# Executive Summary

## Background

The Iowa General Assembly enacted Senate File 485 in 2007 and House File 2571 in 2008. This legislation creates the Iowa Climate Change Advisory Council (ICCAC) which consists of twenty-three (23) voting members appointed by the Governor that serve three-year staggered terms. The Council is also comprised of four (4) non-voting, ex-officio members from the General Assembly.

As specified in Iowa Code section 455B.851, "The council shall submit the greenhouse gas emission reduction proposals to the governor and the general assembly by January 1, 2009." The proposals include the following:

- After consideration of a full range of policies and strategies, including the cost-effectiveness of the strategies, the council shall develop multiple scenarios designed to reduce statewide greenhouse gas emissions by fifty percent and ninety percent by 2050."
- The Council shall also develop short-term, medium-term, and long-term scenarios designed to reduce statewide greenhouse gas emissions and shall consider the cost-effectiveness of the scenarios.
- The Council shall establish 2005 as the baseline year for purposes of calculating reductions in statewide greenhouse gas emissions.

The ICCAC began its deliberative process at its second meeting on December 17, 2007 following an organizational meeting via teleconference on October 15, 2007. ICCAC met a total of eight times, with the final in-person meeting held on November 10, 2008, followed by a conference call on December 10, 2008 for review of this report. About 75 additional teleconference meetings of ICCAC's five supporting Subcommittees (SCs) were also held to identify and analyze various potential policy actions in advance of the ICCAC's November 10, 2008, final decisional meeting.

The five SCs considered information and potential policy options in the following sectors:

- Energy Efficiency and Conservation (EEC)
- Clean and Renewable Energy (CRE)
- Transportation and Land Use (TLU);
- Agriculture, Forestry, and Waste Management (AFW); and
- Cross-Cutting Issues (CC) (i.e., issues that cut across the above sectors).

The Center for Climate Strategies (CCS) provided facilitation and technical assistance to the ICCAC and each of the SCs. The SCs consisted of ICCAC members and selected additional members. Members of the public were invited to observe and provide input at all meetings of the

ICCAC and SCs. The SCs served as advisers to the ICCAC and helped generate initial options on Iowa-specific policy options to be added to the catalog of existing state actions; priority policy options for analysis; draft proposals on the design characteristics and quantification of the proposed policy options; specifications and assistance for analysis of draft policy options (including best available data sources, methods and assumptions); and other key elements of policy option proposals, including related policies and programs, key uncertainties, co-benefits and costs, feasibility issues, and potential barriers to consensus.

## Key Outcomes

In fulfillment of the requirements of this legislation the Council has prepared this Report which includes the following key outcomes:

- The Iowa Greenhouse Gas (GHG) Emissions Inventory and Forecast has been prepared which outlines baseline conditions as of 2005[1] and projected emissions through 2025 if no changes to the business as usual reference case are made. These projections were prepared in close consultation with the Iowa Department of Natural Resources (IDNR) and many Council and Sub-Committee members offered specific recommended improvements during its development. ICCAC recommends that the GHG Emissions Inventory and Forecast be updated annually.
- Approval of a comprehensive package of multi-sector policy options to reduce GHG emissions and address related energy and commerce issues in Iowa. ICCAC approved 56 policy options for inclusion in this Final Report. The ICCAC Members present and voting approved 32 of these policy options unanimously, approved 11 more with a super-majority vote (support of 80% or more of the members present and voting ), and 13 additional options with a simple majority supporting it. One option failed to gain ICCAC approval. Explanations of objections are in included in Appendices F through J of this Report, which contain detailed accounts of the ICCAC's options along with descriptions of key uncertainties in the analysis.
- Evaluation of the direct costs and direct cost savings of the policy options in Iowa. The ICCAC analyzed quantitatively the direct costs or cost savings of 37 of its 56 policy options. Although the total net cost associated with the 37 policies analyzed is estimated at about $ 4.8 billion between 2009 and 2020, the weighted-average cost-effectiveness of the 37 policies is estimated to be approximately $8.80/t$CO_2$e reduced. Many of the policies are estimated to yield significant cost-saving opportunities for Iowans. Other policies will incur net costs.
- The Council developed two GHG Reduction Scenarios. One scenario was specified by the enabling legislation to achieve a 50% reduction from the baseline year [2005] by 2050. The Council developed a second GHG reduction scenario to achieve a 90% GHG reduction below the 2005 baseline year by 2050. The Council chose 2012 and 2020 as its short-term and mid-term intervals, respectively.

[1] Year 2005 was selected as the base year for the GHG reduction scenarios and cost-effectiveness analysis because emissions inventory data are more complete for year 2005 than for previous years.

- For a 50% reduction by 2050 scenario the Council recommends approximately a 1% reduction by 2012 and an 11% reduction by 2020. For the 90% reduction scenario the Council recommends approximately a 3% reduction by 2012 and a 22 % reduction by 2020. For both scenarios, a simple linear extrapolation was used from Iowa's estimated 2009 emissions to the targets of 50% and 90% reductions in 2050, which allowed delineation of interim targets for each scenario in 2012 and 2020. The assumption of linearity was made because there were plenty of reductions in the approved policy options to achieve the interim targets, and a more extensive analysis was beyond the scope of this report. The ICCAC based its options on its review of the potential overall emission reduction estimates (as compared to the GHG emissions inventory and forecast) for 38 of 56 policy options for which emission reductions were quantified, and its review of goals and targets adopted by several other states. Of the 56 policy options, 38 were analyzed quantitatively to have a cumulative effect of reducing emissions by about 20 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) in 2012 and 105 ($MMtCO_2e$) in 2020. Together, if the 38 quantified policy options and the recent federal and state actions (or their functional equivalent) are successfully implemented, the 2020 emission reduction scenario is achievable based on results of analysis of ICCAC proposals conducted through the ICCAC and Subcommittee process.
- In addition, the ICCAC recommends that the state report biennially to the Governor and the state legislature on the state's progress in reducing GHG emissions under these scenarios.

## Iowa GHG Emissions Inventory and Reference Case Projections

In April 2008, CCS completed a draft GHG emissions inventory and reference case projection to assist the ICCAC and SCs in understanding past, current, and possible future GHG emissions in Iowa, and thereby inform the policy development process.[2] The ICCAC and SCs reviewed, discussed, and evaluated the draft inventory and projections methodologies, as well as alternative data and approaches for improving the draft inventory and projections. The final report[3] incorporating comments provided by the Subcommittees that were approved by the ICCAC at their September 2008 meeting and incorporated into the final report during October, is available at: http://www.iaclimatechange.us/Inventory_Forecast_Report.cfm . At the 7th ICCAC meeting in November 2008 the Council received the final I-F Report and agreed to file and forward it to the Governor and Legislature.

The inventory and reference case projections included detailed coverage of all economic sectors and GHGs in Iowa, including future emission trends and assessment issues related to energy, the

[2] Center for Climate Strategies. *Draft Iowa Greenhouse Gas Inventory and Reference Case Projections, 1990–2025*. Prepared for the Iowa Climate Change Advisory Council. April, 2008. Available at: http://www.iaclimatechange.us/Inventory_Forecast_Report.cfm.

[3] Center for Climate Strategies. *Final Iowa Greenhouse Gas Inventory and Reference Case Projections, 1990–2025*. Prepared for the Iowa Climate Change Advisory Council. October, 2008. Available at: http://www.iaclimatechange.us/Inventory_Forecast_Report.cfm. See pages 13 and 14 of this report for a list of the the revisions that the ICCAC made to the inventory and reference case projections; these revisions are also identified at the end of Chapter 2 of the ICCAC final report.

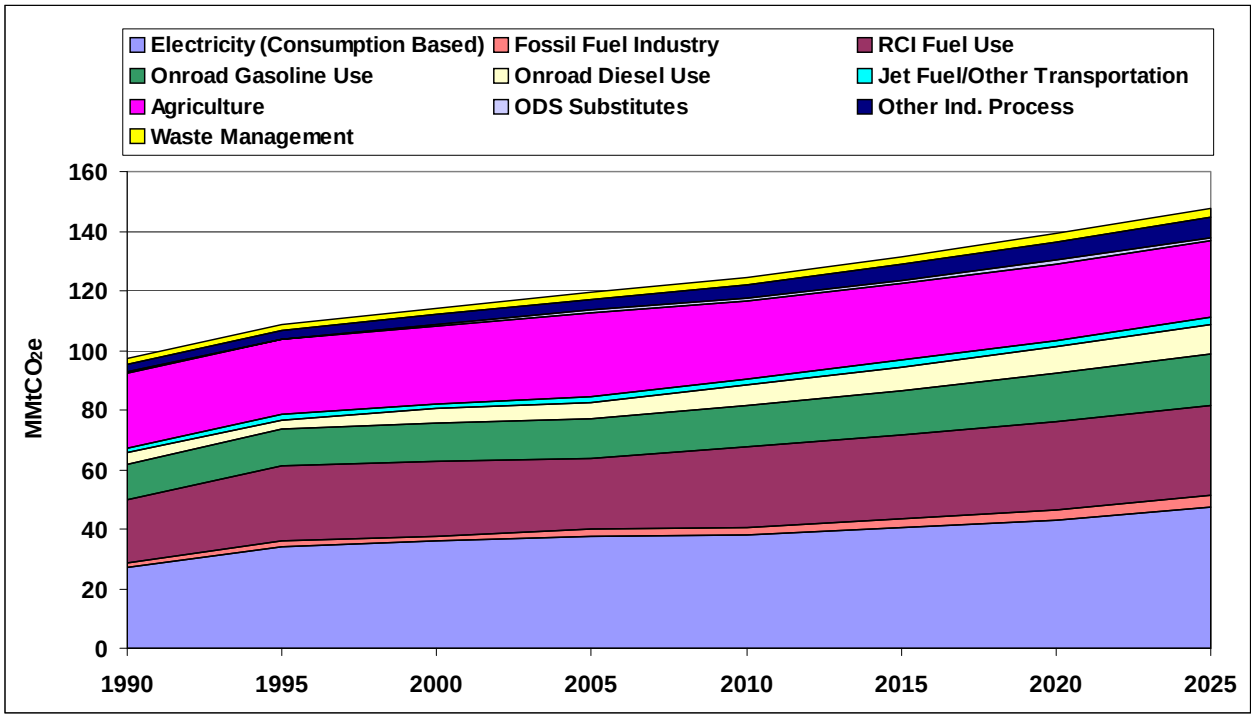
economy, and population growth. It is important to note that the emission estimates reflect the GHG emissions associated with the electricity sources used to meet Iowa's demands, corresponding to a consumption-based approach to emissions accounting. Another way to look at electricity emissions is to consider the GHG emissions produced by electricity generation facilities in the state—a production-based method. The study covers both methods of accounting for emissions, but for consistency, all total results are reported as consumption-based.

As illustrated in Figure ES-1, under the reference case projections, Iowa's gross GHG emissions continue to grow steadily, climbing to about 148 $MMtCO_2e$ by 2025, 52% above 1990 levels. This equates to a 1.1% annual rate of growth from 2005 to 2025. Relative to 2005, the share of emissions associated with electricity consumption and the transportation sector both increase slightly to 32% and 20%, respectively, in 2025. The share of emissions from the industrial processes and fossil fuel industry sectors is projected to increase to 6% and 3%, respectively, by 2025. The share of emissions from the RCI fuel use sector and the waste management sector is projected to remain the same at about 20% and 2%, respectively, of Iowa's gross GHG emissions in 2025. The agriculture sector is the only sector in Iowa whose emission share in 2025 is projected to decrease from its emission share in 2005 (from 23% in 2005 to 17% in 2025).

Emissions associated with electricity consumption are projected to be the largest contributor to future GHG emissions growth, followed by emissions associated with the transportation sector, as shown in Figure 2-4. Other sources of emissions growth include the RCI fuel use sector and the increasing use of HFCs and PFCs as substitutes for ozone-depleting substances in refrigeration, air conditioning, and other applications. The agriculture sector is the only sector in which emissions are projected to decrease from 2005 to 2025. Table 2-2 summarizes the growth rates that drive the growth in the Iowa reference case projections, as well as the sources of these data. Figure ES-2 depicts the 2005 distribution of sources in Iowa compared to the United States (U.S.) .

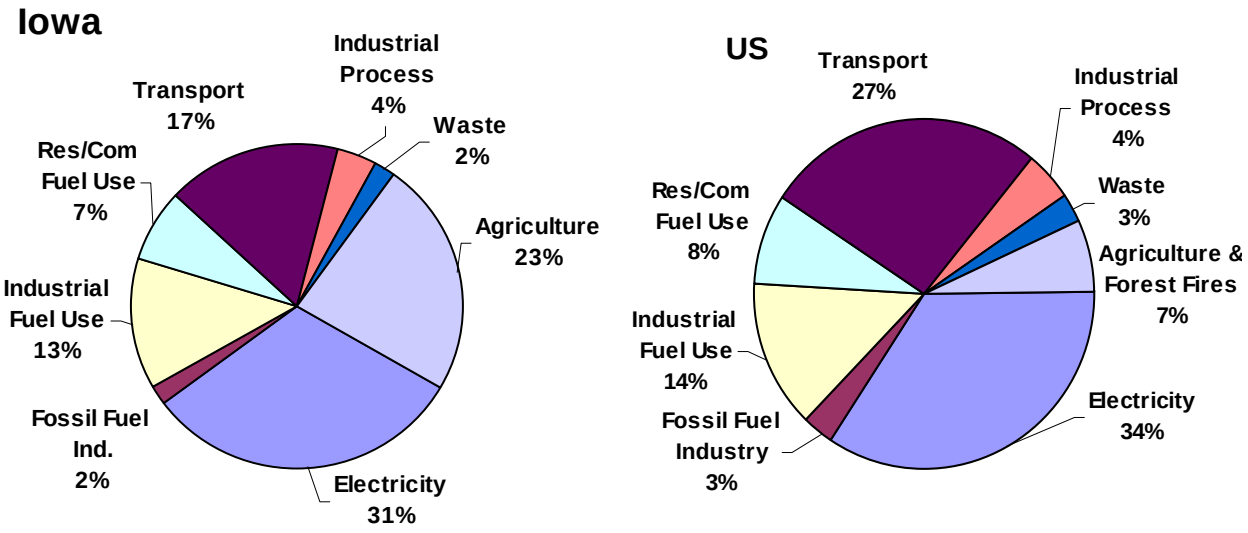
Estimates of carbon sinks within Iowa's forests, including urban forests and land use changes as well as agricultural soils, have also been included in this report. The current estimates indicate that about 27 $MMtCO_2e$ were stored in Iowa soils, forests and agricultural biomass in 2005. When all statewide emission sources and sinks are considered, this leads to *net* emissions of 92 $MMtCO_2e$ in Iowa in 2005, an amount equal to 1.4% of total US net GHG emissions.

**Figure ES-1. Gross GHG emissions by sector, 1990–2025: historical and projected (consumption-based approach) business-as-usual/base case**




ODS – ozone depleting substances

**Figure ES-2. Gross GHG emissions by sector, 2005: Iowa and U.S.**



## Recent Actions

The federal Energy Independence and Security Act of 2007 (EISA) was signed into law in December 2007. This law contains several requirements that will reduce GHG emissions as they are implemented over the next few years. During the ICCAC process, sufficient information was identified (e.g., implementation schedules) to estimate GHG emission reductions associated with implementing the Corporate Average Fuel Economy requirements and energy efficiency requirements for new appliances and lighting associated with the EISA's Title IV (Energy Savings in Buildings and Industry) and Title V (Energy Savings in Government and Public Institutions) requirements in Iowa.

Iowa has recently embarked on statewide public sector energy efficiency initiatives in response to concerns about energy costs. The state is implementing two energy efficiency initiatives under Executive Orders 6 and 41. Executive Order 06[4] by Governor Culver establishes a Green Government Initiative in Iowa that is targeted at three areas (buildings, materials and biofuels). Several Task Forces have been established to address the specific areas. Executive Order 41[5] by Governor Vilsack requires that all state agencies reduce energy consumption in state buildings.

Together, these federal and state requirements are estimated to reduce gross GHG emissions for all sectors combined in Iowa by about 3.4 $MMtCO_2e$ (a 2.4% reduction) from the business-as-usual emissions in 2020.

In addition, Iowa utilities have been pursuing energy efficiency programs for some time. These investments are not quantified in the analysis because EEC subcommittee members indicated that the energy impacts from these efficiency programs are already incorporated into the utility load growth forecasts which were used for the reference case inventory and forecast (eg they are already in the baseline).

## ICCAC Policy Options (Beyond Recent Actions)

The ICCAC developed 56 policy options. The ICCAC Members present and voting approved 32 of these policy options unanimously, approved 11 more with a super-majority vote (support of 80% or more of the members present and voting ), and 13 additional options with a simple majority supporting it. One option failed to gain ICCAC approval and is not included in this report. At this time these policy options have not been prioritized nor ranked in any order of preference. Explanations of objections are in included in Appendices F through J of this Report, which contain detailed accounts of the ICCAC's options.

Of the 56 policy options, 38 were analyzed quantitatively to have a cumulative effect of reducing emissions by about 20 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) in 2012 and 105 ($MMtCO_2e$) in 2020.

[4] State of Iowa, Executive Department. Executive Order Number Six, February 21, 2008. Available at http://publications.iowa.gov

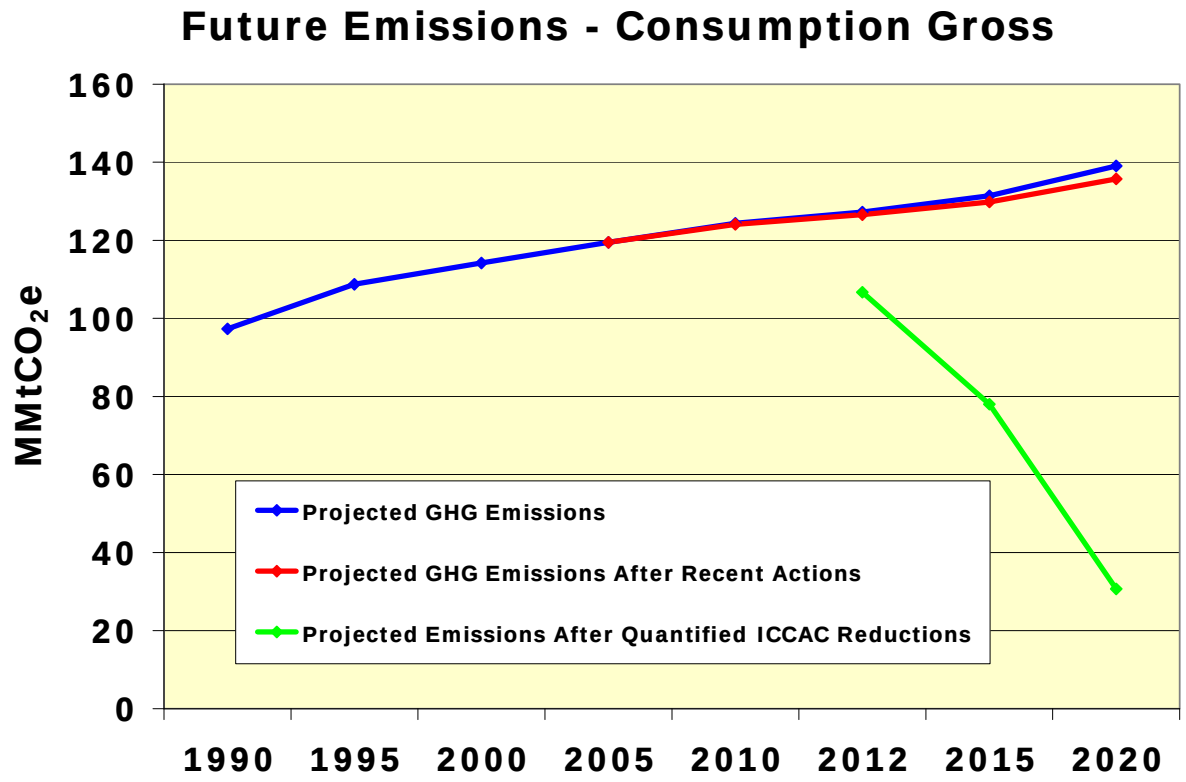
[5] State of Iowa, Executive Department. Executive Order Number Forty-one. April 22, 2005. Available at http://publications.iowa.gov/2619/1/EO_41.pdf

Figure ES-3 presents a graphical summary of the potential cumulative emission reductions associated with the recent federal and state actions and the 38 policy options relative to the business-as-usual reference case projections. Table ES-1a provides the numeric estimates underlying Figure ES-3 for the 50% reduction by 2050 scenario and Table ES-1b provides the same estimate for the 90% reduction scenario by 2050. In Figure ES-3:

- The blue line shows actual (for 1990, 1995, 2000, and 2005) and projected (for 2010, 2012, 2015 and 2020) levels of Iowa' gross GHG emissions on a consumption basis. (The consumption-based approach accounts for emissions associated with the generation of electricity in Iowa to meet the state's demand for electricity)
- The red line shows projected emissions associated with recent federal and state actions that were analyzed quantitatively.
- The green line shows projected emissions if all of the ICCAC's 38 options that were analyzed quantitatively with respect to their GHG reduction potential are implemented successfully and the estimated reductions are fully achieved. (Note that other ICCAC options would have the effect of reducing emissions, but those reductions were not analyzed quantitatively, so are not reflected in the green line.)

For the policy options offered by the ICCAC to yield the levels of estimated emission reductions shown in Table ES-2, they must be implemented in a timely and thorough manner. Table ES-3 depicts the final policy options of the Council and their associated GHG reductions and costs/ savings for each sector.

**Figure ES-3. Annual GHG emissions: reference case projections and ICCAC options (consumption-basis, gross emissions)**




$MMtCO_2e$ = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; ICCAC = Iowa Climate Change Advisory Council.

**Table ES-1a. Annual emissions: reference case projections and impact of ICCAC options (consumption-basis, gross emissions) - 50 % Reduction Scenario by 2050**

| Consumption Basis - Gross Emissions | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2005 | 2010 | 2012 | 2015 | 2020 |
| Projected GHG Emissions | 97.3 | 114.2 | 119.5 | 124.4 | 127.3 | 131.4 | 139.1 |
| Reductions from Recent Actions | | | 0.0 | 0.3 | 0.7 | 1.6 | 3.3 |
| Projected GHG Emissions After Recent Actions* | | | 119.5 | 124.1 | 126.6 | 129.8 | 135.7 |
| Remaining GHGs After Reduction Scenarios Recommended by ICCAC | | | | | 118.8 | NA | 106.3 |
| Total GHG Reductions from ICCAC Policies | | | | | 19.9 | 51.8 | 105.1 |
| Difference Between ICCAC Scenarios and Reductions** | | | | | 12.1 | NA | 75.7 |
| Projected Emissions After Quantified ICCAC Reductions | | | | | 106.7 | 78.0 | 30.6 |

* Reductions from recent actions include the Energy Independence and Security Act of 2007, Title III. GHG reductions from Titles IV and V of this Act have not been quantified because of the uncertainties in how they will be implemented. It is expected that Titles IV and V measures will overlap with EEC policies. Projected annual emissions also include reductions from recent actions.. Existing utility energy efficiency programs are not included in the existing action analysis because they are impounded in the utility load growth forecasts used in the Iowa Inventory and Forecast. ** (Difference = Row 4- row 7)

**Table ES-1b. Annual emissions: reference case projections and impact of ICCAC options (consumption-basis, gross emissions)- 90 % Reduction Scenario by 2050**

| Consumption Basis - Gross Emissions | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2005 | 2010 | 2012 | 2015 | 2020 |
| Projected GHG Emissions | 97.3 | 114.2 | 119.5 | 124.4 | 127.3 | 131.4 | 139.1 |
| Reductions from Recent Actions | | | 0.0 | 0.3 | 0.7 | 1.6 | 3.3 |
| Projected GHG Emissions After Recent Actions* | | | 119.5 | 124.1 | 126.6 | 129.8 | 135.7 |
| Remaining GHGs after Reduction Scenarios Recommended by ICCAC | | | | | 115.3 | NA | 93.5 |
| Total GHG Reductions from ICCAC Policies | | | | | 19.9 | 51.8 | 105.1 |
| Difference Between ICCAC Scenarios and Reductions | | | | | 8.6 | NA | 62.9 |
| Projected Emissions After Quantified ICCAC Reductions | | | | | 106.7 | 78.0 | 30.6 |

* Reductions from recent actions include the Energy Independence and Security Act of 2007, Title III. GHG reductions from Titles IV and V of this Act have not been quantified because of the uncertainties in how they will be implemented. It is expected that Titles IV and V measures will overlap with EEC policies. Projected annual emissions also include reductions from recent actions.. Existing utility energy efficiency programs are not included in the existing action analysis because they are impounded in the utility load growth forecasts used in the Iowa Inventory and Forecast. ** (Difference = Row 4- row 7)

**Table ES-2. Summary by sector of estimated impacts of implementing all of the ICCAC options (cumulative reductions and costs/savings)**

| Sector | GHG Reductions ($MMtCO_2e$) | | | Net Present Value 2009–2020 (Million $) | Cost-Effectiveness ($/tCO_2e$) |
|---|---|---|---|---|---|
| | 2012 | 2020 | Total 2009–2020 | | |
| Energy Efficiency and Conservation | 1.1 | 8.5 | 42.8 | -$1,057 | -$25 |
| Clean and Renewable Energy | 5.8 | 48.0 | 233.5 | $5,921 | $25 |
| Transportation and Land Use | 1.6 | 11.1 | 55.0* | -$2,219 | -$59 |
| Agriculture, Forestry, and Waste Management | 11.3 | 37.4 | 233.0 | $2,139 | $9.2 |
| Cross-Cutting Issues | Non-quantified, enabling options | | | | |
| **TOTAL (includes all adjustments for overlaps)** | **19.9** | **105.1** | **564.3** | **$4,785** | **$8.8** |

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

The values in this table do not include the effects of recent actions. Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the policy options.

Within each sector, values have been adjusted to eliminate double counting for policies or elements of policies that overlap. In addition, values associated with policies or elements of policies within a sector that overlap with policies or elements of policies in another sector have been adjusted to eliminate double counting. Appendix F (for the EEC sectors), Appendix G (for the CRE sectors), Appendix H (for the TLU sectors) and Appendix I (for the AFW sectors) of this report provide documentation of how sector-level emission reductions and costs (or cost savings) were adjusted to eliminate double counting associated with overlaps between policies.

* Deduct total TLU-6 2009-2020 reductions [17.7MMt] from 55.03 total = 37.3, before calculating cost/ton for TLU Options. Total Reductions for calculation of cost-effectiveness: 564.3- 17.7 = 546.6. [$4.785 / 546.6 = $8.8/t

## Table ES-3. Energy Efficiency and Conservation Policy Options

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

DSM = demand-side management; EISA = Energy Independence and Security Act of 2007; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent. Existing utility energy efficiency programs are not included in the recent action analysis because they are impounded in the utility load growth forecasts used in the Iowa Inventory and Forecast.

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

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

## Table ES-3. (continued) Clean and Renewable Energy Policy Options

| No. | Policy Option | $CO_2$ Reduction 2012 | $CO_2$ Reduction 2020 | Total 2009–2020 | Net Present Value 2009–2020 (Million $) | Cost/ton ($/t$CO_2$e) | Change in Generation Cost in 2020 $/MWh* | Level of Support |
|---|---|---|---|---|---|---|---|---|
| CRE-1 | Education | *Not Quantified* | | | | | | Unanimous |
| CRE-2 | Technology Initiatives, Including Renewables | 4.7 | 33.4 | 192.6 | $5,653 | $29.4 | $25.7 | Super Majority (3 Objections) |
| CRE-3 | MGA Cap and Trade, Including Offsets To Promote Renewables | *Not Quantified* | | | | | | Majority (5 Objections) |
| CRE-4 | Decarbonization Fund | 2.2 | 11.4 | 74.1 | $316 | $4.3 | $3.1 | Super Majority (2 Objections) |
| CRE-5 | Performance Standards (50% Reduction by 2050) | 4.9 | 11.4 | 95.4 | $2,650.6 | $27.8 | $7.3 | Super Majority (3 Objections, 1 Abstention) |
| CRE-6 | Voluntary GHG Commitments | *Not Quantified* | | | | | | Unanimous |
| CRE-7 | Policies Related to Nuclear Power | 0.0 | 9.7 | 9.7 | $268 | $27.6 | $4.5 | Majority (5 Objections) |
| CRE-8 | Support for Grid-Based Renewable Energy & Development (MGA Target of 20% of retail sales by 2020) | 0.0 | 2.3 | 4.3 | $93.4 | $21.8 | $1.5 | Unanimous |
| CRE-9 | Transmission System Upgrading | *Not Quantified* | | | | | | Unanimous |
| CRE-10 | R&D for Emerging Technologies and Corresponding Incentives | *Not Quantified* | | | | | | Unanimous |
| CRE-11 | Distributed Generation/Co-Generation | 0.0 | 0.1 | 0.5 | $14 | $29.1 | $0.1 | Super Majority (1 Objection) |
| CRE-12 | Combined Heat and Power | 0.3 | 2.1 | 13.6 | –$564.3 | –$41.4 | $0.0 | Unanimous |
| CRE-13 | Pricing Strategies To Promote Renewable Energy and/or CHP | 1.2 | 5.6 | 35 | $1,128 | $32.1 | $4.7 | Super Majority (3 Objections) |
| | **Sector Total After Adjusting for Overlaps** | **6** | **48** | **233** | **$5,921** | **$25** | | |
| | **Reductions From Recent Actions** | **0** | **0** | **0** | **0** | **0** | | |
| | **Sector Total Plus Recent Actions** | **6** | **48** | **233** | **$5,921** | **$25** | | |

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

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

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

## Table ES-3. (continued) Transportation and Land Use Policy Options

| No. | Policy Option | GHG Reductions ($MMtCO_2e$) | | | Net Present Value 2009–2020 (Million $) | Cost-Effectiveness ($/tCO_2e$) | Level of Support |
|---|---|---|---|---|---|---|---|
| | | 2012 | 2020 | Total 2009–2020 | | | |
| TLU-1 | Smart Growth Bundle with Transit | 0.076 | 0.242 | 1.53 | –$377 | –$245 | Unanimous |
| TLU-1a | Expand and Improve Transit Infrastructure | 0.004 | 0.026 | 0.127 | $7.2 | +$57 | Majority (5 objections) |
| TLU-2 | GHG Impacts for State and Local Capital Funding | *Quantified as part of TLU-1 and TLU-1a* | | | | | Unanimous |
| TLU-4 | Support Passenger Rail Service in Iowa | N/A | 0.008 | 0.026 | $15 | +$597 | Majority (7 objections) |
| TLU-5a | Adopt Best Workplaces for Commuters in Iowa | 0.02 | 0.02 | 0.21 | $18 | $84 | Majority (6 objections) |
| TLU-5b | Distributed Workplace Models | *Non-quantified, qualitative option* | | | | | Unanimous |
| TLU-6 | Light Duty Vehicles Fuel Efficiency Incentives | 0.44 | 3.65 | 17.70* | NQ | NQ | Supermajority (3 objections) |
| TLU-7 | Fuel Efficient Operations for Light Duty Vehicles | 0.11 | 0.65 | 3.41 | –$306.9 | –$90 | Unanimous |
| TLU-8 | New Vehicle Standards (Tailpipe GHG and Fuel Economy) | N/A | 0.8 | 4.1 | –$246 | –$60 | Unanimous |
| TLU-9 | Freight Strategies (Truck and Rail) | 0.39 | 0.63 | 5.9 | $30 | +$5 | Supermajority (1 objection) |
| TLU-10 | Fuel Strategies (20% Low Carbon Fuel Standard) | 0.60 | 5.11 | 22.03 | –$1,359 | –$62 | Unanimous |
| | **Sector Total After Adjusting for Overlaps and Synergies** | **1.64** | **11.14** | **55.03*** | **-$2,218.50** | **-$59** | |
| | **Reductions From Recent Actions (Federal CAFE Requirements)** | **0.26** | **1.93** | **9.39** | ***Not Quantified*** | | |
| | **Sector Total Plus Recent Actions** | **1.9 (8.3)** | **13.07 (48)** | **64.42** | **N/A** | **N/A** | |
| | | | | | | | |

CAFE = corporate average fuel economy; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; $/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; N/A = not applicable.

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

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

*Deduct total TLU-6 2009-2020 reductions [17.7MMt] from 55.03 total = 37.3, before calculating cost/ton for TLU Options.

**Table ES-3. (continued) Agriculture, Forestry, and Waste Management Policy Options**

| No. | Policy Option | GHG Reductions ($MMtCO_2e$) | | | Net Present Value 2009–2020 (Million $) | Cost-Effectiveness ($/tCO_2e$) | Level of Support |
|---|---|---|---|---|---|---|---|
| | | 2012 | 2020 | Total 2009–2020 | | | |
| AFW-1 | Nutrient Management | | | | | | Majority (7 Objections) |
| | Increase Efficiency of Fertilizer | 0.11 | 0.53 | 3.0 | –$103 | –$34 | |
| | Seasonally Flooded Areas | 0.002 | 0.009 | 0.05 | $10 | $194 | |
| | Improved Nutrient Distribution | 0.02 | 0.1 | 0.55 | $373 | $693 | |
| AFW-2 | Wetlands and Drainage | 0.01 | 0.16 | 0.57 | $120 | $218 | Majority (5 Objections) |
| AFW-3 | Expanded Use of Agriculture and Forestry Biomass Feedstocks for Electricity, Heat, or Steam Production | 4.4 | 20 | 113 | $4,281 | $38 | Unanimous |
| AFW-4 | Encourage Large-Scale Manure/Methane Management Capture Utilization | | | | | | Unanimous |
| | Methane Management Capture Utilization | 0.8 | 3 | 17 | $63 | $4 | |
| | Manure Management | 0.2 | 0.7 | 4.6 | –$38 | –$8 | |
| AFW-5 | Land Management to Promote Sequestration Benefits | | | | | | Unanimous |
| | Conservation Tillage | 2.9 | 9 | 56 | –$6 | –$0.1 | |
| | Agriculture Land Conversion | 0.1 | 0.4 | 2.6 | $199 | $76 | |
| | Conservation Grazing | 0.1 | 0.3 | 1.7 | –$116 | –$67 | |
| | Afforestation | 0.2 | 0.6 | 4.1 | $216 | $53 | |
| | Unmanaged Grazed Forested Land | 0.3 | 0.8 | 5.5 | $93.7 | $17 | |
| | Urban Forestry | 0.1 | 0.4 | 2.4 | –$99 | –$41 | |
| AFW-6 | Cellulosic Biofuel* | 2.0 | 9.8 | 49 | –$1,410 | –$29 | Unanimous |
| AFW-7 | Improved On-Farm (or First Point of Purchase) Energy Use and Efficiency | | | | | | Unanimous |
| | Renewable Energy | 0.02 | 0.08 | 0.5 | $23 | $51 | |
| | Energy Efficiency | 0.2 | 0.9 | 5.9 | –$610 | –$104 | |
| AFW-8 | Waste Management Strategies | 1.5 | 4.1 | 26.5 | –$220 | –$8 | Unanimous |
| AFW-9 | Landfill Methane Energy Programs | 0.2 | 0.8 | 4.8 | $4 | $0.8 | Unanimous |
| | **Sector Total After Adjusting for Overlaps** | **11** | **37** | **233** | **$2,139** | **$9** | |
| | **Reductions From Recent Actions** | **0.0** | **0.0** | **0.0** | **$0.0** | **$0.0** | |
| | **Sector Total Plus Recent Actions** | **11** | **37** | **233** | **$2,139** | **$9** | |

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

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

* Note that the costs/savings of this option include a $1.01/gallon federal subsidy for cellulosic ethanol.

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

**Table ES-3. (continued) Cross-Cutting Issues Policy Options**

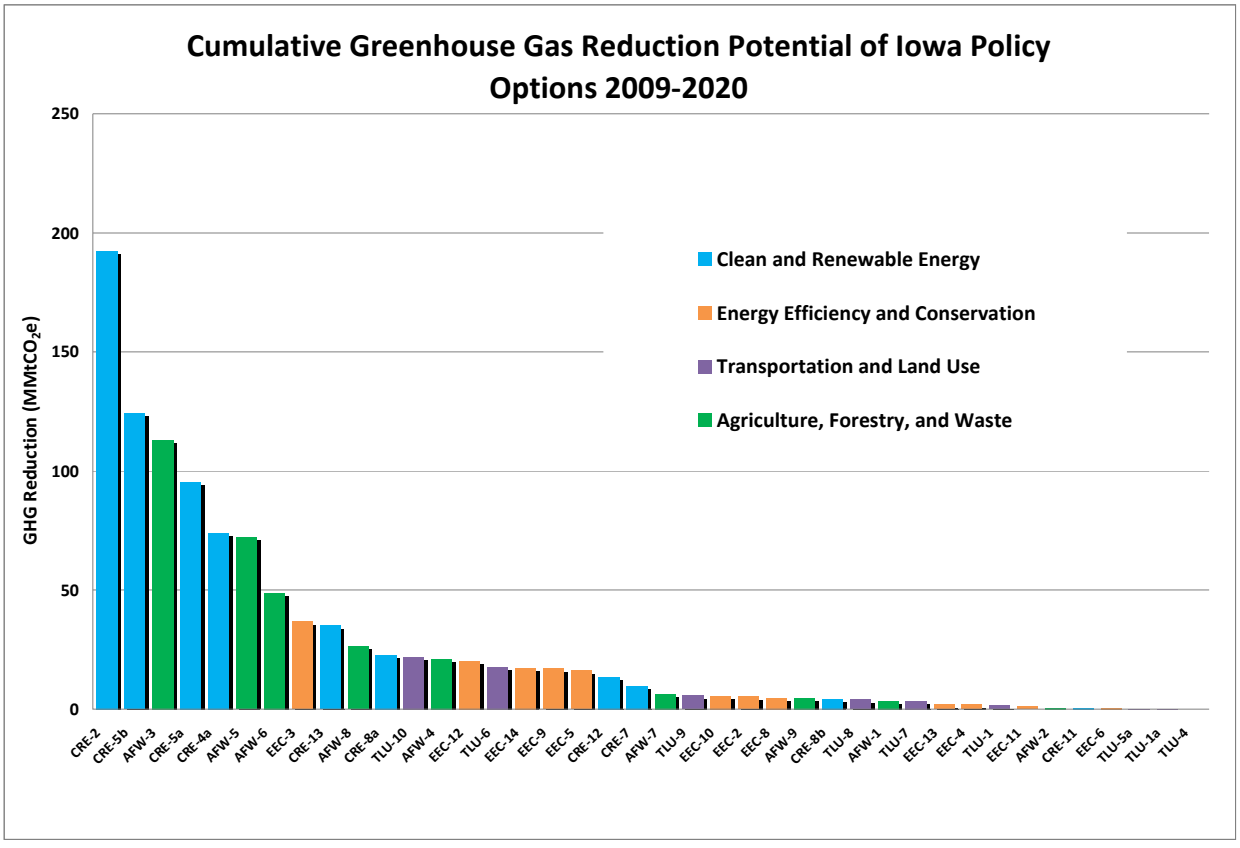
| Policy No. | Policy Option | GHG Reductions ($MMtCO_2e$) | | | Net Present Value 2009–2020 (Million $) | Cost-Effectiveness ($/tCO_2e$) | Status of Option |
|---|---|---|---|---|---|---|---|
| | | 2012 | 2020 | Total 2009–2020 | | | |
| CC-1 | GHG Inventories, Forecasting, Reporting, and Registry | *Not Quantified* | | | | | Unanimous |
| CC-2 | Statewide GHG Reduction Scenarios | *Not Quantified* | | | | | Majority (4 Objections) |
| CC-3 | State and Local Government GHG Emissions (Lead by Example) | *Not Quantified* | | | | | Unanimous |
| CC-4 | Public Education and Outreach | *Not Quantified* | | | | | Unanimous |
| CC-5 | Tax and Cap Policies—Lead Transferred to the CRE SC | *Not Quantified* | | | | | Transferred |
| CC-6 | Seek Funding for Implementation of ICCAC Options | *Not Quantified* | | | | | Unanimous |
| CC-7 | Adaptation and Vulnerability | *Not Quantified* | | | | | Unanimous |
| CC-8 | Participate in Regional and Multistate GHG Reduction Efforts | *Not Quantified* | | | | | Unanimous |
| CC-9 | Encourage the Creation of a Business-Oriented Organization To Facilitate Investment in Climate-Related Business Opportunities and To Share Information and Strategies, Recognize Successes, and Support Aggressive GHG Reduction Goals | *Not Quantified* | | | | | Unanimous |

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

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

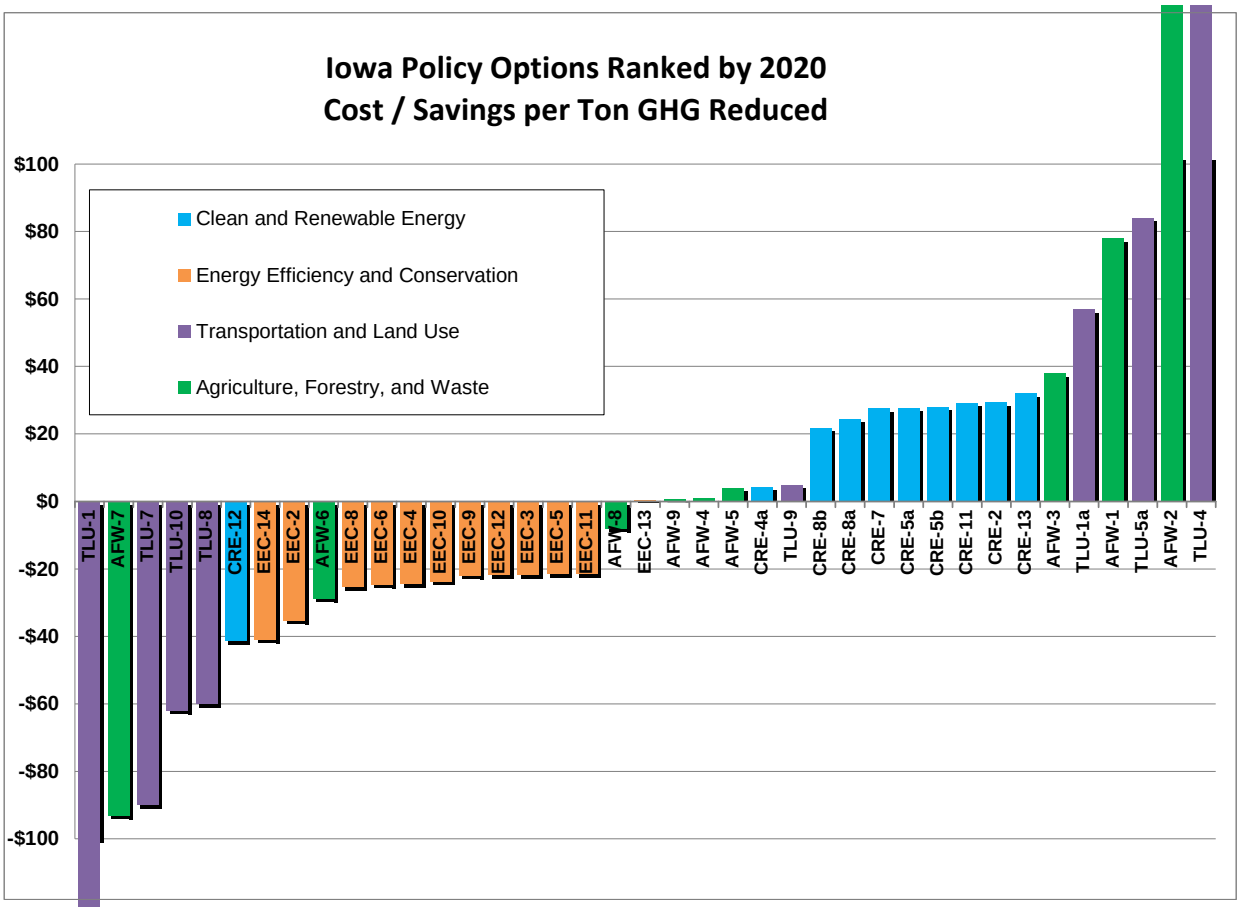
As explained above, the ICCAC considered the estimates of the GHG reductions that could be achieved by 38 of its options derived from 2005 baseline data, and the costs (or cost savings) of 37 of the options. Figure ES-4 presents the estimated tons of GHG emission reductions for each policy option for which estimates were quantified, expressed as a cumulative figure for the period 2009–2020. In addition to the imprecision in GHG reductions achieved by each policy option, there are uncertainties about the exact cost (or cost savings) per ton of reduction achieved. Figure ES-5 presents the estimated dollars-per-ton cost (or cost savings, depicted as a negative number) for each policy option for which cost estimates were quantified, expressed as a cumulative figure for the period 2009–2020. This measure is calculated by dividing the net present value of the cost of the policy option by the cumulative GHG reductions, all for the period 2009–2020.

**Figure ES-4. ICCAC policy options ranked by cumulative (2009–2020) GHG reduction potential**




GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; EEC = Energy Efficiency and Conservation,; TLU = Transportation and Land Use; CRE = Clean and Renewable Energy

**Figure ES-5. ICCAC policy options ranked by cumulative (2009–2025) net cost/cost savings per ton of GHG removed**

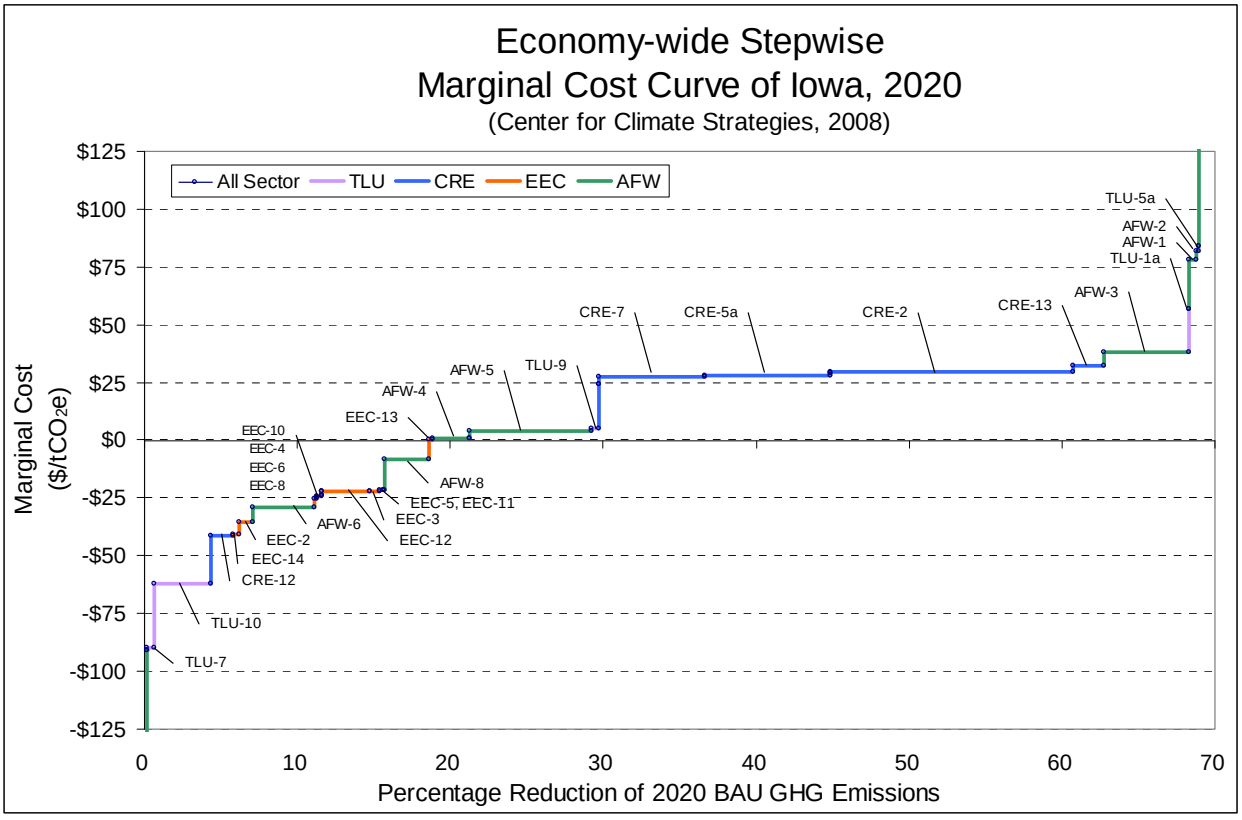



GHG = greenhouse gas; EEC = Energy Efficiency and Conservation; TLU = Transportation and Land Use; CRE = Clean and Renewable Energy; AFW = Agriculture, Forestry, and Waste Management.

Negative values represent net cost savings and positive values represent net costs associated with the policy option.

Figure ES-6 presents a stepwise marginal cost curve for Iowa. The horizontal axis represents the percentage of GHG emissions reduction in 2020 for each option relative to the business as usual (BAU) forecast. The vertical axis represents the marginal cost of mitigation (expressed as the cost-effectiveness of each policy option on a cumulative basis, 2009-2020). In the figure, each horizontal segment represents an individual policy. The width of the segment indicates the GHG emission reduction potential of the option in percentage terms. The height of the segment relative to the x-axis shows the average cost (saving) of reducing one $MMtCO_2e$ of GHG emissions with the application of the option.

**Figure ES-6. Stepwise marginal cost curve for Iowa, 2025**




BAU = business as usual; GHG = greenhouse gas; $tCO_2e$ = metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; EEC = Energy Efficiency and Conservation; TLU = Transportation and Land Use; CRE = Clean and Renewable Energy.

Negative values represent net cost savings and positive values represent net costs associated with the policy option.

Note: Results have been adjusted to remove overlaps between policies.

Finally, Figure ES-7 presents a graph with a linear extrapolation out to 2050 for the two ICCAC scenarios; a 50% GHG Reduction scenario [blue line] and a 90% GHG Reduction scenario [green line]. The 2012 and 2020 intersection points on each of these scenario lines were chosen for the short and mid-term scenario proposals. For both scenarios, a simple linear extrapolation was used from Iowa's estimated 2009 emissions to the targets of 50% and 90% reductions in 2050, which allowed delineation of interim targets for each scenario in 2012 and 2020. The assumption of linearity was made because there were plenty of reductions in the approved policy options to achieve the interim targets, and a more extensive analysis was beyond the scope of this report. For comparative purposes the figure also includes three lines indicating the projected emissions with three cost-effectiveness projections: for less than $40/T, $15/T and $0/T with orange, red and blue shades, respectively.

**Figure ES-7. Iowa Future GHG Emissions Scenarios and 2050 Reduction Goals**