - Tobacco belt

4 Time Paths – converge in fall 2013

1 **Nanticoke Ready**

Fall 2012 start plant modifications

Nov. 2011, detailed engineering

Sept. 2011, research and fuel specs. Complete

March 2010, fuel research underway

2 **Growers Ready**

Fall 2012, harvest 600 to 2,000 kMT's

Fall/Winter 2011, grower get equip't

Summer 2011, research done growers chose crops

Research starts soon

Converging timelines

3 Pellets Ready

- Construction done, Aug. 2013
- Build start Fall 2012
- Design Winter 2011
- Process research done mid 2011
- Raise Funds Spring Fall 2011
- Incorporate Fall 2010
- Research starts winter 2009

4 Transport Ready

Rail, storage, ports ready Aug 2013
Construction starts late 2011
Design starts Aug 2010
Fed/Prov/CN-CP negotiations start ???
Transport study starts January 2010

Today: more questions, than answers

- What is needed – **RESEARCH** ***followed by action***
  - Not these questions, but better questions
  - People who find answers
  - Support for those people
    - sense of urgency & a sense of purpose
    - funds, test plots, staff, equipment, cooperation

it is not just off coal here, but for a global move
from hydrocarbon addiction to carbohydrate reliance

TOMORROW
Ontario goes from pellets to bio-fuels, bio-chemicals, bio-plastics

It's a start, not a conclusion