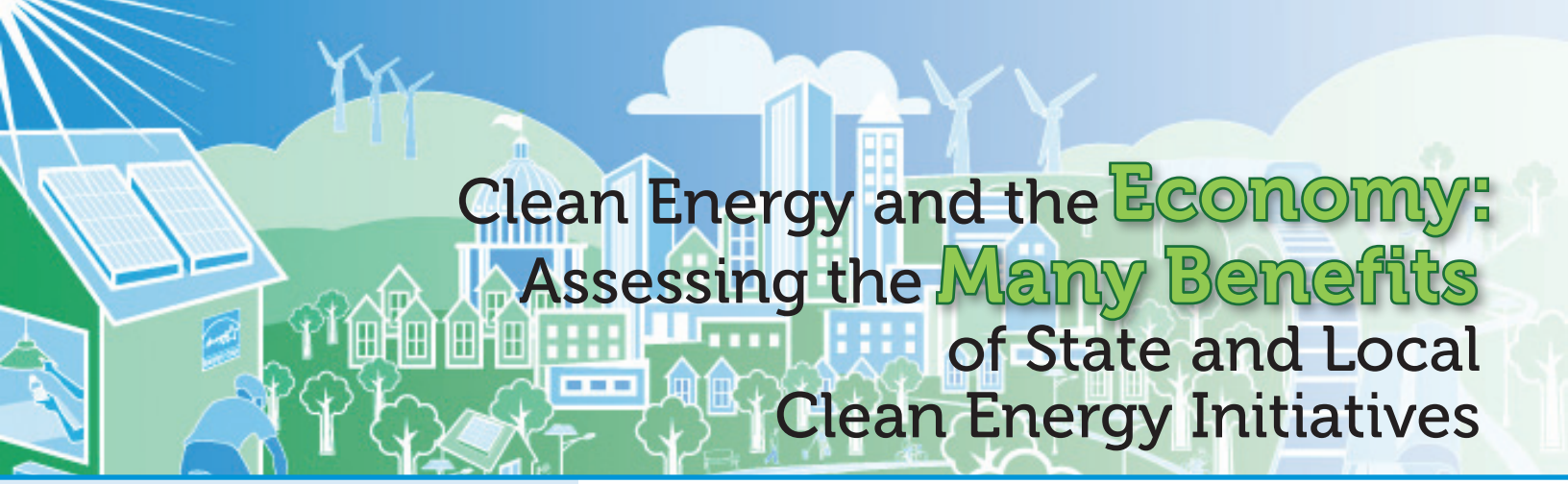

Clean Energy and the Economy: Assessing the Many Benefits of State and Local Clean Energy Initiatives

Multiple Benefits of Clean Energy Initiatives

Reduced energy demand and increased renewable energy generation from state and local clean energy initiatives—such as goals, standards, codes, funds and programs—lead to many benefits including:

- Security, diversity, and overall reliability improvements for the electric system.
- Improved environmental quality, human health and quality of life.
- **Positive economic gains**.

This brochure is part of a series and focuses on **economic benefits.**

What are the economic benefits of clean energy initiatives?

In addition to health, environmental, and electric system benefits, clean energy initiatives that reduce demand for conventional fossil-fuel-powered electricity and/or increase the amount of electricity generated with clean, renewable energy sources can result in:

- Increased personal disposable income.
- Increased commercial and utility revenue.
- Increased income, employment, and output.
- Reduced fuel costs and new plant construction costs in the electricity sector.
- Reduced health care costs as a result of improved air quality and public health.

State and local governments can conduct analyses of their clean energy initiatives using methods and tools described in this brochure.

How do clean energy initiatives result in economic benefits?

- Direct economic benefits result from expenditures on goods and services used in implementation of a given initiative, and from the savings resulting from reduced demand.
- Indirect economic benefits result from economic activity that supports those engaged in implementation of an initiative, including reducing energy demands for those sectors that help produce the technologies.
- Induced economic benefits result when the income generated from the direct and indirect effects is re-spent in the regional economy.

What's Inside:

Direct economic benefits of a wind initiative could result in increases in:

- **Sales** of wind turbines.
- **Income** of local turbine manufacturers.
- **Jobs** of workers who assemble the wind turbines at the manufacturing plant.

Indirect economic benefits of an increase in production of wind turbines could include increases in:

- **Sales** of steel to supply the turbine manufacturers.
- **Income** of supplier companies.
- **Jobs** of workers who supply materials to the turbine assemblers.

Induced economic benefits of a wind initiative could include increases in:

- **Sales** of groceries or related to entertainment in the towns where turbine assembly workers live.
- **Revenue** for local businesses, such as restaurants, stores and movie theaters, in the towns where turbine assembly workers live and spend their money.
- **Jobs** for workers at local establishments that expand or open because turbine assemblers create increased demand for their products and services.

EPA United States Environmental Protection Agency

State and Local Climate and Energy Program

Why assess the economic benefits of clean energy?

Clean energy can be just as cost-effective as other energy options, while also delivering important electric system, environmental, and economic benefits to the state. Typically, however, the benefits are not as well quantified as the costs.

By quantifying the economic benefits of clean energy initiatives, policy makers can:

- ***Comprehensively assess*** the full value of clean energy investments.
- ***Enhance*** the reflection of benefits in cost-benefit analyses.
- ***Demonstrate how*** clean energy can help achieve economic development goals, including creating and retaining jobs.
- ***Build support*** for their clean energy initiatives among state and local decision makers.
- ***Identify additional opportunities*** where meeting today's energy challenges can also serve as an economic development strategy.

How can policy makers measure the macroeconomic benefits of clean energy initiatives?

States and locals can follow these basic steps to analyze the actual or potential macroeconomic benefits of clean energy initiatives:

Step 1: Determine the method of analysis, the desired level of rigor, and the required level of detail about geographic and industrial sectors.

Policy makers can use basic approaches or sophisticated analyses to estimate the economic effects of clean energy initiatives:

- ***Basic approaches*** provide relatively simple approximations of the economic impact of clean energy initiatives, including estimates of employment, price, and output changes . They are appropriate when considering broad economic impacts of proposals or conducting a preliminary analysis. Examples of easy-to-use approaches or tools include:
  - Rule-of-thumb estimates (see examples in table)
  - Job and Economic Development Impact (JEDI) model for Wind Projects (http://www.energyfinder.org/)
- A more ***sophisticated modeling approach*** can be used after a list of potential initiatives has been narrowed down, such as:
  - Input-output models
  - Econometric models
  - Computable general equilibrium models
  - Hybrid models

When choosing a method, states and locals consider many different factors, including time constraints, cost, data requirements, internal staff expertise and overall flexibility and applicability of the methods.

RULES OF THUMB FOR ESTIMATING INCOME, OUTPUT, AND EMPLOYMENT IMPACTS OF CLEAN ENERGY ACTIVITIES

Rule of Thumb	Source
TYPE OF IMPACT: Income/Output	
1 MW of wind generated requires $1 billion investment in wind generator components.	REPP, 2005 http://www.repp.org/articles/static/1/binaries/Ohio_Manufacturing_Report_2.pdf
$1 spent on concentrated solar power in California produces $1.40 of additional GSP.	Stoddard et al., 2006 http://www.nrel.gov/docs/fy06osti/39291.pdf
$1 spent on energy efficiency in Iowa produces $1.50 of additional disposable income.	Weisbrod et al., 1995 http://www.edrgroup.com/library/energy-environment/iowa-energy.html
$1 million in energy savings in Oregon produces $1.5 million of additional output.	Grover, 2005 http://www.oregon.gov/ENERGY/CONS/docs/EcoNW_Study.pdf
TYPE OF IMPACT: Employment	
$1 million in energy savings in Oregon produces about $400,000 in additional wages per year.	Grover, 2005 http://www.oregon.gov/ENERGY/CONS/docs/EcoNW_Study.pdf
$1 billion investment in wind generator components creates 3,000 full-time equivalent (FTE) jobs.	REPP, 2005 http://www.repp.org/articles/static/1/binaries/Ohio_Manufacturing_Report_2.pdf
$1 million invested in energy efficiency in Iowa produces 25 job-years.	Weisbrod et al., 1995 http://www.edrgroup.com/library/energy-environment/iowa-energy.html
$1 million invested in wind in Iowa produces 2.5 job-years.	Weisbrod et al., 1995 http://www.edrgroup.com/library/energy-environment/iowa-energy.html
$1 million invested in wind or PV produces 5.7 job-years vs. 3.9 job-years for coal power.	Singh and Fehrs, 2001 http://www.repp.org/articles/static/1/binaries/LABOR_FINAL_REV.pdf
1 GWh of electricity saved through energy efficiency programs in New York yields 1.5 sustained jobs.	NYSERDA, 2008 http://www.nyserda.org/pdfs/Combined Report.pdf
$1 million of energy efficiency net benefits in Georgia produces 1.6-2.8 jobs.	Jensen and Lounsbury, 2005 http://www.gefa.org/Modules/ShowDocument.aspx?documentid=46

Step 2: Quantify the direct costs for and savings expected from the clean energy initiative.

For initiatives affecting energy demand, such energy efficiency programs, direct costs and savings include:

- **Household and business expenditures:** dollars spent by businesses and households for purchasing and installing equipment.
- **Program administrative costs*:** dollars spent running the program, including labor, materials, and paying incentives to participants. (*When exploring program funding sources, such as consumer surcharges or government revenues, policymakers should consider the impact of diverting funds from other consumer spending or projects.)
- **Energy cost savings:** dollars saved by businesses and households from reduced energy costs, potentially reduced repair and maintenance costs, deferred equipment replacement costs, and increased property values resulting from the new equipment.
- **Sector transfers:** increased flow of dollars to companies that design, manufacture, and install equipment, and reduced flow of dollars to other energy companies—including electric utilities—

as demand for electricity and less-efficient capital declines.

Direct costs and savings of ***initiatives that affect energy supply***, such as those related to renewable energy generation, include:

- **Program administrative costs:** operation costs, including labor, materials, and paying incentives to participants.
- **Construction costs:** equipment purchase costs, installation costs, costs of grid connection, and on-site infrastructure construction costs such as buildings or roads.
- **Operating costs:** operation and maintainenance costs of the equipment and the cost of production surcharges applied to consumers.
- **Displacement savings:** dollars saved by utilities from the displacement of traditional generation, including reduced purchases of fossil fuels and decreased operation and maintenance costs from existing generation resources.
- **Waste heat savings:** dollars saved by utilities or other businesses using waste heat in Combined Heat and Power (CHP) applications for both heating and cooling purposes.

Policy makers can develop a customized approach based on their own needs and resources by adapting and projecting results from existing initiatives to their own conditions or by using more sophisticated modeling tools to estimate direct effects.

Step 3: Quantify the macroeconomic impacts created by those costs and savings.

Together, the direct costs and savings of initiatives shift economic activity among participants, resulting in impacts such as:

- **Increasing personal disposable income** available for non-energy purposes by:
  - **Reducing residential energy costs** through energy efficiency.
  - **Reducing medical expenditures** by decreasing pollution-related illnesses and deaths.
- **Increasing commercial and utility revenue** available for non-energy purchases by lowering energy and fuels costs.
- **Increasing income, employment, and output** by:
  - Reducing the outflow of dollars from the state when it imports electricity.
  - Stimulating the production and sale of clean energy equipment by existing businesses within the state.
  - Increasing the inflow of dollars to the state when it exports technology.
  - Stimulating the construction and operation of new clean energy-based power facilities.
  - Decreasing the cost of doing business and improving competitiveness.
  - Expanding the in-state market for energy efficiency and attracting new businesses and investment.
  - Increasing workforce productivity by decreasing pollution-related illnesses and deaths.
- **Decreasing revenue for utilities** due to the reduction in energy sales from energy efficiency, unless the state's utility revenue structures allow for program cost recovery or financial incentives for energy efficiency programs. This may or may not offset the increase in revenues listed above.

Benefits Flash

A University of **Illinois** 2005 study estimated the direct impacts in 2020 of increasing investment in renewable energy resources, energy efficiency, combined heat and power (CHP), and integrated gasification combined cycle (IGCC) to be:

- **43,000 net new jobs**
- Increased personal income for Illinois residents of **$1.5 billion by 2020**
- Increased net economic output in Illinois of **$7 billion by 2020**

When the study went further to factor in the indirect and induced effects of the investments, the expected benefits in 2020 are much higher:

- **191,000 net new jobs**
- Increased net economic output in Illinois of **$18 billion** by 2020
- Increased personal income for Illinois residents by **$5.5 billion** by 2020

Source: Bournakis and Hewings et al., 2005.

Implementing a 10% Renewable Portfolio Standard (RPS) in **Pennsylvania**—a $4.68 billion investment —between 2006 and 2015 is expected to:

- **Increase output $10.1 billion**
- **Increase earnings $2.8 billion**
- **Create 85,000 jobs**

Source: Pletka. 2004.

In 2008, the **Tennessee** Department of Labor found that:

- **40,000 direct, indirect, and induced jobs** could be created throughout the state from $1.9 billion invested in energy efficient building retrofits, mass transit and freight rail, smart grid, and renewables including wind and solar power and advanced biofuels.
- Tennessee could gain **4,233 full-time jobs in wind** and nearly **400 in solar** by 2015 with an accelerated investment effort.

Source: Tennessee Department of Labor and Workforce Development. 2008.

Southwest Energy Efficiency Project found that investing $9 billion in energy efficiency in the southwest United States between 2003 and 2020 could result in:

- Increased regional employment by 0.45% or by 58,400 FTE jobs per year versus 2020 baseline
- Increased salary income by **$1.34 billion per year** versus 2020 baseline
- **Avoided $10.6 billion capacity investment** (thirty-five 500 MW plants)
- **Avoided $25 billion in costs** for electricity supply per year by 2020
- **Avoided $2.4 billion in costs** for end-use natural gas per year by 2020

Source: SWEEP, 2002.

References:

- Bournakis, A., G. Hewings, J. Cuttica, and S. Mueller. 2005. The Economic and Environmental Impacts of Clean Energy Development in Illinois. Submitted to the Illinois Department of Commerce and Economic Opportunity. June.
- Pletka, R. Economic Impact of Renewable Energy in Pennsylvania. 2004. Prepared by Black & Veatch for The Heinz Endowments and Community Foundation for the Alleghenies. March.
- SWEEP. 2002. The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest. Southwest Energy Efficiency Project, Report for the Hewlett Foundation Energy Series. November.
- Tennessee Department of Labor and Workforce Development. 2008. Growing Green: The Potential for Green Job Growth in Tennessee. November.

Where can state and local governments and policy makers go for more information about tools, methods, and resources available to estimate the benefits of clean energy initiatives?

Assessing the Multiple Benefits of Clean Energy: A Resource for States, an essential manual to help estimate and communicate the benefits of clean energy, provides tools and approaches for state and local governments.

Assessing the Multiple Benefits of Clean Energy: A Resource for States

What the Guide includes:

- A **framework** for determining which benefits to estimate and how.
- **Tools** and methods for estimating energy systems and environmental economic benefits across varying levels of rigor.
- **Easy-to-read tables** that present the range of tools and approaches, their strengths and limitations, and suggestions on when to use them.
- **Benefits estimates** derived using various methods.
- **Analyses** that illustrate benefits to promote clean energy.
- **Case studies** that profile how states use available tools to develop and implement clean energy policies and programs.

How the Guide is organized:

- ***Chapter 1*** introduces the assessment of multiple benefits of clean energy and highlights the relationships between energy savings and other benefits of clean energy initiatives. Included in the chapter are discussions of what the multiple benefits of clean energy are, why states should assess the many benefits of clean energy, and how states can assess the multiple benefits of clean energy.
- ***Chapter 2*** provides policy makers with methods to estimate the potential direct energy impacts of electricity-related clean energy initiatives and policies for planning:
  - Steps to estimate energy impacts of clean energy.
  - Sample framework for developing an energy forecast.
  - Energy data sources.
  - Comparisons of basic and sophisticated forecasting methods and tools.
  - Resources for retrospective data and potential studies.
  - Available tools for estimating impacts.
- ***Chapter 3*** presents detailed information about the energy system to help policy makers understand how to identify and assess the benefits of clean energy initiatives on electricity systems based on their state's needs and resources:
  - An overview of how the electricity system operates.
  - Information on how to select which benefits to evaluate.
  - Steps for estimating electricity system benefits.
  - Descriptions and comparisons of basic and sophisticated forecasting methods and tools.
  - Considerations for determining whether to analyze the various benefits, who typically estimates the specific benefits, and when it is the most effective time to do so.
- ***Chapter 4*** provides help for agencies to assess the greenhouse gas, air pollution, air quality, and human health benefits of clean energy options:
  - Various methods to estimate air and health benefits.
  - Comparisons of different models and tools, including advantages, disadvantages, and when to use them.
  - Data needs and data sources.
- ***Chapter 5*** presents simple to sophisticated methods and tools for assessing the economic benefits of clean energy options so that state and local governments may:
  - Conduct and manage analyses.
  - Review cost-and-benefit estimates.
  - Understand the potential job effects of clean energy initiatives.
  - Make recommendations about clean energy options and appropriate evaluation approaches and tools.

How to access the Guide and get more information:

- ***Assessing the Multiple Benefits of Clean Energy: A Resource for States*** website: http://www.epa.gov/statelocalclimate/resources/benefits.html
- State and Local Climate and Energy Program website: http://www.epa.gov/statelocalclimate/
- State and Local Climate and Energy Newsletter: http://www.epa.gov/statelocalclimate/newsletters
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