Wind Energy: Environmental Factors, Costs & Availability

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Boise State University
Electricity is a **form** of energy

- Energy has many forms
- Electricity is the most useful
- Electricity is generated using some other energy form
US & Idaho Electric Consumption by Fuel Type

US, 2006

- Coal: 49.0%
- Natural Gas: 20.0%
- Petroleum: 1.6%
- Other Gases: 0.4%
- Nuclear: 19.4%
- Other Renewables: 2.4%
- Hydroelectric: 7.0%

Total = 4,065 Billion KWh
Electric Utility Plants = 61.1%
Independent Power Producers & Combined Heat and Power Plants = 18.9%

Source: http://www.eia.doe.gov/

ID, 2005

- Coal: 42%
- Natural Gas: 9%
- Hydro: 48%
- Other: 1%

Source: 2007 Idaho Energy Plan

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Wind Energy Environmental Factors

Pros:
- No emissions
- No waste stream
- No fuel price risk

Cons:
- Visual impacts
- Bird impacts
- Intermittent
Fastest Growing Electricity Source

**Total Installed Wind Capacity**

1. Germany: 21283 MW
2. Spain: 13400 MW
3. United States: 12925 MW
4. India: 7000 MW
5. Denmark: 3134 MW

World total October 2007: 81957 MW

Source: WindPower Monthly
Distributed Scale Wind Farms
Small Scale

Net Metering

Off-grid
Cost of Wind Energy
source: US DOE NREL

- Natural Gas (fuel only)
- Low wind speed sites
- High wind speed sites
- New Bulk Power Competitive Price Band
- 2007: New Wind
- Depreciated Coal
- Depreciated Wind

COE (¢/kWh [constant 2000 $])


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Bring down the costs

- Capture more energy from the wind
  - Larger turbines
  - Improved control systems & drive trains
- Local energy storage
- Reduce O & M costs
  - Reduce damage caused by wind gusts
Boise State Storage Concepts

Compressed Fluid Storage

Flywheel Storage

From Turbine

To Grid

Continuous Variable Transmission

flywheel

electric generator

wind turbine

compressor

H$_2$O

water turbine

storage tanks

Continuously Variable Transmission

Generator

Storage Tanks

Compressed Fluid Storage

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Can I put a wind turbine in the city?

• Wind resource
• Zoning Restrictions
  – Boise City
  – Ada County
• Payback
• Skystream
  – ½ Acre, unobstructed
  – 20’ taller than any object in 250’ radius
Where can I put a wind turbine?

- Small acreage
- Southern Idaho Farms
- Off-grid cabins
What can I do?

• USE LESS!!!!!
• Contact your state & federal representatives
• Comment on IPUC cases; participate in the process
  – http://www.puc.state.id.us/
• Buy green tags
Useful Links:

http://www.idahowind.org
  • Lots of information
  • For Permitting Manual, click “Publications”, 2nd link
http://coen.boisestate.edu/WindEnergy/index.asp
  • Energy page under construction, Wind for Schools is active
http://www.awea.org/

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Kilowatt Hours (kWh)!

Questions? Contact us at:
PO BOX 70, Boise, ID 83707.
Or call (208) 388-2323 (Treasure Valley).
Se habla español.
For faster service please call
Tuesday - Friday, 7:30 a.m. to 6:30 p.m.

Customer Name: TODD A HAYNES
Account Number: 3314540454
Billing Date: 06/18/2007
Print Date: 09/19/2007

Next Read Date: 10/16/2007

Service Agreement No: 6956690618
Service Location: 310 S GARDEN ST/BOISE, ID

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Residential Rate Schedule I01

08/15/2007 - 09/14/2007 30 days

- Service Charge ................................................................................ $4.06
- Non-Summer Energy Charge @ $0.054251 per kWh, 14 days ............... $15.82
- Summer Energy Charge 0-300 kWh @ $0.054251 per kWh, 16 days ...... $8.68
- Summer Energy Charge Over 300 kWh @ $0.08106 per kWh, 16 days .... $10.58
- PCA @ $0.002419 per kWh ................................................................ $1.51
- Franchise Fee % ............................................................................. $0.41
- Conservation Program Funding Charge ........................................... $0.59
- Federal Columbia River Benefits Supplied by BPA ....................... $0.00

Current Charges - Electric Service ..................................................... $41.59

CR = Credit  kWh = Kilowatt-hour  PCA = Power Cost Adjustment  kW = Kilowatt  BLC = Basic Load Capacity  G = Generation

Your Electric Use Pattern

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<th>Month</th>
<th>Avg kWh Per Day</th>
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<tr>
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Utility’s challenge:
meet daily demand variations

Source: http://currentenergy.lbl.gov/

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