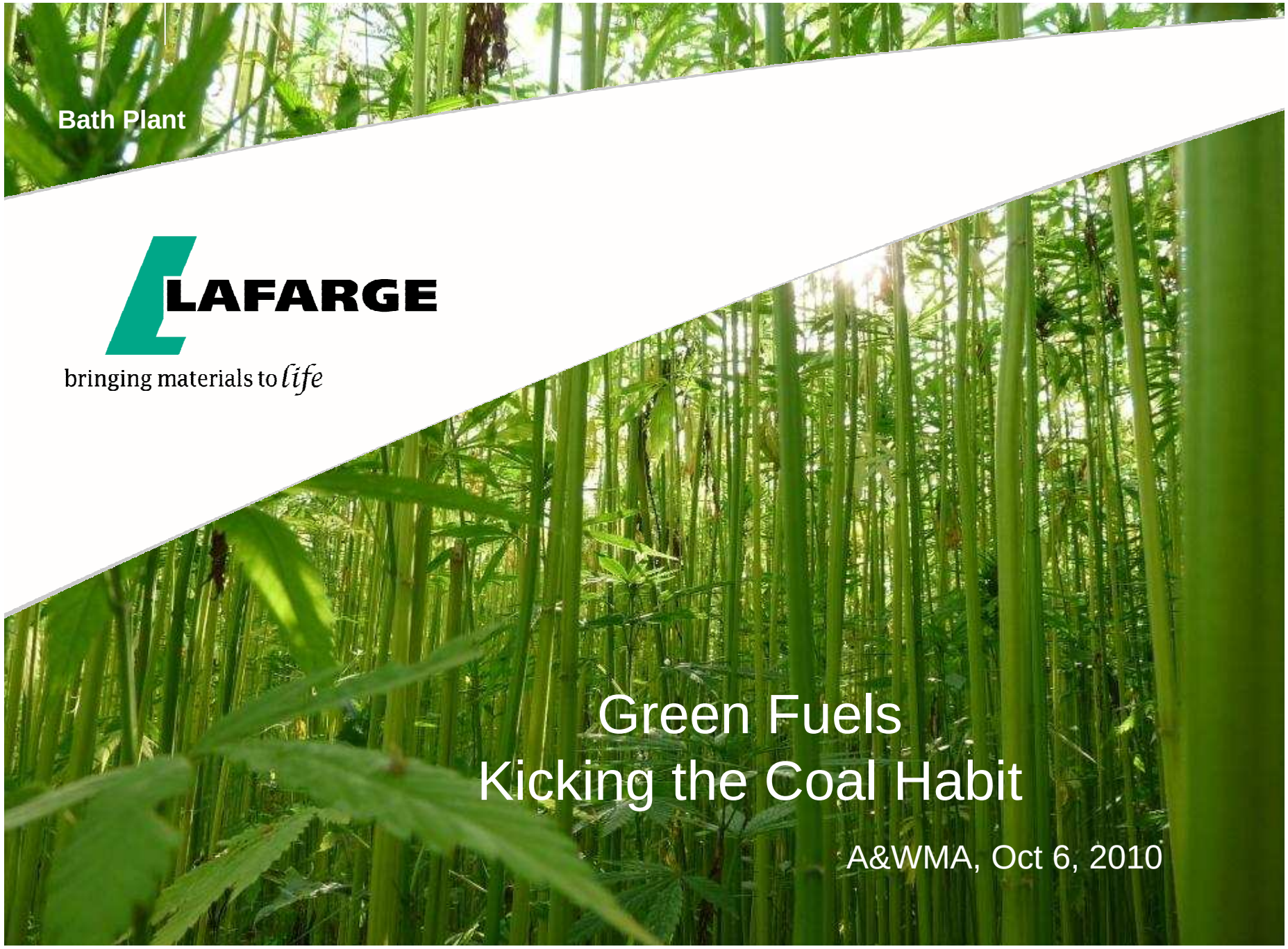
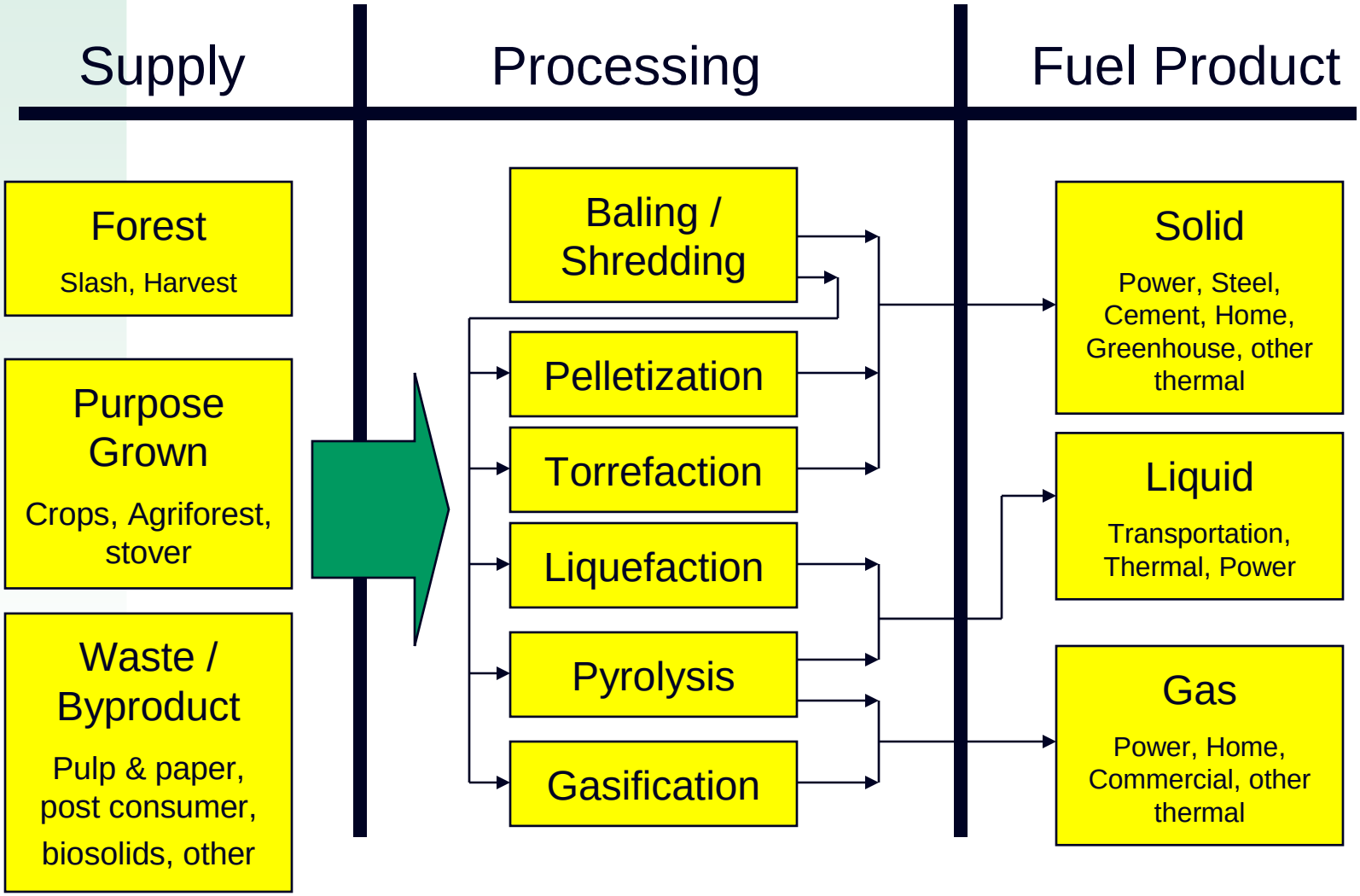

Bath Plant
LAFARGE
bringing materials to life
Green Fuels
Kicking the Coal Habit
A&WMA, Oct 6, 2010

Renewable Energy – Biomass is Different

- Solar
  - The sun shines BUT not all the time
- Wind
  - The wind blows BUT not all the time
- Biomass
  - Fuel must be produced BUT can be stored

Did you know? According to a BIOCAP Canada Foundation study, solid fuel biomass yields the greatest carbon savings for the dollar compared to wind, solar, and ethanol.

Challenge 1: Producing biomass fuels



Challenge 2: Cost of Biomass Fuels

Fuel Type	Cost per Gigajoule
Gasoline	$24
Natural Gas	$5-$12
Grown Biomass	$6-$10
Coal	$3-$4
Coke	$2-$3

Note: Coal releases about 90 kg CO_2/GJ; a "Cap & Trade" cost of $50/tne CO_2 will add about $4.5/GJ to the cost of coal.

Challenge 3: the Quality of Biomass as a Fuel

Characteristic	Coal	Biomass
$/GJ	**$3-$4**	**$6-$10**
Energy Density	**32 GJ/m3**	**13 GJ/m3**
Shipping	**Boat**	**Truck**
% Ash	**20%**	**3-10%**
Ash Chemistry	**Useful**	**Neutral**
Availability	**High**	**Low-Moderate**
CO_2 Emissions	**100%**	**<10%**
Other Emissions	**Present**	**TBD** (expected to be low)
Storage	**Outdoor**	**Covered?**

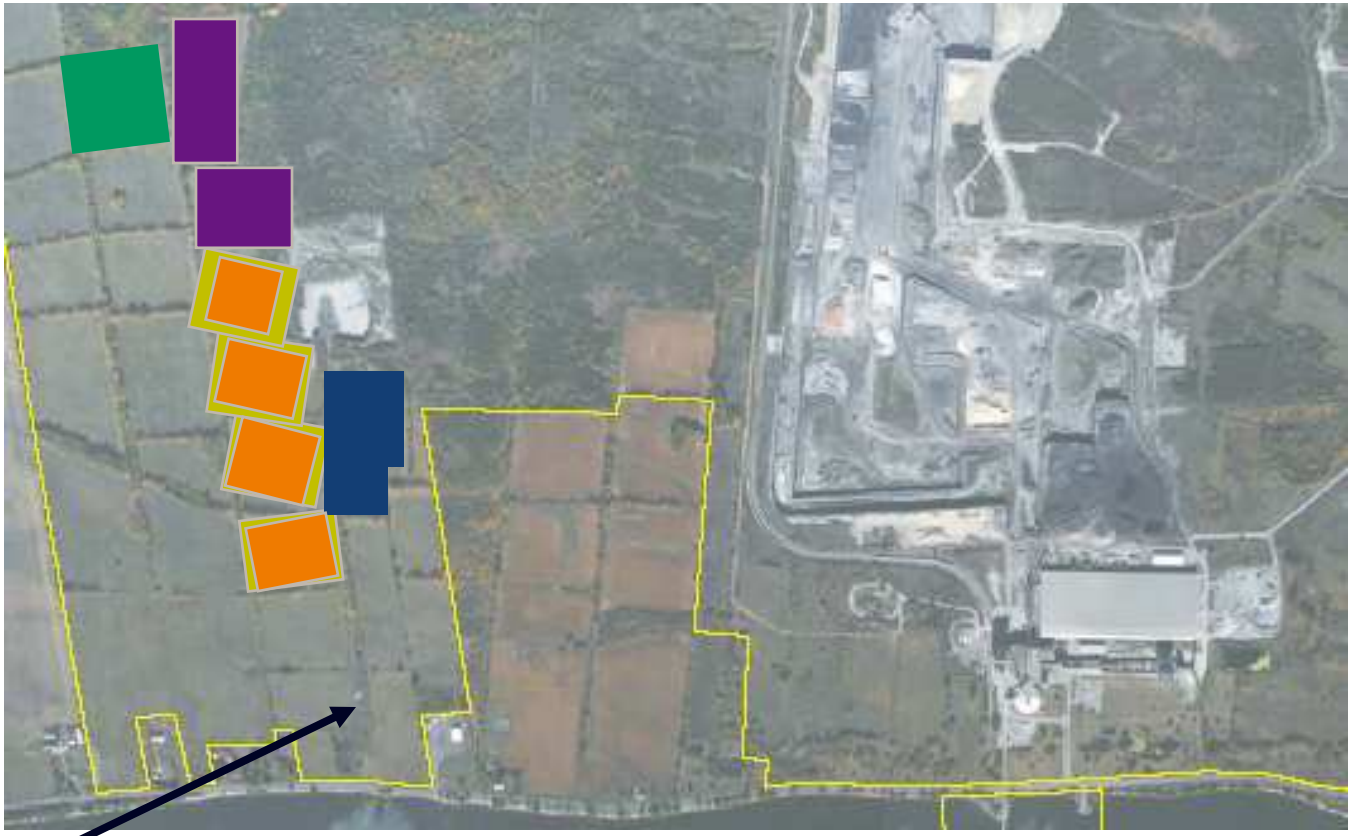
Lafarge Objectives

- Develop sustainable green fuels to meet expected carbon cost programs
- Sustainable means all 3 of…
  - Economic
  - Environmentally Sound
  - Socially positive
- Three projects
  - Life Cycle Assessment
  - Biomass Trial
  - Green Fuel Standard

Life Cycle Assessment

- Purpose: can we produce biomass fuels from crops in a sustainable manner and will they qualify for carbon credits?
- Plant perennial crops and determine
  - Water usage
  - Carbon balance
  - Yields
  - Economics
  - Habitat Effects
- Ministry of the Environment, Climate Change Branch co-funder
- Academic Partners
  - Queen's Institute for Environment and Energy Policy
  - University of Toronto
  - University of Guelph

Scientific Trials



KEY

- Rotation*
- Willow
- Miscanthus
- Flowers
- Poplar

MET Station

*Four Crops in Rotation are:

Big Blue Stem, Little Blue Stem, Switchgrass, Fallow

So, how does one grow fuel?

- Lafarge has tried it from seed to flame.
- Following are some photos of the process and what worked and what didn't and what we'd do differently
- The biomass testing is actively underway today
- Open House tomorrow!

Planting and Yield

Harvesting

Baling and transportation

Storage

From Bale to Shredded Biomass

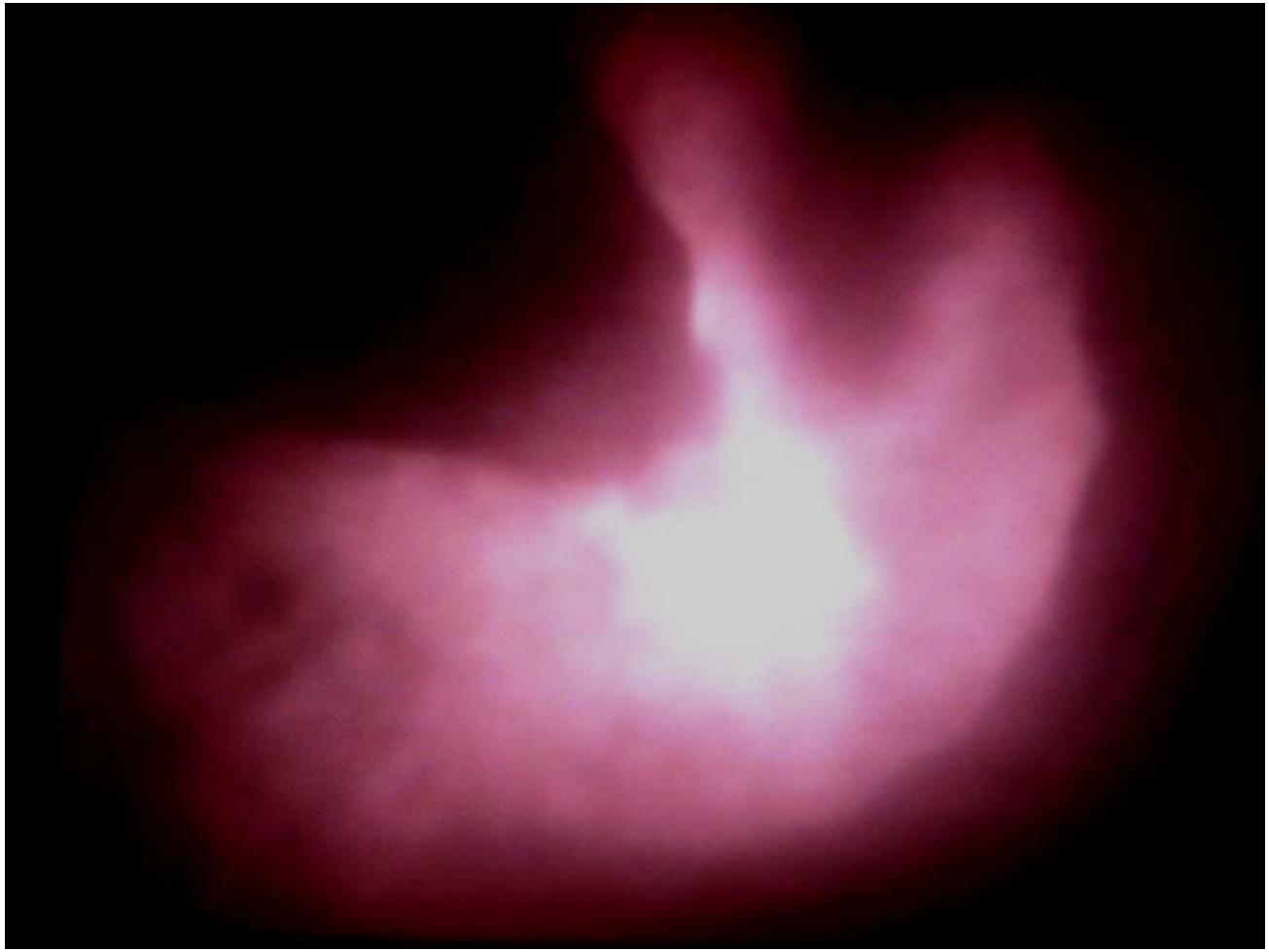
Shredded & Mixed Biomass

Biomass Ready to Process

Moving Biomass from Field to Fuel

Injection

Combustion



A Green Fuel Standard

- What makes a fuel “green”
- Can a fuel be “green” in one combustion process and not in another? (e.g. home fireplace compared to cement kiln or power boiler)
- What if 5 pollutants decrease and one increases?
- What qualities of fuel lead to emissions? Can we conduct lab testing rather than full scale testing?
- Can we adopt a LEED-like approach to grading fuels?
- Can CofAs use this Standard?
- How do we consider the upstream environmental aspects of fuel production?

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