RENEWABLE PORTFOLIO STANDARDS

Report prepared for the

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
STATE OF HAWAII

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1.0 EXECUTIVE SUMMARY AND STUDY OBJECTIVES

The State of Hawaii's Department of Business, Economic Development & Tourism (DBEDT) is actively involved in energy related matters in Hawaii. Recent discussion of the possibility of instituting a Renewable Portfolio Standard (RPS) in Hawaii led to the need to identify similar measures in other states and the costs, benefits, and implementation issues associated with such measures.

A Renewable Portfolio Standard establishes a requirement that a gradually increasing percentage of a state's electricity be generated from renewable resources; typically, defines the types of renewable resources that qualify; and provides a schedule for reaching the desired goals. In addition, some programs establish a renewable credit trading program in which electric generators can either generate the required percentage of electricity from renewable sources or can purchase renewable credits from a generator with excess renewable generation.

The scope of work of this project included the following tasks:

- Clearly define RPS (what is a renewable portfolio standard?);
- Compile a list of states that currently have renewable portfolio standards;
- Identify whether these standards are: (1) mandated by legislation; (2) mandated by government regulation; or (3) pending;
- Summarize the provisions existing for RPS in each state;
- Compile any cost data available for implementing RPS, where available;
- Compile data on the cost of renewable options versus fossil options, where available;
- Compile data on estimated rate impacts, where available;
- Compile estimated economic impacts (e.g., GSP, personal income, employment);
- Compile data, where available, on lessons learned from other states having implemented RPS provisions; and
- Make recommendations for Hawaii for consideration by State policy makers.

To accomplish these objectives, an extensive literature and database search was conducted to identify the most current information concerning the status of RPS programs in the United States. In addition, after having identified the states with existing RPS programs or renewable set-aside requirements, experts in each state were contacted to confirm the validity of the information gathered, determine the current status of the program, learn of any economic, environmental or other benefits observed or estimated, and review any lessons learned that might be applied in Hawaii.

Listed in Table 1 are the experts contacted in each state. The key findings from these interviews are presented later in this report. Based on discussions with the eleven states, it is clear that there are numerous economic and portfolio diversification benefits of renewable energy requirements. Furthermore, it is clear from the literature search that the negative cost impacts of RPS provisions are minimal.

Table 1 - Interviews with Representatives of States with Renewable Energy Requirements

State	RPS Expert Contacted	Organization
Arizona	Ray Williamson	Arizona Corporation Commission
Iowa	Monica Stone	Department of Natural Resources
Maine	Stephen Ward / Laurie LaChance	Maine Public Advocate / Maine State Economist
Massachusetts	Gene Heinz Fry	Department of Telecommunications and Energy
Minnesota	Michael Noble	Minnesotans for an Energy Efficient Economy
Nevada	David McNeil	Nevada Energy Office
New Jersey	Robert Chilton	Gabel and Associates
Pennsylvania	John Hanger	Citizens for the Future of Pennsylvania
Texas	Eric Schubert	Public Utility Commission of Texas
Wisconsin	Don Wichert	Wisconsin Department of Administration

2.0 STATUS OF RENEWABLE PORTFOLIO STANDARDS IN THE UNITED STATES

A Renewable Portfolio Standard (RPS) is a policy to encourage the use of renewable energy sources. It sets minimum targets for the production of electricity generated from renewable resources. The aim is to guarantee a minimum market for the renewable energy industries, thus allowing them to make the investments needed to bring down costs and eventually attain full competitiveness.

Other positive benefits of an RPS include job creation, reduced reliance on foreign oil, reduced air pollution, reduced greenhouse gas emissions, increased environmental security, and conservation of limited fossil resources.

The review of the status of RPS programs in the United States has identified eleven states that have implemented Renewable Portfolio Standards or renewable energy set-asides.

The renewable energy requirements that have been implemented are shown in Table 2 below. This table provides a description of the various requirements that have been implemented including the authority for the standard (law, regulation, etc.), the requirements of the standard, the types of qualifying technologies, funding for the program, and additional comments.

TABLE 2

STATES WITH RENEWABLE ENERGY REQUIREMENTS

State	Authority	Technology / Requirements / Comments	Funding
Arizona	The Arizona Corporation Commission (ACC) approved the "Solar and Environmentally Friendly Portfolio Standard" 4/26/2000.	**Technology:** Solar, wind, landfill gas, biomass. **Requirements:** 0.2% of utility electricity to be from renewable energy (50% of that to be solar), 0.8% by 2004; with ACC review, requirement continues to 1.1% renewable (60% solar) by 2007. **Comments:** Funding is from monthly utility bill surcharges and a systems benefit charge. Caps: 35¢ per month residential, $13/month other, $39/month for customers over 3 MW load.	.0875¢/ kWh Annual funding= $15-$20 million
Connecticut	Law – H.5005 Licensing regulations involving RPS complete (Docket # 98-0615) Law revised in 1999 (HB 6621)	**Technology:** Class 1 Technologies: solar, wind, hydro, sustainable biomass, landfill gas, fuel cells. Class 2 Technologies: hydro, MSW, other biomass **Requirement:** (% of sales) Class 1 or 2: 5.5% in 2000; 6% in 2005; 7% in 2009. Class 1: 0.5% in 2000 +0.25%/yr to 1% by 2002 +0.5%/yr to 3% by 2006 + 1%/yr to 6% in 2009. **Comments:** • Law allows state to implement credit trading program. • Does not apply to municipal and cooperative utilities. • 1999 revision to law allows DPUC to delay the RPS targets by up to 2 years if it finds that requirements cannot reasonably be met. • 1999 DPUC decision to exempt standard offer service from meeting RPS is under appeal. • Funding through a non-bypassable wires charge.	Total Funding = $22 million; Mils/kWh =0.75; 0.75% of revenue
Iowa	Law: Alternate Energy Production Law 1983, revised 1991.	**Technology:** Solar, wind, methane recovery, biomass **Requirement:** 105 average MW, 2% of 1999 sales **Comments:** • Applies to investor-owned utilities (IOUs) only • 250 MW of mostly wind installed	

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TABLE 2 - STATES WITH RENEWABLE ENERGY REQUIREMENTS (continued)			
State	**Authority**	**Technology/Requirements/Comments**	**Funding**
Maine	Law: LD1804 and Public Law chapter 316 Regulations final Docket 97-584, law revised in May 1999	**Technology:** Fuel cells, tidal power, solar, wind, geothermal, hydro, biomass and municipal solid waste (MSW) (under 100 MW) High efficiency cogeneration systems of unlimited size **Requirement:** 30% of sales in 2000 (start of competition) **Comments:** • Renewables currently 46-51% of generation • PUC makes recommendations for changes to legislature no later than 5 years after beginning of retail competition • No credit trading • RPS to be met on a product basis • A recent RFP revealed a 5-10% premium for meeting Maine's RPS • Many qualifying projects are biomass • RPS supported by Maine Electricity Coalition and Independent Energy Producers of Maine	
Massachu-setts	Law: Chapter 164 of the Acts of 1997 Scheduled to begin RPS design in fall 1999	**Technology:** Solar, wind, ocean, clean biomass. Hydro and MSW qualify as existing, but not as new renewables **Requirements:** State to determine existing renewables by 12/31/99 (approx. 7%); +1% from new renewables by 2003; +0.5%/yr to 4% by 2009; +1% per year thereafter until date determined by Division of Energy Resources **Comments:** • +1% new renewables requirement may start one year after any renewable within 10% of average spot market price of electricity. • Language ambiguous as to whether requires support for existing level of renewables. • Does not apply to municipal and cooperative utilities	Total Funding =$30 million; Mils/kWh = 0.7; 0.07% of revenue
Minnesota	• Radioactive Waste Management Facility Authorization (1994) Minn. Stat. 216B.2423 • MN PUC order Docket E-002/RP-98-32	**Technology:** Wind (825 MW) and biomass (125 MW) Preference for in-state projects **Requirements:** 550 MW by 2002; 400 MW more wind by 2012 (4.8% of 2012 sales) **Comments:** • Northern States Power allowed to build temporary dry cask storage of nuclear waste at Prairie Island nuclear plant in exchange for renewable energy development. • 1999 PUC order determined 400 more MW of wind by 2012 was in the public interest.	
Nevada	Implementation Task Force underway Nevada PUC considering comments filed in March 1999. Nevada law enacted in 1997 for RPS – Deregulation: Assembly Bill 366 (www.leg.state.nv.us) PUC will establish docket for rulemaking	**Technology:** 50% from solar, 50% from wind, biomass, geothermal in state. Solar hot water eligible. **Requirements:** 0.2% in 2001, rising 0.2% biannually of 1% in 2009 **Comments:** • Applies to IOUs and independent power producers (IPPs), but not cooperatives, municipal utilities or general improvement districts. • Utilities with 9% or more of their electricity coming from renewables in 1997 are deemed to be in compliance until 2005. One utility exempted until 2005. • Major supporters of legislation were the National Renewable Energy Laboratory and the Nevada Consumer Advocate • Economic analysis developed to show benefits of RPS	

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TABLE 2 - STATES WITH RENEWABLE ENERGY REQUIREMENTS (continued)			
State	**Authority**	**Technology/Requirements/Comments**	**Funding**
New Jersey	Restructuring law passed in January 1999	**Technology:** Class I: solar, wind, fuel cells, geothermal, wave, tidal energy, landfill gas, sustainable biomass. Class II: MSW or hydro that meets high environmental standards. **Requirements:** Class I or II Technologies 2.5%. 0.5% more from Class I by 2001; 1% by 2006 and increasing by 0.5%/yr to 4% by 2012 **Comments:** • Standard applies to retail and basic generation suppliers. • Credit trading jointly implemented by NJ Board of Public Utilities and NJ Department of Environmental Protection. • Funding via a surcharge on the wires charge, the same as existing demand-side management (DSM) costs. 25% of new units must be renewable. • Major supporters: NRDC, utilities, environmental groups.	Total Funding =$30 million; Mils/kWh =0.45; 0.45% of revenues
Pennsylvania	Being addressed in individual utility restructuring cases.	**Technology:** Non-hydro renewables **Requirements:** For PECO, West Penn, and PP&L, 20% of residential customers served by competitive default provider; 2% in 2001, increasing 0.5%/yr. For GPU, 0.2% in 2001 for 20% of customers increasing to 80% in 2004. **Comments:** Requirement imposed on service-territory basis.	Total Funding= $2 million Mils/kWh =0.02; 0.02% of revenue
Texas	Senate Bill 7 www.capitol.state.tx.us/cgi-bin/tlo/ Draft regulations published 10/99. Regulations were adopted in December 1999.	**Technology:** Solar, wind, geothermal, hydro, wave, tidal, biomass, biomass-based waste products, including landfill gas **Requirements:** New & existing renewables: 1,280 MW by 2003; 1,730 MW by 2005; 2,280 MW by 2007; 2,880 MW by 2008 (existing = 880 MW, approx. 2.3% of 2009 sales) **Comments:** • Commission to establish credit trading program • Munis and co-ops subject to requirement if they opt in to retail competition. • Draft regulations require 2,000 MW new renewables by 2009 and energy-based standard. • Facilities installed after 1995 are eligible for credits (above the 2,000 MW requirement).	Total Funding = $15 million+; Mils/kWh =0.065; Revenue = 0.1%+
Wisconsin	Act 9 of 1999 (legislation passed November 1, 1999)	**Technology:** Wind, solar, biomass, geothermal, tidal, a fuel cell that uses a renewable fuel, hydro under 60 MW. **Requirements:** 0.5% by 2001, increasing to 2.2% BY 2011 (0.6% can come from facilities installed before 1/1/98) **Comments:** • 50 MW new renewables by 2000 (included in 1998 Reliability Act) are eligible. • IOUs, munis and co-ops are subject to the requirement. Northern States Power excluded. • First state to adopt RPS without retail competition. • Legislation was supported by a coalition of environmental organizations and small utilities. Renew Wisconsin was a key supporter. • A $500,000 penalty may be assessed for non-compliance. • Wisconsin Electric Power has issued an RFP for 75 MW of renewable capacity.	Total Funding =$3.8 million; Mils/kWh =0.1; 0.15% of revenue

3.0 PREVALENT FORMS OF RENEWABLE PORTFOLIO STANDARDS

Each state is unique, and each RPS reflects the state's specific energy supply situation and the types of renewable resources that are technically feasible.

For example, some states have significant hydroelectric power, but no geothermal. Other states rely primarily on wind or biomass for their renewable energy sources. In addition, each RPS reflects the unique political situation and process in each state.

However, the standards that have been implemented to date tend to have some common characteristics, which include:

- The amount of renewable resource required is based on the energy provided from the renewable (e.g. kilowatt-hours or megawatt-hours of energy produced per year) rather than requiring a specified amount of renewable generation capacity (e.g. kilowatts or megawatts of capacity).
- Most standards allow a wide variety of renewable energy resources including wind, solar, biomass, hydro, solid waste (MSW), fuel cells, methane recovery, tidal power, and geothermal.
- Some states allow only a few types of renewable resource. Examples include solar in Arizona, wind and biomass in Minnesota.
- Standards generally distinguish between existing renewable resources and new renewable resources as of a specified date.
- Most standards contain a schedule for increasing the amount of renewable energy produced over a several year period. Rates of increase range from 0.25% per year to 1% per year. Several states require the rate of increase to accelerate over time. Maine is the only state that mandates a major portion of renewable power (30%) commencing with deregulation on March 1, 2000. However, Maine has historically received 50% of its power from renewable sources.
- Some states apply the renewable energy requirements only to investor-owned utilities (IOUs) or independent power producers (IPPs) while other states apply the requirements to all providers of electric generation, including co-operatives and municipalities.
- Adoption of renewable portfolio standards (RPS) in several states occurred in conjunction with restructuring dockets. In Pennsylvania, implementation of an RPS was a minor issue in the restructuring docket. The investor-owned utilities were most interested in the treatment of stranded costs and agreed to the RPS without much resistance.

As described above, many of the renewable energy requirements that exist today have some common elements. The combination of available renewable energy sources, existing energy policies, and political forces at work will create a Renewable Portfolio Standard for Hawaii uniquely structured to meet the needs of the state.

4.0 LESSONS LEARNED

To date, there is little actual experience with the functioning of a Renewable Portfolio Standard. Of the 11 states that currently have renewable energy requirements, the earliest start is in the year 2000 with most programs being implemented between 2001 and 2003. However, several important lessons learned in the development and implementation of an RPS have been identified in the literature and in the interviews with states.

If a Renewable Portfolio Standard is to be successful and have the desired result, the details of the program must be carefully constructed. The following lessons learned[1] should be considered in development of an RPS for Hawaii.

1. Establish a Realistic Set of Goals

Development of a Renewable Portfolio Standard of necessity requires making informed tradeoffs between different program designs. In order to make these tradeoffs, a realistic set of goals for the program must be established. Efforts should be focused on technologies or markets where state policies might have a lasting impact.

[1] For more details, refer to Reference 13, "Emerging Markets for Wind Power: The Role of State Policies Under Restructuring."

2. Strive for "Market Transformation"

It is unlikely that state policies will last forever. Successful policies will be those that strive to "transform" markets and create a continuing demand for renewables after the policy is removed.

3. Identify Eligible Projects and Technology

Varied approaches have been taken to identifying technologies to be included in the RPS. Most policies include wind, solar, geothermal and some forms of biomass. Treatment of other renewables such as hydro, fuel cells and MSW as well as the distinction between existing and new projects varies between states. Support should generally be provided to technologies that provide substantial and incremental public benefits.

4. Resource Diversity

Renewable energy should include a mix of technologies with diverse characteristics, market needs, costs and social benefits.

5. Policy Stability and Duration

Short duration policies can create immediate markets for renewables but can be destabilizing, making the renewable industry vulnerable to changing political forces. With restructuring there is a tendency for renewables policies to become part of much larger negotiations. Policy duration and stability are especially important for RPS where facilities will be brought on-line under the expectation of continued support. Without some certainty in the length and stability of the policy, new renewable generators will need to amortize their capital costs over a shortened period, increasing the near-term cost. Therefore, continuity in the scope, scale and duration of a renewables policy should be sought.

6. Green Power Market Interactions

Green power marketing involves offering electricity customers an opportunity to voluntarily purchase all or part of their electricity from a company using renewable resources, generally at a premium price. Green power is generally available only in markets where electricity industry restructuring has resulted in retail competition. If a significant green power market exists, RPS should be implemented on a product rather than a company basis. Otherwise, generators may shift their entire renewables purchase requirement into a single green product sold at a premium to those customers willing to pay more for green power.

7. Compatibility with Other State and Federal Policies

State policy makers need to ensure that their programs are compatible with other state and federal policies. If the RPS is to include renewable credit trading, the standard must be compatible with fuel source disclosure requirements and other state regulations that could influence the free trade of renewable credits.

Suggestions from Interviews

Several individuals who were interviewed had specific recommendations for a state considering the establishment of a RPS. These include:

John Hanger, President of Citizens for the Future of Pennsylvania and a former Commissioner of the Public Utility Commission, recommends:

- Start the level of renewables slightly above the existing level;
- Escalate to a total of approximately 10% within 10 years;
- Emphasize the public health benefits;
- Emphasize price stability and lack of risk from rising fuel prices.

Monica Stone, of the Iowa Department of Natural Resources, provided the following recommendations:

- The enacting legislation needs to be as clear and succinct as possible. It should be very specific to leave little room for argument;
- A knowledge of the potential renewable resources and estimated costs will prove useful in supporting the RPS;
- Consider using incentives, including carbon credit trading, to move the market.

Ray Williamson of the Arizona Commerce Commission recommends promoting an RPS from the purely economic perspective. He recommends performing an input/output study to show the additional industry and jobs created by a renewables industry. This is discussed further in the next section.

As very little experience exists with operational Renewable Portfolio Standards, these lessons learned are based on experience with developing an RPS and addressing concerns.

5.0 RELATIVE COST OF RENEWABLES TECHNOLOGIES

Renewable technologies are generally characterized by relatively high capital costs and relatively low fuel and operation and maintenance (O&M) costs. When comparing the cost of various types of electric generation, a "levelized" cost approach is usually employed.

In levelizing costs, capital costs are amortized over the expected power output for the life of the plant. The Energy Information Administration (EIA) of the US Department of Energy has estimated the levelized costs of all generating technologies using its National Energy Modeling System (NEMS). Tables 14 through 17 of reference 6 in the bibliography of this report show cost and performance information for fossil and renewable technologies for the major regions of the country best suited for renewables, but do not include Hawaii.

In the California-Southern Nevada region, geothermal appears to be the least costly but there is very limited capacity available for development at the estimated price of 37.6 mils per kWh. Wind power offers a 10 percent advantage over natural gas fired combustion turbines on the Mainland but it is intermittent and cannot be credited as firm capacity. The levelized cost of biomass is about double that of wind and gas combustion turbines. Note that the cost of energy generated by oil fired combustion turbines can be 2 to 3 times the cost of energy from natural gas fired combustion turbines depending on the cost of fuel in a specific geographic location.

In the Northwest and the Southwest, the cost comparisons are about the same except that biomass is about one-fourth less expensive than in California. In most of Texas, natural gas combustion turbines are 10 mils per kWh cheaper than the next cheapest technology, wind power. Biomass in eastern Texas produces power for approximately the same as in the Northwest and California.

A number of state public utilities commissions including Rhode Island and Massachusetts have studied levelized cost of renewables. For more detailed information, see References 6 and 12 (excerpt provided in Appendix 2 of this report).

Generation costs in Hawaii are included in Appendix 1. Note that Appendix 1 contains both HECO estimates of generation costs and actual costs of renewables in current existing contracts for power purchases. The actual costs for biomass, geothermal and wind generated power are significantly less than HECO's estimates.

6.0 ECONOMIC BENEFITS OF RPS

Overview of Economic Benefits

Renewable energy resources such as wind, biomass and solar energy can provide clean energy with very limited environmental impacts and can produce local economic gain. Renewable energy resources can help reduce the "external" costs of energy supply and utilization. In Hawaii, with its heavy reliance on fossil fuels (especially oil) for the generation of electricity, use of renewable energy can reduce the external and environmental costs of the electric system, and can reduce the risk of oil spills and the risk of fouling Hawaii's economically critical beaches. Renewable energy development can also lead to significant job creation as opposed to reliance on central station power plants fueled by fossil fuels. The benefits listed in Table 3 are those cited most frequently in the literature.

Table 3
Examples of Economic Benefits of Renewable Resources

1.	Job creation
2.	Reduced reliance on foreign oil and gas supplies
3.	Risk management (due to diversifying the portfolio of energy resource options)
4.	Reduced air pollution
5.	Reduced greenhouse gas emissions
6.	Increased environmental security for future generations
7.	Conservation of fossil resources for future generations

In Hawaii, fossil-fired power plants produce a high percentage of the nitrogen oxide, sulfur dioxide, mercury and carbon dioxide emissions. A number of other toxic pollutants emitted by and present in the combustion wastes from fossil-fired power plants pose additional threats to public and environmental health. In order to reduce these polluting emissions

and wastes, the electric industry in Hawaii will need to begin using cleaner fuels and cleaner technologies, such as renewable energy, for generating electricity.

Without serious state commitment to clean electricity, the market share of renewable energy will stagnate or decline as has occurred in Hawaii in the 1990s. To believe that the market alone will achieve larger goals of sustainability, increased renewable energy and significant fuel diversity is wishful thinking.

Government intervention is necessary, because the price tag for electricity generated by fossil fuels does not include most of the costs of damage such generation causes to the environment and human health. Furthermore, the market does not assign value to the public benefits of renewable energy. Predominant among those public benefits are environmental benefits from the displacement of additional fossil or nuclear generation. Renewable energy deployment also provides substantial society-wide benefits via price stability and reliability benefits from the existence of multiple and distributed fuel sources; readiness benefits in the event of sudden fuel price spikes or fuel supply disruption; technology development potential, including export potential; and the benefits provided by conserving fossil resources for future generations.

The next section presents examples of specific economic benefits of renewable resources found to exist by those States that have implemented Renewables Portfolio Standards and economic benefits assessed by national organizations such as the Union of Concerned Scientists (UCS) and the National Renewable Energy Laboratory (NREL). Our review of the available literature indicates the existence of several research studies documenting the economic (personal income, job creation, etc.) benefits of RPS.

Arizona

The State of Arizona recently completed a study of the economic impacts of a Solar Portfolio Standard.[2] The solar portfolio percentage (percent of total retail energy sold) increases annually from 0.4% in 2001 to 1% for the year 2005 and after. Analysis of a number of solar portfolio scenarios showed that the Solar Portfolio Standard will provide significant employment increases over a base case scenario, as well as increased income for the State. It was also determined that the SPS could help stimulate a renewables manufacturing industry in Arizona.

The State also evaluated the costs and ratepayer impacts of a broader Renewables Portfolio Standard in 1999. While economic benefits were not assessed in this second study, the study results indicated that implementation of a broader portfolio standard resulted in slightly higher electric bills for ratepayers (0.5% higher).[3]

Minnesota

In Minnesota, proponents of the RPS submitted a lengthy report (40 pages) to the Minnesota legislature in September 1999.[4] The RPS supporters cited an assessment of economic benefits for the region prepared by the Union of Concerned Scientists (UCS). The UCS study showed that the High Plains region could get over half of its electricity from renewables (wind and biomass) by 2020 under a 20 percent national RPS, for an additional $1.33 on a typical household's monthly electricity bill.

Since the level of development exceeded the 20 percent requirement, renewable developers in the region would be able to sell excess credits to other states to help meet the national requirement at the lowest cost. The income received from these credit sales would support the development of a renewable energy industry in Minnesota, providing jobs and income for state businesses, farmers, and rural economies, diversifying the state's energy mix, and capturing environmental benefits. The study prepared by RPS supporters in Minnesota also documented the environmental and health impacts from power plant pollution.

There is also a coalition in Minnesota that promotes development of renewable resources. The Sustainable Energy for Economic Development (SEED) project is a community-based renewable energy campaign started in 1993 in Minnesota. Four organizations: Clean Water Fund, Minnesotans for an Energy-Efficient Economy, The Minnesota Project and the Sustainable Resources Center, have joined

[2] Arizona Corporation Commission, "Assessing the Economic Impacts of a Solar Portfolio Standard in Arizona," prepared by MRG & Associates, July 1999.

[3] Arizona Corporation Commission, "Evaluation of a Renewable Portfolio Standard in Arizona."

[4] Comments to Minnesota's Legislative Electric Energy Task Force, submitted September 30, 1999 by the Center for Energy and Environment, Institute for Local Self Reliance, Izaak Walton League of America, Clean Water Action Alliance, Minnesotans for an Energy Efficient Economy, and the Union of Concerned Scientists.

forces to work with farmers, rural leaders, and energy advocates to build a stronger base of support for renewable energy development in the state. The goals of the project are to broaden the base of support for renewable energy to develop as much renewable electricity in the state as possible, to sustain existing momentum despite increasing market pressure against renewables, and to do this in ways that provide direct benefits to the host rural communities. SEED has assembled a comprehensive list of the benefits of renewable energy. Most of the cited benefits apply to Hawaii.

R E N E W A B L E E N E R G Y B E N E F I T S . . .

FOR EVERYONE

- Provides cheap, clean and reliable electricity. Renewable energy resources can be developed in an economically efficient and environmentally safe way. Renewables can potentially produce more than enough electricity to meet the energy needs of the state. The most promising Minnesota renewables are wind energy, biomass energy and solar energy from photovoltaics (PVs).
- Creates little or no pollution or waste. Air pollution, land damage from coal mining, contamination of water supplies, global warming and deadly radioactive nuclear waste are the results of coal and nuclear power production, which currently generate nearly all of the state's electricity. Renewables possess minimal environmental risk.
- As renewable energy technology progresses, performance continues to improve and price continues to decline. Coal-fired electricity has seen no significant improvement in price or performance in 30 years; and oil is very susceptible to future price increases.
- Develops an energy source that cannot be depleted. Because wind, biomass and PV resources are dependent only on the sun's energy, their supply will not be depleted by use.

FOR UTILITIES

- Provides customers with the clean and reliable electricity they want. Numerous surveys show that customers have a strong preference for clean energy and are willing to pay more for that energy.
- Creates a diverse electricity supply. By adding diversity to its electricity supply, utilities can gain valuable experience with the technologies of the future.
- Protects against future environmental regulations and pollution taxes and increases price stability. Renewable energy ensures against price increases due to environmental protection. Because most renewables produce no emissions or waste, there is no future risk of price hikes due to environmental externalities.
- Lowers risks because additional energy capacity is manufactured incrementally. As energy demand increases, wind, biomass and PV generation can be added in small stages without the large scale, long-term investments required in constructing oil and coal power plants.

FOR RURAL COMMUNITIES

- Allows farmers to diversify the types of crops they grow and the markets they sell them to. The farmer's risk of downswings in other crop markets is decreased with investment in production of energy crops or leasing of farmer’s land for such renewable resources as wind.
- Revitalizes rural economic development. Energy dollars that once were sent out of the area can now remain in the community where they are earned.
- Creates more jobs, earnings and sales than any other energy production. According to the New York State Energy Office, wind energy systems create 25 to 70% more jobs than conventional power plants producing the same amount of electricity.
- Increased independence from large corporations. Rural communities will have the ability to become energy self-reliant and have more control over the energy source used and the price that is paid for electricity.
- Increases civic pride. Local renewable energy projects will boost community involvement and demonstrate an example for other communities.

Excerpted from Minnesota's Sustainable Energy for Economic Development Project

Nevada

David McNeil of the Nevada Energy Office reported that the State of Nevada worked closely with the National Renewable Energy Laboratory and the Corporation for Solar Technology (CST) to prepare a thorough economic analysis of the costs and benefits of a renewables portfolio standard. The results of this economic analysis provided factual support for RPS with Nevada's legislature.

Wisconsin

The State of Wisconsin Department of Administration used a dynamic macroeconomic model of the Wisconsin economy to estimate the economic impacts of displacing a portion of future investment in fossil fuel power plants (coal and natural gas) with renewable energy resources (biomass, wind, solar and hydro).[5] The levelized costs of various generating resources provided in this paper are shown in the table below. The total cost shown includes fuel, capital, operation and maintenance and environmental costs.

The modeling results show that renewable energy investments produce over three times more jobs, income and economic activity than the same amount of electricity generated from coal and natural gas power plants.

Table 4
Wisconsin Energy Source Cost Estimates
Levelized Cost of Electricity, 2000 – 2030
Cents per kWh in 1993$

Intermittent Resources	
Utility Wind	5.8
Solar Domestic Hot Water	6.3
Small Wind	8.1
Dispatchable Technologies at 80% Capacity Factor	
Small Hydro	3.4
Landfill and Wastewater Methane	3.5
Repower with Refuse Derived Fuel	5.2
Industrial Wood Waste Cogeneration	5.3
Repower Coal with Wood	5.4
Coal fluidized Bed	6.2
Natural Gas Combined Cycle	6.3
Wood Spreader Stoker	6.3
Natural Gas Combustion Turbine	8.5

Between 1995 and 2020, a 75 percent increase in renewable energy use generated approximately 65,000 more job-years of employment, $1.6 billion in higher disposable income and a $3.1 billion increase in gross regional product than conventional power plant investments. This includes the effects of a 0.3 percent average annual increase in electricity prices from renewable energy investments.

Union of Concerned Scientists

The Union of Concerned Scientists (UCS) has played a role in winning support for renewable energy in key federal electricity-restructuring bills and in laws enacted recently in a number of states. New state laws are expected to add 4,200 megawatts of new renewable power -- enough for 1.8 million homes -- an increase of 25 percent over existing levels. UCS led coalitions that convinced the Connecticut and Massachusetts legislatures to include strong support for cleaner energy in resource portfolios. UCS analysis and testimony helped win renewables victories in Arizona, California, Iowa, Minnesota, Nebraska, Nevada, New Jersey, Ohio, and Wisconsin (see the bibliography to this report for a list of pertinent UCS studies).

National Renewable Energy Laboratory (NREL)

NREL reports that renewable energy is already bringing important economic benefits to the United States. For example, in 1996 the photovoltaic industry generated more that $800 million of revenues and employed 15,000 people at over 800 companies, most of them in high quality jobs, such as manufacturing, engineering, sales, installation, servicing and maintenance.[6] The biomass power generation industry employs more than 66,000 people nationwide and has created more than $1.8 billion in personal and corporate income, generating more than $460 million in federal and state taxes. Another recent study showed that the geothermal industry pays about $40 million each year to the U.S. Treasury for rent and royalties from geothermal plants. More importantly, NREL notes that renewable resources help states stem the flow of energy dollars outside of their borders.

[5] State of Wisconsin, Department of Administration, "Fueling Wisconsin's Economy With Renewable Energy," paper prepared by Steve Clemmer, Wisconsin Energy Bureau.

[6] National Renewable Energy Laboratory, "Choices for a Brighter Future: Perspectives on Renewable Energy," September 1999, DOE/GO-1099-878.

7.0 CONCLUSIONS

Renewable energy requirements have been adopted by several other states in an effort to improve utilization of available renewable energy resources, create sustainable, clean industries and jobs, reduce the outflow of money from the states, and improve the environment. Few of these states have the abundance of renewable energy resources that Hawaii does, and none have Hawaii's extreme energy and economic vulnerability to increases in the cost of oil or disruption in oil supplies. Their conventional energy sources are also less costly than Hawaii's. All in all, they have even less of an imperative to move towards renewables than does Hawaii; nevertheless, they predict "minimal" cost impacts from their renewable energy requirements, and expect those costs to be more than offset by job creation and other benefits.

None of the "lessons learned" from the other states indicate issues which should prevent Hawaii from adopting a renewable energy requirement. Methods have been developed to address issues as diverse as preference for certain renewable technologies over others, cost caps, and providing extra credits for in-state development.

A Renewable Portfolio Standard would be consistent with Hawaii's energy policy objectives.

It seems apparent that a Renewable Portfolio Standard could be implemented in Hawaii and could offer even greater benefits to Hawaii than is expected in the other states which have adopted similar requirements.

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Wisconsin Public Service Commission	http://www.psc.state.wi.us/
US Federal Energy Regulatory Commission	http://www.ferc.fed.us/
US Energy Information Administration	http://www.eia.doe.gov/

Other Associations and Groups:

American Council for an Energy Efficient Economy	http://www.aceee.org/
American Wind Energy Association	http://www.awea.org/
Edison Electric Institute	http://www.eei.org/
Electric Power Research Institute	http://www.epri.com/
National Association of Regulatory Utility Commissioners	http://www.naruc.org/

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Appendix 1
GENERATION COST RANGES FOR ENERGY SOURCES IN HAWAII

Resource	HECO Estimate[1] (cents per kWh)	Hawaii Utilities' Current Power Purchase Costs (cents per kWh) [2]
Biomass *	19-25	▪ MECO currently pays about 7 cents plus 2 cents capacity = **9 cents** per kWh to Hawaiian Commercial & Sugar Co. ▪ HECO currently pays 7.2 cents for first 644,000 kWh/day on peak, plus 6.7 cents for anything in excess of that on peak; 5.6 cents for first 250,000 kWh per day off-peak, then 5.19 cents for anything in excess of that off-peak; plus a capacity payment of 4.89 cents per kWh for approximately 10.5 million kWh per month, (it all averages out to be about **8.5 cents** per kWh) to H-POWER (refuse derived fuel). ▪ HECO pays about **6 cents** per kWh to Kapaa Generating partners for electricity from landfill methane. ▪ Kauai Electric currently pays about 5.9 cents for the first 40 million kWh/year, 7.68 cents per kWh for production over 40 million kWh, 3.684 cents for surplus energy during grinding season, 6.3 cents for surplus power during non-grinding season, and a capacity payment, to Lihue plantation (biomass and hydro).
Coal *	7-10	▪ HECO paid an average of **9.98 cents** per kWh in 1998 to AES Hawaii for electricity from coal.
Diesel	Not listed	▪ Diesel-fired units provide essentially all utility power on Molokai and Lanai, and are used to meet peak power needs on other islands. Electricity production costs are **18.1 cents** on Lanai and **19.7 cents** on Molokai.
Geothermal*	11-14	▪ HELCO currently pays 7 cents plus 1.1 cents capacity = **8.1 cents** per kWh to Puna Geothermal.
Hydropower	Not listed	▪ HELCO pays **6.71** cents per kWh (average) for power from Wailuku River Hydro. ▪ Kauai Electric currently pays **3.825 cents** for surplus power from Gay and Robinson (mostly hydro, some bagasse).
Oil*	7-11 [(3)]	▪ HECO paid an average of **5.97 cents** per kWh in 1998 to Kalaeloa Partners for electricity from oil.
Photovoltaic	30-40	
Wind	8-11	▪ HELCO pays **7 cents** per kWh to Apollo Energy for power from Kamaoa Wind Farm. ▪ HELCO just signed a contract with Zond for **5 cents** per kWh at Kahua.

* Baseload power includes capacity payment

(1) Estimate for future costs, as presented in testimony of the Hawaiian Electric Company to the Hawaii State Legislature, March 2, 2000

(2) Actual amounts paid by utilities for energy production or in accordance with existing utility power purchase agreements

(3) Assumes $20/bbl oil, average, next 20 years, as stated by HECO on March 2, 2000.