

# APPROPRIATE METHODOLOGY FOR ASSESSING THE ECONOMIC DEVELOPMENT IMPACTS OF WIND POWER

## Introduction

Interest in wind power development is growing as a means of expanding local economies. Such development holds promise as a provider of short-term employment during facility construction and long-term employment from ongoing facility operation and maintenance. It may also support some expansion of the local economy through ripple effects resulting from initial increases in jobs and income. However, there is a need for a theoretically sound method for assessing the economic impacts of wind power development.

Northwest Economic Associates (NEA), under contract to the National Wind Coordinating Committee (NWCC), conducted a study of three case study areas in the United States where wind power projects were recently developed. The full report, "Assessing the Economic Development Impacts of Wind Power," is available at NWCC's website [http://www.national](http://www.nationalwind.org/)

[wind.org/](http://www.nationalwind.org/). The methodology used for that study is summarized here in order to provide guidance for future studies of the economic impacts of other wind power developments. Because the methodology used in the NEA study was specifically designed for these particular case study areas, it can only be generally applied to other areas. Significant differences in local economic conditions and the amount of goods and services that are purchased locally as opposed to imported from outside the area can limit the applicability of these results to areas that are materially different.

Wind power development results in local economic impacts during two different phases: construction, which creates a one-time surge in economic activity, and operation and maintenance (O&M), which makes an ongoing economic contribution by creating long-term jobs and continuing income streams.

## Economic Impacts During Construction Phase

In order to identify the effect that construction of a wind power project has on a local economy, it is necessary to identify the mix of inputs required to construct the project. This mix of inputs is like a recipe, with ingredients measured in dollars, so a list of inputs would include dollars for turbines, dollars for wiring, and dollars for labor, and so on. It is also important to relate these inputs to the local economy, so it is necessary to determine which inputs are obtained locally as opposed to inputs obtained from sources outside of the local area.

In an ideal situation, a list of inputs would be made up of what was actually used in constructing the project, but this information is often proprietary and difficult to obtain. When data on inputs for construction are not readily available, information can be obtained through interviews of potential suppliers in the local area. This information, combined with knowledge of the local economy, allow the estimation of what inputs are necessary, and which inputs can be obtained from local sources.

In general, many inputs needed for wind power projects are brought in from outside of the local area and do not affect the local economy. For instance, the purchase of turbines made in Europe and towers made in Louisiana for construction of a wind power project in Culberson County, Texas, will not affect the local (Culberson County) economy. Those inputs which are purchased from local sources will have the most effect on the local economy, and should therefore be the focus of data retrieval.

The costs for equipment, such as rotor assembly, tower, and generator, and equipment installation make up about 80 percent of the total construction costs for a wind power project. These equipment items and the specialized skills needed for installation are typically imported from outside the region for most rural areas. The remaining 20 percent of construction costs consists of costs for site preparation prior to installing equipment, which involves the construction of roads, tower foundations, operations buildings, and other such things. For most rural areas, these activities provide the greatest opportunities for local inputs and local economic impacts.

During NEA's research for the three case studies, the search for information focused on these activities. Because no records or other documentation of expenses actually incurred during construction were available for any of the study areas, local officials and potential input suppliers were contacted to obtain estimates of local inputs used. If possible, it would be preferable to obtain this information from the project developer, who would have a far better list of what inputs were necessary and the sources from which they were obtained. However, this is often proprietary information that is not readily released, as was the case for the case study projects.

Local officials and potential suppliers were asked what they knew about the nature and amounts of local inputs that were used in each study area, how many workers from the study area were employed, how many workers from outside the study area resided in the study area during construction, and where and on what these workers spent money locally. Since this approach relied upon recall of events some time after they occurred, some items were no doubt overlooked, and impacts are understated to the degree this occurred in each study area.

Using knowledge about local sources, and about the local economy, it is possible to identify those elements that have a direct effect on the local economy. A direct effect is the first round of buying and selling. In general, this is the purchase of some local inputs, such as fuel, the spending of income earned by workers, annual landowner revenues, and the income effects of tax changes. These direct effects can be used to identify additional rounds of buying and selling for other sectors and to identify the effect on rounds of spending by local households. For the NEA study, this was done by using an economic impact model, described below under "Impact Analysis Using IMPLAN." The information about how the total output of the economy is affected by the round by round multiplier effect of the construction provides us with the basis for estimating the total effect of the construction on employment and income.

## Operation and Maintenance Phase

A similar procedure is followed to estimate the effect of annual O&M activities on the local economy. In this case, we develop a “recipe” for the inputs needed after the project is in operation. Labor and management make up the largest proportion of O&M needs. In some cases, labor and management may actually be employed outside the local area and have little impact on the local economy, while in other cases, labor and management are located in the local area. As more wind turbines are installed in an area, more of the labor and management are likely to be permanently located in the local area.

Ideally, information on the number and types of employees residing in the local area and other inputs purchased locally would be obtained from the project owner. However, due to the proprietary nature of this information, it is not always readily available. It may instead be necessary to obtain estimates by

contacting local officials. An itemized list can be developed of components that are used in the ongoing O&M of the projects, and inputs from local sources will have a direct effect on the economy. They are used to estimate the round by round multiplier effects and the effects on jobs and income through use of the input-output model.

Another major input into O&M for wind power projects is the return on the initial capital investment. For the three case study projects analyzed by NEA, all of the projects were owned by outside interests and very little if any of the capital investment was owned by local residents, so much of the return on capital investment left the local area. In other cases, the capital is supplied from local investors and the return on investment may provide significant local impacts, so should be considered for those projects where local investors play a role.

## Impact Analysis Using IMPLAN

NEA uses an input-output (I-O) model to measure the additional impact that the direct effects identified for the construction and O&M phases have on the local economy, in terms of additional industry output, employment, and income. The model is based on IMPLAN (“IMPact analysis for PLANning”), a system of software and data used to perform economic impact analysis. Originally developed by the USDA Forest Service, the system is now maintained and marketed by the Minnesota IMPLAN Group, Inc. (MIG). MIG develops the data annually, using data collected at the national, state, and county level for all possible elements from a variety of sources.

NEA used county-level IMPLAN data to develop models for each of the case study regions. The models were used to estimate the effects on the rest of the local economy of spending related to the initial construction and ongoing O&M of the wind power developments. The models derive from a 528-business sector categorization based upon the Standard Industrial Classification and the National Income and Product Accounts systems. Sectors directly related to wind industry construction and O&M are identified and the basic data from the IMPLAN database examined and adjusted. These data sets are then converted into economic accounts. The accounts will show how the industry affects the other regional economy sectors, including employment factors.

Impacts are generated within the models by estimating how final demand in the study areas will change as a result of some new economic activity (i.e., the direct effect of the economic activity). Estimating how this new economic activity results in a change to final demand is a key step in impact analysis.

Estimating a change in final demand can be relatively straightforward or very complex. A relatively straightforward situation typically involves a single industry (e.g., a sawmill), which already exists in the study area and for which the value of new or additional output can be measured. The total value of the additional exports (change in final demand) can easily be calculated based on the quantity of new lumber output and value per unit. This change in final demand for the sawmill industry is entered into the model which estimates the impact on the rest of the economy. The direct effect is the change in final demand. The indirect effect is the increase in sales of

other industry sectors in the county, such as logging contractors, forestry products, wholesale and retail trade, and electric services, which includes further round by round sales. The induced effect is the increased household income expenditures generated by the direct and indirect output effects. The total effect is the sum of the direct, indirect, and induced effects.

More complex situations arise when the business is contained in an industry sector that is aggregated from dissimilar production technologies. This applies in the case of wind power, as wind power generation is included in the electric services industry, along with hydropower, coal and gas fired power generation, and nuclear power production. Even without a specific production function for wind power generation, the technology varies significantly among electricity generators represented in the IMPLAN electric services industry. Even if the value of output from a wind power project could be estimated, entering this value as a final demand change to the electric services industry could lead to misleading impact estimates. It is therefore necessary to use care in portraying the changes in final demand associated with wind power construction and O&M.

For construction, the estimates of final demand changes include local expenditures made by labor for specific IMPLAN sectors, such as fuel, lodging, eating and drinking, or retail trade. Construction inputs purchased from local suppliers are also estimated and entered as changes in final demand for these items. The effects on output, income, and employment are estimated in the model.

For O&M, much the same process is followed. The exception is that jobs in the electric services industry are located permanently in the local area. By entering an “expenditure pattern” for local O&M expenses in the same manner as for construction these jobs are not picked up in the effects measured by the model. To adjust for this, these jobs in the electric services industry are estimated outside the model and added to the results estimated by the model. Land owner revenues and tax impacts are entered into the model as a change in local household spending, resulting in additional impacts within the local economy.