



# Boardman Biomass Potential Coal Substitute



**Portland General Electric**

# Planning for tomorrow's Energy Needs

## PGE files a resource plan with OPUC every 2-3 years

- Integrated Resource Planning process (IRP)
- IRP projects electricity demand over 20-years
- Identifies potential mix (portfolio) of generating resources to serve demand
- Provides basis for 5-year action plan and 20-year resource strategy
- OPUC is primarily concerned with **costs** and **economic risks** of potential resources and portfolios using **least-cost planning** principles:
  - Only prudently-incurred costs are allowed
  - Favors low-cost, low-risk resources
- Each generation resource includes review by other regulatory agencies, including DEQ



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# Key proposed resource actions

- **Acquire 122 MWa of Renewable Portfolio Standard (RPS) resources**
  - ✓ Meets 2015 Oregon RPS compliance; need 25% by 2025
- **214 MWa of Energy Efficiency by 2015**
- **300-500 MW high-efficiency combined cycle gas plant**
- **Up to 200 MW of flexible gas capacity resources**
- **Natural gas fueling – Pipeline and storage capacity**
- **Cascade Crossing Transmission - Boardman to Salem**
- **Other: Contract renewals, DSG expansion (67 MW), DR acquisitions (60 MW)**
- **Pursue Boardman 2020 closure plan & replacement ideas**



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# About the Boardman Plant

- 585 Megawatts capacity. PGE owns 65 percent
- PGE's share of the plant's output provides enough power for more than 250,000 homes
- About 15 percent of PGE's resource mix
- Key element of PGE resource diversity, helping to control costs and assure reliability
- One-half to two-thirds cheaper to operate than natural gas
- Low-cost, baseload resource that creates substantial value for our customers by lowering power costs and therefore prices
- 110 full-time employees, 30 contractors, 225 seasonal maintenance positions

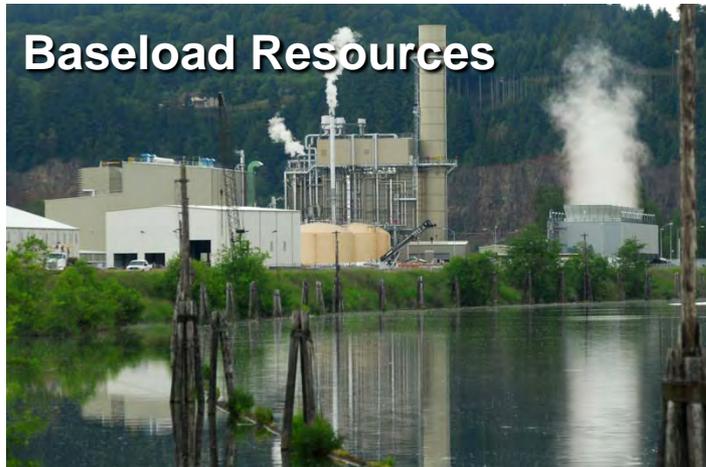


DAN AGUAYO/THE OREGONIAN

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# Replacement resources

**Renewables a valuable resource, but baseload needed for reliability**



**Typical examples include:**

- Natural gas, coal, nuclear, hydro, geothermal – or biomass

**Energy there when customers need it**

- 24 hours a day/7 days a week

**Dependable, on-demand energy during peak demand periods, including:**

- Summer heat waves
- Winter storms



**Typical examples include:**

- Wind farms, solar generation

**Energy generated only a portion of time**

- Approximately 34% for wind; 12-16% for sun, based on current technology

**Typically, not dependable during peak demand periods, including:**

- Summer heat waves (wind)
- Winter cold (wind turbines can't operate in extreme cold or high winds, solar output typically less in winter)

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# Boardman: Exploring biomass potential

- Highly attractive as a potential baseload, carbon-neutral renewable resource that could help meet RPS requirements and enhance fuel diversity
- PGE is researching with help of UW, OIT, WSU and OSU Extension Services
- Boardman conversion would make it one of the largest biomass plants in the nation
- Would preserve significant value of existing plant; maintain and add jobs
- 2020 timeline allows time to determine if biomass conversion is a workable, cost effective alternative
- Subject to and Guided by OPUC Public Process



# Biomass fuel cycle challenges

- **Perception:** Lots of biomass available in Oregon – logging slash; beetle kill; crop residue ....
- **Problem:** Costs an “arm and a leg” to gather and get it to one spot to use as a renewable fuel in power generation, and it’s not renewable or near “carbon neutral” unless the biomass is re-planted or re-generates itself after harvest / collection at equilibrium or there is a societal argument for large supply
- **Potential solution:** Grow your own fuel, robustly and reproducibly within a 50 mile radius of the power plant – for best chance at an economic proposition that is also a near carbon neutral fuel

# Biomass options considered

- **Co-firing with wood pellets**
- **Co-firing with torrefied biomass Other than Wood**
- **100 percent firing with wood pellets**
- **100 percent firing with torrefied biomass Other than Wood**

# Wood pellets (~ 10 % Moisture)

- **Requires burner change out**
- **Pulverizer modifications**
- **Fan system modifications**
- **Boiler modifications**
- **Transport system modifications/additions**

# Torrefied biomass (Charred ~ < 1% Moisture)

- **Produces a fuel product that can be stored, handled, pulverized, and combusted much the same way as coal**
- **No change in major plant equipment**
- **Improves plant efficiency**
- **Fuel delivery challenges**
  - Need to grow “closed loop” energy crops close to Boardman
  - Torrefy, deliver and stockpile fuel
- **Some additional pollution control equipment required**
  - SCR, DSI, Hg
- **AKA Biochar**

# Torrefaction – Heating at low oxygen

- Mild pyrolysis: 200 – 350 °C
- More than wood drying (< 230 °C)
- Less than making charcoal (> 350 °C)
- Recycles organic “gases” for heat
- Charring = Exothermic reaction
- Current demos 5 to 10 ton/hr
- cf. wood dryers 40 ton/hr dry output
- Wood dryers / torrefiers some emission controls
- Several announced coal conversions



- 80 ton/hour wood drying facility
- 2 trains (40 ton/hr each)
- Panama City, Florida
- 10,000 Hp
- 2 Shifts; 10 worker per shift
- Fuel: wood chips or Natural gas

Courtesy: TSI, Inc.; Lynnwood, WA

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# *Arundo donax*

- ***Arundo donax* (Giant Cane)**
  - Perennial, non-food grass traditionally used for musical reeds
  - Native to Mediterranean; East Asia
  - Worldwide distribution (> 2 doz. Common names)
  - 3 Ornamental Varieties at Retail
  - Looks like bamboo but isn't
  - No known biological predator
- **Interest from pulp / paper (UW); “bio-refinery”**
- **6 year history, Treefree; WSU - Prosser, WA; It's robust**
  - 25 – 30 dry tons / acre
  - 20 – 30 feet tall
  - Two harvests / growing season - It's *reproducible*
- **Economically competitive (alfalfa)**
  - Same amounts of water, fertilizer
  - Suitable for Boardman vicinity
  - Minimizes transportation costs
- **Must be Torrefied to Pulverize**
- **Reputation as a Weedy Plant**
  - Sterile Seeds
  - No flowers in Prosser tests
  - Roundup
  - Winterkill
  - Denial of Water

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# Prosser WA – *Arundo donax*

Prosser, July, 2009



After harvest, WSU eradicated  
Using Roundup and denial of water

Clean Edge



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# Different views of Giant Cane



**Home and Garden  
3 varieties:**

- Variegata
- Versicolor
- Peppermint



**In the Wild:  
Along Stream  
Banks**



**Really Wild . . .**

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# Arundo productivity (Dry Wt): Joint UW and WSU biomass projects, 1993-2006

Plant Production in Eastern Washington State	
Plant	Productivity (tons / acre / year)
Wheat Straw	0.8 - 2
Douglas Fir	2
Hybrid Cottonwood (poplar)	6
Eucalyptus	8
<i>Arundo donax</i> (Giant Cane)	25 - 30

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# Torrefied Arundo: High energy density

## Torrefaction effects:

- Decreases mass (de-water)
- Becomes hydrophobic
- Resists bacterial & fungal attack
- Increases energy density
- Decomposes volatile organics
- Makes the biomass “crispy”
- Yields good grindability
- Compatible combustion chemistry
- Sulfur content remains low

Undensified Material	BTU / lb
Canary Reed Grass	9,400
Wheat Straw	9,700
Corn Stover	8,200 - 9,700
Willow	9,400
Bamboo	8,100 - 9,500
Giant Cane ( <i>Arundo</i> )	10,000
Boardman Coal	8,500

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# Preliminary conclusions

- **Arundo is competitive with Boardman area crops**
  - Uses same amount of water
  - Uses same amount of fertilizer
  - Tilled land requirement is within reason
  - Once established: It's a lawn 10 -20 ft high, w/ no weeding or pesticides
- **Can be Controlled**
- **Other Opportunity Fuels are Possible**
- **Torrefaction – No technical issues**
  - Prototypes in development – almost flat learning curve
  - Bracketed by standard wood drying and charcoal production
- **It's carbon-neutral: “Only burn what you grow”**
- **Should take Next Steps**

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# But First: Regulatory, Sustainability and Community Concerns

- 2007 Risk Analysis by ODA
- Discussions with ODA, Weed Control Staff – Morrow and Umatilla Counties
- Formal briefing for Morrow and Umatilla County Commissions
- Requested County provisional permission for 250 – 300 acres
- Draft interim Control Plan led by ODA; MOU with Morrow County in Draft
  - **Limited to 300 acres through end of 2013**
  - **Not allowed in 100 year floodplain**
  - **Transportation control requirements**
  - **Equipment use and sanitation**
  - **Surety Bond**
  - **Community / Stakeholder Advisory Committee – led by OSU Extension**

# Next steps

- PGE recognizes that renewable energy production is supported strongly by public policy initiatives for both renewable power and greenhouse gas reduction (de-carbonizing power generation, transportation)
- Biomass & torrefaction for Boardman 2020 is technically feasible
- Proposed 2012 Test Burn at Boardman of torrefied Giant Cane
  - **Need 5,000 Green tons (250 to 300 acres)**
  - **8 hour test using 3 of 6 pulverizers**
  - **Torrefied Giant Cane only**
- Further investigation of technology and logistics warranted
- Future decisions about Boardman will be made in the context of Integrated Resource Planning process, under OPUC guidelines

# Questions?



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