STATE CLEAN ENERGY -- ENVIRONMENT TECHNICAL FORUM
Call #24: Using Multiple Benefits to Advance Clean Energy
June 14, 2007, 2:00 p.m. - 3:30 p.m. EST
BACKGROUND

Overview

Clean energy resources (e.g., energy efficiency, renewable energy, clean distributed generation including combined heat and power) have often been evaluated and advanced primarily on their energy cost-saving or fuel diversity benefits. However, as states tackle a broad range of environmental, energy and economic issues, clean energy is increasingly being considered and recognized for the multiple benefits it helps provide, such as:

- Improved air quality,
- Lower consumer energy bills,
- Reduced greenhouse gas emissions,
- Improved energy system reliability and security,
- Deferral of new capacity and transmission investments, and,
- Job creation and economic development.

Recognition of the multiple benefits of clean energy is helping to create broad constituencies and increased investment opportunities across state agencies. Long-standing supporters in energy and environmental agencies are being joined by utility regulators, public health officials, economic development directors, and others, to advance policies that address mutual objectives. By more fully recognizing the benefits side of the benefit-cost equation, states are leveraging resources and expertise to promote a holistic and integrated approach to achieving a range of societal goals.

Multiple-benefits approaches to advancing clean energy call for:

- A well-designed method for quantifying a range of projected and actual results,
- A strategy for integrating the results into ongoing planning, regulatory and other efforts, and,
- A communication approach that is tailored to multiple audiences.

This background paper, and the associated session of the Technical Forum, will: (1) describe the leading multiple benefits associated with clean energy, (2) present a sample framework for conducting a multiple benefits assessment, (3) provide a brief overview of readily available tools and analyses for quantifying benefits, and (4) highlight three examples of how states have utilized and communicated multiple benefits to advance clean energy.

Future calls of the Technical Forum, planned for Fall 2007/Winter 2008, will explore multiple benefits issues in greater detail, in particular analytical methods and tools. Additional information will also be contained in a forthcoming EPA report: *A Guidebook for Assessing the Multiple Benefits of Clean Energy* (see Resources, below).

Clean Energy's Multiple Benefits

The leading benefits associated with clean energy can be grouped into the following categories, described in greater detail below: [1]

- Energy and Cost-Savings Benefits,
- Energy System Benefits,
- Greenhouse Gas (GHG) Benefits,
- Air Quality and Human Health Benefits, and,
- Regional Economy and Macroeconomic Benefits.

In recognition of at least one of these benefits, government leaders in nearly every state are taking steps to advance policies and programs that increase the use of clean energy. In a growing number of states, state officials are using more comprehensive benefit-cost comparisons to understand the impacts of these initiatives. States may examine a full range of benefits or focus on just a few, depending on how broadly they perceive their audience and their level of resources. In Connecticut, for example, stakeholders made multiple benefits a priority during the development of their climate change action plan. While Connecticut's existing "energy efficiency program was known to achieve a $3 to $1 direct return on investment based on electricity savings… an additional $4 to $1 payback in terms of reduced health costs and public health benefits was identified as a result of reductions in criteria air pollutants." [2] By exploring benefits beyond the initial energy and costs savings of energy efficiency, the state was able to recognize more fully the magnitude of the benefits associated with their program and garner broader support.

- **Energy and cost savings benefits** are the energy (e.g., kWh, therms) and dollars saved by relying on clean energy resources instead of traditional supply resources. This is particularly important at a time when electricity and fuel prices are rising across much of the country. States generally include estimates of energy and cost savings benefits in their assessment of clean energy; and it is a leading motivation for supporting new or expanded programs. Determining energy (and demand or kW) savings is a key input for evaluating other multiple benefits described below.

- **Energy System Benefits** are the positive impacts on energy systems and energy markets. These benefits include delaying, reducing, or avoiding the need to build or upgrade generation, transmission and distribution (T&D) capacity, reducing T&D line losses, reducing wholesale prices for electricity consumers by reducing peak demand, reducing dependence on imported fuels, and increasing energy security. Particularly as increasing demand is expected to soon outpace available capacity in many areas, states and utilities are evaluating how and where clean energy can be used as a resource to avoid or defer costly infrastructure investments.

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[1] Additional benefits not covered here can include: water quality and quantity benefits, land use benefits, other environmental, economic and energy benefits.
[2] Connecticut Governor's Steering Committee (GSC) on Climate Change. 2005. Connecticut Climate Change Action Plan. http://www.ctclimatechange.com/StateActionPlan.html

- **Greenhouse Gas Benefits** from clean energy investments are critical to lowering the emissions associated with climate change. By decreasing power plants fossil fuel combustion and related carbon dioxide emissions, clean energy can play an important role in helping states meet their GHG emission reduction targets. States are increasingly looking to clean energy to provide a significant amount of their targeted GHG emissions reductions.

- **Air Pollution, Air Quality and Health Benefits** are realized by avoiding emissions from fossil fuel-fired electric generation, which contribute to ground level ozone, particulate matter concentrations and other air quality and health concerns. Power plant emissions reductions help reduce the health effects of air pollution, which include asthma attacks, hospital admissions, and premature death. They also generate economic benefits by reducing health care expenditures and improving productivity of the labor force by reducing illness and resulting sick days.

   It should be noted that in areas where air pollutants from the electric power sector are regulated by an emissions cap and trade program (e.g., Acid Rain Program, NOx SIP Call, Clean Air Interstate Rule, Clean Air Mercury Rule), clean energy investments will not reduce aggregate emissions of the covered pollutants (e.g., SO_2, NOx) unless allowances are associated with the investment and retired. However, even without net emissions changes, clean energy investments could contribute to important changes in the spatial or temporal profile of the capped emissions (e.g., shifting capped emissions away from urban areas and/or from high ozone days).

- **Regional Economy and Macroeconomic Benefits** can affect all sectors and demographics, including businesses, industry, consumers and households. For instance, clean energy can create short-term jobs during the construction of new clean energy-related facilities as well as permanent, long-term employment within the facilities themselves. Sustained investment in clean energy over the longer term can lead to local jobs in the manufacturing, distribution, retail sales, installation, auditing and rating, and maintenance of equipment and technology. Cost-effective clean energy projects can also increase regional economic output by increasing the competitiveness and productivity of industries and businesses. Clean energy initiatives that reduce consumer energy bills can lead to increases in disposable income for residents of the state or region, which can further increase economic activity and jobs. As concerns with revitalizing or sustaining economic development and keeping energy dollars "close to home" increase, many states are looking to measure and promote the local/regional job development and other economic benefits associated with clean energy.

Quantifying Multiple Benefits

Multiple benefits can be analyzed using a range of approaches and measurement techniques. Careful consideration of the context in which benefits data will be applied (e.g., regulatory v. voluntary, prospective v. retrospective) can help construct an appropriate analytic approach. Timing and resource constraints can also affect the level of analytical sophistication. For example, a state interested in measuring the "carbon footprint" impact associated with their renewable energy purchases may use a simple GHG spreadsheet tool for broad reporting purposes, but may need to employ more detailed protocols and approaches for including the data in a GHG emissions registry or as an offset in an emissions trading program.
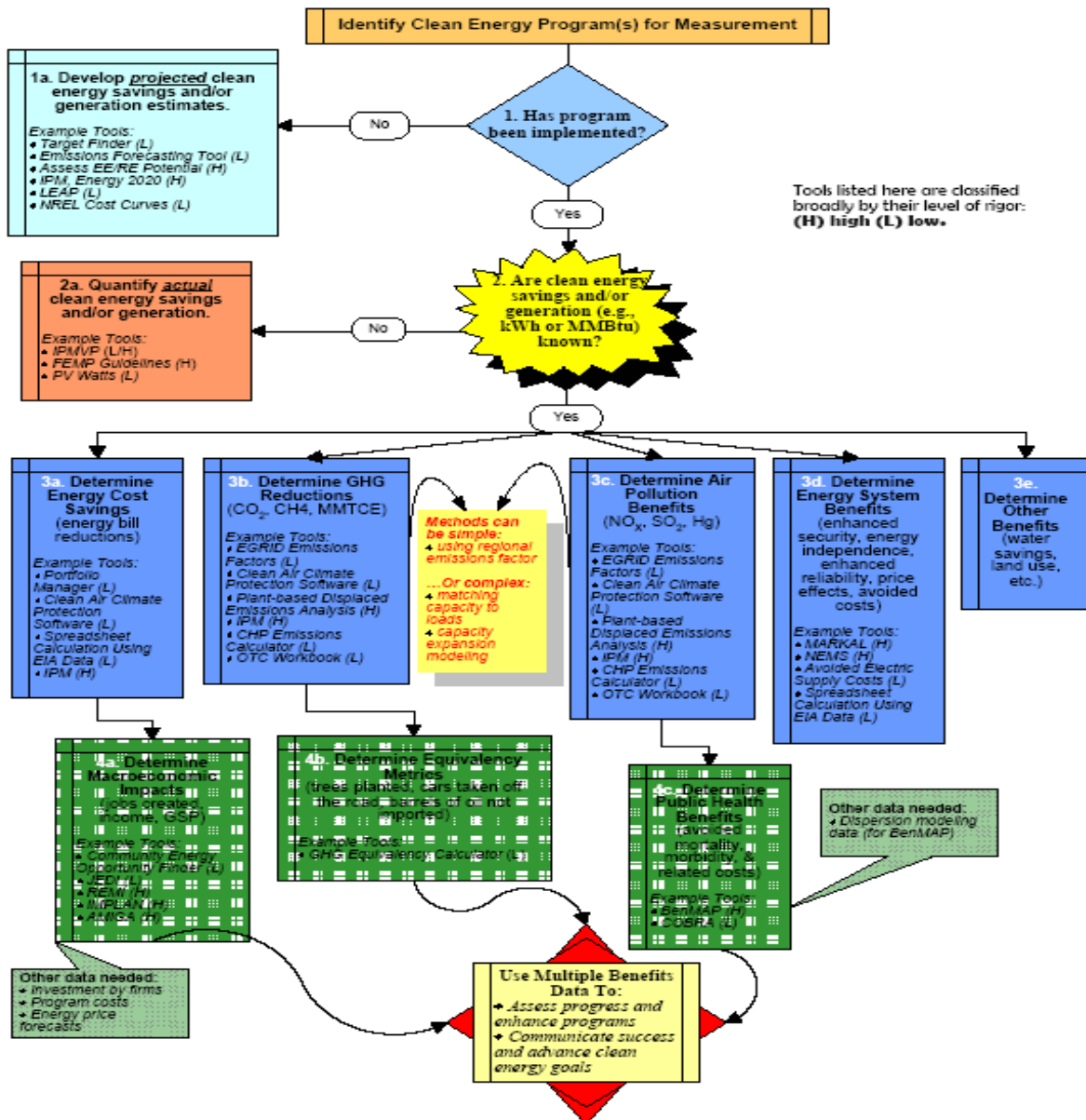
Figure 1, below, developed by the EPA Clean Energy-Environment State Partnership Program, provides a sample framework for determining the multiple benefits of clean energy programs. This framework is intended to provide a stepwise approach to considering multiple benefits, based on the experiences of and lessons learned by many states to date. Each box includes examples of tools and approaches, most of which are described in more detail in the resources section that follows[3]. Each tool is designated according to a higher (H) or lower (L) level of analytical rigor; in many cases, a lower level of rigor is sufficient for a state's assessment purposes.

As shown in Figure 1, the foundation for multiple benefits analysis is the quantification of energy (e.g., kWh) and/or demand (e.g., kW) savings, or energy generation in the case of renewables. From there, the emissions, health, cost-savings, and other data can be derived. For example, if a state is interested in determining the public health impacts of a clean energy scenario they can look to Box 4c "Determine Public Health Benefits" to learn about tools available to help estimate those benefits. Depending upon the level of rigor deemed necessary, the state can use BenMAP which has a higher level of rigor, or a less rigorous model like the COBRA screening model. Beyond identifying possible tools available to determine health benefits, the framework can be used to identify the inputs necessary to generate the data BenMAP and COBRA would require. This would include the estimation of energy savings as identified in Box 2 which would then be used to generate air pollution benefits using tools such as those listed in Box 3c.

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[3] Inclusion of any proprietary tools in the sample framework does not imply endorsement by US EPA. It is for illustrative purposes only.

Example Framework for Determining Benefits of Clean Energy Programs

Identify Clean Energy Program(s) for Measurement

1. Has program been implemented?

No →

1a. Develop _projected_ clean energy savings and/or generation estimates.

Example Tools:
- Target Finder (L)
- Emissions Forecasting Tool (L)
- Assess EE/RE Potential (H)
- IPM, Energy 2020 (H)
- LEAP (L)
- NREL Cost Curves (L)

Yes ↓

Tools listed here are classified broadly by their level of rigor: **(H) high (L) low.**

2. Are clean energy savings and/or generation (e.g., kWh or MMBtu) known?

No →

2a. Quantify _actual_ clean energy savings and/or generation.

Example Tools:
- IPMVP (L/H)
- FEMP Guidelines (H)
- PV Watts (L)

Yes ↓

3a. Determine Energy Cost Savings (energy bill reductions)

Example Tools:
- Portfolio Manager (L)
- Clean Air Climate Protection Software (L)
- Spreadsheet Calculation Using EIA Data (L)
- IPM (H)

3b. Determine GHG Reductions (CO_2, CH4, MMTCE)

Example Tools:
- EGRID Emissions Factors (L)
- Clean Air Climate Protection Software (L)
- Plant-based Displaced Emissions Analysis (H)
- IPM (H)
- CHP Emissions Calculator (L)
- OTC Workbook (L)

Methods can be simple:
- using regional emissions factor

...Or complex:
- matching capacity to loads
- capacity expansion modeling

3c. Determine Air Pollution Benefits (NO_x, SO_2, Hg)

Example Tools:
- EGRID Emissions Factors (L)
- Clean Air Climate Protection Software (L)
- Plant-based Displaced Emissions Analysis (H)
- IPM (H)
- CHP Emissions Calculator (L)
- OTC Workbook (L)

3d. Determine Energy System Benefits (enhanced security, energy independence, enhanced reliability, price effects, avoided costs)

Example Tools:
- MARKAL (H)
- NEMS (H)
- Avoided Electric Supply Costs (L)
- Spreadsheet Calculation Using EIA Data (L)

3e. Determine Other Benefits (water savings, land use, etc.)

4a. Determine Macroeconomic Impacts (jobs created, income, GSP)

Example Tools:
- Community Energy Opportunity Finder (L)
- JEDI (L)
- REMI (H)
- IMPLAN (H)
- AMIGA (H)

Other data needed:
- Investment by firms
- Program costs
- Energy price forecasts

4b. Determine Equivalency Metrics (trees planted, cars taken off the road, barrels of oil not imported)

Example Tools:
- GHG Equivalency Calculator (L)

4c. Determine Public Health Benefits (avoided mortality, morbidity, & related costs)

Example Tools:
- BenMAP (H)
- COBRA (L)

Other data needed:
- Dispersion modeling data (for BenMAP)

Use Multiple Benefits Data To:
- _Assess progress and enhance programs_
- _Communicate success and advance clean energy goals_

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States Integrating Multiple Benefits into Planning and Regulatory Efforts and Communicating Results

Many states are effectively evaluating the multiple benefits of clean energy options using approaches and tools similar to those described above. They are then integrating these results into on-going efforts (including energy planning documents, air quality plans, climate change action plans) and communicating results. The following examples present three states' in-depth efforts to utilize multiple benefits to advance clean energy. Many other states, including the ones profiled below, also utilize more targeted, smaller-scale analyses to identify and convey impacts.

NEW YORK'S ENERGY $MART PROGRAM

Multiple Benefits Evaluated:
- Energy Savings
- Greenhouse Gas Reductions
- Air Pollution Benefits
- Macroeconomic Benefits

New York's Energy $mart Program provides a portfolio of 38 programs designed to increase electricity supply, stimulate demand for energy efficiency products and renewable resource technologies, and overcome market barriers. Since 1998, Energy $mart has provided almost $1 billion to support clean energy projects. The New York State Energy Research and Development Authority (NYSERDA) administers the program, funded by a system benefits charge on the state's investor-owned utilities. NYSERDA oversees one of the most comprehensive and rigorous multiple benefits evaluation of any system benefits charge program and reports results in a series of quarterly and annual reports. The benefits results data generated are used to support continued investment and convey benefits to a wide audience. It permits them to demonstrate the following results, from the last five years, (from the New York Energy $mart[SM] website). Worth noting is the range of benefits, including the number of farms benefited. Additional information about the New York Energy $mart program, is available at www.GetEnergySmart.org. http://www.nyserda.org/ny_energy_smart.asp

- Approximately $198 million in annual energy savings
- 4,200 jobs retained or created
- A leverage of $2.50 in private investment for every NY Energy $mart Program dollar
- 1,400 GWh saved per year
- 860 MW in reduced demand
- Fuel savings of 3.3 TBtu
- Annual carbon dioxide reduction equivalent to 200,000 fewer cars
- 1,300 farms benefited from the **New York Energy $mart[SM]** Program
- Significant annual emission reduction (in tons)
    - Nitrogen oxides (NO_x) – 1,280
    - Sulfur dioxides (SO_x) – 2,320
    - Carbon dioxide (CO_2) – 1,000,000

CONNECTICUT'S 2005 CLIMATE CHANGE ACTION PLAN

Multiple Benefits Evaluated:
- Energy Savings
- Greenhouse Gas Reductions
- Air Pollution, Air Quality and Health Benefits
- Macroeconomic Benefits

Connecticut's 2005 *Climate Change Action Plan* includes 55 clean energy action items aimed at reducing GHG emissions and achieving the regional goals set by the New England Governors/ Eastern Canadian Premiers (NEG/ECP). Unique among the existing state climate change strategies, Connecticut used EPA's COBRA tool as a screening tool to quantify reduced health costs and public health benefits from reduced criteria pollutant emissions, to help evaluate and prioritize the action items under consideration. In addition, the state quantified economy-wide benefits using the REMI regional economic analysis model. For more information, visit Connecticut's Official Climate Change Web site at http://www.ctclimatechange.com/

QUANTIFYING THE NO_x REDUCTIONS FROM CLEAN ENERGY PROGRAMS IN TEXAS

Multiple Benefits Evaluated:
- Energy Savings
- Air Pollution, Air Quality and Health Benefits

In 2001, the Texas State Legislature established the Texas Emissions Reduction Plan (TERP) to help the 41 counties not meeting – or are on the verge of failing to meet - the federal ozone air quality standards. The TERP requires the Texas Commission on Environmental Quality (TCEQ) to promote energy efficiency/renewable energy (EE/RE) measures to meet federal air quality standards and develop a methodology for computing emission reductions for the State Implementation Plan (SIP). TERP adopted the goal of implementing cost-effective EE/RE measures to reduce electric consumption by 5% a year for five years, beginning in 2002, and the TCEQ is required to produce an annual report evaluating the energy savings and emission reductions achieved under the TERP programs. The TCEQ worked with EPA, ERCOT, and Texas A&M University's Energy Systems Laboratory (ESL) to develop methods for quantifying the NO_x emission reductions associated with energy savings from TERP clean energy projects. The methods were used to compile energy savings data from the various TERP programs and integrate those savings into the NO_x emission reductions calculations using EPA's eGRID data.

The ability to demonstrate, through quantitative analysis, that EE/RE programs are providing significant, permanent emission reductions has been an important aspect of the program. For example, the 2004 annual report regarding energy savings and emission reductions for energy-code compliant new residential single and multi-family construction reported the following findings:

- The annual energy savings in 2004 amounted to 233,806 megawatt-hours (MWh) of electricity and 667,945 million BTUs of natural gas, which led to 346 tons of NOx reductions in 2004.

- Cumulative NOx reductions, projected to 2007 and 2012, from energy efficiency savings from code-compliant new residential construction were determined to be:
  - 824 tons/year, and 3.83 tons/peak-day in 2007, and
  - 1,416 tons/year, and 6.58 tons/peak-day in 2012.

Based on these finding, TCEQ, the Texas PUC, and the State Energy Conservation Office (SECO) are working with local governments and utilities to implement efficiency improvement programs and projects, measure and verify energy savings, and incorporate emission reductions into local air quality plans. For example, the Dallas-Fort Worth non-attainment area proposed including efforts under SB.5 in its State Implementation Plan for attainment of the 1-hour ozone standard. Projects eligible for inclusion in the SIP include energy efficiency and renewable energy projects such as building code upgrades, energy efficiency retrofits, renewable energy installations, and green power purchases.

For more information, visit the Texas Commission on Environmental Quality Web site at, http://www.tceq.state.tx.us/ and the Texas Energy Partnership Web site at, http://www.texasenergypartnership.org/

Resources[4]
The following resources include tools referenced in the framework on page 5, which provide states with answers to one or more benefits questions with a lower or higher level of rigor, as well as tools that can help translate and communicate results.

General Multiple Benefits Guidance

A Guidebook for Assessing the Multiple benefits of Clean Energy: EPA is developing a Clean Energy Multiple Benefits Assessment Guidebook to help policymakers identify and demonstrate the multiple benefits of existing or proposed clean energy policies. This Guidebook will present the concepts, methods and data sources for identifying and quantifying the energy savings, energy system, greenhouse gas, air quality, public health and macroeconomic benefits of clean energy initiatives and illustrate how those benefits can be used to support the development and implementation of cost-effective clean energy initiatives. To participate in the review process and shape the content of this document, contact Denise Mulholland at mulholland.denise@epa.gov.

Quantifying Clean Energy Savings, Avoided Electricity Generation and Avoided Emissions

International Performance Measurement and Verification Protocol (IPMVP): The IPMVP is an industry-standard protocol for measuring and verifying energy savings. It is a broad framework that outlines a flexible and broad set of measurement and verification approaches for evaluating energy savings in buildings. Specific techniques are designed to match project costs and savings requirements with particular efficiency measures and technologies. Each option is applicable to different programs and projects based on factors such as the complexity of the efficiency measures under evaluation and the risk expectations. Accordingly, each option varies

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[4] Inclusion of any proprietary tools in this list does not imply endorsement by US EPA.

in accuracy and cost of implementation, as well as strengths and limitations.
http://www.ipmvp.org/

Combined Heat and Power (CHP) Emissions Calculator: The CHP emissions calculator is an educational tool that compares the anticipated emissions from a CHP system to the emissions from systems using separate heat and power (SHP). A user can select from a large number of different SHP system profiles, compare them to a CHP system (characterized by the user), and estimate the CO_2, SO_2 and NO_X emissions from both systems and the corresponding emissions reductions achieved by the CHP system. In addition to estimating emissions reductions, the CHP Emissions Calculator presents the carbon equivalency of these emissions reductions in terms of acres of trees planted and number of cars removed from the road. http://www.epa.gov/chp

E-Calc: E-Calc is a web based calculator allowing government and building industry users to design and evaluate a wide range of projects for energy savings and emissions reduction potential. This tracking tool was developed by Texas A&M University's Energy Systems Laboratory in response to legislative incentives to quantify emissions reductions from building energy savings and distributed renewable technology. E-Calc evaluates residential, commercial, retail, and municipal buildings energy and emissions savings, as well as savings from renewables like solar heating, solar PV, and wind power. http://ecalc.tamu.edu/

Emissions & Generation Resource Integrated Database (eGRID): eGRID is a comprehensive source of data on the environmental characteristics of all domestic electric power generation. It contains data on emissions and resource mix for virtually every power plant and company that generates electricity in the U.S. eGRID also provides numerous search options, including features of individual power plants, generating companies, states, and regions of the power grid. The current version contains U.S. power plant emissions totals for 1996 through 2000, and for 2004. http://www.epa.gov/cleanenergy/egrid/index.html

Power Profiler: This tool can be used to evaluate the environmental benefits of choosing cleaner sources of energy. The Power Profiler is a Web-based tool that allows users to evaluate the air pollution and greenhouse gas impact of their electricity choices. It is particularly useful with the advent of electric customer choice, which allows many electricity customers to choose the source of their power. Using only a ZIP code, the tool generates a report describing the emissions characteristics of one's electricity use. http://www.epa.gov/cleanenergy/powerprofiler.htm

Developing a Greenhouse Gas Emissions Inventory and Forecast

State Inventory Tool (SIT): EPA's State Inventory Tool is an interactive spreadsheet model designed to help states develop GHG emissions inventories. SIT gives users the option of applying their own state-specific numbers or using default data pre-loaded for each state. The default data is gathered by federal agencies and other sources covering fossil fuels, agriculture, forestry, waste management, and industry. SIT provides a streamlined way to update an existing inventory or complete a new inventory and is also accompanied by updated guidance describing best practices. Contact Andrea Denny at denny.andrea@epa.gov.

Emissions Forecasting Tool: This spreadsheet model builds on the design of the State Inventory Tool (SIT) to help states create forecasts of business-as-usual (BAU) GHG emissions through 2020. The tool estimates future emissions through a combination of linear extrapolation of SIT results and economic, energy, population, and technology forecasts conducted by the federal government. The tool can be customized, allowing states to enter their own assumptions about future growth and consumption patterns. Contact Andrea Denny at denny.andrea@epa.gov.

State Energy CO_2 Data Tables: The tables provide state CO_2 emission inventories from fossil fuel combustion, showing annual emissions of CO_2 by sector (commercial, industrial, residential, transportation and electric utilities) from 1990 through 2003. The data tables use fuel consumption data from the Energy Information Administration's *State Energy Data 2003* consumption tables in combination with emission factors from the *U.S. Emissions Inventory 2006*. EPA's data may differ slightly from state-authored inventories because of methodological differences, including scope of coverage, underlying data, emission factors, and assumptions.http://www.epa.gov/climatechange/emissions/state_energyco2inv.html

Determining Equivalency Metrics

Greenhouse Gas Equivalencies Calculator: This calculator enables organizations and individuals to quickly and easily translate greenhouse gas reductions from units typically used to report reductions (e.g., metric tons of carbon dioxide equivalent) into terms that are easier to conceptualize. These include such metrics as gallons of gasoline, barrels of oil, the number of cars not driven for one year, or the number of acres of forest preserved from deforestation. The online tool also allows users to work backwards and calculate greenhouse gas emissions from a known quantity of kilowatt-hours or gallons of gasoline, or a given number of cars and trucks not driven for one year.   http://www.usctcgateway.net/tool/

Integrating Energy & Air Quality Benefits

EPA Guidance Documents on Integrating Energy and Environmental Programs
Under EPA policy and guidance, states can incorporate EE/RE measures into their State Implementation Plan (SIP) for air quality, provided certain criteria are met. The EPA guidance documents on this web site describe the criteria for EE/RE measures and how states can meet them. These materials provide state and local energy and air quality officials with information on how to incorporate EE/RE measures into air quality plans, or as a set-aside under cap-and-trade programs. http://www.epa.gov/cleanenergy/stateandlocal/guidance.htm

EPA Mitigation Impact Screening Tool (MIST): MIST is an easy-to-use software tool that estimates the impacts of urban heat island mitigation strategies on urban air temperatures, ozone, and energy consumption. The cooling strategies assessed include increasing urban albedo (reflectance), increasing urban vegetative cover, or a combination of both. Alternatively, users can evaluate how a particular temperature change will impact ozone concentrations and energy use. The basic steps involved in running MIST are: 1) select the city to model; 2) define the mitigation strategy to test; and 3) estimate impacts on meteorology, air quality, and energy. Availability: Currently in peer review. Contact Niko Dietsch at dietsch.nikolaas@epa.gov.

The Clean Air and Climate Protection Software (CACPS): CACPS is a Windows-based software tool that allows states and localities to analyze the impact of various air pollution control scenarios on traditional air pollutants and greenhouse gases (GHGs). The tool is divided into government and community modules, with each type allowing users to supply data on electricity and fuel-use reductions to analyze GHGs and air pollution impacts. For the community module, CACPS is subdivided into residential, industrial, commercial, transportation, and waste sectors. In the government module, sectors include: buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste. http://www.4cleanair.org/InnovationDetails.asp?innoid=1 (For a copy of the software send an e-mail to 4clnair@4cleanair.org with "CACP Software" in the subject line.)

Estimating Public Health Benefits

Co-Benefits Risk Assessment Tool (COBRA): The COBRA model is a screening tool used to: 1) Approximate the impact of emission changes on ambient air pollution; 2) Translate this into health effect impacts; and 3) Monetize these impacts. COBRA enables policy analysts to obtain a first-order approximation of the costs and benefits of different mitigation policies under consideration. The software quickly compares outcomes in terms of air quality or health effects. COBRA presents results in tabular as well as geographic form to facilitate the visualization of the changes. Contact Denise Mulholland at mulholland.denise@epa.gov.

Environmental Benefits Mapping and Analysis Program (BenMAP): BenMAP is a peer-reviewed tool for estimating the health and economic benefits of air pollution reduction strategies. It combines air pollution monitoring data, air quality modeling data, census information, and population projections to calculate a population's potential exposure to ambient air pollution. BenMAP is used primarily to estimate benefits from changes in particulate matter and ozone concentrations, but can also be adapted for other pollutants. Most Windows-based computers run BenMAP. http://www.epa.gov/ttn/ecas/benmodels.html

Estimating Economy-wide Emissions and Economic Benefits

The National Energy Modeling System (NEMS): NEMS is a general equilibrium energy-economic model of the United States. It projects the production, import, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, cost and performance characteristics of energy technologies, and demographics. There are three classes of modules in NEMS: Supply, Demand, and Conversion. This makes the modeling system unique in its comprehensive treatment of supply-side technologies (particularly in the electricity sector), and its detailed treatment of energy demand at the end-use level. http://www.eia.doe.gov/oiaf/aeo/overview/

Long-range Energy Alternatives Planning System (LEAP): The LEAP model is a scenario-based modeling tool designed to project energy supply and demand and evaluate energy policy options. The tool evaluates the physical, economic and environmental impacts of alternative scenarios to help guide the selection of appropriate energy policies. LEAP includes a Technology and Environmental Database (TED) that provides extensive information describing the technical

characteristics, costs and environmental impacts of a wide range of energy technologies including existing technologies, current best practices and next generation devices. http://forums.seib.org/leap

NREL JEDI Tool

Developed by the National Renewable Energy Laboratory (NREL), the Job and Economic Development Impact (JEDI) model is an interactive model to analyze the economic impacts of constructing and operating wind power plants. Users enter basic information about a wind project (including the state location, the year of construction, and the size of the facility) to determine project cost (i.e., specific expenditures) and the income (i.e., wages and salary), economic activity, and number of jobs that will accrue to the state (or local region) from the project.http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemi d=707

RMI Community Energy Opportunity Finder

This interactive Web site from Rocky Mountain Institute (RMI) calculates the benefits of implementing energy efficiency across a community. RMI's Community Energy Opportunity Finder helps municipalities collect energy use data and then calculate potential energy savings, dollar savings, emission reductions of nitrogen oxides, sulfur dioxide, and carbon dioxide, and jobs creation that could be achieved through energy efficiency programs. In addition, the online tool includes valuable information to help a community get started with its own energy projects, including: case studies of similar initiatives, data sources, and ideas for funding. http://www.energyfinder.org/