US DOE/USDA Biomass Technical Advisory Committee

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Company History

- Founded in 2002

- Series A ($6MM) in 2006
  - Led by MDV and Firelake Capital
  - Proved technology at lab scale

- Series B ($34MM) in 2008
  - Co-led by Globespan and PrairieGold
  - Valero Energy Corporation
  - Money raised for demo plant

- Current Status
  - Integrated pilot is underway
  - US DOE grant $25MM
  - Leveraging strategics for 1st commercial

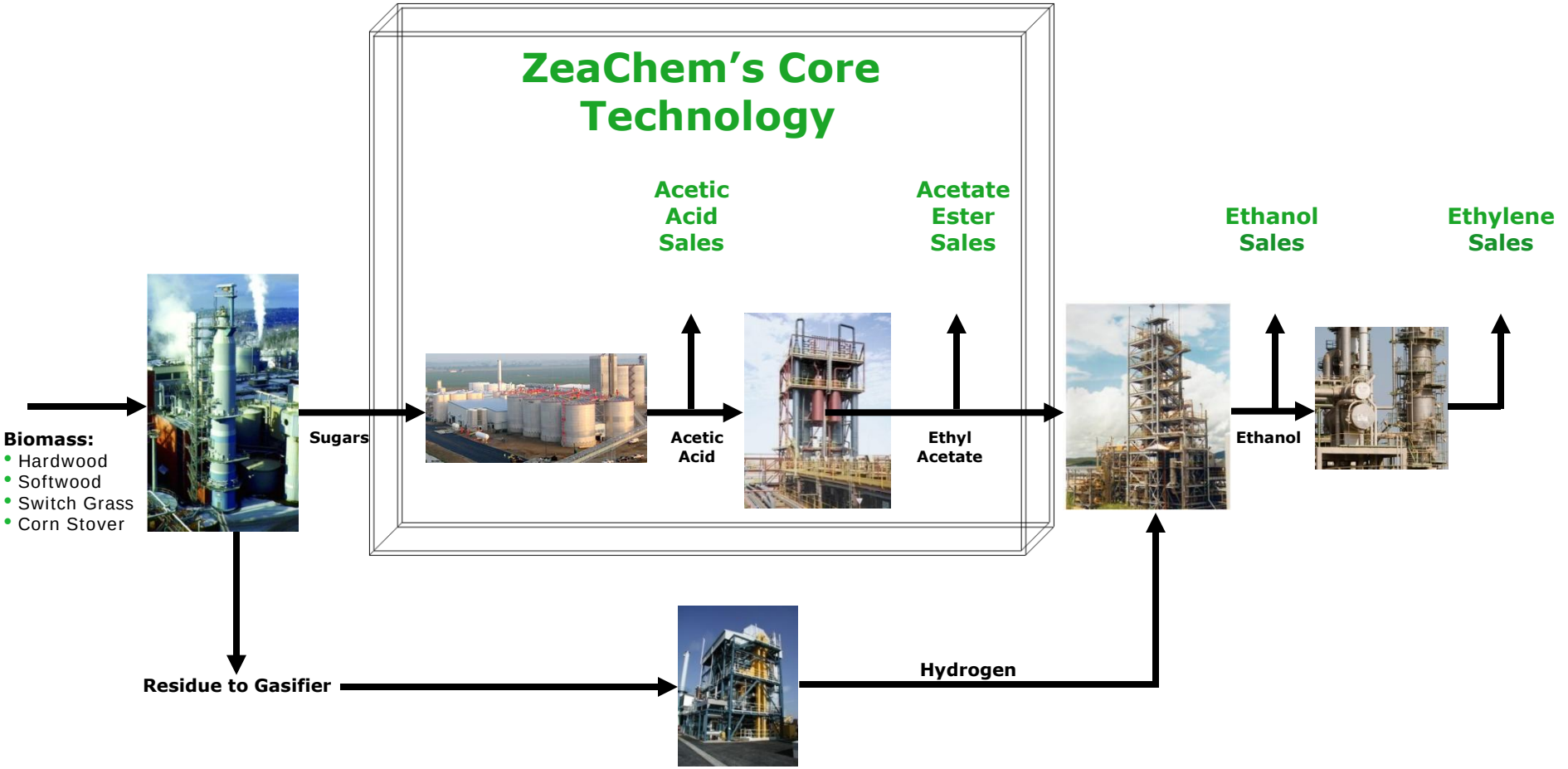
Dedicated Energy Farms

- ZeaChem process is feedstock agnostic
  - Hardwood, softwood, grasses, ag residues
- Dedicated sustainable energy crops
  - Geographic diversity, "Grow where we go"
- Contract with GreenWood Resources
  - Supply high yield hybrid poplar feedstock
- Benefits
  - Efficient harvesting, cost effective
  - "Store on the stump"
  - Integrate energy crop + biorefinery = minimal footprint, low CO_2

Efficient Harvesting

Additional Video Footage: http://apps1.eere.energy.gov/news/b_roll_rd.cfm

ZeaChem C_2 Platform



Other Platforms – Fuels and Chemicals

ZeaChem's Technology

Status: Demo

C2 Platform
- ☑ Acetic Acid
- ☑ Ethyl Acetate
- ☑ Ethanol
- ❑ Ethylene

Status: Lab/Pilot

C3 Platform
- ❑ Propionic Acid
- ❑ Propanol
- ❑ Propylene
  - Chemicals: Plastics, Acrylics
  - Fuels

C4 Platform
- ❑ Butanol

C6 Platform
- ❑ Hexanol
- ❑ Hexene

ZeaChem Technology Deployment

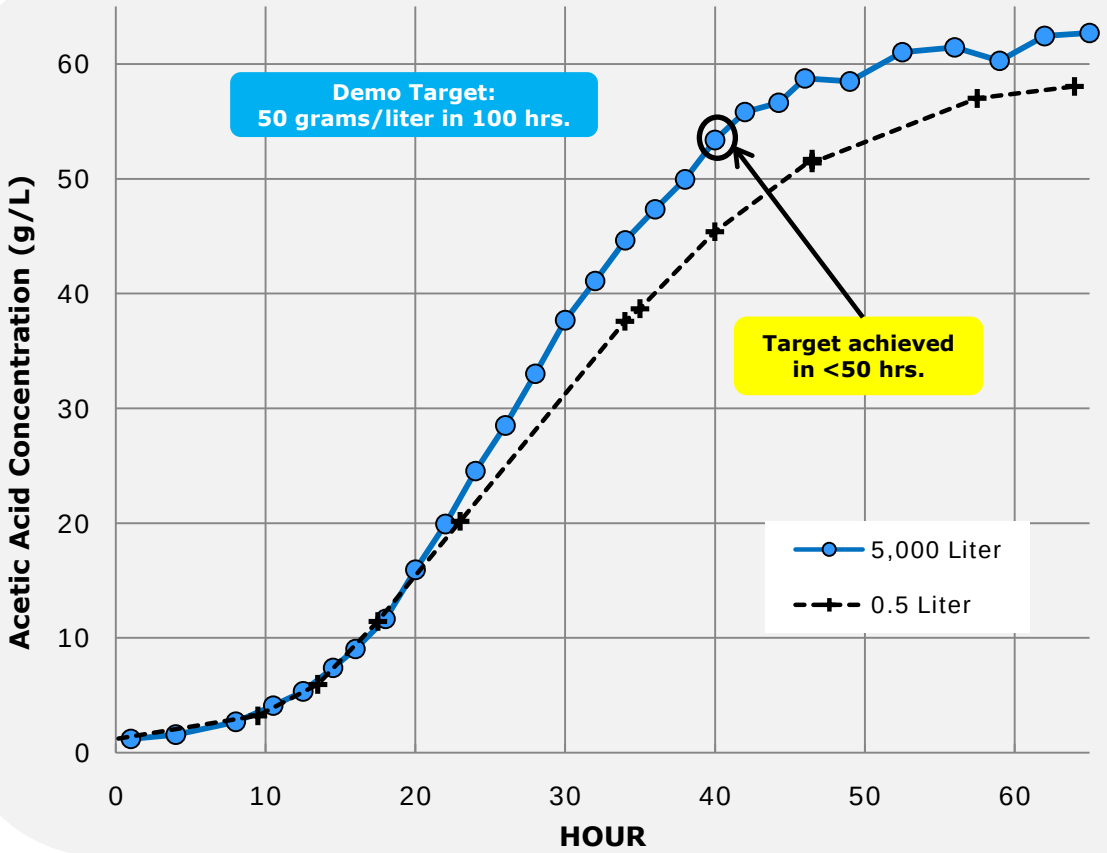
Lab → Pilot → Demo

Milestones:
- Proven at lab
- Raised $6MM for non-integrated pilot

Milestones:
- Proven at non-integrated pilot
- Successfully fermented mixed sugars and hydrolyzates
- Raised $34MM to support integrated pilot/demo

Milestones:
- Constructed announced 11/09
- 10,000x fermentation scale-up met and exceeded targets
- Completed downstream conversion to commercial grade: glacial acetic acid, ethyl acetate, and ethanol

Demonstrated Scale-up Success



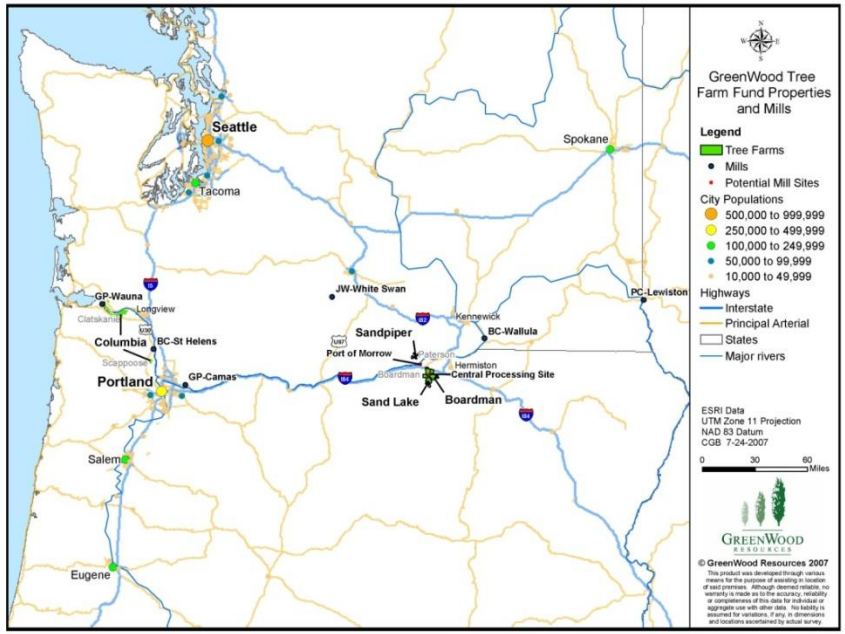
Scale-up

Control

- 10,000x Scale-up
- Repeated numerous times

- Multiple vendor trials
- Glacial Acetic Acid, 99+% pure

Integrated Biorefinery: Boardman, OR



Schematic of future facility

Photo courtesy of Matt Kegler, Diagram supplied by Burns & McDonnell

- Supported by $25MM US DOE ARRA grant
- 250,000 GPY capacity
- Produce ethyl acetate and cellulosic ethanol
- Hybrid poplar + others feedstocks
- 75 Construction jobs, 25 Operating jobs

R&D Barriers & Challenges of Project

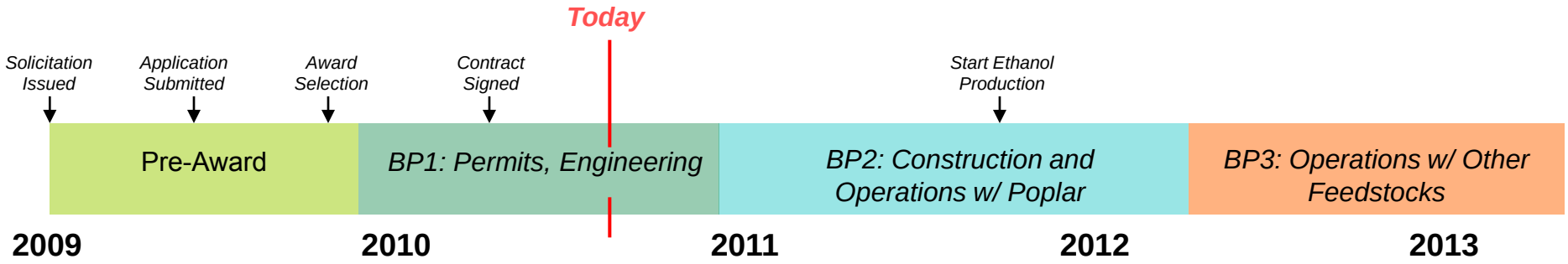
- R&D Barriers Addressed
  - Process Integration: *Experimental/Simulation program is successful to date, but will it all work together?*
  - Maintain Technical Trajectory:

	Integrated Pilot	***1st Commercial***	***Nth Commercial***
Factory Yield, gal EtOH/BDT	*80*	*110*	*135*

- Challenges
  - Feedstock Flexibility: *Broadens commercial opportunities*
  - Hydrogen Supply: *Gasification of lignin residues vs. SMR w/ lignin sales*

Project and Commercial Timelines

- Integrated plant will begin production of ethanol in 2011



- Follow-on 1st Commercial facility of 25-50 Million GPY
  - Feedstock: Hybrid Poplar, Agriculture Residues
  - Products: Ethanol plus other C2 products
  - Financing: Mix of equity and debt with loan guarantee

Policies to Spur Commercialization

- Investment Tax Credit in lieu of Producer Tax Credit for advanced biofuels
  - Extend policy to beyond 2014
  - Grants in lieu of tax credits

- Recognize positive impact of short rotation woody biomass to achieve RFS2
  - Ability to plant poplars on marginal agriculture land, reclamation lands, etc.

- Access to loan guarantees
  - USDA: N/A for bio-based chemicals
  - DOE: Implement for biorefineries (fuels and chemicals

Thank you

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