Planning for Renewable Energy

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Great River Energy

Workshop on Renewable Energy for Minnesota
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Great River Energy Overview

- A Generation & Transmission Cooperative
- 28 Member Distribution Cooperatives
- 600,000 Distribution Customers
- Long term growth rate ~3%
- Summer peaking (~2600 MW)

2005 Energy Growth

- Yellow: 0-2%
- Orange: 2-4%
- Green: 4-6%
- Purple: 6-8%
- Pink: 8%+
GRE is *very* summer peaking

June - July
GRE’s Supply Portfolio

Energy

Capacity

- Coal
- Gas
- Oil
- Wind
- Hydro
- RDF
- Purch

*nameplate rating
GRE Generating Facilities
Wind Power Purchases

- <2005: 3 x 6 MW projects = 18 MW
- 2005: Trimont = 100 MW
- 2007: High Prairie = 100 MW
GRE is meeting MN's Renewable Energy Objective
Coping with growth

100 MW / yr
Planning Objectives

- Environment
- Reliability
- Cost
Environmental Targets

By 2020:

- Supply 20% of energy with renewables
- Reduce CO₂ emissions to 2000 levels
The olden days: a physical world

GRE Generators

GRE Gen = GRE Load

GRE Member Loads
Midwest ISO

Operates transmission and energy markets.
Today: a financial world

GRE Generators ≠ GRE Load

Midwest Independent System Operator

GRE Member Loads
Market Prices: temporal volatility

LMP $/MMh

$350
$300
$250
$200
$150
$100
$50
$0

7/31/06 8/1/06 8/2/06 8/3/06

Monday Tuesday Wednesday

GRE.GRE Real-time LMP

($50)
Market Prices: spatial volatility
Wind Site Value: Cost v. Revenue

Wind Resource ➔ Cost of Wind

Market Price (LMP) ➔ Revenue from Wind
Queued Generating Projects

MISO Generator Interconnection Queue 9/26/06

3443 MW
10,978 MW
12,572 MW
Wind Development Issues

- **Siting**
  - Energy Value
  - Geographic diversity
  - Transmission availability

- **Timing**
  - Transmission interconnection arrangements
  - Federal Production Tax Credit deadlines

- **Cost**
  - Equipment & installation

- **Technical**
  - Equipment reliability (long term)
  - Wind integration / ancillary services

- **Project Size**
  - Economies of scale v. small developer preference
Other renewables

- **Biomass**
  - Waste streams
    - Municipal waste
    - Waste wood
    - Ag waste
    - Landfill gas
  - Energy crops
    - Switchgrass, trees, etc.
  - Co-firing

- **Hydro**

- **Solar**
Other ways to reduce CO$_2$

- CO$_2$ capture & sequestration
Other ways to reduce CO$_2$

- CO$_2$ capture & sequestration
- Improved power plant efficiencies
- "Energy Factories"
  - Combined heat and power
    - power production $\leftrightarrow$ industrial process
  - Coal to liquids or syngas
- Distributed Gasification Combined Cycle
- Nuclear
- Point of use generation
- Conservation!
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