

Jobs and Economic Development Impacts from Small Wind: JEDI Model in the Works



WINDPOWER 2012

Suzanne Tegen

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Overview

- NREL's role in economic impact analysis for wind power
- Jobs and Economic Development Impacts (JEDI) models
- JEDI results
- Small wind JEDI specifics
- What we need from you to finish our model.

www.nrel.gov/analysis/jedi

NREL's Economic Impact Analysis for Wind

- **JEDI models**

- NREL strives to keep JEDI model multipliers updated and consistent. Models, user guides, and reports are peer reviewed, tested, and validated by industry.

- **NREL's roles**

- Gather cost, employment, tax, & other data
- Verify with developers, owners, counties
- Develop & test model
- Facilitate peer review
- Issue user guide
- Publish (www.nrel.gov/analysis/jedi)
- Manage and maintain models.

- **Other NREL economic impacts analyses**

- Workforce development
 - National skills assessment
- Manufacturing and supply chain
- Analysis (including federal, state, and regional policy and employment)
- National discussion on renewable energy employment.



Photo by Warren Gretz, NREL/PIX 09636

JEDI Model Availability

- **Current JEDI models**
 - Utility-scale wind
 - Natural gas (combined cycle)
 - Coal (pulverized coal)
 - Marine and hydrokinetic
 - Concentrating solar power
 - Dry mill corn ethanol
 - Lignocellulosic ethanol
 - Photovoltaic.
- **JEDI models under development**
 - Small wind, offshore wind
 - Hydropower (conventional)
 - Natural gas (combined cycle)
 - Transmission
 - Geothermal
 - Biopower
 - Petroleum.



Photo from Sally Wright, Renewable Energy Research Lab - Umass, NREL/PIX15160

JEDI Model Approach

Based on project-specific or default inputs (derived from industry norms), JEDI estimates the number of jobs and economic impacts that could reasonably be supported by a power generation project.

JEDI estimates *gross not net* jobs. For example, JEDI estimates the number of in-state construction jobs from a new wind farm.

Jobs, earnings, and output are distributed across three categories:

- Project Development and Onsite Labor Impacts
- Local Revenue, Turbine, and Supply Chain Impacts
- Induced Impacts.

JEDI model defaults are based on interviews with industry experts and project developers. Economic multipliers within the model are derived from Minnesota IMPLAN Group (Bureau of Economic Analysis, Bureau of Labor Statistics, etc).

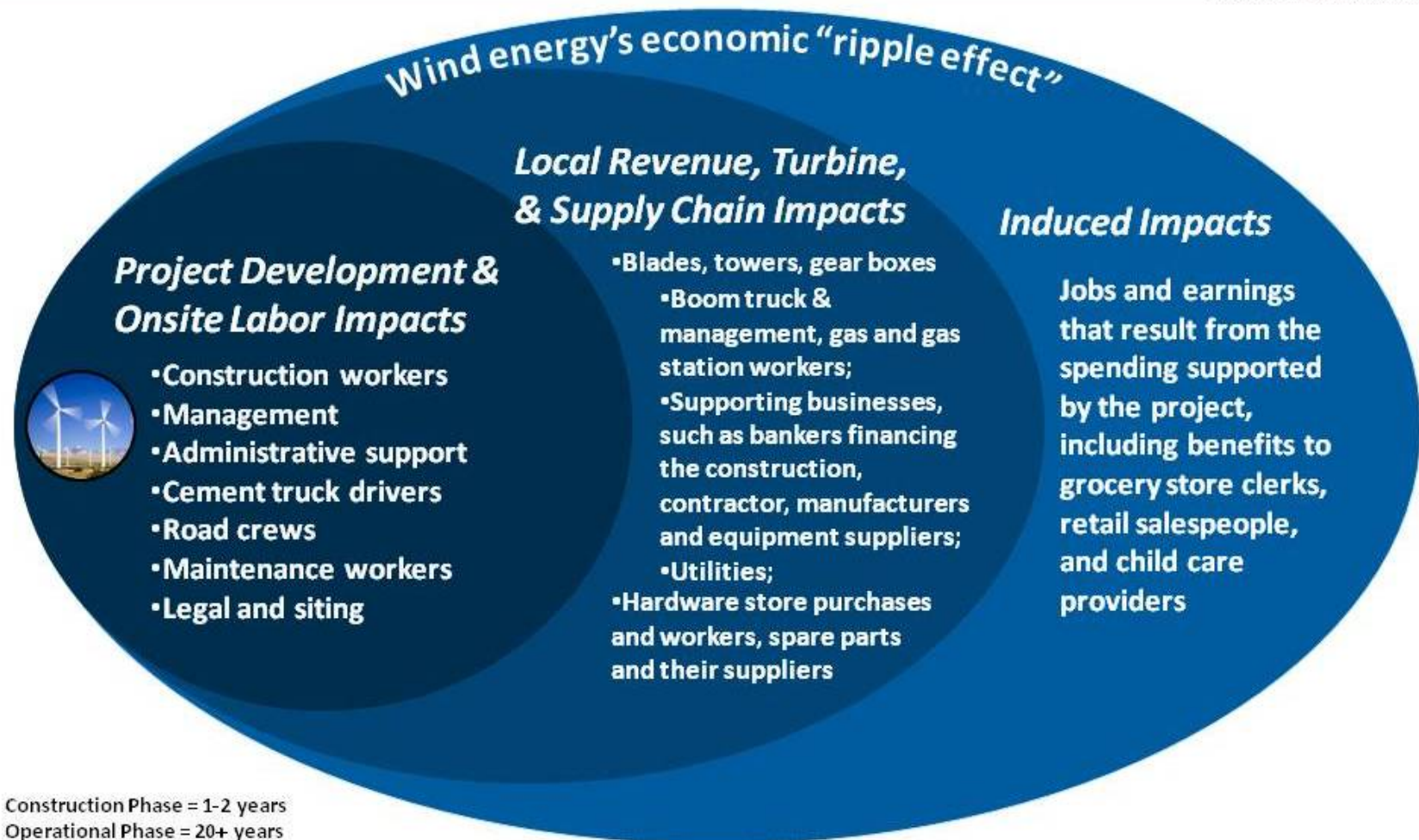


Photo from Jessica Raker, NREL/PIX 14676

Jobs & Economic Impacts from the JEDI Model

Wind Energy's Economic Impact (Large Wind)

JEDI Model Version W1.09.03e



Project Development & Onsite Labor

- Sample job types

- Truck driving
- Crane operation, hoisting, rigging
- Earth moving
- Pouring cement
- Management, support
- Siting.

Photo from Cross Island Farms, NREL/PIX 19923



Photo from Stephanie Lively, Boise State University, NREL/PIX 16147



Photo from istock 947687



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Photo from Northern Power Systems, NREL/PIX 13853



Local Revenues, Turbine, & Supply Chain



Photo by NREL, NREL/PIX 11074



Photo from iStock/5676592



Photo from Clarence Council, NREL/PIX 09091

- Steel mill jobs, parts, services
- Equipment manufacturing & sales
- Blade & tower manufacturers
- Property taxes: financing, banking, accounting.



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Photo from iStock/7792082



Photo from iStock/8384987

Induced Impacts



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



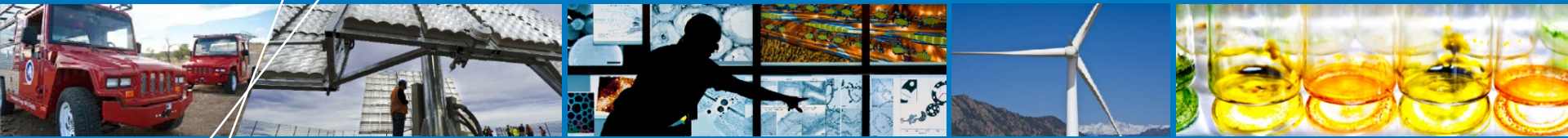
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Using the JEDI Model

Downloading the JEDI Model

omic Developm...

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Energy Analysis

Jobs & Economic Development Impact Models

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Methodology

Interpreting Results

Advanced Users

Publications


Help

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: JEDIsupport@nrel.gov

JEDI Fact Sheet



(PDF 444 KB)
[Download Acrobat Reader](#)

www.nrel.gov/analysis/jedi/

The JEDI Model on Your Screen

	A	B	C	D	E	F
1	Small Wind Project Data					
2						
3	INSTRUCTIONS: Begin by entering Project Location (from pull-down list) and other System Descriptive Data.					
4	After inserting required data press enter (or cursor to the next cell) to continue.					
5	Once Descriptive Data is complete, enter "Y" or "N" on Line 27 to continue.					
6	Enter "Y" to accept System Cost and Local Share defaults or "N" to review/modify values.					
7	To utilize new values in analysis choose "N" in "Utilize Project Cost Data default values analysis?" - Line 27.					
8	Additional information is available by pointing to the red triangles located in cell corners and in the <i>FAQ</i> tab.					
9	Only those cells with a white background can be changed (accept new values).					
10						
11						
12	Project Descriptive Data					
13	Project Location	ARIZONA				
14						
15	Project Sector	Residential				
16	Year of Construction	2012				
17	Construction Period (months)					
18	Turbine Size - DC Nameplate Capacity (KW)	10.0				
19	Number of Turbines Installed					
20	Total Project Size - DC Nameplate Capacity (KW)					
21	Tower Height (feet)					
22	Tower Type	monopole				
23	System Cost (\$/KW)	\$6,240				
24	Annual Operations and Maintenance Cost (\$/KW)					
25	Money Value (Dollar Year)	2012				
26						
27	Utilize <i>Project Cost Data</i> default values in analysis? Choose	Y				
28	"Y" to accept default values below or "N" to over-ride					
29	default values and utilize new user defined values as					
30	entered below. See <i>FAQ</i> for related topics.					

2.4

10.0

50.0

100.0

Other

Choose Tower Height from dropdown list

Choose Tower Type from dropdown list

Press 'Go To Summary Impacts' Button

Go To Summary Impacts

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Choose Tower Height from dropdown list

Choose Tower Type from dropdown list

Click 'Go To Summary Impacts' Button

Go To Summary Impacts

The models contain state multipliers, but county or regional multipliers can be acquired and input into the model to carry out analysis on entities other than states

Detailed User Inputs

Project Cost Data - Default Values

Construction Costs	Cost	Cost Per kW	Percent of Total Cost	Purchased Locally (%)	Manufactured Locally (%)
Site Preparation and Erection Materials					
Foundation Materials (concrete, rebar, etc.)	\$7,176,000	\$240	3.8%	100%	50%
Electrical (wire, conduit, etc.)	\$4,485,000	\$150	2.4%	0%	0%
Tower wiring kit	\$0	\$0	0.0%	0%	0%
Materials Subtotal	\$11,661,000	\$390	6.1%		
Labor					
Trenching and Pipe Installation	\$4,784,000	\$160	2.5%	100%	
Foundation, Erection, and Electrical	\$26,999,700	\$903	14.2%	100%	
Labor Subtotal	\$31,783,700	\$1,063	16.7%		
Construction Subtotal	\$43,444,700	\$1,453	22.8%		
Equipment Costs					
Turbine	\$94,962,400	\$3,176	49.8%	0%	0%
Tower	\$22,724,000	\$760	11.9%	0%	0%
Special Tooling (bolts, wrenches)	\$0	\$0	0.0%	75%	0%
Equipment Subtotal	\$117,686,400	\$3,936	61.7%		
Other Balance of System Costs					
Bird Flight Diverters	\$0	\$0	0.0%	0%	0%
Tower Raising Kit	\$0	\$0	0.0%	0%	0%
Batteries, Controllers and Misc. Electrical	\$0	\$0	0.0%	0%	0%
Buildings/Sheds/Fencing	\$5,382,000	\$180	2.8%	100%	
Shipping Freight	\$5,980,000	\$200	3.1%	0%	
Professional Services	\$7,176,000	\$240	3.8%	0%	
Site Permits/Fees	\$239,200	\$8	0.1%	100%	
Other Subtotal	\$18,777,200	\$628	9.8%		
Subtotal	\$179,908,300	\$6,017	94.3%		
Sales Tax	\$10,845,717	\$363	5.7%	100%	
Total	\$190,754,017	\$6,380	100.0%		

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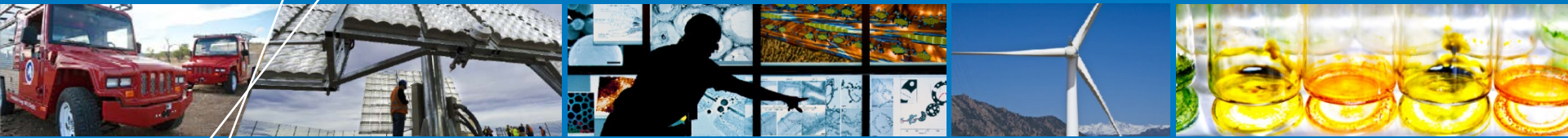
Line item cost inputs are shown here. In addition to *construction* cost inputs, default values are provided for *operating and maintenance* and *financial* parameters or the users can enter their own project-specific data.

JEDI Model Caveats

- Not a precise forecast but an estimate of overall economic impacts
- Inputs need your context!
- Project size
- Gross jobs vs. net jobs
- Local sourcing levels have significant impact
- Full-time equivalent (FTE) jobs.

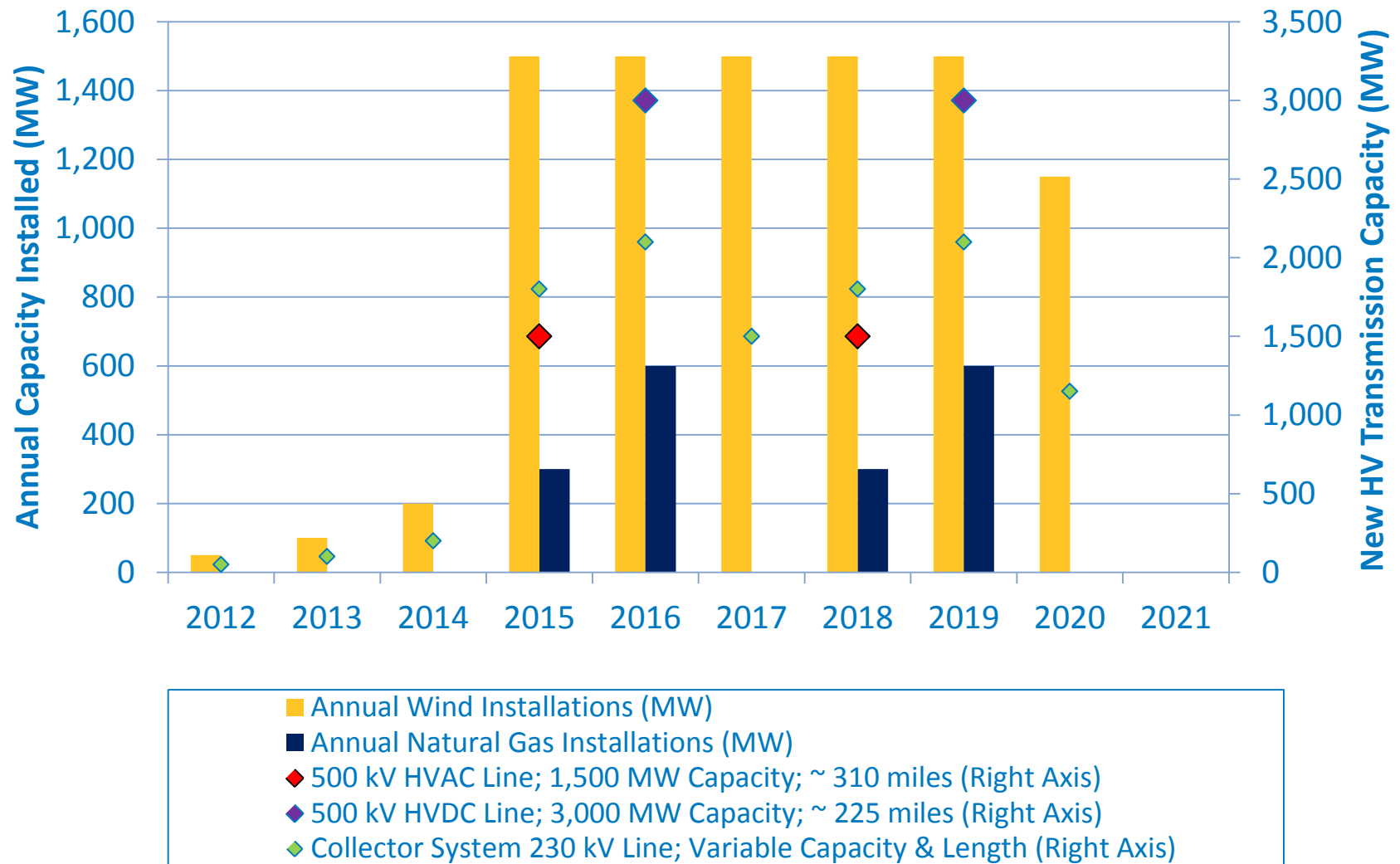


Photo from First Wind, NREL/PIX 16738



NREL's JEDI Results

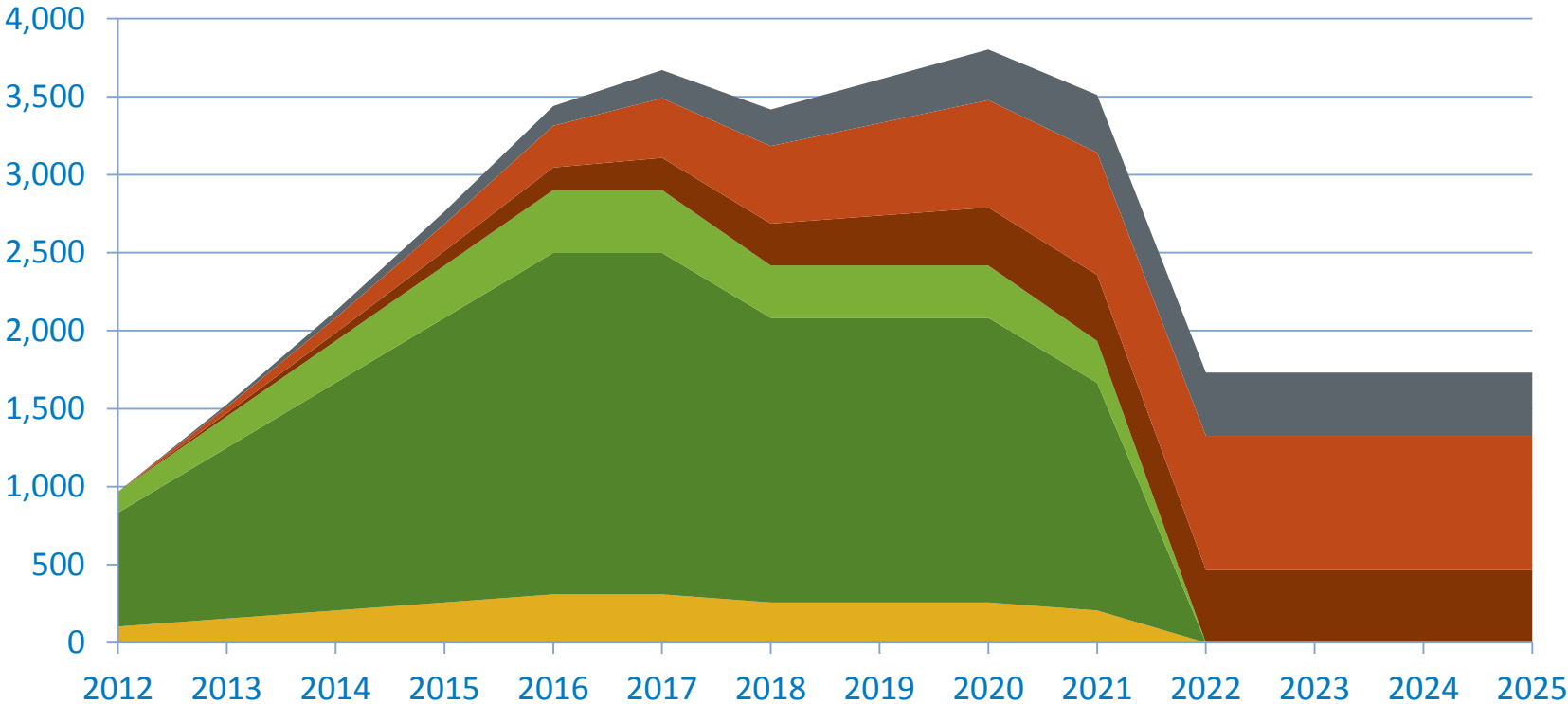
Sample JEDI Results: Wyoming Infrastructure Authority: Deployment (2012 – 2021)



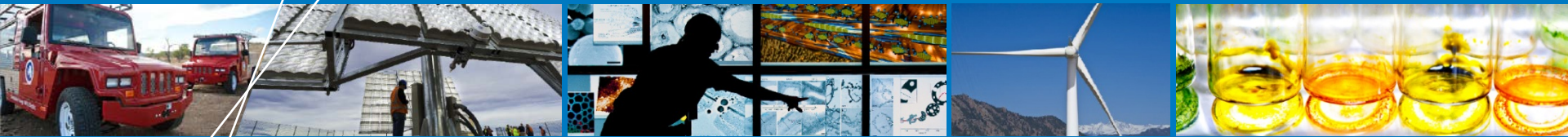
Source: Lantz and Tegen, 2011.

Wyoming: Base Case for New Wind over Time

Wyoming Employment (Annual) from 9,000 MW of New Wind Generation



- Construction Project Development and Onsite Labor Activity
- Construction Equipment and Supply Chain Activity
- Construction Induced Activity
- Operations Onsite Labor Activity
- Operations Local Revenue and Supply Chain Activity
- Operations Induced Activity



Small Wind JEDI Specifics

Small Wind JEDI Model

- **Four turbine size categories:**
 - 0+ kW – 2.4 kW
 - 2.5 kW – 10 kW
 - 10.1 kW – 50 kW
 - 50.1 kW – 100 kW.
- **Costs vary by size, and users should add project-specific information.**
- **Supply chain and manufacturing jobs and impacts vary by size and by state (depending on multipliers).**
- **All default inputs and assumptions come from recent projects and industry interviews.**
- **NREL is requesting more data on current projects to help populate and validate the Small Wind JEDI model.**

Preliminary Small Wind Inputs and Outputs

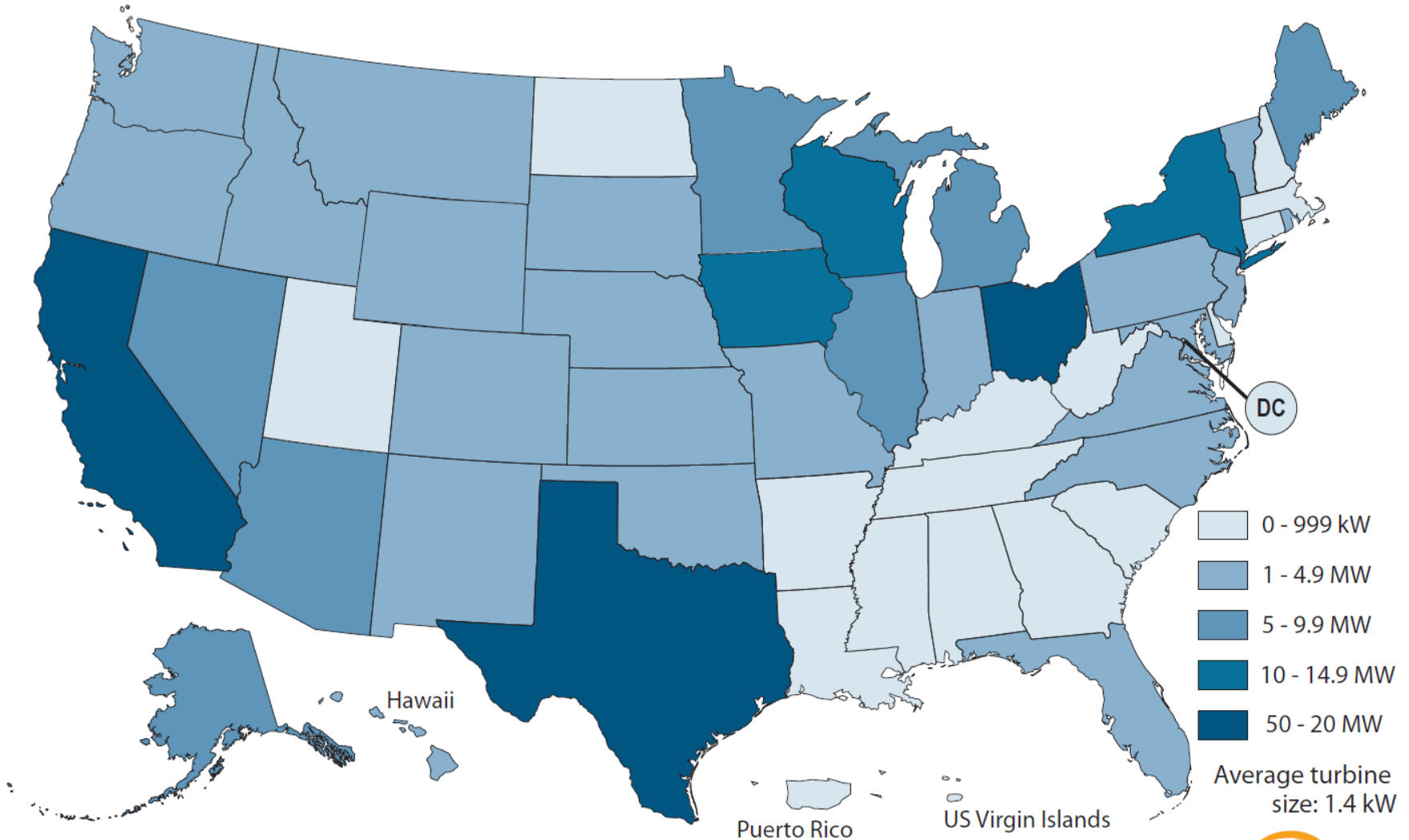
	Up to 2.4 kW	2.5 -10 kW	10.1 – 50 kW	50.1 – 100 kW
Installed Capital Cost	\$6000 - \$6400/kW	\$6000 - \$6300/kW	~\$6,000/kW	\$5000 - \$5400/kW
Operations & Maintenance	Need data	~\$10/kW	~\$50/kW	\$20-\$25/kW

Preliminary model runs indicate small wind supports more jobs per MW than large/utility-scale wind. These JEDI model results are based on the preliminary model and will change as the model is updated.

	Large-Scale FTE	Small Wind FTE
Construction	60-70 jobs/100 MW	Up to 550 jobs/100 MW
Operations	6-7 jobs/100 MW	~ 8-25 jobs/100 MW

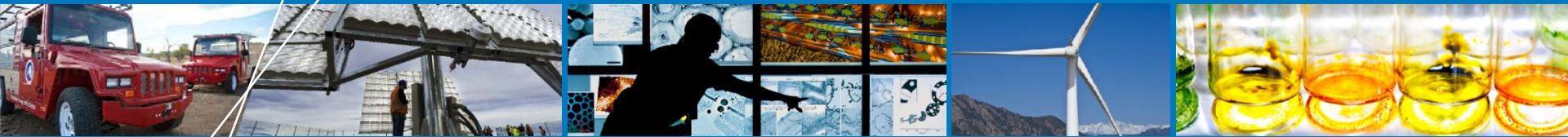
2011 Year End Small Wind Turbine Capacity

Turbines up to 100 kW Cumulative Installations and Sales



Approximately 151,000 small wind turbines totaling 205 MW as of 12/31/2011





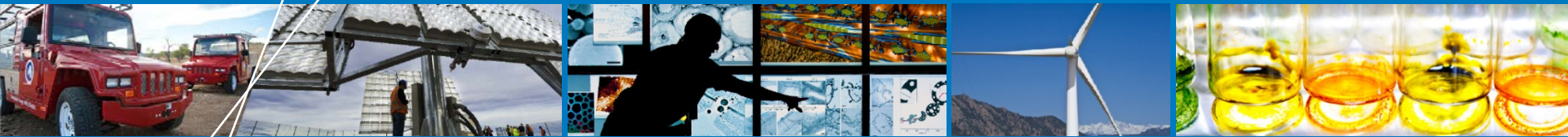
Your Input Is Needed: Improve the Small Wind JEDI Model

Please Contact Me with Comments

- **Data on turbines between <1 - 100 kW**
 - Siting/development cost and labor
 - Site preparation cost and labor
 - Capital cost and labor
 - Installation cost and labor
 - Operations and maintenance cost and labor.
- **Cost and labor ranges may be provided instead of a dollar amount.**
- **We will not release company or project-specific data.**



Photo by Frank Oteri, NREL/PIX 18440



Thank you

Suzanne .Tegen@nrel.gov

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