Appendix G
Energy Supply and Demand Policy Recommendations

Summary of List of Alaska Climate Change Mitigation Policy Recommendations

Policy No.	Policy Recommendation	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effective-ness ($/tCO_2e$)	Level of Support
		2015	**2020**	**2025**	**Total 2010-2025**			
ESD-1a	Rural Village-to-Village Transmission	0.00	0.00	0.01	0.05	$44	$897	Unanimous
ESD-1b	Renewable Energy Grants for Transmission Upgrades	0.06	0.08	0.09	1.06	–$2	–$2	Unanimous
ESD-1	Transmission Optimization and Expansion (Total a & b)	0.07	0.08	0.09	1.11	$42	$38	Unanimous
ESD-2	Energy Efficiency for Residential and Commercial Customers	*Quantified with ESD-2/4/6*						*See below*
ESD-2/4/6	Energy Efficiency for Residential, Commercial, and Industrial Customers, 2% per year	0.34	1.07	1.84	12.41	–$728	–$59	Unanimous
ESD-3	Implementation of Renewable Energy	1.99	2.35	3.86	32.52	$297	$9	Unanimous
ESD-4	Building Standards/Incentives	*Quantified with ESD-2/4/6*						*See above*
ESD-5	Efficiency Improvements for Generators	*Moved to Research Needs Work Group*						
ESD-6	Energy Efficiency for Industrial Installations	*Quantified with ESD-2/4/6*						*See above*
ESD-7	Implementation of Small-Scale Nuclear Power	*Moved to Research Needs Work Group*						
ESD-8	Research and Development for Cold-Climate Renewable Technologies	*Moved to Research Needs Work Group*						
ESD-9	Implementation of Advanced Supply-Side Technologies	*Moved to Research Needs Work Group*						
	Sector Total After Adjusting for Overlaps*	**1.93**	**2.77**	**4.67**	**37.51**	**–$19.46**	**–$4.24**	
	Reductions From Recent Actions				**0.34**			
	Sector Total Plus Recent Actions	**1.93**	**2.77**	**4.67**	**37.85**	**–$19.46**	**–$4.24**	

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/$tCO_2e$ = dollars per metric ton of carbon dioxide equivalent. Note: Sector Total is indicative of potential savings, see note in chapter.

ESD-1. Transmission Optimization and Expansion

Policy Description

A policy of transmission optimization and expansion in Alaska will offset sources of greenhouse gases (GHGs) by linking load centers with both existing and new renewable energy, and improving the efficiency of rural generators by increasing capacity-sharing capabilities. This policy is directed toward establishing improvements in the electrical network of Alaska that will:

- Improve opportunities for renewable resource utilization;
- Enhance coordination between electricity end users and energy providers; and
- Promote the reduction of electric energy losses associated with inadequate and aging infrastructure.

The best renewable resources may not be near existing transmission lines. New transmission, as well as upgrades to existing transmission lines, may be needed to accommodate extensive deployment of renewable generation capacity.

Energy Supply and Demand (ESD)-1 is intended to target transmission projects with established scopes and budgets submitted and accepted for seed funding by the Alaska Energy Authority's (AEA's) Renewable Energy Fund, as well as broadly defined transmission systems between remote rural areas. While addressing the need for improved optimization and the desirability of smart-grid features, ESD-1 does not provide the costs and benefits of incremental grid improvements or a systematic overhaul.

Policy Design

The policy would be implemented through the adoption and revision of existing programs, as well as financial and logistical coordination with electric cooperatives and utilities throughout Alaska. While no specific funding mechanism is currently proposed to implement either transmission expansion or optimization projects, a number of mechanisms could be used in part or in whole:

- A revolving-door mechanism financed by the state via either the AEA revolving loan fund or the Power Cost Equalization (PCE) Endowment Fund for project development;
- A public benefit fund (PBF) in concert with ESD-2, used to fund generator efficiency via village-to-village transmission upgrades;
- State revenues generated by auctioning carbon allowances under a national cap-and-trade policy (or alternately, funding from a carbon tax under a similar framework);
- Power project loans from the AEA to qualified entities for constructing, improving, and expanding transmission and distribution (T&D) facilities;
- Department of Revenue Permanent Fund or other state tax revenues;
- Utilities including transmission operation and maintenance (O&M) in rates.

Goals:

- Interconnection of major generation facilities within the applicable regions of Alaska.
- Access to identified hydroelectric, wind, tidal, and other non-fossil-fired generation resources.
- Displacement of less efficient industrial and commercial electrical generation facilities (including Alyeska Pipeline pump stations, North Slope production facilities, Cook Inlet production facilities, fish processing generation, and others).
- Improved access for combined heat and power production facilities at industrial locations.
- Reduced diesel-fired generation in remote locations.
- Electricity access for resource development, such as mining, tourism, fisheries, and others in remote locations.
- Regional or micro grids supplied by specialized resources (e.g., geothermal facilities).

Timing: To meet anticipated national GHG goals, transmission projects that effectively reduce GHG emissions would need to begin implementation by 2015; interties applying for AEA Renewable Energy (RE) Funds are scheduled to start operation between 2010 and 2013.

Parties: Electric transmission facilities, while primarily owned and/or operated by utility organizations, are subject to regulatory oversight by a host of state and federal agencies. As transmission facilities are notably visible and by their very nature have a wide range of ecological impacts, numerous non-governmental organizations also participate in various ways on transmission system issues. The primary participants in implementation of a statewide policy of transmission optimization and expansion are:

- The AEA and the Alaska Industrial Development and Export Authority (AIDEA), which are currently charged with distributing state funding for RE and PCE-related funding.
- The electric utilities of Alaska—private, municipal, cooperative, and joint-action agencies and various operating organizations among utilities.
- The Denali Commission.
- The Regulatory Commission of Alaska (RCA).
- The Alaska Department of Natural Resources (DNR).
- The U.S. Department of Agriculture’s Rural Utilities Service.
- The U.S. Fish and Wildlife Service.
- The U.S. Army Corp of Engineers.
- Statewide commercial and industrial enterprise owners.

Other: None identified.

Implementation Mechanisms

A statewide policy promoting enhancement of the state's transmission system will be implemented through regulatory polices of the state to reduce barriers to development and to establish, for example, a structural framework for providing low-cost funds for financing system expansion and technological improvements. The Denali Commission and AIDEA/AEA would be the agencies of significance in providing financial and technology support.

Legislation could create a new transmission authority, charged with (1) funding improvements in the electric transmission infrastructure and developing energy storage technologies; (2) facilitating the transmission and use of renewable energy by financing or planning, acquiring, maintaining, and operating electric transmission facilities, storage facilities, and related infrastructure; and (3) facilitating and guiding the transmission siting process among utilities, municipalities, cooperatives and electric authorities, villages, and commercial entities. Such an entity could be funded through one or more of the mechanisms described above.

Related Policies/Programs in Place

The State of Alaska and the Denali Commission have had programs in place to enhance the transmission system. Alaska's AIDEA/AEA has developed transmission facilities, retaining ownership while delegating maintenance and operation to utility participants. AIDEA/AEA includes transmission system development as a component of expanded access to renewable resources by utilities. The federal government has supported improved transmission, for example, by authorizing the various components of the Southeast Alaska Intertie system, which has benefited from periodic contributions of appropriated funds for design and construction by various electric utility organizations.

Seed monies for scoped transmission projects are currently provided by the AEA under the umbrella of the Renewable Energy Fund, while other transmission projects have obtained direct state appropriations.

Type(s) of GHG Reductions

Types: Carbon dioxide (CO_2) and nitrous oxide (N_2O).

Negative Impacts: Loss of CO_2 sink in forests displaced by transmission lines; fuel used in construction and maintenance of transmission lines.

Table G-1. Estimated GHG reductions and net costs of or cost savings from ESD-2/4/6 under 2% scenario

Policy No.	Policy	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million 2008$)	Cost-Effectiveness ($\$/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
ESD-1a	Rural Village-to-Village Transmission	0.00	0.00	0.01	0.05	$44	$897
ESD-1b	Renewable Energy Grants for Transmission Upgrades	0.06	0.08	0.09	1.06	-$2	-$2
ESD-1	**Transmission Optimization and Expansion**	**0.07**	**0.08**	**0.09**	**1.11**	**$42**	**$38**

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $\$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

The two analyses under this policy are designed to quantify, separately, the benefits from a rural transmission program and a renewable energy access program. In both cases, proxy cases are included as examples to assist in the quantification of the cost-effectiveness of these two GHG reduction mechanisms. “Rural Transmission” explores the costs of connecting 200 villages with dispersed microgrids, easing load-following requirements for small-scale generators. Higher efficiency results in reduced fuel consumption and GHG emissions. “RE Access Transmission” tests the net value of implementing transmission to existing renewable energy sources. This analysis does not include the marginal GHG savings associated with reducing line losses along established grid networks or the fuel efficiencies gained by connecting remote industries and Alyeska pump stations to the existing grid.

Estimated GHG Reductions and Net Costs or Cost Savings

The analysis of this policy is based on two sub-scenarios, which are analyzed under a separate construct. Detailed assumptions can be found in at the end of the policy descriptions. Data sources, quantification methods, and key assumptions are explained briefly below for each of the two sub-scenarios:

Rural Village-to-Village Transmission (ESD-1a)

Data Sources: The quantification is an exercise in village-to-village connectivity, assuming a fixed number of villages in rural Alaska (northern, southwestern, and Kodiak) that are not currently connected. Village generators reduce fuel use when connected to another village.

Quantification Methods: This is a simple spreadsheet model, based on a scenario designed by the ESD Technical Work Group (TWG), and using data inputs from Alaska Power Statistics. Using 2001 statistics, 161 villages were identified that generated power only from diesel oil combustion turbines and were not connected to either a central power grid or other towns or villages. The total power generated from these villages was recorded, and their approximate location (latitude and longitude) as determined with Google Maps. The absolute straight-line distance between each village pairing was determined (in miles). Every village pairing within a 60-mile threshold was considered a viable transmission pairing; 31 villages fit this criterion, serving 102,667 megawatt-hours (MWh) of diesel-fired generation in 2003, or 1.6% of Alaska load in 2009. The average distance between the nearest villages within this grouping is 30 miles.

Transmission projects were assumed to begin in 2012 and end in 2020, with three to four villages being connected each year.

Input assumptions included a $300,000 per linear mile cost of transmission, a 15% savings in fuel consumption by connecting two villages, a 20-year economic life of transmission lines, and a 5% discount rate. The capital costs of transmission lines were amortized over the 20-year period; no cost was assumed for O&M or new generators (assumed to be replaced as transmission is built).

Key Assumptions: The model is highly sensitive to the distances between villages, the expected fuel efficiency savings from connecting two villages, as well as the average energy use per village. The total number of villages involved (161), as well as the average energy use per village was determined from the *Alaska Electric Power Statistics* (2003) data set. Communities in this analysis were those that were listed as using internal combustion generation (assumed diesel) and were not obviously connected to a larger community with other energy sources already available. The analysis is sensitive to the assumed expected fuel savings and the threshold distance for connecting villages. Because actual linear distances were calculated, and each village serves a different amount of load, the savings and costs on a village-by-village basis are quite different. This analysis did not attempt to distinguish the most cost-effective set of villages (i.e., those that both are near to each other and serve significant load, where significant savings might be realized). However, we did conduct a sensitivity analysis on the threshold distance and possible savings from connecting two villages. Table G-1 shows the results of this sensitivity as a function of the threshold distance and fuel savings expectation.

Table G-2. Carbon cost efficacy of village-to-village interties, depending on expected fuel savings from connecting two villages and maximum distance threshold between two villages

Threshold Distance (miles)	Villages in Analysis	Average Distance (miles)	Load Served (MWh)	Cost-Effectiveness (2008$/$tCO_2e$) at Interconnection Fuel Savings		
				5%	15%*	25%
20	9	11.8	9,096	$3,489	$969	$464
50*	29	28.3	74,149	$3,274	$897	$422
100	51	49.2	174,717	$4,350	$1,255	$637
200	109	104.2	319,538	$11,188	$3,535	$2,004

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/$tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; MWh = megawatt-hour.

*Default value

Renewable Energy Grants for Transmission Upgrades (ESD-1b)

The transmission for renewable energy access shares a similar quantification structure with the ESD-3 analysis of the implementation of renewable energy projects.

Data Sources: This quantification assumes that projects submitted for seed funding from the AEA Renewable Energy Fund are implemented. Only five projects that focus exclusively on transmission to renewable energy are included in this analysis: (1) Metlakatla–Ketchikan intertie, (2) North Prince of Wales intertie, (3) Kake–Petersburg intertie, (4) transmission and control infrastructure (for wind in Nome), and (5) the Lake and Peninsula Borough wind/hydro intertie.

Program descriptions and data for quantifying emission reductions were obtained from the following sources:

- Alaska Energy Authority, *Renewable Energy Fund Applications and Analysis: Round 1 and Round 2 Project Summaries and AEA Evaluations*. Available at: http://www.akenergyauthority.org/RE_Fund_Applications.html.
- *Distributing Alaska's Power: A Technical and Policy Review of Electric Transmission in Alaska*, September 4, 2008. Prepared for the Denali Commission. http://denali.gov/
- Institute of Social and Economic Research, University of Alaska, Anchorage (November 2003), *Alaska Electric Power Statistics (with Alaska Energy Balance): 1960–2001*, Prepared for the Alaska Energy Authority, Regulatory Commission of Alaska, and Denali Commission.
- Governor Palin's press conference at Alaska Energy Authority: "Palin Unveils Energy Goals for Cities, Villages," *Fairbanks Daily News-Miner*, January 16, 2009. http://www.newsminer.com/news/2009/jan/16/palin-unveils-energy-goals-cities-villages/
- U.S. Energy Information Administration (EIA) (2009), *Assumptions for the Annual Energy Outlook 2009: With Projections to 2030*. Available at: http://www.eia.doe.gov/oiaf/aeo/assumption/index.html.
- Alaska Energy Authority (January 2009), *Alaska Energy: A First Step Toward Energy Independence*. Available at: http://www.akenergyauthority.org/

Quantification Methods: The model is structured from standard analyses conducted by the AEA to determine which RE Fund projects could obtain seed funding. Each project lists (among other variables) annual expected renewable generation that would be accessed, O&M costs, avoided fossil fuel use, local expected prices for fuels, and capital costs. Capital costs are amortized across the expected lifetime of the project (also given by the AEA), starting from the first year of generation. The net present value (NPV) is determined from the discounted costs (including amortized capital costs) and benefits through 2025. Avoided fuel use is translated into avoided CO_2 emissions. Total costeffectiveness is calculated as the cumulative carbon avoided (to 2025) divided by the NPV.

Key Assumptions: Costs, avoided costs, timing, and avoided fuel uses assumed by the AEA and partners in the RE Fund analysis (see ESD-3 quantification for details). Carbon emission coefficients are extracted from the AEA analysis.

Key Uncertainties

Transmission for Renewable Energy: If projects are the only feasible interties available; if the implementation of new medium- to large-scale renewable energy projects would spur interest or need for new transmission connections to a central grid.

Rural interties analysis: Distances between villages, number of villages impacted or participating, direct connection from village to village, efficiency gains expected by connection of two or more villages, cost of transmission, expected start and end of transmission projects, feasibility of connecting multiple villages per year, and avoided costs of diesel (currently from AEA RE Grants program, Round 1, project 110—Kong Wind)

National climate policy and both world oil and natural gas markets will influence the cost-effectiveness of future projects.

Additional Benefits and Costs

Increased transmission and access to renewable generation will produce several co-benefits for Alaska. These include:

- Lower electricity costs and increased reliability in rural areas and villages.
- Reduced environmental damage and costs associated with cleanup of diesel fuel spills in rural villages and along watercourses.
- Reduced criteria and toxic air pollutant emissions from diesel generators.

Feasibility Issues

Transmission infrastructure is often costly and difficult to site based on property, environmental, and line operation and ownership considerations. The siting process requires the participation of large groups of stakeholders with diverse interests and conflicts. In addition, transmission lines in remote areas may be difficult to service, and in Alaska are prone to icing, treefall, landslides, and other disturbances.

Statewide GHG benefits will be greatest if this policy is coordinated and integrated with ESD-2/4/6 (Energy Efficiency for Residential, Commercial, and Industrial Customers, 2% per year) However, avoided fuel costs and displaced carbon will be lower than calculated when combined with energy efficiency.

Fossil fuel use may be avoided in large part if distributed-generation renewable energy projects (i.e., ESD-3) are implemented on a village scale. Village-to-village transmission may still be beneficial for reliability purposes, but will displace less fossil fuel if renewable resources are used instead.

Status of Group Approval

Approved.

Level of Group Approval

Unanimous.

Barriers to Consensus

None.

ESD-2/4/6. Energy Efficiency for Residential, Commercial, and Industrial Customers, 2% per year

Policy Description

This policy seeks to reduce electricity, natural gas, and fuel oil consumption in the residential, commercial, and industrial sectors through energy efficiency and demand-side management (DSM) measures using a variety of programs and policies, including state and utility efficiency programs, appliances standards, and building codes. Details of these programs and policies are provided under the Implementation Mechanisms section, below. This policy involves a variety of stakeholders, including state agencies, utilities, fuel distributors, advocacy groups, energy service companies, and local governments. The potential funding sources for this policy option include (but are not limited to) state funding through legislative actions, a system benefit charge, and a state-capitalized end-use efficiency endowment.

Energy efficiency reduces energy consumption required by appliances and heating and cooling equipment, while maintaining or improving the quality of energy services. Providing strong programs for energy efficiency and conservation in Alaska is one of the most cost-effective and fastest methods to reduce energy use and GHG emissions. The Interior Issues Council's Cost of Energy Task Force report, *Fairbanks Energy*,[1] states:

"Conservation and efficiency increases are by far the most effective means of reducing cost, reducing emissions and reducing fuel usage. The beauty of increasing efficiency is we can start today."

A recent report by the Cold Climate Housing Research Center[2] agrees with this view and states:

"To be sure, supply side solutions are necessary in Alaska, but efficiency measures should be step one in any energy plan—they are the single least expensive way to decrease demand and save energy."

Indeed, energy efficiency has been acknowledged across the nation and by the federal government as the least expensive energy solution. A growing number of states are requiring states and/or utilities to tap into cost-effective energy efficiency measures first before developing supply-side solutions. Contrary to these notions, Alaska has implemented few energy efficiency programs for more than a decade. This means that Alaska has significant untapped energy efficiency resources compared to other states.

The articulation of an energy efficiency vision by the Governor, and the ensuing design and implementation of a comprehensive set of energy efficiency and conservation programs could rapidly set in motion a significant energy use reduction for all sectors in the state: commercial, industrial, institutional, and residential. In 2008, the state invested significant funding toward

[1] Fairbanks Economic Development Corporation. (2007). Fairbanks Energy: Strategic Business Plan. Available at: *http://www.investfairbanks.com/documents/FairbanksEnergyExecutiveSummary.pdf*

[2] Cold Climate Housing Research Center (2008). *Alaska Energy Efficiency Program and Policy Recommendations*. Prepared for the Alaska Energy Authority and Alaska Housing Finance Corporation. Available at: *http://www.cchrc.org/alaska+energy+efficiency+program+and+policy+recommendations.aspx.*

residential weatherization. Similar levels of support for the other sectors and for residential electrical efficiency are now needed to reduce both energy use and the energy costs in these homes and buildings.

Policy Design

Goals: Energy efficiency programs and policies to reduce energy consumption for electricity, natural gas, and fuel oil, and increase annual incremental energy savings to 1% of retail energy sales by 2015 and 2% by 2020 (Table G-3).

Table G-3. Annual incremental savings and expected savings below baseline load growth with 2% energy efficiency per year

2% Energy Efficiency by 2020	2010	2015	2020	2025
Annual incremental savings	0.2%	1.0%	2.0%	2.0%
Annual cumulative savings below baseline	0.2%	3.4%	10.8%	17.8%

Timing: Early action to begin with increased funding in current state programs in 2009.

Parties Involved: AEA, RCA, electric utilities, Alaska Housing Finance Corporation (AHFC), tribal governments, municipal and local governments, industrial partners, AIDEA, and possible third-party efficiency operators.

Implementation Mechanisms

Design and fund a comprehensive set of state and utility energy efficiency programs that will encourage the installation of energy efficient equipment and encourage the conservation of energy in all sectors. These programs would include:

- Public education.
- Comprehensive whole-building energy audits and retrofits for all sectors.
- Rebates and incentives to end users for installing energy-efficient equipment.
- Village retrofit and weatherization programs, including possibly an expanded whole-village retrofit program prior to re-sizing local power plants.
- An energy efficiency program for new and existing schools.
- Incentives for vendors, retailers, and contractors for selling or installing energy-efficient equipment and for optimizing the size of heating, ventilation, and air conditioning (HVAC) equipment.
- Low-cost loans for energy efficiency improvements.
- Training of related professionals (such as commercial energy auditors, HVAC maintenance staff, and retail sales staff).
- Performance incentives for program administrators (e.g., utility and/or third party).
- Energy savings measurement and verification studies.

- Other programs, such as a new construction program, a whole-building program for retrofit, a refrigerator trade-in and recycling program, pilot testing of smart meter installations, and research and development (R&D) testing of energy-efficient equipment in Alaska's climatic conditions.

In addition to the programs, certain other actions are recommended to knock down barriers to the implementation of energy efficiency measures, including:

- Establish energy efficiency building codes for residential and commercial properties statewide (to avoid Alaska's current problem of older buildings with very poor energy performance and high energy costs);
- Establish aggressive appliance standards;
- Change the rate structure of energy utilities to encourage their participation in providing aggressive energy efficiency and conservation programs. Alternatively, allow the utilities to pay a certain customer charge into the statewide energy efficiency delivery office(s), which will provide the above programs, incentives, rebates, loans, and trainings. This model is working exceptionally well in Oregon and avoids the internal conflict that utilities face regarding efficiency programs' detrimental effect on their sales revenues;
- Review the PCE program to determine if energy efficiency incentives can be effectively built in to encourage, rather than discourage, energy efficiency measures for these communities.

New or increased funding is necessary for engaging in most of the programs and policies mentioned above. The potential short-term funding source is state funding through legislative appropriation. The potential long-term funding source is a utility system benefit charge (e.g., a few mills per kilowatt-hour [kWh] for every ratepayer) or a state-capitalized end-use efficiency endowment (when a system benefit charge is politically difficult to establish).

Most of these elements of the policies and programs are outlined in the 2008 *Alaska Energy Efficiency Program and Policy Recommendations* report.[3] That report is the culmination of a significant project to determine future program and policy needs in Alaska related to energy efficiency, and serves as the roadmap and menu of needed actions.

Related Policies/Programs in Place

The Energy Independence and Security Act of 2007 has three titles particularly relevant to this policy: Title III: Appliance and Lighting Efficiency, Title IV: Energy Savings in Building and Industry, and Title V: Energy Savings in Government and Public Institutions.

- **The Weatherization Program:** Targeted at Alaskan residents with incomes below the state median. Funding increased in 2008 from ~$6 million to $300 million. Administered by AHFC.
- **The Home Energy Rebate Program:** Targeted at homeowners who do not qualify for the Weatherization Program. Provides rebates for high-efficiency home upgrades exceeding AHFC standards. Administered by AHFC.

[3] Ibid.

- **Second Mortgage Program for Energy Conservation:** Targeted at homeowners to make cost-effective energy improvements.[4] Administered by AHFC.

Type(s) of GHG Reductions

Reduction in GHG emissions (largely CO_2) from avoided electricity production or on-site fuel combustion.

Estimated GHG Reductions and Net Costs or Cost Savings

The MAG evaluated two energy efficiency scenarios: (1) achieving 1% energy efficiency per year by 2015 and (2) reaching further to achieve 2% energy efficiency by 2020. Evaluating the economics and assessing current actions taken in other states, the MAG determined that the savings that could be achieved with 2% energy efficiency improvements each year would be an appropriate goal. Table G-4 presents results from the selected 2% energy efficiency goal, but additional charts and tables demonstrate and estimate savings for both the 1% and the 2% scenarios.

Table G-4 presents the estimated GHG reductions and net costs of or costs savings from implementing the 2% scenario. The table is broken down by electricity use, natural gas use (for residential, commercial, and industrial (RCI) purposes), and oil use. RCI end uses are not displaced but underlie the calculations summarized here. Figures G-1, G-2, and G-3 present the projected total energy consumption for all RCI sectors for electricity, natural gas, and fuel oil under the 1% and 2% scenarios, as well as the baseline energy consumption by sector in the background.

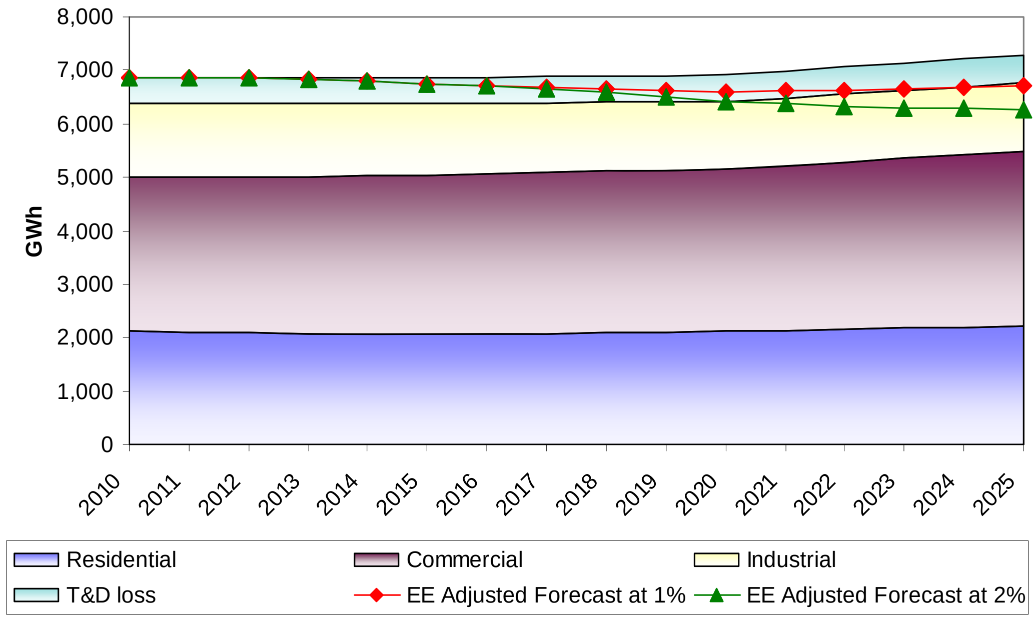
Table G-4. Estimated GHG reductions and net costs of or cost savings from ESD-2/4/6 under 2% scenario

Policy No.	Policy	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($\$/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
ESD-2/4/6a	2% EE, Electric	0.16	0.50	0.88	5.86	–$246	–$42
ESD-2/4/6b	2% EE, Natural Gas	0.11	0.35	0.61	4.09	–$155	–$38
ESD-2/4/6c	2% EE, Oil	0.07	0.21	0.35	2.45	–$327	–$134
ESD-2/4/6	**2% EE, Total**	**0.34**	**1.07**	**1.84**	**12.41**	**–$728**	**–$59**

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $\$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

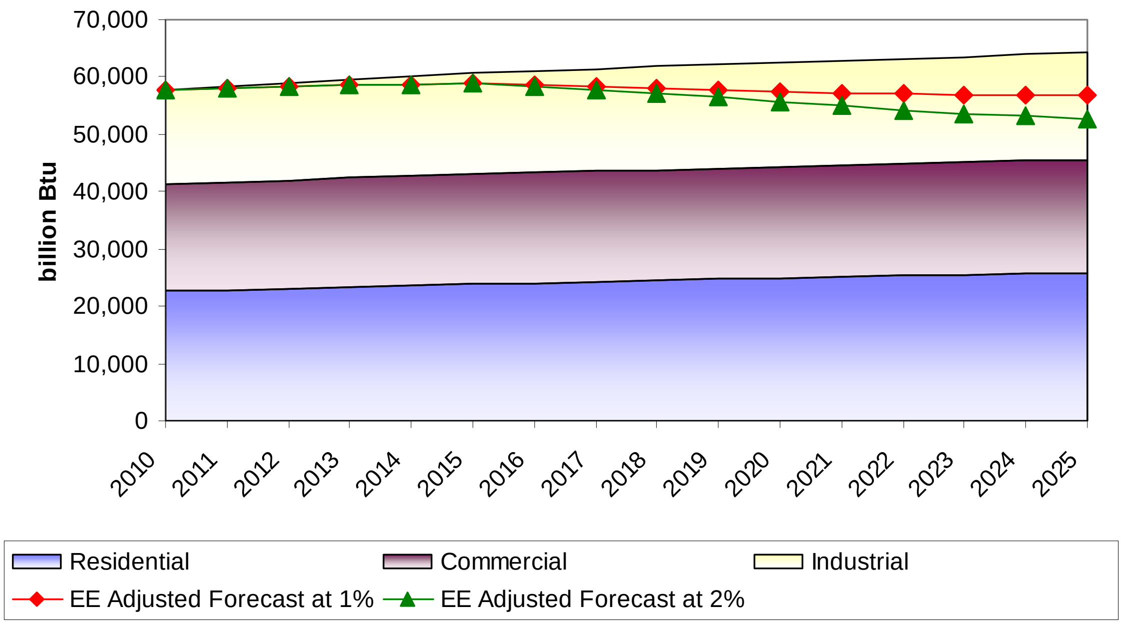
[4] Alaska Housing Finance Corporation. *Home Energy Rebate, Weatherization, and Loan Programs.* Updated 04/22/09. Available online at: http://www.ahfc.state.ak.us/energy/weatherization_rebates.cfm.

Figure G-1. Electricity demand forecast with/without energy efficiency scenarios



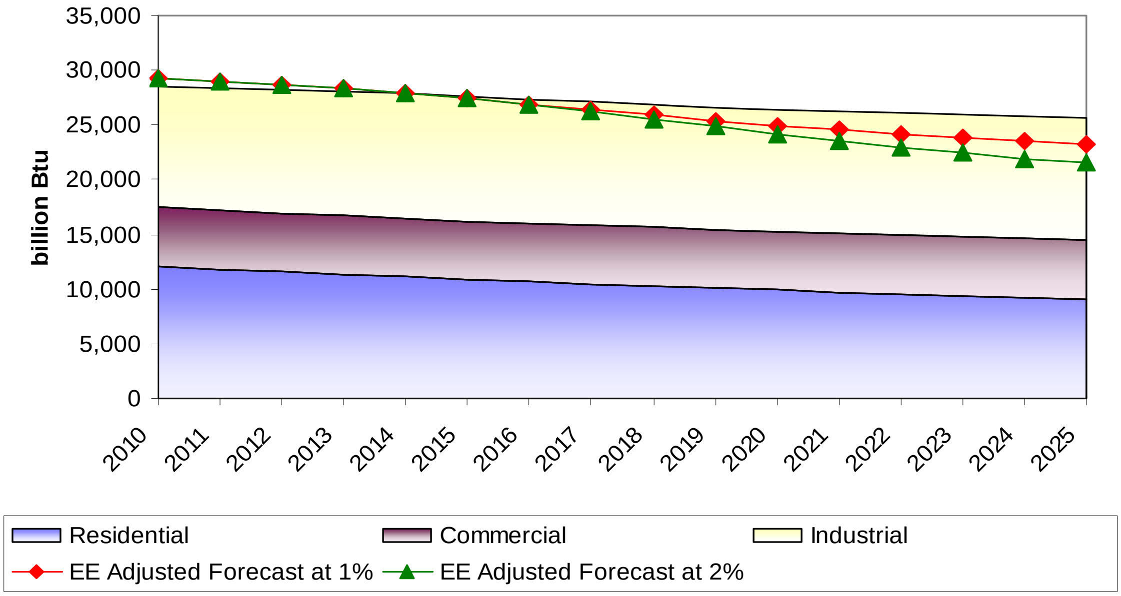
EE = energy efficiency; GWh = gigawatt-hours; T&D = transmission and distribution.

Figure G-2. Natural gas demand forecast with/without energy efficiency scenarios



Btu = British thermal units; EE = energy efficiency.

Figure G-3. **Fuel oil demand forecast with/without energy efficiency scenarios**



Btu = British thermal units; EE = energy efficiency.

Data Sources:

Experience in Other States on Cost of Energy Efficiency:

- U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE) (July 2006), *National Action Plan for Energy Efficiency*, p. ES-4. Available at: http://www.epa.gov/cleanrgy/documents/napee/napee_exsum.pdf.
- Synapse Energy Economics (August 2008). *Costs and Benefits of Electric Utility Energy Efficiency in Massachusetts*, prepared for the Northeast Energy Efficiency Council. Available at: http://www.synapse-energy.com/Downloads/SynapsePresentation.2008-08.0.Sustainability-and-Costs-of-Efficiency-Impacts.S0051.pdfUH.
- K. Takahashi and D. Nichols (2008), "The Sustainability and Costs of Increasing Efficiency Impacts: Evidence From Experience to Date," proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, pp. 8-363–8-375. Available at: http://www.synapse-energy.com/Downloads/SynapsePresentation.2008-08.0.Sustainability-and-Costs-of-Efficiency-Impacts.S0051.pdf
- Bill Prindle (2007), "Energy Efficiency: The First Fuel in the Race for Clean and Secure Energy," presentation at the National Action Plan for Energy Efficiency Southeast Energy Efficiency Workshop on September 28, 2007. Available at: http://www.epa.gov/cleanenergy/documents/southeast-meeting/prindle_new_napee_presentation_atlanta_9_28_07.pdf.
- Martin Kushler, Dan York, and Patti White (April 2004), *Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies*, Washington, DC:

American Council for an Energy Efficient Economy. Available at: http://www.aceee.org/pubs/u041.htm.

WGA 2006—Energy Efficiency Task Force Report to the Clean and Diversified Energy Advisory Committee of the Western Governors' Association (January 2006), *The Potential for More Efficient Electricity Use in the Western United States*, Denver, CO: Western Governors' Association. Available at: http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-text.pdf

Cost of Saved Natural Gas:

- Southwest Energy Efficiency Project (2006), *Natural Gas Demand-Side Management Programs: A National Survey*. Available at: www.swenergy.org.

Cost of Saved Fuels and Measure Lifetime:

- U.S. DOE, Office of Energy Efficiency and Renewable Energy (2007), "Industrial Assessment Centers (IAC) Database." Available at: http://www.iac.rutgers.edu/database/.
- Suzanne Tegen and Howard Geller (January 2006), *Natural Gas Demand-Side Management Programs: A National Survey*, Boulder, CO: Southwest Energy Efficiency Project. Available at: www.swenergy.org.
- U.S. EPA and U.S. DOE (July 2006), *National Action Plan for Energy Efficiency*, p. ES-4, Available at: http://www.epa.gov/cleanrgy/documents/napee/napee_exsum.pdf.
- Martin Kushler, Dan York, and Patti White (January 2005), *Examining the Potential for Energy Efficiency to Help Address the Natural Gas Crisis in the Midwest*, Washington, DC: American Council for an Energy Efficient Economy. Available at: http://www.aceee.org/pubs/u051.htm.
- Southwest Energy Efficiency Project (SWEEP) (January 2006), *Natural Gas Demand-Side Management Programs: A National Survey*. Available at www.swenergy.org.
- Optimal Energy, Inc., et al. (October 31, 2006), Natural Gas Energy Efficiency Resource Development Potential in New York, prepared for the New York State Energy Resource and Development Authority. Available at: http://www.nyserda.org/Energy_information/otherdocs.asp.

Quantification Methods:

- Base project energy savings on the stated energy savings (electricity, natural gas, and oil) target based on two scenarios: (1) a 1% per year annual incremental reduction in total annual consumption by 2015; and (2) further increasing the reduction to 2% per year by 2020. Adjust annual consumption each year based on the previous year's DSM impacts.
- Include all sectors in the analysis, including RCI.
- Estimate the total cost of energy savings using state-specific or region-specific data on the cost of saved energy from energy efficiency measures.
- Estimate the GHG emission reductions through the energy efficiency measures.

Key Assumptions:

Discount Rate: 5% real.

Avoided Cost of Electricity: 9.5 cents/kWh as the population-weighted average cost of avoided electricity in different regions:

- Railbelt: 6 cents/kWh based mainly on the cost of natural gas power plants.
- Southeast: zero due to hydro dominant energy sources in the region.
- Rural: 22 cents/kWh based on oil-based electricity and $96/barrel of oil (2008$/barrel), as the levelized price of oil price for lower 48 oil price over the study period. The oil data are obtained from the U.S. EIA's *Annual Energy Outlook 2009* (AEO 2009).
- The conversion rate between oil and electricity is based on the range of electricity price from 12 to 30 cents/kWh for $50 to $147/barrel of oil, obtained from the ESD TWG members.

Avoided Cost of Natural Gas: $5.28/million British thermal units (MMBtu) (2008$), the levelized cost of projected natural gas prices. The natural gas avoided cost was projected using (1) the average Alaska city gate price of natural gas in 2008 and (2) the trend in projected natural gas prices in the AEO 2009 for the Pacific region.

Avoided Cost of Fuel Oil: $20.11/MMBtu (2008$) (placeholder assumption), levelized price of distillate fuel oil for the Pacific region (AEO 2009 between 2009 and 2025).

T&D Loss: 7% for electricity, 0% for natural gas, 0% for fuel oil.

Cost of Electric Energy Efficiency Measures: 5 cents/kWh for electricity—inflated from the "typical" price of energy efficiency in the lower 48 states. The utility cost of saved energy (CSE) for electric energy efficiency programs (that does not include participants' costs of efficiency measures) is 1–5 cents/kWh saved, with the average about 2.4 cents/kWh saved based on experience in other states (CSE). These data are presented in Table G-5 and Figure G-4. Assuming the cost split between utilities and participants is about 60%/40%, the total cost of energy efficiency programs would be about 4 cents/kWh on average. This estimate was then inflated by 25% to take into account higher costs of products and services in Alaska.

Table G-5. Utility cost of saved energy[5]

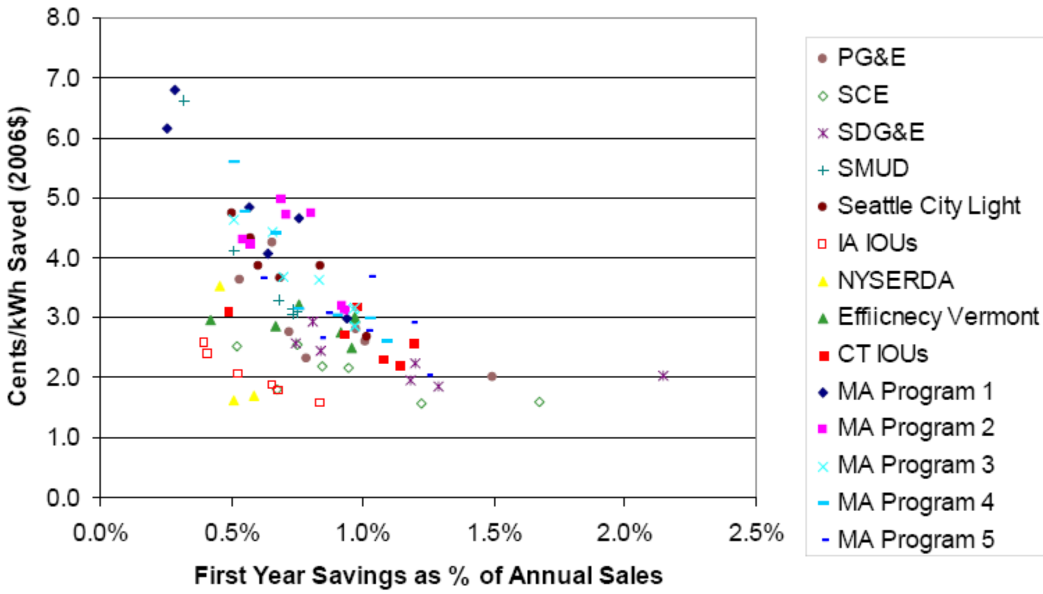
Entity	State	CSE (cents/kWh)
Austin Energy	TX	3
Bonneville Power Administration	ID, MT, OR, WA	3
California Utilities	CA	1
Connecticut Utilities	CT	1
Efficiency Vermont	VT	2
Massachusetts Utilities	MA	3
Minnesota Electric and Gas Investor-Owned Utilities	MN	1

[5] U.S. DOE, Office of Energy Efficiency and Renewable Energy (2007), "Industrial Assessment Centers (IAC) Database. Available at: http://www.iac.rutgers.edu/database/.

Entity	State	CSE (cents/kWh)
Nevada	NV	3
New York State Energy Research and Development Authority	NY	2
Seattle City Light	WA	2
Sacramento Municipal Utility District	CA	3
Wisconsin Department of Administration	WI	5
Average		**2.4**

CSE = cost of saved energy; DOE = U.s. Department of Energy; EPA = U.S. Environmental Protection Agency; KWh = kilowatt-hour.

Figure G-4. Utility cost of saved energy for multiple utilities over multiple years[6]



Cost of Saved Natural Gas: $ $2.99/MMBtu for natural gas—inflated from average the cost of saved natural gas (SWEEP 2006). The natural gas savings per dollar of program investment is 72,700 million cubic feet per year per million dollars, based on the average cost of a number of gas DSM programs reported in Tegen and Geller (2006). The RCI TWG will estimate the cost of saved natural gas per MMBtu based on (1) the natural gas savings per program investment above, (2) a 12-year average measure lifetime, and (3) a real discount rate of 5%.

Costs of Saved Fuel Oil and Propane: For residential and commercial uses, these costs are assumed to be the same as the cost of saved natural gas in terms of $/MMBtu. For the industrial sector, data available at DOE's IAC database might be useful.[7]

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[6] Synapse Energy Economics (August 2008), *Costs and Benefits of Electric Utility Energy Efficiency in Massachusetts*, prepared for the Northeast Energy Efficiency Council. This study concluded that the utility cost of energy efficiency programs tends to decrease as the scale of energy efficiency increases.

[7] U.S. DOE, Office of Energy Efficiency and Renewable Energy (2007, "Industrial Assessment Centers (IAC) Database." Available at: http://www.iac.rutgers.edu/database/

Utility cost of saved energy: The utility cost of saved energy (including incentives, marketing, and administrative costs) is assumed to be 60% of the total cost of energy efficiency. This cost does not include costs paid by participants. Utility costs of saved energy were obtained and adjusted upward to estimate the total costs using the 60%/40% cost split.

Energy Efficiency Measure Lifetime: 12 years on average.

Displaced Emissions for Electricity: 0.655 metric tons of carbon dioxide (tCO_2)/MWh as the population-weighted average emissions in different regions:

- Railbelt: 0.7468 tCO_2/MWh—a typical emission rate for natural gas power plants. Input from the TWG members. The data are obtained from EPA's Emissions & Generation Resource Integrated (eGRID) database.
- Southeast: Zero due to hydro-dominant energy sources in the region. Input from the TWG members.
- Rural: 0.5754 tCO_2/MWh. A typical emission rate for oil power plants. Input from the TWG members. The data are obtained from EPA's eGRID database.

Displaced emissions for natural gas: 0.0528 tCO_2/MMBtu.

Displaced emissions for natural gas: 0.0724 tCO_2/MMBtu based on the emission rate of distillate fuel.

Key Uncertainties

The source of funding to implement the aggressive DSM program envisioned here is uncertain.

There are few data on the cost of saved fuel oil. For this analysis, it was assumed that the costs of saved fuel oil equal the cost per MMBtu saved for natural gas. To the extent that oil appliances are similar to natural gas appliances, the costs will be similar among fuel-saving measures per MMBtu saved. While there are similar applications among all fuels (e.g., water heating, cooking), the similarities between specific appliances running on different fuels are less clear. On the other hand, given that there has not been any significant effort to promote oil-efficient appliances in the United States, there may be more “low-hanging fruit” in energy efficiency measures for oil that is not realized in this quantification.

Two scenarios were initially explored in this analysis. The MAG selected the more ambitious 2% energy efficiency scenario. However, results from both scenarios are shown in Table G-6 and Table G-7 for comparative purposes.

Table G-6. Annual incremental and cumulative savings from 1% and 2% energy efficiency programs

Energy Efficiency Scenarios	2010	2015	2020	2025
1% Energy Efficiency by 2020				
Annual incremental savings	0.2%	1.0%	1.0%	1.0%
Annual cumulative savings below baseline	0.2%	3.4%	8.1%	11.4%
2% Energy Efficiency by 2020				
Annual incremental savings	0.2%	1.0%	2.0%	2.0%
Annual cumulative savings below baseline	0.2%	3.4%	10.8%	17.8%

Table G-7. Estimated GHG reductions and net costs of or cost savings from ESD-2/4/6 under 1% and 2% scenarios

Policy No.	Policy	GHG Reductions ($MMtCO_2e$)				Net Present Value 2010–2025 (Million $)	Cost-Effectiveness ($/tCO_2e$)
		2015	2020	2025	Total 2010–2025		
ESD-2/4/6a	1% EE, Electric	0.16	0.38	0.56	4.35	–$187	–$43
ESD-2/4/6b	1% EE, Natural Gas	0.11	0.26	0.39	3.03	–$117	–$39
ESD-2/4/6c	1% EE, Oil	0.07	0.16	0.23	1.85	–$252	–$137
ESD-2/4/6	**1% EE, Total**	**0.34**	**0.80**	**1.18**	**9.22**	**–$557**	**–$60**
ESD-2/4/6a	2% EE, Electric	0.16	0.50	0.88	5.86	–$246	–$42
ESD-2/4/6b	2% EE, Natural Gas	0.11	0.35	0.61	4.09	–$155	–$38
ESD-2/4/6c	2% EE, Oil	0.07	0.21	0.35	2.45	–$327	–$134
ESD-2/4/6	**2% EE, Total**	**0.34**	**1.07**	**1.84**	**12.41**	**–$728**	**–$59**

EE = energy efficiency; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $\$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

Additional Benefits and Costs

- Indoor comfort and air quality improvements, with related improvements in health and productivity.
- Savings to consumers and businesses on energy bills. Benefits to low-income populations from reduced utility costs.
- Electricity system benefits: reduced peak demand, reduced capital and operating costs, improved utilization and performance of electricity system.
- Reduced risk of power shortages.
- Reduced pollutants from emissions, improved health from fewer pollutants and particulates, and reduced water use for cooling.
- Green-collar employment expansion and economic development.
- Reduced dependence on imported fuel sources.
- Reduced energy price increases and volatility.

Feasibility Issues

None known.

Status of Group Approval

Approved.

Level of Group Support

Unanimous.

Barriers to Consensus

None.

ESD-3. Implementation of Renewable Energy

Policy Description

Renewable energy systems can directly offset fossil fuel use. This is especially true in Alaska's rural villages, which rely on expensive diesel fuel for electricity generation. Renewable energy systems include wind, biomass, hydro, geothermal, solar photovoltaic, solar thermal, and other systems relying on energy flows driven directly or indirectly by solar radiation or geothermal heat. The purpose of this policy is to reduce the use of fossil fuels by establishing an economic and regulatory environment that will allow and encourage utilities and individuals to install capital-intensive renewable energy systems. Electricity generation is likely to be a promising sector for early actions.

Policy Design

This policy focuses on encouraging renewable energy development through implementation of legislation passed by the Alaska legislature in 2008, and the recent AEA report on energy independence.[8] To achieve the policy goals, the State of Alaska will:

- Aggressively publicize, pursue, and monitor progress toward the target of 50% of electricity generation from renewable sources by 2025.
- Set benchmark targets for renewable energy use until 2025.
- Follow through with the existing Renewable Energy Fund process and consider additional funding to support more projects.
- Shift priorities in the PCE Endowment Fund to reward utility, co-op, and village investment in renewable systems; transfer funds from reimbursements to infrastructure.
- Remove or reduce existing legal barriers to renewable energy systems, i.e. unintended consequences from specific regulations that restrict or prohibit beneficial energy systems, as might be found in land use laws, land leasing requirements, or school funding formulas that might reduce reimbursements if a school or community invests in a wind turbine to reduce utility bills. The intent is not to eliminate effective land use laws just for renewable energy, but rather to ensure that aspects of such laws do not unintentionally limit or cause disincentives to renewable energy development.
- Change the utility regulatory system—by statute if necessary—to provide for reasonable and predictable returns on utility investments in cost-effective renewable systems.
- Change the utility regulatory system – by statute if necessary – to provide for reasonable and predictable treatment of small-scale renewable systems installed by individuals and connected to the electric grid.

[8] Alaska Energy Authority (January 2009), *Alaska Energy: A First Step Toward Energy Independence*. Available at: http://www.akenergyauthority.org/

- Provide access to capital for cost-effective renewable energy investments through a combination of grants, rebates, loans, loan guarantees, tax incentives, and other means.

Goals

- 50% of all electricity in Alaska is generated from renewable sources by 2025.
- Maximum cost-effective implementation of renewable energy systems for direct heating, where "cost-effective" includes a monetized value of avoided GHG emissions, as determined by prevailing national or state policy.

Timing: This policy is already underway through the Governor's goal statement and the Renewable Energy Fund. Implementation will need to continue through 2025, with an aggressive push toward statutory and regulatory changes during the next 2 years.

Parties Involved: The entire apparatus of state government must be engaged to ensure that renewable systems are promoted and not stifled. For round 1 and 2 Renewable Energy Fund projects, House Bill (HB) 152 designated the AEA as the lead agency. The Renewable Energy Fund is to be administered by the Department of Revenue. HB 152 also states that the AEA is to coordinate project review with the Alaska DNR. Other agencies and organizations that are anticipated to be involved in policy implementation are:

- Governor
- Legislature
- Alaska Office of Management and Budget (OMB)
- RCA
- Renewable Energy Alaska Project
- Electric utilities
- Tribal governments
- Municipal and local governments

Other: None identified.

Implementation Mechanisms

The AEA has been designated the lead agency to implement renewable energy projects. The AEA has completed its review of projects submitted under Rounds 1 and 2. The AEA is also the lead agency designated to design, develop, and implement the *Alaska Energy: A First Step Towards Energy Independence* report. Additional policy, regulations, and statutory requirements may be required to fully achieve the report's goals and objectives.

The AEA is also involved in energy efficiency programs. Coordination between ESD-2/4/6 and ESD-3 will help to increase the level of GHG savings and their cost-effectiveness.

Overall, the scope for GHG reductions is:

- ESD-3a & 3b: All projects submitted, reviewed, and approved by the AEA, as part of the implementation of Renewable Energy Grant Program Rounds 1 and 2 of HB 152.
- ESD-3c: Hydroelectric projects that include each of the identified Susitna locations (Watana, Low Watana, Watana/Devil Canyon, Staged Watana/Devil Canyon, and Devil Canyon).

Related Policies/Programs in Place

Major programs in place that should be continued are:

- Renewable Energy Fund (per HB 152).
- Railbelt electricity grid coordination efforts.

Type(s) of GHG Reductions

Types: CO_2 and N_2O.

Negative Impacts: Increased use of concrete for hydroelectric dams, loss of carbon-sink forests from reservoirs and transmission lines, transportation for servicing remote wind turbine sites and hydroelectric dams.

Estimated GHG Reductions and Net Costs or Cost Savings

Costs and greenhouse gas reductions were estimated for three separate programs, the AEA Renewable Energy Grants Program Round 1 and Round 2 applications, and building a large hydroelectric facility connected to the railbelt grid. The expected carbon reductions, as well as the net present value (NPV) of these programs are summarized in table G-8. The estimated fuel mix serving Alaska electrical needs (not including North Slope oil & gas operations) as projects allocated seed funding from the renewable energy grants program are implemented is displayed in Figure G-5. The estimated fuel mix resulting from the building of a large grid-connected hydroelectric facility is displayed in Figure G-6. Finally, the expected renewable energy portfolio for both grid and village electricity generation before and after policy implementation is shown in Figure G-7.

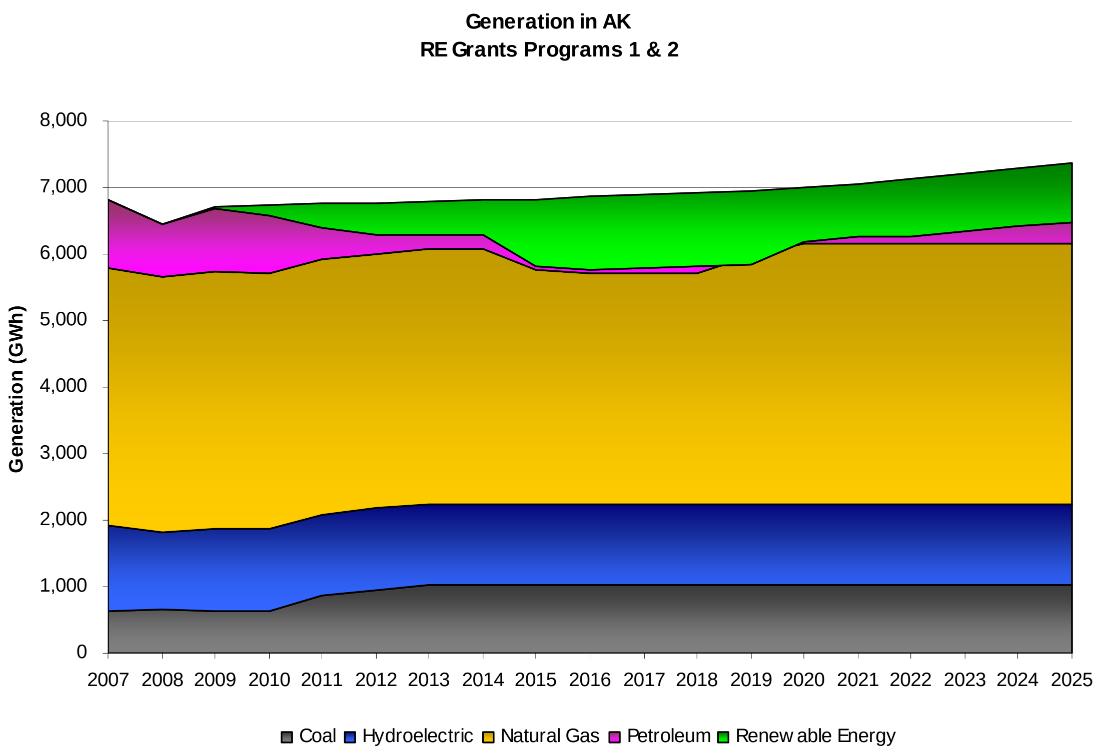
Table G-8. Estimated GHG reductions and net costs of or cost savings from the implementation of renewable energy

Policy No.	Policy	GHG Reductions ($MMtCO_2e$) 2015	2020	2025	Total 2010–2025	Net Present Value 2010–2025 (Million 2008$)	Cost-Effectiveness ($/$tCO_2e$)
ESD-3a	Renewable Energy Grants, Round 1	0.58	0.71	0.84	9.33	–$414	–$44
ESD-3b	Renewable Energy Grants, Round 2	1.41	1.64	1.64	18.80	–$485	–$26
ESD-3c	Large Hydroelectric	0.00	0.00	1.38	4.39	$1,196	$273
ESD-3	**Implementation of Renewable Energy**	**1.99**	**2.35**	**3.86**	**32.52**	**$297**	**$9**

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $\$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent.

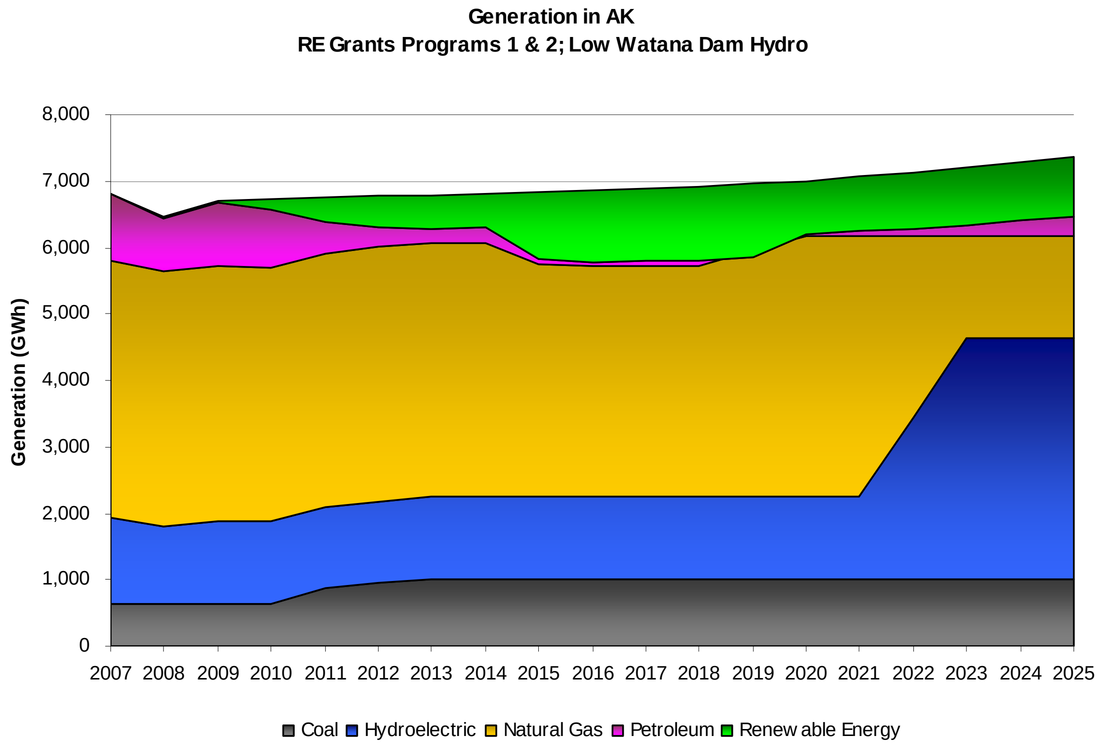
Note: Total cost effectiveness is calculated as total net present value ($297 million 2008$) per cumulative CO_2 emissions (32.52 $MMTCO_2e$) and is not additive between categories.

Figure G-5. Fuel mix through 2025 with full implementation of AEA Renewable Energy Grant programs (limited to those selected for seed grant funding)



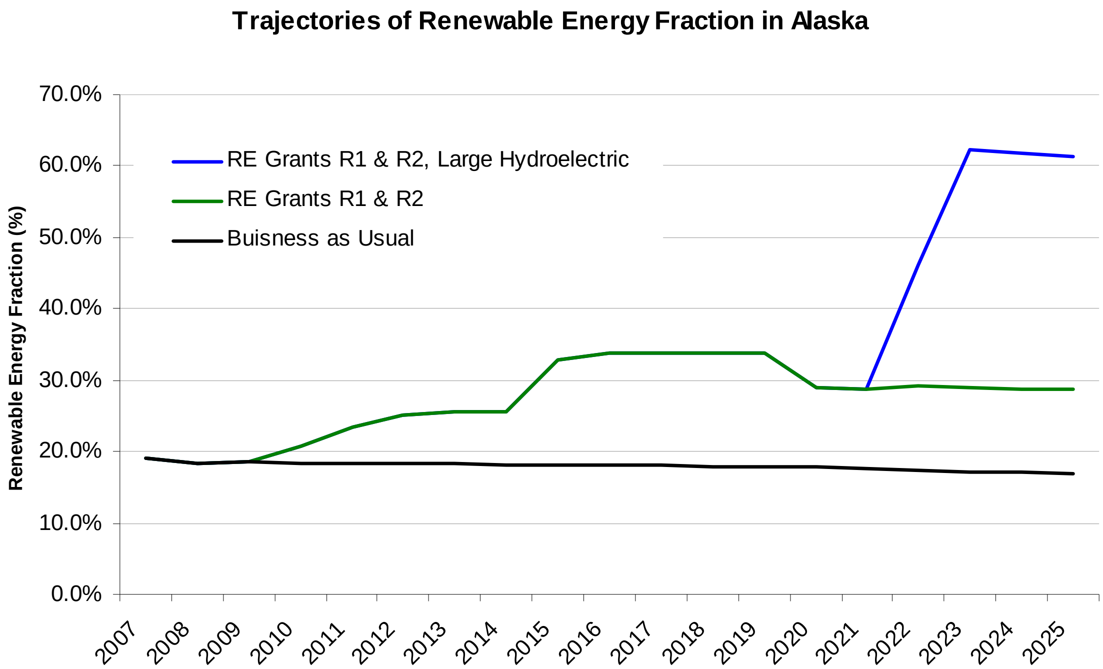
AEA = Alaska Energy Administration; AK = Alaska; GWh = gigawatt hours; RE = renewable energy.

Figure G-6. Fuel mix through 2025 with full implementation of AEA Renewable Energy Grant programs and large hydroelectric project (Low Watana dam equivalent)



AEA = Alaska Energy Administration; AK = Alaska; GWh = gigawatt hours; RE = renewable energy.

Figure G-7. Trajectories of renewable energy fraction in Alaska: business as usual (no additional renewable energy or hydroelectric projects implemented); implementation of selected AEA renewable energy programs; implementation of large hydroelectric project (Low Watana dam equivalent)



AEA = Alaska Energy Administration; RE = renewable energy.

Data Sources: The program description and estimates of emission reductions were obtained from the following sources:

- Alaska Energy Authority (January 2009), *Alaska Energy: A First Step Toward Energy Independence*. Available at: http://www.akenergyauthority.org/
- Alaska Energy Authority (March 16, 2009). Susitna Hydroelectric Project: Project Evaluation (Interim Memorandum, Final). Available at: http://www.aidea.org/aea/SusitnaFiles/Susitna_Hydroelectric_Project_Project_Evaluation_wo_appendices.pdf
- Alaska Energy Authority (2008), *Renewable Energy Fund Applications and Analysis.* . Available at: http://www.akenergyauthority.org/RE_Fund_Applications.html.
- Governor Palin press conference at Alaska Energy Authority, January 16, 2009: *Palin Unveils Energy Goals for Cities, Villages*. Available at: http://www.newsminer.com/news/2009/jan/16/palin-unveils-energy-goals-cities-villages/.
- Energy Information Administration, 2009. *Assumptions for the Annual Energy Outlook 2009: with Projections to 2030.* Available at: http://www.eia.doe.gov/oiaf/aeo/assumption/index.html.

- House Bill 152, Approved February 17, 2009, 25th Legislature. Available at: www.legis.state.ak.us.

Quantification Methods: The model is structured from standard analyses conducted by the AEA to determine which Renewable Energy Fund projects could obtain seed funding. Each of the Round 1 and 2 projects approved by the AEA were analyzed using AEA assumptions. Projects accepted for seed funding (partial or complete) were included. Rejected projects were excluded from the analysis.

- Each project lists (among other variables) annual expected renewable generation that would be accessed, O&M costs, avoided fossil fuel use, local expected prices for fuels, and capital costs. Capital costs were amortized across the expected lifetime of the project (also given by the AEA), starting from the first year of generation. The NPV is determined from the discounted costs (including amortized capital costs) and benefits through 2025.
- Avoided CO_2 emissions are calculated from avoided use of natural gas and diesel.
- Total cost-effectiveness is calculated as the cumulative carbon avoided (to 2025) divided by the NPV.
- The quantity of energy and capacity provided by each approved Round 1 and 2 project was calculated, and then aggregated. The quantity was compared to that of the Alaska goal of 50% renewable generation by 2025 against a business-as-usual load-growth scenario.
- Hydroelectric energy was added to meet the Alaska renewable energy goal of 50% by 2025, using the Susitna Low Watana dam option as a proxy project. Grid-connected hydroelectric energy was assumed to displace natural gas.

Key Assumptions:

- Diesel is the main fuel being displaced by the Round 1 and 2 projects; each project lists the expected displaced fuel and rate accordingly. Only current or projected electric demand is displaced (not conversions from fossil heat to electric heat).
- The rate of new renewable energy generation was assumed to continue until the 50% renewable energy goal was attained in 2025.
- Different prices were used for the avoided costs of electricity and fuel at each renewable energy project site, according to AEA estimations and projections. The price of avoided electricity on the grid was determined from AEA analyses, using proxy prices for the railbelt, south of the Alaska Range.
- It is assumed that the renewable energy projects proposed in Rounds 1 and 2 are the only renewable energy projects that will be implemented over the study period. Additional requirements for renewable energy to meet a 50% target by 2025 are assumed to be met by new, large-scale hydroelectric generation.
- It is assumed that proposed and accepted renewable energy projects do not overlap—i.e. they do not propose to displace the same fossil fuel sources.

Key Uncertainties

There are several uncertainties regarding this analysis and the ability of Alaska to achieve its goal of 50% renewable generation by 2025:

- National climate policy and world oil and natural gas markets will influence the cost-effectiveness of future projects.
- According to this analysis, Alaska can meet the 50% renewable energy goal by building a large, grid-connected hydroelectric facility. However, the cost of this project for both equivalent carbon reductions and on a cost-of-energy basis appears to be more expensive than the distributed projects proposed for AEA Renewable Energy Grants. The smaller projects are chosen (partly) based on cost-effectiveness, while the large hydroelectric project is not.
- Continued funding and/or development of funding mechanisms are necessary to ensure that the 50% renewable goal is reached by 2025.
- The eligibility of Alaska for revenue from the proceeds of federal carbon allowance auctions and the application of these funds to renewable energy projects is uncertain.

Additional Benefits and Costs

Increased renewable generation will produce several co-benefits for Alaska. These include:

- Lower electricity costs, and increased reliability, especially in rural areas and villages;
- Reduced environmental damage and costs associated with cleanup of diesel fuel spills in rural villages and along watercourses; and
- Reduced criteria and toxic air pollutant emissions from diesel generators.

Increased renewable generation will require additional infrastructure in Alaska. In many cases, these are small-scale projects with relatively contained footprints, such as:

- Wind
- Local timber for wood-fired co-generation, and
- Small hydroelectric facilities.

In some cases, however, they may have significant environmental impacts, such as:

- Flooding of forests and wildlands for large hydroelectric reservoirs and associated downstream impacts, and
- New transmission infrastructure and cleared corridors through protected lands.

Feasibility Issues

Statewide GHG benefits will be greatest if this policy is coordinated and integrated with ESD-2/4/6 (Energy Efficiency for Residential, Commercial, and Industrial Customers, 2% per year).

Status of Group Approval

Approved.

Level of Group Approval

Unanimous.

Barriers to Consensus

None.

ESD-5. Efficiency Improvements for Generators

Policy Description

This policy is intended to increase the efficiency of electricity generators. Originally developed to estimate the efficacy of tuning, improving, or replacing current generating units, it was envisioned that these marginal improvements could save anywhere from 3% to 30% of fuel in any given unit simply by upgrading to more efficient equipment. However, it was decided that these improvements would, in the absence of direct state subsidies to support capital improvements, fall under the purview of actions taken and funded by utilities.[9] Instead, the policy was restructured as an Research and Development encouragement policy to create highly efficiency next-generation generators.

Members of the MAG opted to move this policy to the Research Needs Working Group, and unanimously supported a non-quantified policy to encourage utility operators to invest in currently available efficient generators.

[9] Utility operators noted that any generator improvements are intrinsically a utility cost-based decision. Capital costs for improvements and savings from reduced fuel use are passed through to utility ratepayers. Ultimately, if efficiency upgrades resulted in a net benefit for consumers, utilities would undergo these improvements, regardless of GHG implications.

ESD-7. Implementation of Small-Scale Nuclear Power

Policy Description

This policy was conceived to develop technologies for small-scale nuclear generation in outlying rural areas. A series of low-maintenance, low-running cost nuclear generators could reduce the need to import fuel to small villages and towns and reduce emissions from diesel engines. There are currently no small-scale nuclear units available on the market (or that have passed federal regulatory hurdles); thus, this policy could not be quantified for costs or potential benefits. The significant research agenda required to implement this policy rendered it appropriate as a research need.

Members of the MAG opted to move this policy to the Research Needs Working Group.

ESD-8. Research and Development for Cold-Climate Renewable Technologies

Policy Description

This policy was conceived to recognize that Alaska's unique climatic conditions render some technologies difficult or impossible to deploy. The policy seeks to create one or more centers of expertise on cold-climate-compatible renewable energy in Alaska. The significant research agenda required to implement this policy rendered it appropriate as a research need.

Members of the MAG opted to move this policy to the Research Needs Working Group.

ESD-9. Implementation of Advanced Supply-Side Technologies

Policy Description

This policy was conceived to examine Alaska's capacity for significant improvements in generation technology, and look to develop and implement new or emerging forms of energy supply. Research in this area would focus on biomass gasification, coal-to-liquids, carbon capture and storage, and enhanced geothermal systems, among others. The significant research agenda required to implement this policy rendered it appropriate as a research need.

Members of the MAG opted to move this policy to the Research Needs Working Group.

ESD Annex 1: Current Action: Weatherization Program Appropriation

At the time of this analysis, the AEA and AHFC had received a $300 million state and federal appropriation of funds for a residential weatherization improvement program and low-income household weatherization program. Two-thirds of the program funds were directed toward the low-income program. Because there is a potential for significant emission savings from these weatherization funds, these savings should be deducted from the baseline expected emissions.

The OMB released an estimate of weatherization funds expected without the additional appropriation, spanning 2010–2014.[10] Over this period, it is expected that $8 million would be used each year. We assumed that the additional $200 million of funding would be equally divided over this same period at $40 million per year, replacing and exceeding the $8 million annual expected funding from the OMB. Thus, the "current action" additional funding would result in $32 million per year from 2010 to 2014. Similar weatherization and efficiency programs typically require a minimum of 20% administrative costs (advertising and marketing, consumer questions and concerns, coordination of contractors, etc.), which were deducted from the total available funding pool. Using the average historical cost per house for low-income weatherization ($6,518) and the estimated CO_2 reductions per weatherized household (34,962 pounds per house),[11] it was estimated that the weatherization program would result in 0.07 million tons per year of annual CO_2 reductions, or a cumulative 0.34 million tons over the course of the program.

It should be noted that low-income weatherization programs are typically considered social equity and poverty reduction programs, rather than energy efficiency programs. These programs do not necessarily target the most cost-effective energy or emission savings, but rather are structured to alleviate energy bills for low-income residents.

[10] Alaska Housing Finance Corporation (2008). AHFC Weatherization Program, FY2010 Appropriation Request: Brief Statement and Summary of Need. Available online at: http://omb.alaska.gov/10_omb/budget/Rev/enacted/2010proj6332.pdf.

[11] Report by Information Insights, Inc. (June 5, 2008). *Alaska Energy Efficiency Program and Policy Recommendations*. Prepared for Cold Climate Housing Research Center. Available at: http://www.cchrc.org/App_Content/files/08-2_EEP_Draft_Final.pdf.