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A METHODOLOGY FOR ASSESSING THE ECONOMIC DEVELOPMENT IMPACTS OF WIND POWER

Brief

INTRODUCTION

The local economic-development potential of power plants driven by the wind is a major factor contributing to the recent expansion of wind power in the United States. Wind power plants provide short-term employment during construction, long-term employment for ongoing operation and maintenance, and in most cases revenue for local landowners and tax jurisdictions. This brief outlines a sound method for assessing wind power's local economic impacts.

Wind power development can also expand the local economy through ripple effects. Ripple effects stem from subsequent expenditures for goods and services made possible by first-round income from the development, and are expressed in terms of a ***multiplier***. If the local economy offers a wide range of goods and services, the resulting multiplier can be substantial – as much as three or four. If not, then much of the initial income will leave the local economy to buy goods and services from elsewhere. Loss of initial income to other locales is referred to as a ***leakage***.

Northwest Economic Associates (NEA), under contract to the National Wind Coordinating Committee (NWCC), investigated the economic development impacts of three wind projects recently constructed in the United States. The full report, "Assessing the Economic Development Impacts of Wind Power," is available on the NWCC's website 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 projects. The methodology used in the NEA study was specifically designed for these particular case study areas; however, it can 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 those goods and services imported from outside the local area – will strongly influence the results. Listed below are some of the key tasks that should be considered in order to develop a reasonable picture of local economic impacts arising from existing or future wind development.

The methodology described here very likely understates the total economic impacts of wind development. Comments from economic development professionals suggest that more in-depth analysis than that performed in these studies would reveal significant additional local economic benefits that can only be identified through personal discussions with local individuals.

KEY TASKS

1. IDENTIFY PROJECT PHASES

Wind power development produces 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. Both phases should be analyzed to offer a more complete picture of the economic benefits from a project.

2. IDENTIFY INPUTS

In order to identify the effect that the construction phase has on a local economy, it is necessary to identify the mix of inputs required to construct the project. A list of inputs would include dollars for turbines, wiring, labor, etc. (see Sidebar for a list of typical inputs for

wind power development projects). To relate these inputs to the local economy, it is important to distinguish between inputs that are obtained locally and those obtained from outside the local area.

3. Identify Sources of Inputs

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, purchasing turbines made in Europe or towers made in Louisiana for a wind power project in Culberson County, Texas, will not affect the local economy. Those inputs purchased from local sources will have the most effect on the local economy, and should therefore be the focus of data retrieval. They are then applied to an input-output model (discussed below) to estimate subsequent rounds of economic activity and the associated impacts on jobs and income.

4. Approach Project Developer for Information and Interview Local Sources

In an ideal situation, a list would be prepared of inputs actually used in constructing the project. Preferably, this information would come directly from the project developer, but such information is often proprietary and difficult to obtain. If these data are not available from the project developer, the required information can often be assembled through interviews with potential suppliers in the local area. This information, combined with knowledge of the local economy, allows researchers to estimate necessary inputs, and identify those that can be obtained from local sources.

NEA's research for the three case studies focused on those activities likely providing the greatest opportunities for local inputs and local economic impacts, such as the construction of roads, tower foundations, and operations buildings. Because no records or other documentation of construction expenses were available for any of the study areas, researchers contacted local officials and potential suppliers to obtain estimates of local inputs used. NEA asked several questions, including:

- What were the nature and amounts of local inputs used in each study area?
- How many workers from within the study area did the project employ?
- How many workers from outside the study area resided in the study area during construction?
- Where and on what goods did 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.

5. Estimate Direct, Indirect, and Induced Effects

Using knowledge about local sources and the local economy, it is possible to identify those elements that have a direct effect on the local economy.

- A ***direct effect*** arises from the first round of buying and selling. Direct effects include the purchase of inputs from local sources, 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, subsequent rounds of buying and selling for other sectors and to identify the effect of spending by local households.
- The ***indirect effect*** is the increase in sales of other industry sectors in the county, which includes further round-by-round sales.
- The ***induced effect*** is the expenditures generated by increased household income resulting from the direct and indirect effects.
- The ***total effect*** is the sum of the direct, indirect, and induced effects.

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 *(*referred to as ***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 information about how the total output of the economy is affected by the round-by-round multiplier effect of the construction provides the basis for estimating the total effect of the construction on employment and income. A similar basis is used to estimate the effect of annual O&M activities on the local economy.

6. Use Established Economic Models to Estimate Effects

NEA used an input-output (I-O) model to estimate the additional impact on the local economy beyond the direct effects identified for the construction and O&M phases. These additional impacts are expressed 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. 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. More detailed information on IMPLAN can be accessed in the full report. Although NEA selected the IMPLAN model to estimate economic impacts, alternative input-output models could also be used.

More complex situations arise when the business is contained in an industry sector that is aggregated from several different 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 signify-cantly among electricity generators represented in the IMPLAN electric services industry. Even when the value of output from a wind power project can 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 occurrence, these jobs in the electric services industry are estimated outside the model and added to the results estimated by the model. Finally, landowner revenues and tax impacts are entered into the model as a change in local household spending, resulting in additional impacts within the local economy.

7. Consider Returns an Invested Capital

Another major input into O&M for wind power projects is the return on the initial capital investment. For the three case studies conducted by NEA, all of the projects were owned by outside interests. Hence the returns on capital investment left the local area. However, in cases where capital is supplied by local investors, the returns on their investment may provide significant local impacts. Such impacts should be considered for those projects where local investors play a significant role.

Conclusion

Applying the approach described in this brief will provide a reasonable estimate of the local economic impacts from a wind power development project. As mentioned above, the estimate is likely to be conservative. If the approach is augmented through in-depth personal interactions with local officials and residents – activity that was beyond the scope of this project – then additional impacts are likely to be revealed.

Typical Inputs for Wind Power Development Projects

Construction Costs
- Materials
  - Construction (concrete, rebar, equipment, roads and site preparation)
  - Electrical (drop cable, wire,)
  - High-voltage line extension
- Labor
  - Foundation
  - Erection
  - Electrical
  - Management/supervision

Equipment Costs
- Turbines (excluding blades and towers)
- Blades
- Towers
- Transformer
- High-voltage Substation/Interconnection

Project Planning and Development
- Site Evaluation
- Engineering
- Legal Services
- Land Easements
- Permitting and Site Certification

Wind Plant Annual Operating and Maintenance Costs

Personnel
- Field Staff
- Administrative
- Management

Materials and Services
- Vehicles
- Miscellaneous Services
- Fees, Permits, Licenses
- Utilities
- Insurance
- Fuel (motor vehicle gasoline)
- Tools and Miscellaneous Supplies
- Spare Parts Inventory
- Financing (average annual debt payment)
- Equity Payment - Individuals (average annual payment)
- Equity Payment - Corporations (average annual payment)
- Land Lease

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