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ETM 635-Engineering Economy

Team 4

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COMMUNITY WIND: FEASIBILITY STUDY

Abstract

It is socially desirable to invest in alternative energy production. As investors, it is also important that any green energy project be cost effective. This project will investigate the economic feasibility of constructing a community wind power generation project in Oregon. The technology is readily available, but it is necessary to analyze all the costs of the community wind project from conception and design, through operations and maintenance and finally end of life and salvage. We will analyze the system costs and benefits through a 20 year study lifetime to evaluate if the capital investment can be offset by the income from energy production and tax benefits. The goal is to find a positive net present value for the study life of the project with a rate of return that is greater than the minimum attractive rate of return (MARR).

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1 Introduction / Background

The small wind turbines are new technological generators designed to use the wind power for electricity generation. They produce electricity with emissions-free to the environment. The power is used for domestic consumptions as well as commercial usage. Individual's homes, small organizations and farms use the power for their daily cores. This kind of energy does not emit any gases to the environment that causes pollution. The U.S. government has initiated a program for boosting clean energy projects by providing grants and other incentives.

The global warming has posed a great challenge to the fossil fuel generated power. This has called for an alternative source of energy. The cost of indigenous sources of energy is too high that some individuals who want to install new power lines in their homes find it impossible. This kind of energy has been growing as one of the major sectors of power production. It increases the energy but does not warm the ozone layer.

Community wind projects even at a small scale contribute to lowering the rate of global warming. Small firms, private organizations and government agencies can make additional income from community wind projects and also contribute to environment conservation. The community wind is fast making track in the community power supply and investment for the less fortunate people.

A community wind project is a wind project that is initiated by a given community to provide an alternative supply of electricity for domestic power consumption. These community wind projects are locally owned by farmers, the small business owners, the local organizations; schools, colleges & universities, the municipalities and the religious institutions within a given locality. The village electricity corporative also may own the community wind and the Native American tribes. The projects can be a single turbine for family or individual consumption, a group owned or a commercial scale. The commercial scale manufactures the electricity and sells the power to the surrounding community at a cheaper cost. The government has been giving support to this project since it reduces their total cost spent. The subsidies for fossil fuel are reduced by almost 50% when the government allocates funds to such projects.

2 Purpose of Community Wind Project

There are currently only 3500 small wind turbine units installed in Oregon. Oregon is also one of the 7 states to provide state wide rules for small wind systems (1). For example, if you are building a home in a remote location, a small wind energy system can help you avoid the high costs of extending utility power lines to your site. Of course the initial investments are significant but they can be competitive with conventional energy sources when you account for a lifetime of reduced or altogether avoided utility costs (2). Although deciding on a small wind project for your home or place of business is a complicated process, there are many factors to consider but with right set of circumstances and well-designed system you can produce many years of cost-effective, clean, and reliable energy.

3 Project Proposal

3.1 Objective

The purpose of this project is a feasibility study to evaluate a construction of a community wind project in Oregon.

We selected a power generating capacity of 3 MW. This allows our project to fall within the community wind power project guidelines. The community wind scale designation allows specific federal renewable energy incentives to be applied.

3.2 Proposal Summary

This community wind project will have these characteristics:

- Economic, environmental, social, technical, political perspectives
- Connection to current regional utility grid
- Power Purchase Agreement contract with utility provider
- Community wind scale project
- Using available commercial wind technology, producing up to three (3) megawatts of power

4 Design Process

4.1 Typical Wind Power Development Process

The typical wind power development process has been described by Taylor and Parsons. [4] Our project will follow these using twelve steps:

1. A group of investors or landowners interested in developing a wind project form an organization and hire a wind power consultant.
2. An initial “meeting-of-the-minds” review is held.
3. If the result is positive a feasibility study is commissioned.
4. The investors capitalize the project.
5. A site is selected based on wind and geographic considerations.
6. A transmission and grid interconnect study is performed with the intention of a PPA (Power Purchase Agreement) with the local power utility.
7. Onsite environmental studies are performed.
8. Wind turbine vendor is selected and a purchase is initiated.
9. A wind turbine layout is designed.
10. The necessary permits are acquired.
11. Wind tower/farm construction and operation then follows till project completion.
12. Operations, Warranty, Maintenance, and Administration manage the wind generation for 20+ years.

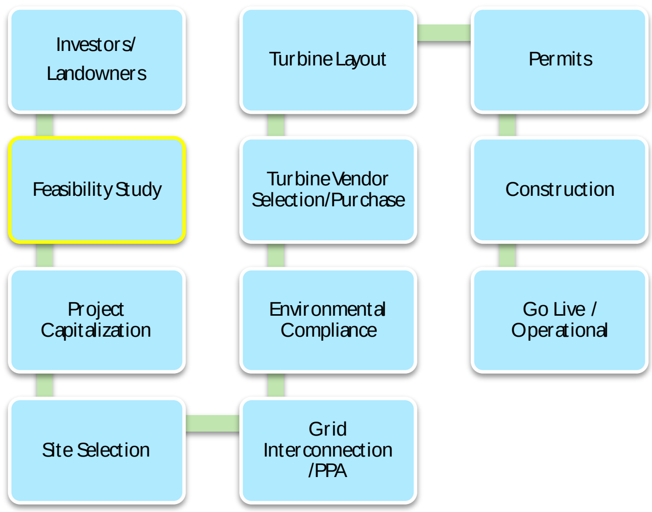

Figure 1 Typical Wind Development Process (4)

4.2 Wind Power Feasibility Studies

Community scale wind energy for communities is gaining popularity due to its value as a long-term financial investment and its positive contribution to the environment. A wind power feasibility study examines many perspectives and factors, including:

- Wind speed analysis
- Transmission, grid interconnection, and Power Purchase Agreements (PPA) feasibility
- Federal, state, county, and city zoning permits
- Project economics including government incentives and financing
- Site evaluation
- Land control issues
- Fatal environmental and development flaws and hazards
- Wetland and soil condition
- Impact on protected species
- Other social and political considerations that may impact the project

For this study we will consider only the on the economic analysis of the project.

4.3 Financial Incentive Program

Multiple incentive programs are offered by the federal government and Bonneville Environmental Foundation. The major one is the Federal Production Tax Credit (PTC) which provides for tax rebate of 2.2¢/kWh (in 2011, adjusted annually for inflation) (5).

[Contact: Erin Johnston, Energy Trust of Oregon, (503) 459-4075, Email: erin.johnston@energytrust.org]

Table 1 Incentive Programs Available in Oregon

The Federal Production Tax Credit (PTC)	2.2¢/kWh credit (adjusted annually for inflation) that projects can earn during the first ten years of production. This credit is part of section 45 of the IRS tax code and has been the main driver of wind energy development in the U.S. to date.
Community Renewable Energy Feasibility Fund Program	Maximum: $50,000 per project
Bonneville Environmental Foundation	Loans and Grants for Renewable Energy Programs (has multiple restrictions and requirements)
Oregon State Community Wind Incentive Program	No longer active
USDA - Rural Energy for America Program (REAP) Grants	Varies (but typically $20,000 – $30,000)

4.4 Technical Requirements for Digby Community Wind Project (DCWP)

4.4.1 Wind Power Generation Subsystem

4.4.1.1 Wind Turbine

We selected the 1.5 MW GE Turbine since it was already prequalified for receiving all federal and state tax incentives and rebates applicable to community wind projects. GE 1.5MW is a wind turbine manufactured by General Electric. The turbine is efficient and can produce up to 1500 KW power per second. It does not require much stronger wing to rotate. The turbine is cost effective since it is cheap to buy from the market. This device was first manufactured in china to boost the local production of power efficiently. Today the turbine has been proven to be effective and used globally. The small wind will use this turbine as it is one of the recommended turbines due to its efficiency and cost. The turbine is long lasting and withstands adverse weather conditions (3). For the purpose of our project we are going to use two of the GE turbines. The Technical Data and the Power curve of the 1.5 MW GE turbine is shown in Figure 1.

Technical data

Operating Data		1.5sle	1.5xle
Rated Capacity:		1,500 kW	1,500 kW
Temperature Range: (with Cold Weather Extreme Package)	Operation:	-30°C – +40°C	-30°C – +40°C
	Survival:	-40°C – +50°C	-40°C – +50°C
Cut-in Wind Speed:		3.5 m/s	3.5 m/s
Cut-out Wind Speed (10 min avg.):		25 m/s	20 m/s
Rated Wind Speed:		14 m/s	11.5 m/s
Wind Class — IEC:		IIa (V_{e50} = 55 m/s V_{ave} = 8.5 m/s)	IIIb (V_{e50} = 52.5 m/s V_{ave} = 8.0 m/s)
Electrical Interface			
Frequency		50/60 Hz	50/60 Hz
Voltage		690V	690V
Rotor			
Rotor Diameter:		77 m	82.5 m
Swept Area:		4657 m²	5346 m²
Tower			
Hub Heights:		65/80 m	80 m
Power Control		Active Blade Pitch Control	Active Blade Pitch Control

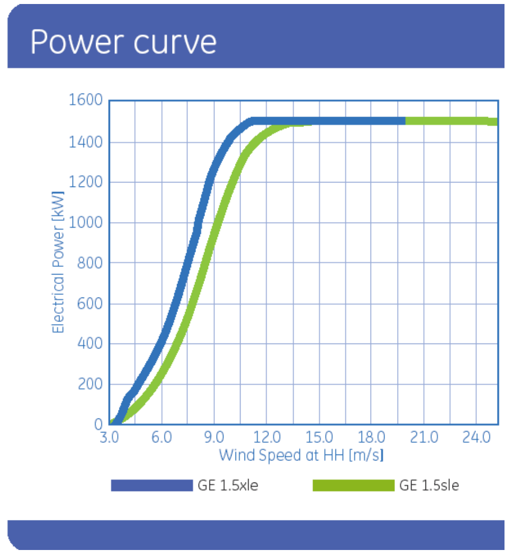

Figure 2 GE 1.5MW Turbine Specifications (3)

4.4.1.2 Utility Interconnection

It is important to coordinate with the regional electric utility to interconnect to their grid and substation. This may require specific modification to both the substation and the wind energy interconnect subsystem. The utility typically controls the specifications.

4.4.2 Site Location

The small wind plant requires an open space where there is feasible flow of wind. The turbines are to be in an average height in which they don't get any obstacle that shields them from wind. One of these places available here in Oregon is the Cascade Locks. The place, due to its location provides a humble position to locate such a project site. It also has an average wind speed of 15.2 MPH. Figure 2 shows the Oregon Wind Speed map. Cascade Locks; provide such outstanding requirement for the small community wind. Cascade Locks is situated In the Hood River Oregon within the height of 57 feet high in Larch Mountain giving it a free flow of wind. The turbines can therefore, rotate continuously providing a reliable source of electricity to consumers. The Colombian river falls creates a vacuum that accelerates the speed of wind down the slopes. This speed will help turn the turbines at a greater speed producing much power. This forms the basis why the location is preferred; the reliable wind with a high speed and the location height provide a free turn to the firm's turbines.

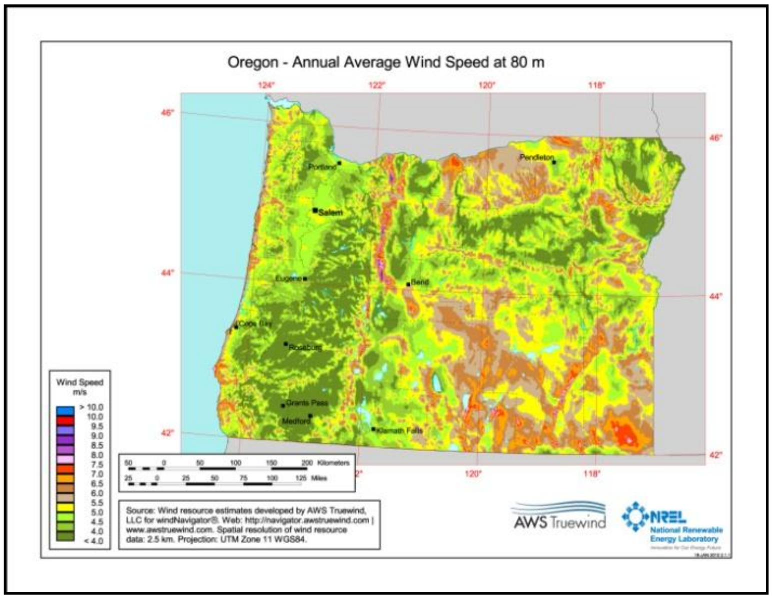

Figure 3 Oregon Wind Map (6)

4.4.2.1 Zoning Ordinances of Hood River

ARTICLE 64 – Land Use Permits – Hood River County Ordinance outlines the required the content of the application and the procedure the planning committee takes for the approval process.

Section 55.50 - General Exception to Building Height Limitation

The following type of structure or structural parts are not subject to the building height limitations of this ordinance: chimneys, tanks, church spires, belfries, domes, monuments, fire and hose towers, observation towers, masts, aerials, cooling towers, elevator shafts, transmission towers, smoke-stacks, flagpoles, radio or television towers, and other similar projections. Structures or structural parts listed within the Airport Height Combining Zone, including structures necessary to operate the airport, are excluded from the provisions of this section.

4.4.2.2 Generally Established Regulations

Some of the regulations which must be followed when constructing and operating our Hood River community wind farm are illustrated in Table 2.

Table 2 Regulations for Hood River

Setback	Generally 1.5*Height of the tower; from property line, structures, utility lines, road systems.
Height	Max 140’
Noise	Use Oregon Environmental Quality Commission noise regulations (OAR 340-035-0035).
Lot Size	Energy Trust incentives, systems must be on a minimum of one acre.
Location	For turbines 20 kW or less, allow systems with foundations that are based on the manufacturer’s “worst case” soil conditions. For turbines greater than 20 kW, require an engineer’s wet stamp and a soil analysis.
Insurance	Added as an appurtenant structure to existing homeowner, farm or business policy.

Attractive Nuisance	Protective fencing, no climbing rungs 10 feet from ground, warning signs

4.4.2.3 Permits

Land Use

Permits are required before installing towers and wind turbines in Oregon; have to contact the hood river county/city planning and construction permitting agencies. Need to do this early on in the process to determine what land use and construction permits you will need for your site and how long those processes take.

Interconnection

Will need electrical building permits; if the system is connected to the utility power grid, you we will have to identify the terms and conditions of connecting to the utility's service. Terms and conditions should cover installing and connecting your turbine, as well as the terms and conditions of any exchange or purchase of power from your wind resource.

As shown in the Zoning Map (Figure 4.) we must stay away from the restricted structure heights in the Airport Zone.

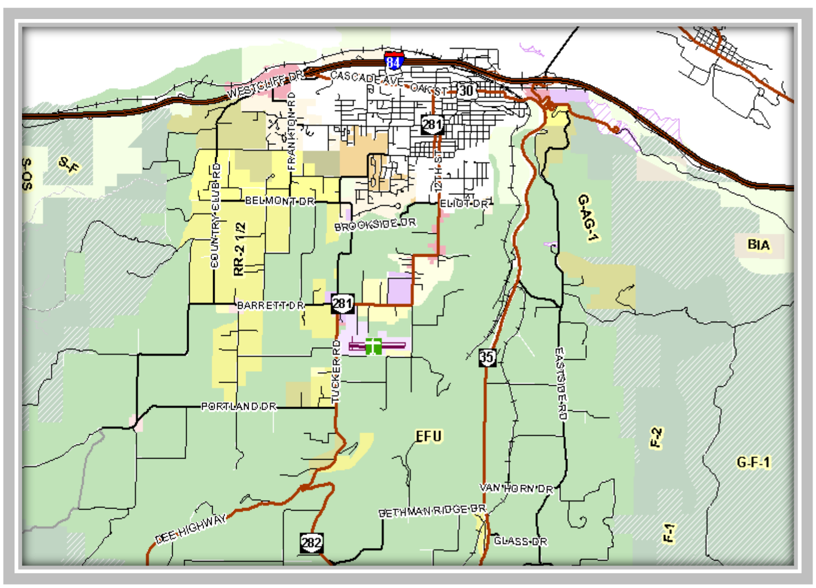

Figure 4 Hood River Area Zoning Map

4.5 Project Development, Construction, Operations, Maintenance, and Administration

Many wind power systems of this magnitude have been studied previously. We will use a project management process similar to the feasibility study of Falmouth Hospital done in 2005 as the model for our analysis. [8]

4.5.1 Construction Management

Site preparation and construction is the main cost of the project and requires detailed project planning and coordination. Special attention needs to be paid for heavy crane access to the site. The main aspects of construction include:

- ***Roads.*** Likely new roadways are required (or old roads improved) at the construction site for vehicle, crane, and turbine access.
- **Grading.** New roads, turbine foundation site, crane site, and storage facilities will require grading.
- ***Cables.*** Cables will need to be laid.
- ***Foundations***: Turbine towers and transformers require special foundations.
- ***Utility Facility Upgrade.*** All utility interconnect requirements will need to be completed before connecting to the grid.
- ***Meteorological Tower(s).*** Typically independent meteorological towers should be set up to provide independent wind data for warranty purposes.

4.5.2 Operations, Administration, and Maintenance, and (OA&M)

Once the project is completed and starts commercial operation daily administration and scheduled (preventive) maintenance begins. Typically a crew of two trained technicians is required to service a turbine. To keep the systems under warranty preventative maintenance is critical. Also, all the high voltage equipment that connects to the utility grid must be maintained and is typically included in the interconnection agreement. Finally, overall site maintenance such vegetation, animal control, road repairs, erosion control, etc. must be well managed.

Replacement parts inventory is also important for maintaining the turbines. Turbine life is typically 20+ years but certain parts such as blades, gearboxes, and brakes need to be replaced much earlier.

4.5.3 Decommissioning

Permits typically require that funds be available for decommissioning at the end of the project life. This guarantee can be a bond, corporate guarantee, letter of credit, or reserve fund. This will be monitored to ensure ongoing compliance. An alternative approach at the end repowering which may involve turbine replacement, removal of old hardware, foundation replacement, road reconfiguration, permit revision, financing, a new PPA, and site restoration.

The Table 3 gives a breakdown of installation and OA&M costs of 3 MW system with two GE 1.5 MW Turbines. Note that the section labeled "Installed Cost plus OA&M for 1st Year" only indicates the cost of one turbine. The rest of the table uses the values for 2 turbines, to create the 3MW system.

Installed Cost Plus OA&M for Ist Year		
ITEM		
Feasibility and Conception	$51,000	2%
Project Design	$127,500	4%
Pre-Construction	$178,500	6%
Construction	$2,150,000	75%
Operations and Maintenance	$127,500	4%
Turbine	$220,000	8%
Total	**$2,854,500**	**100%**
$/KW	$1,903	

Project Cost	
Project Cost per kW	$1,900
Project Power, kW	3000
Total Cost	$5,700,000

Expenses – OA&M		Annual Escalation
Operations & Maintenance	$45,000	3.0%
Operations & Maintenance Contingency Fund	$25,000	2.0%
Project Management Fee	$70,000	2.0%
Insurance	$1,000	2.0%
Property Tax	$10,000	-1.0%
Lease Payments to Landowners	$12,000	2.0%
Admin/Financial/Legal Management	$5,000	2.0%
Production Tax Expense ($/kWh)	$0.00	0.0%
Warranty Expense	$20,000	2.0%
Decomm. Fund Pre-Warranty Expiration	$ -	2.0%
Decomm. Fund Post-Warranty Expiration	$3,000	2.0%
Other Expense	$ -	1.0%

Table 3 Installation and OA&M Costs of 3 MW system with two GE 1.5 MW Turbines

5 Engineering Economics Modeling and Analysis

We wish to thank the Windustry, a member supported organization which promotes progressive renewable energy solution, for providing the Wind Energy Calculator, a modeling tool developed for the Windustry as part of their Community Wind Toolbox.[8] This spreadsheet easily supports community wind projects in most states, and business models. We were able to select the incentives currently available in Oregon and a business model which included local community as well as outside financial investors. We were able to determine the specific costs and income parameters required by our 3MW system installed in Hood River Oregon, which were then supplied to the model.

A full 20 year spreadsheet is too large to include as a table in this report. However we will illustrate many of the 20 year graphs and the project financial summary below. A summary pro-forma is included in the Appendix (Figure 11). (The full excel spreadsheet will be made available from the authors on request.)

5.1 System Life Cycle

We are using a 20 year study life for this project. The selection of 20 years is a standard used in the wind power industry and allows for normal useful life of components, including the wind turbines, and proper maintenance of system components during the operational life, and the typical warranty period.

5.2 Analysis of Results and Recommendations

Figure 5 illustrates the predicted reduction in system efficiency over time. This loss is normal as system components age. Of course we assume that the wind profile for our Hood River location does not change over the 20 year study period.

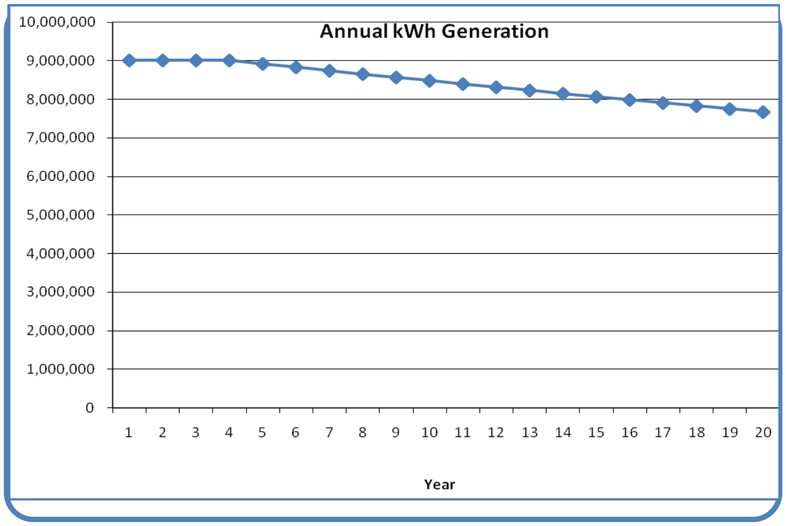

Figure 5 20 Year Annual kWh Generation

Figure 6 illustrates the 20 year revenue profile. This gradual reduction in generation factors in the efficiency losses with the increase of PPA contract income per kWh over the same time period.

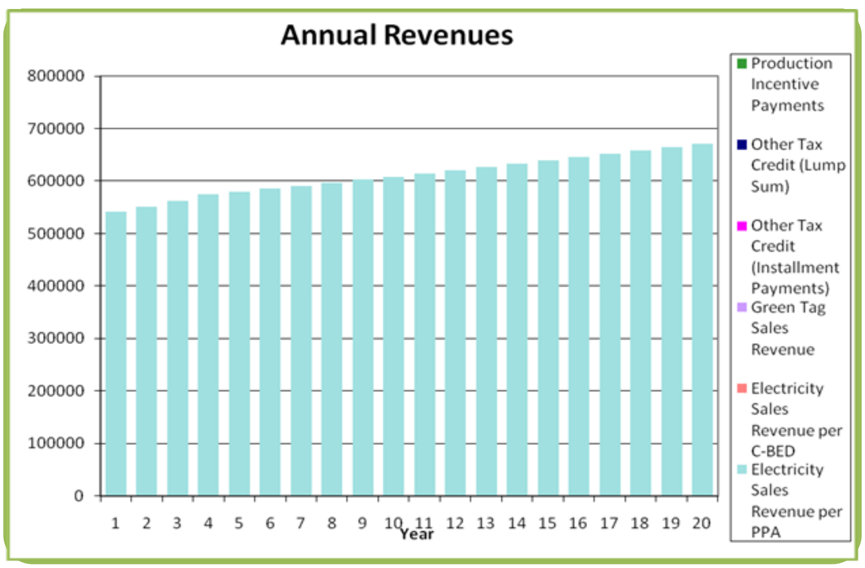

Figure 6 20 Year Annual Revenues (100% PPA Revenue)

Figure 7 illustrates the 20 year annual expenses profile. The economic advantage to the large investors is clearly indicated by the large values of the depreciation allowances from the MACRS method allowed for community wind projects.

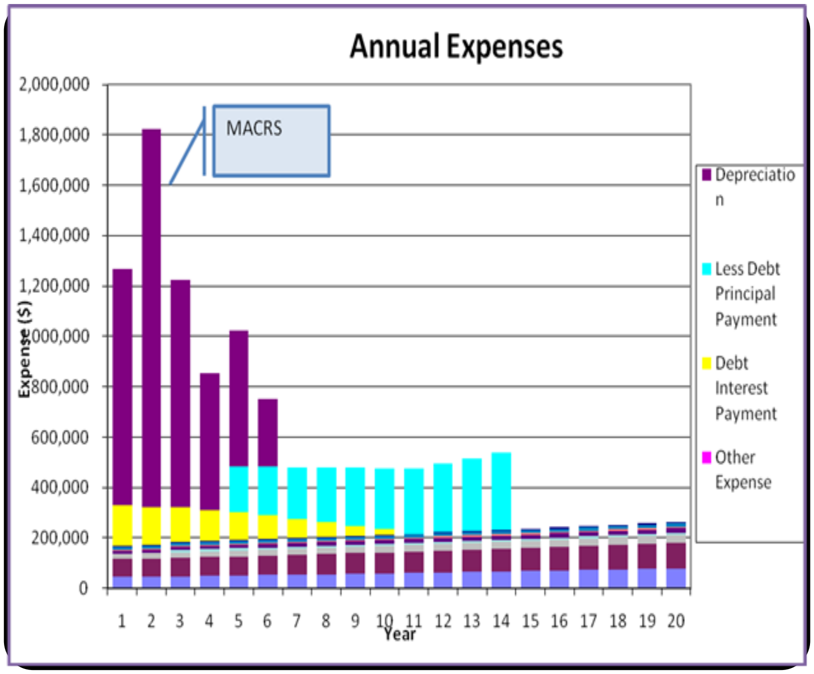

Figure 7 20 Year Annual Expenses

Figure 8 shows the 20 year tax benefits and liabilities for this project. Again the greatest tax benefits occur during the first 10 years and include depreciation and tax credits. After year 10 the wind project has a tax liability since it is now producing income without balancing benefits.

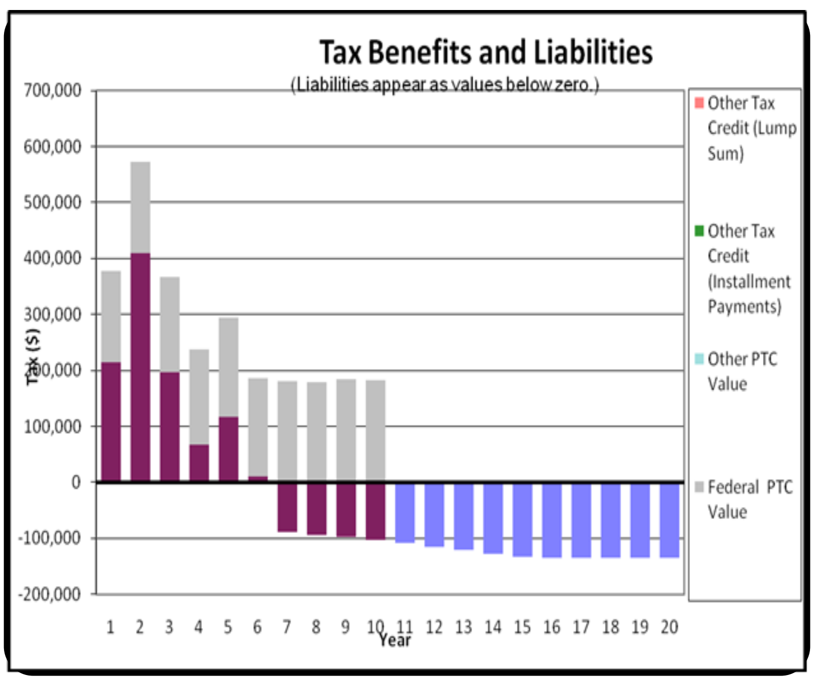

Figure 8 20 Year Tax Benefits & Liabilities

The net after tax cash flow is shown in Figure 9. Since virtually all these values are positive, the expectation is that this project will have an acceptable and positive net present value. The only negative years are between year 11 and year 14 when the depreciation benefits have been exhausted and the debt repayment is still occurring.

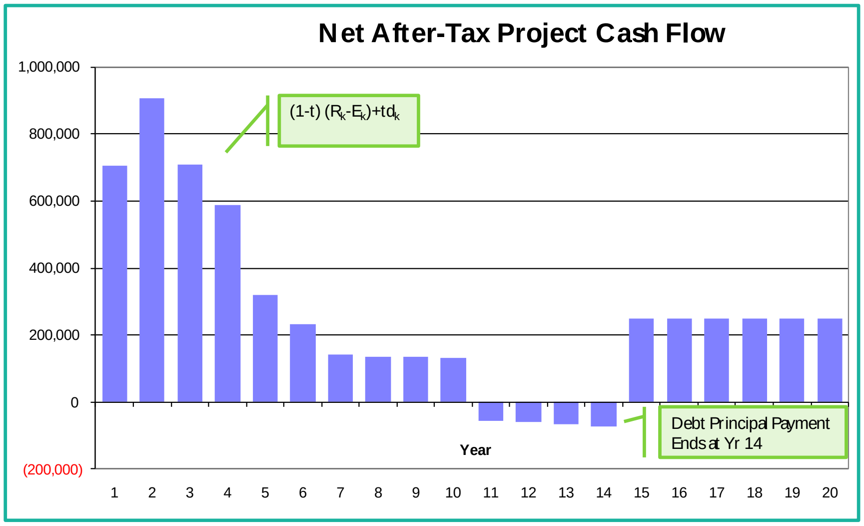

Figure 9 20 Year Net After Tax Cash Flow

The 20 year return to investors is positive in all years except years 11 through 14, similar to the net after tax cash flow in Figure 9. The investor and owner profiles are Figure 10 in the Appendix.

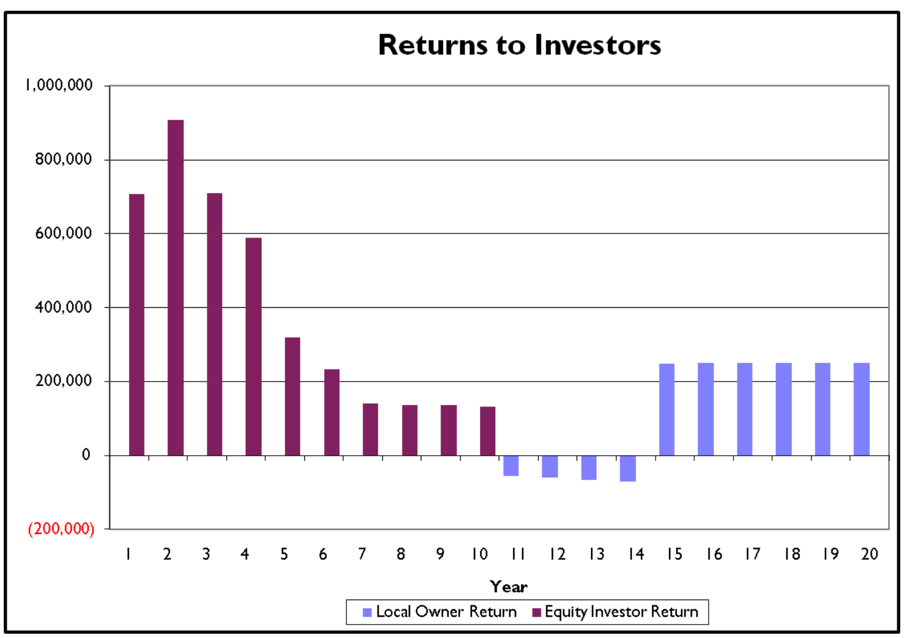

Figure 10 20 Year Return to Investors

Table 4 gives the financial summary of our community wind system.

Table 4 Hood River Project Financial Summary

ETM 535/635	**Digby: Project Summary**
Project Name	Hood River Project
Project Size (MW)	3 (2 Turbines)
Turbine Model	GE 1.5MW
Net Capacity Factor (Years 1-20)	32%
Total kWh Produced (Years 1-20)	168,613,754
PPA Rate	$0.0600
Total Installed Cost	$5,700,00
O & M Rate (% of revenues)	9.9%
Capital Cost per kW	$1,900
IRR (Years 1-20)	20%
Net Present Value (Years 1-20)	$1,072,523

The final result is that we have a Net Present Value of $1,072,523 and Internal Rate of Return (IRR) of 20% over the first 20 years of operation. [The typical MARR for similar projects is in the range of 5% - 15% and IRR > MARR.] The Based on this result we can recommend this system.

6 Conclusion

For a project like this with a large capital investment, over $5 million, it is important to perform a comprehensive feasibility study. The multiyear economic modeling is needed to support investment by the community wind investors as well as outside financial equity investors.

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8 Appendices

8.1 The project investor profile.

Table 5 Project Investor Profile

Project Debt	
Total Debt	$2,400,000
Debt Term in Years	10
Interest Rate	6%
Annual Debt Payment	$326,083
Local Owner Financing	
Local Owner Equity	$2,000,000
Local Owner Discount Rate	8%
Local Owner Tax Rate	35%
Is the Local Owner also the Land Owner?	no
Is the Local Owner also the Project Manager?	no
Equity Investor Financing	
Equity Investor Equity	$300,000
Equity Investor Discount Rate	12%
Equity Investor Tax Rate	35%
Equity Investor Required Rate of Return	15%

8.2 Community Wind Project: 20-Year Pro-Forma

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CAPITAL EXPENDITURES																					
Equity Investment (Project Cost Less Debt & Grants)	(2,300,000)																				
REVENUES																					
kWh/yr		9,014,040	9,014,040	9,014,040	9,014,040	8,923,900	8,834,661	8,746,314	8,658,851	8,572,262	8,486,540	8,401,674	8,317,658	8,234,481	8,152,136	8,070,615	7,989,909	7,910,010	7,830,910	7,752,600	7,675,074
PPA Rate ($/kWh)		0.060	0.061	0.062	0.064	0.065	0.066	0.068	0.069	0.070	0.072	0.073	0.075	0.076	0.078	0.079	0.081	0.082	0.084	0.086	0.087
C-BED Rate ($/kWh)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Electricity Sales Revenue per PPA		540,842	551,659	562,692	573,946	579,571	585,251	590,986	596,778	602,626	608,532	614,496	620,518	626,599	632,739	638,940	645,202	651,525	657,910	664,357	670,868
Electricity Sales Revenue per C-BED		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green Tag Rate ($/kWh)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Green Tag Sales Revenue		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Installment Payments)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Lump Sum)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production Incentive Payments		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Revenues		540,842	551,659	562,692	573,946	579,571	585,251	590,986	596,778	602,626	608,532	614,496	620,518	626,599	632,739	638,940	645,202	651,525	657,910	664,357	670,868
EXPENSES																					
Operations & Maintenance		45,000	46,350	47,741	49,173	50,648	52,167	53,732	55,344	57,005	58,715	60,476	62,291	64,159	66,084	68,067	70,109	72,212	74,378	76,609	78,908
Operations & Maintenance Contingency Fund		25,000	25,500	26,010	26,530	27,061	27,602	28,154	28,717	29,291	29,877	30,475	31,084	31,706	32,340	32,987	33,647	34,320	35,006	35,706	36,420
Project Management Fee		70,000	71,400	72,828	74,285	75,770	77,286	78,831	80,408	82,016	83,656	85,330	87,036	88,777	90,552	92,364	94,211	96,095	98,017	99,977	101,977
Insurance		21,000	21,420	21,848	22,285	22,731	23,186	23,649	24,122	24,605	25,097	25,599	26,111	26,633	27,166	27,709	28,263	28,828	29,405	29,993	30,593
Property Tax		9,900	9,801	9,703	9,606	9,510	9,415	9,321	9,227	9,135	9,044	8,953	8,864	8,775	8,687	8,601	8,515	8,429	8,345	8,262	8,179
Leaseholder Payments		12,000	12,240	12,485	12,734	12,989	13,249	13,514	13,784	14,060	14,341	14,628	14,920	15,219	15,523	15,834	16,150	16,473	16,803	17,139	17,482
Admin/Financial/Legal Management		5,000	5,100	5,202	5,306	5,412	5,520	5,631	5,743	5,858	5,975	6,095	6,217	6,341	6,468	6,597	6,729	6,864	7,001	7,141	7,284
Production Tax Expense		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warranty Expense		20,000	20,400	20,808	21,224	21,649	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decomm. Fund Pre-Warranty Expiration		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decomm. Fund Post-Warranty Expiration		3,000	3,060	3,121	3,184	3,247	3,312	3,378	3,446	3,515	3,585	3,657	3,730	3,805	3,881	3,958	4,038	4,118	4,201	4,285	4,370
Other Expense		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Annual Operating Expenses		210,900	215,271	219,746	224,327	229,017	211,737	216,211	220,793	225,486	230,291	235,213	240,253	245,415	250,702	256,116	261,661	267,340	273,156	279,113	285,213
EBITDA & Taxable Income																					
EBITDA		329,942	336,388	342,947	349,619	350,554	373,514	374,775	375,985	377,141	378,241	379,283	380,264	381,183	382,037	382,824	383,541	384,185	384,754	385,245	385,655
Depreciation		940,000	1,504,000	902,400	541,440	541,440	270,720	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Debt Interest Payment		0	0	0	0	144,000	133,075	121,495	109,219	96,207	82,415	67,795	52,297	35,870	18,458	0	0	0	0	0	0
Total Annual Expenses		1,150,900	1,719,271	1,122,146	765,767	914,457	615,532	337,706	330,012	321,693	312,706	303,008	292,551	281,286	269,160	256,116	261,661	267,340	273,156	279,113	285,213
Taxable Income	(2,300,000)	(610,058)	(1,167,612)	(559,453)	(191,821)	(334,886)	(30,281)	253,281	266,766	280,933	295,826	311,488	327,967	345,313	363,580	382,824	383,541	384,185	384,754	385,245	385,655
TAXES																					
Local Owner Income Tax Benefit/(Liability)		0	0	0	0	0	0	0	0	0	0	(109,021)	(114,788)	(120,860)	(127,253)	(133,988)	(134,239)	(134,465)	(134,664)	(134,836)	(134,979)
Equity Investor Income Tax Benefit (Liability)		213,520	408,664	195,809	67,137	117,210	10,598	(88,648)	(93,368)	(98,327)	(103,539)	0	0	0	0	0	0	0	0	0	0
Federal PTC Value		163,518	163,518	170,950	170,950	176,599	174,833	180,297	178,494	183,777	181,940	0	0	0	0	0	0	0	0	0	0
Other PTC Value		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Installment Payments)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Tax Credit (Lump Sum)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Tax Benefit/(Liability)		377,038	572,182	366,759	238,088	293,809	185,432	91,649	85,126	85,451	78,400	(109,021)	(114,788)	(120,860)	(127,253)	(133,988)	(134,239)	(134,465)	(134,664)	(134,836)	(134,979)
AFTER-TAX CASH FLOWS																					
Add Back Depreciation		940,000	1,504,000	902,400	541,440	541,440	270,720	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Less Debt Principal Payment		0	0	0	0	182,083	193,008	204,589	216,864	229,876	243,668	258,288	273,786	290,213	307,626	0	0	0	0	0	0
Net After-Tax Project Cash Flow	(2,300,000)	706,980	908,570	709,706	587,707	318,280	232,862	140,341	135,028	136,508	130,558	(55,821)	(60,607)	(65,759)	(71,299)	248,836	249,301	249,720	250,090	250,409	250,676
Local Owner Return	(2,000,000)	0	0	0	0	0	0	0	0	0	0	(55,821)	(60,607)	(65,759)	(71,299)	248,836	249,301	249,720	250,090	250,409	250,676
Equity Investor Return	(300,000)	706,980	908,570	709,706	587,707	318,280	232,862	140,341	135,028	136,508	130,558	0	0	0	0	0	0	0	0	0	0
PROJECT RESULTS																					
O & M Rate (% of revenues)	9.9%																				
Capital Cost per kWh	$1,900																				
IRR (Years 1-20)	20%																				
Net Present Value (Years 1-20)	$1,072,523																				
LOCAL OWNER RESULTS																					
Running IRR		#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Overall IRR	-3%																				
NPV	($1,703,369)																				
EQUITY INVESTOR RESULTS																					
Required Rate of Return	15%																				
Running IRR		136%	228%	244%	247%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%	248%
Overall IRR	248%																				
NPV	$2,442,049																				
DEBT COVERAGE																					
Debt Service Coverage Ratio		0.00	0.00	0.00	0.00	1.63	1.74	1.78	1.82	1.86	1.91	1.96	2.01	2.06	2.11	0.00	0.00	0.00	0.00	0.00	0.00
OTHER DETAILS																					
Running Total of Decommissioning Fund		3,000	6,060	9,181	12,365	15,612	18,924	22,303	25,749	29,264	32,849	36,506	40,236	44,041	47,922	51,880	55,918	60,036	64,237	68,522	72,892
Running Total of O&M Contingency Fund		25,000	50,500	76,510	103,040	130,101	157,703	185,857	214,574	243,866	273,743	304,218	335,302	367,008	399,348	432,335	465,982	500,302	535,308	571,014	607,434

Figure 11 Community Wind Project: 20-Year Pro-Forma [based on windindustry project calculator]