BCAP Project Area 10: New York Willow

Mike Buckley
ReEnergy Holdings

Tim Volk
Justin Heavey
SUNY-ESF
Fast Facts: ReEnergy Holdings

- ~300 MWs of renewable energy generation
- ~300 employees; 5 states

Renewable Energy Facility
Recycling Facility
Headquartered in Latham, NY
ReEnergy Holdings in New York

- 80 employees
- 103 MW of installed capacity, or 738,000 MWh – enough to serve 96,000 homes
- $24 million in annual fuel purchases
- Support more than 300 indirect jobs, most in the forest
ReEnergy Facilities in NYS

- ReEnergy Black River: 60 MW
- ReEnergy Lyonsdale: 22 MW
- ReEnergy Chateaugay: 21 MW
ReEnergy Biopower

- Large demand for woody feedstocks
- Primarily forest residues
- Recent contract with Fort Drum Army post; 100% renewable electricity for next 20 years
Fuel Supply Program

• End-market for BCAP Shrub Willow

• Equipment Leasing Program
  o ReEnergy launched a program allowing loggers to gain access to state-of-the-art equipment and secure long-term agreements to provide fuel to ReEnergy

• SFI Certification
  o First company solely devoted to electricity production to be certified by SFI
  o Commitment to use best management practices and protect forest health
More than 3,100 tons of willow delivered to Lyonsdale and Black River facilities over first two harvest seasons, 2013 and 2014. YTD 2015: 1,200 tons.

Willow found to be suitable fuel in terms of moisture and ash content, now incorporated directly with other feedstocks upon delivery.

Current willow plantings are planned to be harvested about 350-400 acres per year.

This will produce roughly 8,000-9,000 green tons of feedstock annually.
Woody Biomass in Society

World Energy Use

- Increasing exponentially, mostly non-renewable sources

Biomass Energy

- 43% of all renewables world in US

Projected Supply

- 1,500 million dry tons per year by 2030
- 600 million from energy crops like willow
Willow Genus (*Salix* spp.)

**Shrub willow**

*Salix purpurea*, *Salix miyabeana*, *Salix sachlinensis*, *Salix viminalis*, *Salix eriocephala*, *Salix caprea*...

...and many cultivars of these species

Not tree willows!

(Salix babylonica)
SUNY-ESF Willow Project

Research on shrub willow since 1986

• Cropping methods
• Breeding
• Yield
• Economics
• Best practices
• Environmental sustainability
• Commercialization
Why Shrub Willow?

- Unique plant characteristics
- Ease of establishment
- Regrows after each harvest
- 4-5 dry tons/acre/year
- Limited pests and diseases
Willow in Central and Northern NY

- About 1,150 acres in the ground
- Harvesting about 350-400 acres per year
- Delivered to ReEnergy biopower facilities
- Mixed with forest residues
- Renewable electricity
Willow in Central and Northern NY
Willow Crop Production Cycle

1. **One Crop Establishment**
2. **Planting**
3. **Site Preparation**
4. **Coppice (cut-back)**
5. **Rapid Regrowth**
6. **Minor Maintenance**
7. **Three Years Growth**
8. **Harvest Biomass**
9. **15 dry tons/acre each harvest**

Process:
- Seven Harvessts
- 7 Crop Cycles
Mechanized Planting

-Specialized planter cuts large willow stems ("whips") to about 10 inch "cuttings" and plants in one pass

-Equipment and planting services are available from Celtic Energy and Double A Willow

-Improved willow varieties available from Double A Willow
-Orders for spring planting must be placed several months in advance
Double-Row Planting Pattern

5,500 plants per acre
75% survival rate

2.5 foot Row spacing

6 foot Alley Spacing

2 foot Plant Spacing
Willow Harvesting

New Holland forage harvester and 130FB header

- Developed by Case New Holland and SUNY-ESF from 2008 - 2012
- Reduced harvesting costs by 35% (Eisenbies et al. 2014)
- Now available for purchase or rental
EcoWillow Model

- Cash flow model
- Willow biomass crops
- All phases of production
- User-friendly & customizable
- Recently updated using:
  - Commercial operations
  - Latest research studies
  - Example production scenarios

Download at: www.esf.edu/willow
Economics of Production

Base Case Scenario 2014

- Conservative estimates of profitability
- 22-year life cycle of the planting including tear-out
- Does not include best BCAP incentives or best practice targets

Model Outputs

- Break-even scenario
- Payback is entire life cycle of project
Economics of Production

Base Case Scenario + BCAP Incentives

• 2014 base case assumptions and 2015 BCAP funding

Model Outputs

• Positive NPV
• IRR 10%
• Payback...
  o 10 years after planting
  o Third Harvest
• All-in costs about $25/ton
Economics of Production

Improved Base Case + BCAP Incentives

- Adds current BCAP incentives and best practice targets to base case

Model Outputs

- Positive NPV
- IRR 20%
- Payback
  - 7 years after planting
  - Second harvest
- All-in costs about $20/ton
Willow Environmental Benefits

• Carbon neutral lifecycle does not contribute to climate change

• Low lifecycle herbicide/pesticide/fertilizer requirements

• Perennial crop limits soil erosion and nutrient runoff

• Revitalize idle or marginal lands

• Wildlife habitat for birds and mammals

• Creates jobs and rural development
Potentially Available Land

- Recent GIS analysis
- 25-mile road network
- ReEnergy Black River
- 170,000 suitable acres
  - Hay/Pasture: 110,000 acres
  - Row Crops: 40,000 acres
  - Herbaceous/Scrub: 20,000 acres
- Can be grown on marginal lands
- Revitalize underutilized land base
Willow Extension Services

Training and education for BCAP willow...

- Technical assistance
- Outreach programs
- Crop monitoring
- Equipment access
- Analytical tools & research summaries
- Land assessments & consulting services
Willow Summary

- Promising source woody of biomass
- Years of research at SUNY-ESF
- Positive economic returns with BCAP
- 1,150 acres already established
- Secure market in ReEnergy
- Environmental benefits
- Extension services available
- BCAP incentives for a limited time
Thank You!

Please contact us at...

**ReEnergy Holdings**
Michael Buckley
bcap@reenergyholdings.com
(518) 810-0200

**SUNY-ESF**
Justin Heavey
jpheavey@esf.edu
(315) 470-6775

**Celtic Energy Farms**
Robert McDonagh
celticenergyfarm@verizon.net
(917) 796-7954

**Double A Willow**
Dennis Rak
Dennis.Rak@doubleavineyards.com
(716) 952-7023