Appendix F
Energy Efficiency and Conservation Policy Options

Summary List of ICCAC Options

No.	Policy Option	CO_2 Reduction 2012	CO_2 Reduction 2020	Total 2009–2020	Net Present Value 2009–2020 (Million $)	Cost/Ton ($/t$CO_2$e)	Level of Support
EEC-1	Consumer Education Programs	*Not quantified*					Unanimous
EEC-2	Demand-Side Management (DSM)/Energy Efficiency Programs for Natural Gas	0.08	1.24	5.43	–$191.77	–$35.29	Super Majority (4 objections)
EEC-3	Financial Mechanisms for Energy Efficiency	1.62	6.11	36.81	–$805.05	–$21.87	Super Majority (1 objection)
EEC-4	Improved Building Codes for Energy Efficiency	0.05	0.40	1.89	–$46.27	–$24.44	Super Majority (5 objections)
EEC-5	Incentive Mechanisms for Achieving Energy Efficiency	0.35	3.29	16.33	–$350.79	–$21.48	Unanimous
EEC-6	Promotion and Incentives for Improved Design and Construction in the Private Sector	0.00	0.12	0.46	–$11.36	–$24.57	Super Majority (1 objection)
EEC-7	Training and Education for Builders and Contractors	*Not quantified*					Unanimous
EEC-8	Focus on Specific Residential Market Segments	0.09	0.98	4.83	–$122.53	–$25.37	Unanimous
EEC-9	Midwestern Governors Association Energy Security and Climate Stewardship Platform	0.13	4.13	17.14	–$375.69	–$21.92	Majority (9 objections)
EEC-10	Energy Management Training/Training of Building Operators	0.10	1.29	5.48	–$129.49	–$23.63	Super Majority (1 objection)
EEC-11	Rate Structures and Technologies To Promote Reductions	0.04	0.21	1.20	–$25.73	–$21.45	Unanimous
EEC-12	Demand-Side Management (DSM)/Energy Efficiency Programs for Electricity	0.39	4.38	20.33	–$444.81	–$21.88	Super Majority (4 objections)
EEC-13	Government Lead by Example: Improved Design, Construction, and Energy Operations in New and Existing State and Local Government Buildings	0.08	0.36	1.97	1.04	0.53	Majority (6 objections)
EEC-14	More Stringent Appliance Efficiency Standards	0.94	2.20	17.33	–$708.15	–$40.85	Super Majority (2 objections)
	Sector Total After Adjusting for Overlaps	**1.1**	**8.6**	**43.2**	**–$1,064.5**	**–$24.7**	
	Reductions From Recent Actions: EISA (2007) and Executive Orders #6 and 41	**0.44**	**1.42**	**9.19**			
	Sector Total Plus Recent Actions	**1.6**	**10.0**	**52.3**			

CO_2 = carbon dioxide; DSM = demand-side management; NPV = net present value; $/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; EISA = Energy Independence and Security Act (2007).

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings.

The numbering used to denote the above policy options is for reference purposes only; it does not reflect prioritization among these important policy options.

Overlap Discussion

The Iowa Climate Change Advisory Council (ICCAC) and the Energy Efficiency and Conservation Subcommittee (EEC SC) have developed 14 policy options to reduce the emissions of greenhouse gases (GHGs) in the residential, commercial, and industrial (RCI) sector. In addition to estimating the impacts of each individual policy option, the *combined* impacts of the policy options in each sector were estimated, assuming that all were implemented together. This involved eliminating any overlaps in coverage that would occur to avoid double counting of impacts. Also, some of the policy options in one sector overlapped with policy options in another sector; therefore, these overlaps were identified and the impact analysis was adjusted to eliminate double counting of impacts associated with these intersectoral overlaps. The following section identifies where these overlaps occurred and explains the methods used to adjust the impacts analysis to avoid double counting of impacts.

EEC Cumulative Impacts Analysis Methodology

To assess the cumulative emission reductions for the policies in the RCI sector, it is necessary to consider any overlaps among the policy options that affect similar types of energy use. Specifically, some policies (such as EEC-3) are defined by their goals for reducing energy use, while others (such as EEC-12 and EEC-2) are defined by addressing a specific type of energy use. Policies were compared in terms of the type of energy use they target and the energy reduction strategies they implement. Overlaps were identified and quantified by sector (RCI or government/institutional), type of energy use targeted (water heating, space heating, etc.), and measure (e.g., solar hot water). If a policy's impact by sector and type of energy use was less than the impact from an overlapping policy for that same sector and type of energy use, it was excluded from the cumulative analysis.

EEC-3 provides tax incentives and other mechanisms that are not covered by utility and nonutility energy efficiency programs. Nonetheless, from the perspective of the practical, achievable potential for the deployment of energy efficiency through 2020, there is significant overlap with EEC-12. This option does not overlap with EEC-2 because, as it is quantified, it does not target natural gas efficiency. In contrast, this option is more aggressive in deploying energy efficiency, as it assumes that 2% of retail sales are conserved by 2010, while this level is not achieved in EEC-12 until 2016. For this reason, this option is assumed to overlap with EEC-12 by 85%, and its delivered reductions in energy and carbon dioxide (CO_2) are reduced by this amount.

EEC-4 improved building codes don't overlap with EEC-12 and EEC-2, at least in theory, because EEC-12 and EEC-2 should be either applied to existing demand or would be for energy efficiency improvements beyond new codes. There are no overlaps for this option.

EEC-5 includes financial mechanisms, such as decoupling utility revenues from sales of electricity or natural gas, allowing utilities to rate-base their energy efficiency expenditures and earn returns on these investments, and allowing utilities to earn interest on customer loans for energy efficiency equipment. In theory, these implementation mechanisms will provide new sources of funding for energy efficiency measures and thus increase their deployment. However, this measure targets an incremental 1.5% of retail sales being conserved via energy efficiency by 2012, which, when combined with EEC-12, would exceed achievable levels of programmatic energy efficiency.[1] Furthermore, the load management and time-of-use measures overlap with EEC-11. This option is assumed to overlap 90% with other options.

EEC-6 looks for ways to improve the efficiency of new buildings and major retrofits beyond existing building codes. Several of the measures that could be used to achieve this are placing caps on consumption of energy per unit area of floor space for new buildings and encouraging building commissioning and recommissioning, including energy tracking and benchmarking. While these measures might improve energy efficiency, they are largely captured under EEC-4 and EEC-12 and EEC-2. This option is assumed to overlap 90% with other options.

EEC-8 focuses on low-income residents who may not receive energy efficiency investments under utility demand-side management (DSM) programs. However, well-designed DSM programs should target low-income residences. This option also targets residential and commercial energy consumers who have significant disincentives for investing in energy efficiency measures due to landlord-tenant market failures. It targets minimum efficiency goals for rental properties, such as using compact fluorescent light bulbs and energy-efficient appliances, with inspections occurring with the departure of current tenants via a pre-rental inspection program before a new tenant takes possession. This option is assumed to overlap 75% with EEC-12 and EEC-2.

EEC-9 adheres to the Midwestern Governors Association (MGA) target for energy efficiency. It is 100% redundant to EEC-12, and is eliminated from the adjusted cumulative totals.

EEC-10 provides a certification program for building operators. Utilities already have such programs, but their reach isn't as large as envisioned under this policy. This option is assumed to overlap 90% with EEC-12 and EEC-2.

EEC-11 quantifies the reduced use of electricity due to more rational pricing mechanisms, such as real-time pricing. Higher prices result in lower energy use overall. The quantification of this option explicitly excludes conservation measures, such as high-efficiency air conditioners and chillers, which are included in EEC-12. This option does not overlap with any others.

The government high-efficiency building standards in EEC-13 typically show little overlap with utility programmatic investments and are additional to code improvements. This option does not overlap with any others.

EEC-14 deploys ENERGY STAR equipment in government, residential, commercial, and industrial facilities. It also raises appliance efficiency standards for products not covered by federal standards, although the list of products that are eligible for state standards shrank considerably after the passage of the Energy Independence and Security Act (EISA) in 2007. EEC-12 and EEC-2 also provide incentives for customers to purchase efficient appliances and office equipment. This option is assumed to overlap 75% with EEC-12 and EEC-2 and other policy options.

[1] The report prepared by Quantec LLC for the Iowa Utilities Association, *Assessment of Energy and Capacity Savings Potential in Iowa, Volume II*, shows the best utility programs in the country are able to achieve incremental energy efficiency investments of slightly over 2% of energy sales (p. I-10). Thus, the combined energy targets under EEC-5 and EEC-12/EEC-2 would be impractical to attain.

Overlaps Between Sectors

The electricity energy efficiency investments from the suite of EEC policy options reduce electricity demand and thus make it possible to meet renewable energy mandates more cost-effectively. For example, under EEC-12, electricity demand in 2020 is reduced by almost 5,000 gigawatt-hours (GWh) versus the reference case. Clean and Renewable Energy option CRE-8b assumes a 20% renewable portfolio standard (RPS) by 2020, which is 4% more of renewable sources of energy (as a percentage of retail sales) than is forecasted under the reference case. Therefore, the implementation of EEC-12 would require 200 GWh fewer of renewable resources to meet the RPS target. Using the renewable energy cost assumptions for CRE-8b, the reduced spending on renewables that cost more than reference case generation in 2020 would result in savings of $0.3 million in that year.

Finally, an additional feedback is that certain CRE policies will have the effect of reducing the GHG emissions associated with energy production, so that EEC policies that target electricity use will have a reduced impact on overall emissions. However, this impact is small and has not been reflected in the analysis beyond the avoided CO_2 methodology that assumes in the later years of the program that 21% new renewables are avoided by implementing the EEC options. See the Annex to this document for a discussion of the avoided CO_2 methodology.

Reductions from Recent Actions

Recent actions are accounted for in the summary table as policies that have been enacted, but that are not in the reference case Iowa inventory and forecast. These include the federal Energy Independence and Security Act (EISA) of 2007, which was signed into law in December 2007. This law contains several requirements that will reduce GHG emissions as they are implemented over the next few years. During the ICCAC process, sufficient information was identified (e.g., implementation schedules) to estimate GHG emission reductions associated with implementing energy efficiency requirements for new appliances and lighting in Iowa under Title III of the EISA.[2] The 2020 residential electricity savings are estimated at 5.5% of sales, and natural gas savings are estimated at 1% of sales from more efficient residential furnaces. The net effect of these reductions was estimated at 1,300 GWh of electricity, and 1,300 billion British thermal units (BBtu) of natural gas savings in Iowa by 2020. The associated GHG reductions for these savings are projected to be 1.1 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) for 2020 using the EEC CO_2 methodology. Note, however, that GHG emission reductions associated with the EISA Title IV (Energy Savings in Buildings and Industry) and Title V (Energy Savings in Government and Public Institutions) requirements have not been quantified because of the uncertainties about how they will be implemented.

[2] American Council for an Energy Eefficient Economy. Annual Energy Independence and Security Act of 2007. Savings Estimates as passed by the Senate. 2008. Available at: http://www.aceee.org/energy/national/EnergyBillSavings12-14.pdf.

Also, Iowa's Executive Orders #41 (Governor Vilsack)[3] and #6 (Governor Culver)[4] to reduce energy use in state buildings will also have an impact on future GHG emissions. The avoided electricity and natural gas GHG emissions are estimated at about 0.30 $MMtCO_2e$ in 2020. These actions are expected to achieve annual energy reductions from state government operations of 5% for 3 years for Executive Order #41 (2007–2010) and 2% a year for 7 years (2008–2015) for Executive Order #6. These forecasted reductions are reduced by implementation rates of 60% and 80%, respectively. The less than 100% implementation rate assumes Executive Order #41 is benchmarked relative to the year 2000, which reduces the energy reduction achievement in current energy levels. Also, there are other means by which state facilities cannot participate in the programs. The reductions from these recent actions are reflected in the energy and GHG reductions quantified in EEC-13.

As mentioned in the text below, Iowa utilities have been pursuing energy efficiency programs for some time. These investments are not quantified in the analysis because EEC SC members indicated that the energy impacts from these efficiency programs are already incorporated into the utility load growth forecasts that were used for the reference case inventory and forecast (i.e., they are already in the baseline). The assumed incremental (new) statewide energy efficiency investments are equal to 0.82% of retail natural gas sales, and 0.69% of electricity sales over the planning period. These investments are deducted from each of the relevant energy efficiency targets in the individual policy options. For example, the energy efficiency target in EEC-12 (culminating at 2% of retail sales) is reduced by 0.69% to an incremental 1.31% of new investments by 2020. This approach avoids double counting reductions from existing programs in the policy options. Assuming incremental energy efficiency investments from existing actions in Iowa remained unchanged from 2006 levels, Iowa's cumulative electric energy efficiency deployment would be approximately 15% of sales in 2020. For natural gas, Iowa's cumulative natural gas energy efficiency deployment would be approximately 19% of sales in 2020. When using the levelized cost estimate assumptions developed for the RCI sector, total utility and participant spending on energy efficiency/DSM from existing actions in the reference case is estimated at $270 million in 2020.

The Iowa Utilities Board (IUB) is reviewing investor-owned utility plans to increase incremental electricity and natural gas investments to 1.5% of natural gas and electricity sales. Because these plans have not been approved, they are not included in the quantitative analyses. However, these targets are similar to those of options EEC-2 and EEC-12 for natural gas and electricity, with the primary difference that the two ICCAC options escalate to investments equal to 2% of sales later in the planning period.

[3] State of Iowa, Executive Department. *Executive Order Number Forty-One*. Available at: http://publications.iowa.gov/2619/1/EO_41.pdf.

[4] State of Iowa, Executive Department. *Executive Order Number Six*. February 2008. Available at: http://publications.iowa.gov/6275/1/06-080221%5B1%5D.pdf.

EEC-1. Consumer Education Programs

Policy Description

The ultimate effectiveness of emission reduction activities in many cases depends on providing information and education to consumers regarding the GHG emission implications of their choices. Public education and outreach is vital to fostering a broad awareness of climate change issues and effects (including co-benefits, such as clean air and public health) among the state's citizens. Such awareness is necessary to engage citizens in actions to reduce GHG emissions in their personal and professional lives. Public education and outreach efforts should integrate with and build upon existing outreach efforts involving climate change and related issues in the state. Ultimately, public education and outreach will be the foundation for the long-term success of all of the mitigation actions proposed in the climate change planning process, as well as those that may evolve in the future.

This option focuses on public education and outreach to stimulate decisions that yield energy efficiency savings. Consumer education is an integral component of most existing DSM programs offered by investor-owned and consumer-owned utilities.

Policy Design

Goals: Achieve at least a 5% reduction in residential energy consumption.

Timing: 1% reduction beginning in 2010 and increased linearly to 5% in 2020.

Implementing Parties: Iowa Office of Energy Independence, community colleges, secondary schools, building professional trade groups, utilities.

Implementation Mechanisms

Possible policy mechanisms include:

- Evaluate techniques for assessing the impact of various educational efforts, and disseminate standard methodology to utilities, the IUB, and others.
- Use the 2007 Iowa Residential Energy Survey to guide educational programs and efforts.
- Implement energy districts. Energy districts are based on the conservation district model of the 1930s and 1940s that created a unique local-state-federal partnership to bring conservation technical and financial assistance to every farm. This locally led process could make energy efficiency a highly visible local economic development tool. Districts could participate in national programs; partner with local business for a "distributed efficiency storefront"; develop agricultural energy initiatives with local conservation district, the U.S. Department of Agriculture (USDA), and Extension partners; develop a local carbon offset program with funds and offsets entirely within county; and work with utilities to encourage local distributed generation.

- Work with the Center for Energy and Environmental Education (CEEE) at the University of Northern Iowa (UNI), the Iowa Department of Education, and other appropriate agencies to better incorporate energy efficiency in education curricula.
- Develop and present/distribute seminars and/or publications aimed at residential consumers about state/federal tax credits for investment in energy-efficient technologies and practices, what renters can do to improve energy efficiency, availability of green mortgages, and sources for self-liquidating financing of energy efficiency technologies.
- Develop and present/distribute seminars and/or publications aimed at housing professionals (builders, architects, realtors, appraisers, bankers, landlords, and others) to extend information about green mortgages, self-liquidating financing, ENERGY STAR, National Association of Home Builders (NAHB) and Leadership in Energy and Environmental Design home certification standards, and benefits of efficiency investments by landlords.
- Develop and present/distribute seminars and/or publications aimed at commercial and industrial consumers to extend information about tax credits, best practices, and such available resources as the Industrial Assessment Center (IAC) at Iowa State University (ISU), the National Building Control Information Program, NAHB, Iowa Energy Center (IEC), etc.
- Develop and present/distribute seminars and/or publications aimed at heating, ventilation, and air conditioning (HVAC) contractors. (Utilities are starting to require very high levels of service that many contractors cannot provide right now.)
- Display energy efficiency measures in retail outlets and other public settings.
- Determine education efforts that will be needed to support other new/expanded energy efficiency initiatives, including (1) expand the Weatherization Assistance Program to make the homes of low-income Iowans more energy efficient, (2) develop minimum energy efficiency standards and enforcement mechanism for rental properties, (3) develop financial incentives to more effectively encourage retrofitting of rental properties with energy-efficient appliances and weatherization measures, and (4) develop financing mechanisms to make energy-efficient appliances affordable for everyone.
- Utilize and promote ISU's IAC to extend information about energy efficiency to Iowa business and industry. Encourage development of K-12 energy efficiency curricula.

Related Policies/Programs in Place

Municipal utilities, through the Iowa Association of Municipal Utilities (IAMU), have developed a new direct mail energy and environmental magazine called *Eco@Home*. IAMU is also developing an energy-related "town meeting kit" for its members.

While utility energy efficiency plans must be cost-effective, the Iowa General Assembly (2007 session) amended Iowa Code § 476.6(14), which provides that educational programs and assessments of consumers' needs for information to make effective choices regarding energy use and energy efficiency need not be cost-effective (Laws of the Eighty-Second G.A., H.F. 918).

Low-income education programs delivered by Community Action Program (CAP) agencies through investor-owned energy efficiency programs include the following:

- Energy efficiency curriculum developed by MidAmerican Energy.
- School energy efficiency kits (4^{th}–6^{th} grades) distributed by Aquila.
- IEC "shall cooperate with the state board of education in developing a curriculum which promotes energy efficiency and conservation" (Iowa Code § 266.39C(4)). After experiencing difficulties implementing a statewide energy curriculum (see Feasibility issues below), IEC has sponsored Iowa teachers (covering both conference and travel expenses) to attend NEED (National Energy Education Development) training conferences. With a range of sponsors and a core staff, NEED has materials available and continuously up to date. In recent years, the NEED training sponsorship has been extended to 4-H leaders.
- IEC devotes the largest portions of its funds to energy efficiency research, demonstration projects, and education projects, addressing energy use in agricultural, industrial, commercial, municipal, and residential settings. In the last several years, IEC has developed the Residential Home Series Booklets (www.energy.iastate.edu/homeseries/index.htm) and has signed cooperative agreements allowing for their reproduction and use in neighboring states.
- USDA's Section 9006 Renewable Energy & Energy Efficiency Program.
- Muscatine Power & Water has been using an energy efficiency curriculum for several years with local schools.
- Some municipal utilities and rural electric cooperatives (RECs) have educational programs or comprehensive curricula in their service territories.
- Independence Municipal Utilities utilizes a new program from its power supplier, Wisconsin Public Power Inc., that may represent an emerging good practice for supporting development of customer-owned small-scale renewable generation.
- Wisconsin has a statewide comprehensive curriculum, called KEEP, which could serve as a model for a similar program in Iowa.
- CEEE has many individual programs for encouraging energy education for students.
- Some utilities provide scholarships for Building Operator Certification training.

Additional resources are available from www.energystar.gov and www.energytaxincentives.org.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of methane (CH_4), and nitrous oxide (N_2O) emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

None identified.

Additional Benefits and Costs

All of the other policy options rely on public education for success.

Feasibility Issues

Home rule allows local schools to determine their curricula. This could affect implementation of some of the options.

Status of Group Approval

Approved.

Level of Group Support

Unanimous.

Barriers to Consensus

None.

EEC-2. Demand-Side Management (DSM)/Energy Efficiency Programs for Natural Gas

Policy Description

A DSM/energy efficiency approach requires actions that influence both the quantity and the patterns of energy consumed by end users. This policy option focuses on DSM/energy efficiency programs run by gas utilities, and may be designed to work in tandem with other strategies that can also encourage efficiency gains.

The 2008 session of the Iowa General Assembly passed legislation to require the establishment of energy efficiency savings goals for all of Iowa's municipal gas utilities and one cooperative gas utility.

Policy Design

Goals: Invest in energy efficiency equal to 1.0% of statewide retail gas sales per year within 3 years; 1.5% per year in 5 years; and 2.0% per year in 7 years.

Timing: Phase in, beginning in 2010.

Parties Involved:

- Extend the DSM obligations and goals to all gas utilities in Iowa. Investor-owned utilities (IOUs) are starting at 0.8%.
- IOUs, the Iowa Utility Association, municipal utilities, IAMU, and consumer cooperatives.

Implementation Mechanisms

Possible policy mechanisms include the following:

- Establish (via IUB) DSM goals for investor-owned utilities.
- Revise existing statutes to incorporate prescribed energy efficiency goals.
- Change the determination of DSM cost-effectiveness by accounting for the estimated valuation of CO_2 emissions avoided by programs.
- Extend the energy efficiency goals and obligations to all gas utilities in Iowa.
- Expand DSM measures eligible for program incentives.
- Extend investor-owned natural gas program funding requirements and eligibility to natural gas transportation customers.
- Expand the scope of utility activity that can contribute to achieving DSM goals to account for natural gas savings accruing when an electric utility provides incentives for installation of geothermal systems and building shell measures in an area in which natural gas service is available.

- Expand the scope of utility activity that can contribute to achieving DSM goals to include actions that are on the utility side of the meter, so-called "infrastructure" investments (a term adopted in Minnesota in 2007).
- Recognize the contribution of increased building energy codes and equipment energy standards toward the achievement of DSM goals.
- Include in the measurement of DSM goals the energy savings from renewable measures that are implemented on the customer side of the meter.

Related Policies/Programs in Place

Natural gas utilities in Iowa must offer cost-effective energy efficiency programs (Iowa Code § 476.6(14)). The IUB establishes energy efficiency goals for rate-regulated gas utilities (Iowa Code § 476.6(16)). DSM offered by municipal and rural electric cooperative utilities is not regulated. Most natural gas transportation customers served by competitive commodity suppliers do not fund energy efficiency programs mandated in § 476.6(16) and are not eligible to participate in these programs.

Investor-Owned Natural Gas Utilities

IOUs have a long history of conducting DSM/energy efficiency programs, under statutes adopted in 1990 and modified in 1996. The IUB conducts contested proceedings for the review of plans, programs, and energy savings goals developed by IOUs. New plans were filed in April 2008, and the IUB has directed the IOUs to include analyses of the effects of goals equivalent to saving 1.5% of retail natural gas sales in Iowa.

Municipal and Cooperative Natural Gas Utilities

Although municipal gas utilities were required to file biennial energy efficiency plans, and many have conducted DSM programs, legislation passed in 2008 requires each utility or group of utilities to determine the maximum potential energy and capacity savings available from actual and projected customer usage through cost-effective energy efficiency measures and programs. Based on the energy efficiency assessment, each utility must establish an energy efficiency goal, along with a set of cost-effective energy efficiency programs designed to meet the goal. The process must be started by July 1, 2008, with a progress report submitted to the IUB by January 1, 2009, and a final report filed by January 1, 2010. The report must include the utility's cost-effective energy efficiency goal, and for each measure utilized by the utility in meeting the goal, the measure's description, projected cost, and the analysis of its cost-effectiveness. On January 1 of each even-numbered year, commencing January 1, 2012, utilities must file a report with the IUB identifying their progress in meeting the energy efficiency goal and any updates or amendments to their energy efficiency plans and goals. This requirement takes the place of the current energy efficiency plan filings.

The assumed incremental (new) statewide natural gas energy efficiency investments are equal to 0.82% of retail sales over the planning period.

Type(s) of GHG Reductions

For direct fuel use, CO_2 emissions from natural gas combustion and likely very small amounts of CH_4 emissions from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-2-1. Estimated GHG reductions and net costs of or cost savings from EEC-2

Quantification Factors	2012	2020	Units
GHG emission reductions	0.08	1.24	$MMtCO_2e$
Net present value	–$6.5	–$191.8	$ Million
Cumulative GHG reductions	0.15	5.43	$MMtCO_2e$
Cost-effectiveness	–$42.62	–$35.29	$/tCO_2e$

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

Assuming incremental energy efficiency investments in Iowa remained unchanged from the 2006 levels reported in IUB (2008), Iowa's cumulative natural gas energy efficiency deployment would be approximately 19% of sales in 2020. When using the levelized cost estimate assumptions developed for the EEC sector, total utility and participant spending on energy efficiency/DSM in the reference case is estimated at $270 million in 2020. Under EEC-2, additional energy efficiency spending is estimated at $113 million in 2020, which achieves another cumulative 8.5% of sales.

Data Sources:

- Energy consumption by sector (billion BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.
- Quantec LLC, Summit Blue Consulting, Nextant, Inc., A-TEC Energy Corporation, and Britt/Makela Group. February 2008. *Assessment of Energy and Capacity Savings Potential in Iowa: Final Report*, vol. I. Prepared for the Iowa Utility Association. (No Web link available.)
- IUB. January 1, 2008. *The Status of Energy Efficiency Programs in Iowa and the 2007 Iowa Residential Energy Survey. Report to the Iowa General Assembly*. p. 50. Available at: http://www.state.ia.us/government/com/util/docs/misc/EE/noi072/noi072_StatusReport.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- Levelized costs of gas are $5.45 million Btu (2008 dollars) (Quantec 2008).
- This figure includes all utility and participant costs. Utility fixed costs are assumed to be 24% of the capital cost, based on MEC energy efficiency plan submitted in April 2008 filing Docket # EEP-08-02. Vol II, pp. A1-8. (No Web link available.)
- The annual real escalation rate for the cost of energy efficiency programs is 0%.

- Avoided cost of gas in 2009 is $9.49 MMBtu (2008 dollars). The figure is from 2009–2013 Energy Efficiency Plan Interstate Power and Light Company Docket No. EEP-08-1, p. 31. (No Web link available.)
- The energy efficiency programs begin in 2010.
- The value used for the real rate at which costs are discounted annually is 5%.
- Net present value (NPV) is calculated in 2005 dollars beginning in 2009.
- Energy efficiency costs are expressed as levelized costs over the life of the energy efficiency options. The incremental costs (typically incurred in the first year of program implementation) are spread over all future years of the life of the energy efficiency measures.
- 2008 IOU assessment of potential does not evaluate potential from either natural gas transportation customers in funding and eligibility for DSM programs, or fuel switching by end users.
- Statewide natural gas energy efficiency programs are assumed to be 0.82% of retail sales over the planning period.
- IOU gas sales comprise approximately 90% of statewide gas sales over the planning period.

Key Uncertainties

Energy efficiency investments most likely will not lead to reductions in utility rates, but typically result in reduced energy expenditures (customer bills) over the life of the investment, compared to no investments in energy efficiency.

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[5]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills, when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

[5] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

Level of Group Support

Super Majority (4 objections).

Barriers to Consensus

Unspecified.

EEC-3. Financial Mechanisms for Energy Efficiency

Policy Description

This option refers to financial mechanisms that could increase energy efficiency provided by nonutility entities and investment by providing incentives to a variety of energy consumers to improve energy performance of buildings, equipment, and residences. Some of the utilities active in Iowa have offered such financing mechanisms in other states and for specific market segments in Iowa. At least one Iowa utility has a pilot program for a no-interest revolving loan fund. IEC has offered a revolving loan fund for renewable energy for a number of years.

Policy Design

Goals: Reduce electricity, natural gas, and heating fuels consumption across all end-user categories by 2% of retail sales annually. End users include public-sector, industrial, commercial, multifamily residential, and residential users. GHG reductions and costs of or benefits from natural gas and heating fuels are not quantified in this option.

Timing: Initial 2% realized in 2010, with continued annual decline.

Implementing Parties: All public-sector, residential, commercial, and industrial electricity consumers; nonutility entities delivering financial mechanisms.

Implementation Mechanisms

- Financial and technical assistance for energy audits.
  - Currently the Iowa Department of Natural Resources (DNR) has $600,000 to direct to public and nonprofit facilities to provide energy audits and technical assistance to follow up on audit recommendations. New legislation allows for fees, so the program should be self-funding. Financing for improvements through the Treasurer's office in a lease/purchase agreement.
  - Provide $1 million to expand energy audit programs for industrial, commercial, and multifamily residential sectors, and offer assistance for building and production facilities owners to follow up on audit recommendations.
  - Provide $10 million revolving low- or no-interest loan fund(s) through IEC or the Iowa Finance Authority for energy efficiency investments, potentially targeted at industrial, commercial, and multifamily residential energy users.
  - Performance contracting is a self-financing mechanism for improvements in energy efficiency. The money saved through less energy consumption is leveraged to pay for financing, installing, operating, and maintaining the energy efficiency measures.
  - Provide $10 million tax credits for purchasing appliances that meet ENERGY STAR 2007 requirements.
  - Provide $10 million in income tax credits to nonresidential and multifamily buildings of at least 20,000 square feet that are constructed or rehabilitated to meet criteria set forth by U.S. Green Building Council or other criteria. Apply credits to three types of alternative

energy sources: photovoltaics, wind turbines, and fuel cells. Allow the credits to be claimed only if they serve a green whole building, a green base building, or green tenant space.

Related Policies/Programs in Place

MGA Stewardship Platform.

Executive Orders #6 (Governor Culver)[6] and #41 (Governor Vilsack).[7] See EEC-13.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-3-1. Estimated GHG reductions and net costs of or cost savings from EEC-3

Quantification Factors	2012	2020	Units
GHG emission reductions	1.62	6.11	$MMtCO_2e$
Net present value	–$103.8	–$805.0	$ Million
Cumulative GHG reductions	3.27	36.81	$MMtCO_2e$
Cost-effectiveness	–$31.75	–$21.87	$/tCO$_2$e

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO$_2$e = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

- Energy Consumption by Sector (BBtu). See EEC-12.
- Power Station Electricity Generation (GWh) and Fuel Use (BBtu). See EEC-12.
- MGA. 2007. *Energy Security and Climate Stewardship Platform for the Midwest*. Midwestern Energy Security and Climate Stewardship Summit. Available at: http://www.midwesterngovernors.org/Publications/MGA_Platform2WebVersion.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

[6] State of Iowa, Executive Department. *Executive Order Number Six*. February 2008. Available at: http://publications.iowa.gov/6275/1/06-080221%5B1%5D.pdf.

[7] State of Iowa, Executive Department. *Executive Order Number Forty-One*. April 22, 2005. Available at: http://publications.iowa.gov/2619/1/EO_41.pdf.

Key Assumptions:

- GHG reductions and costs or benefits from natural gas and heating fuels are not quantified in this option, so actual reductions from this option are likely to be larger than those presented in the analysis.
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- The quantification includes only electric energy efficiency measures.
- The levelized costs of energy efficiency and avoided costs come from EEC-12.
- The energy efficiency programs begin in 2010.
- The value used for the real rate at which costs are discounted annually is 5%.
- The annual real escalation rate for the cost of energy efficiency programs is 0%.
- NPV is calculated in 2005 dollars beginning in 2009.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2-equivalemt (CO_2e) reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[8]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills, when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Super Majority (1 objection).

Barriers to Consensus

Unspecified.

[8] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-4. Improved Building Codes for Energy Efficiency

Policy Description

Buildings are significant consumers of energy and other resources. Adoption and enforcement of building energy and related codes can be an effective way to eliminate the least efficient energy approaches in new or renovated buildings.

This policy option sets a goal for reducing building energy consumption, to be achieved by increasing standards for the minimum performance of new and substantially renovated commercial and residential buildings through the adoption and enforcement of building codes. Building codes would be made more stringent via incorporation of aspects of advanced/next generation building designs and construction standards, such as sustainable design and green building standards. Building codes should promote further reduction of GHG emissions through adoption of sustainable design or green building standards.

Other aspects of the policy design include:

- Undertaking a comprehensive review of existing state and local building codes in Iowa to determine where increased energy efficiency can be achieved. This review will be undertaken by the new Commission on Energy Efficiency Standards and Practices, established by legislation enacted this year.
- Increasing the stringency of the Iowa Energy Code:
    - Residential—2006 International Energy Conservation Code (IECC)
    - Commercial—2006 IECC (including ASHRAE/IESNA [American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America] 90.1-2004).
- Developing a training and certification program for code officials, builders, and contractors on energy efficiency and related sustainable design standards, and in code enforcement.
- Providing tools to state and local governments for measuring and tracking cost savings.
- Targeting existing buildings for efficiency improvements during both major and minor renovation, through application and enforcement of building codes and with tax rebates or other incentives.
- Allowing compliance flexibility. New and substantially renovated buildings can utilize a combination of increased energy efficiency, switching to low- and no-carbon-based fuels for previously carbon-based end uses, making off-site purchases of grid-supplied "green power," and/or installing on-site off-grid low/no-CO_2-emitting power-generating equipment.
- Setting caps on consumption of energy per unit area of floor space for new buildings.
- Requiring high-efficiency appliances in new construction and retrofits.
- Providing incentives, such as permitting and fee advantages, tax credits, financing incentives (such as "green mortgages"), or other measures to encourage retrofitting existing residential

and commercial buildings or developing nontraditional off-grid low-carbon and carbon-neutral energy sources. The state can work with financial institutions to develop loan tools for these programs.

Advanced/next-generation building design requirements might include use of specific materials (e.g., local building materials), implementation of specific technologies (e.g., energy-efficient roofing materials and landscaping to lower electricity demand), or attainment of points under an advanced standard (e.g., green building or sustainable design). Energy-reduction targets should be periodically reassessed.

Potential measures supporting this policy can include outreach and public education, public recognition programs, improved enforcement of building codes, encouraging or providing incentives for energy tracking and benchmarking, performance contracting/shared savings arrangements, technical support resources for implementation, and development of a clearinghouse for information on and access to software tools to calculate the impact of energy efficiency and solar technologies on building energy performance.

Policy Design

Goals: Reduce energy consumption per square foot of floor space at new construction and renovated buildings by 15% by 2012 and 50% by 2025.

Timing: New codes become effective initially in 2010, and the final goal is achieved by 2025.

Implementing Parties: Department of Public Safety (code adoption, enforcement), local governments**,** builders, contractors, developers, trade associations (Master Builders Association, NAHB, architects, American Institute of Architects (AIA)–Iowa Chapter, etc.).

Implementation Mechanisms

- Require the periodic and regular (no less than every 3 years) review and adoption of state and local building codes, particularly energy efficiency requirements, to ensure best management practices. At least every 3 years, the state will review (with opportunity for public comment) and adopt more stringent standards for energy efficiency.
- Develop more effective energy building code enforcement mechanisms and monitor compliance.
- Developing a training and certification program for code officials and contractors on energy efficiency codes and sustainable design standards.
- Develop mechanisms to facilitate enforcement in areas of the state where there is currently no building code enforcement.
- Extend enhanced tax credits for “green development” of brownfields and grayfields, starting in 2009. The enhanced tax credits will require compliance with the sustainable design standards established by the Building Code Commissioner.

Related Policies/Programs in Place

- Development of sustainable design standards for the state to be adopted by the Building Code Commissioner.
- Development of the Iowa Green Communities Initiative by the Iowa Department of Economic Development (IDED), establishing "green development" standards for projects receiving funding from the Community Development Division of IDED.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-4-1. Estimated GHG reductions and net costs of or cost savings from EEC-4

Quantification Factors	2012	2020	Units
GHG emission reductions	0.05	0.40	$MMtCO_2e$
Net present value	–$3.0	–$46.3	$ Million
Cumulative GHG reductions	0.10	1.89	$MMtCO_2e$
Cost-effectiveness	–$31.45	–$24.44	$/t$CO_2e$

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/t$CO_2e$ = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.
- 2001 RECS—U.S. Department of Energy, Energy Information Administration. "Residential Energy Consumption Survey 2001: Consumption and Expenditure Data Tables." Table CE1-1c: Total Energy Consumption in U.S. Households by Climate Zone. Available at: http://www.eia.doe.gov/emeu/recs/recs2001/detailcetbls.html#space.
- Heating degree-days (HDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-1. Monthly State, Regional and National Heating Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Minnesota. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf.
- Cooling degree-days (CDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-2. Monthly State, Regional and National Cooling Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf.

- CBECS—U.S. Department of Energy, Energy Information Administration. "Commercial Buildings Energy Consumption Survey." Ratio of 1990–1999 buildings to all buildings total energy use. Available at: http://www.eia.doe.gov/emeu/cbecs/pdf/consumption_year const.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- Levelized costs and avoided costs are from EEC-12 and EEC-2.
- The energy efficiency programs begin in 2010.
- New residential and commercial space grows at 1.3% and 1.2% per year, respectively.
- Building codes apply to 18.4% of residential electricity use and 54% of commercial electricity end use.
- Transmission and distribution (T&D) losses for electricity are 7%.
- Compliance with this policy is assumed to be 50% at the start of the program and rises to 75% by 2020 under the new compliance regime. For the portion of the new buildings (or retrofits) that don't comply, energy use in these structures is assumed to be 20% higher than the policy level.
- Building energy consumption is a function of Iowa's climate. According to the amount of HDD and CDD, Iowa is in the Residential Energy Consumption Survey climate zone 2 (2001 RECS).
- New commercial buildings in climate zone 2 have higher electric intensity relative to existing stock, so are adjusted upward by 24% (CBECS).
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- Code improvements result in differential efficiency gains for natural gas and electricity:
    - Assumes code or efficiency improvement affects gas and electricity according to fuel use.
    - Residential: Electricity code improvement of 1% results in 2.23% gas improvement.
    - Commercial: Electricity code improvement of 1% results in 0.63% gas improvement (CBECS).
- In each year, the new building stock is "treated" at the new efficiency goal (less noncompliance), and then joins the existing stock in the next year.
- NPV is calculated in 2005 dollars beginning in 2009.

- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- Energy efficiency costs are expressed as levelized costs over the life of the energy efficiency options. The incremental costs (typically incurred in the first year of program implementation) are spread over all future years of the life of the energy efficiency measures.
- The value used for the real rate at which costs are discounted annually is 5%.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[9]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Super Majority (5 objections).

Barriers to Consensus

Unspecified.

[9] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-5. Incentives for Energy Efficiency

Policy Description

The IUB is charged with responsibility for energy efficiency programs and energy efficiency plans by Iowa utilities. IOUs conduct energy efficiency programs under plans that are reviewed and approved by the IUB. Consumer-owned utilities (municipal utilities and electric cooperatives) operate voluntary plans and programs, but must provide reports on their plans to the IUB. The 2008 session of the Iowa General Assembly passed legislation that requires RECs and municipal electric utilities to establish energy efficiency savings goals. Energy efficiency plans in Iowa address both electric and natural gas use through a variety of programs.

Incentive approaches are of three types: (1) incentives offered by governing bodies to utilities to induce superior utility performance in implementing DSM/energy efficiency programs, (2) incentives offered by utilities to customers to induce them to participate in and invest in programs, and (3) incentives offered to other energy efficiency stakeholders.

Policy Design

Goals: Equivalent of 5% of retail sales improvement in energy efficiency from Type 1 incentives 5% improvement from Type 2, and 5% for Type 3.

Timing: Incentives offered and energy improvements realized beginning 2012.

Implementing Parties: Residential and commercial property owners and tenants, government housing and other state and federal government agencies, weatherization and energy service providers, local business associations, community action agencies/human resource development councils, such nongovernmental organizations as Habitat for Humanity, HVAC contractors, building contractors/design firms, lenders, retailers of energy-efficient products and services, and residential/commercial energy audit contractors.

Implementation Mechanisms

Type 1 Incentives to Utilities

Implementation of various incentives to utilities would most likely require legislative action to reverse the statutory decision to terminate incentives to IOUs.

Type 2 Incentives to Utility Customers

Incentives to customers of IOUs are reviewed and authorized by the IUB in contested case proceedings for the review of energy efficiency plans. Proceedings are currently underway for the review of new (2009–2013) energy efficiency plans. Incentives to customers or members of municipal utilities and electric cooperatives are solely at the discretion of each customer-owned utility.

Type 3 Incentives to Other Energy Efficiency Stakeholders, Such as Retailers, Contractors, and Designers

Incentives to these stakeholders from IOUs are implemented after review and authorization of utility plans by the IUB. Incentives to these stakeholders that target customers or members of municipal utilities and electric cooperatives are solely at the discretion of each customer-owned utility. Incentives to these stakeholders from other entities, such as units of state or local government, would require action by those governing bodies.

Related Policies/Programs in Place

Type 1 Incentives to IOUs

IOUs have a long history of conducting DSM/energy efficiency programs under statutes adopted in 1990 and modified in 1996. The original statutes enacted in 1990 authorized the IUB to approve incentives for IOUs. The IUB developed rules that permitted the IOUs to seek incentives, including:

- Carrying charges on energy efficiency program costs, which were deferred until final approval.
- Returns on costs approved for recovery, which were earned over a 4-year amortization period.
- A reward mechanism based on the net societal benefits results of each IOU's programs, up to as much as 25% of the net societal benefits.
- Opportunity to apply for recovery of net revenues reduced by DSM programs.

The revision of the energy efficiency statutes in 1996 removed all of these incentive mechanisms, and substituted an automatic adjustment mechanism for cost recovery, which accelerated IOUs' recovery of costs and eliminated the additional costs of incentives. Incentives are now back in discussion, based on the assumption that Iowa IOUs might improve their DSM performance very much beyond current levels of energy and capacity savings if they are given an incentive for doing so.

Potential mechanisms for incentives to IOUs could include the following:

- Decouple IOU revenues from sales of electricity or natural gas.
- Allow IOUs to rate-base their energy efficiency expenditures and earn returns on these investments.
- Allow IOUs to recover revenues that decrease due to DSM, net of utility system cost savings.
- Allow IOUs to implement a revenue normalization mechanism to recognize the impacts of declining per-customer sales due to DSM and other causes, while also recognizing additional sales due to customer growth.
- Allow IOUs to offer all DSM programs as shared-savings or Pay-As-You-Go loan programs, with the interest or earnings on these loans retained as earnings by the IOUs.
- Offer the IOUs some form of monetary reward based on amounts of capacity and energy saved, recoverable from customers as part of DSM costs.

- Evaluate alternative rate regulation structures to better align utility interests with energy efficiency goals. For example, MidAmerican's revenue sharing mechanism incorporates an element of reward for energy efficiency because energy efficiency contributes to the utility's ability to sell electricity in the wholesale market and generate additional revenues that are, pursuant to the revenue sharing arrangement, allocated between the utility and its customers. Thus, the utility and its customers are rewarded for energy efficiency.
- Allow IOUs to "own" all or part of the "carbon credit" impact of capacity and energy saved by DSM programs, and to retain as earnings any funds received from sale of credits based on these savings, above a certain level.
- Require IOUs to document performance, and penalize IOUs that do not meet specific goals by certain dates, to the extent that there is inadequacy in the current Iowa statutes and rules requiring program documentation, and allow the IUB to conduct prudence reviews and impose penalties.

Type 2 Incentives to Utility Customers

Iowa IOUs offer incentives for participation in DSM programs to customers in many forms, including:

- Rate discounts or payments to participants in load management programs, for savings of peak load electric kilowatt (kW).
- Time-of-use rates to electric customers, which offer lower rates off peak and much higher rates during peak electric use periods.
- Free energy audits and simple on-site energy efficiency measures installed during audits.
- Advanced energy efficiency evaluation and design services, typically for nonresidential customers.
- Assistance to residential homebuilders in the form of training, inspection of homes, cash payments for meeting standards, and certification/recognition of highly efficiency homes.
- Rebates and loans to customers for purchasing energy-efficient appliances and equipment.
- Customer education and training on energy-efficient appliances and measures (insulation, infiltration, building weatherization measures, HVAC sizing and maintenance, etc.).

Other customer incentives may be possible.

Type 3 Incentives, to Other Energy Efficiency Stakeholders

Another solution to the assumption that Iowa IOUs will not improve their DSM performance very much beyond current levels of energy and capacity savings is to transfer the administration of energy efficiency programs to an independent, third-party administrator. The administrator would be subject to a performance-based compensation structure, including incentives for superior performance.

Another means of overcoming the utilities' disincentive to aggressively promote DSM programs and achieve energy efficiency results is to replace the current system of utility-administered incentives with a system that provides incentives directly to retailers of energy-efficient products and services, energy-efficient product lenders, and building contractors/designers. Some utilities currently offer these stakeholders incentives to promote energy-efficient products, including training, free publicity, and per-item restocking payments to dealers and sales people for promotion of energy-efficient appliances and equipment. Similarly, incentives could be paid directly to marketing firms to advertise and educate consumers about energy-efficient products and energy efficiency services.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-5-1. Estimated GHG reductions and net costs of or cost savings from EEC-5

Quantification Factors	2012	2020	Units
GHG emission reductions	0.35	3.29	$MMtCO_2e$
Net present value	–$10.7	–$350.8	$ Million
Cumulative GHG reductions	0.35	16.33	$MMtCO_2e$
Cost-effectiveness	–$30.68	–$21.48	$/tCO_2e$

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

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- Only GHG emission reductions and cost savings from electricity energy efficiency have been quantified.
- Peak avoided costs and levelized costs are assumed to be the same as from EEC-12
- The energy efficiency programs begin in 2012 and end after 2030.
- The three types of incentives will each improve efficiency by 5.0% *over the improvements made in EEC-12*.
- The annual real escalation rate for the cost of energy efficiency programs is 0.

- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- Energy efficiency costs are expressed as levelized costs over the life of the energy efficiency options. The incremental costs (typically incurred in the first year of program implementation) are spread over future years of the life of the energy efficiency measures.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[10]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Unanimous.

Barriers to Consensus

None.

[10] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-6. Promotion and Incentives for Improved Design and Construction in the Private Sector

Policy Description

This policy option provides incentives and targets to induce the owners and developers of new and reused (major retrofitted) residential and commercial buildings to improve the buildings' efficiency for using energy and other resources, along with provisions for raising targets periodically and providing resources to building industry professionals to help achieve the desired building performance. This policy can include elements to encourage the improvement and review of energy use goals over time, and to encourage flexibility in contracting arrangements to encourage integrated energy- and resource-efficient design and construction.

Policy Design

Goals: Reduce energy consumption by the equivalent of 10% of retail electric sales and natural gas in residential and commercial buildings. Additional savings beyond 10% result in larger CO_2 reductions, as identified in the Additional Costs and Benefits section.

Timing: Compliance will begin on January 1, 2010.

Implementing Parties: Building industry professionals, architects.

Implementation Mechanisms

Incentives for improved building construction are offered by various utilities. Incentives offered by IOUs are covered in the Types 2 and 3 incentives of EEC-5. Adoption of tax incentives or other government-funded incentives would most likely require legislative action.

Related Policies/Programs in Place

The Iowa Building Code Commissioner has initiated a practice of updating the State Energy Code every 3 years, as new editions of the IECC are published. In addition, annual revisions have been and will continue to be made to the rules to improve enforcement.

During the 2008 session of the Iowa General Assembly, several pieces of legislation were enacted that will encourage greater energy efficiency, including Senate File 517, which extended the applicability of the State Energy Code, provides for the adoption of sustainable design standards for the state by the Building Code Commissioner, and revises provisions related to the Energy Bank administered by the Department of Natural Resources; and Senate File 2386, which establishes a 2-year commission to study and report on ways to improve energy codes and their enforcement in Iowa.

Iowa rate-regulated utilities have a long history of offering energy efficiency programs focusing on new construction practices, under statutes adopted in 1990 and modified in 1996. Programs have differentiated between the residential and nonresidential sectors. In this decade, the rate-regulated utilities have increased their efforts to offer coordinated programs that provide similar program design and program incentives in both sectors. The residential sector has seen multioption programs with both builder option and ENERGY STAR emphases. The nonresidential sector has seen a multi-tiered approach focusing on design team assistance, design team incentives, and owner incentives.

Additional potential elements of this option include:

- Target new, renovated, and/or existing buildings (retrofits).
- Set a cap on consumption of energy per unit area of floor space for new buildings.
- Encourage building commissioning and recommissioning, including energy tracking and benchmarking.
- Set up a "feebate" program to encourage energy efficiency in building design.
- Provide incentives, in the form of tax credits, DSM program support, financing incentives (such as "green mortgages"), or other inducements for retrofitting existing residential and commercial buildings.
- Encourage the use of alternative and local building materials and practices.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-6-1. Estimated GHG reductions and net costs of or cost savings from EEC-6

Quantification Factors	2012	2020	Units
GHG emission reductions	0.00	0.12	$MMtCO_2e$
Net present value	–$0.3	–$11.4	$ Million
Cumulative GHG reductions	0.00	0.46	$MMtCO_2e$
Cost-effectiveness	–$177.04	–$24.57	$/t$CO_2e$

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/t$CO_2e$ = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.
- RECS 2001—U.S. Department of Energy, Energy Information Administration. "Residential Energy Consumption Survey 2001: Consumption and Expenditure Data Tables." Table CE1-1c: Total Energy Consumption in U.S. Households by Climate Zone. Available at: http://www.eia.doe.gov/emeu/recs/recs2001/detailcetbls.html#space.
- Heating degree-days (HDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information

Service. Historical Climatology Series 5-1. Monthly State, Regional and National Heating Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Minnesota. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf.

- Cooling degree-days (CDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-2. Monthly State, Regional and National Cooling Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf.
- CBECS—U.S. Department of Energy, Energy Information Administration. "Commercial Buildings Energy Consumption Survey." Ratio of 1990–1999 buildings to all buildings total energy use. Available at: http://www.eia.doe.gov/emeu/cbecs/pdf/consumption_yearconst.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-Use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- The energy efficiency programs begin in 2010 and continue through 2030.
- New residential and commercial space grows at 1.3% and 1.2% per year, respectively.
- The policy applies to 18.4% of residential electricity use and 54% of commercial electricity use.
- T&D losses for electricity are 7%.
- Compliance with this policy is assumed to be 50% at the start of the program and rises to 75% by 2020 under the new compliance regime. For the portion of the new buildings (or retrofits) that don't comply, energy use in these structures is assumed to be 20% higher than the policy level.
- Building energy consumption is a function of Iowa's climate. According to the amount of HDD and CDD, Iowa is in the Residential Energy Consumption Survey climate zone 2 (RECS 2001).
- New commercial buildings in climate zone 2 have higher electric intensity relative to existing stock, so are adjusted upward by 24% (CBECS).
- Efficiency improvements result in differential efficiency gains for natural gas and electricity:
  - Assumes code or efficiency improvement affects gas and electricity according to fuel use.
  - Residential: Electricity efficiency improvement of 1% results in 2.23% gas improvement.

    - Commercial: Electricity efficiency improvement of 1% results in 0.63% gas improvement (CBECS).
- New residential and commercial space grows at 1.3% and 1.4% per year, respectively.
- In each year, the new building stock is "treated" at the new efficiency goal (less noncompliance) and then joins the existing stock in the next year
- The annual real escalation rate for the cost of energy efficiency programs is 0%.
- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[11]

Additional Benefits and Costs

Doubling the target to 20% by 2020 raises the GHG reduction to 0.22 million metric tons of carbon dioxide equivalent ($MMtCO_2e$). The cost per ton stays the same at $25.17.

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Super Majority (1 objection).

Barriers to Consensus

Unspecified.

[11] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-7. Training and Education for Builders and Contractors

Policy Description

This option refers to an education and outreach program for building professionals and code enforcement officials to encourage incorporation of energy efficiency and GHG emission reduction measures into construction. These programs can train designers, architects, builders, contractors, and code officials on a variety of relevant energy efficiency issues, such as building shell design, insulation, and proper heating and air conditioning sizing and installation, and can be supported by licensing requirements for design and building trade professionals that address knowledge of techniques for reducing energy use and sustainable design.

Policy Design

Goals: Implement training and education of design and building trade professionals to ensure improvements in energy efficiency and conservation in new and existing buildings.

Timing: Training and education programs in place by 2010.

Implementing Parties: Departments of Public Safety and Natural Resources, Office for Energy Independence, local code enforcement agencies; Iowa Association of Building Officials, AIA–Iowa Chapter, Iowa Engineering Society, Iowa Building Trades Council, Master Builders of Iowa, Associated Building Contractors, Iowa Center for Sustainable Communities; code-writing bodies, including the International Code Council; organizations sponsoring and promoting sustainable design, such as the U.S. Green Building Council; community colleges and universities.

Implementation Mechanisms

The program will train designers, architects, builders, contractors, and code officials on a variety of relevant energy efficiency issues, such as building shell design, insulation, and proper heating and air conditioning sizing and installation, and can be supported by licensing requirements for design and building trade professionals that address knowledge of techniques for reducing energy use and sustainable design.

Related Policies/Programs in Place

- Extension of energy codes to all commercial construction and all new one- and two-family residential construction (Senate File 517).
- Regular updating of State Energy Code.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Not quantified.

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

None identified.

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Unanimous.

Barriers to Consensus

None.

EEC-8. Technology Improvements in Targeted Markets

Policy Description

This option includes energy efficiency programs, funds, or goals (such as improved weatherization and appliances/HVAC) that focus on specific market segments at rental properties and low-income residential units. Targeting specific market segments can also be an effective component of a regional market transformation alliance.

Policy Design

Goals: Improvement in energy efficiency equal to 15% of retail sales.

Timing: Improvements realized beginning in 2010 at 1% per year for 3 years, then 1.5% for 4 years, then 2% per year until achieved.

Implementing Parties: Builders, contractors, landlords, and others TBD.

Implementation Mechanisms

None identified.

Related Policies/Programs in Place

Since 1990, Iowa's investor-owned electric and gas utilities have been mandated to have separate low-income energy efficiency policies; before then, some companies had done so voluntarily. Another market segment that has unique challenges is rental property (both residential and commercial), where tenants pay energy bills but landlords maintain the facilities. Some policy approaches for these important segments include:

- Expanding Iowa's Weatherization Assistance Program to make the homes of low-income Iowans more energy-efficient.
- Develop minimum efficiency goals for rental properties, such as use of compact fluorescent light bulbs and energy-efficient appliances. Evaluate each unit with the departure of current tenants via a pre-rental inspection program before a new tenant takes possession.
- Provide financial mechanisms to assist with the retrofitting of rental properties with energy-efficient appliances, insulation, and high-efficiency furnaces.
- Establish a shared savings or zero-interest loan program to make energy-efficient appliances affordable for everyone.
- Design policies that allow paying for energy-efficient appliances over time on residential utility bills.

Auction any emission allowances made available in a regional cap-and-trade system, and use the proceeds for renewable energy and energy efficiency investments and assistance for low-income families.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-8-1. Estimated GHG reductions and net costs of or cost savings from EEC-8

Quantification Factors	2012	2020	Units
GHG emission reductions	0.09	0.98	$MMtCO_2e$
Net present value	–$6.4	–$122.5	$ Million
Cumulative GHG reductions	0.19	4.83	$MMtCO_2e$
Cost-effectiveness	–$34.15	–$25.37	$/$tCO_2e$

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

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.
- RECS 2001—U.S. Department of Energy, Energy Information Administration. "Residential Energy Consumption Survey 2001: Consumption and Expenditure Data Tables." Table CE1-1c: Total Energy Consumption in U.S. Households by Climate Zone. Available at: http://www.eia.doe.gov/emeu/recs/recs2001/detailcetbls.html#space.
- Heating degree-days (HDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-1. Monthly State, Regional and National Heating Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Minnesota. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf.
- Cooling degree-days (CDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-2. Monthly State, Regional and National Cooling Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf.
- CBECS—U.S. Department of Energy, Energy Information Administration. "Commercial Buildings Energy Consumption Survey." Ratio of 1990–1999 buildings to all buildings total energy use. Available at: http://www.eia.doe.gov/emeu/cbecs/pdf/consumption_year const.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.

- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- The energy efficiency programs begin in 2010, with energy efficiency improvements in rental properties and low-income residential units assumed to be 1% per year for 3 years, 1.5% for 4 years, then 2% per year until a cumulative reduction of 15% is achieved in the targeted buildings. With this trajectory, a 15% cumulative reduction is reached in 2019.
- 31.6% of residential electricity use is eligible for federal assistance, and thus for the program.
- 34% of commercial space is not owner occupied, and thus can benefit from efficiency investments that are likely to have been missed given "owner-tenant" disincentives for efficiency.
- New residential and commercial space grows at 1.3% and 1.2% per year, respectively.
- Efficiency improvements result in the same efficiency gains for natural gas as for electricity.
- The policy applies to 18.4% of residential electricity use and 54% of commercial electricity use.
- T&D losses for electricity are 7%.
- Compliance with this policy is assumed to be 50% at the start of the program and rises to 75% by 2020 under the new compliance regime. For the portion of the new buildings (or retrofits) that don't comply, energy use in these structures is assumed to be 20% higher than the policy level.
- Building energy consumption is a function of Iowa's climate. According to the amount of HDD and CDD, Iowa is in the Residential Energy Consumption Survey climate zone 2 (RECS 2001).
- New commercial buildings in climate zone 2 have higher electric intensity relative to existing stock, so are adjusted upward by 24% (CBECS).
- Efficiency improvements result in differential efficiency gains for natural gas and electricity:
    - Assumes code or efficiency improvement affects gas and electricity according to fuel usage.
    - Residential: Electricity efficiency improvement of 1% results in 2.23% gas improvement.
    - Commercial: Electricity efficiency improvement of 1% results in 0.63% gas improvement (CBECS).
- In each year, the new building stock is "treated" at the new efficiency goal (less noncompliance), and then joins the existing stock in the next year.
- The annual real escalation rate for the cost of energy efficiency programs is 0%.

- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[12]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Unanimous.

Barriers to Consensus

None.

[12] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-9. Midwestern Governors Association Energy Security and Climate Stewardship Platform

Policy Description

Electricity use in Iowa has increased at 1.5% from 2000 to 2006; consequently, efficiency can reduce any increase in demand. Natural gas increases have been greater than 2% recently.

In November 2007, Governor Culver signed on to the MGA Energy Security and Climate Stewardship Platform.[13] This policy is designed to address the energy efficiency goal of meeting at least 2% of the region's annual retail sales of natural gas and electricity through energy efficiency programs by 2015 and annually thereafter.

This policy option will require all of Iowa's utilities—investor owned, municipal, and cooperatives—to save at least 2% of their annual retail sales of natural gas and electricity through energy efficiency programs by 2015 and annually thereafter.

Policy Design

Goals:

- Translate regional goal of at least 2% of the region's annual retail sales of natural gas and electricity through energy efficiency by 2015 and annually thereafter into an Iowa-specific goal.
- Reduce electricity consumption through efficiency measures every year after 2015.

Timing: See above.

Implementing Parties: All electric and gas suppliers, energy-related centers at the state Regents institutions.

Implementation Mechanisms

Based on MGA accord and Iowa implementation statutes.

Related Policies/Programs in Place

See Governor Culver's Executive Order #6 (February 2008)[14] and Governor Vilsack's Executive Order #41 (April 2005).[15]

[13] Midwestern Governors Association. 2007. *Energy Security and Climate Stewardship Platform for the Midwest.* Midwestern Energy Security & Climate Stewardship Summit. Available at: http://www.wisgov.state.wi.us/docview.asp?docid=12495.

[14] State of Iowa, Executive Department. *Executive Order Number Six*. February 2008. Available at: http://publications.iowa.gov/6275/1/06-080221%5B1%5D.pdf.

[15] State of Iowa, Executive Department. *Executive Order Number Forty-One*. April 22, 2005. Available at: http://publications.iowa.gov/2619/1/EO_41.pdf.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-9-1. Estimated GHG reductions and net costs of or cost savings from EEC-9

Quantification Factors	2012	2020	Units
GHG emission reductions	0.13	4.13	$MMtCO_2e$
Net present value	–$4.1	–$375.7	$ Million
Cumulative GHG reductions	0.13	17.14	$MMtCO_2e$
Cost-effectiveness	–$31.32	–$21.92	$/$tCO_2e$

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

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.

Quantification Methods:

- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- Only GHG emission reductions and cost savings from electricity energy efficiency have been quantified.
- See EEC-12 for levelized and avoided cost assumptions.
- Iowa utilities begin reducing 2% of their annual retail electricity sales in 2015 and continue through 2030.
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[16]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Majority (9 objections).

Barriers to Consensus

Several members of the ICCAC believe that federal policies to reduce GHG emissions are preferable to regional efforts like the MGA Energy Security and Climate Stewardship Platform.

[16] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-10. Energy Management Training/Building Operators

Policy Description

In many facilities, utility bills can be significantly decreased through more efficient equipment and building operation. Administrative and technical training can inform and encourage energy managers, school officials, building operators, and others responsible for facility energy efficiency to utilize methods for minimizing unnecessary energy waste. This policy would increase education and demonstrate the benefits of energy-efficient building operation through government "leading by example" of energy service contracting.

Policy Design

Goals: Require energy managers and facility operators in all sectors to obtain certification for successful completion of the training program.

Timing: Starting in 2010.

Implementing Parties: State and local entities, private energy managers, and facility operators throughout the state.

Implementation Mechanisms

Specifically, this policy involves developing, implementing, and requiring a statewide energy efficiency and conservation education and training program for energy managers and facility operators to learn techniques for improving the efficiency of their steam, process heat, pumping, compressed air, motors, and other systems. Successful completion of this training would be required for energy managers and facility operators in all sectors (residential, commercial, industrial, and institutional) by a licensing or certification requirement, which would need to be established. Continuing education credits would be required annually.

A key organization in implementing energy efficiency training for building operators would be the Building Owners and Managers Association.

Related Policies/Programs in Place

The Building Operator Certification (BOC) is a program component of the Custom Rebate DSM program offered in partnership by the IOUs and the Midwest Energy Efficiency Alliance. As described by the IOUs, BOC is a nationally recognized competency-based training and certification program for operations and maintenance staff working in commercial, institutional, or industrial buildings. BOC achieves energy savings by training individuals directly responsible for maintenance of energy-using building equipment and day-to-day building operations.

Interstate Power and Light Company caps program impacts at a maximum of 10% of the customer's 12 months' kilowatt-hour (kWh) and therm usage. IOU Building Operator program reports average energy savings achieved by program participants as 0.18 kWh and 0.71 therms per participant's square foot of facility.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-10-1. Estimated GHG reductions and net costs of or cost savings from EEC-10

Quantification Factors	2012	2020	Units
GHG emission reductions	0.03	0.53	$MMtCO_2e$
Net present value	–$1.9	–$51.6	$ Million
Cumulative GHG reductions	0.05	2.16	$MMtCO_2e$
Cost-effectiveness	–$39.80	–$23.89	$/t$CO_2e$

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/t$CO_2e$ = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

- ACEEE 2008—American Council for an Energy Efficient Economy. February 2008. *Energy Efficiency: The First Fuel for a Clean Energy Future. Resources for Meeting Maryland's Electricity Needs.* Report No. E082, p. 84. Available at: http://aceee.org/pubs/e082.pdf?CFID=534012&CFTOKEN=57232379.
- CBECS 2006a—U.S. Department of Energy, Energy Information Administration. "2003 Commercial Buildings Energy Consumption Survey Detailed Tables." Table A2. Available at: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html - buildingchar03.
- Interstate Power and Light. *DSM Plan*. Vol. I, pp. 100-101. No Web link available.

Quantification Methods:

- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- Building manager certification trains 5% of building operators in year 1 rising to 75% in 2020. (Subcommittee assumption)
- Training program applies to heating, cooling, and ventilation energy use at commercial buildings, which is 41% of energy use.
- 50% of commercial buildings (by square footage) have energy managers who are trained under the program. The remaining 50% of commercial buildings do not receive benefits under the program. The estimate is derived from square footage by principal building activity from CBECS (2006a) data for the Midwest region. It assumes: (1) that all education, mercantile, office, and service buildings have energy managers who would participate, and (2) that the other building types, including warehouses, places of religious worship, and

health care facilities don't have energy managers and, therefore, don't participate. These two stringent assumptions are likely to average each other out and provide a rough estimate for likely coverage of the program.

- Energy savings is equal to 10% of cooling load and 7.5% of heating and ventilation load, which equates to 4% of net energy savings (ACEEE 2008).
- Efficiency improvements result in differential efficiency gains for natural gas and electricity:
  - Assumes code or efficiency improvement affects gas and electricity according to fuel use.
  - Commercial: Electricity efficiency improvement of 1% results in 0.63% gas efficiency improvement (CBECS 2006a).
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[17]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Super Majority (1 objection).

Barriers to Consensus

Unspecified.

[17] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-11. Rate Structures

Policy Description

This policy option could include various elements of utility rate design that are geared toward reducing GHG emissions, often with other benefits as well, such as reducing peak power demand. The overall goal is to present rate structures so as to better reflect the actual economic and environmental costs of producing and delivering electricity as those costs vary by time of day, day of the week, season of the year, and from year to year. In this way, rates provide consumers with information reflecting the impacts of their consumption choices.

The reduction of GHGs from changes in rate structures can come from two sources. The first is the reduction of absolute levels of energy use by consumers due to higher prices. Real-time pricing and smart metering give consumers information about their energy use that enables them to better rationalize their use. Time-of-use pricing, or other schemes to reflect rational pricing that result in price increases during peak periods, potentially reduces demand by the estimated price elasticity of demand, typically by –0.20% to –0.50% (U.S. EIA 2003), so that a 10% increase in prices would lead to a 2%– 5% reduction in demand. In a survey of experience with smart metering, Owen and Ward (2006) found energy savings of 0%–10%.

The other source of GHG reductions from policies to reduce peak demand is energy efficiency measures that reduce demand during peak periods, such as high-efficiency air conditioners and chillers. These measures are included in the existing DSM measures in EEC-12 (DSM/energy efficiency) and EEC-14 (appliance standards). These measures also reduce new generation capacity investments, which are not quantified for GHG reductions because they are covered under other policy options.

The GHG impacts of other types of rate structures are more difficult to quantify. Curtailment programs that allow loads to be shifted during peak periods might result in different emission profiles as these loads move from peak to shoulder or baseload periods. Overall CO_2 savings from these programs are also difficult to quantify; thus, they are not quantified for this policy.

Policy Design

Goals: Reduce electricity consumption through pricing by 2% of retail sales.

Timing: Compliance will begin on January 1, 2010.

Implementing Parties: All Iowa utilities and utility customers.

Implementation Mechanisms

- Programs for customers of IOUs are reviewed and authorized by the IUB in contested case proceedings for the review of energy efficiency plans. Proceedings—labeled EEP (energy efficiency plan) proceedings—are currently underway for the review of new (2009–2013) EEPs. The current plans of IOUs include two types of rate programs: residential direct-load-control programs and nonresidential interruptible programs.

- The relationship of EEP proceedings to traditional rate proceedings for rate and revenue design in programs besides direct-load-control and interruptible programs, such as those listed in the Related Polices section below, has not been taken up in Iowa. The other rate design options (beyond interruptible and direct-load-control), to the extent currently available, have been implemented through general rate case proceedings. The IUB examines rate-regulated utilities' rate structures in rate proceedings to be sure that the rate structures in place send the appropriate price signals.
- Section 1252 of the Energy Policy Act of 2005 established the Public Utilities Regulatory Policies Act (PURPA) Standard 14, entitled "Time-Based Metering and Communications." Standard 14 directed the IUB to consider adopting four types of time-based rate schedules: time-of-use pricing, critical peak pricing, real-time pricing, and load management programs. The IUB declined to adopt PURPA Standard 14 in its entirety, finding that rate proceedings are the appropriate forum for many of these issues (IUB Docket No. NOI-06-3, March 6, 2007). The IUB intends to begin informal discussions with interested participants regarding these topics and potential pilot projects.
- Programs for customers or members of municipal utilities and electric cooperatives are solely at the discretion of each customer-owned utility. The IUB hopes the consumer-owned utilities will be active in ongoing discussions and potential pilot programs to test other rate design options beyond the well-established load management programs.

Related Policies/Programs in Place

Rate-regulated utilities have employed two types of rate structures for many years and, in some cases, for many decades:

- **Seasonal rates**—These rates typically have higher prices in the season of the year when demand and prices are the highest. In Iowa the higher season is typically a summer period of 3–4 months.
- **Time-of-day (TOD) rates**—These rates typically price electricity higher at times of higher power demand, based on either a two- or three-tiered time-differentiated structure, and thus better reflect the actual cost of generation, transmission, and distribution. Time-of-use rates may or may not have a significant impact on total GHG emissions, but do affect on-peak power demand and, thus, both the need for peaking capacity and fuel for peaking plants.

Other possible policy mechanisms include several that have been offered on a much more limited basis:

- **Critical peak pricing (CPP)**—Also known as extreme-day pricing, CPP refers to programs aiming to reduce system demand by encouraging customers to reduce their loads for a limited number of hours during the year. CPP programs integrate a pricing structure similar to TOD, with the distinction of more extreme pricing signals for the critical events. (A price structure in which the extreme price is fixed by tariff reduces to a multi-tiered time-of-day rate.)
- **Real-time pricing—**A tariff structure for customers to pay electric rates tied to market prices for energy. The prices are typically posted by the utility based on day-ahead hourly prices, but could be posted on a real-time basis.

- **Inverted block pricing**—Also known as tiered/increasing peak, under this policy mechanism rates for electricity and natural gas use include a rate for some base usage level and increased rates for higher levels of consumption.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-11-1. Estimated GHG reductions and net costs of or cost savings from EEC-11

Quantification Factors	2012	2020	Units
GHG emission reductions	0.04	0.21	$MMtCO_2e$
Net present value	–$2.6	–$25.7	$ Million
Cumulative GHG reductions	0.08	1.20	$MMtCO_2e$
Cost-effectiveness	–$32.21	–$21.45	$/t$CO_2e$

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/t$CO_2e$ = dollars per metric ton of carbon dioxide equivalent.

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.
- Owen, Gill, and Judith Ward. March 2006. *Smart Meters: Commercial, Regulatory and Policy Drivers*. Appendix 2. "Sustainability First." Available at: http://www.sustainabilityfirst.org.uk/docs/smartmeterspdfappendices.pdf.
- Quantec LLC, Summit Blue Consulting, Nextant, Inc., A-TEC Energy Corporation, and Britt/Makela Group. February 2008. *Assessment of Energy and Capacity Savings Potential in Iowa: Final Report*, vol. I. Prepared for the Iowa Utility Association. (No Web link available.)
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Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- Peak avoided costs and levelized costs are assumed to be the same as for EEC-12. A host of measures could fall under this category, from smart meters to interruptible load programs. These measures tend to have low capital costs; thus, using the levelized costs estimates from Quantec (2008) is a conservative assumption.
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.
- Demand-response measures are assumed to reduce electricity demand by 5%. This number is a midpoint from the survey in which Owen and Ward (2006) found energy savings from smart meters to vary by 0%–10%. This is consistent with what price elasticity of demand would predict. If peak price tariffs are 10%–20% higher than nonpeak tariffs, then demand reductions would range from 2.5% to 10% using price elasticities of –0.20% to –0.5%.
- The installation of demand-response measures increases from 2% of total sales in the beginning of the program to 40% by 2020 as the program gets implemented. Assuming a 5% demand reduction and 40% participation, the program reaches the target of 2% of retail sales by 2020.
- The program applies only to peak load hours, which are assumed to be January–March and April–September, 0700–2300 hours, for a total of 44% of total annual hours.
- Residential, commercial, and industrial customers all implement the program at the same rate.
- Existing and planned (business-as-usual [BAU]) demand-response measures are 50% of the total policy reductions (subcommittee assumption).
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.

Key Uncertainties

There is uncertainty as to the benefits and costs of rate options and rate designs that are dependent on utility-wide implementation of real-time metering (IUB Docket No. NOI-06-3).

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[18]

Additional Benefits and Costs

Metering and associated infrastructure investments needed to support real-time pricing offer the potential for additional cost savings to the utility.

[18] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

- Identifying the cost of metering and associated infrastructure investment needed to support various pricing options.
- Designing rate programs that customers will embrace.
- Quantifying the energy impacts associated with various rate options.
- Educating customers about pricing options in order to obtain anticipated energy benefits.

Status of Group Approval

Approved.

Level of Group Support

Unanimous.

Barriers to Consensus

None.

EEC-12. Demand-Side Management (DSM)/ Energy Efficiency Programs for Electricity

Policy Description

DSM/energy efficiency is a policy approach that requires actions that influence both the quantity and the patterns of energy consumed by end users. This policy option focuses on DSM/energy efficiency programs run by electric utilities, and may be designed to work in tandem with other strategies that can also encourage efficiency gains.

Policy Design

Goals: Invest in energy efficiency equal to 1.0% of retail electricity sales per year within 3 years; 1.5% per year in 5 years; and 2.0% per year in 7 years.

Timing: Phase in, beginning in 2010.

Implementing Parties:

- Extend the DSM obligations and goals to all electric utilities in Iowa. IOUs are starting at 0.8% of retail sales; municipal utilities and rural electric cooperatives start at varying levels.
- IOUs and the Iowa Utility Association, municipal utilities and the IAMU, electric cooperatives and the Iowa Association of Electric Cooperatives.

Implementation Mechanisms

Possible policy mechanisms include:

- Have the IUB establish DSM goals for investor-owned utilities.
- Revise existing statutes to incorporate prescribed energy efficiency goals.
- Change the determination of DSM cost-effectiveness by accounting for the estimated valuation of CO_2 emissions avoided by programs.
- Extend the DSM obligations and goals to all to all electric utilities in Iowa.
- Expand DSM measures eligible for program incentives.
- Expand the scope of utility activity that can contribute to achieving DSM goals to include actions that are on the utility side of the meter, so-called “infrastructure” investments.
- Recognize the contribution of increased building energy codes and equipment energy standards to the achievement of DSM goals.
- Include in the measurement of DSM goals the energy savings from renewable measures that are implemented on the customer side of the meter.

Related Policies/Programs in Place

Electric utilities in Iowa must offer cost-effective energy efficiency programs (Iowa Code §§ 476.6(14)). The IUB establishes energy efficiency goals for IOUs (Iowa Code § 476.6(16)). DSM offered by non-rate-regulated utilities is not regulated (Iowa Code § 476.6(16)).

Investor-Owned Electric Utilities

Iowa IOUs have a long history of conducting DSM/energy efficiency programs, under statutes adopted in 1990 and modified in 1996. The IUB conducts contested proceedings for the review of plans, programs, and energy saving goals developed by IOUs. New plans were filed in April 2008, and the IUB has directed the IOUs to include analyses of the effects of goals equivalent to saving 1.5% of retail electric sales in Iowa.

Municipal and Cooperative Electric Utilities

Although the rural electric cooperatives and municipal electric utilities were required to file biennial energy efficiency plans, and many have historically conducted DSM programs, legislation passed in 2008 requires each utility or group of utilities to determine the maximum potential energy and capacity savings available from actual and projected customer usage through cost-effective energy efficiency measures and programs. Based on this assessment, each utility must establish an energy efficiency goal and a set of cost-effective energy efficiency programs designed to meet the energy efficiency goal.

The process must be started by July 1, 2008, with a progress report submitted to the IUB by January 1, 2009, and a final report filed by January 1, 2010. The report must include the utility's cost-effective energy efficiency goal, and for each measure utilized by the utility in meeting the goal, the measure's description, projected cost, and the analysis of its cost-effectiveness. On January 1 of each even-numbered year, commencing January 1, 2012, utilities must file a report with the IUB identifying their progress in meeting the energy efficiency goal and any updates or amendments to their energy efficiency plans and goals. This requirement will take the place of the current energy efficiency plan filings.

IOU BAU electric efficiency investments equate to 0.8% of load in 2008. The assumed incremental (new) statewide electric energy efficiency investments are equal to 0.69% of retail sales over the planning period. Proposed energy efficiency plans, pending IUB determination, would achieve 1.3%–1.5% of retail sales by 2012.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-12-1. Estimated GHG reductions and net costs of or cost savings from EEC-12

Quantification Factors	2012	2020	Units
GHG emission reductions	0.39	4.38	$MMtCO_2e$
Net present value	–$24.6	–$444.8	$ Million
Cumulative GHG reductions	0.78	20.33	$MMtCO_2e$
Cost-effectiveness	–$31.60	–$21.88	$\$/tCO_2e$

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

Assuming incremental energy efficiency investments in Iowa remained unchanged from 2006 levels reported in IUB (2008), Iowa's cumulative electric energy efficiency deployment would be approximately 15% of sales in 2020. When using the levelized cost estimate assumptions developed for the EEC sector, total utility and participant spending on energy efficiency/DSM in the reference case is estimated at $270 million in 2020. Under EEC-12, additional energy efficiency spending is estimated at $178 million in 2020, which achieves another cumulative 10% of sales.

Data Sources:

- Capital costs—Quantec LLC, Summit Blue Consulting, Nextant, Inc., A-TEC Energy Corporation, and Britt/Makela Group. February 2008. *Assessment of Energy and Capacity Savings Potential in Iowa: Final Report*, vol. I. p. ES-3. Prepared for the Iowa Utility Association. (No Web link available.)
- IUB. January 1, 2008. The Status of Energy Efficiency Programs in Iowa and the 2007 Iowa Residential Energy Survey. Report to the Iowa General Assembly. p. 50. Available at: http://www.state.ia.us/government/com/util/docs/misc/EE/noi072/noi072_StatusReport.pdf.
- Expert testimony in IUB Interventions filed relative to the EEP filings of the regulated utilities.

Energy Consumption by Sector (BBtu)

- Historical energy consumption in the state, by sector, is from the U.S. Department of Energy, Energy Information Administration, State Energy Data System. Available at: http://www.eia.doe.gov/emeu/states/_seds.html.
- To calculate projected energy consumption through 2030, growth factors were applied to the historical 2005 data. The growth factors are based on a combination of two parameters:
  - One accounts for growth within the RCI sectors, with growth factors for the residential sector based on projected population growth (from U.S. Bureau of the Census, Population Estimates Branch, and State Library of Iowa, State Data Center Program [http://data.iowadatacenter.org/datatables/State/stpopest19002007.xls] and State Library of Iowa, State Data Center Program, "Iowa Census Data Tables: Projections" http://data.iowadatacenter.org/browse/projections.html); growth in the commercial sector based on non-manufacturing employment growth projections; and industrial-sector growth based on manufacturing employment. Employment projections were taken from Iowa Workforce Development, Labor Market and Economic Research Bureau, "Iowa

Statewide Projections (2004–2014)" (http://iwin.iwd.state.ia.us/pubs/statewide/indprojstatewide.pdf).

  - The other factor is growth in electricity sales, which was calculated based on historical retail sales from U.S. Department of Energy, Energy Information Administration, "Iowa Electricity Profile," Table 8: Retail Sales, Revenue, and Average Retail Price by Sector, 1990 Through 2006. Available at: http://www.eia.doe.gov/cneaf/electricity/st_profiles/iowa.html.

Power Station Electricity Generation (GWh) and Fuel Use (BBtu)

- Gross generation for 2005 was obtained from the EIA database (EIA-906/920) on fuel stocks at all electric power sector generating facilities, broken down by fuel type. (See U.S. Department of Energy, Energy Information Administration. Form EIA-906: Power Plant Report and Form EIA-920: Combined Heat and Power Plant Report. Available at: http://www.eia.doe.gov/cneaf/solar.renewables/page/state_profiles/rspt05ar.xls.)

- Data for later years were projected from the 2005 figure based on projections of growth in generation for the Mid-Continent Area Power Pool (MAPP) region. The projected regional consumption and generation data are from U.S. Department of Energy, Energy Information Administration, "Supplemental Tables to the Annual Energy Outlook 2008," Data Tables 62–91: Electricity Generation & Renewable Resource. Available at: http://www.eia.doe.gov/oiaf/aeo/supplement/index.html. On-site usage was subtracted from all generation figures.

Quantification Methods:

Heat Rates (Btu/kWh)

- Heat rates indicate how much fuel is used (Btu) to generate a given amount of electricity (kWh). They vary greatly, depending on the type of power stations and the fuel used. Heat rates are used to convert figures for electricity into figures for fuel use, so the fuel use can be converted into GHG emissions using GHG emission factors. Heat rates for 2005 for each type of generation and fuel were calculated from 2005 fuel use (in BBtu), divided by 2005 generation (GWh). Projections for 2006 and beyond are based on annual combustion efficiency growth rates for the MAPP region. Combustion efficiency for a given year is calculated for each fuel type as the fuel use (in quadrillion Btu) divided by the electricity generated (in billion kWh), and the combustion efficiency growth rate applied to this value is based on the change in combustion efficiency from the previous year.

GHG Emissions Associated With End-Use Consumption (by Sector)

- Historical CO_2 data by sector (and further broken down by fuel type) were calculated by two U.S. Environmental Protection Agency (EPA) State Greenhouse Gas Inventory Tool (SIT) software modules: the Fossil Fuel Combustion Module and—for emissions from industrial sources—the SIT module for industry. CH_4 and N_2O emissions were calculated by the Stationary Combustion Module and—for emissions from industrial sources—the SIT module for industry.

- Projected emissions through 2030 were based on the 2005 data, with growth factors compounded from year to year as discussed above for energy consumption.

GHG Emissions Associated With Electricity Generation From Different Technologies and Fuels

- The projected data for each GHG were calculated for each fuel and generation type (e.g., non-lignite coal in a steam plant) as a direct product of the projected generation data (in GWh) described above. Metric tons (t) of CO_2 are calculated from generation as:

  tCO_2 = GWh × (Btu/kWh) × (tCO_2/MBtu) × (% of that fuel in the fuel mix)
  where (Btu/kWh) is the heat rate and (tons CO_2/MBtu) is the CO_2 emission factor, where MBtu is thousands of Btu

  CH_4 and N_2O emissions were calculated similarly, and were then converted to CO_2e using global warming potentials of 21 for CH_4 and 310 for N_2O. The emission factors used for each GHG were the same as those used in the EPA SIT software modules.

Key Assumptions:

- The levelized cost of energy efficiency measures is $37.13/megawatt-hour (MWh) (2008 dollars) in 2009. This figure includes all utility and participant costs. Utility fixed costs are assumed to be 24% of the capital cost, based on MidAmerican's energy efficiency plan filing Docket #EEP-08-02, Vol. II, p. A1-8. (No Web link available.)
- The levelized cost of peak electricity demand-response measures is $37.13/MWh (2008 dollars). This figure includes all utility and participant costs. Utility fixed costs are assumed to be 24% of the capital cost, based on MidAmerican's energy efficiency plan filing Docket #EEP-08-02, Vol. II, p. A1-8. (No Web link available.)
- The avoided cost of electricity in 2009 is $0.3072/MWh (2008 dollars). This figure is from 2009–2013 Energy Efficiency Plan, Interstate Power and Light Company Docket No. EEP-08-1, 23-Apr-08, p. 33, Values base case without externality factor. (No Web link available.)
- The avoided cost of peak electricity in 2009 is $72/MWh (2008 dollars). This figure is from 2009–2013 Energy Efficiency Plan, Interstate Power and Light Company Docket No. EEP-08-1, 23-Apr-08, p. 33, Values base case without externality factor. (No Web link available.)
- T&D losses are 7%. From IA_ES_Forecast.xls assumptions tab. Net average T&D losses 2005–2030. Available at: http://www.iaclimatechange.us/Inventory_Forecast_Report.cfm.
- The energy efficiency programs begin in 2010.
- The annual real escalation rate for the cost of energy efficiency programs is 0%.
- NPV is calculated in 2005 dollars beginning in 2009.
- DSM/energy Efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- Energy efficiency costs are expressed as levelized costs over the life of the energy efficiency options. The incremental costs (typically incurred in the first year of program implementation) are spread over all future years of the life of the energy efficiency measures.
- Statewide electricity energy efficiency programs are assumed to be 0.69% of retail sales over the planning period.

- IOU electric sales comprise approximately 76% of statewide electricity sales over the planning period.
- The value used for the real rate at which costs are discounted annually is 5%.

Key Uncertainties

Construction of new generation plants, while actively discussed in the state, is not certain. In addition, some existing generation units are likely to be retired.

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[19] The sensitivity analysis in Table F-12-2 indicates the outcomes of applying different assumptions about avoided generation for EEC-12.

Table F-12-2. Sensitivity analysis incorporating various assumptions for EEC-12

Scenarios	Avoided Generation Mix		EEC-12 Outcomes		
	2009–2012	2013–2020	Year 2020 Reductions ($MMtCO_2e$)	Cumulative 2009–2020 Reductions ($MMtCO_2e$)	2009–2020 ($\$/tCO_2e$)
Reference: Marginal then New Build	50% coal, 50% gas	78% coal, 21% renewables, 1% gas	4.4	20.3	–$22
Marginal (More Coal Case)	50% coal, 50% gas	50% coal, 50% gas	4	18.9	–$24
Marginal (More Gas Case)	35% coal, 65% gas	35% coal, 65% gas	3.6	16.7	–$27

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

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

[19] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

Level of Group Support

Super Majority (4 objections).

Barriers to Consensus

Several members of the ICCAC believe that this option does not adequately assess the costs and benefits, reflect the impact of different load growth scenarios, or reflect the impact of how electric utilities manage existing generation fleet resources.

EEC-13. Government Lead by Example: Improved Design, Construction, and Energy Operations in New and Existing State and Local Government Buildings

Policy Description

The state of Iowa and municipal and county governments and school districts can provide leadership in energy efficiency by adopting policies that improve the energy efficiency of new and renovated public buildings, and the equipment and appliances used therein. This policy option provides targets to improve the efficiency of energy use in new and existing state and local government buildings that are much higher than code standards.

Policy Design

Goals:

- Require that all new construction and major renovations of government-owned buildings, including schools and publicly owned hospitals, meet sustainable design standards.
- Starting in 2008, all new state buildings and major renovations will be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional average for that building type.
- All state and local governments will require the procurement of energy-efficient equipment, including lighting, office equipment, and other appliances, such as ENERGY STAR. (This goal element is quantified under EEC-14.)
- The fossil fuel reduction standard for all new buildings will be increased to:
    - 60% in 2010
    - 70% in 2015
    - 80% in 2020
    - 90% in 2025

All state buildings will be carbon-neutral in 2030 (zero net energy, using no fossil fuel GHG-emitting energy to operate).

Timing: See above.

Implementing Parties: State and local governments, the Capitol Planning organization, all three Regents institutions, Iowa Association of Counties, League of Cities, Iowa Association of School Boards, Iowa State Education Association, School Administrators of Iowa, private contractors, Iowa State Building & Construction Trades Council.

Implementation Mechanisms

These goals can be met by a combination of demand-reduction measures, on-site carbon-neutral generation, and grid-based green power purchases that exceed the amount of green power purchases currently provided by the utility.

- **Require Sustainable Design Standards:** Mandate that all new construction and major renovations of government-owned buildings, including schools and publicly owned hospitals, meet sustainable design standards, with increasingly more stringent requirements.
- **Collect Data on State and Local Government Building and Facilities Energy Use:** A key implementation mechanism for this option will be to first provide a thorough assessment of the status and energy consumption of all existing state and local government buildings, including establishing a database of buildings and building attributes, including floor area, insulation level, energy-using equipment, and history of energy consumption. This baseline, or "carbon footprint," will be used to assess program success.
- **Benchmark State Buildings:** Benchmarking is the process of using the data on building size, use, and energy use to quickly compare a building against others of similar size and use to determine how efficiently the building is operating. It is an important step in identifying and prioritizing opportunities for energy savings.
- **Commission State Buildings:** Building commissioning is a process of reviewing and tuning up the operation of building systems and controls, much like tuning up a vehicle. Potential targets for commissioning might include commissioning state buildings upon completion of construction or renovation, and whenever the energy use in a building shows an unexpected and unexplained increase in energy use.
- **Purchase Green Power:** Iowa should enter into agreements to purchase green power for a portion of the state's electricity needs, as laid out in Iowa Gov. Tom Vilsack's April 2005 Executive Order #41 on Energy Efficiency and Renewable Energy,[20] and Iowa Gov. Chet Culver's February 2008 Executive Order #6 on the same topic.[21] The state should increase purchases over time, until 30% of power needs are met through direct use of renewable energy or green power purchased by 2030.
- **Set Energy Use Targets:** Targets for energy use in the operation of state buildings might include capping state and local buildings' and facilities' energy use per square foot. Motion sensors, which are a specific technology for reducing lighting energy use in government buildings, may have broad application.
- **Renovate State and Local Buildings and Facilities Through a Buildings and Facilities Energy Program:** Within 5 years, the state should renovate all state and local buildings and facilities with more than 5,000 square feet, and smaller buildings identified through an energy benchmark process as having a high potential for energy savings. State and local buildings and facilities energy programs will provide funds for energy audits, engineering analyses, and renovation costs.
- **Develop and Use Renewable Energy Resources:** The state should evaluate the potential for direct use of solar, wind, biomass, geothermal, and hydropower to meet the needs of state government operations, and should invest in these renewable resources whenever they are practical and cost-effective, and use them as a means to lead by example.

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[20] State of Iowa, Executive Department. *Executive Order Number Forty-One*. April 22, 2005. Available at: http://publications.iowa.gov/2619/1/EO_41.pdf.

[21] State of Iowa, Executive Department. *Executive Order Number Six*. February 2008. Available at: http://publications.iowa.gov/6275/1/06-080221%5B1%5D.pdf.

- **Require Carbon-Neutral Bonding:** Climate-neutral bonding will require that any building projects financed with the issuance of state, county, or local/municipal bonds result in no net increase in GHG emissions. If a new construction project is expected to increase emissions, there must be GHG emission reductions to offset the increase within the state or particular jurisdiction. Offsets could include on-site renewable energy development, renewable energy purchases, energy efficiency (in existing state buildings), carbon sequestration (tree planting), and switching to cleaner or renewable fuels. Any GHGs emitted after the bond-financed project becomes operational will be required to be offset. The new buildings could also offset their emissions by purchasing renewable electricity from their local utility. Paying a premium for what's known as "green pricing" electricity will usually be a more expensive offset option than energy efficiency. A community or state could install its own renewable energy project as a way to offset its GHG emissions.
- **Conduct Monitoring and Verification:** Building energy use will need to be reviewed periodically.

Related Policies/Programs in Place

See Governor Culver's Executive Order #6, which requires state buildings to reduce energy use by 15% by 2015.[22] Elements of this policy include:

- Government buildings, facilities, and related operations (including wastewater and water utilities) will be in operation for many years and should be designed in a manner that meets or exceeds private-sector-mandated building and trade energy efficiency. When life-cycle cost are considered, the discount rate should be smaller and the assumptions of future energy prices should be higher than those commonly considered in the private sector, so that the state may be seen as a leader in energy efficiency and workforce efficiency. All new state buildings and facilities, and renovations and additions must meet sustainable design standards established by the Building Code Commissioner at increasingly stringent levels over time, and must meet or exceed the energy efficiency and renewable energy goals stated in the order.
- Existing state and local government buildings must be retrofitted for energy efficiency achieving 100% of cost-effective energy efficiency by 2015. To meet this goal, the state and local governments must benchmark all buildings and facilities within the next 3 years.
- Energy performance and operations of state and other government buildings must be audited (in tandem with an audit program). Audit results could be used to target and prioritize investments in improving government building energy efficiency.
- Efficiency goals must be improved and reviewed over time, and contracting arrangements must be made more flexible to encourage integrated energy-efficient design and construction.
- The implementation infrastructure (meters, accounting systems, staff, etc.) should be established as soon as possible.

[22] State of Iowa, Executive Department. *Executive Order Number Six*. February 2008. Available at: http://publications.iowa.gov/6275/1/06-080221%5B1%5D.pdf.

- "Retained savings" policies should be established that enable government agencies to retain funds saved by reducing energy bills and use the funds for further investment in energy efficiency/renewable energy measures or other uses.
- Carbon-neutral bonding is required for new construction and for renovations and additions. A carbon-neutral performance standard will require architects and engineers to design and build buildings that meet a climate-neutral requirement, meet or exceed the state's existing sustainable building guidelines, and save the taxpayers money as life-cycle costs will yield lower operational costs.
- Incentives should focus on specific technologies, including white roofs, rooftop gardens, and landscaping to lower electricity demand, and solar photovoltaics to provide electricity when demand is highest.

Potential supporting measures for this option include training and certification of building-sector professionals, but could also include surveys of government energy and water use, energy benchmarking, measurement, and tracking programs for municipal and state buildings.

Executive Order #41 (Governor Vilsack) requires that all state agencies reduce energy consumption per square foot per degree-day in all conditioned facilities (buildings) by an average of 15% by 2010 relative to 2000 levels.[23]

Iowa Code 473.13A—Energy conservation measures identified and implemented.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-13-1. Estimated GHG reductions and net costs of or cost savings from EEC-13

Quantification Factors	2012	2020	Units
GHG emission reductions	0.08	0.36	$MMtCO_2e$
Net present value	$0.0	$1.0	$ Million
Cumulative GHG reductions	0.14	1.97	$MMtCO_2e$
Cost-effectiveness	–$0.16	0.53	$/tCO_2e$

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

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.

[23] State of Iowa, Executive Department. *Executive Order Number Forty-One*. April 22, 2005. Available at: http://publications.iowa.gov/2619/1/EO_41.pdf.

- RECS 2001—U.S. Department of Energy, Energy Information Administration. "Residential Energy Consumption Survey 2001: Consumption and Expenditure Data Tables." Table CE1-1c: Total Energy Consumption in U.S. Households by Climate Zone. Available at: http://www.eia.doe.gov/emeu/recs/recs2001/detailcetbls.html#space.

- Heating degree-days (HDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-1. Monthly State, Regional and National Heating Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Minnesota. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf.

- Cooling degree-days (CDD) data from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service. Historical Climatology Series 5-2. Monthly State, Regional and National Cooling Degree-Days Weighted by Population (Includes Aerially Weighted Temperature and Precipitation. Asheville, NC: National Climatic Data Center. Available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf.

- CBECS—U.S. Department of Energy, Energy Information Administration. "Commercial Buildings Energy Consumption Survey." Ratio of 1990–1999 buildings to all buildings total energy use. Available at: http://www.eia.doe.gov/emeu/cbecs/pdf/consumption_year const.pdf.

- CBECS 2006a—U.S. Department of Energy, Energy Information Administration. October 2006. "2003 Commercial Buildings Energy Consumption Survey: Detailed Tables." Table A2: Census Region, Number of Buildings and Floorspace for All Buildings (Including Malls), 2003. Available at: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html - buildingchar03.

- CBECS 2006b—U.S. Department of Energy, Energy Information Administration. October 2006. "2003 Commercial Buildings Energy Consumption Survey: Detailed Tables." Table B5: Census Region and Divisions, Floorspace for Non-Mall Buildings, 2003. West South Central region for state and local governments. Available at: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/pdf2003/alltables.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- The reduction in GHGs from state buildings begins in 2008, with new buildings or major renovations emitting 50% less GHGs than older construction. Then emissions are reduced by

60% in 2010, 70% in 2015, 80% in 2020, and 90% in 2025. The reductions in each year are calculated relative to the BAU baseline.

- New government space grows at 1.2% per year.
- Compliance with this policy is assumed to be 50% at the start of the program and rises to 75% by 2020 under the new compliance regime. For the portion of the new buildings (or retrofits) that don't comply, energy use in these structures is assumed to be 20% higher than the policy level.
- Building energy consumption is a function of Iowa's climate. According to the amount of HDD and CDD, Iowa is in the Residential Energy Consumption Survey climate zone 2 (RECS 2001).
- New commercial buildings in climate zone 2 have higher electric intensity relative to existing stock, so are adjusted upward by 24% (CBECS).
- This policy covers 74% of all electricity use. (Government appliances are covered under EEC-14.)
- Efficiency improvements result in differential efficiency gains for natural gas and electricity:
  - Assumes code or efficiency improvement affects gas and electricity according to fuel use.
  - Commercial/Government: Electricity efficiency improvement of 1% results in 0.63% gas improvement (CBECS 2006a).
- State and local governments consume 16.9% of all commercial electricity (CBECS 2006b).
- T&D losses for electricity are 7%.
- Wind and biomass are the types of renewable energy resources purchased by governments to meet the fossil fuel reduction targets, given their relevant abundance in Iowa. Purchases of renewables are assumed to be 80% wind and 20% biomass.
- Renewable electricity costs for wind and biomass in the analysis come from the levelized costs developed by the CRE SC.
- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- The value used for the real rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[24]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Super Majority (6 objections).

Barriers to Consensus

Unspecified.

[24] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

EEC-14. More Stringent Appliance Efficiency Standards

Policy Description

Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby creating economies of scale. Appliance efficiency standards can be implemented at the state level for appliances not covered by federal standards, or standards can be jointly developed by multiple states.

Policy Design

Goals: Achieve 5% reduction in energy consumption from residential, commercial, and industrial consumers via:

- 80% minimum efficiency standards by 2010 for appliances not covered by federal standards, as recommended by the Appliance Standards Awareness Project and the American Council for an Energy-Efficient Economy.[25]
- 100% market penetration of ENERGY STAR appliances in purchase transactions in which state funds are involved (state purchasing contracts, state grants or loans, etc.) by 2012.
- A doubling of market penetration of ENERGY STAR appliances in purchases made in the residential, commercial, and industrial sectors, where applicable, up to 100% by 2017.

Timing: As noted above.

Implementing Parties: As noted above.

Implementation Mechanisms

To ensure that appliances purchased in the state will maximize the cost-effective potential for energy efficiency and minimize GHG emissions, the following policy prescriptions should be considered:

- Create incentives for improving standards for appliances not regulated by federal standards, and consider working with other states to do so.
- More stringent appliance standards at the federal level. Require the preferential procurement of ENERGY STAR products if available (equipment, appliance, or technology), if state funds are involved (state purchasing contracts, state grants or loans, etc.).

[25] See Appliance Standards Awareness Project and American Council for an Energy-Efficient Economy. *Energy Efficiency Standards Benefits—2006 Model Bill*. Available at: http://www.standardsasap.org/documents/a062_sc.pdf. The analysis recommends standards for the following products: bottle-type water dispensers; commercial boilers; commercial hot-food-holding containers; compact audio products; DVD players and recorders; liquid-immersion distribution transformers; medium-voltage, dry-type distribution transformers; metal halide lamp fixtures; pool heaters; portable electric spas; residential furnaces and boilers; residential pool pumps; single-voltage external AC-to-DC power supplies; state-regulated incandescent reflector lamps; and walk-in refrigerators and freezers.

- State sales tax exemptions, whether temporary or permanent, for ENERGY STAR-certified products.
- State income tax credits to reduce the incremental cost of ENERGY STAR appliances relative to standard appliances.

Related Policies/Programs in Place

There are existing federal standards for 17 residential products and 11 pieces of commercial equipment. Laws require the U.S. Department of Energy (DOE) to set minimum appliance efficiency standards that are technologically feasible and economically justified. However, state standards can play a role for many appliances not covered by federal standards.

ENERGY STAR is a joint EPA/DOE program designed to promote energy-efficient products in the marketplace. ENERGY STAR products and appliances surpass the minimum federal and state energy efficiency standards.

Type(s) of GHG Reductions

Avoiding electricity generation from fossil fuel sources results in GHG reductions primarily from CO_2 emissions, but also trace amounts of CH_4 and N_2O emissions. For direct fuel use, CO_2 from natural gas combustion and likely very small amounts of CH_4 from the transport of natural gas to end users are reduced.

Estimated GHG Reductions and Net Costs or Cost Savings

Table F-14-1. Estimated GHG reductions and net costs of or cost savings from EEC-14

Quantification Factors	2012	2020	Units
GHG emission reductions	0.94	2.20	$MMtCO_2e$
Net present value	–$110.4	–$708.1	$ Million
Cumulative GHG reductions	1.94	17.33	$MMtCO_2e$
Cost-effectiveness	–$56.95	–$40.85	$/tCO_2e$

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

Data Sources:

- Energy consumption by sector (BBtu). See EEC-12.
- Power station electricity generation (GWh) and fuel use (BBtu). See EEC-12.
- ASAP 2006—Appliance Standards Awareness Project and American Council for an Energy-Efficient Economy. 2006. *Energy Efficiency Standards Benefits—2006 Model Bill*. Available at: http://www.standardsasap.org/documents/a062_sc.pdf.
- RECS 2001—U.S. Department of Energy, Energy Information Administration. 2001. "Residential Energy Consumption Survey 2001: Consumption and Expenditure Data Tables." Table CE1-1c: Total Energy Consumption in U.S. Households by Climate Zone. Available at: http://www.eia.doe.gov/emeu/recs/recs2001/detailcetbls.html#space.
- CBECS—U.S. Department of Energy, Energy Information Administration. "Commercial Buildings Energy Consumption Survey." Ratio of 1990–1999 buildings to all buildings total

energy use. Available at: http://www.eia.doe.gov/emeu/cbecs/pdf/consumption_yearconst.pdf.

- CBECS 2006c—U.S. Department of Energy, Energy Information Administration. October 2006. Commercial Buildings Energy Consumption Survey. Table 3a: Electricity End-Use Consumption by Principal Building Activity, 1999 (Preliminary Estimates). Available at: http://www.eia.doe.gov/emeu/cbecs/enduse_consumption/pba.html.
- MECS 2005—U.S. Department of Energy, Energy Information Administration. March 8, 2005. "2002 Manufacturing Energy Consumption Survey." Table 5.7: Energy Consumed as a Fuel by end Use by Region with Total Consumption of Electricity (physical units). Available at: http://www.eia.doe.gov/emeu/mecs/mecs2002/data02/shelltables.html.
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- C.A. Webber, R.E. Brown, and A. Mahajan, and J. Koomey. February 15, 2002. *Savings Estimates for the ENERGY STAR® Voluntary Labeling Program: 2001 Status Report*. LBNL-48496. Lawrence Berkeley National Laboratory. Available at: http://enduse.lbl.gov/info/LBNL-48496.pdf.
- WGA 2005— Western Governors' Association, Clean and Diversified Energy Advisory Committee. November 18, 2005. *The Potential for More Efficient Electricity Use in the Western United States: Final Report*. Available at: http://www.naesco.org/resources/industry/documents/2005-11-18.pdf.
- Nexus Market Research, Inc. June 28, 2006. *Massachusetts Energy Star® Appliance Program: Market Penetration Tracking And Analysis*. Available at: http://www.cee1.org/eval/db_pdf/475.pdf.

Quantification Methods:

- Heat rates (Btu/kWh). See EEC-12.
- GHG emissions associated with end-use consumption (by sector). See EEC-12.
- GHG emissions associated with electricity generation from different technologies and fuels. See EEC-12.

Key Assumptions:

- DSM/energy efficiency programs are assumed to displace marginal sources of generation (50% coal, 50% gas) through 2012. From 2013 on, the programs are assumed to displace the new-build mix of 78% coal, 21% renewables, and 1% gas.
- Improved appliance standards begin to take effect in 2010, with full implementation by 2017. The energy reduction due to improved appliance efficiency is calculated relative to the BAU baseline. For Iowa government operations, the assumed BAU penetration rate of ENERGY STAR appliances is 75% between 2010 and 2012. For the residential, commercial, and industrial sectors, the assumed BAU penetration rate is 50% in 2010 and rises to 75% in

2017. This is consistent with the 2005 penetration rates for various ENERGY STAR products in Nexus Market Research (2006).

- ENERGY STAR appliances are 30% more efficient than other appliance choices. There are some discrepancies about the relative efficiency of ENERGY STAR products. Webber et al. (2002) show efficiency gains ranging from 7% to 90%, but a recent *Consumer Reports* (2008) article highlights some of the problems with this voluntary program, which has a third-party verification system and sets efficiency benchmarks for products to qualify that are not realistic with everyday use. The 30% efficiency improvement is a rough estimate, given the uncertainties about the product brand.
- 39% of electricity is consumed by appliances in residential buildings, which assumes that refrigerators and one-half of other appliances and lighting apply to this option (RECS 2001).
- 26% of electricity is consumed by appliances (office equipment) in government and commercial buildings (CBECS 2006c).
- 8% of electricity is consumed by appliances in industrial buildings, which assumes one-half of HVAC and facilities support are covered by ENERGY STAR appliances, such as heat pumps and furnaces (MECS 2005).
- Appliance efficiency improvements result in differential efficiency gains for natural gas and electricity.
  - Residential: Electricity improvement of 1% results in 2.23% gas improvement (RECS 2001).
  - Commercial: Electricity improvement of 1% results in 0.63% gas improvement (CBECS).
  - Industrial: Electricity improvement of 1% results in 0.84% gas improvement. Source: Gas facility support divided by electricity facility support (in BBtu) in MECS 2005.
- The levelized cost (2005$) of appliance efficiency standards is $11.90/MWh and $3.49/BBtu (WGA 2005). Natural gas cost/BBtu is equivalent to MWh cost at the rate of 1 GWh/3.41BBtu. [Is this correct?]
- EISA developed standards, or instructed DOE to develop standards, for many of the products in the Appliance Standards Awareness Project (ASAP) 2006 model bill. EEC-14 applies only to the following products: bottle-type water dispensers, commercial hot-food-holding cabinets, hot tubs, residential furnace fuel efficiency (from 82% in the EISA to 90% annual fuel utilization efficiency [AFUE] in the ASAP model bill), pool heaters, and commercial boilers. GWh and BBtu reductions are from ASAP 2006.
- The annual real escalation rate for cost of energy efficiency programs is 0%.
- The rate at which costs are discounted annually is 5%.
- NPV is calculated in 2005 dollars beginning in 2009.

Key Uncertainties

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM investments (the avoided CO_2 methodology).[26]

Additional Benefits and Costs

Energy efficiency investments should reduce the bills of utility customers who make the investments, but will probably not lead to absolute reductions in utility rates or bills for all customers. However, cost-effective energy efficiency improvements should reduce overall utility costs and average bills when compared to more expensive alternatives.

Feasibility Issues

None identified.

Status of Group Approval

Approved.

Level of Group Support

Super Majority (2 objections).

Barriers to Consensus

One member was concerned about Iowa acting by itself in the Midwest to regulate appliance standards.

[26] The Annex to this document defines the rationale behind the assumption used for the avoided CO_2 methodology in these analyses and provides several scenarios for the impacts of different mixes of avoided generation technologies.

Annex A

Avoided Electricity Emissions for the Residential, Commercial, and Industrial Sectors

To estimate emission reductions from policy options that are expected to displace conventional grid-supplied electricity (i.e., energy efficiency and conservation) a simple, straightforward approach is used. Through 2012, we assume that these policy options would displace generation from a "marginal" mix of fuel-based electricity sources of 50% coal and 50% gas. (We assume that sources without significant fuel costs would not be displaced—e.g., hydro or other renewable generation.) After 2012, we assume that the policy options are likely to avoid a mix of new-build capacity additions. The new-build mix for the RCI sector is estimated to be 78% coal, 21% renewables, and 1% gas. This mix is what is proposed to be built as part of the Marshalltown (Sutherland) coal plant package, which includes wind generation and biomass co-firing requirements, as well as additional wind resources that the CRE SC perceived as being likely to be built as part of the reference case forecast.

There is a risk that GHG reductions are overstated and the costs per ton of CO_2e reductions are understated, if high-CO_2-intensity resources are assumed to be redispatched or not built due to increased energy efficiency and DSM. Table F-A-1 provides several scenarios for avoided generation mixes. The scenarios differ in that each scenario that includes less coal or more gas results in about 10% fewer tCO_2 reductions.

Recall that the NPV of options for the EEC sector is the difference between avoided costs and the levelized costs of the investments, and is unaffected by the CO_2 methodology. The changes in the \$/ton (the last column of the table) are due to changes in total tons of CO_2 mitigated between the scenarios. The cost savings increase as CO_2 reductions decrease because the total cost savings number is constant, but is being spread out among fewer tons of CO_2. Table F-A-1 represents three different ways to look at what could happen under different scenarios. Note the 10% decrease in cumulative CO_2 reductions from scenario to scenario.

Table F-A-1. Potential outcomes of different mitigation scenarios

Scenarios	Avoided Generation Mix		EEC-12 Outcomes		
	2009–2012	2013–2020	Year 2020 Reductions ($MMtCO_2e$)	Cumulative 2009–2020 Reductions ($MMtCO_2e$)	2009–2020 (\$/tCO_2e)
Reference: Marginal then New Build	50% coal, 50% gas	78% coal, 21% renewables, 1% gas	4.4	20.3	–\$22
Marginal (More Coal Case)	50% coal, 50% gas	50% coal, 50% gas	4	18.9	–\$24
Marginal (More Gas Case)	35% coal, 65% gas	35% coal, 65% gas	3.6	16.7	–\$27

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

The reference approach described in the beginning of this annex provides a transparent way to estimate emission reductions and to avoid double counting (by ensuring that the same MWh from a fossil fuel source are not "avoided" more than once). The reference approach can be considered a "first-order" approach; it does not attempt to capture a number of factors, such as the distinction between peak, intermediate, and baseload generation; issues in system dispatch and control; impacts of nondispatchable and intermittent sources, such as wind and solar; or the dynamics of regional electricity markets. These relationships are complex and could mean that policy options affect generation and emissions (as well as costs) in a manner somewhat different from that estimated here. Nonetheless, this approach provides reasonable first-order approximations of emission impacts and offers the advantages of simplicity and transparency that are important for stakeholder processes.

Existing Energy Efficiency Actions In Iowa

IOU BAU incremental (new) electric efficiency investments equate to 0.8% of load in 2008. The assumed incremental statewide electric energy efficiency investments are equal to 0.69% of retail sales over the planning period (2009–2020). For natural gas, the assumed incremental statewide natural gas energy efficiency investments are equal to 0.82% of retail sales. These reductions are subtracted from EEC-12 and EEC-2, respectively.

Proposed energy efficiency plans, pending IUB determination, would achieve between 1.3% and 1.5% of retail sales by 2012. These proposals are not included in the analyses, as they have not been approved yet. Their inclusion would have simply changed the accounting for reductions from the policy options (e.g., EEC-12) to the recent actions line in the summary table at the beginning of this appendix.

The state government is also taking aggressive actions to reduce energy use. For example, Governor Culver's Executive Order #6 requires state buildings to reduce energy use by 15% by 2015,[27] and Governor Vilsack's Executive Order #41 requires that all state agencies reduce energy consumption per square foot per degree-day in all conditioned facilities (buildings) by an average of 15% by 2010 relative to 2000 levels.[28] The combined effects of these executive orders are shown in the recent actions line in the summary table. The calculations show that these orders save approximately 315 GWh of electricity and 680 BBtu of natural gas by 2015 with an accompanying GHG reduction of 0.29 $MMtCO_2e$ in 2015.

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[27] State of Iowa, Executive Department. *Executive Order Number Six*. February 2008. Available at: http://publications.iowa.gov/6275/1/06-080221%5B1%5D.pdf.

[28] State of Iowa, Executive Department. *Executive Order Number Forty-One*. Available at: http://publications.iowa.gov/2619/1/EO_41.pdf.