Jobs and Economic Impacts from Wind Power

Suzanne Tegen, Ph.D.

Strategic Energy Analysis Center, NREL

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“It seems only natural for rural utilities to do everything they can to advance both farm-based renewable energy development and rural economic development in a cost-effective way. In my opinion, wind energy is the next great chapter in the rural electrification story.”

Aaron Jones, Washington Rural Electric Cooperative Association; Olympia, WA
Defining Economic Development Impacts

1. On-site Labor and Professional services
2. Turbine Production and Supply Chain Impacts
3. Induced Impacts (Household purchases due to injection of income)
Jobs and Economic Impacts from the JEDI Model

Wind Energy’s Economic Impacts

Wind energy’s economic “ripple effect”

Project Development & Onsite Labor Impacts
- Construction workers
- Management
- Administrative support
- Cement truck drivers
- Road crews
- Maintenance workers
- Legal and siting

Local Revenue, Turbine, & Supply Chain Impacts
- Blades, towers, gear boxes
  - Boom truck & management, gas and gas station workers;
  - Supporting businesses, such as bankers financing the construction, contractor, manufacturers and equipment suppliers;
- Utilities;
- Hardware store purchases and workers, spare parts and their suppliers

Induced Impacts
- Jobs and earnings that result from the spending supported by the project, including benefits to grocery store clerks, retail salespeople, and child care providers

Construction Phase = 1-2 years
Operational Phase = 20+ years
Project Development & Onsite Labor

Sample Jobs:
- Truck Drivers
- Crane Operators
- Earth Moving
- Cement Pouring
- Management Support
Local Revenues, Turbine, & Supply Chain

Steel mill jobs, parts, services - Equipment manufacturing and sales - Blade and tower manufacturers

Property taxes - Financing, banking, accounting
Induced Impacts

Money spent on local area goods and services from increased revenue: sandwich shops, child care, grocery stores, clothing, other retail, public transit, new cars, restaurants, medical services
JEDI Caveats

• Not intended to provide a precise forecast, but an estimate of overall economic impacts
• Gross jobs vs. net jobs
• Local sourcing levels have significant impact
• Full-Time Equivalent (FTE) jobs
• Simplicity/complexity trade-off
Measuring Economic Development Impacts

General Input-Output Methodology

- Aggregated economic data is used to recreate inter-industry transactions throughout the economy
  - These transactions demonstrate how spending in one industry affects spending in other industries
- From inter-industry transaction data, industry-specific multipliers are derived
- Multipliers are used to measure how changes in demand for goods and services in one industry result in changes in demand for goods and services throughout the economy

Other Jobs and EDI Models

IMPLAN (social accounting matrix), RIMS II, REMI, IMSET
JEDI Model uses IMPLAN www.implan.com
240-MW Iowa wind project

- $640,000/yr in lease payments to farmers
- $2M/yr in property tax revenues
- $5.5M/yr in O&M income
- 40 long-term jobs
- 200 short-term construction jobs
- Manufacturing
2009 U.S. Wind Manufacturing (draft)

New Facilities Opened in 2009

1. Hexcel (glass prepeg), Windsor, CO, +100 jobs
2. Creative Foam (composites), Longmont, CO, +150 jobs
3. Nordic Windpower (turbines), Pocatello, ID, +160 jobs
4. Dragon Wind (towers), Lamar, CO, +60-80 jobs
5. Towers Tech (towers), Abilene, TX, +150 jobs
6. Trinity Structural Towers (towers), Newton, IA, +140 jobs
7. Goain North America (elevation systems), Ankeny, IA, +12 jobs
8. Mille Lacs Band of Ojibwe (generators), Mille Lacs Reservation, MN, +7 jobs
9. RLTC Wind Towers (towers), MacGregor, TX, +75-250 jobs
10. RBC Bearings (bearings), Houston, TX
11. Sector 5 Technologies (components), Oelwein, IA, +99 jobs
12. Vacon Inc (AC drives), Chambersburg, PA, +94 jobs
13. WInergy (gear drives), Elgin, IL, + jobs

Figure includes wind turbine and component manufacturing facilities, as well as other supply chain facilities, but excludes corporate headquarters and service-oriented facilities. The facilities shown here are not intended to be exhaustive. Those facilities designated as "turbines" may include turbine assembly and/or turbine component manufacturing, in some cases also including towers, nacelles and blades.
Explaining variability in economic development impacts

- Size and cost of the project
  - Higher costs often results in increased impact for both construction and O&M

- Size and diversity of the local economy
  - Level of analysis
  - Multiplier effect

- Developer preferences and contractor / equipment availability
  - Goods and services
  - *Turbine manufacturing*

- Magnitude and allocation of project revenues
Examples of JEDI at Work: Wind projects offer competitive salaries

Median Household Income (2007$) in counties where the six largest wind power projects are located compared to wind farm salaries

Reategui, NREL
Michigan: Dollars spent on new electricity generation

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Dollars (millions)</th>
<th>Michigan Assumptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>500</td>
<td>Price of coal $17/MWh</td>
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<tr>
<td></td>
<td></td>
<td>$1,900/kW to construct</td>
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<tr>
<td></td>
<td></td>
<td>60% rail/ship labor from MI</td>
</tr>
<tr>
<td>Gas</td>
<td>400</td>
<td>Price of gas $55/MWh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25% of gas from MI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$700/kW to construct</td>
</tr>
<tr>
<td>Wind</td>
<td>150</td>
<td>$1,300/kW to construct</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No taxes until 2013, but</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$5,000/turbine in fees until then</td>
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<tr>
<td></td>
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<td>25% capacity factor</td>
</tr>
</tbody>
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2005
JEDI at Work: Comparing Between Power Generation Alternatives

Total economic impacts from energy equivalent wind and coal in Colorado

- CO Wind 43% Cf (991 MW)
- CO Wind 35% Cf (1328 MW)
- CO Coal (500 MW, 55% in-state coal)
- CO Coal (500 MW, 0% in-state coal)

- Landowner revenue
- Property taxes
- Coal mining & transport
- Operations
- Construction

Millions of dollars

- $0
- $200
- $400
- $600
- $800
- $1,000
- $1,200
- $1,400
- $1,600
- $1,800
The jobs and economic development impact (JEDI) models are user-friendly tools that estimate the economic impacts of constructing and operating power generation and biofuel plants at the local and state levels. First developed by NREL's Wind Powering America program to model wind energy impacts, JEDI has been expanded to analyze concentrating solar power, biofuels, coal and natural gas power plants.

On this site, you can download the models for free, learn more about how JEDI works, understand the output, and get answers to questions about using the model.

**Contact**
For questions regarding the JEDI models or model updates, please contact: JEDI-support@nrel.gov

Challenges to modeling Renewables

Renewables represents a new industry

- Not isolated as an industry in conventional I/O tables

Requires detailed knowledge of project costs and industry specific expenditures

- Equipment, Engineering, Labor, Permitting, O&M, etc.

Enter JEDI

- Provides a project basic project recipe for specific RE technologies
- Applies Industry Specific Multipliers derived from IMPLAN
Conclusions

• Analyzing Jobs and Economic Impacts is an important task, and even more so in today’s economic and political climate
  • It is not however, the sole metric upon which we can/should evaluate renewable energy projects
• The JEDI tool provides a user friendly, free platform to carry out economic impacts analysis for renewable energy projects
• Individual projects vary in key aspects that affect economic development to state and local regions
• In extreme cases (i.e. local turbine manufacturing) impacts to a state or local region may be 5 to 10 times different.
• Acquiring as much project specific information as possible is critical – the more accurate the inputs, the better the outputs!
• General questions: jedisupport@nrel.gov
NREL’s Existing Information

- Wind Powering America website: www.windpoweringamerica.gov
- Reports
- Fact sheets (here)
- Maps

Economic Development Impacts of Community Wind Projects: A Review and Empirical Evaluation

Economic Benefits, Carbon Dioxide (CO₂) Emissions Reductions, and Water Conservation Benefits from 1,000 Megawatts (MW) of New Wind Power in Massachusetts

Wind power is one of the fastest-growing forms of new power generation in the United States. The nation’s total wind power generating capacity increased by 50% in 2008, and new wind power installations constituted 42% of all new electric power installations. This growth is the result of many drivers, including increased economic competitiveness and favorable state policies such as Renewable Portfolio Standards. However, new wind power installations provide more than cost-competitive electricity. Wind power also supports economic development in many regions.

Wind projects have already reached the 1,000-MW mark. We forecast the cumulative economic benefits from 1,000 MW of development in Massachusetts to be $1.4 billion, annual CO₂ reductions are estimated at 2.6 million tons, and annual water savings are 1,293 million gallons.

Economic Benefits

Building and operating 1,000 MW of wind power requires a significant investment. But this investment will generate a wide range of economic benefits for the state.
Thank You

Suzanne Tegen
Strategic Energy Analysis Center
National Renewable Energy Laboratory
www.windpoweringamerica.gov
www.nrel.gov/analysis/
JEDI at Work: Employment Impacts from construction over time (Lantz)

Construction Period Jobs Added to the Nebraska Labor Force from Building 7,800 MW of Wind Power

- CBED High
- CBED Low
- Trad High
- Trad Low
Input-Output Limitations

- **Static**
  - Snapshot of industry relationships and personal consumption patterns
  - Dynamic modeling unreliable

- **Linear**
  - Does not account for system feedback or supply constraints
  - Assumes that prices remain fixed regardless of changes in demand

- **Structural Change**
  - Does not automatically account for industry improvements