Summary List of Pending Options for Analysis

Policy Option		GHG Reductions* ($MMtCO_2e$)			Net Present Value 2009–2025 (Million $)	Cost-Effective-ness ($/$tCO_2e$)
		2012	2025	Total 2009–2025		
EE-1	Undertake State Assessments that Quantify the Amount of Energy Efficiency that Would Cost Less on a Unit Cost Basis than New Generation	*Not Quantified*				
EE-2	Require Retail Energy Providers to Make Energy Efficiency a Priority	9.6	157.9	1200	-$33,096	-$28
EE-3	Remove Utility Financial Disincentives and Enable Investment Recovery for Energy-Efficiency Program Costs	*Not Quantified*				
EE-4	Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement	6.2	97.8	684	-$13,291	-$19
EE-5	Have the Public Sector Lead by Example	8.0	29.5	292	-$1,900	-$6
EE-6	Accelerate Adoption of Energy-Efficiency Technologies and Best Practices by Residential, Commercial and Industrial Customers	*Not Quantified*				
EE-7	**Combined Heat and Power**	*Not Quantified*				
	Total After Adjusting for Overlaps	16.4	209.7	1640	-$43,433	-$27
	Reductions From Recent Actions	25.2	105.7	960	**N/A**	**N/A**
	Total Plus Recent Actions	41.6	315.3	2600	**N/A**	**N/A**

GHG = greenhouse gas; MMt = million metric tons; t = metric ton; CO_2e = carbon dioxide equivalent; VMT = vehicle miles traveled; UC = unanimous consent; TBD = to be determined.

Summary Statement

Policy Description

The region and each jurisdiction should meet Midwestern Governors Association regional energy-efficiency (EE) goals through a combination of policies and programs such as those laid out in this document in EE-1 through EE-7. Jurisdictions may choose to formally adopt goals or may simply put policies in place to achieve them. As jurisdictions adopt energy-efficiency goals and related policies, they should continually measure and evaluate their progress, and make adjustments as necessary to meet these goals.

States should pursue policies and programs that result in a 2 percent reduction in energy use from natural gas and electricity per year from a three-year rolling average base period, if cost-effective, and should consider policies that would capture additional cost-effective savings beyond 2 percent per year. The 2 percent reduction in energy use will come from application of a full suite of policy options, including an energy-efficiency goal for utilities, building codes, appliance standards, government lead-by-example programs, and aggressive new partnerships to engage all stakeholders in reducing energy use.

Policy Design

Goals:

Central to the MGA platform is an energy efficiency goal for utilities/retail energy providers that is discussed in EE-2. Further important reductions will be achieved through the measures described in EE-4 (building codes and appliance standards) and EE-5 (public-sector lead-by-example programs). The actions described in EE-1, EE-3 and EE-6 are each supporting activities that will provide important policy, regulatory or other frameworks to produce reductions in energy use quantified through EE-2, EE-4 and EE-5.

Critical to achieving the goals above and tracking success in doing so include the following:

1. **Jurisdictions should commit to implementing all cost-effective energy-efficiency (EE) measures.**
2. **Jurisdictions should invest in research, development and demonstration programs that help to identify future cost-effective EE measures.**
3. **The MGA should establish a long-term mechanism for regional coordination and tracking of progress toward meeting the Energy and Climate Accord goals.**

Timing:

- As soon as possible, identify which jurisdictions have already established an EE target. Certain MGA jurisdictions already have such targets in place.
- By the end of 2009, all jurisdictions should have begun an assessment of EE potential, which could take the form of market-characterization/baseline studies that would enable jurisdictions to set EE targets.

Parties Involved: Key parties include utilities, regulators, non-utility EE providers, trade allies (contractors, EE auditors, architects, etc.), environmental organizations, other non-governmental organizations (NGOs) that have experience implementing EE, low-income advocates, consumer advocates, and academics.

Other: Recognize past EE performance (in some jurisdictions the most cost-effective energy-efficiency measures have already been implemented). While recognizing past performance, however, every jurisdiction should be expected to meet the incremental savings requirements going forward. As there are constant improvements in EE technology, and the opportunities continue to be large, no jurisdiction is in immediate danger of running out of cost-effective savings potential, and states that have already mounted aggressive EE programs have the advantage of a well-developed energy-efficiency infrastructure and operational capability with which to achieve more savings.

Implementation Mechanisms

Implementation mechanisms relevant to the policy designs noted above, and additional considerations in designing those policies, include the following:

1. **States/provinces should commit to implementing all cost-effective energy-efficiency (EE) measures. The definition of "cost-effective" may include the following considerations:**

   - "All cost-effective energy-efficiency (EE) measures" is defined to mean all EE measures whose benefits outweigh their costs, where costs are determined via "total resource cost" (TRC) assessments. "Cost" is defined as the sum of EE program costs and the incremental cost of EE measure as compared to standard practice (BAU).
   - It may be necessary to modify cost-effectiveness tests somewhat for application to natural-gas energy efficiency. (See table below for important differences between electricity and natural gas.)
   - Though not traditionally a part of the TRC test, a monetary estimate of CO_2 impact should be included in the evaluation of energy-efficiency cost-effectiveness. Consideration should be given to adopting a regionwide range of values for CO_2 costs to be used in energy-efficiency cost-effectiveness evaluations, perhaps based on values currently in use in some jurisdictions. It is recognized that CO_2 values may differ from jurisdiction to jurisdiction. Further, CO_2 values will change over time, and thus the CO_2 values used for cost-effectiveness evaluations should be reviewed and revised regularly.
   - The utility-cost test can be applied to augment the TRC test, as it allows a better comparison of energy efficiency to alternate supply-side resources and is an easier test to administer, in terms of the monitoring and verification necessary to calculate the test.
   - Cost-effectiveness should be thought of as distinct from "economically achievable." which is an estimate of the amount of efficiency that can be accomplished over a given time period with a given amount of resources. It is recognized that cost-effectiveness is dependent on avoided costs and CO_2 costs, which have risen very substantially (for

electricity) in recent years and will likely continue to change. As a result, cost-effectiveness evaluations should be revisited periodically. The region may wish to consider adopting a regionwide set of avoided costs, though it is recognized that different utilities in the region face different cost structures.

2. **In keeping with MGA recommendations, set a goal of saving 2 percent of electricity consumption through efficiency measures and conservation on the "customer side of the meter," with an additional goal for savings on the supply side of the meter.**

- Determine EE's contribution to reducing GHGs in the MGA region.
- The jurisdictions (and, by collaboration, the region) should perform periodic studies of EE potential (see option EE-1), and based on those assessments, conduct reviews of the EE goal and related policies to account for changes in economic growth and other factors.
- States and provinces may continue to use "bottom-up" (assessment of the impacts of energy-efficiency initiatives/active policies through measurement and verification) methods to determine achievement of goals. States and provinces should measure the contribution of energy-efficiency initiatives, energy codes and standards, prices and other factors to ensure that the goal will be met or exceeded.
- As a separate goal, utilities should undertake measures to improve efficiencies on the supply side. These measures could include (but are not limited to) transformer upgrades, transmission and distribution line replacements to reduce losses, and efficiency improvements at existing power plants for electric utilities, and reduction of transmission and distribution losses for gas utilities. At present, pending studies on what level of savings are possible on the supply side (and noting that different utility areas have different levels of savings available), no specific numerical target has been set for this goal. Transmission and distribution efficiency savings that are incremental to routine maintenance can count toward the regional savings goals.
- Though a substantial majority of the EEAG agreed upon the desirability of having both demand- and supply-side goals as above, at least one member argues that if cost-effective, available supply-side energy-efficiency opportunities exist, then achievement of supply-side opportunities should count in full toward an overall 2 percent annual savings goal.
- It is noted that gas utilities may in general have lower demand-side efficiency resource potential than electric utilities, in addition to very limited potential for supply-side efficiency improvements.

Table Important Differences Between Electricity and Natural Gas Sectors	
Electricity	**Gas**
Increasing use per customer	Dramatically declining use per customer
Reductions in peak demand can translate into significant cost savings on infrastructure (cost avoidance is potentially high because of peaking plants that providers don't have to build). Reductions in overall demand can also reduce, delay or eliminate the need for new baseload power plants.	Natural gas offers mostly "commodity savings." That is, it is possible to reduce the amount of natural gas people use, but that reduction does not really help avoid infrastructure costs. This means it will be difficult for natural gas utilities to get the 0.5% infrastructure EE savings on their side of the meter.
Lots of end-use technologies (roughly 350)	Many fewer end-use technologies (roughly 33)
Many electric utilities do Integrated Resource Planning, in which EE can be viewed as the first, best option.	Gas utilities don't do IRP.

Related Policies/Programs in Place

- Manitoba is providing assistance to Saskatchewan in developing EE programs in an example of peer-to-peer experience sharing.

Type(s) of GHG Reductions

Greenhouse gas emissions from direct fossil fuel combustion and from fuels burned to generate electricity, primarily CO_2, but also methane (CH_4), nitrous oxide (N_2O) and other emissions (including criteria pollutant emissions) with direct or indirect impacts on climate.

Estimated GHG Reductions and Net Costs or Cost Savings

GHG reductions and costs of this option will not be assessed directly, as meeting regional energy-efficiency goals will in effect be implemented through other options being considered by the EEAG, including EE-2, EE-4 and EE-5.

Key Uncertainties

None cited.

Additional Benefits and Costs

Feasibility Issues

None cited.

Status of Group Approval

Consensus reached at full EEAG Advisory Group meeting on January 14 and 15, and final agreement reached on April 23 and 24, 2009.

Level of Group Support

Full support except as noted in text above.

Barriers to Consensus

None cited.

EE-1. Undertake Assessments that Quantify the Amount of Energy Efficiency that Would Cost Less on a Unit Cost Basis than New Generation

Policy Description

This policy/action item encompasses two goals: (1) to measure energy-efficiency and energy-conservation potential, in the context of carbon emissions reduction policies, and (2) to measure such potential in the same way from jurisdiction to jurisdiction. This analysis should include a cost-benefit analysis. These metrics and any new energy-efficiency and conservation assessment protocol must reflect an expanded definition of "cost" (not just cost per unit of energy, but also carbon liability, etc.). These metrics must capture efficiency gains from technology advancement. The development of a consistent, transparent assessment process for efficiency and conservation potential is a good opportunity for a consortium of stakeholders to work collaboratively. The assessment should include an evaluation of the availability of energy-efficiency resources under a range of different carbon costs, as well as measuring what is cost-effective based on avoided costs. Note that this assessment of potential should not delay the implementation of energy-efficiency programs in the region.

Policy Design

In the near term, produce a white paper addressing energy-efficiency and conservation potential in Midwestern states.

- Utilities, state and provincial governments, and NGOs have variously conducted studies of energy-efficiency potential in several jurisdictions in the MGA region. These studies have not typically taken account of two important factors: (1) the potential for energy conservation (energy savings resulting from behavioral changes) and (2) the effect of a price for carbon on cost-effectiveness of energy-efficiency programs. The MGA should oversee a study, under the supervision of the EEAG, that accomplishes the following:
  - reviews existing energy-efficiency potential studies in the MGA region, specifically examining studies covering energy-efficiency potential with regard to electricity, natural gas, and other fuels as applicable — reviewing their methodologies and their results;
  - assesses the gap between the savings estimates from existing potential studies and the MGA energy-efficiency goals; and
  - discusses the likely effect on energy savings potential from a broader analysis that incorporates additional key factors such as the potential for energy conservation, the potential effect of a price for carbon on the cost-effectiveness of different energy-efficiency programs, and the use of a sensitivity analysis of different assumptions for generation-capital costs and fuel costs.

The project would both provide data on the existing state of the art for efficiency-potential studies, and address the new approaches and considerations that will likely be required in order to meet the ambitious MGA energy-efficiency goals.

This white paper would be intended to accomplish four fundamental objectives:

1. to review and summarize the available studies on energy-efficiency potential that have been conducted in the Midwest, and discuss the implications of those studies for the MGA energy-efficiency goals. The studies reviewed should include those that have focused on the impact that behavioral and operational changes have on energy use, as well as those that have focused on the impact of education programs;
2. to identify the shortcomings and gaps in those previous studies and discuss how they limit our ability to adequately assess energy-efficiency potential in the region (especially given the new energy market and public policy circumstances we now face);
3. to produce a core set of principles and methodologies that would be recommended for inclusion in future studies of energy-efficiency potential in the region; and
4. to use the preceding information as a platform from which to build momentum for a series of studies of energy-efficiency potential, to cover each jurisdiction in the region.

The white paper will touch on the role of regulatory barriers with regard to energy efficiency, but it is expected that it will do so in a generic fashion, not in great detail.

The white paper should be produced by a group of nonprofit agencies, likely to include the Energy Center of Wisconsin and the American Council for an Energy-Efficient Economy (ACEEE). Other members of the EEAG would be asked to review and comment on the project plan once it is fleshed out, and on the draft final report before publication.

The Energy Foundation has agreed to provide funding for this project.**As a longer-term goal, jurisdictions should require comprehensive efficiency and conservation market assessments and/or potential assessments that can be used in resource planning and in energy-efficiency program planning. These assessments should be regularly performed by utilities, energy offices or other entities.**

- These assessments should produce cost curves for conservation potential that allow for a dynamic assessment in relation to various avoided-cost estimates. Since the conditions that define cost-effective energy-efficiency potential change over time, the regional assessments, and the jurisdiction-level assessments that feed into them, should be updated regularly, as costs and other key parameters change, to ensure that the assessment remains dynamic, and germane to energy- and climate-planning processes. The MGA should provide guidance on methodology for these assessments to ensure some regional consistency. Methodological issues that the MGA working group should consider include: whether the analysis is top-down or bottom-up, specifying scope and timeline, etc. An analysis should include every economic sector, and preferably list them separately. Such an analysis at the state/provincial level may cost between $100,000 and $1 million, depending on how much data are already available. (For example, Great River Energy did a recent analysis for its service territory that cost $50,000.)
  - These assessments should include assessments of the existing building stock in the jurisdictions, as well as appliance and HVAC (heating, ventilation and air conditioning) system saturation surveys.
  - Energy-efficiency and conservation assessments should be done at regular intervals so the body of information is not static and remains up-to-date.

- A regional clearinghouse, in the form of a new organization or a group within an existing organization in the region, should be set up to collect, analyze and distribute the data collected during energy-efficiency assessments within the MGA jurisdictions.

Timing: An assessment of what MGA jurisdictions are currently doing as well as initial discussions of potential collaboration and needs can begin immediately. Recommendations on studies of energy-efficiency potential can be forwarded to the Steering Committee as soon as they are agreed upon by the full EEAG. A work plan and outline for the "white paper" described above was prepared in November 2008.

Parties Involved: energy offices, utilities, advocacy organizations, legislatures and utility commissions.

Other: None cited.

Implementation Mechanisms

- The EEAG has commissioned a study, as described above, to be funded by the Energy Foundation, for delivery in November 2008 to the EEAG and the MGA.
- An analysis of the efficiency of different economic sectors (possibly divided by SIC code) could prove informative; allowing comparison to best cases in other regions would be useful. This would provide guidance on which sectors have room to improve, and give some guidance on the unique issues and barriers in each sector in our region.
- The MGA should consider suggesting that state public utility commissions (PUCs and PSCs) or state energy offices, or utilities themselves, should be responsible for carrying out energy-efficiency assessments and setting energy-efficiency goals consistent with the MGA Energy and Climate Accords and taking account of the conclusions of the study described above.

Related Policies/Programs in Place

At the July 23-24 EEAG meeting, EEAG members and facilitators noted recent studies on the impact of behavioral issues related to energy efficiency in Minnesota and California (for the Sacramento Municipal Utility District), and by Hydro One (with similar studies by other Canadian hydroelectric utilities). Ongoing studies relating consumer education to energy savings were also mentioned, including studies by Otter Tail Power Co. and the New York State Energy Research and Development Authority (NYSERDA). An ongoing utility study of natural gas energy-efficiency potential in Minnesota was also mentioned, as was an energy-efficiency assessment for municipal utilities in Iowa.

Type(s) of GHG Reductions

This option will lend support for GHG savings as noted under, for example, EE-2.

Estimated GHG Reductions and Net Costs or Cost Savings

This option supports other MGA options, thus its costs and benefits will not be quantified separately.

Key Uncertainties

None cited.

Additional Benefits and Costs

Feasibility Issues

None cited.

Status of Group Approval

Initial approval for proceeding with procurement of funding for the "white paper" described above was provided by the EEAG in its teleconference call of July 2, 2008.

Level of Group Support

Consensus by full EEAG at its in-person meeting on January 14 and 15, 2009.

Barriers to Consensus

None

EE-2. Require Retail Energy Providers to Make Energy Efficiency a Priority

Policy Description

States need to establish vehicles to achieve energy-efficiency savings. The two most common models are to require regulated utilities to provide EE services through an energy-efficiency performance standard or to create a public benefits fund to support the efforts of non-utility EE providers. The purpose of electric utility resource plans and natural-gas utility planning should be to develop the portfolio of demand- and supply-side resources that minimizes the costs of energy services, subject to meeting other important state policy objectives. Utilities should choose least-cost resources, but research and development (R&D) and demonstration projects that may cost more should be allowed and encouraged with cost recovery.

Policy Design

This suite of policies draws on a number of approaches to require retail energy providers — to include municipals, co-ops, investor-owned distribution utilities and non-utility EE providers wherever possible — to implement all cost-effective energy efficiency. It is recognized that significant and not-fully-resolved issues exist in implementing energy efficiency in jurisdictions where energy markets (typically, electricity markets) have been partially or substantially deregulated or restructured. It is further recognized that many municipal, tribal and cooperative utilities and delivered-fuel dealers are not subject to regulation by state public utility commissions. In these jurisdictions, other design approaches may need to be implemented.

In general, approaches to spurring implementation of energy efficiency by retail energy providers could include:

- States in the Midwest region not already doing so should consider adopting resource planning processes that ensure that EE resources are considered on an equal footing with supply-side resources to meet energy demand. This process should include public input. The presiding regulatory commissions or other appropriate governmental bodies will make the final decisions on resource plans. This is important. Use this language if you can

- States should commit to meet an energy-efficiency standard of 2 percent for electric utilities and 1.5 percent for natural gas utilities. States should apply EE standards consistently to investor-owned, cooperative and municipal utilities, while recognizing regulatory and other differences in customers served and service territories, making appropriate adjustments to individual goals. Such a goal will place the MGA states among a select group of states that have achieved the highest levels of energy efficiency.

- State regulatory approval to build new supply facilities using conventional carbon-emitting resources should be given only if the authority determines that cost-effective renewable energy and energy efficiency cannot meet the projected electricity and gas energy and demand needs at a lower cost. Such determination should include consideration of public input.

- Regulators should allow timely cost recovery for cost-effective energy-efficiency programs. Regulators should also take steps to reduce utility disincentives to undertake energy efficiency due to earnings erosion, and should develop mechanisms to reward utilities for performance. Projects eligible for cost recovery should include research, development and demonstration programs and energy-efficiency pilot and training programs. Such projects may not be cost-effective on their own; however, they provide support to cost-effective EE programs, and in doing so should also be eligible for cost recovery. Where programs are provided by a non-utility entity or a combination of utilities and other providers, the handling of cost recovery and incentives should be consistent.
- If large-volume electricity or gas consumers are allowed to "self-direct" their spending on energy efficiency and to avoid charges for energy efficiency paid through utility bills and, instead, to implement their own EE measures, their savings achieved through those measures should be independently verified, and if so verified, would count toward the state's energy-efficiency goal, as well as the EE goal of the utility serving the consumer.
- States should include consideration of combined heat and power (CHP) as an eligible resource when developing energy efficiency standards. When doing so, many issues should be identified and addressed to ensure the energy efficiency and emission reduction impacts are realized. These include but are not limited to fuel choice, system size, qualifying level of efficiency, and verification of the efficiency levels achieved.
- States should include consideration of measures to implement energy efficiency on both the customer and utility sides of the meter, including load management that reduces overall energy consumption, as a part of energy-efficiency programs.
- Energy-efficiency savings must be, to the extent possible, measurable and verifiable in a transparent and consistent manner across states/provinces to provide consistent reporting and good, full compliance with energy-efficiency goals. All efficiency achievements measured should be counted toward goals without attribution adjustments such as for "free riders" or "free drivers."Free riders are consumers who take advantage of an efficiency incentive even though they would have made the efficiency investment in the absence of the incentive. Free drivers are consumers who buy an efficient product without taking advantage of the incentive, but do so as an indirect result of the incentive program.
- The entities implementing energy-efficiency programs could vary across states/provinces.
- An effort is needed to develop mechanisms to provide energy-efficiency services to the customers of heating oil and propane providers. Possibilities include collecting fees from providers and incorporating their customers into existing programs. Legislation may be required to provide the authority to collect funds from heating oil and propane providers.
- States and provinces should establish a means for sharing information on what works and what does not in developing and offering EE programs.
- Efforts toward education and training to promote awareness of energy-efficiency and climate-change issues, and to help change behavior to reduce energy use and climate impacts, should be a part of every utility *and non-utility EE* effort in every jurisdiction.

- States and provinces may consider establishing consistently funded public benefits funds to support energy-efficiency efforts by non-utility providers, where appropriate.

Goals:

- In order to meet the MGA target of saving 2 percent of energy use annually by 2015, a quantitative goal is needed. A majority of the full EEAG recommends that an annual target of 2 percent annual savings for electricity utilities and 1.5 percent for natural gas utilities for each jurisdiction — and, by extension, for each retail energy provider within a jurisdiction — should come from demand-side energy efficiency and conservation, with an additional goal of pursuing available supply-side savings. (As noted in item 3 under "Implementation Mechanisms" in the Summary Statement, a minority of EEAG members felt that supply-side savings as available should count toward the 2 percent efficiency savings goal.) Consistent with the goals expressed for the region as a whole in the Summary Statement, goals for each retail energy provider are as follows:

    - By 2015, achieve a 2 percent annual reduction in use of electricity and a 1.5 percent annual reduction in natural gas use relative to the rolling average of weather-normalized retail sales in the previous three years. This goal should be re-evaluated periodically based on new market-potential studies and program experience. Note that this decrease in energy use may be offset by load growth, yielding an absolute year-to-year change in energy consumption that may be different from 2 percent.
    - The goal is to ramp up starting as soon as possible, beginning at existing levels of savings in each jurisdiction, and increasing annually so that the annual reduction in use rises to 2 percent for electricity and 1.5 percent for natural gas for utilities (as above) by 2015. For the purpose of analyzing this option, assume provisionally that "as soon as possible" is 2010.
    - Annual savings goals in years after 2015 continue to be a 2 percent and 1.5 percent annual reduction in use of electricity and natural gas respectively, relative to the rolling average of weather-normalized retail sales in the previous three years.
    - The principle behind the goal is that all cost-effective conservation be applied. The rate of improvement, 2 percent per year for electricity and 1.5 percent for natural gas, provides an appropriate trajectory. The annual reduction goals should continue as long as cost-effective measures are available. The initial cumulative target should be established by each jurisdiction.
    - Annual savings goals for stationary use of delivered fuels (oil and propane/liquefied petroleum gas (LPG)) will be 1.5 percent annual reductions, although the EEAG recognizes that programs to provide energy-efficiency measures to the users of these fuels may need to be designed and funded differently from programs serving electricity and natural gas customers.
    - The savings target applies to non-transportation-sector gas and electricity use. If, for example, significant use of all-electric or plug-in hybrid cars, or of cars fueled with compressed natural gas, were to increase electricity or natural gas use significantly, the savings target would be calculated excluding sales to the transportation markets.

- ○ Each jurisdiction should have the same 2 percent electricity and 1.5 percent natural gas annual goal for energy-efficiency improvement by its utilities, independent of prior EE achievements, as determining a fair way to "trade" responsibilities for reaching the regional goal appears highly problematic.

Timing: As noted above, consistent with MGA targets.

Parties Involved: Municipal, cooperative and investor-owned utilities; regulatory agencies; organizations providing public input into utilities proceedings; residential, commercial, institutional and industrial energy consumers; energy-efficiency service providers.

Other: None cited.

Implementation Mechanisms

Potential implementation mechanisms could include:

1. **Establish energy-efficiency performance standards in each state**

   States should establish energy-efficiency performance standards for electric and natural gas utilities (including investor-owned utilities, municipal utilities and cooperative utilities) that set energy savings goals for utilities, specify measurement and evaluation standards, and address any state-specific issues related to energy savings.

2. **Establish public benefit fees to fund the provision of energy-efficiency services, as and if appropriate. Public benefit funds, if developed, must be consistently funded year-to-year to maintain the integrity of the EE programs they support.**

3. **MGA governors should consider entering into a compact that includes adoption of resource planning processes that use similar standards, metrics, carbon costs and definitions across jurisdictions.**

   - The MGA could work with stakeholders to develop the compact. Adopting this action would encourage all participating jurisdictions to pursue energy efficiency before building new energy supply, and would provide a vehicle for implementing the other energy-efficiency policy options. It is recognized that the different states include utilities with different business environments. Utilities range from distribution-only entities to fully integrated utilities that are responsible for both generation and distribution. As a consequence, regional resource planning processes will need to be tailored by state.

4. **Require regulators to include the adequacy of a utility's EE programs and plans as one of the elements they consider when approving a "certificate of need" for new generation.**

5. **States and provinces should establish a means for sharing information on what works and what does not in developing and offering EE programs.**

- Some states and provinces have had more success than others in implementing energy-efficiency programs. There should be information-sharing from jurisdictions that have established programs, to identify what is working where. One way to do this is to establish forums in which actors from different jurisdictions could share experiences. These could be organized by the types of stakeholders who want to learn from each other, for example, state/state groups, NGO/NGO groups, etc.
- Make sure utilities in each state are comfortable with trying to meet the EE goals, to avoid resistance to the goals from utilities.
- Encourage EE programs to start with what we know works now — commercial lighting, for example — rather than focusing, at least in the short term, on options that may be harder to implement and provide lower near-term savings. The commercial and industrial sectors are a clear area in which programs should be focused. There are some fundamental, simple things that should be used in jurisdictions that haven't done very much yet. There are many EE opportunities for residential customers. In particular, low-income households need special attention, due to typically older houses or apartments and more financial stress from rising energy prices (and other household expenses).

6. **Efforts toward education and training to promote awareness of energy-efficiency and climate-change issues, and to help change behavior to reduce energy use and climate impacts, should be a part of every utility and non-utility EE effort in every jurisdiction.**

7. **Consumer Education Associated with Energy-Efficiency Efforts**

    - Consumer education should be provided to support energy-efficiency efforts by both utility and non-utility efficiency providers. Education should focus on shifting consumer attitudes about energy efficiency, and underlining the importance of consumer action in addressing energy and environmental problems, as well as in reducing consumers' own costs.
    - Governments, utilities, advocacy groups and others should form partnerships and coordinate to address the public with consistent messages regarding the benefits of energy efficiency and the availability of EE programs.

Related Policies/Programs in Place

- Wisconsin has developed recommendations related to the provision of energy-efficiency services to propane and heating oil consumers.

Type(s) of GHG Reductions

Greenhouse gas emissions from direct fossil fuel combustion and from fuels burned to generate electricity, primarily CO_2, but also methane (CH_4), nitrous oxide (N_2O) and other emissions (including criteria pollutant emissions) with direct or indirect impacts on climate.

Estimated GHG Reductions and Net Costs or Cost Savings

The table below provides a summary of the estimated emissions reductions and cost savings (negative values under "NPV[1] 2009-2025" and "Cost-Efficiency" indicate that the option results in a net cost savings to the economy).

	Option Name	GHG Reductions ($MMtCO_2e$)		Cost-Eff ($\$/tCO_2e$)	NPV 2009-2025 ($million)	Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)
		2012	2025			
EE-3	Require Retail Energy Providers to Make Energy Efficiency a Priority	9.6	157.9	-$28	-$33,096	1200.7
	Illinois	1.7	32.6	-$25	-$6,139	242.7
	Indiana	2.4	27.7	-$24	-$5,275	215.8
	Iowa	0.2	7.7	-$29	-$1,586	55.5
	Kansas	1.0	11.4	-$25	-$2,193	88.4
	Manitoba	0.0	0.6	-$150	-$659	4.4
	Michigan	0.1	12.9	-$32	-$2,843	89.0
	Minnesota	0.2	9.9	-$28	-$1,947	69.6
	Missouri	1.8	21.0	-$23	-$3,750	163.3
	Nebraska	0.6	7.4	-$23	-$1,340	57.1
	North Dakota	0.3	3.2	-$24	-$580	24.6
	Ohio	1.2	12.8	-$41	-$4,717	116.0
	South Dakota	0.2	2.8	-$26	-$547	21.4
	Wisconsin	0.1	7.8	-$29	-$1,521	53.0

Sensitivity Analysis:

The estimated net cost of this EEAG option is in large part a function of the difference between the values used for the avoided cost of electricity and the cost of saved energy. "Best estimate" assumptions for both of these parameters are described below. In order to explore the sensitivity of cost and cost-effectiveness results to changes in these parameters, two sensitivity analyses were prepared:

- An analysis reflecting a higher value for electricity generation avoided by energy efficiency ($75 per MWh versus the $60 per MWh described below), reflecting, for example, the impact of the recent rapid escalation in the cost of new generation facilities on average avoided costs. Using the higher avoided cost yields an NPV for EE-2 of about -$41.8 billion (that is, $41.8 billion is saved through implementation of the option) for the period 2009 to 2025, with a cost-effectiveness of -$35 per ton of CO_2e.
- An analysis reflecting a higher value for the cost of electricity saved through the programs provided in this option ($45 per MWh versus the $30 per MWh described below), reflecting, for example, an assumption that as energy-efficiency programs become more aggressive, over time, more of the less-expensive EE opportunities will have already been taken advantage of, leaving, on average, a more expensive remaining pool of energy-efficiency resources. Using the higher avoided cost yields an NPV for EE-2 of about -$24.4 billion (that

[1] NPV is the abbreviation of Net Present Value, which expresses a stream of future costs or savings — or, in this case, the annual costs of the option minus the annual savings of the option — in terms of present value. In doing so, the NPV calculation "discounts" monetary flows that are further in the future relative to those that will accrue in the near term.

is, $24.4 billion is saved by the option) for the period 2009 to 2025, with a cost-effectiveness of -$20 per ton of CO_2e.

Presentations of summary results by jurisdiction for each of these sensitivity cases can be found in the Annex to this Options Document.

Data Sources:
Data sources for assumptions can be found in the Annex to this document. Sources of key assumptions used across jurisdictions will be listed here (some are described below) as analyses are completed.

Quantification Methods:

The Annex to this document provides a printout example (for Illinois) of the worksheets used to analyze this option.

This option is evaluated by applying the target savings fraction, phased in over time as indicated in the goals for the option, to projected electricity, natural gas, fuel oil and LPG/propane use in each jurisdiction. Savings from existing or recently adopted programs are evaluated first, and net savings goals are adjusted based on the savings from existing programs. Costs of saved energy based on national studies are applied, along with jurisdiction-specific avoided costs by fuel, to estimate the net cost of the option in each jurisdiction. Rough estimates of costs of electric and natural gas energy-efficiency programs (including administration costs and incentive costs paid by the utility or non-utility administrator) are applied to estimate, for reference, the magnitude of the investment required by the organization running the programs to meet the goals of the option.

Key Assumptions:

Key assumptions used in evaluating this option are provided in the Annex to this document for a group of common assumptions used across options. An example of state-specific assumptions (for Illinois) is also provided.

Some of the key assumptions used are:

- **Avoided costs**: Electricity avoided costs are currently assumed, pending receipt or development of more jurisdiction- or region-specific data, to be $60 per MWh (in levelized, 2006 dollars)[2]. Natural-gas avoided costs are based on average historical city-gate gas prices in each jurisdiction, projected into the future using regional price trends from the U.S. Energy Information Administration (EIA) Annual Energy Outlook.
- **Costs of saved energy**: The average levelized cost of electricity saved through efficiency programs included in this option is taken to be $30 per MWh, based on a composite of a number of recent state and national studies. The cost of saved natural gas is assumed to be $2.50 per MMBtu, again based on a rough average of national experience. The

[2] It has been suggested by EEAG members that given recent significant increases in power plant costs and fuel prices, a higher avoided cost might be applicable — perhaps $90 to $100/MWh. Other EEAG members have made the case that ultimately, as the efficiency programs called for in this option produce deep cuts in generation, it will be existing, not new, generation that will in significant measure be displaced, so a figure lower than $60/MWh, reflecting only avoided fuel and variable O&M (operation and maintenance) costs for generators, may be more realistic.

natural-gas cost of saved energy was also used for oil- and LPG/propane-saving measures. Though the $30/MWh cost has been shown in a number of existing studies, the level of savings reached by 2025 through application of a 2 percent annual goal is beyond that shown in most studies, and it is uncertain whether this cost per unit of saved energy will hold at such high levels of savings.

- **Savings from existing programs**: In most MGA jurisdictions, pending additional information, estimates for electricity savings through existing U.S. state efficiency programs as a fraction of sales in 2006 are taken from Table 6 of the ACEEE document The State Energy Efficiency Scorecard for 2008.[3] Estimates of savings from existing programs for other fuels are placeholder assumptions. More-recent data for some states (IL, OH, MI, WI) were provided by EEAG members.
- **Utility (or non-utility) outlays per unit energy savings** (for calculation of investment needs) are assumed to be $125 per MWh first-year savings for electricity programs, and about $13 per MMBtu first-year savings for natural gas programs. As with the total cost of saved energy, these estimates are based on experience with existing programs, and it is uncertain whether the cost will remain at this level as the level of savings required from the programs rises significantly.
- **The fraction of annual sales saved via EE-2** (as the sum of "recent actions" and additional effort under EE-2) increases to 2 percent annually for electricity, and 1.5 percent annually for natural gas, fuel oil and LPG/propane by 2015, continuing at that level through 2025 (and, for illustrative purposes, through 2030). These annual savings targets apply to the average of sales in the previous three years for each fuel. Previous years' sales are calculated as reference forecast sales for those years less the savings that have accrued through those dates from the EE-2, EE-4 and EE-5 options, as well as the recent actions accounted for under those options. Thus, for example, the GWh savings target for EE-2 for 2018 for electricity would be calculated as 2 percent of the average electricity sales in 2015 through 2017 **NET** of all EEAG savings (including recent actions) that reduced sales in those years.
- **GHG emissions reduction per unit electricity savings**: Pending receipt or derivation of additional information, the average emissions savings per unit of electricity generation avoided is assumed to start in 2007 at the 2000-2006 average value for the jurisdiction (derived from U.S. EIA data, except in Manitoba), declining slowly based on the assumption that 20 percent of avoided generation by 2030 will be from combined-cycle natural gas generation (except in Manitoba, where the historical average for the hydro-dominated system is used throughout). Typically (again excluding Manitoba), avoided emission factors decline from about 1.0 metric tons of CO_2/MWh in 2009 to 0.9 tons of CO_2/MWh in 2025, varying somewhat by state.

Key Uncertainties

The interplay between energy-efficiency options and greenhouse gas policy options is as uncertain as it is undeniable. This option assumes that retail energy providers will continue to capture energy savings through programs paid through retail rates and delivered by the providers or their surrogates. In a carbon-constrained economy, it is very likely that many businesses and industries and any number or third-party market entrants will capture and commoditize emission savings from energy efficiency. Retail energy providers or other third-party administrators of their programs would not likely be able to produce savings of 2 percent or more per year when a cap-and-trade system goes into effect.

Additional Benefits and Costs

Feasibility Issues

The fact that not all energy providers are regulated makes it difficult to require all providers to make energy efficiency a priority. This same fact makes it equally hard to require all providers to adopt integrated resource planning and the adoption of EE as the first way to meet new demand.

Status of Group Approval

Consensus reached at EEAG in-person meeting on January 14 and 15, 2009, pending final review of staff changes to document.

Level of Group Support

Full consensus except where noted in the document.

Barriers to Consensus

None cited.

EE-3. Remove Utility Financial Disincentives and Enable Investment Recovery for Energy-Efficiency Program Costs

Policy Description

Regulatory practices and rate designs sometimes result in barriers to efficiency investments because efficiency reduces potential energy sales. Changes should be implemented to remove financial disincentives and provide appropriate incentives for prudent expenditures on energy efficiency by regulated utilities. This policy develops the next generation of utility regulatory practices, and as such is key to successfully implementing all other energy-efficiency options.

Policy Design

The revision of practices for regulating energy utilities should be designed to send a message to all involved parties (regulators, utilities, consumers) that energy efficiency is a supportable, profitable and viable means of providing consumers' energy needs. Decoupling, incentives and regulatory restructuring that make energy efficiency financially attractive, along with innovative efficiency-program delivery methods that go beyond relying only on utilities and engage the rest of society, are opportunities to be addressed by changing regulatory practice. Midwestern states and provinces must examine their regulatory frameworks to identify the changes needed to best encourage aggressive energy efficiency. As such, policy revisions should have several major components:

- Provide for cost recovery, including recovery of both long-term and operations and maintenance (O&M) costs associated with providing energy-efficiency programs and services.
- Consider rate design changes with the purpose of implementing regulatory policies that reduce the utilities' disincentive to promote energy efficiency.
- Provide new opportunities for utility earnings associated with the successful achievement of energy-efficiency goals and with business related directly to providing EE services.
- Any policy changes such as the above should carefully balance the interests of consumers and utility shareholders.

Potential components of this policy include:

- Mechanisms that ensure reliable cost recovery for conservation and energy-efficiency programs, including capital and O&M costs.
- Remove disincentives to utility energy-efficiency investments, using tools and strategies such as rate design (utility side) and decoupling (this has historically had more consideration in natural gas markets) of sales from revenues. It is suggested that decoupling policies, if implemented, not start as requirements, but offer utilities the option to come forward to implement decoupling. At present, a number of consumer advocates are concerned about the issue, and it is recognized that implementation of decoupling regionwide may be a longer process.

- Provide opportunities for utility earnings by setting incentives (in dollar terms or as a percentage return on investment charges for meeting goals, allowing a percentage of the benefits of energy-efficiency measures to be kept by utilities, and/or allowing capitalization of EE costs). Sustainable business and sustainable energy must both be attained.
- Note that the mix of rewards, design parameters and incentives that will effectively spur utilities to significant investments will be different for different utility companies.
- Regulatory and legislative actions should be mutually supportive in setting incentive structures for utilities to invest in energy efficiency.
- Goals should be quantifiable, and rules governing incentives should be fair and reasonable for all.

Goals:

- States should consider and implement standards that remove disincentives for utilities to pursue energy-efficiency programs, and provide utilities with incentives to meet the MGA energy-efficiency goals.
- Develop a menu of different options for providing utilities with incentives, based on experience within the states and provinces.
- Develop a set of guiding principles for rate design, cost recovery and financial incentives for energy-efficiency programs and investments. There should be some overarching principles that give common guidance and consistency across jurisdictions.

Timing:

- Begin process of developing standards and criteria for reducing utilities' disincentives to implement energy-efficiency programs, and develop standards and criteria for utility incentives, within six months of MGA decision.
- Compile and disseminate to utilities, regulators and others information on "best practices" with regard to rate design, cost recovery and financial incentives for energy-efficiency programs and investments. These collections of best practices should be complete and available in time to inform and guide the implementation of utility energy-efficiency programs undertaken in response to EE-3 goals.

Parties Involved:

All utilities, regulatory commissioners/regulatory agencies, legislators, the environmental community, consumer advocacy groups.

Other: None cited.

Implementation Mechanisms

Making the Business Case, Reviewing/Developing Business Models and Principles

- Energy-efficiency proponents must make a compelling business case to regulators and the public that EE is a least-cost resource. All stakeholders must get this message out to key policy and decision makers, in both government and private industry.

- There is a need to survey and catalog business models in other jurisdictions that support EE. Such analysis has been done by the American Council for an Energy-Efficient Economy (ACEEE), Midwest Energy Efficiency Alliance (MEEA) and the Regulatory Assistance Project (RAP). Further analysis could draw out best practices in program design and delivery.

Related Policies/Programs in Place

- Minnesota – Financial incentive mechanisms for utility energy-efficiency investments have been implemented.
- The Minnesota Public Utility Commission (PUC) has hired a consultant (the Regulatory Assistance Project, or RAP) to do a study to come up with a decoupling mechanism. Results of the study are available as the June 2008 document Revenue Decoupling – Standards and Criteria, A Report to the Minnesota Public Utilities Commission, by Wayne Shirley, Jim Lazar and Frederick Weston (http://www.raponline.org/showpdf.asp?PDF_URL=Pubs/MN%2DRAP%5FDecoupling%5FRpt%5F6%2D2008%2Epdf), and may be useful for the work of the EEAG. The study is consistent with a statutory mandate from the state's legislation. Minnesota can approve pilot decoupling programs pursuant to statute. The study by RAP, once accepted by the PUC, is expected to provide the general design criteria and parameters that the PUC would like to see in utilities' designs in order to get the commission's approval to proceed with programs.
- Eight to 10 other states have financial incentive mechanisms for utility energy efficiency, and other states are looking into it. These mechanisms usually involve sharing of benefits or reward for meeting goals (this has significantly ramped up interest and engagement).

Type(s) of GHG Reductions

This option will lend support for GHG savings as noted under, for example, EE-2.

Estimated GHG Reductions and Net Costs or Cost Savings

This option supports other MGA options, thus its costs and benefits will not be quantified separately.

Key Uncertainties

None cited.

Additional Benefits and Costs

None cited.

Feasibility Issues

None cited.

Status of Group Approval

Consensus by full EEAG at its in-person meeting on January 14 and 15, 2009

Level of Group Support

Full consensus.

Barriers to Consensus

None

EE-4. Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement

Policy Description

The experience of other countries and regions in developing progressive codes and standards should be a model for the Midwest region. All jurisdictions should adopt residential and commercial building codes that meet or exceed the national model energy codes. Jurisdictions should set up statutorily mandated updates every three years to ensure that building codes keep up with technological advances in energy efficiency. Similarly, all jurisdictions should adopt standards for appliances and equipment that go beyond federal law where allowed, and cover types of appliances and equipment not currently covered by federal law. This policy proposes coupling the implementation of more-stringent codes and standards with mandatory education and training for building-sector professionals and with increased enforcement to ensure that standards are met. Other, market-based approaches are also recommended, including increased building and appliance efficiency, incentives for efficiency improvements in current building stock, and other mechanisms to greatly improve the efficiency with which energy is used in buildings in the Midwest.

Policy Design

Strengthening of building energy codes and appliance efficiency standards is key to improving the efficiency of energy use in the residential and commercial sectors in the Midwest. The design of policies to improve building energy and appliance codes and standards should include the following major elements:

Strengthening of Building Energy Codes and Code Adoption

- It is recommended that all jurisdictions adopt state- or province-wide building energy codes for commercial and residential buildings. It is recognized that some jurisdictions do not have statewide building codes. In those cases, new legislation is needed to ensure that all new construction, residential and commercial, meets or exceeds the current national model energy code. Jurisdictions should allow municipalities to adopt more-stringent building energy codes and standards.[3] Jurisdictions should be encouraged to become active in the building energy code development process. States and provinces should update building codes to reflect the latest in proven conservation and building technology at least every three years, based on the IECC (International Energy Conservation Code) and ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) code update process, for Midwest states, and every five years, based on the Model National Energy Code of Canada.
- Building energy-efficiency codes should be strengthened through the adoption of codes that meet or exceed the current national model codes for residential and commercial buildings, and statutory requirements instituted to ensure regular improvement of the code.

[3] Noted that the recommendation that jurisdictions to adopt more-stringent building energy codes is not supported by one EEAG member.

Specifically, this improvement goal should increase building energy efficiency to meet or exceed IECC 2009 for residential construction and ASHRAE 90.1 2007 edition for commercial buildings.[4]

- Individual state or provincial building energy-efficiency codes could exceed the national standards adopted by the Midwest states/provinces as a group.
- Building energy codes should be applied as widely as possible to new and renovated residential and commercial construction.
- The energy codes should be applied as widely as possible to new and renovated residential and commercial construction. Energy code improvements should be consistent with maintaining building durability, ensuring appropriate indoor air quality and minimizing moisture problems.
- Jurisdictions, including states, provinces and local governments, should explore options to improve the energy performance of rental property through codes and ordinances. For instance, states and provinces could consider uniform energy-efficiency standards for existing rental property.Local ordinances could require the owner of rental housing to hold and periodically renew a certificate of occupancy. Options should be considered to mitigate costs of compliance. These could include financing mechanisms. To qualify for the certificate, the property would have to meet minimum standards for the age or condition of the refrigerator, HVAC equipment, insulation and weatherization. If workable enforcement mechanisms could be found, such standards and ordinances would allow better use of limited Low Income Home Energy Assistance Program (LIHEAP) funds are available to the states.

Enhanced Enforcement and Mandatory Training Related to Building Energy Code Implementation

- Currently, much building energy-efficiency code enforcement is "passive" enforcement — for example, through the use of RES*check*® and COM*check*® software programs. There is a need to go beyond this situation to much more use of active enforcement. Active enforcement includes looking at building plans and inspecting buildings during construction — inspections have to be done at the stages of construction where the energy-efficiency measures can be checked easily (for example, by checking insulation before walls are completed). As codes are increased, funding of additional/more-stringent inspections should be allocated (potentially funded through fees and permits) to ensure a stronger enforcement to maximize efficiency savings.

- Training should be provided for code officials in the implementation of energy codes for existing and new buildings, and funding should be provided for code-enforcement jurisdictions to train and hire additional FTE (full-time equivalent personnel) for inspection and plan review.

[4] Noted that this recommendation is not supported by one EEAG member.

- Training should be mandatory for all builders if states enter into a more stringent building code environment with enforcement, and training should be provided for architects and engineers.

- Training programs should be promoted for building operators to improve education and skills to maximize energy efficiency in current and new building stock.

- Training should be available to homeowners to manage mechanical equipment, indoor air quality and indoor moisture issues (an example is the Builders Association of Minnesota home-smart.org Web site).

- Jurisdictions should ensure that where any third-party energy-efficiency program verification is required that the third party should be free from any conflict of interest (e.g., mechanical and/or insulation contractors should not be allowed to verify compliance on any project for which they performed the design or installation).

Adopt Green Building Programs

- Jurisdictions (states, provinces and/or cities) should adopt point-of-sale disclosure programs for new construction and remodeled buildings that will allow for consistent measurement of energy performance.

- Encourage use of green building programs for private sector and government buildings, such as LEED (Leadership in Energy and Environmental Design), ENERGY STAR® and others.

Appliance/Equipment Efficiency Improvement

- Encourage the federal government to increase standards for covered appliances and expand standards and certification to all major energy-using devices. Home electronics are a particular category of devices for which new regulations may be helpful. Encourage the federal government to set a national standard for furnaces of 90 percent AFUE (annual fuel utilization efficiency).

- Educate the sales force and consumers, including education at the point-of-sale on appliance efficiency, and continuing to improve the federal ENERGY STAR® program.

- Encourage ENERGY STAR® to include coverage of additional gas appliances.

- Provide incentives for the retirement of existing appliances.

- Provide additional incentives for the purchase of ENERGY STAR® appliances, including rebates from utility programs, and tax credits as applicable.

Certification Programs

- Adapt effective, market-based certification programs to buildings and appliances not now covered, so that energy efficiency becomes a visible selling point for a wider array of products.

- Jurisdictions or local governments should develop certification programs for rental housing that would clearly and uniformly disclose the amount of electricity and heating fuel used in the 12 most recent consecutive months in any offer to rent a residence. Such a requirement would help the market provide an incentive for energy efficiency in rental property.

Upgrading Existing Buildings, and "Beyond Code" Construction

- Develop incentive programs to upgrade home and commercial buildings' energy performance prior to sale, while implementing financing mechanisms to aid in such upgrades, so that buildings will reflect the latest in proven, cost-effective techniques and practices for conservation and energy efficiency, including hot water use efficiency.

- Jurisdictions should consider adopting housing codes that require minimum energy-efficiency standards for rental housing, including, for example, the presence of storm windows or the equivalent, insulation, efficient appliances and efficient lighting.

- Establish incentives to exceed building codes. For example, if developers build an "ENERGY STAR structure," they might qualify for preferential and/or lower-interest financing.

- Encourage development of zero-energy building design and construction. For example, the Architecture 2030 Challenge is one such standard, endorsed by the American Institute of Architects, the U.S. Green Building Council, the U.S. Environmental Protection Agency, the U.S. Conference of Mayors, and numerous individual cities and organizations. The Architecture 2030 Challenge is asking the architecture and building community to adopt the following targets:

- All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50 percent of the regional average for that building type.
- At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50 percent of the regional average for that building type.
- The fossil fuel reduction standard for all new buildings and major renovations shall be increased to:
  - 60 percent in 2010
    70 percent in 2015
    80 percent in 2020
    90 percent in 2025
    Carbon-neutral in 2030 (using no fossil fuel, GHG-emitting energy to operate).
- These targets may be accomplished by implementing innovative sustainable-design strategies, generating on-site renewable power and/or purchasing (20 percent maximum) renewable-energy and/or certified renewable-energy credits.

Goals:

- All U.S. MGA jurisdictions will set a goal of adopting building energy codes that meet or exceed the national model code, with an automatic, statutorily required increase to coincide with the national model code review process.[5]
- At least 90 percent of building projects in Midwest states/provinces will be reviewed and inspected on-site, and inspection programs will be instituted to accomplish this goal. Jurisdictions will provide funding for training and education of code officials.
- Midwest states and provinces will adopt policies to certify compliance with building codes. Different alternatives for certification procedures are possible, including third-party certification, or certification done by a builder or owner that includes the filing of a certificate of compliance with the code along with the deed on the building.[6]
- At least 80 percent of building code inspectors will have completed at least 16 hours of training in their adopted building code within two years.

Timing:

- Implementation of state- and province-wide building energy codes by July 2010
- Implementation of mandatory training supporting application of building energy codes as soon as possible after codes come into force.
- Implementation of appliance/equipment standards by 2011.

[5] Noted that this recommendation is not supported by one EEAG member.
[6] Noted that this recommendation is not supported by one EEAG member.

Parties Involved: State and provincial governments, code associations, building industry (builders, developers, unions, engineers and architects), industry groups, environmental advocates, groups representing homeowners/renters.

Other: None cited.

Implementation Mechanisms

1. Actions Proposed for Implementation by the MGA

The MGA should also work with appliance manufacturers to put in place policies that lead to ever-more energy-efficient and grid-smart appliances; this would include working with regional representatives to develop better ENERGY STAR® programs that address EE education for consumers as well as sales staff. This also requires identifying key intervention points where new appliances that are more efficient can be installed, such as home sales, title transfers and as a result of home energy ratings.

2. Code Adoption

Adopt codes with no amendment or with a minimum number of amendments in order to facilitate application, effectiveness and continuity of building energy codes adopted.

3. Training for Building Energy Code Implementation

Develop regional training or regional training modules for building energy code inspectors for jurisdictions with the same or similar building energy codes to share resources, minimize costs and maximize results.

- Training should be provided for building code inspection/enforcement officials, as well as for builders/architects/engineers.
- Training for building inspectors and others could be provided via the International Code Council.
- Involve community colleges and universities in setting up and providing training programs.
- Encourage public and private universities to set a minimum requirement for exposure to green building concepts for architecture students and engineers.
- Involve private code-training firms in providing training programs.
- Use utility energy-efficiency funds for training.
- Emphasize that energy is now part of the job for building inspectors; that is, as a central part of their responsibility in addition to safety and other concerns.
- Specify a minimum percentage of building inspectors in each jurisdiction who are to have received at least 16 hours of training in enforcement of the energy provisions of the adopted version of IECC.

4. Provide incentives for going beyond building energy codes currently in force

- Streamlined review of permits
- Tax benefits for additional investments in building efficiency
- Removal/reduction of administrative hurdles

5. Encourage utilities and conservation service providers to work more closely with the building industry to increase building energy performance and energy code training and enforcement. For example, regulators could give utilities credit for energy saved from enhanced building performance gained through utility-sponsored programs. Continue to identify areas of future collaboration between utilities and the building sector.

6. Commissioning

- States/provinces could require that all state/provincial buildings must be commissioned; that is, must be checked to make sure that their energy performance is as designed. This requirement could apply to both state/provincial and local government buildings.
- Encourage development/expansion of the commissioning industry, and educate building owners in the benefits of commissioning.

Related Policies/Programs in Place

- See Appendix detailing policies in place in each state.

Type(s) of GHG Reductions

Greenhouse gas emissions from direct fossil fuel combustion and from fuels burned to generate electricity, primarily CO_2, but also methane (CH_4), nitrous oxide (N_2O) and other emissions (including criteria pollutant emissions) with direct or indirect impacts on climate.

Estimated GHG Reductions and Net Costs or Cost Savings

	Option Name	GHG Reductions ($MMtCO_2e$)		Cost-Eff ($/t$CO_2e$)	NPV 2009-2025 ($million)	Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)
		2012	2025			
EE-5	Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement	6.2	97.8	-$19	-$13,291	683.5
	Illinois	1.2	19.1	-$17	-$2,279	133.6
	Indiana	0.6	9.5	-$20	-$1,316	66.1
	Iowa	0.3	4.0	-$21	-$578	27.6
	Kansas	0.3	4.0	-$17	-$483	27.9
	Manitoba	0.0	0.3	-$146	-$265	1.8
	Michigan	0.8	12.8	-$22	-$1,946	89.7
	Minnesota	0.6	9.4	-$18	-$1,209	65.5
	Missouri	0.5	9.2	-$19	-$1,188	63.3
	Nebraska	0.2	2.7	-$20	-$375	18.9
	North Dakota	0.1	1.2	-$19	-$160	8.3
	Ohio	1.0	15.7	-$20	-$2,229	110.4
	South Dakota	0.1	1.2	-$22	-$178	8.1
	Wisconsin	0.6	8.8	-$17	-$1,085	62.3

Data Sources:

Data sources for assumptions can be found in the Annex to this document. Sources of key assumptions used across jurisdictions will be listed here (some are described below) as analyses are completed.

Quantification Methods:

The Annex to this document provides a printout example (for Illinois) of the worksheets used to analyze this option. Different methods were used to estimate the energy/emissions savings and costs of the building energy codes, appliance/equipment standards, and "beyond code" building energy-efficiency improvements included in this option, as described briefly below.

Building Energy Codes Element

- New residential codes adopted as a result of this option achieve improvements in the efficiency of space conditioning and lighting energy use that are equivalent to the benefits achieved by moving from IECC 2006 to model IECC 2009 codes. The level of energy-efficiency improvements assumed for each jurisdiction was based on analysis done for the Energy Efficient Codes Coalition (EECC) by ICF. The EECC analysis evaluated the savings resulting from an improvement from IECC 2006 equivalent residential-building energy codes to IECC 2009 codes, evaluated for the nation as a whole by climate zone[7]. The savings modeled in the EECC analysis (and used here) include about 14.7 to 16.3 percent savings in electricity used for heating, cooling, water

[7] Savings estimates for MGA jurisdictions were based on EECC results from a workbook dated January 2009, obtained from an EEAG member, and summarized in narrative form as the document Energy & Cost Savings Analysis of 2009 IECC Efficiency Improvements, As Adopted by the ICC September 22, 2008, An Analysis Prepared for the Energy Efficient Codes Coalition (EECC) by ICF International, available as http://www.thirtypercentsolution.org/solution/EECC-Savings_Analysis-Jan-2009.pdf. A printout of the workbook itself is available as http://www.thirtypercentsolution.org/solution/ICF-data.pdf.

heating and lighting, and 7.7 to 11.5 percent savings in gas, fuel oil and LPG/propane used for heating, cooling and water heating, with values used for different Midwest jurisdictions selected based on the national climate zones each jurisdiction experiences. It was assumed that EE-4 code improvements would average a 10 percent reduction in requirements for space conditioning and lighting in commercial buildings, relative to the IECC 2006 and ASHRAE 90.1 standards. The latter is a rough assumption based, for example, on ASHRAE analysis showing 11.9 percent overall energy savings due to upgrading standards from ASHRAE 90.1—1999 to ASHRAE 90.1—2004[8].

In effect, the calculation approach outlined above (for both the residential and commercial sectors) assumes that as a result of applying MGA EEAG recommendations, MGA jurisdictions implement building energy codes that are about three years ahead of what would have been implemented in the absence of MGA policies in this area. Please note that as yet, no attempt has been made to estimate the different levels of initial savings that some jurisdictions will achieve in the first step of bringing existing codes up to, for example, the IECC 2006 level. Several MGA jurisdictions, including several of the more populous Midwest states, have codes that are already at that level for one or both sectors.

- Costs of saved energy are calculated based on an average seven-year payback.
- Renovations substantial enough to trigger the requirements of the new code are assumed to be equivalent to 60 percent of new building space.
- New buildings meeting existing codes in each jurisdiction are assumed to use about as much energy per unit of floor space as average existing 2005 buildings.

Appliance/Equipment Standard Element

- Extrapolation of cost and savings results for six devices from ASAP (Appliance Standards Awareness Project)/ACEEE 2006 state-by-state estimates (those devices from the ASAP/ACEEE estimates not covered by Federal Energy Bill, plus higher-efficiency furnaces).
- Results for portable luminaries and televisions extrapolated from California Title 20 estimates.

Beyond-Code Building Energy Improvements for Existing and New Buildings Element

- Beyond-code buildings meet progressive Architecture 2030 goals.
- 25 percent of new and existing buildings are included in the beyond-code element by 2030.
- Some of beyond-code improvement comes from application of solar technologies (thermal hot water and space heating, and photovoltaic power), "green power" purchase, and use of biomass and biofuels.

[8] See, for example, http://www.ashrae.org/pressroom/detail/16999.

- Energy-efficiency costs of saved energy are assumed to be the same as used in the building energy codes analysis.

Key Assumptions: Many of the key assumptions used to develop the estimates above are provided in the Annex to this document.

Key Uncertainties

None cited.

Additional Benefits and Costs

None discussed.

Feasibility Issues

None cited.

Status of Group Approval

Consensus reached by EEAG subgroup on March 6 conference call, with exceptions noted by footnote. Consensus reached by full EEAG at meeting on April 23, 2009.

Level of Group Support

Full support except where noted in the text.

Barriers to Consensus

Noted in the text.

EE-5. Have the Public Sector Lead by Example

Policy Description

The U.S. federal government and several states have taken the lead in establishing challenging energy-use reduction goals for state and federal buildings. These programs provide leadership and set an example for the private sector. Public initiatives also represent opportunities for testing more-effective energy management programs, shared savings contracts and other technical and programmatic plans that can help show the private sector how these programs can work and reduce per-capita energy use. Commissioning and recommissioning existing commercial properties is a good example of how the public sector can initiate these programs on public buildings and monitor results to show the potential payback for the private sector. These programs often make good business sense for governments to pursue, because they reduce energy costs for state and provincial governments.

Policy Design

Public sector lead-by-example in the MGA region includes ensuring that new government buildings — including publicly supported housing— are built and operated to be more efficient than required by existing and future codes; upgrading the performance and operation of existing government buildings; setting procurement guidelines for public purchases; and establishing activities designed to support improvements in the energy efficiency of government installations — including creation of a workforce trained and qualified to carry out improvements — as well as activities designed to inform the private sector regarding the success of public energy-efficiency programs. The improvements in public buildings and other lead-by-example activities described here save energy and money for the public sector, demonstrate EE technologies and approaches applicable in the broader economy, and help build a workforce to address buildings' energy performance for the private sector as well.

Affected government buildings for purposes of this option are defined as those that are government-owned, are nongovernment buildings with at least 20 percent of their construction costs funded with government money or are government-leased buildings.

Make new buildings and major retrofits of existing buildings meet stringent energy-efficiency standards

- All new government buildings, including publicly funded housing, must meet stringent energy-efficiency standards that exceed the provisions of the energy codes in force when the buildings are constructed.
- These performance goals should encompass both water-efficiency and energy-efficiency measures.

Make existing buildings highly energy-efficient

- Set a definite goal of having 20 percent of all government buildings, including publicly funded housing, recommissioned (evaluated to assure that buildings perform and are operated as they were originally designed to) and improved to meet or exceed current energy codes by 2015, with an additional 3 percent of buildings recommissioned and improved to meet or exceed codes in each subsequent year. Regularly certify the energy performance of all buildings in subsequent years.**Set energy-efficiency procurement guidelines for equipment purchases by public entities**
- Governments should set the ENERGY STAR® standard as the basis for procurement of energy-using equipment, appliances and other devices.
- Governments should also set stringent water-efficiency performance standards for equipment purchases.
- All new fleet purchases should be hybrid/alternative-fueled vehicles and should meet energy-efficiency standards where practical, given the duty c**ycle of the vehicle.**

Develop and carry out activities to support public-sector lead-by-example programs

- Provide financing mechanisms that allow and encourage governments to invest in energy efficiency.
- Prepare accurate inventories of public buildings and their energy use — that is, carry out benchmarking on all public buildings — in preparation for selecting buildings for recommissioning and upgrading of energy efficiency.
- Coordinate government lead-by-example programs with the energy-efficiency programs and actions of utilities and others.
- Jurisdictions should establish energy management processes that stipulate energy-efficiency improvement/maintenance goals, policies and practices, and set up procedures for consistent and ongoing accounting, tracking and benchmarking of energy use.
- Provide initial and ongoing training and other workforce development for public-sector building-energy managers and others involved in decisions and activities related to building-energy use. It is expected that this workforce development will help spur the development of energy-efficiency jobs for buildings in the private sector as well.

Analyze, improve and encourage the use of laws pertaining to Energy Savings Performance Contracts

- Revise ESPC laws to reflect current industry demands for renewable technology. Traditional performance-contracting laws do not have rules that encourage the implementation of distributed renewable technology.
- Revise ESPC laws to provide more-comprehensive energy reduction projects to mirror federal standards and include new provisions for technology applications.

- Revise the process for procuring performance contracts in order to reduce transaction costs, provide procurement alternatives and provide greater process transparency.
- Require appropriate standard measurement and verification practices developed by the International Protocol for Measurement and Verification.
- Require the NGA to develop a standard contract for ESPC contracts that pertain to state buildings.
- Introduce new legislation for ESPC to states that do not currently have ESPC procurement laws. Encourage the National Governors Association to develop a document that considers the best practices for implementing statewide performance-contracting projects.

Use lead-by-example programs to inform the public regarding the benefits of energy efficiency

- Conduct consumer information campaigns that inform the public regarding energy efficiency in general, and the methods and results of lead-by-example programs in particular. Offer facilities supported by lead-by-example programs as examples of energy-efficient buildings and technologies for the general public and private-sector decision makers to review.
- Fund and demonstrate existing and new technologies through pilot programs coupled with education and outreach to other public-sector agencies, the general public and the private sector.

Goals:

- Carry out benchmarking on all existing government facilities by 2013.
- Reduce energy consumption in existing and new government buildings by 15 percent in 2015, 20 percent in 2020 and 25 percent in 2025, relative to forecast levels.

  Commission all new government facilities and implement energy-efficiency measures in all new government buildings, including publicly funded housing, in order to meet overall targets for reducing energy use in government facilities.

Timing: Implementation can begin immediately for these measures.

Parties Involved: Governors' offices, legislatures, energy offices, procurement and general-services administrations, housing authorities, nonprofit housing sector.

Other: None cited.

Implementation Mechanisms

Potential implementation mechanisms for the lead-by-example elements summarized above include the following:

Make new buildings and major retrofits of existing buildings meet stringent energy-efficiency standards

- State and provincial governments should encourage creation of prototype energy-efficiency building designs to be made available for application to local government buildings.
- Set guidelines such that the energy efficiency of new state and other public buildings substantially exceeds that of buildings that meet the minimum energy-efficiency codes in force at the time of construction.
- New publicly subsidized housing should be made energy-efficient, with specific goals/targets for energy use. One possibility is to use Enterprise Green Communities guidelines as a basis for multifamily housing efficiency measures.
- Provide in-home training and workshops to educate residents in new publicly funded housing on how to implement and use energy- and water-efficiency measures.

Make existing public buildings highly energy-efficient

- Benchmark the energy performance of government buildings.
- Institute a recommissioning program that will cover 20 percent of all existing government buildings by 2015, with an additional 3 percent of government buildings covered annually thereafter until all existing buildings are recommissioned.
- Institute a program of upgrading energy efficiency that will cover 20 percent of all existing government buildings by 2015, with an additional 3 percent of government buildings covered annually thereafter.
- Existing publicly funded buildings should be made energy-efficient, with specific goals and targets for energy use, possibly including Enterprise Green Communities guidelines.
- Provide in-home training and workshops to educate residents of publicly funded housing on how to implement and use energy- and water-efficiency measures.

Develop and carry out activities to support public-sector lead-by-example programs

- Governments should design programs that incorporate financing for the incremental costs of water- and energy-efficient government buildings.
- Funding should be provided for programs to train operations staff of public buildings in methods to maintain and improve the energy and water efficiency of the buildings they manage.
- Establish financing mechanisms for capital-equipment upgrades for public buildings.
- Set up financing mechanisms to support energy-efficiency goals in low-income housing. One possibility is to utilize QAP (Qualified Allocation Plans). QAP, which are used to allocate U.S. federal low-income housing tax credits, should be allocated to developers who commit to strong energy- and water-efficiency standards.

Set energy-efficiency procurement guidelines for equipment purchases by public entities

- State governments should create master purchasing contracts for energy-efficiency technologies that are available to local governments.
- Update procurement guidelines to reflect energy- and water-efficiency procurement guidelines — including the ability for government procurements to acquire energy-efficient products rather than "low cost at all cost." This could include using life-cycle cost models (not least-first cost criteria) to guide all procurements.
- Use procurement guidelines to help highlight new technologies such as plug-in hybrid vehicles, as well as the use of existing but not widely adopted technologies such as hybrid vehicles. The program should also highlight new lighting technologies such as LED lighting for streetlights and holiday lighting.

Analyze, improve and encourage the use of laws pertaining to Energy Savings Performance Contracts

- Revise ESPC laws to reflect current industry demands for renewable technology. Traditional performance-contracting laws do not have rules that encourage the implementation of distributed renewable technology.
- Revise ESPC laws to provide more-comprehensive energy reduction projects to mirror federal standards and include new provisions for technology applications.
- Revise the process for procuring performance contracts in order to reduce transaction costs, provide procurement alternatives and provide greater process transparency.
- Require appropriate standard measurement and verification practices developed by the International Protocol for Measurement and Verification and by the Federal Energy Management Program (FEMP).
- Require the MGA to develop a standard contract for ESPC contracts that pertain to state buildings.
- Introduce new legislation for ESPC to states that do not currently have ESPC procurement laws. Encourage the Midwestern Governors Association to develop a document that considers the best practices for implementing state- and province-wide performance-contracting projects.
- Consider the creation of a publicly or privately administered energy-efficiency financing program to leverage private lease-purchasing financing with a state revolving-loan fund.

Use lead-by-example programs to inform the public regarding the benefits of energy efficiency

- Encourage energy conservation through education and outreach that provides consumers and private-sector decision makers with examples of energy-efficiency benefits from lead-by-example programs.
- Include a focus on public-housing demonstration projects that include working installations of renewable-energy, energy-efficiency and geothermal heat pump technologies, as applicable.
- Collect and distribute to public agencies information on best practices for communicating energy-efficient building designs to visitors of energy-efficient public buildings.
- Develop and publicize a curriculum for teaching energy efficiency and energy conservation in schools, building in the results of public-sector lead-by-example programs where appropriate.

Related Policies/Programs in Place

Illinois, Iowa, Michigan, Minnesota, Ohio and Wisconsin are examples of Midwest states with goals to reduce energy consumption in state facilities.

Type(s) of GHG Reductions

Greenhouse gas emissions from direct fossil fuel combustion and from fuels burned to generate electricity, primarily CO_2, but also methane (CH_4), nitrous oxide (N_2O) and other emissions (including criteria pollutant emissions) with direct or indirect impacts on climate.

Estimated GHG Reductions and Net Costs or Cost Savings

	Option Name	GHG Reductions ($MMtCO_2e$) 2012	GHG Reductions ($MMtCO_2e$) 2025	Cost-Eff ($/tCO$_2$e)	NPV 2009-2025 ($million)	Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)
EE-6	Have the Public Sector Lead by Example	8.0	29.5	-$6	-$1,897	291.9
	Illinois	1.8	6.5	-$4	-$263	64.7
	Indiana	0.8	2.9	-$9	-$255	28.7
	Iowa	0.2	0.9	-$10	-$87	8.7
	Kansas	0.3	1.0	-$6	-$65	10.4
	Manitoba	0.0	0.1	-$70	-$45	0.6
	Michigan	1.2	4.4	-$6	-$259	43.3
	Minnesota	0.5	1.7	-$7	-$126	17.3
	Missouri	0.6	2.1	-$9	-$187	20.4
	Nebraska	0.2	0.7	-$10	-$67	6.7
	North Dakota	0.1	0.3	-$10	-$31	3.2
	Ohio	1.5	5.5	-$7	-$356	54.5
	South Dakota	0.1	0.3	-$10	-$30	2.9
	Wisconsin	0.8	3.1	-$4	-$126	30.3

Data Sources:

Many data sources for this option are similar to those used to evaluate EE-4. See the Annex to this document for further details.

Quantification Methods:

The fractional savings goals described above are applied to the stock of new and existing government buildings, assuming costs of saved energy similar to those used in evaluating option EE-4. Some of the reduction in conventional electricity and fossil energy use is provided through investments in solar thermal and photovoltaic energy, biomass energy and "green power," in addition to energy efficiency, as described in the Annex to this document.

Key Assumptions:

- Government fractions of commercial/institutional floor space are assumed similar to regional averages as derived from CBECS (Commercial Building Energy Consumption Survey) data.
- Estimates of average per-unit energy use in government buildings, relative to that in average commercial/institutional floor space, are derived from CBECS (Commercial Building Energy Consumption Survey) data. Government building energy use is assumed to be either about 117 percent (the states in the eastern part of the region) or about 113 percent (western states in the region and Manitoba) of the per-unit floor-space intensities of fuel use in all commercial/institutional buildings in those areas.
- As per the goal of this Option, energy consumption in existing and new government buildings is assumed to be reduced by 15 percent in 2015, 20 percent in 2020 and 25 percent in 2025, relative to forecast levels in each year.
- As noted above, a portion of the electricity and fossil fuels reduction under this Option comes from Solar HW/SH/PV, from green-power purchase and from biomass fuel use, as some of the buildings covered under this option will need to be "beyond code."

Key Uncertainties

None cited.

Additional Benefits and Costs

Feasibility Issues

None cited.

Status of Group Approval

Consensus by full EEAG at its in-person meeting on January 14 and 15, 2009.

Level of Group Support

Full consensus.

Barriers to Consensus

None cited.

EE-6. Accelerate Adoption of Energy-Efficiency Technologies and Best Practices by Residential, Commercial and Industrial Customers

Policy Description

This option could start with using the "bully pulpit" by developing an education campaign (e.g., public service announcements), but could also entail changing local government aid to reward communities with specific energy-efficiency goals. A great deal of progress could be made by building the capacity to conduct more residential, commercial and industrial energy-efficiency assessments and providing carefully targeted incentives for consumers to act on the recommendations. Whatever combination of "carrots and sticks" that policymakers use to encourage greater efficiency, low-income customers will need programs to assist them with the front-end costs of efficiency improvements.

Utilities and other energy-efficiency stakeholders must promote awareness of EE in innovative ways. Such promotion must go beyond traditional programs and include behavior change. Since utilities cannot meet the MGA's 2 percent annual EE target without the consent and cooperation of a huge number of actors in society, any successful effort must have more than just utilities promoting EE; EE must become the cultural norm. For example, contractors and others who help determine what happens on the ground must be enlisted**.** One significant issue that MGA states should address is the financing of energy-efficiency measures; the MGA states will not meet the ambitious goals laid out in this document without the financial wherewithal to do so.

Policy Design

This option includes a number of initiatives designed to spur uptake of energy-efficient technologies and practices in the residential, commercial and industrial sectors. These initiatives are organized under the general categories of partnering and information-sharing to promote energy efficiency; providing kindergarten through 12th-grade education regarding energy efficiency; identifying near-term market-transformation opportunities; and expanding the scope of utility incentives and services and financial incentives for energy-efficiency investments.

Encourage partnering and information-sharing for energy efficiency by including a wide variety of players to help achieve common goals.

- **Expand the network of organizations providing energy-efficiency outreach and consumer awareness beyond utilities to manufacturers, retailers and contractors.** Traditionally, utilities have been given sole responsibility for developing education and awareness campaigns. But since utilities cannot accomplish the MGA target on their own, jurisdictions should consider creating opportunities for manufacturers, retailers, contractors and NGOs to individually or jointly develop and deliver consumer awareness and education campaigns that are more comprehensive and pervasive. These campaigns would still be governed by public oversight and standards. Not all money allocated to improving education and awareness has to be channeled through the utility/energy provider. Manufacturers, retailers and contractors have a core competency and passionate interest in seeing campaigns succeed, and may be more effective if given greater opportunity to do it themselves.

- States, provinces and utilities should establish a means for sharing information on what works and what does not in developing and offering utility EE programs.

Create financial incentives for energy-efficiency investments in buildings, appliances and equipment.

- States have a wide variety of financing options available to promote energy efficiency, including tax incentives, loans, grants and rebates, and programs that combine several of these financing elements. Many states have experimented with these programs with varying degrees of success, but there is no common "tool kit" that state policymakers can use to help them develop, implement and refine these financing options. Such a tool kit is likely to be more useful to individual jurisdictions in the Midwest than are specific, prescriptive recommendations from the MGA on which energy-efficiency financing mechanisms to implement. As such, a "tool kit" that lists and describes the types of financial incentive programs that can be developed will enable state officials and others to understand and choose from a menu of options that best suit their situation. A tool kit for state officials should be developed that focuses on financing options that state policymakers have at their disposal, detailing financing mechanisms and pros and cons of each, and providing lessons from the financing measures currently in place, as well as offering legislative or regulatory language for implementation of these financing mechanisms. The tool kit should include options for financing energy-efficiency improvements in rental housing, including low-income rentals.
- **Create incentives and remove disincentives for consumers of specific types to improve energy efficiency.** In the public sector — for example, in public schools — this may include allowing agencies to keep some of the proceeds from energy savings for use in other budget areas.
- **Rate-design changes to promote energy efficiency.** Demand response is defined as changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized. Time-based rates and other forms of demand response have been used within the electric power industry for decades. Dynamic pricing of electricity is receiving increasing attention today because it holds the potential for significantly improving the efficiency of electricity markets in both restructured and non-restructured states. Under dynamic pricing, customers pay lower prices for all but, say, 100 hours of the year, during which time they pay significantly higher prices. Thus, they have a strong incentive to use less power when it is most expensive to generate and deliver. Besides financial and reliability benefits, such pricing also can provide environmental benefits by reducing generation plants' emissions during peak periods, and can contribute to reduced generation-facility construction costs. These benefits flow to society as a whole, not just to participants in demand-response programs. Demand-response programs coupled with direct feedback and specific education or advice have helped customers in some programs reduce their electricity consumption by

up to 10 percent. Policymakers should ensure that demand-response programs actually result in reduced electricity usage.

- **Direct public-benefit funds directly to third parties, such as manufacturers and service providers, in addition to utilities.** States/provinces may consider directing public-benefit funds directly to third parties such as manufacturers, service providers of EE, and other applicable third parties to develop and deliver their own set of innovative financial incentives and services for EE suited to their customer base. Provision of such incentives and services would be subject to independent verification. The aim is to open EE up to innovation to include private-sector solutions.
- Provide regulatory incentives for building professionals to adopt energy-efficient building practices**.**

Create or reinforce education programs at the K-12 level to provide children with grounding in energy efficiency and its relationship to climate-change mitigation.

Consumer education is frequently discussed, but providing young people with the background to make good choices as consumers will make a huge difference over time. Providing education at the K-12 levels will include:

- Develop and require the presentation of a curriculum on the concepts of energy efficiency, particularly as they relate to mitigation of climate change. This could be not unlike a civics course, but focused on energy efficiency. Such a program could include involving school students and staff in identifying and implementing energy-conservation and energy-efficiency opportunities in the school buildings themselves.
- Develop a functional, standardized educational curriculum with K-12 students to promote and sell energy-efficient products. The program should utilize teaching staff to give in-school presentations to inspire a commitment to saving energy while arming students with the information they need to evaluate energy usage in their own homes. Students should be given materials to help promote energy efficiency, while teachers are provided with educational lesson plans on energy and sustainability that are targeted to each classroom's grade level and subject matter.
- Energy-efficiency topics could either be a part of a stand-alone curriculum, or integrated into existing programs.
- It is recognized that education programs will typically not prove cost-effective based on standard cost-effectiveness tests, but should be pursued anyway.

Provide information to building professionals and consumers to increase the availability of and markets for energy-efficient buildings, appliances and equipment.

- Provide information to building professionals on opportunities for energy efficiency in buildings.
- Provide information to building occupants to help them assess the energy costs of a building.
- Extend appliance/equipment labeling programs to additional types of devices.

Identify near-term market-transformation opportunities (such as LED lighting) and adopt policies that accelerate market penetration of those technologies and practices.

Expand the number and type of technologies for which utilities offer incentives.

- Utilities should expand the number and type of EE technologies for which they provide incentives. Since EE programs require a broad array of incentives to consumers and businesses, states/provinces should evaluate the benefits of regional coordination of some programs.
- Allow utilities to provide performance contracting on the demand side as a source of utility revenue (for example, to offset reductions in sales due to energy-efficiency gains) and to spur innovation. (It is recognized that this opportunity may apply more to investor-owned utilities than to municipal and other public utilities, which already, for example, have incentives to seek energy-efficiency improvements to avoid the need to purchase power from markets.)

Explore technology options to support demand-response programs.

- A key requirement for most demand-response programs and time-based rates is the availability of enabling technology. For states or utilities to implement demand-response and time-based rates, customers would need meters that record usage on a more frequent basis, preferably hourly. Currently, regulatory commissions and utilities are in various stages of developing and reviewing advanced metering infrastructure (AMI) implementation. Introducing other demand technologies such as smart thermostats would increase the amount of load that could be reduced under a demand-response program. A systemwide deployment of smart meters creates a platform for providing “smart prices” to customers. Smart prices reflect the varying cost of electricity in the wholesale market, and would yield additional benefits in the form of cost savings associated with the reduced need for peaking generation capacity and with lower transmission and distribution costs.

Goals:

- Provide K-12 energy-efficiency/climate-change curriculum for implementation regionwide.
- Provide brochure for distribution to developers and builders through local planning authorities regionwide.
- Provide a “tool kit” for policymakers in the MGA jurisdictions describing and providing background on potential financial incentives to promote energy efficiency.
- Develop mechanisms whereby Tax Increment Financing strategies can use the TIF leverage to improve the energy efficiency of a project. Explore options for using TIF strategies to encourage EE development. Develop a model rule that could be adopted and adapted as appropriate by MGA states.

Timing:

- Complete curriculum by the end of 2009, and implement in schools for the 2010-2011 school year.

- Date by which implementation of information brochure for builders/developers would be developed for introduction to builders/developers: 20?? (“as soon as possible”). Implementation at the county/city/town level: 20??.
- Begin outreach to tenants on choosing energy-efficient buildings as soon as possible.
- Develop model rule for TIF strategies by the end of 2009.

Parties Involved: Lawmakers, utility commissions, utilities, building departments, energy offices, departments of revenue, contractors, architects, engineers, local/county/state planning commissions, commercial tenants. For K-12 curriculum effort, teachers, school boards (and other state and local school authorities), students.

Other: None cited.

Implementation Mechanisms

Possible implementation mechanisms for the elements of the Policy Design presented above include:

Encourage partnering and information-sharing for energy efficiency by including a wide variety of players to help achieve common goals.

Develop a resource for state officials in the form of a “tool kit” on efficiency financing options. Preparation of the tool kit on energy-efficiency financing mechanisms for Midwestern states referenced in the Policy Design section above will involve the following goals and major tasks.

Goals of Tool Kit:

- To provide pertinent background information that describes energy-efficiency financing options available to states, including a brief description of pros and cons of different financing options.
- To offer a set of lessons learned from existing financing programs that states currently offer.
- To provide legislative and regulatory tools such as sample legislative language.

Major Tasks to Develop Tool Kit

This effort will build on an existing body of work that identified, on a national basis, state tax-incentive programs, loan programs, rebate programs and a number of innovative ways to leverage private with public capital to support energy efficiency. This effort also identified, again on a national basis, lessons learned from many efficiency financing programs. The MGA effort will:

a. Identify and seek results of programs that have worked, or not worked, on a national basis, but highlighting and focusing on Midwest jurisdictions. Examples of such financing mechanisms might be the following (note that this is a non-inclusive list and the final list of measures will include additional options):

i. Linkage of building efficiency targets to availability of Tax Increment Financing.[9]

ii. Linkage of Community Development Block Grants or other federal funds that are distributed by states for installation of energy-efficiency measures.

iii. Tax incentives for efficiency measures.

iv. Low-interest loans for energy-efficiency investments.

v. Grants for energy-efficiency investments, including grants for LEED-certified buildings.

vi. Payment for energy-efficiency measures that are tied to the electric meter through a tariff or to property taxes through a property lien.

vii. Bond-financed efficiency financing mechanisms, including the use of Private Activity Bonds, taxable revenue bonds and general obligation bonds for energy-efficiency investments that fit within the structures that each type of bonding provides (income-qualified financing, government/private-sector financing, etc.).

viii. Set a tax- or fee-based penalty or reward mechanism based on the relative efficiency of buildings or appliances.

ix. Encourage and provide incentives for energy-efficiency improvements in new and existing low-income and other housing.[10]

b. Summarize each of the major approaches to financing energy efficiency in a two-page document.

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[9] The concept of "rehabilitation with energy-efficiency improvement" TIF districts offers one way to give developers lower development costs in exchange for building to a minimum level of energy efficiency. In this financing mechanism, the city or other local authority uses its low-cost bonding ability to borrow funds to install necessary infrastructure for a development or redevelopment, and then the developer builds that infrastructure using those funds. The incremental taxes pay back the bonding costs of the infrastructure. By law, bond proceeds must be used to benefit the development. This financing option would explore the potential to use part of the increment from the TIF to help the developer defray some the costs of the energy-efficiency investments in building/buildings — and possibly for related climate-friendly upgrades such as solar energy equipment or district heating systems. This type of financing may provide an access point for subsidies to improve commercial-sector buildings. States may be able to pass specific state TIF districts that have specific criteria, for example, energy-efficiency criteria, even if such criteria are not present under existing statutes. (There may be legal limits on how the bonding can be affected because it is under the municipality bond rating.) TIF locks in the property tax level for the duration of the TIF, which is in itself a major benefit to the developer.

[10] Low-income housing development should be as efficient as possible, and redevelopment of low-income housing at a high level of energy efficiency is important. Much of low-income housing is currently among the least energy-efficient residences; upgrading such housing provides major energy-efficiency as well as social benefits. Housing funds, programming, HUD/FHA programs and other mechanisms may apply. House age and condition — regardless of the income level of tenants or owners — should be a key consideration in developing incentives for housing energy-efficiency upgrades.

c. Provide a table highlighting major advantages and disadvantages of each approach, including the potential markets that each could serve.

d. Offer perspectives, based on other states' experience, on lessons learned from each option.

e. Provide legislative language and/or links for further information on each policy.

The goal is to provide state officials and the advocates who work with those officials a set of brief documents that offer concrete results from existing financing programs and concrete steps that can be taken to implement the best of these programs in different states.

Timing: This project will be complete approximately eight to 10 weeks from the time the project begins.

Provide education programs at the K-12 level that supply children with a grounding in energy efficiency and its relationship to climate-change mitigation.

- Develop a functional, standardized educational curriculum and fundraising program with K-12 students to promote and sell energy-efficient products. The program should utilize teaching staff to give in-school presentations to inspire a commitment to saving energy while arming students with the information they need to evaluate energy usage in their own homes. Students should be given materials to help promote energy efficiency, while teachers are provided with fun, educational lesson plans on energy and sustainability that are targeted to each classroom's grade level and subject matter.

Creation of incentives and removal of disincentives for consumers of specific types to improve energy efficiency.

- In the public sector — for example, in public schools — this may include allowing agencies to keep some of the proceeds from energy savings for use in other budget areas, while not reducing the amount of budget allocated to other areas.

Provide information to building professionals and consumers to increase the availability of and markets for energy-efficient buildings, appliances and equipment.

- **Educate developers, decision makers and other stakeholders (including architecture and engineering firms) on energy efficiency.**
    - Develop a professional marketing campaign. This could include development and distribution of a mandatory brochure provided to developers when they submit building plans for approval at the local government level. The brochure would include, for example, an illustration of the actual benefits, in terms of building effort required, energy and greenhouse-gas savings, and other potential environmental and monetary benefits — to the developer and the community — of energy-efficient building designs and practices. The brochure would provide a "trigger point" demonstrating why it is in the interest of developers and builders to implement energy-efficient building practices. The brochure could be supplemented by a Web site that has similar types of information, as well as external links allowing users to explore the issue in more detail — therefore acting as a clearinghouse of information

for builders and developers on energy-efficient building practices. Another supplement could be the development and implementation of an orientation program and/or an online learning tool to explain the importance of energy efficiency. The key to bringing energy-efficiency concerns to the attention of developers and builders is bringing those concerns to the attention of members of local planning commissions and similar authorities. If local planning authorities have information on the potential benefits of energy efficiency in buildings, it will spur a whole host of questions from the commissioners to developers, starting a process of energy-efficiency improvement that begins from education, not a mandate. Information could be comprehensive, including the building and the entire development (landscaping, pavement, etc.).

- **Provide regulatory incentives for construction of energy-efficient buildings.**
    - State and local authorities could provide regulatory incentives, including offering building developers whose buildings meet specified LEED or similar standards to receive priority in permitting, thus enhancing builder flexibility and reducing the time and cost required to go through the permitting process in exchange for upfront commitments to build a structure that meets efficiency standards.
- **Provide information to residential and commercial building occupants to help them assess the energy costs of a building**. Prepare a guide on how to evaluate the energy efficiency of the space that you want to lease and/or the building practices of your developer.
- **Outreach to tenants through chambers of commerce and state affiliates of the Federation of Business.**
- **Design-in smart metering-type technologies in new buildings that provide time-of-day or variable price information so as to provide immediate feedback on the cost (and environmental) implications of energy-use decisions**. (The current high costs of some types of smart meters may prove a considerable barrier, as utilities may be unwilling to shoulder the cost of such meters without incentives.)
- **Expand labeling to more types of appliances to reflect energy consumption so consumers can make more-informed choices.**
- **Address landlord/rental apartment issues to provide incentives to build or retrofit energy efficiency into apartments.**
    - Require landlords to provide energy cost information (in rental contract) to potential tenants at the commercial and residential levels.
    - Possibly apply rent control on buildings that don't meet energy-efficiency codes and standards — give landlords a period of time to bring building up to code, and then enforce rent control. Requirements such as these should be supported with loan programs and incentives (see above).

Identify near-term market-transformation opportunities (such as LED lighting) and adopt policies that accelerate market penetration of those technologies and practices.

- Establish rebate programs to provide incentives for purchase of energy-efficient products. Establishment of such programs would include determining the appropriate level of economic incentives and the appropriate model for application of the incentives, whether at the point of sale and/or as incentives to manufacturers or at the wholesale level.

- Given the long-term nature of climate-change mitigation goals, identifying and addressing mid- and long-term transformation opportunities is also important.

Expand the number and type of technologies for which utilities offer incentives.

- Allow utilities to do performance contracting and to collect customer payments for performance contracting through utility bill payments.

Related Policies/Programs in Place

- A program in Minnesota entitled "Schools for Energy Efficiency" (SEE) is run by an engineering firm and uses a curriculum working with students to identify savings opportunities within the schools themselves.

Type(s) of GHG Reductions

This option will lend support for GHG savings as noted under, for example, EE-2, EE-4 and EE-5.

Estimated GHG Reductions and Net Costs or Cost Savings

This option was not quantified. It supports EE-2, EE-4 and EE-5.

Key Uncertainties

None cited.

Additional Benefits and Costs

Feasibility Issues

None cited.

Status of Group Approval

Consensus reached at EEAG meeting on January 14 and 15.

Level of Group Support

Full consensus.

Barriers to Consensus

None

EE-7. Combined Heat and Power

Policy Description

Combined Heat and Power (CHP) is a form of distributed generation, an integrated system that is located at or near the point of use, generates at least a portion of the electricity required at the site and utilizes the heat from the prime mover that would otherwise be lost to the atmosphere, for heating, cooling, and/or dehumidification. District Energy Systems and Waste Heat Recovery Systems that produce both electricity and useful heat are included under the definition of CHP.

When properly applied and operated, these systems can reach fuel use efficiencies in excess of 80%. Today, in the 12 state Midwest Region, there exists approximately 10.6 GW of CHP operated from a wide variety of fuels that removes approximately 31 MMT of CO_2 from the atmosphere annually. The broad implementation of CHP in the Midwest (and nationally) is hindered by regulated electric fees and tariffs, costly grid interconnect requirements, lack of inclusion in state energy efficiency resource and renewable portfolio standards, lack of output based emission standards, less favorable tax treatment, high first costs, and lack of education of the benefits of CHP (regulators, legislators, and end users).

Electric utilities play a pivotal role in the accelerated adoption of CHP and the Green House Gas (GHG) reductions it can provide. The true efficiency gains of CHP are on a system-wide basis and necessarily include avoiding or decreasing more GHG-intensive utility operation. Revisions in regulatory policies and procedures, together with recognition of the energy efficiency benefits of CHP, should assist in encouraging utilities to recognize and expand the utilization of CHP.

Supportive policies at the federal and state levels would greatly benefit the implementation rate for CHP technologies. A recent (December 2008) study by the U.S. Department of Energy Oak Ridge National Laboratory outlines the potential benefits associated with CHP achieving 20% of the total U.S. electric generating capacity by the year 2030. This would result in 240 GW of CHP power installed, 5.3 Quads of energy saved per year, and an annual reduction of 848 MMT of CO_2 (equivalent of planting 191 million acres of forest or removing 153 million cars from the road).

The University of Illinois at Chicago Energy Resources Center (UIC/ERC), at the request of the EEAG, adapted the approach utilized in the national study to estimate the benefits of an aggressive but realistic program to promote CHP in the Midwest. The UIC/ERC also assisted the EEAG to define policy options that would assist in realizing the benefits.

Policy Design

Combined Heat and Power (CHP) is an important strategy in the toolbox of global warming solutions. **The goal of the MGA is to double the installed CHP capacity in the Midwest from 10.6 MW (2008) to 21.2 MW in 2030. This would represent approximately 7.5% of the total electric generating capacity in the Midwest in 2030.**

- An estimate of the total electric generating capacity in the Midwest in 2030 was obtained from DOE EIA data: 282,110 MW
- The total technical potential for CHP in the Midwest in 2030 was estimated to be 42,000MW. This was derived from several studies.
- The current CHP installed capacity (2008) in the Midwest is 10,580 MW, which represents 12.5% of the total CHP capacity installed nationally, and 4.3% of total electric generating capacity in the Midwest
- Adapting the spread sheet analysis utilized on the national study, the UIC generated four possible scenarios:
  - Scenario #1 (Baseline): Extending the trend line of CHP installations over the past 25 to 30 years, the business as usual case estimated a total of 16,700 MW of CHP installed in the Midwest by 2030. This would represent approximately 5.9% of the total electric generating capacity in the Midwest in 2030.

  - **Scenario #2: Under this scenario, a total of 21,200 MW of CHP would be installed in the Midwest by 2030. This would represent a doubling of the CHP installed capacity over the presently (2008) installed capacity of 10,800 MW. This level of installed capacity would represent approximately 7.5% of the total electric generating capacity in the Midwest in 2030.**

  - Scenario #3: Under this scenario, a total of 25,200 MW of CHP would be installed in the Midwest by 2030. This would represent approximately 8.9% of the total electric generating capacity in the Midwest in 2030.

  - Scenario #4: Under this scenario, a total of 30,113 MW of CHP would be installed in the Midwest by 2030. This would represent approximately 10.7% of the total electric generating capacity in the Midwest in 2030.
- To check the reasonableness of achieving the estimated installed CHP capacity, it was determined that the aggressive scenario would require that 72% of the technical potential for CHP in the Midwest be realized. It was felt that this was doable with adequate policy incentives.

While the approach and calculations were done in a different manner than the CCS quantification, the approach, assumptions, and calculation methods utilized in the Midwest CHP study were discussed with David Von Hippel of Center for Climate Strategies (consultant to the EEAG who conducted the analyses of the other EEAG recommended efficiency recommendations). It was determined that the approach and results are reasonable and roughly comparable to the CCS quantification of the other EE policy options.

The following chart provides the estimated benefits of the four scenarios studied in the Midwest along with the goal established by the MGA.

Emissions Reduction with CHP

	2008		2030			
	Capacity (MW)	Total CO_2 Reduction		Capacity (MW)	Total CO_2 Reduction	Incremental CO_2 Reduction (Difference from Baseline)
National CHP	85,000	245 MMT		240,900	848 MMT	-----
Midwest CHP	10,600	31 MMT	**Scenario #1 (Baseline)**	16,700	51 MMT	-----
			Scenario #2	21,200	64 MMT	13 MMT
			Scenario #3	25,200	77 MMT	26 MMT
			Scenario #4	30,113	92 MMT	41 MMT

Implementation Mechanisms

State Energy Efficiency Resource and Renewable Portfolio Standards:
More states are adopting energy efficiency resource standards (EERS) and/or renewable portfolio standards (RPS) to ensure that cost effective energy efficiency measures and renewable energy sources help offset growing electricity demand. As of May, 2009 fourteen states have portfolio standards that include CHP and two states have pending standards that may allow CHP to count in their programs.[11]

States should include consideration of CHP as an eligible resource when developing energy efficiency standards. However, CHP is qualitatively different than other efficiency measures usually included in an efficiency resource standard. Because of this, some additional policy issues need to be identified and addressed by states to ensure the energy efficiency and emission reduction impacts are realized. These may include:

- Consideration of the fuel used in CHP systems and what fuels would be granted credit for an energy efficiency resource standard.
- Consideration of qualifying efficiency levels and the resulting impact on greenhouse gas emissions
- Consideration of measurement and verification techniques of CHP system efficiencies

[11] Renewable Portfolio Standards, An Effective Policy to Support Clean Energy Supply, an EPA Fact Sheet www.epa.gov/chp/documents/rps_fs.pdf

- Consideration of overall greenhouse gas impact when utilizing a renewable fuel in conjunction with both a renewable portfolio and energy efficiency resource standard.

CHP when fueled by renewable sources should be specifically recognized in renewable portfolio standards, again with standard agreed upon methods to compute the energy efficiency contributions.

Carbon Emission Cap and Trade Design:
Combined heat and power should be recognized as a valuable GHG reduction option in any GHG trading system established in the Midwest, and care should be taken to ensure that a Midwest or Federal cap and trade system does not discriminated against CHP or other similar technologies.

Likewise, any alternative carbon tax system established in the Midwest needs to acknowledge the benefits of CHP in reducing overall GHG emissions even though on-site emission may increase.

Output Based Emission Standards:
Output-based regulations relate air emissions to the productive output of a process and encourage use of fuel conversion efficiency as an air pollution control or prevention measure. Output–based regulations that include both the thermal and electric output of a CHP process can recognize the higher efficiency and environmental benefits of CHP. All Midwest states should work toward adopting output based emission standards that recognize the benefits of CHP and like technologies.

Grid Interconnection Standards:
Regulatory agencies should establish standardized grid interconnection procedures. These interconnect standards tend to address two separate issues:

- Technical Issues
- Procedural Issues

On the technical issue side, the electric utilities and State Commissions often suggest using IEEE 1547 as the technical standard. Unfortunately, the interpretation of IEEE 1547 by individual electric utilities can result in a favorable or unfavorable grid interconnect standard. Therefore, the technical side of developing a grid interconnect standard is crucial to the success of CHP.

Most interconnect standard development issues tend to revolve around procedural issues (how much to charge for studies, how long to process applications, what type of recourse does the applicant have if not satisfied with the handling of the application etc). Once again, these are issues that can either be favorable or unfavorable for CHP and must be adequately addressed.

1) States that have developed standard interconnection procedures are unlikely to want to reopen this issue. It is imperative that Midwest state Utility and/or Commerce Commissions implement the interconnection process of CHP (and other distributed generation technologies like wind and solar photovoltaic) in a fair and equitable manner.

2) Those states that do not yet have grid interconnect standards or are in the process of developing them should seek assistance in the process from the Environmental Law and Policy Center, the ACEEE, the USCHPA, the Midwest CHP Application Center and other organizations that can present the case for favorable interconnection standards.

It is also recommended that independent system operators such as MISO develop policies and procedures that encourage the utilization of CHP and recognize the GHG reduction benefits to be gained from the increased use of CHP.

Regulated Fees and Tariffs:
Electric rate structures can have significant impact on CHP economics. Many current rate structures that link utility revenues and returns to the number of kilowatt-hours sold are a disincentive for utilities to encourage customer-owned CHP and other forms of distributed generation. Furthermore, many of the system and societal benefits that CHP provides are not accounted for under current ratemaking processes. Rate structures that recover the majority of the cost of service in non-bypassable fixed charges and/or ratcheted demand charges reduce the money saving potential of CHP.

It is recommended that alternative regulatory business models for electric utilities be explored in the Midwest that would remove these disincentives for their acceptance of CHP, and encourage utilities to evaluate programs that recognize the value of CHP to both the utility and ratepayer regarding avoided costs associated with building new capacity, new transmission and distribution lines, and maintenance of old congested lines.

Smart Grid Regulations:
As the concepts of a more intelligent grid are further discussed in regulatory environments, it is essential that these discussions include the role of distributed generation (including CHP).

Related Policies/Programs in Place

Type(s) of GHG Reductions

Estimated GHG Reductions and Net Costs or Cost Savings

An aggressive program that implements the policy issue recommendations outlined above can result in significant GHG reductions and energy/cost savings for the consumer. The potential GHG reductions associated with the recommended CHP installed capacity goal for 2030 are outlined in the Quantification Approach and Results section. Unfortunately, the brief study conducted by the UIC/ERC at the request of the EEAG, was not able to take into account the costs of implementing such a program nor the cost savings resulting from such a program. Were time and funds available, such an effort should be undertaken?

Key Uncertainties

None Cited

Additional Benefits and Costs

None Cited

Feasibility Issues

None Cited

Status of Group Approval

Consensus on the concepts in this document was reached by the full EEAG at their May 11/12, 2009 meeting.

Level of Group Support

Full consensus.

Barriers to Consensus

None cited.

ANNEX: Additional Details of Analyses

Estimate of Mitigation Option Costs and Benefits for Midwestern Governors' Association Energy Efficiency Advisory Group GHG Analysis

Common Assumptions for EEAG GHG Analysis

Date Last Modified: *12/8/2008* *D. Von Hippel/M.Brown*

Common Assumptions

Real Discount Rate		**5%**	
Levelized, Avoided Costs (2009-2025, 2006$)			
Electricity - Sales-Weighted Average	Illinois	**$60.0**	$/MWh
	Indiana	**$60.0**	$/MWh
	Iowa	**$60.0**	$/MWh
	Kansas	**$60.0**	$/MWh
	Manitoba	**$60.0**	$/MWh
	Michigan	**$60.0**	$/MWh
	Minnesota	**$60.0**	$/MWh
	Missouri	**$60.0**	$/MWh
	Nebraska	**$60.0**	$/MWh
	North Dakota	**$60.0**	$/MWh
	Ohio	**$60.0**	$/MWh
	South Dakota	**$60.0**	$/MWh
	Wisconsin	**$60.0**	$/MWh
Placeholder values only at present.			

Natural Gas - City-Gate Price	Illinois	**$6.31**	$/MMBtu	
(Based on USDOE Annual Energy	Indiana	**$6.27**	$/MMBtu	
Outlook Growth Rates except as	Iowa	**$7.17**	$/MMBtu	
noted, with historical prices	Kansas	**$6.85**	$/MMBtu	
from US DOE EIA statistics)	Manitoba	**$6.50**	$/MMBtu	Assumption
	Michigan	**$6.45**	$/MMBtu	
	Minnesota	**$6.52**	$/MMBtu	
	Missouri	**$6.24**	$/MMBtu	
	Nebraska	**$6.36**	$/MMBtu	
	North Dakota	**$5.81**	$/MMBtu	
	Ohio	**$7.72**	$/MMBtu	
	South Dakota	**$7.12**	$/MMBtu	
	Wisconsin	**$6.45**	$/MMBtu	

City-Gate prices used until other estimates are available.

Levelized Retail Prices (2009-2025, 2006$)

Electricity - Illinois - Residential Prices	$93.66	$/MWh	
Electricity - Illinois - Commercial Prices	$80.55	$/MWh	
Electricity - Illinois - Industrial Prices	$54.73	$/MWh	
Electricity - Indiana - Residential Prices	$74.39	$/MWh	
Electricity - Indiana - Commercial Prices	$64.19	$/MWh	
Electricity - Indiana - Industrial Prices	$43.80	$/MWh	
Electricity - Iowa - Residential Prices	$83.05	$/MWh	
Electricity - Iowa - Commercial Prices	$61.10	$/MWh	
Electricity - Iowa - Industrial Prices	$40.20	$/MWh	
Electricity - Kansas - Residential Prices	$78.05	$/MWh	
Electricity - Kansas - Commercial Prices	$64.97	$/MWh	
Electricity - Kansas - Industrial Prices	$48.44	$/MWh	
Electricity - Manitoba - Residential Prices	$65.70	$/MWh	Assumed similar to ND
Electricity - Manitoba - Commercial Prices	$60.75	$/MWh	Assumed similar to ND
Electricity - Manitoba - Industrial Prices	$49.40	$/MWh	Assumed similar to ND
Electricity - Michigan - Residential Prices	$95.05	$/MWh	
Electricity - Michigan - Commercial Prices	$79.84	$/MWh	
Electricity - Michigan - Industrial Prices	$55.95	$/MWh	
Electricity - Minnesota - Residential Prices	$85.68	$/MWh	
Electricity - Minnesota - Commercial Prices	$67.17	$/MWh	
Electricity - Minnesota - Industrial Prices	$51.73	$/MWh	
Electricity - Missouri - Residential Prices	$64.91	$/MWh	
Electricity - Missouri - Commercial Prices	$52.89	$/MWh	
Electricity - Missouri - Industrial Prices	$39.62	$/MWh	
Electricity - Nebraska - Residential Prices	$64.68	$/MWh	
Electricity - Nebraska - Commercial Prices	$56.31	$/MWh	
Electricity - Nebraska - Industrial Prices	$44.12	$/MWh	
Electricity - North Dakota - Residential Prices	$65.70	$/MWh	
Electricity - North Dakota - Commercial Prices	$60.75	$/MWh	
Electricity - North Dakota - Industrial Prices	$49.40	$/MWh	
Electricity - Ohio - Residential Prices	$85.30	$/MWh	
Electricity - Ohio - Commercial Prices	$78.90	$/MWh	
Electricity - Ohio - Industrial Prices	$50.65	$/MWh	
Electricity - South Dakota - Residential Prices	$72.37	$/MWh	
Electricity - South Dakota - Commercial Prices	$60.29	$/MWh	
Electricity - South Dakota - Industrial Prices	$46.97	$/MWh	
Electricity - Wisconsin - Residential Prices	$100.89	$/MWh	
Electricity - Wisconsin - Commercial Prices	$77.61	$/MWh	
Electricity - Wisconsin - Industrial Prices	$52.24	$/MWh	

Natural Gas - Illinois - Residential Prices	**$9.28**	$/MMBtu	
Natural Gas - Illinois - Commercial Prices	**$9.03**	$/MMBtu	
Natural Gas - Illinois - Industrial Prices	**$7.78**	$/MMBtu	
Natural Gas - Indiana - Residential Prices	**$9.65**	$/MMBtu	
Natural Gas - Indiana - Commercial Prices	**$8.76**	$/MMBtu	
Natural Gas - Indiana - Industrial Prices	**$7.33**	$/MMBtu	
Natural Gas - Iowa - Residential Prices	**$10.14**	$/MMBtu	
Natural Gas - Iowa - Commercial Prices	**$8.61**	$/MMBtu	
Natural Gas - Iowa - Industrial Prices	**$7.53**	$/MMBtu	
Natural Gas - Kansas - Residential Prices	**$11.21**	$/MMBtu	
Natural Gas - Kansas - Commercial Prices	**$10.52**	$/MMBtu	
Natural Gas - Kansas - Industrial Prices	**$6.34**	$/MMBtu	
Natural Gas - Manitoba - Residential Prices	**$7.88**	$/MMBtu	Assumed similar to ND
Natural Gas - Manitoba - Commercial Prices	**$7.23**	$/MMBtu	Assumed similar to ND
Natural Gas - Manitoba - Industrial Prices	**$6.02**	$/MMBtu	Assumed similar to ND
Natural Gas - Michigan - Residential Prices	**$9.47**	$/MMBtu	
Natural Gas - Michigan - Commercial Prices	**$9.17**	$/MMBtu	
Natural Gas - Michigan - Industrial Prices	**$8.38**	$/MMBtu	
Natural Gas - Minnesota - Residential Prices	**$9.59**	$/MMBtu	
Natural Gas - Minnesota - Commercial Prices	**$8.75**	$/MMBtu	
Natural Gas - Minnesota - Industrial Prices	**$6.99**	$/MMBtu	
Natural Gas - Missouri - Residential Prices	**$11.59**	$/MMBtu	
Natural Gas - Missouri - Commercial Prices	**$10.32**	$/MMBtu	
Natural Gas - Missouri - Industrial Prices	**$9.91**	$/MMBtu	
Natural Gas - Nebraska - Residential Prices	**$9.63**	$/MMBtu	
Natural Gas - Nebraska - Commercial Prices	**$7.99**	$/MMBtu	
Natural Gas - Nebraska - Industrial Prices	**$7.23**	$/MMBtu	
Natural Gas - North Dakota - Residential Prices	**$7.88**	$/MMBtu	
Natural Gas - North Dakota - Commercial Prices	**$7.23**	$/MMBtu	
Natural Gas - North Dakota - Industrial Prices	**$6.02**	$/MMBtu	
Natural Gas - Ohio - Residential Prices	**$11.58**	$/MMBtu	
Natural Gas - Ohio - Commercial Prices	**$10.22**	$/MMBtu	
Natural Gas - Ohio - Industrial Prices	**$9.67**	$/MMBtu	
Natural Gas - South Dakota - Residential Prices	**$9.47**	$/MMBtu	
Natural Gas - South Dakota - Commercial Prices	**$7.59**	$/MMBtu	
Natural Gas - South Dakota - Industrial Prices	**$0.00**	$/MMBtu	
Natural Gas - Wisconsin - Residential Prices	**$10.39**	$/MMBtu	
Natural Gas - Wisconsin - Commercial Prices	**$9.09**	$/MMBtu	
Natural Gas - Wisconsin - Industrial Prices	**$8.29**	$/MMBtu	

Biomass - All Users	Illinois	**$2.5**	$/MMBtu	NC Value as Placeholder
	Indiana	**$2.5**	$/MMBtu	NC Value as Placeholder
	Iowa	**$2.5**	$/MMBtu	NC Value as Placeholder
	Kansas	**$2.5**	$/MMBtu	NC Value as Placeholder
	Manitoba	**$2.5**	$/MMBtu	NC Value as Placeholder
	Michigan	**$2.5**	$/MMBtu	NC Value as Placeholder
	Minnesota	**$2.5**	$/MMBtu	NC Value as Placeholder
	Missouri	**$2.5**	$/MMBtu	NC Value as Placeholder
	Nebraska	**$2.5**	$/MMBtu	NC Value as Placeholder
	North Dakota	**$2.5**	$/MMBtu	NC Value as Placeholder
	Ohio	**$2.5**	$/MMBtu	NC Value as Placeholder
	South Dakota	**$2.5**	$/MMBtu	NC Value as Placeholder
	Wisconsin	**$2.5**	$/MMBtu	NC Value as Placeholder

NC Estimate based on national study of state-by-state biomass resource resource assessments--see worksheet "Biomass_Data" in this workbook. Price equivalent of $38/dry ton at 16 MMBtu/dry ton. Replace with more NC-specific estimates (for example, from AF group when available).

Coal - Industrial Users	Illinois	**$2.4**	$/MMBtu	NC Value as Placeholder
	Indiana	**$2.4**		NC Value as Placeholder
	Iowa	**$2.4**		NC Value as Placeholder
	Kansas	**$2.4**		NC Value as Placeholder
	Manitoba	**$2.4**		NC Value as Placeholder
	Michigan	**$2.4**		NC Value as Placeholder
	Minnesota	**$2.4**		NC Value as Placeholder
	Missouri	**$2.4**		NC Value as Placeholder
	Nebraska	**$2.4**		NC Value as Placeholder
	North Dakota	**$2.4**		NC Value as Placeholder
	Ohio	**$2.4**		NC Value as Placeholder
	South Dakota	**$2.4**		NC Value as Placeholder
	Wisconsin	**$2.4**		NC Value as Placeholder

average coal heat content of 26.75 MMBTU/ton, based on 2001 USDOE/EIA data. USDOE/EIA figures for 2005 from suggest NC average coal price of $65.25 per ton for coal for "Other Industrial Users". www.eia.doe.gov/cneaf/coal/page/acr/table34.html

Oil - Distillate/Diesel	Illinois	**$15.05**	$/MMBtu	
(Based on USDOE Annual Energy	Indiana	**$15.01**	$/MMBtu	
Outlook Growth Rates except as	Iowa	**$15.09**	$/MMBtu	
noted, with historical prices	Kansas	**$14.97**	$/MMBtu	
from US DOE EIA statistics)	Manitoba	**$15.0**	$/MMBtu	KS Value as Placeholder
	Michigan	**$14.45**	$/MMBtu	
	Minnesota	**$15.12**	$/MMBtu	
	Missouri	**$14.66**	$/MMBtu	
	Nebraska	**$15.03**	$/MMBtu	
	North Dakota	**$15.10**	$/MMBtu	
	Ohio	**$14.68**	$/MMBtu	
	South Dakota	**$15.03**	$/MMBtu	
	Wisconsin	**$14.97**	$/MMBtu	

For 2000-2007, uses USDOE/EIA histoical data, by state, for the wholesale price of #2 distillate oil, from web pages such as http://tonto.eia.doe.gov/dnav/pet/pet_pri_refoth_dcu_SIL_a.htm (for IL; see, for example "IL_EIA_data" worksheet in this workbook). For 2008-on, growth in prices estimated based on cost increases in residential and commercial petroleum costs from USDOE EIA Annual Energy Outlook, 2008 (see "aeo2008" worksheet in this workbook), weighted by relative residential and commercial oil consumption in each state (from "Fuel_Forecast_1" worksheet in this workbook). These cost does not include fuel taxes. Costs per gallon converted to cost per MMBtu using conversion factor below (0.139 MMBtu/gallon).

LPG

Illinois	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Indiana	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Iowa	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Kansas	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Manitoba	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Michigan	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Minnesota	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Missouri	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Nebraska	**$12.6**	$/MMBtu	Midwest Value as Placeholder
North Dakota	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Ohio	**$12.6**	$/MMBtu	Midwest Value as Placeholder
South Dakota	**$12.6**	$/MMBtu	Midwest Value as Placeholder
Wisconsin	**$12.6**	$/MMBtu	Midwest Value as Placeholder

USDOE/EIA data (http://tonto.eia.doe.gov/dnav/pet/pet_pri_prop_dcu_r20_a.htm) gives Midwest average wholesale prices for propane of $1.19 per gallon in 2007. This cost does not include fuel taxes. Prices expressed on $/MMBtu basis a conversion factor of 0.09133 MMBtu/gallon (see "Fuel Data" woksheet)

Landfill Gas - All Users **$5.0** $/MMBtu **not changed**

Placeholder Estimate

Biogas Gas - All Users **$5.0** $/MMBtu **not changed**

Placeholder Estimate

Emission Rates, etc.

Electricity T&D losses (fraction of total generation)

	2012	2025/all	Units
Illinois	**6.1%**	**5.6%**	
Indiana	**6.2%**	**5.7%**	
Iowa	**5.2%**	**4.8%**	
Kansas	**8.0%**	**7.4%**	
Manitoba	**11.8%**	**11.1%**	
Michigan	**5.9%**	**5.4%**	
Minnesota	**6.1%**	**5.7%**	
Missouri	**6.9%**	**6.3%**	
Nebraska	**7.1%**	**6.6%**	
North Dakota	**11.5%**	**10.6%**	
Ohio	**6.1%**	**5.7%**	
South Dakota	**8.2%**	**7.5%**	
Wisconsin	**4.8%**	**4.4%**	

For US States, T&D losses for 2000-2006 derived from USDOE EIA data (see, for example, worksheet "IL_EIA_data" in this workbook). Value for 2007 is the average of 2004-2006 losses for the jurisdiction, and values for 2008-on are estimated based on trends in estimated losses in the reliability region (power pool region) in which the state is located as included in the USDOE EIA Annual Energy Outlook 2008 "Reference" case, as estimated in the "aeo2008_data" worksheet in this workbook. For Manitoba, estimates for 2000-2008 are derived from Manitoba Hydro data (See "Manitoba_data" worksheet in this workbook). A reduction in losses of 0.5% per year from 2008-on is assumed for Manitoba, pending receipt of additional data.

Avoided electricity emissions rate ***See Note 2***

Assumed fraction of marginal generation from new combined cycle plants in 2030		2012	2025/all	Units	
20%	Illinois	**0.987**	**0.909**	tCO_2/MWh	
20%	Indiana	**0.912**	**0.843**	tCO_2/MWh	
20%	Iowa	**0.979**	**0.902**	tCO_2/MWh	
20%	Kansas	**0.995**	**0.916**	tCO_2/MWh	
	Manitoba	**0.021**	**0.021**	tCO_2/MWh	*Mostly hydro. Assumes average of 2000-2005 continues*
20%	Michigan	**0.802**	**0.746**	tCO_2/MWh	
20%	Minnesota	**1.037**	**0.953**	tCO_2/MWh	
20%	Missouri	**0.948**	**0.875**	tCO_2/MWh	
20%	Nebraska	**0.991**	**0.913**	tCO_2/MWh	
20%	North Dakota	**1.045**	**0.960**	tCO_2/MWh	
20%	Ohio	**0.909**	**0.840**	tCO_2/MWh	
20%	South Dakota	**0.976**	**0.899**	tCO_2/MWh	
20%	Wisconsin	**1.046**	**0.962**	tCO_2/MWh	

Where estimates are not available from jurisdictions, default estimates will start with existing average emissions rate of existing fossil-fueled sources, and apply regional trends from USDOE EIA Annual Energy Outlook results, adjusting estimate of marginal emissions; by 2025 the predominant effect is assumed to be a reduction in reference case new coal and gas builds during the 2015-2025 period.

Multi-Gas Emission Factors

Except as noted, the following emission factors are calculated from values in the North Carolina Inventory and Forecast prepared for the CAPAG, and reflect the average emissions in 2000 per BTU and physical amount of fuel. They include combustion CH4 and N20 as well as CO2 emissions for consistency with the inventory. These values would be expected to be nearly the same in the MGA states, but will be derived on a regional basis from USDOE EIA Annual Energy Outlook or similar data as these estimates are refined.

	tCO_2e/billion BTU		
LPG - RCI	**63.425**	assumed equal to CO_2 factor for propane	
Coal - RCI	**92.961**		Placeholder from N
Natural Gas - RCI	**52.071**		Placeholder from N
Biomass - RCI	**2.793**		Placeholder from N
Oil - RCI	**74.342**	assumed equal to CO_2 factor for misc pet prods	Placeholder from N
Landfill Gas - RCI	**0.260**		Placeholder from N

As suggested by North Carolina CAPAG Agriculture, Forestry and Waste TWG. This value excludes benefits from capture and use of methane that would have escaped from landfills, as those benefits are captured in the AFW TWG analysis.

Biogas - RCI	**0.260**	*Placeholder Value-- assumed same as landfill gas for now-- May in fact be negative*

Inflation index (to 2006$)

Calculated using http://data.bls.gov/cgi-bin/cpicalc.pl

	Cost Year	Index
	1997	1.26
	1998	1.24
	1999	1.21
	2000	1.17
	2001	1.14
	2002	1.12
	2003	1.10
	2004	1.07
	2005	1.03
	2006	1.00
	2007	0.97
As of 9/08	2008	0.92

Conversion Factors (*see Note 1*)

Natural Gas Conversion	1.03	million Btu/ thousand cf
Electricity Conversion	3413	MMBTU/GWh
Distillate Fuel Oil	5.825	MMBTU/bbl
Distillate Fuel Oil	0.1387	MMBTU/gal
Kerosene	5.670	MMBTU/bbl
Kerosene	0.1350	MMBTU/gal
Residual Fuel Oil	6.287	MMBTU/bbl
Residual Fuel Oil	0.1497	MMBTU/gal
Propane	3.836	MMBTU/bbl
Propane	0.0913	MMBTU/gal
LPG	4.130	MMBTU/bbl
LPG	0.0983	MMBTU/gal

Energy Units Conversion	1055	J/Btu
	947.87	GBtu/PJ
	277.78	GWh/PJ

NOTES AND DATA FROM SOURCES

Note 1

Fuel heat contents from 2007 USDOE EIA Annual Energy Outlook Publication "Appendix A, Thermal Conversion Factors" available as http://www.eia.doe.gov/emeu/aer/pdf/pages/sec13_1.pdf. See table below.

Table A1. Approximate Heat Content of Petroleum Products
(Million Btu per Barrel)

Asphalt	6.636
Aviation Gasoline	5.048
Butane	4.326
Butane-Propane Mixture (60 percent-40 percent)	4.130
Distillate Fuel Oil	5.825
Ethane	3.082
Ethane-Propane Mixture (70 percent-30 percent)	3.308
Isobutane	3.974
Jet Fuel, Kerosene-Type	5.670
Jet Fuel, Naphtha-Type	5.355
Kerosene	5.670
Lubricants	6.065
Motor Gasoline	
Conventional[1]	5.253
Oxygenated[1]	5.150
Reformulated[1]	5.150
Fuel Ethanol[2]	3.539
Natural Gasoline	4.620
Pentanes Plus	4.620
Petrochemical Feedstocks	
Naphtha less than 401° F	5.248
Other Oils equal to or greater than 401° F	5.825
Still Gas	6.000
Petroleum Coke	6.024
Plant Condensate	5.418
Propane	3.836
Residual Fuel Oil	6.287
Road Oil	6.636
Special Naphthas	5.248
Still Gas	6.000
Unfinished Oils	5.825
Unfractionated Stream	5.418
Waxes	5.537
Miscellaneous	5.796

[1]See Table A3 for motor gasoline annual weighted averages beginning in 1994.
[2]Fuel ethanol, which is derived from agricultural feedstocks (primarily corn), is not a petroleum product but is blended into motor gasoline.
Web Page: For related information, see http://www.eia.doe.gov/emeu/aer/append_a.html.
Sources: See "Thermal Conversion Factor Source Documentation," which follows Table A6.

Note 2

For the electricity market regions in the USDOE EIA Annual Energy Outlook 2008 electricity generation model that pertain to the MGA states, coal-fired generation continues to be the dominant source of both existing and marginal generation, with only modest decreases in carbon emission factors forecast through 2030 (see row 660 and below in "aeo_2008_data" worksheet in this workbook).
It seems more likely that cost trends and the need to comply with environmental policies will induce at least some new and replacement power production to be combined-cycle natural gas units. Based on the assumption that the efficiency of such plants wiil be 6,333 Btu/kWh in about 2025 (as assumed in the Annual Energy Outlook 2008 modeling, see http://www.eia.doe.gov/oiaf/aeo/electricity.html) the implied emissions per kWh of generation by this technology would be 0.330 metric tons CO_2/MWh.

Estimate of Mitigation Option Costs and Benefits for Midwestern Governors' Association Energy Efficiency Advisory Group GHG Analysis

GHG Emissions Totals for MGA EEAG GHG Analysis

Date Last Modified:	4/16/2009	D. Von Hippel/M. Brown

Summary Results and Totals for EEAG Mitigation Options (Includes updated natural gas goal for EE-3)

	Option Name	GHG Reductions ($MMtCO_2e$) 2012	GHG Reductions ($MMtCO_2e$) 2025	Cost-Eff ($/$tCO_2e$)	NPV 2009-2025 ($million)	Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)
EE-1	Establish Quantifiable Goals for Energy Efficiency	Not Quantified				
EE-2	Undertake State Assessments that Quantify the Amount of Energy Efficiency that Would Cost Less on a Unit Cost Basis than New Generation	Not Quantified				
EE-3	Require Retail Energy Providers to Make Energy Efficiency a Priority	9.6	157.9	-$28	-$33,096	1200.7
	Illinois	1.7	32.6	-$25	-$6,139	242.7
	Indiana	2.4	27.7	-$24	-$5,275	215.8
	Iowa	0.2	7.7	-$29	-$1,586	55.5
	Kansas	1.0	11.4	-$25	-$2,193	88.4
	Manitoba	0.0	0.6	-$150	-$659	4.4
	Michigan	0.1	12.9	-$32	-$2,843	89.0
	Minnesota	0.2	9.9	-$28	-$1,947	69.6
	Missouri	1.8	21.0	-$23	-$3,750	163.3
	Nebraska	0.6	7.4	-$23	-$1,340	57.1
	North Dakota	0.3	3.2	-$24	-$580	24.6
	Ohio	1.2	12.8	-$41	-$4,717	116.0
	South Dakota	0.2	2.8	-$26	-$547	21.4
	Wisconsin	0.1	7.8	-$29	-$1,521	53.0
EE-4	Remove Utility Financial Disincentives and Enable Investment Recovery for Energy Efficiency Program Costs	Not Quantified				
EE-5	Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement	6.2	97.8	-$19	-$13,291	683.5
	Illinois	1.2	19.1	-$17	-$2,279	133.6
	Indiana	0.6	9.5	-$20	-$1,316	66.1
	Iowa	0.3	4.0	-$21	-$578	27.6
	Kansas	0.3	4.0	-$17	-$483	27.9
	Manitoba	0.0	0.3	-$146	-$265	1.8
	Michigan	0.8	12.8	-$22	-$1,946	89.7
	Minnesota	0.6	9.4	-$18	-$1,209	65.5
	Missouri	0.5	9.2	-$19	-$1,188	63.3
	Nebraska	0.2	2.7	-$20	-$375	18.9
	North Dakota	0.1	1.2	-$19	-$160	8.3
	Ohio	1.0	15.7	-$20	-$2,229	110.4
	South Dakota	0.1	1.2	-$22	-$178	8.1
	Wisconsin	0.6	8.8	-$17	-$1,085	62.3
EE-6	Have the Public Sector Lead by Example	8.0	29.5	-$6	-$1,897	291.9
	Illinois	1.8	6.5	-$4	-$263	64.7
	Indiana	0.8	2.9	-$9	-$255	28.7
	Iowa	0.2	0.9	-$10	-$87	8.7
	Kansas	0.3	1.0	-$6	-$65	10.4
	Manitoba	0.0	0.1	-$70	-$45	0.6
	Michigan	1.2	4.4	-$6	-$259	43.3
	Minnesota	0.5	1.7	-$7	-$126	17.3
	Missouri	0.6	2.1	-$9	-$187	20.4
	Nebraska	0.2	0.7	-$10	-$67	6.7
	North Dakota	0.1	0.3	-$10	-$31	3.2
	Ohio	1.5	5.5	-$7	-$356	54.5
	South Dakota	0.1	0.3	-$10	-$30	2.9
	Wisconsin	0.8	3.1	-$4	-$126	30.3
EE-7	Accelerate Adoption of Energy Efficiency Technologies and Best Practices by Residential, Commercial, and Industrial Customers	Not Quantified				
	Total Gross Savings from EE-3, EE-5, EE-6	23.8	285.1	-$22	-$48,285	2,176.1

Adjustment for Estimated Overlap Between EEAG Options							
Overlap between EEAG Options							
EE-5, Overlap with EE-3		0.9	51.3	-$11	-$3,245	301.6	***See Note 1***
	Illinois	0.2	10.1	-$8	-$471	59.5	
	Indiana	0.1	5.0	-$12	-$358	29.2	
	Iowa	0.0	2.0	-$13	-$152	11.7	
	Kansas	0.0	2.1	-$10	-$117	11.9	
	Manitoba	0.0	0.2	-$72	-$66	0.9	
	Michigan	0.1	6.7	-$11	-$425	39.5	
	Minnesota	0.1	4.8	-$11	-$316	28.1	
	Missouri	0.1	5.1	-$12	-$363	29.9	
	Nebraska	0.0	1.4	-$13	-$106	8.1	
	North Dakota	0.0	0.6	-$13	-$48	3.6	
	Ohio	0.2	8.3	-$11	-$535	49.0	
	South Dakota	0.0	0.6	-$15	-$48	3.3	
	Wisconsin	0.1	4.5	-$9	-$239	26.9	
EE-6, Overlap with EE-3		6.5	24.1	-$7	-$1,607	238.5	***See Note 2***
	Illinois	1.4	5.3	-$4	-$226	52.9	
	Indiana	0.6	2.4	-$9	-$213	23.4	
	Iowa	0.2	0.7	-$10	-$74	7.1	
	Kansas	0.2	0.8	-$6	-$53	8.4	
	Manitoba	0.0	0.1	-$65	-$37	0.6	
	Michigan	1.0	3.6	-$6	-$225	35.6	
	Minnesota	0.4	1.4	-$8	-$107	14.2	
	Missouri	0.5	1.7	-$9	-$151	16.6	
	Nebraska	0.2	0.6	-$10	-$56	5.5	
	North Dakota	0.1	0.3	-$10	-$26	2.6	
	Ohio	1.2	4.5	-$7	-$304	44.4	
	South Dakota	0.1	0.2	-$11	-$26	2.4	
	Wisconsin	0.7	2.5	-$4	-$110	24.8	
Total Estimated Overlap Among EEAG Policies		7.48	75.42	-$9	-$4,852	540.08	
Total Savings Net of Overlaps for EEAG Policies		16.4	209.7	-$27	-$43,433	1636.0	

Additional Emissions Savings from Recent Actions (not included in forecast or in policy options above)

	Option Name	**GHG Reductions ($MMtCO_2e$) 2012**	**GHG Reductions ($MMtCO_2e$) 2025**		**Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)**
EE-3	Require Retail Energy Providers to Make Energy Efficiency a Priority	23.5	99.8		908.1
	Illinois	3.2	11.7		112.9
	Indiana	0.1	0.2		2.7
	Iowa	2.7	6.7		73.0
	Kansas	0.0	0.0		0.0
	Manitoba	0.1	0.2		2.1
	Michigan	3.7	17.6		159.2
	Minnesota	4.4	12.9		132.7
	Missouri	0.0	0.1		0.8
	Nebraska	0.1	0.3		3.6
	North Dakota	0.0	0.0		0.1
	Ohio	3.3	32.6		241.9
	South Dakota	0.0	0.0		0.0
	Wisconsin	5.9	17.4		179.2
EE-5	Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement	Not Quantified			
EE-6	Have the Public Sector Lead by Example	1.7	5.9		55.6
	Illinois	0.4	1.3		12.3
	Indiana	0.2	0.6		5.5
	Iowa	0.1	0.2		1.7
	Kansas	0.1	0.2		2.0
	Manitoba	0.0	0.0		0.1
	Michigan	0.2	0.9		8.2
	Minnesota	0.1	0.3		3.3
	Missouri	0.1	0.4		3.9
	Nebraska	0.0	0.1		1.3
	North Dakota	0.0	0.1		0.6
	Ohio	0.3	1.1		10.4
	South Dakota	0.0	0.1		0.6
	Wisconsin	0.2	0.6		5.8
	Total of EE-3 and EE-6 Recent Actions	25.2	105.7		963.7
Total Emissions Reductions Net of Overlaps (including recent actions)		41.6	315.3		2599.7

TABLE BELOW SHOWS NET ADJUSTED SAVINGS BY OPTION FOR EE-5 AND EE-6 (OPTION EE-3 IS NOT ADJUSTED)

	Option Name	GHG Reductions 2012	GHG Reductions 2025	Cost-Eff ($/tCO$_2$e)	NPV 2009-2025 ($million)	Cumulative Emissions Reductions (MMt CO$_2$e, 2009-2025)
EE-5	Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement	5.3	46.4	-$26	-$10,047	381.9
	Illinois	1.0	9.0	-$24	-$1,808	74.1
	Indiana	0.5	4.5	-$26	-$957	36.9
	Iowa	0.2	1.9	-$27	-$426	15.9
	Kansas	0.2	1.9	-$23	-$366	15.9
	Manitoba	0.0	0.1	-$223	-$199	0.9
	Michigan	0.7	6.1	-$30	-$1,521	50.3
	Minnesota	0.5	4.6	-$24	-$893	37.4
	Missouri	0.4	4.1	-$25	-$825	33.4
	Nebraska	0.1	1.3	-$25	-$268	10.8
	North Dakota	0.1	0.6	-$24	-$112	4.7
	Ohio	0.8	7.4	-$28	-$1,694	61.4
	South Dakota	0.1	0.6	-$27	-$130	4.8
	Wisconsin	0.5	4.2	-$24	-$846	35.4
EE-6	Have the Public Sector Lead by Example	1.5	5.4	-$5	-$290	53.4
	Illinois	0.3	1.2	-$3	-$38	11.8
	Indiana	0.1	0.5	-$8	-$42	5.3
	Iowa	0.0	0.2	-$8	-$13	1.6
	Kansas	0.1	0.2	-$6	-$12	2.0
	Manitoba	0.0	0.0	-$114	-$7	0.1
	Michigan	0.2	0.8	-$4	-$34	7.7
	Minnesota	0.1	0.3	-$6	-$19	3.1
	Missouri	0.1	0.4	-$9	-$36	3.9
	Nebraska	0.0	0.1	-$9	-$12	1.2
	North Dakota	0.0	0.1	-$8	-$5	0.6
	Ohio	0.3	1.0	-$5	-$52	10.0
	South Dakota	0.0	0.1	-$9	-$5	0.5
	Wisconsin	0.2	0.6	-$3	-$16	5.5
	Total Savings Net of Overlaps for EEAG Options	16.4	209.7	-$27	-$43,433	1636

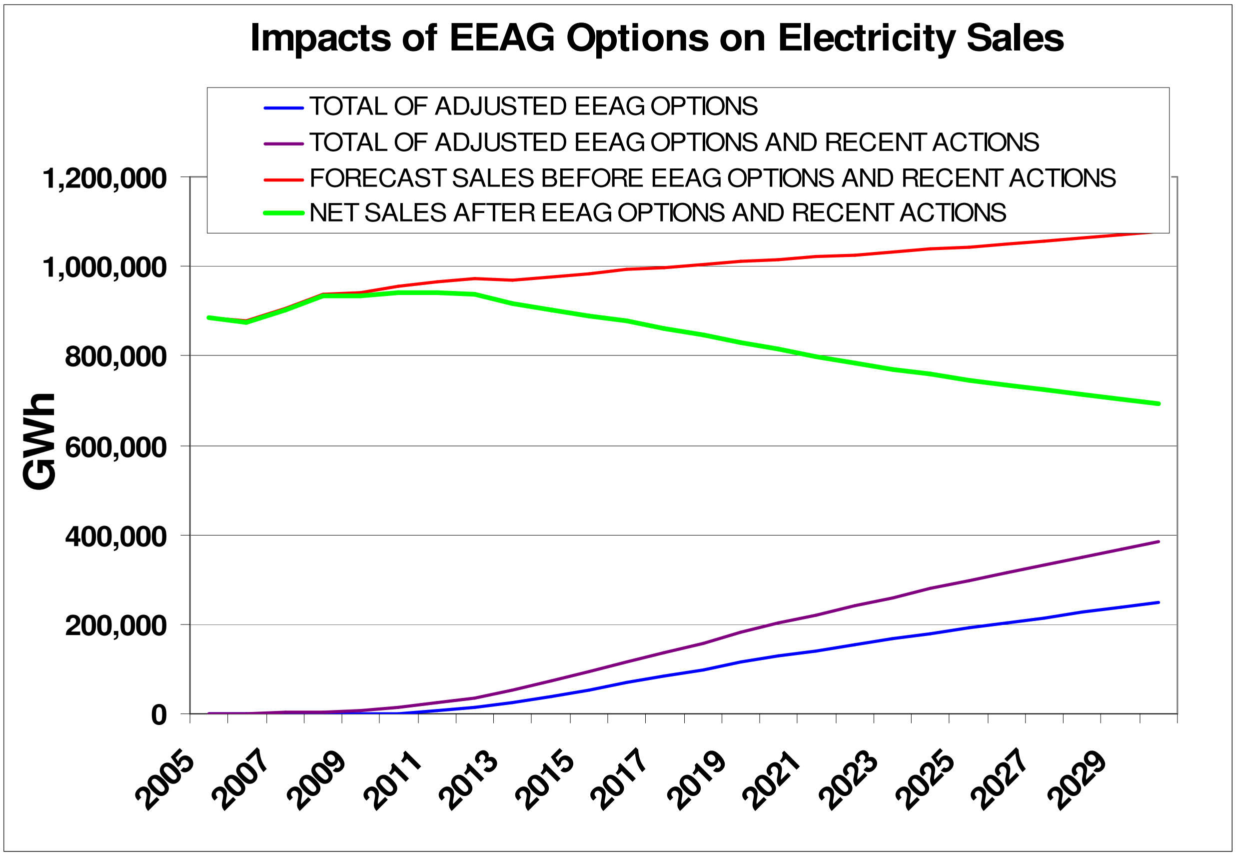
NOTES ON ESTIMATES OF OVERLAP BETWEEN POLICIES

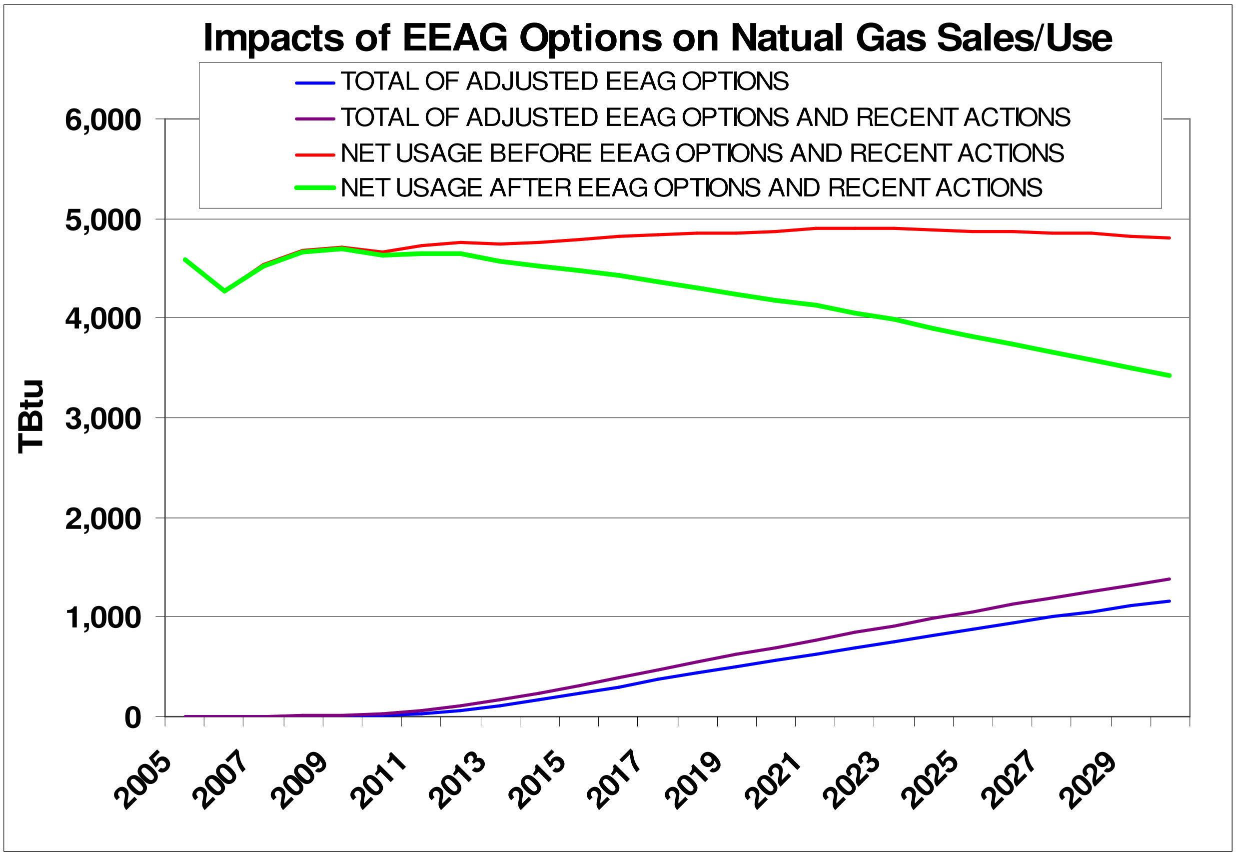
Note 1:

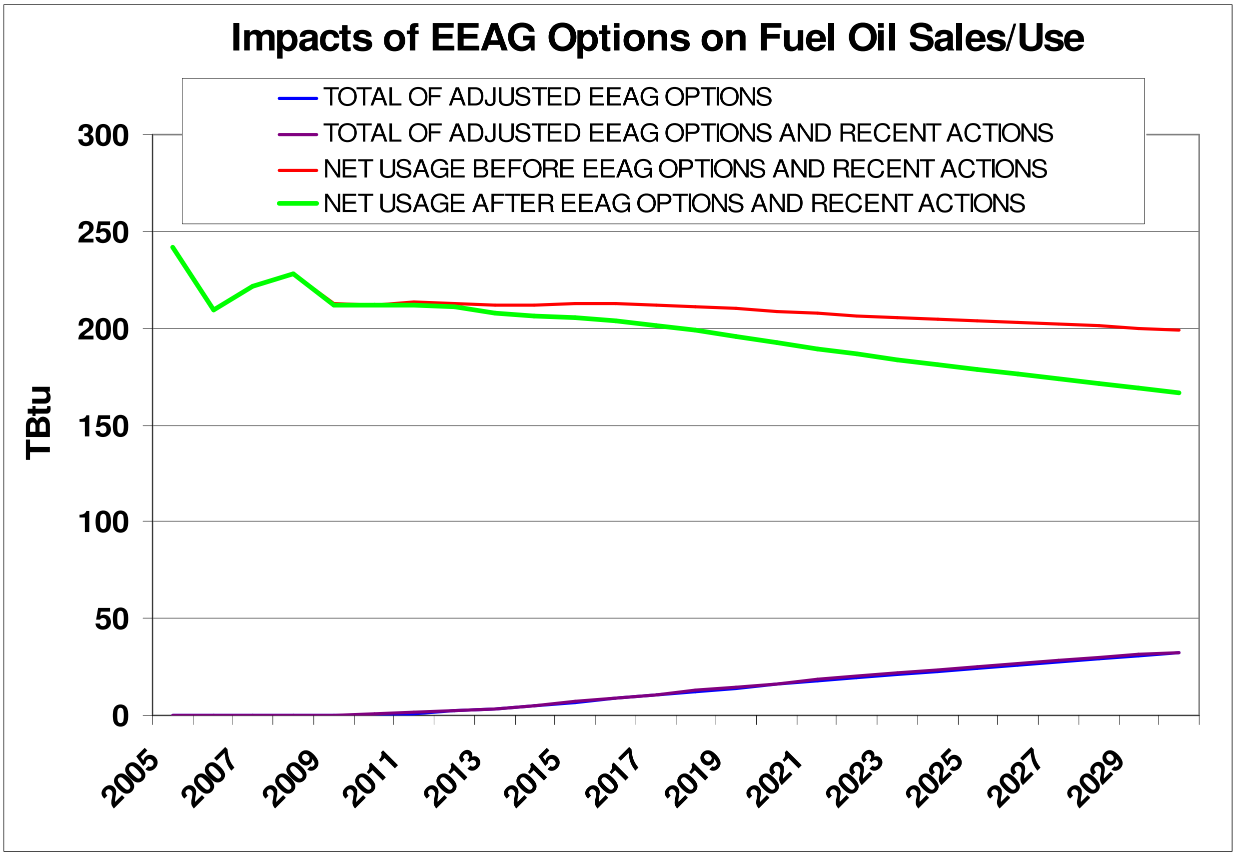
The overlap between EE-3 and EE-5 occurs when EE programs in EE-3 include measures targeted at space conditioning (and lighitng, for the commercial/institutional sector) energy use use in existing buildings or in the "beyond code" component of new buildings. We assume that the overlap here is 80% for electricity for those components of EE-5, based on a savings target for EE-3 at the 2%/yr level, 90% for natural gas, and 90% for fuel oil and LPG/propane.

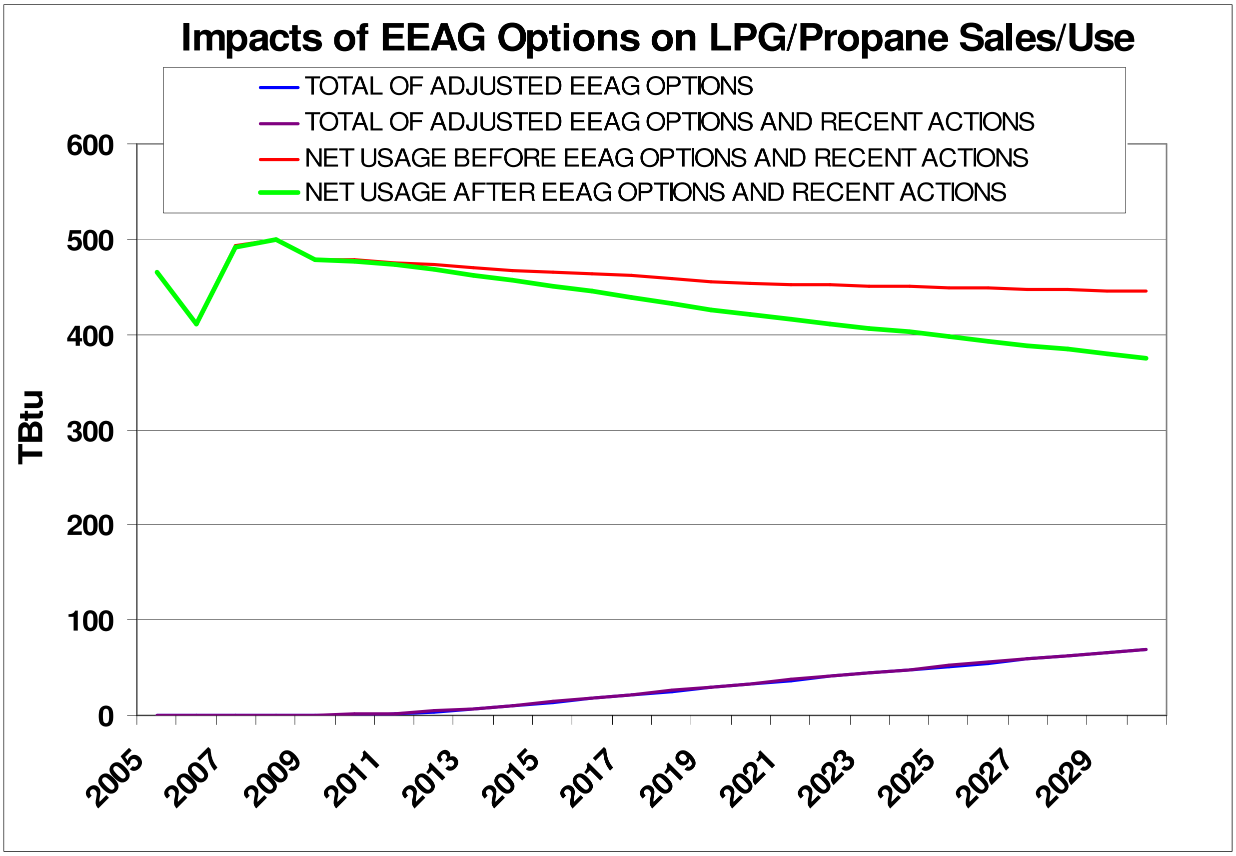
Note 2:

The overlap between EE-3 and EE-6 occurs when EE programs in EE-3 in , which assumes relatively few (and lighitng, for the public non-residential building sector) energy use use in existing buildings or in the "beyond code" component of new public buildings. We assume tha the overlap here is 80% for electricity for those components of EE-5, based on a savings target for EE-3 at the 2%/yr level, 90% for natural gas, and 90% for fuel oil and LPG/propane.


Impacts of EEAG Options on Electricity Sales
TOTAL OF ADJUSTED EEAG OPTIONS
TOTAL OF ADJUSTED EEAG OPTIONS AND RECENT ACTIONS
FORECAST SALES BEFORE EEAG OPTIONS AND RECENT ACTIONS
NET SALES AFTER EEAG OPTIONS AND RECENT ACTIONS
GWh
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029


Impacts of EEAG Options on Natual Gas Sales/Use
TOTAL OF ADJUSTED EEAG OPTIONS
TOTAL OF ADJUSTED EEAG OPTIONS AND RECENT ACTIONS
NET USAGE BEFORE EEAG OPTIONS AND RECENT ACTIONS
NET USAGE AFTER EEAG OPTIONS AND RECENT ACTIONS
TBtu
6,000
5,000
4,000
3,000
2,000
1,000
0
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029


Impacts of EEAG Options on Fuel Oil Sales/Use
TOTAL OF ADJUSTED EEAG OPTIONS
TOTAL OF ADJUSTED EEAG OPTIONS AND RECENT ACTIONS
NET USAGE BEFORE EEAG OPTIONS AND RECENT ACTIONS
NET USAGE AFTER EEAG OPTIONS AND RECENT ACTIONS
TBtu
300
250
200
150
100
50
0
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029



JURISDICTION-BY-JURISDICTION RESULTS FOR OPTION EE-2 USING ALTERNATIVE VALUES FOR ELECTRICITY AVOIDED COSTS AND COSTS OF SAVED ELECTRICAL ENERGY

Sensitivity Analysis, as Described in EE-2 Section of this Options Document

Summary Results and Totals for EEAG Mitigation Options (Includes updated natural gas goal for EE-3; High Electric Avoided Costs Sensitivity Case)

	Option Name	GHG Reductions ($MMtCO_2e$) 2012	2025	Cost-Eff ($\$/tCO_2e$)	NPV 2009-2025 ($million)	Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)
EE-3	Require Retail Energy Providers to Make Energy Efficiency a Priority	9.6	157.9	-$35	-$41,781	1200.7
	Illinois	1.7	32.6	-$32	-$7,709	242.7
	Indiana	2.4	27.7	-$33	-$7,040	215.8
	Iowa	0.2	7.7	-$35	-$1,944	55.5
	Kansas	1.0	11.4	-$32	-$2,847	88.4
	Manitoba	0.0	0.6	-$207	-$905	4.4
	Michigan	0.1	12.9	-$39	-$3,509	89.0
	Minnesota	0.2	9.9	-$34	-$2,343	69.6
	Missouri	1.8	21.0	-$31	-$5,122	163.3
	Nebraska	0.6	7.4	-$31	-$1,772	57.1
	North Dakota	0.3	3.2	-$31	-$768	24.6
	Ohio	1.2	12.8	-$45	-$5,278	116.0
	South Dakota	0.2	2.8	-$34	-$717	21.4
	Wisconsin	0.1	7.8	-$34	-$1,825	53.0

Summary Results and Totals for EEAG Mitigation Options (Includes updated natural gas goal for EE-3; Higher Electric Costs of Saved Energy Sensitivity Case)						
		GHG Reductions ($MMtCO_2e$)				
	Option Name	**2012**	**2025**	**Cost-Eff ($\$/tCO_2e$)**	**NPV 2009-2025 ($million)**	**Cumulative Emissions Reductions (MMt CO_2e, 2009-2025)**
EE-3	Require Retail Energy Providers to Make Energy Efficiency a Priority	9.6	157.9	-$20	-$24,412	1200.7
	Illinois	1.7	32.6	-$19	-$4,569	242.7
	Indiana	2.4	27.7	-$16	-$3,511	215.8
	Iowa	0.2	7.7	-$22	-$1,227	55.5
	Kansas	1.0	11.4	-$17	-$1,539	88.4
	Manitoba	0.0	0.6	-$94	-$412	4.4
	Michigan	0.1	12.9	-$24	-$2,178	89.0
	Minnesota	0.2	9.9	-$22	-$1,551	69.6
	Missouri	1.8	21.0	-$15	-$2,377	163.3
	Nebraska	0.6	7.4	-$16	-$907	57.1
	North Dakota	0.3	3.2	-$16	-$391	24.6
	Ohio	1.2	12.8	-$36	-$4,156	116.0
	South Dakota	0.2	2.8	-$18	-$377	21.4
	Wisconsin	0.1	7.8	-$23	-$1,217	53.0

EXAMPLES OF ANALYSES OF EE-2, EE-4, AND EE-5 AS PREPARED FOR INDIVIDUAL JURISDICTIONS

Estimate of Mitigation Option Costs and Benefits for Midwestern Governors' Association Energy Efficiency Advisory Group GHG Analysis

EE-3 **Require Retail Energy Providers to Make Energy Efficiency a Priority**

RESULTS FOR ILLINOIS

Date Last Modified: *4/16/2009 D. Von Hippel/M. Brown*

Key Data and Assumptions	2012	2025/all	Units
Program Effectiveness Assumptions			
Current/expected Efficiency Program Results			
Fraction of electric utility sales saved annually		0.50%	
Fraction of gas utility sales saved annually		0.00%	
Fraction of fuel oil sales saved annually		0.00%	
Fraction of propane/LPG sales saved annually		0.00%	

Existing legislation, passed in 2007, calls for annual savings of 0.2% in 2008, 0.4% in 2009, 2% by 2015. Modeled here as rising to 0.5% by 2010 for "current/expected", with further improvements assumed to meet MGA program targets (and included below). Source, www.lation/publicacts/95/PDF/095 - 0481.pdf; see Sec. 12 - 103.

A powerpoint summary of the Illinois legislation provided by Marty Kushler of ACEEE reads (in part) as follows: "In 2006, Governor called for the establishment of an EERS (Energy Efficiency Resource Standard). In July 2007, Illinois passed SB 1592 (very strong bi-partisan). Establishes an EERS for electricity savings. EERS starts at 0.2% for 2008, ramps up to 1%/year by 2011 and 2%/year by 2015. Includes rate cap of 0.5% per year and 2.0% in total." To model this option in Illinois, one can ascribe part of the EERS savings as "existing actions", with part ascribed to the MGA option (as is currently done here), or ascribe essentially all of the savigns to the existing legislation. One question is whether the rate [increase] cap will have the effect of limiting the scope of savings from the existing legislation.

Year that existing efficiency programs begin		2008	
Year that existing efficiency targets are achieved		2010	
[Notes]			
MGA EE-3 Program Targets			
Fraction of electricity sales saved annually		2.00%	
Fraction of natural gas sales saved annually		1.50%	
Fraction of fuel oil sales saved annually		1.50%	
Fraction of propane/LPG sales saved annually		1.50%	
[Notes]			
Year that EE-3 actions begin		2010	
Year that target is achieved		2015	
Fraction of jurisdiction-wide electricity and gas sales covered (existing and new programs)			
Residential		100%	Assumption
Commercial		100%	Assumption
Industrial		100%	Assumption
Fraction of jurisdiction-wide fuel oil and propane/LPG Sales Covered (existing and new programs)			
Residential		100%	Assumption
Commercial		100%	Assumption
Industrial		0%	Assumption
Levelized Incremental Cost of Electricity Energy Efficiency		$30	$/MWh

Rough estimate based on national figures from ACEEE report [INSERT REFERENCE]. Similar to values based on savings included in the GDS Report for the NC Utilities Commission, A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina, dated 12/2006. See ***Note 1****. The 2.9 cent/kWh average from the GDS report is based on a discount rate of 10 percent nominal, and has been recalculated using a real discount rate of 5%/yr to yield the value above. By comparison, a report prepared for the Western Governors Association (CDEAC EE Report, 2006--See* ***Note 2****), which in turn is based on Funding and Savings for Energy Efficiency Programs in Program Years 2000 through 2004 (CEC Rogers, Messenger Bender 2005) and on The Fifth Northwest Electric Power and Conservation Plan (Northwest Power and Conservation Council 2005), cites an average levelized cost of electricity savings of $25/MWh.*

Electricity Savings per Program Spending (first year savings)		8.0	MWh/$1000 spent, or
(Used to translate savings targets to utility outlays)		$125	$/MWh 1st yr savings

Based on rough average of several sources. Since 2000, NW utilities have achieved around 7 MWh/$1000 (T. Eckman, 2006, ttp://www.nwcouncil.org/energy/present/idaho.pdf), while CA utilities have averaged closer to 5 MWh/$1000 (M. Messenger, 2003, http://www.energy.ca.gov/reports/2003-09-24_400-03-022D.PDF). A calculation of the implied cost per unit first-year savings for the energy efficiency program defined for North Carolina in the GDS report (see reference above) yield program costs (including sponsor incentive costs and administration/marketing costs) on the order of $100 per MWh first year savings.

Avoided Delivered Electricity Cost		$60	$/MWh
See common assumptions ("Common Factors" worksheet in this workbook)			
Natural Gas Savings per Program Spending		72,700	MCF/yr per $million
(Used to translate savings targets to utility outlays)		74,881	MMBtu/yr per $million

Based on average cost of gas DSM programs reported in Tegen, S. and Geller, H., 2006. Natural Gas Demand-Side Management Programs: A National Survey, Southwest Energy Efficiency Project, www.swenergy.org.

Levelized Cost of Natural Gas Savings | **$2.5** | $/MMBtu

Rough average as provided by Marty Kusler of ACEEE (Personal communication, 9/08).

Avoided Delivered Natural Gas Cost | **$6.3** | $/MMBtu

See common assumptions

Levelized Cost of Fuel Oil Savings | **$2.5** | $/MMBtu

Assumed the same as for Natural Gas, given the similarity of measures to reduce consumption of the two fuels.

Avoided Delivered Fuel Oil Cost | **$15.0** | $/MMBtu

See common assumptions

Levelized Cost of Propane/LPG Savings | **$2.5** | $/MMBtu

Assumed the same as for Natural Gas, given the similarity of measures to reduce consumption of the two fuels.

Avoided Delivered Propane/LPG Cost | **$12.6** | $/MMBtu

See common assumptions

Other Data, Assumptions, Calculations	**2012**	**2025/all**	**Units**
Calculations of Program Energy Savings made using	Forecast Set #1: Estimates based on AEO Projections		
Calculations used to estimate impacts, costs, and energy efficiency investment levels			
During analysis period, implied new annual energy savings from:			
Current/expected electric efficiency programs	771	631	GWh
Current/expected gas efficiency programs	0	0	Billion Btu
Current/expected fuel oil efficiency programs	0	0	Billion Btu
Current/expected Propane/LPG efficiency programs	0	0	Billion Btu
Electric efficiency programs to meet MGA EE-3 targets	1,542	2,524	GWh
Gas efficiency programs to meet MGA EE-3 targets	6,976	11,650	Billion Btu
Fuel oil efficiency programs to meet MGA EE-3 targets	47	85	Billion Btu
Propane/LPG efficiency programs to meet MGA EE-3 targets	158	304	Billion Btu
Input Data and Analysis			
Electricity Use *(from forecasts)*	159,343	170,956	GWh
Residential	51,724	51,955	GWh
Commercial	57,555	70,166	GWh
Industrial	50,063	48,836	GWh
RCI Electricity Prices (statewide averages, $2006)			
Residential	$94	$93	$/MWh
Commercial	$82	$79	$/MWh
Industrial	$56	$53	$/MWh
2000-2007 electricity prices are from EIA, with future values estimated based on changes in USDOE EIA Annual Energy Outlook 2008 estimates of changes in regional electricity prices.			
Total Implied Electricity Revenues (RCI, statewide)	$12,393	$12,961	$million
Residential	$4,852	$4,828	$million
Commercial	$4,726	$5,569	$million
Industrial	$2,815	$2,564	$million
RCI Gas Sales *(from forecasts)*	940,664	957,572	Billion Btu
Residential	455,812	463,517	Billion Btu
Commercial	216,185	238,822	Billion Btu
Industrial	268,667	255,233	Billion Btu
Conversion Factor: Million Btu per Thousand Cubic feet		1.03	MMBtu/Mcf
RCI Gas Prices (statewide averages, real 2005 dollars)			
Residential	$9.36	$9.46	$/MMBtu
Commercial	$9.09	$9.30	$/MMBtu
Industrial	$8.01	$7.76	$/MMBtu
See Common Factors worksheet in this workbook. Future values estimated based on changes in USDOE EIA Annual Energy Outlook 2008 estimates of changes in regional gas prices.			
Total Implied Gas Revenues (RCI, statewide)	$8,382	$8,588	$million
Residential	$4,267	$4,387	$million
Commercial	$1,965	$2,221	$million
Industrial	$2,151	$1,981	$million

RCI Fuel Oil Sales	*(from forecast)*	16,002	15,516	Billion Btu
Residential		1,517	1,404	Billion Btu
Commercial		5,048	5,489	Billion Btu
Industrial		9,438	8,623	Billion Btu
RCI Propane/LPG Sales	*(from forecast)*	66,798	61,720	Billion Btu
Residential		18,340	21,143	Billion Btu
Commercial		3,308	3,449	Billion Btu
Industrial		45,150	37,128	Billion Btu

Investment in Efficiency Programs

Current/expected Efficiency Program Results			
Electric Efficiency Programs Investment (annual)	$96.4	$78.9	$million
Fraction of Electricity Revenues Invested	0.78%	0.61%	
Gas Efficiency Programs Investment (annual)	$0.0	$0.0	$million
Fraction of Gas Revenues Invested	0.00%	0.00%	
Efficiency Programs to Meet MGA EE-3 targets			
Electric Efficiency Programs Investment (annual)	$192.8	$315.5	$million
Fraction of Electricity Revenues Invested	1.56%	2.43%	
Gas Efficiency Programs Investment (annual)	$93.2	$155.6	$million
Fraction of Gas Revenues Invested	1.11%	1.81%	

Average Generation Level Capacity Savings per Unit Customer Energy Savings	0.18	MW/GWh

Placeholder estimate. Note that this "peak factor" indicates that the efficiency measures included in the indicated scenario are about 60% more likely to provide savings on-peak as efficiency savings that provide the same level of energy savings at all times. By way of comparison, a factor of 0.219 was estimated from electrical energy and peak power savings for "Achievable Cost-effective Electricity Savings Base Case for North Carolina" scenario as indicated on page 145 of A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina, dated December 2006, and prepared as a Report for the North Carolina Utilities Commission by GDS Associates, Inc.

Additional Results	2012	2025/all	Units
Current/expected Efficiency Program Results			
Reduction in Electricity Use (Cumulative)	3,025	12,173	GWh
as % of overall projected sales in that year	1.9%	7.1%	
Reduction in Generation Requirements	3,223	12,901	GWh
GHG Emission Savings	**3.2**	**11.7**	$MMtCO_2e$
Reduction in Natural Gas Use	0	0	Billion Btu
as % of overall projected sales in that year	0.0%	0.0%	
GHG Emission Savings, Gas	**0.0**	**0.0**	$MMtCO_2e$
Reduction in Fuel Oil Use	0	0	Billion Btu
as % of overall projected sales in that year	0.0%	0.0%	
GHG Emission Savings, Fuel Oil	**0.0**	**0.0**	$MMtCO_2e$
Reduction in Propane/LPG Use	0	0	Billion Btu
as % of overall projected sales in that year	0.0%	0.0%	
GHG Emission Savings, Propane/LPG	**0.0**	**0.0**	$MMtCO_2e$
Efficiency Programs to Meet MGA EE-3 targets			
Reduction in Electricity Use (Cumulative)	3,069	38,122	GWh
as % of overall projected sales in that year	1.9%	22.3%	
Incremental Reduction in Generation Requirements	3,269	40,402	GWh
Incremental GHG Emission Savings, Electricity	**3.2**	**36.7**	$MMtCO_2e$
Reduction in Natural Gas Use (Cumulative)	14,010	173,912	Billion Btu
as % of overall projected sales in that year	1.5%	18.2%	
Incremental GHG Emission Savings, Gas	**0.7**	**9.1**	$MMtCO_2e$
Reduction in Fuel Oil Use	97	1,248	Billion Btu
as % of overall projected sales in that year	0.0%	0.1%	
GHG Emission Savings, Fuel Oil	**0.0**	**0.1**	$MMtCO_2e$
Reduction in Propane/LPG Use	318	4,225	Billion Btu
as % of overall projected sales in that year	0.0%	0.4%	
GHG Emission Savings, Propane/LPG	**0.0**	**0.3**	$MMtCO_2e$
Implied peak power savings from			
Current/expected utility savings	545	2,191	MW
Efficiency Programs to Meet MGA EE-3 targets	552	6,862	MW

Economic Analysis

Efficiency Programs to Meet MGA EE-3 targets

--Electricity Programs

Net Present Value (2009-2025)		**-$4,782**	$million
Cumulative Emissions Reductions (2009-2025)		**288**	$MMtCO_2e$
Cost-Effectiveness		**-$17**	$\$/tCO_2e$
--Natural Gas Programs			
Net Present Value (2009-2025)		**-$2,761**	$million
Cumulative Emissions Reductions (2009-2025)		**69**	$MMtCO_2e$
Cost-Effectiveness		**-$40**	$\$/tCO_2e$
--Fuel Oil Programs			
Net Present Value (2009-2025)		**-$65**	$million
Cumulative Emissions Reductions (2009-2025)		**1**	$MMtCO_2e$
Cost-Effectiveness		**-$92**	$\$/tCO_2e$
--Propane/LPG Programs			
Net Present Value (2009-2025)		**-$174**	$million
Cumulative Emissions Reductions (2009-2025)		**2**	$MMtCO_2e$
Cost-Effectiveness		**-$87**	$\$/tCO_2e$

--Total of Electric, Gas, Fuel Oil, Propane/LPG Programs to Meet MGA EE-3 Targets

Incremental GHG Emission Savings, All Fuels	**4.0**	**46.1**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$7,781**	$million
Cumulative Emissions Reductions (2009-2025)		**359.4**	$MMtCO_2e$
Cost-Effectiveness		**-$22**	$\$/tCO_2e$

Additional Annual Savings from Electric, Gas, Fuel Oil, Propane/LPG Programs to Meet MGA EE-3 Targets (beyond Current/Expected Programs)

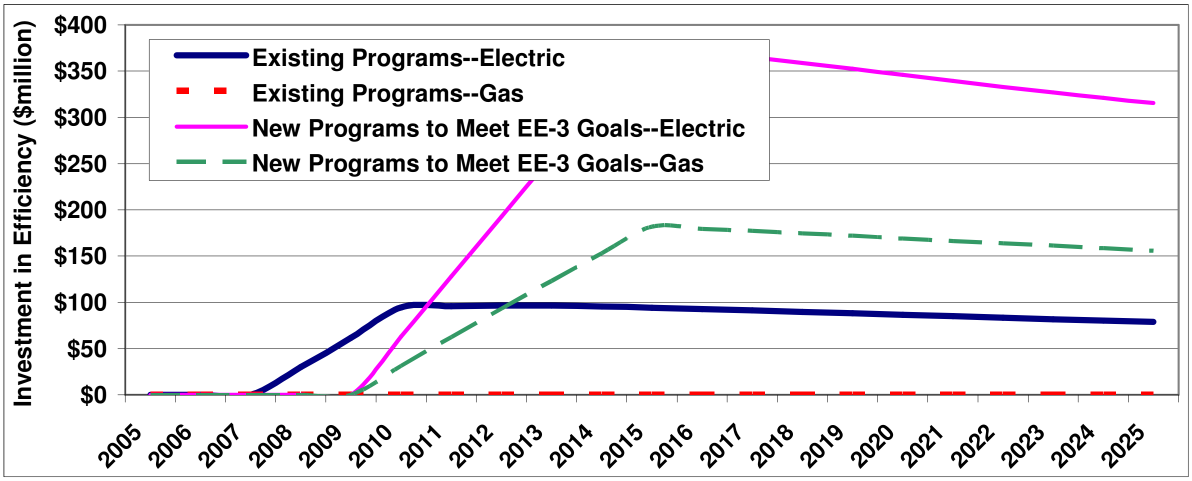
Electricity Programs	771	1,893	GWh
Natural Gas Programs	6,976	11,650	Billion Btu
Fuel Oil Programs	47	85	Billion Btu
Propane/LPG Programs	158	304	Billion Btu

Additional Cumulative Savings from Electric, Gas, Fuel Oil, Propane/LPG Programs to Meet MGA EE-3 Targets (beyond Current/Expected Programs)

Electricity Programs	1,027	26,932	GWh
Natural Gas Programs	14,010	173,912	Billion Btu
Fuel Oil Programs	97	1,248	Billion Btu
Propane/LPG Programs	318	4,225	Billion Btu

--Total Additional Cost and Savings of Electric, Gas, Fuel Oil, Propane/LPG Programs to Meet MGA EE-3 Targets (beyond Current/Expected Programs)

Incremental GHG Emission Savings, All Fuels	**1.7**	**32.6**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$6,139**	$million
Cumulative Emissions Reductions (2009-2025)		**242.7**	$MMtCO_2e$
Cost-Effectiveness		**-$25**	$\$/tCO_2e$



Notes and Sources

Note 1:

The "GDS Report" is available as
http://www.ncuc.commerce.state.nc.us/rps/NC RPS Energy Efficiency Report 12-06.pdf
Links to related NCUC documents on analysis of an RPS for NC (December 2006) are:
http://www.ncuc.commerce.state.nc.us/rps/NC RPS Report 12-06.pdf
http://www.ncuc.commerce.state.nc.us/rps/NC RPS Presentation to ERC 12-13-06.pdf

Note 2:

The Energy Efficiency Task Force Report to the Clean and Diversified Energy Advisory Committee of the Western Governors Association,
The Potential for More Efficient Electricity Use in the Western United States, January, 2006. This report is referred to here as the "WGA CDEAC EE report" and can be found at: http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf.

Estimate of Mitigation Option Costs and Benefits for Midwestern Governors' Association Energy Efficiency Advisory Group GHG Analysis

EE-5 **Strengthen Building Codes and Appliance Standards and Requisite Training, Quality Assurance and Enforcement**

RESULTS FOR ILLINOIS

Date Last Modified:	4/15/2009 D. Von Hippel/M. Brown

Note: This option has three separate analytical components:

1. ***Improved Building Codes***
2. ***Appliance and Equipment Efficiency Standards***
3. ***"Beyond Code" Building Energy Efficiency Improvements***

Key Data and Assumptions--Building Codes	2012	2025/all	Units
First Year Results Accrue		**2011**	
Based on Codes going into force in mid-2010, as assumed in Option Document			
Electricity			
Levelized Cost of Electricity Savings		**$43.3**	$/MWh
Based on 7 year payback as estimated in WGA CDEAC EE Report. (See Note 1, below.)			
Levelized Cost of Natural Gas Savings		**$4.5**	$/MMBtu
Based on 7 year payback as estimated in WGA CDEAC EE Report. (See Note 1, below.) Also used for measures that reduce oil and LPG/propane use, as those fuels serve substantially the same end-uses as natural gas.			
Avoided Electricity Cost		**$60**	$/MWh
Weighted average over total 2007-2020 electricity savings for this policy in each sector. See common assumptions ("Common Factors" worksheet in this workbook).			
Avoided Natural Gas Cost		**$6.3**	$/MMBtu
See common assumptions ("Common Factors" worksheet in this workbook)			
Avoided Distillate Oil Cost		**$15.0**	$/MMBtu
See common assumptions ("Common Factors" worksheet in this workbook)			
Avoided LPG/Propane Cost		**$12.6**	$/MMBtu
See common assumptions ("Common Factors" worksheet in this workbook)			

Other Data, Assumptions, Calculations--Building Codes	2012	2025/all	Units
Adjustment for Inclusion of Rennovated Residential Space as Well as New Under New Code Requirements. *(Currently set at 1.0 so that no rennovated residential space is included--need to ask building professionals for an opinion on this value.)*		**1.00**	
Adjustment for Inclusion of Rennovated Commercial Space as Well as New Under New Code Requirements. *Currently set at 1.6 so that about 0.6 unit of renovated space is included per unit of new space (initial assumption). Based on regional and national studies--see Note 3. It may be useful to obtain further jurisdiction-specfic information regarding this value if available in the future.*		**1.60**	
Adjustment for Inclusion of New Industrial Space in Estimated Electricity Savings due to New Code Requirements (applied to total residential plus commercial savings)		**108.1%**	
Adjustment for Inclusion of New Industrial Space in Estimated Natural Gas Savings due to New Code Requirements (applied to total residential plus commercial savings) (See ***Note 2***)		**105.6%**	

Residential Sector Assumptions and Calculations (See *Note 4*)

Population	12,988,724	13,340,507	
Number of housing units	5,445,140	5,801,015	

Based on census data for 2000-2007. From 2008-on, assumes that average rate of growth of housing stock varies with the rate of growth in population year-to-year multiplied by the ratio of average housing stock growth and population growth in 2000-2007, as computed below. This means that housing will continue to grow faster than population, consistent with a trend of decreasing household size as populations age. Note that this algorithm will not work well where populations are decreasing. In those cases, a different algorthm should be used.

Average Annual Growth Rate of Population, 2000-2007		**0.42%**	
Average Annual Growth Rate of Housing Stock, 2000-2007		**0.99%**	
Ratio of above		**2.37**	
Persons per household (provided for reference)	2.385	2.300	
Net New housing units added annually	35,636	21,436	

Calculated based on data and assumptions above.

New Private Housing Units Authorized (2003-2007 Census Data, for reference)			
Average Ratio of New Private Housing Units to Net New Housing Units Calculated As Above, 2003-2007, provided for reference only.		1.126	

Residential Electricity Use	51,724	51,955	GWh
Residential Gas Use	455,812	463,517	GBtu
Residential Oil Use	1,517	1,404	GBtu
Residential LPG/Propane Use	18,340	21,143	GBtu

Using Forecast Set #1: Estimates based on AEO Projections (Forecast set chosen in EE-3 option analysis for this jurisdiction).

Electricity use per household for new homes relative to existing homes in 2005 (includes impacts of existing codes).		**100.0%**	
Implied electricity use in new households	337	202	GWh
Residential Electric Space Conditioning Multiplier (fraction of electricity used for space conditioning)		42.7%	

Based on data from 2001 USDOE EIA RECS and heating and cooling degree data for this jurisdiction. See Note 5, below.

Natural gas, oil, and LPG/propane use per household for new homes relative to existing homes in 2005 (includes impacts of existing codes).		**100.0%**	
Implied natural gas use in new households	3,122	1,878	GBtu
Implied oil use in new households	13	8	GBtu
Implied LPG/propane use in new households	110	66	GBtu
Residential Natural Gas Space Conditioning Multiplier (fraction of gas used for space conditioning)		92.9%	

Based on data from 2001 USDOE EIA RECS and heating and cooling degree data for this jurisdiction. See Note 5 below. This same factor is used for LPG/Propane use as well.

Annual energy use for space conditioning in new residential buildings (not cumulative)

Electricity	144	86	GWh
Natural Gas	2,902	1,745	GBtu
Oil	12	7	GBtu

Assumes essentially 100% of residential oil use is used for space conditioning.

LPG/Propane	102	62	GBtu

Electricity consumption per unit for space conditioning in new homes meeting existing building energy codes in the jurisdiction, relative to 2006 IECC levels.		100%

Measure of the stringency of existing codes relative to the 2006 IEEC yardstick. Should be set at more than 100% if codes are less stringent than 2006 IECC, and less than 100% if codes are more stringent than IECC.

Gas, oil, and LPG consumption per unit for space conditioning in new homes meeting existing building energy codes in the jurisdiction, relative to 2006 IECC levels.		100%

Measure of the stringency of existing codes relative to the 2006 IEEC yardstick. Should be set at more than 100% if codes are less stringent than 2006 IECC, and less than 100% if codes are more stringent than IECC.

Reduction in electricity consumption per unit for space conditioning, water heating, and lighting in new homes meeting EE-5 revised building codes, relative to 2006 IECC levels.	15.20%	
Reduction in gas, oil, and LPG/propane consumption per unit for space conditioning and water heating in new homes meeting EE-5 revised building codes, relative to 2006 IECC levels.	8.05%	

Reflects an interpretation of EE-5 goals as expressed by the the EEAG. Assumes that improvement will be the equivalent of the savings estimated for the Energy Efficient Codes Coalition as resulting from an improvement from IECC 2006 equivalent residential building energy codes to IECC 2009 codes. See ***Note 10***.

Average rate of compliance with EE-5 revised building energy codes	95%

Placeholder estimate (target).

Implied annual (not cumulative) reduction in residential electricity use due to implementation of EE-5 building energy codes:	21	12	GWh
Implied annual (not cumulative) reduction in residential natural gas use due to implementation of EE-5 building energy codes:	222	133	GBtu
Implied annual (not cumulative) reduction in residential oil use due to implementation of EE-5 building energy codes:	1	1	GBtu
Implied annual (not cumulative) reduction in residential LPG/propane use due to implementation of EE-5 building energy codes:	8	5	GBtu

Commercial Sector Assumptions and Calculations (See *Note 4*)

	2012	2025/all	Units
Commercial Floorspace (million square feet)	3,540	3,636	
Implied New Commercial Floorspace (million square feet/yr)	10	6	

Estimated from jurisdiction-level historical data and USDOE AEO projections for regional growth in commercial floorspace by region. See "Multi_jurisdiction_data" worksheet in this workbook.

Commercial Electricity Use	57,555	70,166	GWh
Commercial Gas Use	216,185	238,822	GBtu
Commercial Oil Use	5,048	5,489	GBtu
Commercial LPG/Propane Use	3,308	3,449	GBtu

Using Forecast Set #1: Estimates based on AEO Projections (Forecast set chosen in EE-3 option analysis for this jurisdiction).

Electricity use per square foot for new commercial buildings relative to existing commercial buildings in 2005 (includes impacts of existing codes). This factor is intended to reflect that new commercial buildings are often more energy-intensive than older buildings. See ***Note 5***.		**124.1%**	
Implied electricity use in new commercial buildings	175	105	GWh
Commercial Electric Space Conditioning and Lighting Multiplier (fraction of electricity used for space conditioning and lighting)		66.7%	

Based on data from 2003 USDOE EIA CBECS for this region. See Note 6, below.

Natural gas, oil, and LPG/propane use per square foot for new commercial buildings relative to existing buildings in 2005 (includes impacts of existing codes).		**100.0%**	
Implied natural gas use in new commercial buildings	586	352	GBtu
Implied oil use in new commercial buildings	15	9	GBtu
Implied natural gasLPG/propane use in new commercial buildings	8	5	GBtu
Commercial Natural Gas Space Conditioning Multiplier (fraction of gas used for space conditioning)		80.3%	

Based on data from 2003 USDOE EIA CBECS for this region. See Note 6, below. This same factor is used for LPG/Propane use as well.

Commercial Oil Space Conditioning Multiplier (fraction of oil used for space conditioning)	93.9%

Based on data from 2003 USDOE EIA CBECS for this region. See Note 6, below.

Annual energy use for space conditioning and lighting in new Commercial buildings (not cumulative)

Electricity	116	70	GWh
Natural Gas	470	283	GBtu
Oil	15	9	GBtu
LPG/Propane	6	4	GBtu

Electricity consumption per unit for space conditioning in new commercial buildings meeting existing building energy codes in the jurisdiction, relative to the most recent ASHRAE 90.1 Commercial Code levels. **100%**

Measure of the stringency of existing codes relative to the 2006 IEEC yardstick. Should be set at more than 100% if codes are less stringent than 2006 ASHRAE 90.1 Commercial Code levels, and less than 100% if codes are more stringent than ASHRAE 90.1 Commercial Code levels.

Gas, oil, and LPG consumption per unit for space conditioning in new commercial space meeting existing building energy codes in the jurisdiction, relative to 2006 ASHRAE 90.1 Commercial Code levels. **100%**

Measure of the stringency of existing codes relative to the 2006 ASHRAE yardstick. Should be set at more than 100% if codes are less stringent than 2006 ASHRAE 90.1 Commercial Code levels, and less than 100% if codes are more stringent than ASHRAE 90.1 Commercial Code levels.

Reduction in electricity, gas, oil, and LPG/propane consumption per unit for space conditioning in new buildings meeting EE-5 revised building codes, relative to 2006 ASHRAE 90.1 Commercial Code levels. **10%**

Rough Estimate. As no existing analytical results were immediately available to compare 2006 to 2009 ASHRAE (or IECC) Commercial codes, 10 percent improvement in the covered end-uses was taken as a representative value. It is similar to the values from residential sector analyses (for example, the EECC analyses referenced above, and also roughly consistent with the the overall 11.9% on-site energy use savings (presumably expressed as a fraction of all energy use, not just heating/cooling/lighting) by ASHRAE as a benefit of moving from ASHRAE 90.1-1999 to ASHRAE 90.1-2004 energy codes (see, for example, http://www.ashrae.org/pressroom/detail/16999).

Average rate of compliance with EE-5 revised building energy codes **95%**

Placeholder estimate (target).

	2012	2025/all	Units
Implied annual (not cumulative) reduction in Commercial electricity use due to implementation of EE-5 building energy codes:	18	11	GWh
Implied annual (not cumulative) reduction in Commercial natural gas use due to implementation of EE-5 building energy codes:	72	43	GBtu
Implied annual (not cumulative) reduction in Commercial oil use due to implementation of EE-5 building energy codes:	2.2	1.3	GBtu
Implied annual (not cumulative) reduction in Commercial LPG/propane use due to implementation of EE-5 building energy codes:	1.0	0.6	GBtu

Other Data, Assumptions, Calculations--Appliance Standards | 2012 | 2025/all | Units

Data and Assumptions: Appliance and Equipment Energy Efficiency Standards (excluding televisions, which are treated below)

Projected Energy Savings from Proposed Standards (in 2020)

*The data below (except for data for Portable Luminaires--see **Note 8** regarding those devices) are drawn from Appliance Standards Awareness Project (ASAP) and the American Council for an Energy Efficient Economy (ACEEE), 2006. "Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards", http://www.aceee.org/store/proddetail.cfm?CFID=2177299&CFTOKEN=30942959&ItemID=411&CategoryID=7, and "Energy Standards Benefits -- 2006 Model Energy Bill" for Illinois, file s062_il.pdf, and represent cost and savings for a package of appliance and equipment improvements, as estimated by the authors, for Illinois. See Note 7, below, for a printout of the full Table from which these data have been extracted. The appliances and equipment included in the list below are drawn from a broader list of 15 products included in the ASAP/ACEEE report, and cover only those devices for which ASAP staff suggest that state-level standards are likely to be a significant improvement over those that are or will shortly be in force at the Federal level--or for which Federal standards do not exist.*

Standards that Save Electricity (data from ASAP/ACEEE source above)

Products	Annual Savings/yr-unit (kWh)	Incremental Cost/unit	Annual savings from one year's sales (GWh)	Energy Savings through 2020 (GWh)
Bottle-type Water Dispensers	266	$ 12.00	1.5	11.6
Commercial Hot Food Holding Cabinets	1815	$ 453.00	1.3	16.5
Compact Audio Products	53	$ 1.00	15.2	76.1
DVD Players and Recorders	11	$ 1.00	2.2	11
Portable Electric Spa (Hot Tubs)	250	$ 100.00	0.6	5.6
Residential Gas Furnaces and Furnace Fans	770	$ 100.00	120.6	1025.2
Portable Luminaires	24.1	$ 2.50	53.4	480.4
TOTAL OF ABOVE			194.8	1,626.4

Standards that Save Electricity (results derived from above)

Products	Lifetime (years) (from National document referenced above)	Implied Number of Units/yr	Implied Levelized Cost per Unit ($/yr)	Implied Levelized Cost/MWh saved
Bottle-type Water Dispensers	8.00	5,639	$2.01	$7.55
Commercial Hot Food Holding Cabinets	13.00	716	$54.20	$29.86
Compact Audio Products	5.00	286,792	$0.24	$4.60
DVD Players and Recorders	5.00	200,000	$0.24	$22.17
Portable Electric Spa (Hot Tubs)	10.00	2,400	$14.24	$56.95
Residential Gas Furnaces and Furnace Fans	18.00	156,623	$9.94	$12.91
Portable Luminaires	12.00	2,214,869	$0.31	$13.06

Costs Levelized using an assumed real interest rate of 7% per year.

Standards that Save Natural Gas (data from ASAP/ACEEE source above)

Products	Annual Savings/yr-unit (therms)	Incremental Cost/unit	Annual savings from one year's sales (Million CF)	Energy Savings through 2020 (Million CF)
Residential Gas Furnaces and Furnace Fans	102	373	1607.2	13949.8

Standards that Save Natural Gas (results derived from above)

Products	Lifetime (years) (from National document referenced above)	Number of Units/yr	Implied Levelized Cost per Unit ($/yr)	Implied Levelized Cost/MMBtu saved
Residential Gas Furnaces and Furnace Fans	18.00	156,623	$37.08	$3.74

Standards for above devices assumed to take effect starting in **2011**

Annual Cost and Savings Results for Devices Above (Cumulative)

Savings by Product

Bottle-type Water Dispensers	3	12	GWh
Commercial Hot Food Holding Cabinets	3	17	GWh
Compact Audio Products	30	76	GWh
DVD Players and Recorders	4	11	GWh
Portable Electric Spa (Hot Tubs)	1	6	GWh
Residential Gas Furnaces and Furnace Fans (Electricity Savings)	241	1,809	GWh
Residential Portable Luminaires	107	641	GWh
Residential Gas Furnaces and Furnace Fans (Gas Savings)	3,311	24,831	GBtu

Cumulative Costs by Product (Incremental cost of improvement before consideration of value of energy savings)

Bottle-type Water Dispensers	$ 23	$ 91	$ thousand
Commercial Hot Food Holding Cabinets	$ 78	$ 505	$ thousand
Compact Audio Products	$ 140	$ 350	$ thousand
DVD Players and Recorders	$ 98	$ 244	$ thousand
Portable Electric Spa (Hot Tubs)	$ 68	$ 342	$ thousand
Residential Gas Furnaces and Furnace Fans (Electricity Savings)	$ 3,114	$ 23,356	$ thousand
Residential Portable Luminaires	$ 1,394	$ 8,366	$ thousand
Residential Gas Furnaces and Furnace Fans (Gas Savings)	$ 12,397	$ 92,979	$ thousand

Data and Assumptions: Television Performance Standards

Standards for Active Mode energy consumption by televisions based on California Title 20 Standards currently under development

*Except as noted, assumptions below are taken from Codes and Standards Enhancement (CASE) Initiative For PY2008: Title 20 Standards Development Title:Analysis of Standards Options for Televisions *Revised Proposal*, prepared as a part of a docket before the California Energy Commission for Pacific Gas and Electric Company, prepared by Alex Chase, Energy Solutions. Dated July 3, 2008, available as http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-07-16_workshop/proposals/PGE_Revised_Television_Proposal.pdf.*

"Tier 1" Standards assumed to take effect in	**2011**	
"Tier 2" Standards assumed to take effect in	**2013**	
Useful lifetime of televisions	**10**	years
Annual Sales of televisions in the US in 2011	**39.80**	million
Estimated TV Sales per household in 2011 (National)	**0.30**	per year
Annual increase in sales of televisions in the US from 2011-on	**2.0%**	per year
Estimated TV Sales in 2030 (National)	**57.98**	million
Estimated TV Sales per household in 2030 (National)	**0.35**	per year
Estimated annual increase in televisions per household through 2030	**0.742%**	per year
Fraction of televisions sold that that use liquid crystal display (LCD) screens	**90.0%**	

The remainder of screens are assumed to be of the plasma-type, though other technologies are starting to penetrate the market.

Per-unit incremental energy savings, kWh/yr (from Table 6 and 7 of reference above)

			Fraction of Units Claiming Incremental Savings	
	Base level to Tier 1	Tier 1 to Tier 2	Base level to Tier 1	Tier 1 to Tier 2
LCD	**97.2**	**41.1**	**66.0%**	**100.0%**
Plasma	**251.3**	**176.3**	**95.0%**	**100.0%**

Estimated TV Sales per household in Jurisdiction relative to average sales per household in US	100%	
Placeholder value, to be adjusted if data are available.		
Incremental cost of television energy efficiency improvements	$ -	per MWh

No data on costs are provided in source document above. Andrew deLaski of ASAP (personal communications) suggests that "the incremental cost will be zero or close to zero".

Annual First-year Savings per TV Sold: LCD Units	64	105	kWh/yr
Annual First-year Savings per TV Sold: Plasma Units	239	415	kWh/yr
Number of TVs Sold: LCD Units	1,483,179	1,739,594	per year
Number of TVs Sold: Plasma Units	164,798	193,288	per year
Implied first-year (not cumulative) savings from implementing TV standards: LCD Units	95	183	GWh
Implied first-year (not cumulative) savings from implementing TV standards: Plasma Units	39	80	GWh
Implied cumulative savings from implementing TV standards: LCD Units	189	1,740	GWh
Implied cumulative savings from implementing TV standards: Plasma Units	78	763	GWh

Other Data, Assumptions, Calculations--Existing Building and "Beyond Code" Improvements	2012	2025/all	Units
Energy Efficiency Improvements in Existing Buildings			
Average Electricity and Gas Savings Targets for Buildings Participating in Program (existing commercial and residential buildings) *Placeholder estimate, assuming a target efficiency increase in participating existing buildings that starts at 4% in 2010 and increases to 50% in 2030, relative to average building energy consumption in 2005.*	**8.4%**	**37.0%**	
Date program of improvement of existing buildings "ramped up" *Placeholder Estimate*		2017	
Fraction of existing (as of 2006) commercial (non-public) and residential buildings (excluding public housing) participating in program through 2030 *Program Goal (placeholder)*		25%	
Fraction of existing commercial and residential buildings participating annually after ramp-in *Adjusted iteratively to meet final target above. Currently MATCHES targets.*		1.47%	/yr
Implied non-public commercial building floorspace included in program annually (million square feet) *Calculated from above and from estimates of government-sector floorspace fractions derived from CBECS data--see "Multi-jurisdiction_data" worksheet in this workbook. Excludes public sector floorspace.*	**10.095**	**35.333**	/yr
Estimate of fraction of occupied homes in public housing *Midwest average calculated from reported number of housing units "owned by public housing authority" from page 80 of American Housing Survey for the United States: 2007, U.S. Department of Housing and Urban Development and U.S. Census Bureau, available as http://www.census.gov/prod/2008pubs/h150-07.pdf. State-specific data are available for 1998--see "Multi_jurisdiction_data" worksheet in this workbook. Note that publicly-owned housing is only a portion of the total of the housing stock used by those receiving public housing assistance, so a broader definition of this fraction may be appropriate.*	**1.52%**		
Implied number of existing homes included in program annually *Calculated from parameters above. Excludes public housing, which is covered in Option EE-6.*	**21,513**	**75,295**	/yr
Energy Efficiency Improvements in New Buildings			
Fraction of new residential and commercial buildings participating in program through target dates *Program Goal (placeholder)*		25%	/yr
Date program of improvement of new buildings "ramped up" *Placeholder Estimate*		2017	
Annual **reduction** in commercial electricity use relative to revised energy above for new and renovated buildings	**31.3%**	**73.3%**	
Annual **reduction** in commercial gas and LPG/propane use relative to revised energy code above for new and renovated buildings	**30.0%**	**72.0%**	
Annual **reduction** in commercial oil use relative to revised energy code above for new and renovated buildings *Based on goals in http://www.architecture2030.org/pdfs/2030Blueprint.pdf, The 2030 Blueprint: Solving Climate Change Saves Billions, Architecture 2030, page 6, which target having new construction as having "net zero" GHG emissions by 2030. Reflects fact that building code improvements are based on space conditioning (and for commercial sector, lighting) energy use, while Architecture 2030 goals cover all building energy use.*	**28.6%**	**70.6%**	
Annual **reduction** in residential electricity use relative to revised energy code above for new and renovated buildings	**31.5%**	**73.5%**	
Annual **reduction** in residential gas and LPG/propane use relative to revised energy code above for new and renovated buildings	**30.5%**	**72.5%**	
Annual **reduction** in residential oil use relative to revised energy code above for new and renovated buildings *Based on goals in http://www.architecture2030.org/pdfs/2030Blueprint.pdf, The 2030 Blueprint: Solving Climate Change Saves Billions, Architecture 2030, page 6, which target having new construction as having "net zero" GHG emissions by 2030. Reflects fact that building code improvements are based on space conditioning (and for commercial sector, lighting) energy use, while Architecture 2030 goals cover all building energy use.*	**30.0%**	**72.0%**	
Ratio of substantially rennovated commercial space (also covered under program) to new commercial space.		1.00	

Ratio of substantially rennovated housing (also covered under program) to new housing. *Placeholder estimate, but consistent with that applied in the Achitecture 2030 document referenced above for the United States as a whole. Note that this assumption is different from the analogous assumption used for the building energy codes element of this option.*		1.00	
Implied new commercial floorspace meeting EE-5 beyond-code targets annually (million square feet) *Calculated from above. Excludes public-sector buildings covered under EE-6.*	0.959	2.018	/yr
Implied new residential units meeting EE-5 beyond-code targets annually *Calculated from above. Excludes public housing covered under EE-6.*	5,013	10,555	/yr

CALCULATION OF SAVINGS

Energy Efficiency Improvements in Existing Buildings

	2012	2025/all	Units
Implied total electricity savings in existing commercial buildings participating in program annually. *First-year savings--not cumulative.*	12.3	189.5	GWh/yr
Implied total gas savings in existing commercial buildings participating in program annually. *First-year savings--not cumulative.*	51.2	788.6	GBtu/yr
Implied total oil savings in existing commercial buildings participating in program annually. *First-year savings--not cumulative.*	1.4	20.9	GBtu/yr
Implied total LPG/propane savings in existing commercial buildings participating in program annually. *First-year savings--not cumulative.*	0.7	10.6	GBtu/yr
Implied total electricity savings in existing housing participating in program. *First-year savings--not cumulative.*	17.1	263.1	GWh/yr
Implied total gas savings in existing housing participating in program. *First-year savings--not cumulative.*	158.3	2,440.7	GBtu/yr
Implied total oil savings in existing housing participating in program. *First-year savings--not cumulative.*	0.7	10.3	GBtu/yr
Implied total LPG/propane savings in existing housing participating in program. *First-year savings--not cumulative.*	5.6	86.1	GBtu/yr
Implied cumulative electricity savings in existing commercial buildings participating in program	16.8	1,508.1	GWh/yr
Implied cumulative gas savings in existing commercial buildings participating in program	70.0	6,274.9	GBtu/yr
Implied cumulative oil savings in existing commercial buildings participating in program	1.9	166.0	GBtu/yr
Implied cumulative LPG/propane savings in existing commercial buildings participating in program	0.9	84.5	GBtu/yr
Implied cumulative electricity savings in existing housing	23.4	2,093.8	GWh/yr
Implied cumulative gas savings in existing housing	216.7	19,420.0	GBtu/yr
Implied cumulative oil savings in existing housing	0.9	81.7	GBtu/yr
Implied cumulative LPG/propane savings in existing housing	7.6	685.1	GBtu/yr

	2012	2025/all	Units
Energy Efficiency Improvements in New Buildings			
Implied required intensity improvement beyond revised code to EE-5 targets, commercial buildings, electricity use per square foot	5.64	13.19	kWh/yr
Implied required intensity improvement beyond revised code to EE-5 targets, commercial buildings, gas use per square foot	18.08	43.42	kBtu/yr
Implied required intensity improvement beyond revised code to EE-5 targets, commercial buildings, oil use per square foot	0.46	1.13	kBtu/yr
Implied required intensity improvement beyond revised code to EE-5 targets, commercial buildings, LPG/propane use per square foot	0.24	0.58	kBtu/yr
Average Fraction of Improvement in Electric Energy Intensities for commercial buildings from:			
Energy Efficiency Improvement	90%	80%	
Solar Thermal Energy (hot water/space heat/space cooling)	3%	7%	
On-site Solar PV	1%	3%	
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	5%	
Green Power Purchase (from off-site, beyond electricity supply RPS)	5%	5%	
All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.			
Average Fraction of Improvement in Gas and Oil Energy Intensities for commercial buildings from:			
Energy Efficiency Improvement	96%	92%	
Solar Thermal Energy (hot water/space heat/space cooling)	3%	5%	
On-site Solar PV	0%	0%	
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	3%	
Green Power Purchase (from off-site, beyond electricity supply RPS)	0%	0%	
All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.			
Implied Cumulative Impacts of Action, New Commercial Building Space (Electricity savings)			
Energy Efficiency Improvement	73.55	3,451.48	GWh
Solar Thermal Energy (hot water/space heat/space cooling)	2.45	226.51	GWh
On-site Solar PV	0.82	92.65	GWh
On-site Biomass/Biogas/Landfill Gas Energy Use	0.82	144.09	GWh
Green Power Purchase (from off-site, beyond electricity supply RPS)	4.09	206.04	GWh
Implied Cumulative Impacts of Action, New Commercial Building Space (Natural Gas savings)			
Energy Efficiency Improvement	251.12	12,592.99	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	7.85	572.62	GBtu/yr
On-site Solar PV	-	-	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	2.62	303.24	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	-	-	GBtu/yr
Implied Cumulative Impacts of Action, New Commercial Building Space (Oil Products savings)			
Energy Efficiency Improvement	6.33	324.49	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	0.20	14.77	GBtu/yr
On-site Solar PV	-	-	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	0.07	7.83	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	-	-	GBtu/yr
Implied Cumulative Impacts of Action, New Commercial Building Space (LPG/propane savings)			
Energy Efficiency Improvement	3.38	169.57	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	0.11	7.71	GBtu/yr
On-site Solar PV	-	-	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	0.04	4.08	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	-	-	GBtu/yr
Implied required intensity improvement to meet Architecture 2030 goals, housing, electricity use per unit	6.77	16.48	MWh/yr
Implied required intensity improvement to meet Architecture 2030 goals, housing, gas use per unit	57.61	146.57	MBtu/yr
Implied required intensity improvement to meet Architecture 2030 goals, housing, oil use per unit	0.19	0.44	MBtu/yr
Implied required intensity improvement to meet Architecture 2030 goals, housing, LPG/propane use per unit	2.30	6.61	MBtu/yr

Average Fraction of Improvement in Electric Energy Intensities for Housing from:

Energy Efficiency Improvement	90%	80%
Solar Thermal Energy (hot water/space heat/space cooling)	3%	7%
On-site Solar PV	1%	3%
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	5%
Green Power Purchase (from off-site, beyond electricity supply RPS)	5%	5%

All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.

Average Fraction of Improvement in Gas and Oil Energy Intensities for Housing from:

Energy Efficiency Improvement	96%	92%
Solar Thermal Energy (hot water/space heat/space cooling)	3%	5%
On-site Solar PV	0%	0%
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	3%
Green Power Purchase (from off-site, beyond electricity supply RPS)	0%	0%

All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.

Implied Cumulative Impacts of Option, New Housing (Electricity savings)

Energy Efficiency Improvement	**43.70**	**1,503.03**	GWh
Solar Thermal Energy (hot water/space heat/space cooling)	**1.46**	**94.91**	GWh
On-site Solar PV	**0.49**	**38.53**	GWh
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.49**	**59.21**	GWh
Green Power Purchase (from off-site, beyond electricity supply RPS)	**2.43**	**89.25**	GWh

Implied Cumulative Impacts of Option, New Housing (Natural Gas savings)

Energy Efficiency Improvement	**395.78**	**15,011.85**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**12.37**	**666.86**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**4.12**	**346.36**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

Implied Cumulative Impacts of Option, New Housing (Oil Products savings)

Energy Efficiency Improvement	**1.30**	**47.54**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**0.04**	**2.10**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.01**	**1.09**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

Implied Cumulative Impacts of Option, New Housing (LPG/propane savings)

Energy Efficiency Improvement	**15.78**	**641.04**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**0.49**	**28.62**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.16**	**14.93**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

Additional Inputs to/Intermediate Results of Costs Analyses, Beyond Code Elements

	2012	2025/all	Units
Estimated annual levelized cost of residential solar hot water per unit output	41.19	30.60	$/MMBtu
Based on inputs to/results of solar hot water heating analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Estimated annual levelized cost of commercial solar hot water per unit output	38.89	28.89	$/MMBtu
Based on inputs to/results of solar hot water heating analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Adjustment to solar thermal costs for inclusion of space heat/cooling measures	1.00	1.00	
Placeholder assumption--Value of 1.0 implies that solar space heat and cooling will cost the same per unit output as solar water heating.			
Implied Per Unit Cost Electricity Avoided by residential Solar WH/SH/Cooling	130.70	97.09	$/MWh
Implied Per Unit Cost Natural Gas Avoided by residential Solar WH/SH/Cooling	28.83	21.42	$/MMBtu
Assumes delivered solar WH/SH/Cooling replaces electric with EF of 0.93, gas with EF of 0.70 (and therefore one MMBtu of delivered solar heat is the equivalent of more than one MMBtu of each fuel).			
Implied Per Unit Cost Electricity Avoided by Solar WH/SH/Cooling (Commercial)	123.40	91.67	$/MWh
Implied Per Unit Cost Natural Gas Avoided by Solar WH/SH/Cooling (Commecial)	27.22	20.22	$/MMBtu
Assumes delivered solar WH/SH/Cooling replaces electric with EF of 0.93, gas with EF of 0.70 (and therefore one MMBtu of delivered solar heat is the equivalent of more than one MMBtu of each fuel).			
Estimated annual levelized cost of on-site Solar PV, Commercial	546	270	$/MWh
Based on inputs to/results of solar PV analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Estimated annual levelized cost of on-site residential Solar PV	506	250	$/MWh
Based on inputs to/results of solar PV analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Fuel Cost for On-site Biomass/Biogas/Landfill Gas Energy Use		2.52	$/MMBtu
Based on costs for Biomass fuel, which will likely dominate this category of fuel inputs. See "Common Assumptions" worksheet in this workbook. If significantly processed biomass fuels (such as pelletized fuels) are required, this cost may need to be increased.			
Relative Efficiency of On-site Biomass/Biogas/Landfill Gas displacing electricity		0.75	
Placeholder assumption.			
Factor to reflect probable higher costs of on-site Biomass/Biogas/Landfill Gas Equipment Relative to Electric Equipment		1.50	
Placeholder assumption--In most cases, heating/water heating equipment designed to use biomass-derived fuels will be more expensive than equipment designed to use electricity. This factor loads these incremental capital costs into estimated fuel costs.			
Implied Per Unit Cost Electricity Avoided by Biomass/Biogas/Landfill Gas	17.11	17.11	$/MWh
Incremental Cost for Green Power Purchase (from off-site, beyond supply RPS)	25.00	20.00	$/MWh
Placeholder assumption.			

	2012	2025/all	Units
Results of Costs Analyses, Building Code Revision Elements			
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Commercial Buildings (Electricity savings)	$ (625)	$ (3,572)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Commercial Buildings (Gas savings)	$ (266)	$ (1,522)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Commercial Buildings (Oil savings)	$ (49)	$ (280)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Commercial Buildings (LPG/propane savings)	$ (16)	$ (94)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Residential Buildings (Electricity savings)	$ (692)	$ (4,160)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Residential Buildings (Gas savings)	$ (781)	$ (4,692)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Residential Buildings (Oil savings)	$ (20)	$ (117)	$ thousand
Implied Annual Net Costs of Option, Code Revision Element, New and Renovated Residential Buildings (LPG/propane savings)	$ (126)	$ (758)	$ thousand
Results of Costs Analyses, Beyond Code Elements			
Implied Annual Net Costs of Option, Beyond Code Elements, Existing Commercial Buildings (Electricity savings)	$ (282)	$ (25,246)	$ thousand
Implied Annual Net Costs of Option, Beyond Code Elements, Existing Commercial Buildings (Gas savings)	$ (124)	$ (11,082)	$ thousand
Implied Annual Net Costs of Option, Beyond Code Elements, Existing Commercial Buildings (Oil savings)	$ (19)	$ (1,743)	$ thousand
Implied Annual Net Costs of Option, Beyond Code Elements, Existing Commercial Buildings (LPG/propane savings)	$ (8)	$ (684)	$ thousand
Implied Annual Net Costs of Option, Existing Housing (Electricity savings)	$ (391)	$ (35,049)	$ thousand
Implied Annual Net Costs of Option, Existing Housing (Gas savings)	$ (383)	$ (34,298)	$ thousand
Implied Annual Net Costs of Option, Existing Housing (Oil savings)	$ (10)	$ (858)	$ thousand
Implied Annual Net Costs of Option, Existing Housing (LPG/propane savings)	$ (62)	$ (5,543)	$ thousand
Implied Annual Net Costs of Action, New Commercial Buildings (Electricity savings)			
Energy Efficiency Improvement	$ (1,231)	$ (57,776)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 155	$ 9,399	$ thousand
On-site Solar PV	$ 405	$ 25,954	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (35)	$ (6,181)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ 102	$ 4,508	$ thousand
Implied Annual Net Costs of Action, New Commercial Buildings (Gas savings)			
Energy Efficiency Improvement	$ (444)	$ (22,241)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 164	$ 9,277	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (10)	$ (1,152)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Implied Annual Net Costs of Action, New Commercial Buildings (Oil savings)

Energy Efficiency Improvement	$ (66)	$ (3,407)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 2	$ 110	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (1)	$ (98)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Implied Annual Net Costs of Action, New Commercial Buildings (LPG/propane savings)

Energy Efficiency Improvement	$ (27)	$ (1,372)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 2	$ 76	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (0)	$ (41)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Implied Annual Net Costs of Action, New Housing (Electricity savings)

Energy Efficiency Improvement	$ (731)	$ (25,160)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 103	$ 4,631	$ thousand
On-site Solar PV	$ 221	$ 10,177	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (21)	$ (2,540)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ 61	$ 1,973	$ thousand

Implied Annual Net Costs of Action, New Housing (Gas savings)

Energy Efficiency Improvement	$ (699)	$ (26,513)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 279	$ 11,897	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (16)	$ (1,316)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Implied Annual Net Costs of Action, New Housing (Oil savings)

Energy Efficiency Improvement	$ (14)	$ (499)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 1	$ 19	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (0)	$ (14)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Implied Annual Net Costs of Action, New Housing (LPG/propane savings)

Energy Efficiency Improvement	$ (128)	$ (5,186)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 8	$ 328	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (2)	$ (151)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Results--Building Codes	2012	2025/all	Units
Electricity			
Recent Actions not included in forecast -- assume all recent savings are included in forecast			
Reduction in Electricity Sales: Residential	0	0	GWh (sales)
Redu		0	GWh (sales)
Redu		0	GWh (sales)
TOTA		0	GWh (sales)
Reduction in Generation Requirements	0	0	GWh (generati
GHG Emission Savings	**0.00**	**0.00**	$MMtCO_2e$

These rows are not used currently but are retained in case there is need to estimate savings from current activities

Savings due to Additional Effort in EE-5	2012	2025/all	Units
Reduction in Electricity Sales: Residential	41	249	GWh (sales)
Reduction in Electricity Sales: Commercial	37	213	GWh (sales)
Reduction in Electricity Sales: Industrial	6	37	GWh (sales)
TOTAL Reduction in Electricity Sales	85	499	GWh (sales)
Reduction in Generation Requirements	91	529	GWh (generati
GHG Emission Savings	**0.09**	**0.48**	$MMtCO_2e$

Economic Analysis (for Electricity Savings due to Additional Effort in EE-5)		
Net Present Value (2009-2025)	**-$42.0**	$million
Cumulative Emissions Reductions (2009-2025)	4.4	$MMtCO_2e$
Cost-Effectiveness	**-$9.51**	$\$/tCO_2e$

Natural Gas	2012	2025/all	Units
Recent Actions not included in forecast			
Reduction in Gas Sales: Residential	0	0	Billion BTU
Reductio		0	Billion BTU
Reductio		0	Billion BTU
Reductio		0	Billion BTU
GHG Emission Savings	0	0.00	$MMtCO_2e$

These rows are not used currently but are retained in case there is need to estimate savings from current activities

Savings due to Additional Effort in EE-5	2012	2025/all	Units
Reduction in Gas Sales: Residential	442	2,657	Billion BTU
Reduction in Gas Sales: Commercial	151	862	Billion BTU
Reduction in Gas Sales: Industrial	33	199	Billion BTU
Total Reduction in Gas Use	626	3,717	Billion BTU
GHG Emission Savings	0.03	0.19	$MMtCO_2e$

Economic Analysis (for Gas Savings due to Additional Effort in EE-5)		
Net Present Value (2009-2025)	**-$32.9**	$million
Cumulative Emissions Reductions (2009-2025)	1.7	$MMtCO_2e$
Cost-Effectiveness	**-$19.16**	$\$/tCO_2e$

Oil	2012	2025/all	Units
Savings due to Additional Effort in EE-5			
Reduction in Oil Sales: Residential	2	11	Billion BTU
Reduction in Oil Sales: Commercial	5	27	Billion BTU
Total Reduction in Oil Use	7	38	Billion BTU
GHG Emission Savings	0.00	0.00	$MMtCO_2e$

Economic Analysis (for Oil Savings due to Additional Effort in EE-5)		
Net Present Value (2009-2025)	**-$2.0**	$million
Cumulative Emissions Reductions (2009-2025)	0.0	$MMtCO_2e$
Cost-Effectiveness	**-$79.86**	$\$/tCO_2e$

LPG/propane	2012	2025/all	Units
Savings due to Additional Effort in EE-5			
Reduction in LPG Sales: Residential	16	94	Billion BTU
Reduction in LPG Sales: Commercial	2	12	Billion BTU
Total Reduction in LPG Use	18	105	Billion BTU
GHG Emission Savings	0.00	0.01	$MMtCO_2e$

Economic Analysis (for LPG/Propane Savings due to Additional Effort in EE-5)		
Net Present Value (2009-2025)	**-$4.3**	$million
Cumulative Emissions Reductions (2009-2025)	0.1	$MMtCO_2e$
Cost-Effectiveness	**-$72.03**	$\$/tCO_2e$

Summary Results for Building Code portion of EE-5	2012	2025	Units
Recent Actions Not Included in Forecast (Current/planned building code changes)			
Electric GHG Emission Savings	**0.00**	**0.00**	$MMtCO_2e$
Gas GHG Emission Savings	**0.00**	**0.00**	$MMtCO_2e$
Total GHG Emission Savings	**0.00**	**0.00**	$MMtCO_2e$
Total for Code Changes under Option (All Fuels)			
GHG Emission Savings	**0.12**	**0.68**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$81**	$million
Cumulative Emissions Reductions (2009-2025)		6.2	$MMtCO_2e$
Cost-Effectiveness		**-$13.05**	$\$/tCO_2e$

Results--Appliance and Equipment Standards	2012	2025/all	Units
Electricity			
Reduction in Electricity Sales: Residential	651	5,046	GWh (sales)
Reduction in Electricity Sales: Commercial	6	29	GWh (sales)
TOTAL Reduction in Electricity Sales	657	5,074	GWh (sales)
Reduction in Generation Requirements	700	5,378	GWh (generati
GHG Emission Savings	**0.69**	**4.89**	$MMtCO_2e$
Economic Analysis (for Electricity Savings due to Additional Effort in EE-5)			
Net Present Value (2009-2025)		**-$1,359.3**	$million
Cumulative Emissions Reductions (2009-2025)		44.9	$MMtCO_2e$
Cost-Effectiveness		**-$30.29**	$\$/tCO_2e$
Natural Gas			
Reduction in Natural Gas Sales: Residential	3,311	24,831	Billion BTU
Reduction in Natural Gas Sales: Commercial	0	0	Billion BTU
TOTAL Reduction in Natural Gas Sales	3,311	24,831	Billion BTU
GHG Emission Savings	**0.17**	**1.29**	$MMtCO_2e$
Economic Analysis (for Natural Gas Savings due to Additional Effort in EE-5)			
Net Present Value (2009-2025)		**-$284.3**	$million
Cumulative Emissions Reductions (2009-2025)		10.3	$MMtCO_2e$
Cost-Effectiveness		**-$27.48**	$\$/tCO_2e$

Summary Results for Appliance/Equipment standards portion of EE-5	2012	2025	Units
Total for Appliance and Equipment Standards under Option (Electricity and Gas)			
GHG Emission Savings	**0.86**	**6.18**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$1,644**	$million
Cumulative Emissions Reductions (2009-2025)		55.2	$MMtCO_2e$
Cost-Effectiveness		**-$29.77**	$\$/tCO_2e$

Results--Beyond Code Building Improvements, Existing and New	2012	2025/all	Units
Electricity			
Reduction in Electricity Sales: Residential	72	3,879	GWh (sales)
Reduction in Electricity Sales: Commercial	99	5,629	GWh (sales)
TOTAL Reduction in Electricity Sales	170	9,508	GWh (sales)
Reduction in Generation Requirements	182	10,076	GWh (generation)
GHG Emission Savings	**0.18**	**9.16**	$MMtCO_2e$
Economic Analysis (for Electricity Savings due to Additional Effort in EE-5)			
Net Present Value (2009-2025)		**-$283.8**	$million
Cumulative Emissions Reductions (2009-2025)		54.6	$MMtCO_2e$
Cost-Effectiveness		**-$5.20**	$\$/tCO_2e$
Natural Gas			
Reduction in Natural Gas Sales: Residential	629	35,445	Billion BTU
Reduction in Natural Gas Sales: Commercial	332	19,744	Billion BTU
TOTAL Reduction in Natural Gas Sales	961	55,189	Billion BTU
GHG Emission Savings	**0.05**	**2.87**	$MMtCO_2e$
Economic Analysis (for Natural Gas Savings due to Additional Effort in EE-5)			
Net Present Value (2009-2025)		**-$226.2**	$million
Cumulative Emissions Reductions (2009-2025)		16.8	$MMtCO_2e$
Cost-Effectiveness		**-$13.49**	$\$/tCO_2e$
Oil			
Reduction in Oil Sales: Residential	2	132	Billion BTU
Reduction in Oil Sales: Commercial	8	513	Billion BTU
TOTAL Reduction in Oil Sales	11	646	Billion BTU
GHG Emission Savings	**0.00**	**0.05**	$MMtCO_2e$
Economic Analysis (for Oil Savings due to Additional Effort in EE-5)			
Net Present Value (2009-2025)		**-$19.4**	$million
Cumulative Emissions Reductions (2009-2025)		0.3	$MMtCO_2e$
Cost-Effectiveness		**-$70.48**	$\$/tCO_2e$
LPG/propane			
Reduction in LPG/propane Sales: Residential	24	1,370	Billion BTU
Reduction in LPG/propane Sales: Commercial	4	266	Billion BTU
TOTAL Reduction in LPG/propane Sales	29	1,636	Billion BTU
GHG Emission Savings	**0.00**	**0.10**	$MMtCO_2e$
Economic Analysis (for LPG/propane Savings due to Additional Effort in EE-5)			
Net Present Value (2009-2025)		**-$25.2**	$million
Cumulative Emissions Reductions (2009-2025)		0.6	$MMtCO_2e$
Cost-Effectiveness		**-$41.52**	$\$/tCO_2e$

Summary Results for Beyond Code portion of EE-5	2012	2025	Units
Total for Beyond Code Building Improvements, Existing and New (All fuels)			
GHG Emission Savings	**0.23**	**12.19**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$555**	$million
Cumulative Emissions Reductions (2009-2025)		72.2	$MMtCO_2e$
Cost-Effectiveness		**-$7.68**	$\$/tCO_2e$

Summary Total: All Elements of EE-5	2012	2025/all	Units
Total for All Elements of EE-5 (All fuels)			
GHG Emission Savings	**1.22**	**19.05**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$2,279**	$million
Cumulative Emissions Reductions (2009-2025)		133.6	$MMtCO_2e$
Cost-Effectiveness		**-$17.06**	$\$/tCO_2e$

NOTES AND DATA FROM SOURCES

Note 1:

From The Energy Efficiency Task Force Report to the Clean and Diversified Energy Advisory Committee of the Western Governors Association.
The Potential for More Efficient Electricity Use in the Western United States, January, 2006. This report is referred to here as the “WGA CDEAC EE report” and can be found at:
http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf.
The CDEAC report provides a cost of saved energy (electricity)
based on an average 7-year payback for code improvements (page 42).

For Illinois, the equivalent cost is estimated as follows for electricity and natural gas

payback	7	years, from CDEAC report	
lifespan	25	years, conservative assumption	
elec price	**87.10**	$/MWh	see common factors
NG price	**$9.16**	$/MMBTU	see common factors

Electricity levelized cost	$43.260	$/MWh
Natural Gas levelized cost	$4.548	$/MMBTU

As a point of reference, an USDOE National Renewable Energy Laboratory study of building energy efficiency measures applied applied to a "representative" home in Greensburg, KS, found that improvements to increase the home's energy efficiency to 30 better than required by 2003 IECC codes yielded a simple payback (cost of improvements divided by annual utility savings) of 5.5 years ("Example Performance Targets and Efficiency Packages, Greensburg, Kansas", by Dr. Ren Anderson, NREL, 2007). Available as http://www.nrel.gov/docs/fy08osti/43944.pdf.

Note 2:

Based on results from Table 5.8 of the 2002 Energy Consumptions by Manufacturers--Data Tables published by the US Department of Energy's Energy Information Administration, and available as http://www.eia.doe.gov/emeu/mecs/mecs2002/data02/pdf/table5.8_02.pdf, approximately 17% of industrial electricity use in the Midwest Census region is used for HVAC, lighting, and "other facility support", with 14% of natural gas used for HVAC and "other facility support".

In Illinois, as of 2005, total electricity and gas use by sector was as follows (for electricity, from Retail Sales of Electricity by State by Provider, downloaded from
http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html (file sales_revenue.xls), for gas, from USDOE EIA data, and for both electricity and gas, as reported in the "Fuel Forecast" worksheets in this workbook).

	MWh	Fraction of Total	GBtu	Fraction of Total
Residential	48,593	34%	450,699	49%
Commercial	49,977	35%	207,939	22%
Industrial	45,888	32%	268,352	29%
Total	144,458	100%	926,990	100%

Thus industrial use of electricity for non-process uses in Illinois may be roughly 8.1% of total Residential and Commercial electricity use, and industrial use of gas for non-process uses in Illinois may be roughly 5.6% of total Residential and Commercial gas use.
These figures are used as initial rules of thumb in estimating the contribution of savings from this policy from industrial sector measures.

Note 3:

The estimate of 0.6 unit of renovated space per unit of new construction in the commercial sector is a rough assumption.
It is likely that the ratio of commercial space undergoing major renovation to new commerial space will fluctuate year by year. A review of CBECS data (Table B5) suggests that in the East North Central Region renovated space (space renovated since 1980) is nearly one-third of new commercial building space constructed since 1980, just counting "annexes and additions", and building space undergoing any kind of renovation was nearly equal to the amount of space constructed since 1980. Some of these renovations likely would not affect building energy performance, but CBECS data suggest that a substantial portion of renovated space involves changes to outside walls and roofs, additions or annexes, or changes to HVAC systems, all of which would seem to be markets for EE-5.
It is clear that the renovation market represents a substantial opportunity for improving energy efficiency through code changes.
Looking at the few easily accessible studies nationwide, a study of the non-residential renovation market in California (Remodeling and Renovation of Nonresidential Buildings in California, by Donald R. Dohrmann, John H. Reed, Sylvia Bender, Catherine Chappell, and Pierre Landry, available as http://www.energy.ca.gov/papers/2002-08-18_aceee_presentations/PANEL-10_DOHRMANN.PDF) suggests that by 1999 the value of renovations and additions to non-residential space was similar to that in new non-residential space, based on building permit data. As both California likely includes more new building space than the Midwest, as a fraction of total building stock, the analogy with California may be imperfect here. A study for a Texas building code report (see http://www.pnl.gov/main/publications/external/technical_reports/PNNL-15356.pdf) referenced the California report, but concluded that a more appropriate "conservative" value was approximately 20 percent as a long-term national average.

Note 4:
The analysis of new building codes is based roughly on the analytical structure used by the Building Codes Assistance Project (see http://www.bcap-energy.org). The analysis uses existing energy consumption and parameters to account for savings due to energy used for space conditioning in different climates and the estimated impact of building codes.

Note 5:
The following parameters are used to adjust the total electricity consumption in the residential sector to electricity use for space conditioning (data from the Residential Energy Consumption Survey (EIA)). A parameter for the commercial sector is used to adjust estimates of commercial electric energy use for Heating, Cooling, & Lighting for new buildings for climate.

July 2002-June 2003 State Heating Degree Days (HDD)						
				Residential		**Commercial**
	HDD65	CDD65	RECS Climate Zone	% electric space conditioning, WH and Lighting	% gas space conditioning and WH	
IL	6355	876	2	42.7%	92.9%	1.2408

Sources: http://www5.ncdc.noaa.gov/climatenormals/hcs/HCS_52.pdf and http://www5.ncdc.noaa.gov/climatenormals/hcs/HCS_51.pdf

Energy Intensity Correction Factor by Climate Zone

All Buildings	1.1538
>7000 HDD	1.1309
5500-7000	1.2408
4000-5499	1.0297
<4000	1.1986
>2000 CDD & <4000 HDD	1.1953

Household Electricity End Use						
	Climate Zone					
	<2000 CDD				>2000 CDD and <4000 HDD	
	>7000 HDD	5500-7000 HDD	4000-5499 HDD	<4000 HDD		
Quadrillion Btus						
Climate Category	**1**	**2**	**3**	**4**	**5**	
Space-Heating	0.02	0.05	0.09	0.07	0.06	
Electric AC (central & room)	0.02	0.10	0.17	0.16	0.42	
Water Heating	0.04	0.07	0.10	0.08	0.13	
Refrigerators	0.05	0.12	0.13	0.11	0.11	
Other Appliance & Lighting	0.23	0.50	0.57	0.47	0.49	
TOTAL	0.36	0.84	1.06	0.89	1.21	4.36
Lighting (% of total)	16.5%	16.5%	16.5%	16.5%	16.5%	***See Note 9***
Percent Electric Space Conditioning, WH, and Lighting	**38.7%**	**42.7%**	**50.4%**	**51.3%**	**66.9%**	
Source: 2005 RECS (http://www.eia.doe.gov/emeu/recs/recs2005/c&e/detailed_tables2005c&e.html)						

Household Natural Gas End Use					
	Climate Zone				
	<2000 CDD				>2000 CDD and <4000 HDD
	>7000 HDD	5500-7000 HDD	4000-5499 HDD	<4000 HDD	
Quadrillion Btus					
Climate Category	**1**	**2**	**3**	**4**	**5**
Space-Heating	0.45	1.20	0.86	0.31	0.13
Electric AC (central & room)	0.00	0.00	0.00	0.00	0.00
Water Heating	0.13	0.38	0.33	0.36	0.20
Appliances	0.03	0.12	0.10	0.12	0.07
TOTAL	0.61	1.70	1.29	0.79	0.40

Note 6:

Full set of CBECS data tables available at http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003pdf/alltables.pdf

2003 CBECS electricity end-use data below extracted from http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003excel/e05.xls

Released: September, 2008

Table E5. Electricity Consumption (kWh) by End Use for Non-Mall Buildings, 2003

	Total Electricity Consumption (billion kWh)										
	Total	Space Heating	Cooling	Ventilation	Water Heating	Lighting	Cooking	Refrigeration	Office Equipment	Computers	Other
Midwest........................	214	13	15	30	3	84	1	26	4	10	28
East North Central.....	153	8	10	23	2	61	1	17	3	8	20
West North Central.....	62	5	5	7	1	23	0.0	9	1	3	8
IMPLIED FRACTION OF TOTAL CONSUMPTION											
Midwest........................	100.0%	6.1%	7.0%	14.0%	1.4%	39.3%	0.5%	12.1%	1.9%	4.7%	13.1%
East North Central.....	100.0%	5.2%	6.5%	15.0%	1.3%	39.9%	0.7%	11.1%	2.0%	5.2%	13.1%
West North Central.....	100.0%	8.1%	8.1%	11.3%	1.6%	37.1%	0.0%	14.5%	1.6%	4.8%	12.9%

2003 CBECS natural gas end-use data below extracted from http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003excel/e07.xls

Released: September, 2008

Table E7. Natural Gas Consumption (Btu) and Energy Intensities by End Use for

	(trillion Btu)					(thousand Btu/square foot)				
	Total	Space Heating	Water Heating	Cooking	Other	Total	Space Heating	Water Heating	Cooking	Other
Midwest........................	705	555	80	29	41	53.5	42.1	6.1	2.2	3.1
East North Central.....	528	424	60	20	24	55.2	44.3	6.3	2.1	2.5
West North Central.....	177	131	20	8	18	49.1	36.5	5.5	2.4	4.8
IMPLIED FRACTION OF TOTAL CONSUMPTION										
Midwest........................	100%	78.7%	11.3%	4.1%	5.8%					
East North Central.....	100%	80.3%	11.4%	3.8%	4.5%					
West North Central.....	100%	74.0%	11.3%	4.5%	10.2%					

2003 CBECS oil products end-use data below extracted from http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003excel/e09.xls

Released: September, 2008

Table E9. Fuel Oil Consumption (Btu) and Energy Intensities by End Use for

	(trillion Btu)					(thousand Btu/square foot)				
	Total	Space Heating	Water Heating	Cooking	Other	Total	Space Heating	Water Heating	Cooking	Other
Midwest........................	24	Q	1	Q	1	8.3	7.6	0.2	0.0	0.5
East North Central.....	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
West North Central.....	Q	Q	Q	Q	Q	14.4	12.9	0.5	0.1	0.9
IMPLIED FRACTION OF TOTAL CONSUMPTION (Where calculations are possible from data above)										
Midwest........................		91.6%	2.4%	0.0%	6.0%					
East North Central.....		93.9%				Estimated from data above and regional floorspace data.				
West North Central.....		89.6%	3.5%	0.7%	6.3%					

Note 7:

Table below from ASAP and ACEEE, 2006. "Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards", http://www.aceee.org/store/proddetail.cfm?CFID=2177299&CFTOKEN=30942959&ItemID=411&CategoryID=7, and "Energy Standards Benefits -- 2006 Model Energy Bill" for Illinois, file s062_il.pdf, obtained from the Appliance Standards Awareness Project, 11/11/08.

Energy Efficiency Standards Benefits -- 2006 Model Bill

Illinois																
Summary of Benefits by Product				2020							2030					
								Emissions Reductions								
Products	Annual Savings per Unit	Incremental Cost per Unit	Annual Energy Savings from One Year's Sales	Energy Savings	Summer Peak Capacity Reduction	Direct and Indirect Natural Gas Savings[1]	Value of Bill Savings[2]	Carbon	NOx	SO2	Energy Savings	Summer Peak Capacity Reduction	Value of Bill Savings[2]	Pay Back Period	Net Present Value[3]
	kWh or [therms]	$	GWh [Million CF]	GWh [Million CF]	MW	Million CF	$Million	1000 MT	Metric Tons	Metric Tons	GWh [Million CF]	MW	$Million	Years	$Million (2005$)
Bottle-type water dispensers	266	12	1.5	11.6	1.6	58.9	1.0	2.4	7.7	40.2	11.6	1.6	1.0	0.5	8.3
Commercial boilers[4]	[420]	2,968	[23.8]	[202.1]	NA	202.1	2.1	3.3	9.8	0.1	[439.8]	NA	4.6	5.7	20.7
Commercial hot food holding cabinets	1,815	453	1.3	16.5	5.4	83.7	1.4	3.5	10.9	57.1	19.8	6.5	1.6	3.0	9.4
Compact audio products	53	1	15.2	76.1	10.5	385.2	6.4	16.0	50.2	262.7	76.1	10.5	6.4	0.2	62.5
DVD players and recorders	11	1	2.2	11.0	1.5	55.8	0.9	2.3	7.3	38.0	11.0	1.5	0.9	1.1	7.1
Liquid-immersed distribution transformers	6	2	28.8	360.2	49.7	1,824.5	29.6	75.7	237.9	1,244.1	648.4	89.5	53.2	5.0	289.5
Medium voltage dry-type distribution transformers	6/kVA	2/kVA	1.8	22.1	3.1	112.0	1.8	4.6	14.6	76.4	39.8	5.5	3.3	4.1	19.3
Metal halide lamp fixtures	307	30	31.7	396.4	129.7	2,007.7	32.5	83.3	261.8	1,369.0	634.2	207.5	52.1	1.2	346.8
Pool heaters[4]	[58]	295	[23.9]	[203.1]	NA	203.1	2.2	3.3	9.9	0.1	[358.4]	NA	3.9	4.8	12.8
Portable electric spas (hot tubs)	250	100	0.6	5.9	1.4	29.9	0.5	1.2	3.9	20.4	5.9	1.4	0.5	4.7	1.8
Residential furnaces and residential boilers[4,5]	770	100	120.6	1,025.2	171.5	19,142.5	241.1	445.4	1,360.5	3,545.8	2,171.0	363.3	510.6	1.5	2,196.3
	[102]	[373]	[1607.2]	[13949.8]							[29557.8]			[3]	
Residential pool pumps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Singe-voltage external AC to DC power supplies	4	0.5	30.8	215.3	29.7	1,090.5	18.2	45.2	142.2	743.6	215.3	29.7	18.2	1.4	135.6
State-regulated incandescent reflector lamps	61	1	270.7	254.5	62.8	1,289.1	20.9	53.5	168.1	879.0	254.5	62.8	20.9	0.1	197.7
Walk-in refrigerators and freezers	8,220	957	17.6	211.8	49.3	1,072.7	17.4	44.5	139.9	731.5	211.8	49.3	17.4	1.4	127.6
Total			**523**	**2,607**	**516**	**27,558**	**376**	**784**	**2,425**	**9,008**	**4,299**	**829**	**695**		**3,435**
[natural gas]			**[1654.9]**	**[14355]**							**[30356]**				

Notes:

[1] Direct natural gas savings are savings from use of more efficient natural gas appliances. Indirect natural gas savings are reductions in natural gas at power plants due to use of more efficient electric appliances. Indirect gas savings assume that half the power saved at power plants would be generated with natural gas.

[2] Value of energy savings is based on energy savings and average state energy prices. This value does not take account of the incremental cost of more efficient products.

[3] Net present value is the total monetary value of bill savings achieved by products sold under the standards between now and 2030 minus the total incremental product cost incurred by purchasers as a result of the standards over the same period expressed in current dollars. Both costs and savings are discounted using a 5% real discount rate.

[4] Commercial boilers, pool heaters, and residential boilers and furnaces save natural gas. Gas savings are expressed in cubic feet and enclosed in brackets to distinguish from electricity savings.

[5] Residential furnaces and boilers include both natural gas and oil furnaces and boilers as well as furnace fans. Annual savings per unit, incremental cost per unit and pay back period shown here are just for gas furnaces and furnace fans, which are the most common of these products. For these calculations, gas furnace values are enclosed in brackets and listed below furnace fan values.

Note 8:
Estimates of savings through measures to increase the efficiency of Portable Luminaires are based on data from
2008 Appliance Efficiency Rulemaking, California Energy Commission Staff Report, August, 2008, CEC-400-2008-022, PHASE 1, PART A,
DOCKET # 08-AAER-1A, available as http://www.energy.ca.gov/2008publications/CEC-400-2008-022/CEC-400-2008-022.PDF.
California sales of Portable Luminaires are estimated in this document at 5,662,757 units per year in 2008 to 2010. It is assumed that the
same rate of sales per household applies to this jurisdiction through the analysis period, that is, a rate of about 0.415 units per household per year.

Note 9:
Estimates of lighting energy use were not available on a regional or climate-zone basis, so it was assumed that approximately the same fraction of
electricity was used for lighting in all homes in the region. The fraction used was derived from 2006 estimates presented in Table 2.1.5 of the
Building Energy Databook, available as http://buildingsdatabook.eren.doe.gov/docs%5CDataBooks%5C2008_BEDB_Updated.pdf.
In that table, total national electricity use for lighting was estimated at 0.76 QBtu, as compared with total on-site electricity use of
4.61 QBtu.

Note 10:
Reflects an interpretation of EE-5 goals as expressed by the the EEAG. The EEAG's goal statement for codes element of EE-5 states (in part)
"Specifically, this improvement goal should increase building energy efficiency to meet or exceed IECC 2009 for residential construction and
ASHRAE 90.1 2007 edition for commercial buildings." Assumes that improvement will be the equivalent of the savings estimated for the
Energy Efficient Codes Coalition (EECC) by ICF as resulting from an improvement from IECC 2006 equivalent residential building energy codes to
IECC 2009 codes for the climate zone(s) in which this jurisdiction is located. Based on EECC results from a workbook dated January, 2009,
obtained from an EEAG member and summarized in the worksheet "Building_Code_Data" in this workbook (summarized in narrative form as
the document Energy & Cost Savings Analysis of 2009 IECC Efficiency Improvements, As Adopted by the ICC September 22, 2008,
An Analysis Prepared for the Energy Efficient Codes Coalition (EECC) by ICF International, available as
http://www.thirtypercentsolution.org/solution/EECC-Savings_Analysis-Jan-2009.pdf, with a workbook printout available as
http://www.thirtypercentsolution.org/solution/ICF-data.pdf), fractional electricity and gas savings in
improving from 2006 IECC residential building energy codes to 2009 codes is calculated as follows for this jurisdiction:

Fuel Type and End Uses Included in Denominator of Fractions Shown	**Climate Zone 4**	**Climate Zone 5**	**Implied Weighted-Average Savings**
Electricity used for heating, cooling, water heating, and lighting	14.69%	15.29%	15.20%
Gas used for heating, cooling, and water heating	9.91%	7.72%	8.05%
Rough estimate of population fraction by Zone	15%	85%	

Estimate of Mitigation Option Costs and Benefits for Midwestern Governors' Association Energy Efficiency Advisory Group GHG Analysis

EE-6 **Have the Public Sector Lead by Example**

RESULTS FOR ILLINOIS

Date Last Modified:	12/11/2008 D. Von Hippel/M. Brown

Key Data and Assumptions	2012	2025/all	Units
First Year Results of EE-6 Programs Accrue		2010	
Based on an assumption that implementation will begin "immediately", as described in Option Document			
Electricity			
Levelized Cost of Electricity Savings		$43.3	$/MWh
Based on 7 year payback as estimated in WGA CDEAC EE Report. (See Note 1, below.)			
Levelized Cost of Natural Gas Savings		$4.5	$/MMBtu
Based on 7 year payback as estimated in WGA CDEAC EE Report. (See Note 1, below.) Also used for measures that reduce oil and LPG/propane use, as those fuels serve substantially the same end-uses as natural gas.			
Avoided Electricity Cost		$60	$/MWh
Weighted average over total 2007-2020 electricity savings for this policy in each sector. See common assumptions ("Common Factors" worksheet in this workbook).			
Avoided Natural Gas Cost		$6.3	$/MMBtu
See common assumptions ("Common Factors" worksheet in this workbook)			
Avoided Distillate Oil Cost		$15.0	$/MMBtu
See common assumptions ("Common Factors" worksheet in this workbook)			
Avoided LPG/Propane Cost		$12.6	$/MMBtu
See common assumptions ("Common Factors" worksheet in this workbook)			

Other Data, Assumptions, Calculations	2012	2025/all	Units

Fractional Energy Savings Targets from Existing or Recent Actions (all fuels). Savings are assumed, based on existing policies, that reduce forecast energy consumption by the public sector (state/provincial and local government) by:

5% by 2025, assuming a program start date of 2007

	2012	2025/all
Fractional Savings by year are thus:	1.58%	5.00%

Placeholder values, to be replaced with data from jurisdictions when available.

Fractional EE-6 Energy Savings Targets (all fuels). Savings are assumed, based on goals in Policy Design, to reduce forecast public sector energy use by: 15% by 2015, 20% by 2020, and 25% by 2025. It is assumed that this trend continues to yield savings of 30% by 2030.

	2012	2025/all
Fractional Savings by year are thus:	7.50%	25.00%

Residential Sector Assumptions and Calculations (background for public housing measures)

	2012	2025/all	Units
Population	12,988,724	13,340,507	
Number of housing units	5,445,140	5,801,015	

Based on census data for 2000-2007. From 2008-on, assumes that average rate of growth of housing stock varies with the rate of growth in population year-to-year multiplied by the ratio of average housing stock growth and population growth in 2000-2007, as computed below. This means that housing will continue to grow faster than population, consistent with a trend of decreasing household size as populations age. Note that this algorithm will not work well where populations are decreasing. In those cases, a different algorthm should be used.

	2012	2025/all	Units
Average Annual Growth Rate of Population, 2000-2007		**0.42%**	
Average Annual Growth Rate of Housing Stock, 2000-2007		**0.99%**	
Ratio of above		**2.37**	
Persons per household (provided for reference)	2.385	2.300	
Net New housing units added annually	35,636	21,436	

Calculated based on data and assumptions above.

	2012	2025/all	Units
New Private Housing Units Authorized (2003-2007 Census Data, for reference)			
Average Ratio of New Private Housing Units to Net New Housing Units Calculated As Above, 2003-2007, provided for reference only.		1.126	
Residential Electricity Use	51,724	51,955	GWh/yr
Residential Gas Use	455,812	463,517	GBtu/yr
Residential Oil Use	1,517	1,404	GBtu/yr
Residential LPG/Propane Use	18,340	21,143	GBtu/yr

Using Forecast Set #1: Estimates based on AEO Projections (Forecast set chosen in EE-3 option analysis for this jurisdiction).

	2012	2025/all	Units
Commercial Sector Assumptions and Calculations			
Commercial Floorspace (million square feet)	3,540	3,636	
Implied New Commercial Floorspace (million square feet/yr)	10	6	

Estimated from jurisdiction-level historical data and USDOE AEO projections for regional growth in commercial floorspace by region. See "Multi_jurisdiction_data" worksheet in this workbook.

	2012	2025/all	Units
Commercial Electricity Use	57,555	70,166	GWh/yr
Commercial Gas Use	216,185	238,822	GBtu/yr
Commercial Oil Use	5,048	5,489	GBtu/yr
Commercial LPG/Propane Use	3,308	3,449	GBtu/yr

Using Forecast Set #1: Estimates based on AEO Projections (Forecast set chosen in EE-3 option analysis for this jurisdiction).

Other Data, Assumptions, Calculations	2012	2025/all	Units

Energy Efficiency Improvements in Existing and New Public-Sector Buildings

Estimate of fraction of occupied homes in public housing	**1.52%**		

Midwest average calculated from reported number of housing units "owned by public housing authority" from page 80 of American Housing Survey for the United States: 2007, U.S. Department of Housing and Urban Development and U.S. Census Bureau, available as http://www.census.gov/prod/2008pubs/h150-07.pdf. State-specific data are available for 1998--see "Multi_jurisdiction_data" worksheet in this workbook. Note that publicly-owned housing is only a portion of the total of the housing stock used by those receiving public housing assistance, so a broader definition of this fraction may be appropriate.

Fraction of commercial/institutional building floorspace in State or Provincial government-owned buildings		4.6%	
Fraction of commercial/institutional building floorspace in local government-owned buildings		21.7%	

Calculated from estimates of government-sector floorspace fractions derived from CBECS data--see "Multi-jurisdiction_data" worksheet in this workbook.

Use of electricity per unit of public housing relative to average housing unit	100.0%		
Use of natural gas per unit of public housing relative to average housing unit	100.0%		
Use of oil per unit of public housing relative to average housing unit	100.0%		
Use of LPG/propane per unit of public housing relative to average housing unit	100.0%		

Placeholder values--to be updated when better data are available.

	2012	2025/all	Units
Implied use of electricity in public housing before application of policies.	787	790	GWh/yr
Implied use of natural gas in public housing before application of policies.	6,933	7,050	GBtu/yr
Implied use of oil in public housing before application of policies.	23	21	GBtu/yr
Implied use of LPG/propane in public housing before application of policies.	279	322	GBtu/yr

Use of electricity per unit floorspace in state/provincial and local public buildings relative to average commercial sector building	117.4%		
Use of natural gas per unit floorspace in state/provincial and local public buildings relative to average commercial sector building	117.4%		
Use of oil per unit floorspace in state/provincial and local public buildings relative to average commercial sector building	117.4%		
Use of LPG/propane per unit floorspace in state/provincial and local public buildings relative to average commercial sector building	117.4%		

*Placeholder values based on CBECS data (see **Note 2**)--to be updated when better data are available.*

	2012	2025/all	Units
Implied use of electricity in state/provincial and local public buildings before application of policies.	17,802	21,702	GWh/yr
Implied use of natural gas in state/provincial and local public buildings before application of policies.	66,866	73,867	GBtu/yr
Implied use of oil in state/provincial and local public buildings before application of policies.	1,561	1,698	GBtu/yr
Implied use of LPG/propane in state/provincial and local public buildings before application of policies.	1,023	1,067	GBtu/yr

CALCULATION OF SAVINGS

Public Sector Building Energy Efficiency Improvements Through Existing Policies

	2012	2025/all	Units
Implied total cumulative electricity savings in public-sector non-residential buildings through implementation of recent policies.	281.1	1,085.1	GWh/yr
Implied total cumulative natural gas savings in public-sector non-residential buildings through implementation of recent policies.	1,055.8	3,693.4	GBtu/yr
Implied total cumulative oil savings in public-sector non-residential buildings through implementation of recent policies.	24.7	84.9	GBtu/yr
Implied total cumulative LPG/propane savings in public-sector non-residential buildings through implementation of recent policies.	16.2	53.3	GBtu/yr
Implied total cumulative electricity savings in public housing through implementation of recent policies.	12.4	39.5	GWh/yr
Implied total cumulative natural gas savings in public housing through implementation of recent policies.	109.5	352.5	GBtu/yr
Implied total cumulative oil savings in public housing through implementation of recent policies.	0.4	1.1	GBtu/yr
Implied total cumulative LPG/propane savings in public housing through implementation of recent policies.	4.4	16.1	GBtu/yr
Implied total cumulative electricity savings in public sector non-residential buildings through implementation of EE-6	1,335.1	5,425.5	GWh/yr
Implied total cumulative natural gas savings in public sector non-residential buildings through implementation of EE-6.	5,014.9	18,466.8	GBtu/yr
Implied total cumulative oil savings in public sector non-residential buildings through implementation of EE-6.	117.1	424.4	GBtu/yr
Implied total cumulative LPG/propane savings in public sector non-residential buildings through implementation of EE-6.	76.7	266.7	GBtu/yr
Implied total cumulative electricity savings in public housing through implementation of EE-6.	59.0	197.6	GWh/yr
Implied total cumulative natural gas savings in public housing through implementation of EE-6.	520.0	1,762.5	GBtu/yr
Implied total cumulative oil savings in public housing through implementation of EE-6.	1.7	5.3	GBtu/yr
Implied total cumulative LPG/propane savings in public housing through implementation of EE-6.	20.9	80.4	GBtu/yr

	2012	2025/all	Units
Energy Efficiency Improvements in Public Buildings (includes both new and existing buildings)			
Average Fraction of Improvement in Electric Energy Intensities for non-residential public sector buildings from:			
Energy Efficiency Improvement	90%	80%	
Solar Thermal Energy (hot water/space heat/space cooling)	3%	7%	
On-site Solar PV	1%	3%	
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	5%	
Green Power Purchase (from off-site, beyond electricity supply RPS)	5%	5%	
All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.			
Average Fraction of Improvement in Gas and Oil Energy Intensities for non-residential public sector buildings from:			
Energy Efficiency Improvement	96%	92%	
Solar Thermal Energy (hot water/space heat/space cooling)	3%	5%	
On-site Solar PV	0%	0%	
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	3%	
Green Power Purchase (from off-site, beyond electricity supply RPS)	0%	0%	
All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.			
Implied Cumulative Impacts of Action, Non-residential Public Sector Buildings (Electricity savings)			
Energy Efficiency Improvement	**1,201.6**	**4,340.4**	GWh/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**40.1**	**379.8**	GWh/yr
On-site Solar PV	**13.4**	**162.8**	GWh/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**13.4**	**271.3**	GWh/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**66.8**	**271.3**	GWh/yr
Implied Cumulative Impacts of Action, Non-residential Public Sector Buildings (Natural Gas savings)			
Energy Efficiency Improvement	**4,814.3**	**16,989.4**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**150.4**	**923.3**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**50.1**	**554.0**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr
Implied Cumulative Impacts of Action, Non-residential Public Sector Buildings (Oil Products savings)			
Energy Efficiency Improvement	**112.4**	**390.5**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**3.5**	**21.2**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**1.2**	**12.7**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr
Implied Cumulative Impacts of Action, Non-residential Public Sector Buildings (LPG/propane savings)			
Energy Efficiency Improvement	**73.7**	**245.4**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**2.3**	**13.3**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.8**	**8.0**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

Average Fraction of Improvement in Electric Energy Intensities for Housing from:

Energy Efficiency Improvement	90%	80%
Solar Thermal Energy (hot water/space heat/space cooling)	3%	7%
On-site Solar PV	1%	3%
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	5%
Green Power Purchase (from off-site, beyond electricity supply RPS)	5%	5%

All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.

Average Fraction of Improvement in Gas and Oil Energy Intensities for Housing from:

Energy Efficiency Improvement	96%	92%
Solar Thermal Energy (hot water/space heat/space cooling)	3%	5%
On-site Solar PV	0%	0%
On-site Biomass/Biogas/Landfill Gas Energy Use	1%	3%
Green Power Purchase (from off-site, beyond electricity supply RPS)	0%	0%

All "placeholder" assumptions, except on-site biomass/biogas/landfill gas energy use calculated so that values sum to 100%.

Implied Cumulative Impacts of Option, Public Housing (Electricity savings)

Energy Efficiency Improvement	**53.1**	**158.0**	GWh/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**1.8**	**13.8**	GWh/yr
On-site Solar PV	**0.6**	**5.9**	GWh/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.6**	**9.9**	GWh/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**3.0**	**9.9**	GWh/yr

Implied Cumulative Impacts of Option, Public Housing (Natural Gas savings)

Energy Efficiency Improvement	**499.2**	**1,621.5**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**15.6**	**88.1**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**5.2**	**52.9**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

Implied Cumulative Impacts of Option, Public Housing (Oil Products savings)

Energy Efficiency Improvement	**1.66**	**4.91**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**0.05**	**0.27**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.02**	**0.16**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

Implied Cumulative Impacts of Option, Public Housing (LPG/propane savings)

Energy Efficiency Improvement	**20.08**	**73.96**	GBtu/yr
Solar Thermal Energy (hot water/space heat/space cooling)	**0.63**	**4.02**	GBtu/yr
On-site Solar PV	**-**	**-**	GBtu/yr
On-site Biomass/Biogas/Landfill Gas Energy Use	**0.21**	**2.41**	GBtu/yr
Green Power Purchase (from off-site, beyond electricity supply RPS)	**-**	**-**	GBtu/yr

	2012	2025/all	Units
Additional Inputs to/Intermediate Results of Costs Analyses, Beyond Code Elements			
Estimated annual levelized cost of residential solar hot water per unit output	**41.19**	**30.60**	$/MMBtu
Based on inputs to/results of solar hot water heating analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Estimated annual levelized cost of commercial solar hot water per unit output	**38.89**	**28.89**	$/MMBtu
Based on inputs to/results of solar hot water heating analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Adjustment to solar thermal costs for inclusion of space heat/cooling measures	1.00	1.00	
Placeholder assumption--Value of 1.0 implies that solar space heat and cooling will cost the same per unit output as solar water heating.			
Implied Per Unit Cost Electricity Avoided by residential Solar WH/SH/Cooling	**130.70**	**97.09**	$/MWh
Implied Per Unit Cost Natural Gas Avoided by residential Solar WH/SH/Cooling	**28.83**	**21.42**	$/MMBtu
Assumes delivered solar WH/SH/Cooling replaces electric with EF of 0.93, gas with EF of 0.70 (and therefore one MMBtu of delivered solar heat is the equivalent of more than one MMBtu of each fuel).			
Implied Per Unit Cost Electricity Avoided by Solar WH/SH/Cooling (Commercial)	**123.40**	**91.67**	$/MWh
Implied Per Unit Cost Natural Gas Avoided by Solar WH/SH/Cooling (Commecial)	**27.22**	**20.22**	$/MMBtu
Assumes delivered solar WH/SH/Cooling replaces electric with EF of 0.93, gas with EF of 0.70 (and therefore one MMBtu of delivered solar heat is the equivalent of more than one MMBtu of each fuel).			
Estimated annual levelized cost of on-site Solar PV, Commercial	**546**	**270**	$/MWh
Based on inputs to/results of solar PV analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Estimated annual levelized cost of on-site residential Solar PV	**506**	**250**	$/MWh
Based on inputs to/results of solar PV analysis included in "EEAG-Solar_Data" worksheet in this workbook.			
Fuel Cost for On-site Biomass/Biogas/Landfill Gas Energy Use		2.52	$/MMBtu
Based on costs for Biomass fuel, which will likely dominate this category of fuel inputs. See "Common Assumptions" worksheet in this workbook. If significantly processed biomass fuels (such as pelletized fuels) are required, this cost may need to be increased.			
Relative Efficiency of On-site Biomass/Biogas/Landfill Gas displacing electricity		0.75	
Placeholder assumption.			
Factor to reflect probable higher costs of on-site Biomass/Biogas/Landfill Gas Equipment Relative to Electric Equipment		1.50	
Placeholder assumption--In most cases, heating/water heating equipment designed to use biomass-derived fuels will be more expensive than equipment designed to use electricity. This factor loads these incremental capital costs into estimated fuel costs.			
Implied Per Unit Cost Electricity Avoided by Biomass/Biogas/Landfill Gas	**17.11**	**17.11**	$/MWh
Incremental Cost for Green Power Purchase (from off-site, beyond supply RPS)	25.00	20.00	$/MWh
Placeholder assumption.			

	2012	2025/all	Units
Results of Costs Analyses, EE-6 Policies			
Implied Annual Net Costs of EE-6, Non-residential Public Sector Buildings (Electricity savings)			
Energy Efficiency Improvement	$ (20,115)	$ (72,657)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 2,539	$ 17,627	$ thousand
On-site Solar PV	$ 6,900	$ 52,311	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (573)	$ (11,636)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ 1,669	$ 6,290	$ thousand
Implied Annual Net Costs of EE-6, Non-residential Public Sector Buildings (Gas savings)			
Energy Efficiency Improvement	$ (8,503)	$ (30,006)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 3,145	$ 16,316	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (190)	$ (2,104)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand
Implied Annual Net Costs of EE-6, Non-residential Public Sector Buildings (Oil savings)			
Energy Efficiency Improvement	$ (1,180)	$ (4,100)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 43	$ 191	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (15)	$ (160)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand
Implied Annual Net Costs of EE-6, Non-residential Public Sector Buildings (LPG/propane savings)			
Energy Efficiency Improvement	$ (596)	$ (1,985)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 34	$ 152	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (8)	$ (81)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand
Implied Annual Net Costs of EE-6, Public Housing (Electricity savings)			
Energy Efficiency Improvement	$ (889)	$ (2,646)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 125	$ 740	$ thousand
On-site Solar PV	$ 280	$ 1,775	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (25)	$ (424)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ 74	$ 231	$ thousand
Implied Annual Net Costs of EE-6, Public Housing (Gas savings)			
Energy Efficiency Improvement	$ (882)	$ (2,864)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 351	$ 1,694	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (20)	$ (201)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand
Implied Annual Net Costs of EE-6, Public Housing (Oil savings)			
Energy Efficiency Improvement	$ (17)	$ (52)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 1	$ 3	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (0)	$ (2)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand
Implied Annual Net Costs of EE-6, Public Housing (LPG/propane savings)			
Energy Efficiency Improvement	$ (162)	$ (598)	$ thousand
Solar Thermal Energy (hot water/space heat/space cooling)	$ 10	$ 51	$ thousand
On-site Solar PV	$ -	$ -	$ thousand
On-site Biomass/Biogas/Landfill Gas Energy Use	$ (2)	$ (24)	$ thousand
Green Power Purchase (from off-site, beyond electricity supply RPS)	$ -	$ -	$ thousand

Results--Recent Actions	2012	2025/all	Units
Electricity			
Recent Actions not included in forecast			
Reduction in Electricity Sales: Residential	12	40	GWh (sales)
Reduction in Electricity Sales: Commercial	281	1,085	GWh (sales)
TOTAL Reduction in Electricity Sales	294	1,125	GWh (sales)
Reduction in Generation Requirements	313	1,192	GWh (generation)
GHG Emission Savings	**0.31**	**1.08**	$MMtCO_2e$
Cumulative Emissions Reductions (2009-2025)		10.2	$MMtCO_2e$
Natural Gas			
Recent Actions not included in forecast			
Reduction in Gas Sales: Residential	109	352	Billion BTU
Reduction in Gas Sales: Commercial	1,056	3,693	Billion BTU
Reduction in Gas Use	1,165	4,046	Billion BTU
GHG Emission Savings	0.06	0.21	$MMtCO_2e$
Cumulative Emissions Reductions (2009-2025)		2.0	$MMtCO_2e$
Oil			
Recent Actions not included in forecast			
Reduction in Oil Sales: Residential	0	1	Billion BTU
Reduction in Oil Sales: Commercial	25	85	Billion BTU
Reduction in Oil Use	25	86	Billion BTU
GHG Emission Savings	0.002	0.006	$MMtCO_2e$
Cumulative Emissions Reductions (2009-2025)		0.06	$MMtCO_2e$
LPG/propane			
Recent Actions not included in forecast			
Reduction in Oil Sales: Residential	4	16	Billion BTU
Reduction in Oil Sales: Commercial	16	53	Billion BTU
Reduction in Oil Use	21	69	Billion BTU
GHG Emission Savings	0.001	0.004	$MMtCO_2e$
Cumulative Emissions Reductions (2009-2025)		0.042	$MMtCO_2e$

Summary Results for Public Sector Recent Actions	2012	2025	Units
Recent Actions Not Included in Forecast (Current/planned building code changes)			
Electric GHG Emission Savings	**0.31**	**1.08**	$MMtCO_2e$
Gas GHG Emission Savings	**0.06**	**0.21**	$MMtCO_2e$
Oil GHG Emission Savings	**0.002**	**0.006**	$MMtCO_2e$
LPG/Propane GHG Emission Savings	**0.001**	**0.004**	$MMtCO_2e$
Total GHG Emission Savings	**0.37**	**1.31**	$MMtCO_2e$
Total for Recent Actions (All Fuels)			
GHG Emission Savings	**0.37**	**1.31**	$MMtCO_2e$
Cumulative Emissions Reductions (2009-2025)		12.3	$MMtCO_2e$

Results--EE-6 Policies	2012	2025/all	Units
Electricity			
Reduction in Electricity Sales: Residential	59	198	GWh (sales)
Reduction in Electricity Sales: Commercial	1,335	5,426	GWh (sales)
TOTAL Reduction in Electricity Sales	1,394	5,623	GWh (sales)
Reduction in Generation Requirements	1,485	5,959	GWh (generation)
GHG Emission Savings	**1.47**	**5.42**	$MMtCO_2e$
Economic Analysis (for Electricity Savings due to Additional Effort in EE-6)			
Net Present Value (2009-2025)		**-$111.6**	$million
Cumulative Emissions Reductions (2009-2025)		53.6	$MMtCO_2e$
Cost-Effectiveness		**-$2.08**	$\$/tCO_2e$
Natural Gas			
Reduction in Natural Gas Sales: Residential	520	1,762	Billion BTU
Reduction in Natural Gas Sales: Commercial	5,015	18,467	Billion BTU
TOTAL Reduction in Natural Gas Sales	5,535	20,229	Billion BTU
GHG Emission Savings	**0.29**	**1.05**	$MMtCO_2e$
Economic Analysis (for Natural Gas Savings due to Additional Effort in EE-6)			
Net Present Value (2009-2025)		**-$112.5**	$million
Cumulative Emissions Reductions (2009-2025)		10.5	$MMtCO_2e$
Cost-Effectiveness		**-$10.70**	$\$/tCO_2e$
Oil			
Reduction in Oil Sales: Residential	2	5	Billion BTU
Reduction in Oil Sales: Commercial	117	424	Billion BTU
TOTAL Reduction in Oil Sales	119	430	Billion BTU
GHG Emission Savings	**0.01**	**0.03**	$MMtCO_2e$
Economic Analysis (for Oil Savings due to Additional Effort in EE-6)			
Net Present Value (2009-2025)		**-$24.6**	$million
Cumulative Emissions Reductions (2009-2025)		0.3	$MMtCO_2e$
Cost-Effectiveness		**-$76.03**	$\$/tCO_2e$
LPG/propane			
Reduction in LPG/propane Sales: Residential	42	161	Billion BTU
Reduction in LPG/propane Sales: Commercial	77	267	Billion BTU
TOTAL Reduction in LPG/propane Sales	119	428	Billion BTU
GHG Emission Savings	**0.01**	**0.03**	$MMtCO_2e$
Economic Analysis (for LPG/propane Savings due to Additional Effort in EE-6)			
Net Present Value (2009-2025)		**-$14.8**	$million
Cumulative Emissions Reductions (2009-2025)		0.3	$MMtCO_2e$
Cost-Effectiveness		**-$54.65**	$\$/tCO_2e$

Summary Results for EE-6 Public Lead by Example Policies	2012	2025	Units
Total			
GHG Emission Savings	**1.77**	**6.53**	$MMtCO_2e$
Net Present Value (2009-2025)		**-$263**	$million
Cumulative Emissions Reductions (2009-2025)		64.7	$MMtCO_2e$
Cost-Effectiveness		**-$4.07**	$\$/tCO_2e$

NOTES AND DATA FROM SOURCES

Note 1:

From The Energy Efficiency Task Force Report to the Clean and Diversified Energy Advisory Committee of the Western Governors Association.
The Potential for More Efficient Electricity Use in the Western United States, January, 2006. This report is referred to here as the "WGA CDEAC EE report" and can be found at:
http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf.
The CDEAC report provides a cost of saved energy (electricity)
based on an average 7-year payback for code improvements (page 42).

For Illinois, the equivalent cost is estimated as follows for electricity and natural gas

payback	7	years, from CDEAC report	
lifespan	25	years, conservative assumption	
elec price	**$87.10**	$/MWh	see common factors
NG price	**$9.16**	$/MMBTU	see common factors

Electricity levelized cost	$43.260	$/MWh
Natural Gas levelized cost	$4.548	$/MMBTU

Note 2:

Data below are from USDOE Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey, Detailed Tables, October 2006
Full set of CBECS data tables available at http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003pdf/alltables.pdf
Data below from Table C5. Consumption and Gross Energy Intensity by Census Region for Sum of Major Fuels for Non-Mall Buildings, 2003, and from Table C7. Consumption and Gross Energy Intensity by Census Division for Sum of Major Fuels for Non-Mall Buildings, 2003: [Parts 1 and 2]

REGION	CENSUS DIVISION	OWNERSHIP	Sum of Major Fuel Consumption (trillion Btu)	Total Floorspace of Buildings (million square feet)	Energy Intensity for Sum of Major Fuels (thousand Btu/square foot)	Implied fraction of average energy intensity for all buildings
Midwest Region	All	All Buildings	1690	17080	98.9	100.0%
Midwest Region	All	All Government Owned	547	4610	118.6	119.9%
Midwest Region	All	--Federal	167	921	181.32	183.3%
Midwest Region	All	--State	119	764	156.1	157.8%
Midwest Region	All	--Local	261	2925	85.9	86.9%
Midwest Region	East North Central	All Buildings	1254	11595	108.1	100.0%
Midwest Region	East North Central	All Government Owned	454	3580	126.9	117.4%
Midwest Region	East North Central	--Federal				0.0%
Midwest Region	East North Central	--State		536		0.0%
Midwest Region	East North Central	--Local	202	2199	106.7	98.7%
Midwest Region	West North Central	All Buildings	436	5485	79.5	100.0%
Midwest Region	West North Central	All Government Owned	92	1030	89.5	112.6%
Midwest Region	West North Central	--Federal				0.0%
Midwest Region	West North Central	--State				0.0%
Midwest Region	West North Central	--Local	50	726	68.4	86.0%