

# Renewable Energy Committee Report

Submitted to the Colorado State Senate Majority  
Ad Hoc Energy Task Force

Approved by the Colorado Renewable Energy Society  
Board of Directors - October 25, 2001

**Renewable Energy Committee Report  
October 26, 2001**

The Renewable Energy Committee hereby submits this report, prepared at the request of the Chairman of the Colorado State Senate Majority Ad Hoc Energy Task Force. The report is a compilation of material suggested and submitted by citizens with an interest in preparing renewable energy information for members of the public and decision-makers. The document was approved for submission by the Board of Directors of the Colorado Renewable Energy Society at its October 25, 2001 Board Meeting.

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## **Introduction**

Colorado, the United States, and the world face a host of interlocking issues related to energy, the environment, the economy, and security. This renewable energy report provides information to help assess which public policy initiatives in Colorado will best expand renewable energy's role in addressing our state's and nation's economic, environmental, and national security needs.

All energy resources have particular strengths and weaknesses, and different histories of public and policy support. Conventional energy sources (coal, oil, natural gas, nuclear power, and hydroelectric power) are mature industries that have played a vital role in establishing the present strength of the state's and nation's economic well-being. They have all benefited from a wide range of critically important state and national public policy support. Although conventional energy sources continue to deliver impressive technological and operational improvements, well-documented resource constraints and environmental questions persist, causing many to advocate a shift in policy that supports more sustainable energy development. Additional advances from conventional energy resources are to be expected. However, these advances may not succeed at resolving the issues of finite limits of resource availability, foreign dependence, and environmental constraints (such as urban air pollution, habitat destruction, containment of radioactive wastes, and contribution to global warming). By contrast, renewable energy is infinite, environmentally benign, and local/domestic. Public opinion polls conducted over the past twenty years have continually demonstrated the Americans favor a greater national commitment to renewable energy resource development.

At present, renewable energy is only a minor contributor to the state's and nation's energy supply, resulting in limited economic, environmental, and national security benefits. Recent changes in market conditions and policy commitments have produced an ever-increasing level of deployment of cost-effective renewable energy technologies across the electric, buildings, and transportation sectors. With each advance in renewable energy deployment, we move closer to achieving our shared economic, environmental, and national security goals. But despite the progress, renewable energy technologies are still in their relative infancy. In addition, the economic calculus applied to energy in the marketplace does not account for the environmental attributes of renewable energy or the environmental, health care, and national security risks associated with conventional energy sources.

Colorado should wait no longer to create the policy climate that will place this state at the center of global renewable energy development.

## **Colorado Has an Abundance of Renewable Energy Resources and Technologies**

Renewable energy resources –sun, wind, biomass, and geothermal energy--abound in Colorado, representing an opportunity for this generation of Coloradans to initiate the dawning of the solar age in our beautiful state.

At present, the most cost-effective renewable electricity resource is wind power. Wind power is the world's fastest growing energy source as measured in annual percentage growth. In March 2001, the Colorado Public Utilities Commission required Xcel Energy to accept a bid from ENRON to construct 162 megawatts of wind-generated electricity near Lamar as a rate-based resource. The decision was made on economic grounds, and will produce significant environmental and rural economic development benefits. As more utility-scale wind projects are developed and more experience is gained, the price of wind power is expected to continue to fall below the 3.25 cent per kWh estimate reported for the Lamar wind project."

Opportunities abound for utilizing animal waste for energy at Colorado's large feedlots, while simultaneously addressing odor and regional haze issues.

Colorado has many more sunny days than most states, yet Colorado state and local governments have not have not recognized this as a basis for taking the lead to ensure that we utilize this environmentally benign and domestic resource.

Photovoltaics (PV) are solid-state devices that convert solar energy into direct current electricity without moving parts. The price of PV is increasingly cost-effective. In the last year PV systems have virtually replaced diesel for emergency road signs on Colorado highways. PV is rapidly penetrating the distributed energy markets - and residential systems can be purchased now at some Home Depots. Although there is an ever-increasing number of "off-grid" homes in Colorado, many more opportunities for photovoltaics exist.

Colorado's sunny climate is ideal for solar water and space heating. If oriented to the sun, new residential developments, at the Stapleton site and elsewhere, could result in substantial savings to homeowners. Housing developments ought to be held to a standard of designing the long-term interest of the homeowners by proper street and home orientation. Failure to ensure proper design in the past has ensured a massive waste of energy into the future- a practice that should be halted.

Colorado's state institutional buildings, college campuses, hospitals, and correctional facilities are well suited to employ solar thermal systems to provide life-cycle cost-effective hot water. Short-term thinking is driving the decision-making to virtually ignore renewable energy opportunities, and the lack of a state renewable energy policy encourages the wasteful behavior. Renewable energy opportunities are largely being passed by because decision-makers have either not recognized the opportunities, or have preferred to let market forces alone determine the pace of renewable energy development. This lack of foresight has delivered the energy system and environmental consequences we have today, and will impose the same on Colorado citizens into the future.

It is time to change. Exercising leadership and foresight will create a legacy that will be appreciated by Colorado citizens for years to come.

### **Renewable Energy Has Been Analyzed in Colorado: It Is Time to Act**

In addition to several private studies, Colorado State Government has conducted the following analyses on opportunities for renewable energy development:

In November 1997, the **Governor's Renewable Energy Task Force** released its report entitled "Renewable Energy in Colorado's Future." The 108-page report discusses renewable resources, costs, and benefits in Colorado; analyzes each of its recommendations; and contains appendices, notes, glossary, and a resource guide of Colorado, national and international sources for additional information. Among the 33 recommendations, were such items as support for renewable energy business enterprises and improving prospects for renewable energy industries with global reach. The Report's recommendations fall into six categories:

1. Bringing renewable energy into our homes and businesses.
  - Issue a Governor's "1,000 by 2000" solar rooftop challenge.
  - Issue a Governor's "green power corporate challenge and award."
  - Encourage use of renewables by designers, developers, and builders.
  - Evaluate home loan programs for inclusion of renewables.
  - Support renewables in low-income housing finance.
  - Support non-profit groups recruiting green power customers.
  - Establish a standard and definition for "green power."
  - Adopt net metering for renewables systems on homes and businesses.
  - Make mortgages available to off-grid PV homebuyers.
2. Bringing renewable energy into our communities.
  - Adopt local ordinances that promote use of renewable energy.
  - Encourage Colorado governments to purchase green power.
  - Develop Stapleton as a renewable energy model.
  - Install PV systems on Colorado schools.
  - Encourage PV use in niche markets.
3. Supporting renewable energy business enterprises.
  - Create a licensing program for solar contractors.
  - Support continued training and certification for installers.
  - Lease state lands for renewable energy production.
  - Offer renewable energy production tax credits.
  - Reduce property taxes for renewable energy facilities.
  - Reduce liability risks for responsibly designed and operated wind farms.
4. Building strong Colorado renewables industries.
  - Support the export of Colorado technologies and products.
  - Build a Colorado Renewable Energy Industries Center.
  - Analyze benefits of investment in Colorado renewables industries.
  - Create a single source of information about funding and sources of capital.

5. Preparing for changes under possible utility restructuring.
  - Support renewables through a surcharge.
  - Create disclosure and labeling for electric power.
  - Give green power customers priority in retail pilot programs.
  - Ensure strong and fair markets for green power.
6. Public Education: Spreading the word about renewables.
  - Launch a public awareness campaign for renewables.
  - Develop a public process to ensure responsive leadership
  - Introduce renewable energy curricula to Colorado schools.
  - Promote task force recommendations.
  - Ensure long-term support for renewables at the state level.

An energy and economic modeling exercise was conducted in April 1999 by the consulting firm Stone and Webster, commissioned by the **Colorado Electricity Advisory Panel**. A technical subcommittee of the Panel asked Stone and Webster, as part of its modeling effort to determine the rate impacts of restructuring Colorado's electric power industry, to model an "aggressive environmental (wind)" segment. For analytical purposes, the segment was determined to equal 50 megawatts a year, applied to the base case of 250 megawatts a year of Colorado's electric load growth. The results confirmed what the earlier analysis by the Governor's Renewable Energy Task Force concluded—50 megawatts of wind power a year would have a rate impact of less than one percent on the average residential ratepayer. This encouraging result was with a conventional pricing scenario that came nowhere near the high Colorado natural gas prices experienced a year ago - nor with the encouraging low wind bid prices that were submitted at about the same time.

### **A Diverse Fuel Portfolio Needs to be Pursued**

Just as smart investors diversify their stock portfolio, diversifying the state's power options with Colorado's abundant, cost-effective renewable resources, will reduce price volatility and make the state less dependent on fossil fuel and electricity imports. At present, Colorado is heavily dependent on coal to generate electricity. Colorado is part of a highly integrated western electricity market. Fuel diversity within the larger market is at least as important as fuel diversity within the state. Proposed future generation additions in the West are primarily gas-fired. The volatility of gas prices and concerns about long-term supplies have raised concerns that there should be a public policy that diversifies the fuel used in future generation and that market forces have not led to adequate fuel diversity. The central question is how much should be paid to promote fuel diversity. When considering investments to promote fuel diversity it is important to examine the risks of the fuel sources to which you are diversifying. In the case of solar and wind energy, there is no fuel risk.

## Colorado's Renewable Energy Resources

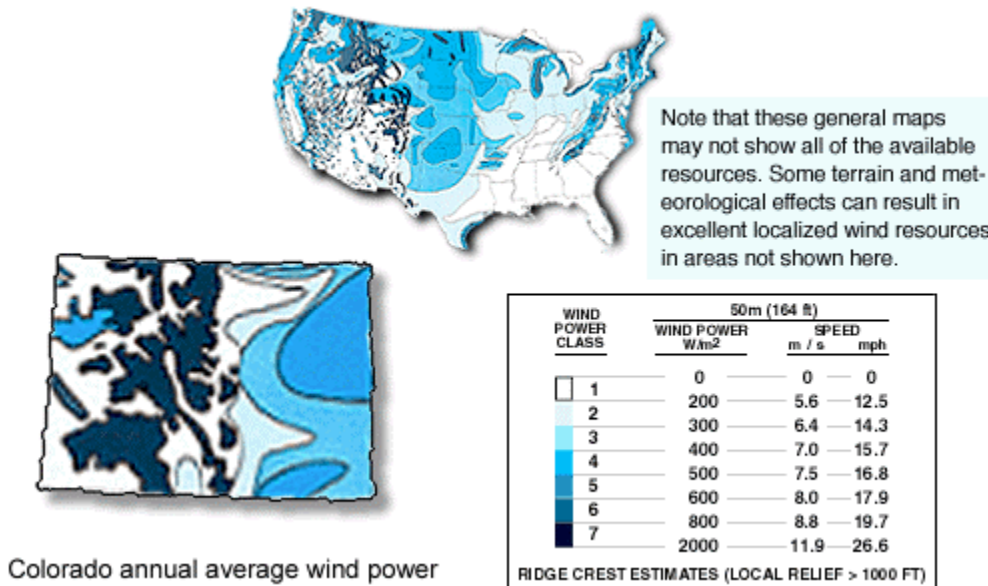
### Colorado Wind Resources

Colorado wind maps available on U.S. Department of Energy websites show general wind power potential, indicating that Colorado has excellent wind resources in portions of the state.

Wind resources can be used with large wind turbines for utility applications and small wind turbines for on-site generation. As a renewable resource, wind power is evaluated according to wind power classes, which are based on typical wind speeds. These steps range from class 1 (the lowest) to class 7 (the highest). In general, wind power class 3 or higher can be useful for generating wind power with large (utility-scale) turbines, and small turbines can be used at any wind speed. Class 4 and above are considered good resources. The USDOE map shows about 16% of the state of Colorado having good wind resources available for development. If Colorado's potential were developed with utility-scale wind turbines, the power produced each year would equal 461,000,000 megawatt-hours – a factor of more than 12 times the entire state's electricity consumption.

A few facts about wind power:

- Wind is the fastest growing source of electricity worldwide. 450 new windmills along the Oregon-Washington line will generate 300 megawatts (MW) by the end of 2001 (enough electricity for 70,000 homes).
- A wind farm on the Nevada Test Site will have 325 wind turbines producing 260 MW upon completion in 2004 (enough power for 260,000 people).
- Germany has over 6000 MW of wind power, and is well positioned to make its goal of 22,000 MW by 2010.
- A 107 MW wind farm in Minnesota sells power at an average cost of 3 cents per kilowatt-hour (kWh), which is competitive with conventional power.



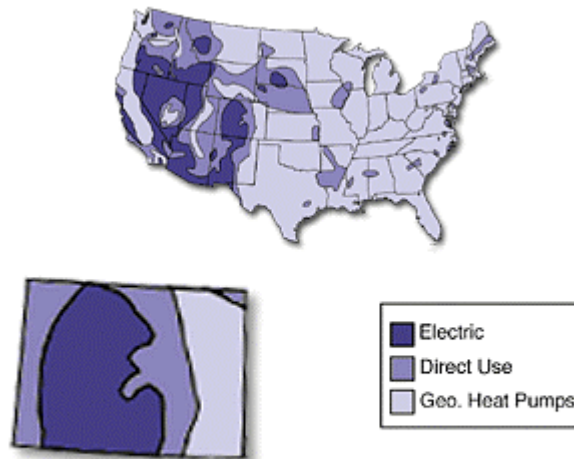
Colorado annual average wind power

## Colorado Geothermal Resources

Two types of geothermal resources are being tapped commercially: hydrothermal fluid resources and earth energy. Hydrothermal fluid resources (reservoirs of steam or very hot water) are well suited for electricity generation. Earth energy, the heat contained in soil and rocks at shallow depths, is excellent for direct use and geothermal heat pumps. Direct-use applications require moderate temperatures; geothermal heat pumps can operate with low-temperature resources.

Colorado has high-temperature resources that are suitable for **electricity generation**. Every geothermal site has a unique set of characteristics and operating conditions. For example, the fluid produced from a geothermal well can be steam, brine, or a mixture of the two; and the temperature and pressure of the resource can vary considerably from site to site. Therefore, a plant design must be carefully matched to the type and temperature of a particular resource.

Direct-use resources can be used to provide heat in a variety of applications. The versatility and inexhaustibility of these resources make it attractive for municipalities, as well as individuals and businesses. **Geothermal heat pumps** are similar to conventional air conditioners and refrigerators. But whereas air conditioners and refrigerators discharge waste heat into the air, geothermal heat pumps discharge waste heat into the ground during hot weather and extract useful heat from the ground during cold weather. They are among the most efficient, and therefore least polluting, heating, cooling, and water-heating systems available.



Colorado geothermal resource

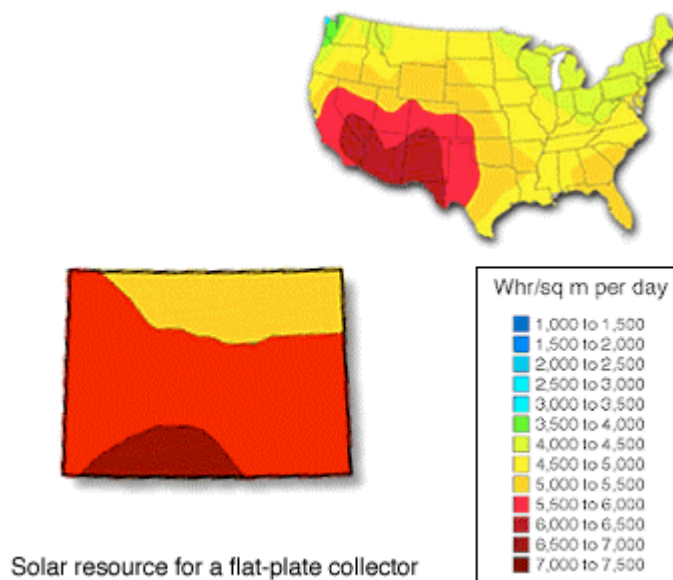
## Solar Panels for Electricity and Heat

Two kinds of solar panels collect sunlight and convert it to either electricity or heat. These technologies include photovoltaic (PV) modules and solar thermal panels. The USDOE maps show how much solar radiation reaches a flat-plate collector, which is installed in a tilted position, for example, on a roof. A general rule of thumb is that a flat-plate collector gets the most sun if it is tilted towards the south at an angle equal to the latitude of the location.

Solar space and water heating are effective in Colorado, and the products on the market today are superior to those that were installed in the pioneering days of solar installations in the late 1970s.

Many of the most cost-effective solar applications have been through simple building design modifications known as "passive solar energy" and "daylighting design." Solar designers often cite examples where a new building's energy consumption was halved at no extra initial cost. Moving a window from the north to south side of a room is one such example. Costs can be reduced since heating and air-conditioning equipment can be down-sized.

The map reveals that for flat-plate collectors, Colorado has very good resources throughout the state. Let's say you installed a PV array with a collector area equal to the size of a football field. In one of Colorado's better locations, you would produce around 1,224,000 kWh per year. This is enough to power about 120 average homes. Because of their simplicity, flat-plate collectors are often used for residential and commercial building applications. They can also be used in large arrays for utility applications.



Solar resource for a flat-plate collector

Solar concentrating devices can be used instead of panels for both thermal and electrical energy collection.

## Colorado Biomass Power Resources

Recent studies indicate that Colorado has a fair biomass resource potential. An estimated 5.2 billion kWh of electricity could be generated using renewable biomass fuels in Colorado. This is enough electricity to fully supply the annual needs of 521,000 average homes, or 42 percent of the residential electricity use in Colorado. These biomass resource supply figures are based on estimates for five general categories of biomass: urban residues, mill residues, forest residues, agricultural residues, and energy crops. Of these potential biomass supplies and the quantities cited below, most forest residues, agricultural residues, and energy crops are not presently economic for energy use. New tax credits or incentives, increased monetary valuation of environmental benefits, or sustained high prices for fossil fuels could make these fuel sources more economic in the future.

**Wood** is the most commonly used biomass fuel for heat and power. The most economic sources of wood fuels are usually urban residues and mill residues. **Urban residues** used for power generation consist mainly of chips and grindings of clean, non-hazardous wood from construction activities, woody yard and right-of-way trimmings, and discarded wood products such as waste pallets and crates. Local governments can encourage segregation of clean wood from other forms of municipal waste to help ensure its re-use for mulch, energy, and other markets. Using clean and segregated biomass materials for electricity generation recovers their energy value while avoiding landfill disposal. **Mill residues**, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Colorado are 158,000 and 180,000 dry tons per year, respectively.

**Forest residues** include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Colorado is 720,000 dry tons per year.

**Agricultural residues** are the biomass materials remaining after harvesting agricultural crops. These residues include wheat straw, corn stover (leaves, stalks, and cobs), orchard trimmings, rice straw and husks, and bagasse (sugar cane residue). Due to the high costs for recovering most agricultural residues, they are not yet widely used for energy purposes; however, they can offer a sizeable biomass resource if supply infrastructures are developed to economically recover and deliver them to energy facilities. An estimated 2,524,000 dry tons per year is available from corn stover and wheat straw in Colorado.

**Energy crops** are crops developed and grown specifically for fuel. These crops are carefully selected to be fast growing, drought and pest resistant, and readily harvested alternative crops. Energy crops include fast-growing trees, shrubs, and grasses such as hybrid poplars, hybrid willows, and switchgrass, respectively. In addition to environmental benefits, energy crops can provide income benefits for farmers and rural landowners. For Colorado, the production potential for energy crops has not been estimated.

**Biofuel Resources.** In general, current U.S. ethanol production is based largely on the starch in kernels of field corn, the nation's largest agricultural crop. (The predominant use of field corn is for animal feed. Current ethanol production uses only about 7% of the crop.) Any starch or sugar crop, however, can now be used to make ethanol.

As commercialization of **advanced bioethanol technology** makes possible ethanol production from biomass other than starch and sugar, vast additional resources will become available to supplement ethanol production from corn kernels. The first advanced bioethanol technology plants will likely use "opportunity" feedstocks such as paper mill or food processing wastes, that are from concentrated sources and now have low value or must be disposed. In the intermediate future, ethanol can be made from agricultural residues such as corn stover (stalks and husks—roughly equivalent in mass to the corn grain crop), or forestry residues such as from lumber mills or from forest thinning to reduce fire danger near urban areas. In the long term, ethanol could be made from dedicated energy crops of fast-growing trees and grasses such as poplars and switchgrass.

Current U.S. **biodiesel production** is based largely on oil from soybeans and recycled restaurant cooking oils. Both of these are currently in surplus and biodiesel production uses only a very minor fraction of available supply. Any animal fat or vegetable oil, however, can be used to make biodiesel.

**Select renewable energy facts:**

- According to a study by five federal research laboratories, a strong national commitment to incorporate renewables and energy efficiency domestically would yield net economic benefits of \$128 billion per year in the U.S. by 2020, or roughly 1% of U.S. GNP. This commitment would yield close to \$1,000 savings per year in energy service costs by 2020 for each U.S. household.
- According to a study by REPP-CREST, wind, solar, biomass, and geothermal technologies have all exceeded published cost reductions from 1975 to present. The use of photovoltaics has grown by 17% annually, while prices have dropped by 20% - 30% for every doubling in cumulative sales. The economics of wind energy has greatly improved over the past 15 years, with costs tumbling by a factor of five.
- Solar power is taking off in Europe and Japan. Japan has set a national goal to install PV on 70,000 roofs, and aims to install 4,600 MW of solar PV by 2010. Since 1994, 33,000 homes in Japan have made use of subsidies to install 120 MW of rooftop PV. Germany has implemented a 100,000-roof solar energy program for a total goal of 300 MW.

## Will Colorado Become America's Renewable Energy Leader?

### Policy Mechanisms Available to Decision-Makers

The preceding discussion demonstrates Colorado's considerable renewable energy potential. Yet Colorado is far behind most other states in the implementation of a public policy agenda that fosters growth in the renewable energy industries. Colorado, with its vast solar and wind resources, and considerable technical skill levels, has the opportunity to become America's leader in researching, manufacturing, and deploying these energy technologies. With this opportunity comes increasing energy productivity and greater long-term energy security. The phrase "considerable technical skill levels" has many facets, including Colorado's industry, universities, and non-governmental organizations. Colorado also is home to the world's premier facility devoted to renewable energy - the U.S. Department of Energy's National Renewable Energy Laboratory (NREL). And this same facility is one of the most important of the Department of Energy laboratories working on energy efficiency - for which there is no similar single designated national center. NREL has roughly 1000 employees and a \$200 million annual budget, which is split about equally between in-house programs and contracted research with industry and universities around the country. Many former NREL employees have set up local renewable energy and energy efficiency businesses. As a national laboratory, NREL responds to requests from across the country, refraining from offering unsolicited policy recommendations. State economic development can be encouraged through greater utilization of this unique resource.

As decision-makers determine whether to expand renewable energy opportunities in Colorado, and establish Colorado's competitive advantage in renewable energy, policy initiatives from other states serve as useful guideposts. Detailed explanations of these plans are included in the appendix.

Twelve policy mechanisms are listed below, along with an accounting of states employing renewable energy and energy efficiency initiatives.

1. **Renewable Portfolio Standard:** Arizona, Montana, Minnesota, Nevada, Texas
2. **Systems Benefit Fund or Universal Service Charge:** 22 states (**not including Colorado**)
3. **Renewable Energy System Personal Tax Credit:** Arizona, California, Idaho, Montana, Oregon, North Carolina
4. **Net Metering:** (now a total of 34 states: partial list:) Arkansas, Arizona, California, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Washington, Wyoming, and **Colorado** (limited to 1200 Xcel Energy customers only)
5. **Electric Fuel Source Information and Disclosure:** Arizona, California, Nevada, Texas, Washington, and **Colorado** (investor-owned utilities only)
6. **Corporate Tax Credit:** Montana (35%), Oregon, Texas
7. **Sales Tax benefit:** Arizona, Washington
8. **Property Tax benefit:** Arizona, Montana, Nevada, Oregon, Texas, and **Colorado**
9. **Rebates:** Arizona, California, Nevada, Oregon, Texas, Washington
10. **Loans:** Arizona, California, Idaho, Oregon, Texas, Washington
11. **Green Power offerings:** Arizona, California, Iowa, Idaho, Minnesota, Nevada, New Mexico, Oregon, Rhode Island, Texas, Utah, Washington, Wyoming, and **Colorado**.
12. **State Agency Green Power purchase requirements:** Maryland (6%), New Jersey (15%)

Of these twelve policy mechanisms, the first four are offered as the most effective means of advancing renewable energy at the State level. Colorado has not adopted the most effective policies. Colorado has adopted four of the remaining nine other policies. Another policy option is the replication of a successful (Texas) scientific polling of electricity customers to determine their preferences of energy sources, environmental interests, and willingness to pay. That scientific polling proved to Texas policy makers that energy consumers wanted and were willing to pay for a shift to renewable energy sources. Texas is now one of the leading states for making this citizen-mandated change.

## **Proposed Policy Initiatives to Encourage Renewable Energy Development in Colorado**

The Colorado General Assembly should consider the following policy initiatives:

**1. Set goals for renewable energy use - the Renewable Portfolio Standard.**

A Renewable Portfolio Standard establishes goals for states to generate certain percentages of total power use from renewable energy sources and savings through gains in energy efficiency. The Texas RPS was adopted in 1999 and signed into law by then Governor George W. Bush, requiring the installation of 2000 megawatts of new renewable capacity by the year 2009. The State of Nevada, with significant solar and wind resources, calls for a 15% RPS by 2010. After reviewing approaches from 10 states, Colorado renewable energy advocates favor adoption of an RPS that would require state utilities to achieve 10% of all new utility generation built in Colorado be supplied by non-hydroelectric renewable energy by 2010. This “10% by 2010” Colorado RPS goal is even more conservative than the “Recommendations of Air Pollution Prevention Forum to Increase the Generation of Electricity from Renewable Resources, Western Regional Air Partnership, Western Governor’s Association.” That forum’s report states “The goal of the States in the Transport Region (including Colorado) should be to achieve annual additions in order that renewables will comprise 10% of the regional power needs by 2005 and 20% by 2015.”

**2. Finance Renewable Energy and Energy Efficiency - a Universal Service Charge.**

A Colorado Telecommunications Universal Service Charge (USC) equaling 2.9% of the customers’ basic telephone service appears on monthly Colorado telephone bills. This charge has provided rural Colorado with an opportunity to receive affordable telephone service and access to modern telecommunications networks. The same type of charge exists in nearly every state. Based upon this same theory, twenty-two states have similar charges attached to electric bills to raise funds for energy-related public purposes. Annual revenues from state USCs (sometimes called System Benefits Funds) programs range from \$1 million (Rhode Island) to \$135 million (California). Administration of the funds varies by state (agencies and non-profits, and in Montana- the utilities). Colorado’s USC could be used to fund energy efficiency programs, low-income weatherization efforts, low-income energy bill assistance, renewable energy and energy efficiency research and development, consumer education programs concerning energy efficiency, renewable energy demonstration and promotion activities, and energy-related environmental improvements. The USC ought not be used to fund large-scale acquisition of renewable energy resources, or utility-sponsored Green Pricing programs, as these investments are paid for separately. The charge should be set at a level that provides at least 1% of the consumers’ bill to be set aside for renewable energy programs. Administrative, governance, and mechanical issues are not addressed in this proposal, but there are many models to choose from in other states. Low-income, energy efficiency, renewable energy, utility, and utility regulatory representatives ought to be brought to the table by legislators to craft a workable proposal for consideration by the Colorado General Assembly.

3. **Promote business.** The state should institute an investment tax credit to assist renewable and energy efficiency business development.
4. **Identify public preferences.** The state should require utilities to query users, using rigorous scientific polling techniques, to determine their preferences regarding energy sources. This has been conducted with great success in Texas, as the results created a will by utilities, regulators, and the public to move Texas into a leadership position relative to renewable energy and energy efficiency.
5. **Expand Net Metering.** The state should require statewide approval of equal tariffs for small-scale renewable energy on-site electric generation and use. Net metering provides an important incentive to homeowners and businesses that are considering installing photovoltaics.

## Appendix

### Definitions of Renewable Energy Policy Mechanisms

The following material was developed by the Database of State Incentives for Renewable Energy, a database of state policies on renewables and efficiency:

#### State Financial Incentives

Many states offer **personal income tax credits or deductions** to cover the expense of purchasing and installing renewable energy equipment. Some states offer personal income tax credits up to a certain percentage or predetermined dollar amount for the cost or installation of renewable energy equipment. Allowable tax credit percentage rates vary between 5% and 40%. Available credit may be limited to a certain number of years following the purchase or installation of renewable energy equipment. Eligible technologies may include solar and photovoltaic energy systems, geothermal energy, wind energy, biomass, hydroelectric, and alternative fuel technologies.

**Corporate tax incentives** allow corporations to receive credits or deductions ranging from 10% to 35% against the cost of equipment or installation to promote renewable energy equipment. In some cases, the incentive decreases over time. Some states allow the tax credit only if a corporation has invested a certain dollar amount into a given renewable energy project. In most cases, there is no maximum limit imposed on the amount of the deductible or credit.

**Sales tax incentives** typically provide an exemption from the state sales tax for the cost of renewable energy equipment.

**Property tax incentives** typically follow one of three basic structures: exemptions, exclusions, and credits. The majority of the property tax provisions for renewable energy follow a simple model that provides the added value of the renewable device is not included in the valuation of the property for taxation purposes. That is, if a renewable energy heating system costs \$1,500 to install versus \$1000 for a conventional heating system, then the renewable energy system is assessed at \$1000. Property taxes are collected locally, so some states allow the local authorities the option of providing a property tax incentive for renewable energy devices. Six states have such provisions: Connecticut, Iowa, Maryland, New Hampshire, Vermont, and Virginia.

**Rebate programs** are offered at the state, local, and utility levels to promote the installation of renewable energy equipment. The majority of the programs are available from state agencies and municipally-owned utilities and support solar water heating and/or photovoltaic systems. Eligible sectors usually include residents and businesses, although some programs are available to industry, institutions, and government agencies as well. Rebates typically range from \$150 to \$4000. In some cases, rebate programs are combined with low or no-interest loans.

States offer a variety of **grant programs** to encourage the use and development of renewable energy technologies. Most programs offer support for a broad range of renewable

energy technologies, while some states focus on promoting one particular type of renewable energy such as wind technology or alternative fuels. Grants are available primarily to the commercial, industrial, utility, education, and government sectors. Some grant programs focus on research and development, while others are designed to help a project achieve commercialization. Programs vary in the amount offered--from \$500 to \$1,000,000-- with some states not setting a limit.

**Loan programs** offer financing for the purchase of renewable energy equipment. Low-interest, or no-interest, loans for energy efficiency are a very common strategy for demand-side management by utilities. Utility loan programs for renewables are offered primarily by municipally-owned utilities. State governments also offer loans to assist in the purchase of renewable energy equipment. A broad range of renewable energy technologies are eligible. In many states, loans are available to residential, commercial, industrial, transportation, public, and nonprofit sectors. Repayment schedules vary; while most are determined on an individual project basis, some offer a 7-10 year loan term.

**Industrial Recruitment Incentives** focus on special efforts and programs designed to attract renewable energy equipment manufacturers to locate within a state or city. Renewable energy industrial recruitment usually consists of financial incentives like tax credits, grants, or a commitment to purchase a specific amount of the product for use by a government agency. The recruitment incentives are designed to attract industries that will benefit the environment and create jobs. In most cases, the financial incentives are temporary measures that will help support the industries in their early years but include a sunset provision to encourage the industries to become self-sufficient within a number of years.

**Utility leasing programs** target remote power customers for which line extension would be very costly. The customers can lease the technology, e.g., photovoltaics, from the utility, and in some cases, the customer can opt to purchase the system after a specified number of years.

A few **utilities sell renewable energy equipment** to their customers as part of a buy-down, low-income assistance, lease, or remote power program.

**Public Benefit Funds (PBF) or Universal Service Charges (USC)** are typically state-level programs as a measure to assure support for renewable energy resources, energy efficiency initiatives, and low-income support programs. The fund created by the charge is most commonly supported through a charge to all customers on electricity consumption. The use of these funds often include: rebates on renewable energy systems and energy efficiency measures; funding for renewable energy R&D and energy efficiency implementation, development of renewable energy education programs, and low-income support for energy issues, including efficiency and renewable energy.

### **Rules, Regulations, And Policies**

**"Disclosure"** typically refers to the requirement that utilities provide their customers with additional information about the energy they are supplying. This information often includes fuel mix percentages and emissions statistics. Fuel mix information, for example, can be presented as a pie chart on customers' monthly bills. "Certification" is a related issue, which refers to the assessment of green power offerings to assure that they are indeed utilizing the type

and amount of renewable energy as advertised. One example of green power certification is the *Green-e* stamp. Both disclosure and certification are designed to help consumers make informed decisions about the energy and supplier they choose. It is worth noting, though, that two states that have not moved ahead with restructure--Florida and Colorado--have enacted disclosure provisions. Indeed, disclosure is often thought of as a good policy to help educate customers about electricity and thereby to prepare markets in advance of retail competition.

**Renewables Portfolio Standards (RPS)** require that a certain percentage of a utility's overall or new generating capacity or energy sales must be derived from renewable resources, i.e., x% of electric sales must be from renewable energy in the year 200x. Portfolio Standards most commonly refer to electric sales measured in megawatt-hours (MWh), as opposed to electric capacity measured in megawatts (MW). The term "set asides" is frequently used to refer to programs where a utility is required to include a certain amount of renewables capacity in new installations. On September 20, 2001, the European Commission adopted specific country guidelines in an attempt to double energy generation from renewable energy sources by 2010. The EU Council of Ministers and the European Parliament have already approved the Commission directive. It should increase the share of electricity generated by wind, solar and water from the current 6 percent to 12 percent in the energy balance of western European countries. The directive of the European Commission sets concrete targets for each member country to increase the current level of electricity generation from renewables. Britain, where the share of wind and solar electricity is among the smallest, must bring its green power generation to 10 percent from 1.7 percent. France must increase to 21 percent from 15 percent, while Sweden must increase its share of renewables in the national energy mix to 60 from 49 percent.

For those consumers who have their own electricity generating units, **net metering** allows for the flow of electricity both to and from the customer through a single, bi-directional meter. With net metering, during times when the customer's generation exceeds his or her use, electricity from the customer to the utility offsets electricity consumed at another time. In effect, the customer is using the excess generation to offset electricity that would have been purchased at the retail rate. This may be thought of as analogous to the installation of compact fluorescent light bulbs or other efficiency devices that reduce total electricity consumption. Under most state rules, residential, commercial, and industrial customers are eligible for net metering, but some states restrict eligibility to particular customer classes.

When an electric customer requests service for a location not currently serviced by the electric grid, they are charged a distance-based fee for the **cost of extending power lines** to their load. In many cases it is cheaper to have an on-site renewable energy system to meet their electricity needs. Certain states require utilities to provide their customers with information on renewable energy options when a line extension is requested.

Many states have rules regarding the **licensing of renewable energy contractors**. Contractor licensing requirements can be enacted for solar water heat, active and passive solar space heat, solar industrial process heat, solar thermal electricity, and photovoltaics. These requirements--where they do exist--are designed to ensure that contractors have the necessary experience and knowledge to properly install systems.

Statutes **requiring renewable energy equipment to meet certain standards** are generally seen as a tool for reducing the chance that consumers will be sold inferior equipment. Beyond being a consumer protection measure, equipment certification benefits renewables by reducing the number of problem systems and the resulting bad publicity.

**Solar and wind access** laws statutes provide for solar or wind easements or access rights. Easements allow for the rights to existing access to a renewable resource on the part of one property owner to be secured from an owner whose property could be developed in such a way as to restrict that resource. This easement is transferred with the property title. Access rights, conversely, automatically provide for the right to continued access to a renewable resource. Solar easements are the most common type of state solar access rule. Furthermore, some states prohibit neighborhood covenants that preclude the use of renewables. At the local level, communities use many different mechanisms to protect solar access, including solar access ordinances, development guidelines requiring proper street orientation, zoning ordinances that contain building height restrictions, and solar permits.

**Construction and design policies** include state construction policies, green building programs, and energy codes. State construction policies are typically legislative mandates requiring an evaluation of the cost and performance benefits of incorporating renewable energy technologies into state construction projects such as schools and office buildings. Many cities are developing "Green Building" guidelines that require or encourage consideration of renewable energy technologies. Some guidelines are voluntary measures for all building types, while others are requirements for municipal building projects or residential construction. Local energy codes are used to achieve energy efficiency in new construction and renovations by requiring that certain building projects surpass state requirements for resource conservation. Incorporating renewables is one way to meet code requirements.

**Sources of Information contained in this report include:**

- American Solar Energy Society
- American Wind Energy Association
- Colorado Public Utilities Commission
- Colorado Electricity Advisory Panel (see COPUC)
- Colorado Renewable Energy Society
- Colorado Governor's Renewable Energy Task Force
- Interstate Renewable Energy Council
- National Renewable Energy Laboratory
- Western Governors Association

## **Related Websites**

American Council for an Energy Efficient Economy

[www.acee.gov](http://www.acee.gov)

American Solar Energy Society

[www.ases.org](http://www.ases.org)

American Wind Energy Association

[www.awea.org](http://www.awea.org)

Colorado Public Utilities Commission

<http://www.dora.state.co.us/puc/>

Colorado Electricity Advisory Panel

<http://www.dora.state.co.us/puc/euir/euir.htm>

Colorado Solar Decathlon

[www.solar.colorado.edu](http://www.solar.colorado.edu)

Colorado Renewable Energy Society

[www.cres.gen.co.us](http://www.cres.gen.co.us)

Department of Energy – Office of Power Technologies

[www.eren.doe.gov/power](http://www.eren.doe.gov/power)

[www.eren.doe.gov/power/rep/html](http://www.eren.doe.gov/power/rep/html)

Energy Information Administration

[www.eia.doe.gov](http://www.eia.doe.gov)

Energy-efficient Product Information

[www.energystar.gov](http://www.energystar.gov)

National Renewable Energy Laboratory

[www.nrel.gov](http://www.nrel.gov)

Solar Energy Industries Association

[www.seia.org](http://www.seia.org)

Union of Concerned Scientists

[www.ucsusa.org](http://www.ucsusa.org)

U.S. Environmental Protection Agency

[www.epa.gov](http://www.epa.gov)