Errors and Excesses in the NREL's JEDI-WIM Model that Provides Estimates of the State or Local Economic Impact of "Wind Farms"

Includes

A demonstration of the NREL Model's Overestimates -- Using the Example of a "Wind Farm" proposed for Highland County, Virginia

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April 28, 2004

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Introduction and Summary

One of the US Department of Energy's (DOE) national "laboratories,"[1] NREL, has developed and begun promoting a "wind farm" "Jobs and Economic Development Impact" (JEDI) model, also referred to as the "Wind Impact Model" (WIM). This interactive model purports to permit calculating the state or local economic impact resulting from building a potential "wind farm."[2]

The model is designed to estimate job and economic benefits by (i) using various "default" assumptions provided in the model or (ii) changing those default assumptions to fit better the facts for a particular "wind farm."

As detailed below, anyone using the model should recognize that:

- Acceptance of the "default" assumptions would produce unrealistically high estimates of economic benefit for a state or locality, in both potential jobs and potential economic activity.
- Key factors affecting net state or local economic benefits and costs that offset benefits are not reflected in the model and, if taken into account, would further reduce the net local economic benefits.

To show the extent of overstated economic benefits, this paper includes a demonstration of the model that permits comparing results when using NREL's "*default*" *assumptions* with the results when using *more realistic assumptions*. A potential "wind farm" in Highland County, Virginia, is used for the demonstration.

In summary:

- The demonstration using JEDI-WIM shows that NREL's "default" recommendations produces estimates of local economic benefits and jobs that are more than 200% higher than estimates based on more reasonable assumptions.
- If costs resulting from a "wind farm" – which are ignored by the JEDI-WIM model -- were taken into account by the model, those costs would almost certainly exceed benefits.

Fundamental errors underlying NREL's JEDI-WIM model assumptions

As detailed below, there are two types of fundamental errors reflected in NREL's JEDI-WIM model:

- The first type of error, discussed in paragraph 1, below, is in the "default" assumptions that result in gross *overestimation* of local economic benefits. Errors in the assumptions affect calculations of "direct" benefits as well as claimed "indirect" and "induced" job creation and other economic benefits.
- The second type of fundamental error, discussed in paragraph 2, below is failure to consider the *costs* that would result from having a "wind farm in the state or locality.

1. **Errors Resulting in Overestimation of State and Local Economic Benefits.** These errors include:

   a. **Overestimating the number of jobs that will be created and filled by local residents.**[3] These overestimations occur at both the construction and permanent operation states.

      1) **During Construction**. Experience at other "wind farms" demonstrates that few jobs during construction are filled by local residents. In fact, most are filled by imported workers. For example, data on the 80-megawatt Top of Iowa "wind farm" (consisting of eighty-nine 900 kW turbines collected by the Iowa Department of Natural Resources (DNR) indicates that only 20 of 200 jobs created during the construction period (which lasted about 6 months) were filled by local people.[4]

         This low number of jobs for local workers is quite understandable since workers with specialized skills required during construction – such as erection of towers, installing turbines and electronic controls – often would not be available locally.

      2) **Permanent jobs.** The default assumptions in the JEDI-WIM overstate both the total number of permanent jobs that would be created and the number of these jobs that would be filled by local residents -- rather than by workers who would travel to the site (e.g., technicians skilled in repairing and maintaining turbines, electronic equipment) only when needed, rather than remaining in the area continually. The Top of Iowa "wind farm" with 89 turbines apparently requires fewer permanent employees that NREL's model would assume for the 30 turbine Highland County project.

   b. **Overstating local economic benefit by counting full price of goods and services rather than value added**.[5] The "default" values in JEDI model incorrectly assume that the full price paid by the "wind farm" owners or employees for goods and services purchased in a state or locality results in a state or *local* economic benefit.[6]

      Specifically, the default values are incorrect because they ignore the fact that part – generally a large part -- of the price paid to a local supplier has to be paid out by that local supplier to someone else, often located outside the local area. The money paid out is a part of the local supplier's cost of acquiring the goods (e.g., the purchase of fuel, wiring, cement) that the local supplier is reselling to the "wind farm."

      The only portion of the price paid by the "wind farm" that should be counted in NREL's JEDI-WIM model (which might result in a local economic benefit) is the difference between the local supplier's cost and the price he or she charges; i.e., the "value added" portion. Furthermore, it should be noted that if the local business providing the goods and services to the "wind farm" is not locally owned, the portion of the "value added" that is profit to the owner may also flow outside the local area and, therefore, not contribute to any local economic benefit.

   c. **Overstating local value of land rental payments**. The default values also assume incorrectly that all land rental payments (i.e. land for turbines, substation, lines) should be counted as a local economic benefit. This assumption could be justified only if the land is locally owned AND the income from the rental payments is spent locally. There would be little or no local economic benefit from the land rental payments if:

      1) The payments go to an absentee land owner, OR

2) The money is spent or invested outside the area (e.g., in a mutual fund managed in some distant city that invests in stocks or bonds having no local connection).

2. Failure to consider costs that offset benefits. The model focuses only on potential *benefits* and fails to consider *costs* that will be borne in the state or locality if a "wind farm" is constructed. Three examples of such costs deserve particular attention:

a. Counting state and/or local taxes without counting costs incurred by state and local governments because a wind farm is constructed. The model counts as an economic benefit state or local taxes that may be paid by a "wind farm" owner. However, there is no provision in the model to offset that revenue with costs incurred by state or local governments because a "wind farm" is built. Without question, governments will incur costs to provide facilities and services required by the "wind farm," or its owner and employees, or by the people filling the jobs that the model says would be created "indirectly" or "induced." Such costs would include:

1) Building and/or repairing roads required to transport equipment, materials and supplies to the site. A lot of heavy equipment, materials (e.g., tons of rebar, crushed stone, and cement) must be hauled to the site. (Materials that are produced locally and jobs filled by local workers – such as truck drivers – would legitimately be counted as potential economic benefits during the construction period.[7])

2) Police and fire protection.

3) Education and social service costs for workers and their families.

b. Potential adverse impact on environmental, ecological, scenic and property values, business income and other factors because of the existence of a "wind farm." Reports from areas with "wind farms" in the US and Europe increasingly show concerns about adverse impacts on scenic and property values, and strong adverse citizen opposition to having to live near "wind farms" because of lights, noise, "blade flicker" and other annoyances. Environmentalists are also concerned about adverse impacts on birds, bats, wildlife and other ecological values. Some people are also concerned about the potential loss of business and adverse impact on tourism and retirement or second home purchases in areas affected by "wind farms." NREL's model apparently does not consider any of these costs.

c. Higher electricity costs imposed on electric customers via monthly bills. No one disputes the fact that the true cost of electricity from wind is higher than the cost of electricity produced from traditional energy sources. Those higher costs are passed through in some way to electric customers via monthly bills.

If the 50 MW "wind farm" being considered for Highland County, Virginia were to be built and it achieves a capacity factor of 30%, it would produce 131,400,000 kilowatt-hours (kWh)[8] of electricity each year (i.e., 50,000 kW x 8760 hours in year x .30 capacity factor). If that electricity cost electric customers only $0.02 per kWh more than electricity from other sources, the added cost to consumers annually would be $2,628,000 per year. When consumers are required to pay higher electricity bills they have less money to spend on other needs such as food, shelter, clothing education or health care. These are costs and adverse economic impacts that should be considered in a legitimate economic analysis.

Testing the Extent of the NREL Model's Overestimation of Economic Benefits

A "wind farm" being proposed for Highland County, Virginia, is used in this analysis to demonstrate the model's significant upward bias when using the default assumptions to estimate economic benefits. While final details of the proposed "wind farm" are not available at this time, information in an application for a Department of Agriculture grant indicates that the "wind farm" would make use of NEG Micon 1.65 MW turbines and have a total rated capacity of about 50 MW. This suggests that the wind farm would have about 30 turbines (i.e., 30 x 1.65 = 49.5 MW).

Note that NREL's JEDI-WIM model – as it has been made available publicly – permits calculation of alleged economic benefits at the State level. Additional detailed economic data are necessary to get the model to make calculations at the County or other regional level. NREL does not make county level detail available but instead refers potential users to Minnesota IMPLAN, Inc. of Stillwater, MN, to purchase such data.

The cost of the IMPLAN data can be significant and not readily affordable for this self-financed analysis. Therefore, I have used an alternative approach. Specifically, I have:.

- Used the Highland "wind farm" parameters (i.e., 50 MW; 30 turbines of 1.65 MW each).
- Run the model using NREL's "default" assumptions.
- Run the model using "local share" assumptions that would much more closely reflect the potential local economic benefit in the Highland County area.

Certainly, the people of Highland County (or any other area where the model is used) deserve a much more thorough analysis of economic benefits and costs than is permitted by the NREL's JEDI-WIM model and this paper. If the NREL model were to be used, several actions – in addition to the demonstration undertaken for this paper – should be taken. Specifically:

1. The validity of the IMPLAN data on Virginia's economy that underlies the NREL model should be checked.
2. The assumptions regarding taxes, including property taxes that would be applicable to the proposed "wind farm" should be checked.
3. Detailed information should be compiled on the following matters and substituted for data assumed in the NREL model.
    a. The supplies, equipment and materials that would be available and procured in the Highland County, VA, area – and the local *value added* for each product or service procured IN that area. Clearly, the total price paid by the "wind farm" developer or owner should not be used when estimating potential local economic benefits.
    b. The short term construction jobs and the few permanent jobs that will be available to and can be filled by existing residents of the Highland County area and, in the case of the few permanent jobs, the number that would be filled by permanent residents rather than visiting workers who live elsewhere.
    c. The additional costs that will be incurred locally – by governments, businesses and individuals – during and after construction because of the existence of the "wind farm."

Details of the Analysis that Demonstrates the NREL model's overestimation of local economic benefits -- Using the potential Highland County, VA, "wind farm"

As indicated above, different and more realistic "local share" assumptions have been used to determine the extent of the overestimation of local economic benefits and jobs that results from using NREL's assumptions. A 3-page attachment to this paper provides:

- On pages 1 and 2, the input assumptions – including:
  - All of the dollar cost numbers specified in the NREL model. (none of which were changed).
  - The "default" values for "local share" which are the assumptions specified by NREL (none of which were change).
  - Alternative, lower, "local share" assumptions which are more realistic than those developed by NREL.
- On page 3, the model outputs – derived from the two sets of input assumptions.

NOTE however, that the changes in assumptions for this demonstration are limited to the "Local Share" assumptions. Changes have NOT been made in the assumptions with respect to Permanent jobs – which seem to be overstated in the default assumptions. Therefore, the resulting calculations will still OVERSTATE potential local economic benefit and local jobs. Further, overstatements in the *direct* jobs and are likely to contribute to overstatement in the *indirect* and *induced* jobs and economic impacts.

The table below – which continues on to the next page -- shows the changes from the default "local share" assumptions used in the demonstration to produce a more realistic estimate of local job and economic benefits. The table also shows the rationale for using the lower percentage.

Identification of "Default" Assumptions that have been changed to provide more realistic estimates of local benefits			
Variable	Local Share		Rationale for Changing Assumption
	JEDI-WIM Default Assumption	More Realistic Assumption	
Construction Cost			
Material			
Construction (concrete, rebar, equip, roads and site prep)	90%	45%	Count only "value added" (e.g., cement, rebar, equip originate elsewhere)
Electrical (drop cable, wire)	100%	15%	Count only local "value added"
HV line extension	100%	15%	
Labor			
Foundation	100%	20%	Most workers during construction imported
Erection	75%	10%	Skills likely imported
Electrical	75%	10%	Skills required for turbines likely imported
Other Costs			
HV Sub/Interconnection	100%	20%	Little local content likely; some value added
Legal Services	100%	50%	Only small part likely provided locally
Site Certificate/Permitting	100%	50%	Only small part would be done locally
Wind Plant Annual Operating & Maintenance Costs			
Personnel			
Field Salaries	100%	50%	Apparently few of the small number of
Administrative	100%	50%	Employees needed for an operating "wind
Management	100%	50%	Farm" spend full time AT the "wind farm"

Identification of "Default" Assumptions that have been changed to provide more realistic estimates of local benefits Continued			
	Local Share		
Variable	JEDI-MIM Default Assumption	More Realistic Assumption	Rationale for Changing Assumption
Materials and Services			
Vehicles	100%	15%	Only local "value added" should be counted
Misc. Services	80%	15%	Only local "value added" should be counted
Fees, Permits, licenses	100%	50%	Only part of these costs is local.
Utilities	100%	20%	Only local "value added" should be counted
Fuel (motor vehicle gasoline)	100%	15%	Only local "value added" should be counted
Tools and Misc. Supplies	100%	15%	Only local "value added" should be counted
Financial Parameters			
Individual Investors (% of total equity)	100%	10%	Important consideration is whether equity investors are local or absentee AND where their profits are spent.
Land Lease (total cost)	100%	10%	Even 10% is too high if landowners are absentee and the money is spent or invested elsewhere

Results from the Demonstration

The numbers shown in "boxes" on page 3 of the attachment show the significant differences in the results from the model by using more realistic assumptions in lieu of the default assumptions.

The following table summarizes the most significant reductions in estimated local economic benefit and jobs when more realistic assumptions are substituted for NREL's "default" assumptions.

Reductions in Local Economic Benefits and Jobs when Using More Realistic "Local Share" Assumptions			
	Using NREL Default Assumptions	**Using More Realistic Assumptions**	**Reduced Local Benefits**
Project Construction Costs Local Spending	$5,846,329	$1,864,084	Drop by $3,982,245
Direct Operating & Maintenance Costs (annual) Local Spending	$390,811	$172,465	Drop by $218,346 annually
Other Annual Costs Land leases	$136,400	$13,200*	Drop by $123,200 annually
Construction Period Jobs: Direct Indirect Induced Total	 47.9 31.3** 34.5** 113.7	 14.9 9.9** 11.1** 36.0	 Drop by about 33 jobs Drop by about 21 jobs Drop by about 23 jobs
Jobs During Operating Years: Direct Indirect Induced Total	 12.9*** 1.9*** 4.8*** 19.7	 5.6*** 0.8*** 2.5*** 8.9	 Drop by about 7 jobs Drop by about 1 job Drop by about 2 jobs

* The $13,200 is still too high if the landowners are absentee owners and/or if the income from land leases is spent or invested other than in Highland County.

** Any claims of jobs created "Indirectly" or "Induced" should be treated VERY skeptically because they are based on underlying assumptions about the make up and workings of the economy of Virginia at the state level which may have NO applicability to Highland County. As indicated earlier, specific information about the Highland County economy should be substituted in the NREL model before any credence is given to "indirect" or "induced" jobs.

*** All the numbers on jobs during operating years produced by NREL's model are highly suspect because the assumed number of jobs during operating years is higher than is demonstrated by actual "wind farm" experience – such as is documented by the Iowa Department of Natural Resources paper, "Top of Iowa Wind Farm Case Study."

Principal Conclusions

Clearly, the NREL JEDI-WIM model as it as been provided by NREL, in its "default mode" grossly overestimates potential local economic and job benefits from a potential "wind farm" in Highland County, Virginia, by over 200% during the short term construction period and 180% to 200% annually during continuing operation.

Also, the model is seriously deficient because it does not take into account significant costs that are incurred by governments, organizations and individuals when a "wind farm" is constructed – which cost may offset in part or completely the expected economic benefits.

The model would, similarly, overestimate local benefits and understate (or ignore) costs if used to analyze economic costs and benefits associated with other "wind farms."

Hopefully, NREL will correct the fundamental errors identified in this paper and begin using more realistic "local share" assumptions.

* * *

Author: The analysis underlying this paper and views expressed are provided in my role as a citizen, consumer and taxpayer and are not on behalf of any client or other interest. All the analysis and writing was entirely self-financed. I am semi-retired after spending more than 30 years on energy matters in the federal government and private sector. I now work without compensation to shed light on the adverse impacts of government and private policies, regulations, programs and projects that are *detrimental to the interests of consumers and taxpayers*. "Wind energy" meets this criterion, as does the NREL JEDI-WIM Model.

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Endnotes:

[1] DOE's government-owned, contractor-operated national "laboratories" undertake a variety of research, development and analytical activities. Virtually all of the activity is financed with tax dollars. Quite likely, the work in the "hard" sciences is objective, conducted in accordance with accepted scientific methods and engineering principles, and undergoes credible peer-review. Some of the national "laboratories," such as the National Renewable Energy "Laboratory" (NREL), also engage in analyses involving public policies, programs and regulations. Much of that work turns out not to be credibly objective, scientific or peer reviewed. Instead, these activities all too often appear biased and designed to promote a particular technology, policy, program, regulatory requirement, special interest, or perhaps even a personal philosophy. Such "analyses" often appear designed to support preconceived notions and conclusions. These "analyses" are often driven by assumptions that virtually assure that the desired conclusion is reached. As demonstrated in this paper, NREL's "JEDI-Wind Impact Model" is an example of a "laboratory" product that overstates benefits and understates or ignores costs -- in this case resulting in a faulty estimate of the potential local economic benefits of a "wind farm." In summary, the NREL model produces results that are highly biased.

[2] NREL release, http://www.nrel.gov/docs/fy04osti/35872.pdf. As of April 23, 2004, The JEDI model is also described at http://www.eere.energy.gov/windpoweringamerica/economics.html An article at that site provides a PowerPoint presentation on the model and indicates that a paper on the model will soon be available. The model and documentation were kindly provided to this analyst by NREL. The documentation uses the name "Wind Impact Model" or WIM.

[3] In addition to overestimating jobs that would be filled locally and, therefore, the compensation that would be paid to local residents, the model – in its calculation of indirect or induced effects – appears to assume that the taxes on income will flow to the state or locality. When workers are imported for temporary or intermittent work, revenue from any income tax that they pay generally will flow to the government(s) in the state or locality where they reside – not where they work temporarily.

[4] Iowa Department of Natural Resources, *Top of Iowa Wind Farm Case Study*, July 2003.
http://www.state.ia.us/dnr/energy/MAIN/PROGRAMS/WIND/topOfIowaWindFarm.html
http://www.state.ia.us/dnr/energy/MAIN/PROGRAMS/WIND/documents/topofiaWindFarmCaseStudy.pdf

[5] "Value added is defined by one economics textbook as "The difference between the value of goods produced and the cost of materials and supplies used in producing them. In a $1 loaf of bread embodying $0.60 worth of wheat and other materials, the valued added is $0.40. Value added consists of the wages, interest and profit components added to the output by a firm or industry. Samuelson, Paul A. and William D. Nordhaus, Economics, 14th Edition, p. 748.

[6] Unfortunately, this is a common mistake made in "input-output models" that purport to calculate state or local economic benefits.

[7] The total construction period reported in the *Top of Iowa Wind Farm Case Study* was less than 6 months.

[8] 131,400,000 kWh of electricity may sound like a lot but it is not. That amount of electricity is equal to 18/100 of 1% of the electricity produced in Virginia during 2002 (US Energy Information Administration data).

April 28, 2004

Demonstrating the Overestimation of Local Economic Benefits of a "Wind Farm" that Results from the Use of NREL's JEDI-WIM Model's "Default Assumptions" by Substituting More Realistic "Local Share" Assumptions

NOTES:

1. For this demonstration, ONLY the local share assumptions -- Column 9 on pages 1 & 2 --have been modified. All other "default" assumptions were left the same.
2. The First two pages show the Project Descriptive Data and the Project Cost Data.
3. Page 3 shows the Wind Plant - Project Data Summary (i.e., summary of Page 1 and 2 inputs) and a Summary of Local Impacts -- which are the results produced by the Model
4. Significant $ RESULTS Appear on page 3 on the "Local Spending" Lines under "Project Construction Costs," "Direct Operating and Maintenance Costs" (annual), and "Other Annual Costs." Specifically, compare the numbers for those lines in Column 3, which are based on "Default" Assumptions and Column 6, which are based on more realistic assumptions..
5. Other significant RESULTS are shown for JOBS, EARNINGS AND OUTPUTS in the bottom half of page 3, under "Local Economic Impacts - Summary Results." Specifically, compare the numbers in columns 2, 3 & 4. which are based on "Default" assumptions with those in columns 5, 6 & 7, based on realistic local share assumptions,

	JEDI-WIM Defaults NOT Modified				Defaults Modified to provide more realistic local share			
Project Descriptive Data								
Project Location	VIRGINIA				VIRGINIA			
Year of Construction	2004				2004			
Project Size - Nameplate Capacity (MW)	50				50			
Turbine Size (KW)	1650				1650			
Number of Turbines	30				30			
Construction Cost ($/KW)	1000				1000			
Annual Direct Operations and Maintenance Cost ($/kW)	12.5				12.5			
Money Value - Current or Constant (Dollar Year)	2004				2004			
Utilize Model Default Values (below)? (Y or N)	y				n			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Project Cost Data								
Construction Costs	Cost	Cost Per KW	Percent of Total Cost	Local Share	Cost	Cost Per KW	Percent of Total Cost	Local Share
Materials								
Construction (concrete, rebar, equip, roads and site prep)	$ 2,626,821	$ 53	5.3%	90.0%	$ 2,626,821	$ 53	5.3%	45.0%
Transformer	$ 663,570	$ 13	1.3%	0.0%	$ 663,570	$ 13	1.3%	0.0%
Electrical (drop cable, wire,)	$ 311,191	$ 6	0.6%	100.0%	$ 311,191	$ 6	0.6%	15.0%
HV line extension	$ 572,043	$ 11	1.1%	100.0%	$ 572,043	$ 11	1.1%	15.0%
Materials Subtotal	$ 4,173,625	$ 83	8.3%		$ 4,173,625	$ 83	8.3%	
Labor								
Foundation	$ 228,817	$ 5	0.5%	100.0%	$ 228,817	$ 5	0.5%	20.0%
Erection	$ 228,817	$ 5	0.5%	75.0%	$ 228,817	$ 5	0.5%	10.0%
Electrical	$ 251,699	$ 5	0.5%	75.0%	$ 251,699	$ 5	0.5%	10.0%
Management/supervision	$ 137,290	$ 3	0.3%	0.0%	$ 137,290	$ 3	0.3%	0.0%
Labor Subtotal	$ 846,624	$ 17	1.7%		$ 846,624	$ 17	1.7%	
Construction Subtotal	$ 5,020,249	$ 100	10.0%		$ 5,020,249	$ 100	10.0%	
Equipment Costs								
Turbines (excluding blades and towers)	$ 27,465,000	$ 549	54.9%	0.0%	$ 27,465,000	$ 549	54.9%	0.0%
Blades	$ 9,155,000	$ 183	18.3%	0.0%	$ 9,155,000	$ 183	18.3%	0.0%
Towers	$ 5,750,000	$ 115	11.5%	0.0%	$ 5,750,000	$ 115	11.5%	0.0%
Equipment Subtotal	$ 42,370,000	$ 847	84.7%		$ 42,370,000	$ 847	84.7%	
Other Costs								
HV Sub/Interconnection	$ 1,830,537	$ 37	3.7%	100.0%	$ 1,830,537	$ 37	3.7%	20.0%
Engineering	$ 600,000	$ 12	1.2%	0.0%	$ 600,000	$ 12	1.2%	0.0%
Legal Services	$ 46,500	$ 1	0.1%	100.0%	$ 46,500	$ 1	0.1%	50.0%
Land Easements	$ -	na	0.0%	100.0%	$ -	na	0.0%	10.0%
Site Certificate/Permitting	$ 132,714	$ 3	0.3%	100.0%	$ 132,714	$ 3	0.3%	50.0%
Other Subtotal	$ 2,609,751	$ 52	5.2%		$ 2,609,751	$ 52	5.2%	
Total	$ 50,000,000	$ 1,000	100.0%		$ 50,000,000	$ 1,000	100.0%	

Wind Plant Annual Operating and Maintenance Costs

	Cost	Cost Per KW	Percent of Total Cost	Local Share	Cost	Cost Per KW	Percent of Total Cost	Local Share
Personnel								
Field Salaries	$ 242,347	$ 4.85	38.8%	100.0%	$ 242,347	$ 4.85	38.8%	50.0%
Adminstrative	$ 63,776	$ 1.28	10.2%	100.0%	$ 63,776	$ 1.28	10.2%	50.0%
Manangement	$ 191,327	$ 3.83	30.6%	100.0%	$ 191,327	$ 3.83	30.6%	50.0%
Personnel Subtotal	$ 497,449	$ 9.95	79.6%		$ 497,449	$ 9.95	79.6%	
Materials and Services								
Vehicles	$ 8,929	$ 0.18	1.4%	100.0%	$ 8,929	$ 0.18	1.4%	15.0%
Misc. Services	$ 25,510	$ 0.51	4.1%	80.0%	$ 25,510	$ 0.51	4.1%	15.0%
Fees, Permits, Licenses	$ 8,929	$ 0.18	1.4%	100.0%	$ 8,929	$ 0.18	1.4%	50.0%
Utilities	$ 25,510	$ 0.51	4.1%	100.0%	$ 25,510	$ 0.51	4.1%	20.0%
Insurance	$ 38,265	$ 0.77	6.1%	0.0%	$ 38,265	$ 0.77	6.1%	0.0%
Fuel (motor vehicle gasoline)	$ 6,378	$ 0.13	1.0%	100.0%	$ 6,378	$ 0.13	1.0%	15.0%
Tools and Misc. Supplies	$ 10,204	$ 0.20	1.6%	100.0%	$ 10,204	$ 0.20	1.6%	15.0%
Spare Parts Inventory	$ 3,827	$ 0.08	0.6%	2.0%	$ 3,827	$ 0.08	0.6%	2.0%
Materials and Services Subtotal	$ 127,551	$ 2.55	20.4%		$ 127,551	$ 2.55	20.4%	
Total	$ 625,000.00	$ 12.50	100.0%		$ 625,000	$ 12.50	100.0%	

Other Parameters				
Financial Parameters			Local Share	
Debt Financing				
Percentage financed	80%			
Years financed (term)	10			
Interest rate	10%			
Equity Financing/Repayment				
Percentage equity	20%			
Individual Investors (percent of total equity)	0%		100%	
Corporate Investors (percent of total equity)	100%		0%	
Return on equity (annual interest rate)	16%			
Repayment term (years)	10			
Tax Parameters				
Local Property/Other Tax Rate (percent of taxable value)	1.0%			
Assessed value (percent of construction cost)	85.0%			
Taxable Value (percent of assessed value)	33.3%			
Taxable Value	$ 14,166,667			
Local Taxes	$ 141,667		100%	
Land Lease Parameters				
Land Lease Cost (per tubine)	$ 4,400			
Number of Turbines	30			
Land Lease (total cost)	$ 132,000			
Lease Payment recipient (F = farmer/household, O = Other)	F		100%	
Payroll Parameters	Base Wage per Hc	Annual Wage		
Field Salaries (technicians, other)	$ 15.50	$ 32,240		
Adminstrative	$ 11.04	$ 22,968		
Manangement	$ 26.00	$ 54,080		

			Local Share	
	80%			
	10			
	10%			
	20%			
	0%		10%	
	100%		0%	
	16%			
	10			
	1.0%			
	85.0%			
	33.3%			
	$ 14,166,667			
	$ 141,667		100%	
	$ 4,400			
	30			
	$ 132,000			
	F		10%	
	Base Wage per H	Annual Wage		
	$ 15.50	$ 32,240		
	$ 11.04	$ 22,968		
	$ 26.00	$ 54,080		

(1)	(2)	(3)	(4)	(5)	(6)	(7)

Wind Plant - Project Data Summary

Year of Construction		2004			2004	
Project Location		VIRGINIA			VIRGINIA	
Project Size - Nameplate Capacity (MW)		50			50	
Turbine Size (KW)		1650			1650	
Number of Turbines		30			30	
Construction Cost ($/KW)		$ 1,000			$ 1,000	
Annual Direct O&M Cost ($/KW)		$ 12.50			$ 12.50	
Money Value (Dollar Year)		2004			2004	
Project Construction Cost		$ 50,000,000			$ 50,000,000	
Local Spending		$ 5,846,329			$ 1,864,084	
Total Annual Operational Expenses		$ 8,423,067			$ 8,418,667	
Direct Operating and Maintenance Costs		$ 625,000			$ 625,000	
Local Spending		$ 390,811			$ 172,485	
Other Annual Costs		$ 7,798,067			$ 7,793,667	
Local Spending		$ 278,067			$ 154,867	
Debt and Equity Payments		$ -			$ -	
Property Taxes		$ 141,667			$ 141,667	
Land Lease		$ 136,400			$ 13,200	

Local Economic Impacts - Summary Results

	Jobs	Earnings	Output	Jobs	Earnings	Output
During construction period						
Direct Impacts	47.9	$ 1.50	$ 5.71	14.9	$ 0.47	$ 1.80
Construction Sector Only	44.0	$ 1.38	$ 5.36	14.2	$ 0.45	$ 1.73
Indirect Impacts	31.3	$ 1.12	$ 3.75	9.9	$ 0.36	$ 1.19
Induced Impacts	34.5	$ 1.09	$ 3.18	11.1	$ 0.35	$ 1.02
Total Impacts (Direct, Indirect, Induced)	113.7	$ 3.71	$ 12.64	36.0	$ 1.18	$ 4.01
During operating years (annual)						
Direct Impacts	12.9	$ 0.41	$ 0.67	5.6	$ 0.18	$ 0.26
Plant Workers Only	10.1	$ 0.31	$ 0.31	5.0	$ 0.16	$ 0.16
Indirect Impacts	1.9	$ 0.07	$ 0.23	0.8	$ 0.03	$ 0.09
Induced Impacts	4.8	$ 0.15	$ 0.45	2.5	$ 0.08	$ 0.24
Total Impacts (Direct, Indirect, Induced)	19.7	$ 0.63	$ 1.35	8.9	$ 0.28	$ 0.59

Notes: Earnings and Output values are millions of dollars in year 2004 dollars. Jobs are full-time equivalent for one year
Plant workers includes field technicians, administration and management.
Economic impacts "During operating years" represent impacts that occur from plant operations/expenditures.
The analysis does not include impacts associated with spending of plant "profits" and assumes no tax abatement.
Totals may not add up due to independent rounding.