



Cost Estimates for Mid to Large Scale Wind Energy Projects

An explanation on the estimates:

It is important to be aware that the costs contained in the project expense examples contained below will vary greatly based on numerous factors. Some of these variables include the site, number of turbines, pre-construction work, engineering fees, and interconnection. Also, certain costs contained in the project expense example can fluctuate on a monthly basis and depending on the time of year a project is to begin. We obtained the cost information from our market research which involved calling and speaking with many manufacturers, developers, construction companies, permitting agencies, and industry experts. In areas where it was difficult to get particular cost information we relied on *Community Wind: An Oregon Guidebook (2005)*¹. The assumptions based on the Energy Trust of Oregon example were adjusted to account for inflation and project size

This document was created to provide an example of what a project may potentially cost. It is meant to provide the reader with a better understanding of the various elements involved in the process of constructing a wind farm with multiple turbines or erecting a single turbine.

The example projects include:

- 100kW – Northwind turbine
- 600kW – EnerTech E48 turbine
- 10.5MW – five 2.1MW Vestas turbines

Although the expense models were calculated based on estimates received from the turbine manufacturers listed above the REC does not endorse these companies and we strongly recommend comparing turbines from multiple manufacturers.

¹ Andre, Don; Grove, Jennifer; Grossman Moynihan, Leslie; Peterson, Sarah; and Raker, Jessica *Community Wind: An Oregon Guidebook*, Energy Trust of Oregon and Northwest Sustainable Energy for Economic Development, 2005.

	<u>100kW</u>		
		\$/kW	%
Turbine			
Turbine and tower	\$ 300,000	\$ 3,000	
Freight	3,500	35	
FAA lights	<u>3,600</u>	36	
Subtotal	<u>307,100</u>	3,071	56.78%
Balance of Plant			
Site Development	75,000	750	
Foundations	4,000	40	
Cranes plus labor	4,400	44	
Electrical System & Transformer	6,000	60	
Supervision	<u>1,800</u>	18	
Subtotal	<u>91,200</u>	912	16.86%
Interconnection			
HV line extension	2,000	20	
Interconnection Feasibility Studies	1,650	17	
Interconnection/Construction	5,000		
Labor (electrical)	<u>1,200</u>	12	
Subtotal	<u>9,850</u>	99	1.82%
Soft Costs			
Legal	3,000	30	
Permitting	2,225	22	
Development/Engineering	60,000	600	
Insurance (construction & transportation)	1,000	10	
Title Insurance	700	7	
Financing (Application, underwriting, loan fees)	800	8	
Feasibility Study	30,000	300	
MET Tower	30,000		
Contingencies	<u>5,000</u>	50	
Subtotal	<u>132,725</u>	1,327	24.54%
Total	<u>\$ 540,875</u>	\$ 5,409	
Operating Costs			
Operations & Maintenance	\$ 2,000	20	
Repair & Reserve	1,950	20	
Management/Administrative	1,500	15	
Property Taxes	1,000	10	
Land Lease	3,000	30	
Equipment Insurance	1,000	10	
Miscellaneous	<u>600</u>	6	
Total	<u>\$ 11,050</u>	111	

		<u>600kW</u>	
		\$/kW	%
Turbine			
Turbine and tower	\$ 1,200,000	\$ 2,000	
Freight	200,000	333	
FAA lights	<u>3,600</u>	6	
Subtotal	<u>1,403,600</u>	2,339	70.03%
Balance of Plant			
Site Development	150,000	250	
Foundations	37,800	63	
Cranes plus labor	38,400	64	
Electrical System & Transformer	36,000	60	
Supervision	<u>11,400</u>	19	
Subtotal	<u>273,600</u>	456	13.65%
Interconnection			
HV line extension	12,000	20	
Interconnection Feasibility Studies	5,150	9	
Interconnection/Construction	10,000		
Labor (electrical)	<u>7,200</u>	12	
Subtotal	<u>34,350</u>	57	1.71%
Soft Costs			
Legal	18,000	30	
Permitting	29,225	49	
Development/Engineering	120,000	200	
Insurance (construction & transportation)	9,000	15	
Title Insurance	4,200	7	
Financing (Application, underwriting, loan fees)	4,800	8	
Feasibility Study	53,500	89	
MET Tower	30,000		
Contingencies	<u>24,000</u>	40	
Subtotal	<u>292,725</u>	488	14.61%
Total	<u>\$ 2,004,275</u>	\$ 3,340	
Operating Costs			
Operations & Maintenance	\$ 12,000	20	
Repair & Reserve	7,800	13	
Management/Administrative	6,000	10	
Property Taxes	9,000	15	
Land Lease	3,000	5	
Equipment Insurance	6,000	10	
Miscellaneous	<u>3,600</u>	6	
Total	<u>\$ 47,400</u>	79	

	<u>10.5MW*</u>		
		\$/kW	%
Turbine			
Turbine and tower	\$ 15,000,000	\$ 1,429	
Freight	500,000	48	
FAA lights	<u>10,800</u>	1	
Subtotal	<u>15,510,800</u>	1,477	77.12%
Balance of Plant			
Site Development	225,000	21	
Foundations	630,000	60	
Cranes plus labor	483,000	46	
Electrical System & Transformer	630,000	60	
Supervision	<u>210,000</u>	20	
Subtotal	<u>2,178,000</u>	207	10.83%
Interconnection			
HV line extension	210,000	20	
Interconnection Feasibility Studies	81,850	8	
Interconnection/Construction	500,000		
Labor (electrical)	<u>126,000</u>	12	
Subtotal	<u>917,850</u>	87	4.56%
Soft Costs			
Legal	315,000	30	
Permitting	111,525	11	
Development/Engineering	300,000	29	
Insurance (construction & transportation)	210,000	20	
Title Insurance	73,500	7	
Financing (Application, underwriting, loan fees)	84,000	8	
Feasibility Study	67,000	6	
MET Tower	30,000		
Contingencies	<u>315,000</u>	30	
Subtotal	<u>1,506,025</u>	143	7.49%
Total	<u>\$ 20,112,675</u>	\$ 1,915	
Operating Costs			
Operations & Maintenance	\$ 60,000	6	
Repair & Reserve	97,500	9	
Management/Administrative	40,000	4	
Property Taxes	140,000	13	
Land Lease	15,000	1	
Equipment Insurance	90,000	9	
Miscellaneous	<u>8,000</u>	1	
Total	<u>\$ 450,499</u>	43	

* The 10.5MW example is composed of five 2.1MW Vestas turbines.

TURBINE

Turbine and tower: The estimates were obtained from various manufacturers. For any turbine where more than one quote was given, the amounts were averaged and the average was used.

Freight: The turbine, tower, and other components typically need to be shipped to the site. The quotes are from several turbine manufacturers. These estimates can vary greatly depending on the size of the turbine, number of turbines, and where the turbine is being shipped to and from.

FAA Lights: The lights are required by the FAA for any turbine over 200 feet tall. There are numerous companies which manufacture lights designed specifically for wind turbines. It was assumed for the 10.5 project with 5 turbines that at least 3 turbines would have lights installed on them. The cost of installing the lights is mixed in with the construction costs.

BALANCE OF PLANT

Site Development: The site development consists of geotechnical, surveying, turbine layout, and other site engineering work.

Foundations: The foundation is the base on which the turbines are erected.

Cranes plus Crane & Erection Labor: This line item is the cost for the rental of the cranes and labor associated with the construction process.

Electrical System & Transformer: This involves the process of hooking the electrical system (turbine wiring) to the transformer located at the power station which converts the power into energy.

Supervision: The cost associated with having the developer oversee the construction.

INTERCONNECTION

HV Line Extension: The line extension is when the turbine is interconnected either with transmission/distribution lines or a substation.

Interconnection Feasibility Studies: There is a flat rate for an application and an additional price per kilowatt fee for system impact studies.

Interconnection/Construction: This is to implement the necessary upgrades recommended by the system impact studies.

Labor (electrical): This line item consists of hiring electrical engineers and electricians to do the interconnection.

SOFT COSTS

Legal: Legal fees include title work and contracts. Additional fees may apply in areas without an adopted wind ordinance.

Permitting: Permitting includes Erosion and Sedimentation, wildlife impact studies, building permits, and National Pollutant Discharge Elimination System (NPDES) permits.

Development/Engineering: The development/engineering fees include fees for surveying, cut/fill, road construction, site clearing, and electrical engineering fees.

Insurance: This line item is for the insurance on the construction of the project.

Title Insurance: Title insurance protects the financiers of a project.

Financing: The financing line item is the cost associated with financing applications and associated legal fees.

MET Tower: The meteorological (MET) towers are installed to conduct feasibility studies for potential sites. The feasibility study helps to determine if a site has a developable wind resource.

Contingencies: Contingencies are the amount reserved for unforeseen costs which may arise during construction.

OPERATING COSTS

Operations and Maintenance: The monitoring and annual maintenance of turbines.

Repair and Reserve: The repair and reserve is money set aside typically based on a percentage of the original turbine cost. The money is used for any unexpected repairs necessary for the turbines.

Management/Administrative: The costs associated with the administrative duties required for a wind farm.

Property Tax: This was calculated by taking the appropriate tax rate and estimating the potential taxes for each project.

Land Lease: The land lease is the amount of money to be paid to the owner of the land.

Equipment Insurance: This line item covers the insurance on the equipment used in the operation and maintenance of the wind farm.

Miscellaneous: The miscellaneous line item is a fund of monies set aside for any unforeseen expenses that may arise.