MIDWESTERN ENERGY SECURITY AND CLIMATE STEWARDSHIP ROADMAP

2009

MIDWESTERN GOVERNORS ASSOCIATION

Jobs+ Energy Forum

MGA

ADVISORY GROUP RECOMMENDATIONS

TABLE OF CONTENTS

Background

This report documents the Midwestern Governors Association (MGA) advisory group recommendations to develop a comprehensive and far-sighted policy strategy for transforming the regional energy economy of the Midwest. Some of the recommended policies represent actions that are already in progress in a subset of the states and provinces, while others represent regional positions on key federal policies. In a world of complex and interlinked energy-use and development incentives, there is no way to completely segregate the impacts of state or provincial, regional, and national policies. But the regional MGA partnership brings an unprecedented opportunity for Midwestern states and provinces to learn from and build on others' experience, and coordinate efforts where synergies exist at a regional scale.

Preamble

The Midwest is a vital part of the U.S. economy and an integral part of the nation's identity. Home to 20 percent of the nation's population, it is a region of geographical variation, traversed by robust rivers, capped by majestic lakes, endowed with productive soils, and blanketed by a terrain where rural abuts urban and forests flatten into plains.

In 2007, governors of the diverse Midwestern states and the premier of Manitoba unified behind a commitment to advance the region toward a lower-carbon energy economy that "maximizes the energy resources and economic advantages of Midwestern states while reducing emissions of atmospheric CO_2 and other greenhouse gases." The MGA's *Energy Security and Climate Stewardship Platform for the Midwest* (Energy Platform) articulates a comprehensive, multi-sector vision of a regional economy that increases energy efficiency, shifts energy dependence onto lower-carbon renewable and fossil-fuel technologies, and adds economic value to the Midwest's energy, agriculture, manufacturing and technology sectors.

To facilitate that transition, the MGA convened industry, agricultural, labor, environmental and governmental stakeholders to serve on three advisory groups: Energy Efficiency (EEAG); Renewable Electricity and Advanced Coal with Carbon Capture and Storage (REACCCS); and Bioeconomy and Transportation (BTAG). These groups were tasked with drawing up enabling policy recommendations for the region's states and provinces to meet the governors' and premier's measurable goals and policy objectives.

The diversity of the region means that there is no single path that all jurisdictions can or should follow in their effort to transform their energy sectors. However, the regional nature of many of the supply-chain and infrastructure challenges associated with advanced energy and efficiency options means there is much to be gained from a cooperative strategy for technology development and deployment. While the advisory groups worked to develop a coordinated regional strategy, the individual states and provinces have continued to pursue efforts on multiple fronts to expedite this transformation. Throughout this process, many excellent models of success from the Midwestern states and provinces have been presented and have been used by the advisory groups to craft policy recommendations for the entire region.

Executive Summary

This *Energy Security and Climate Stewardship Roadmap: Advisory Group Recommendations* (Energy Roadmap) outlines strategies for capturing the enormous opportunity for the Midwest to build on its historic strengths and reclaim its position as a manufacturing powerhouse and a place of innovation and meaningful work. We have the opportunity to improve and expand our region's electric grid, reduce our dependence on foreign oil, and mitigate environmental impacts of conventional energy sources. The recommendations found in this document represent nothing short of a new industrial revolution that will reshape this century and beyond. The Midwest has the human, intellectual and natural capital to lead this new economy.

Still, the challenges we face are real. The Midwest is a major producer of agricultural, forestry, and energy-intensive industrial products, and is therefore highly vulnerable to the volatility of petroleum prices characterizing oil markets over the last few years. Its reliance on electricity generated from conventional coal-fired plants also makes it very CO_2-intensive in its overall emissions profile at a time when the world is transitioning to a low-carbon energy economy. The Midwest faces the challenge of how to sustain its dynamic industrial, manufacturing and agricultural economy, while lessening its dependence on energy imported from overseas and increasing its climate stewardship.

The high energy intensity of the Midwest has emerged naturally from the long-term availability of low-cost coal and oil in the region and the fact that the Midwest has been and remains a manufacturing and agricultural center that produces goods and grows commodities for a much larger North American and world market. The region's economic growth and energy security now depend on rapidly accelerating the deployment of cost-effective ways to use the current energy supply more efficiently, diversify energy sources, and lower the carbon intensity of the region's traditional fossil energy supply.

These ambitious objectives require a multi-pronged policy strategy that changes incentives for both energy supply and demand in multiple sectors. The sectors in the Midwest with the highest greenhouse gas (GHG) emissions are electric generation, transportation, and industrial energy use, in that order. Approximately 72 percent of the electricity generated in the region is from coal; that electricity supports local commercial, residential and industrial end-use, as well as wholesale markets in the eastern United States.[1] The transportation sector is responsible for the highest GHG emissions of any end-use sector in the region, with the majority of those emissions from gasoline combustion in passenger cars. Both sectors continue to generate increasing emissions due to regional population growth, and, in the case of transportation, increased energy demand per person. Emissions from the industrial sector, on the other hand, are declining, in part due to a contraction of the manufacturing sector itself, but in part due to improved efficiencies and to the use of less GHG-intensive fuels in that sector.[2]

Smoothly transitioning to a fundamentally new, lower-carbon energy economy in the region will require a commitment for:

- Immediate adoption of policies capitalizing on existing low-cost, low-carbon opportunities such as energy efficiency measures in multiple sectors;
- Modifications of the existing regulatory framework for energy supply to remove disincentives for reduced energy use;

[1] Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009).

[2] Larsen, John, Thomas Damassa, Ryan Levinson, "Charting the Midwest: An Inventory and Analysis of Greenhouse Gas Emissions in America's Heartland" World Resources Institute, 2007.

- Establishment of a stable regulatory environment for development of renewable energy, the regional transmission infrastructure needed to bring it to market, and advanced technologies such as carbon capture and storage;
- Adoption of additional market policies to expedite research, development and commercialization of existing and advanced renewable and fossil energy technologies; and
- Large-scale investment in the human capital necessary for an advanced energy economy to thrive, including consumer education, workforce and regulator training, and technical assistance for business interests and entrepreneurs.

A transition of this magnitude cannot happen overnight. Logistical, technical and cost obstacles persist for many promising zero- and low-carbon renewable and fossil energy technologies. Aggressive commercial deployment of a host of new advanced technologies will require development of necessary legal and regulatory frameworks, together with public funding and incentives to reduce the financial risk incurred by early innovators deploying new technologies in a commercial setting. While the full potential of many advanced technologies will not be available in the near term, current policy decisions are critical to establishing a foundation for industry development and to providing the support and incentives needed to accelerate the pace at which such technologies move forward.

The governor-appointed advisory groups responsible for developing this Energy Roadmap were asked to identify the highest-priority next steps that states and provinces should take in order to help achieve the MGA's energy targets. The advisory groups have deemed the following 16 recommendations as the most critical in the near term. However, the full Energy Roadmap contains a larger number of important actions that the advisory groups urge Midwestern jurisdictions to take to secure their energy future, accelerate the transition to low-carbon energy technologies, and stimulate manufacturing and job growth.

ENERGY EFFICIENCY

Energy efficiency technologies are often cited as the most cost-effective and easily deployed method of reducing energy demand and GHG emissions and lowering energy prices. There are underutilized energy options available today that can have a substantial and immediate impact on energy demand and emissions.

A. Priority Recommendation: Require Utility Energy Efficiency Savings

Require retail energy providers to make energy efficiency a priority in order to meet a region-wide energy efficiency standard of 2 percent annual savings for electric utilities and 1.5 percent annual reductions for natural-gas utilities. Energy efficiency standards should be applied 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.

The Energy Security and Climate Stewardship Platform for the Midwest (Energy Platform) includes a commitment to "meet at least 2 percent of regional annual retail sales of natural gas and electricity through energy efficiency improvements by 2015, and continue to achieve an additional 2 percent in efficiency improvements every year thereafter." A review of studies of energy efficiency resource potential in the region found this to be an aggressive but supportable goal for electricity given the range of mitigation options available.

All MGA jurisdictions should carry out an assessment of their energy efficiency potential. Retail energy providers are in a good position to drive energy efficiency across their customer bases, and several states and provinces have already been actively involved in developing energy efficiency programs through their energy providers. Iowa, Minnesota and Wisconsin have established programs that are among the most ambitious in the nation and that provide many examples of award-winning efficiency programs. Illinois, Iowa, Michigan, Minnesota, Ohio and Wisconsin all have policies or regulatory proceedings under way to ramp up to achieve energy savings between 1 and 2 percent.[3] South Dakota recently included energy efficiency as an eligible activity in new renewable energy standards or objectives. In addition, Manitoba Hydro has Power Smart programs that provide energy efficiency assistance to Manitoba's residential, commercial and industrial customers, with resulting savings of over $36 million annually on electricity and natural-gas bills.[4]

B. Priority Recommendation: Reward Utility Energy Efficiency Investments

Implement changes in regulatory practices and rate designs to remove financial disincentives and provide appropriate incentives for prudent expenditures on energy efficiency by regulated utilities, including providing cost recovery for energy efficiency programs and services and providing new opportunities for utility earnings associated with the successful achievement of energy efficiency goals.

Regulatory practices and rate designs can result in barriers to efficiency investments. Jurisdictions should examine their regulatory frameworks to identify the changes needed to provide appropriate incentives for prudent expenditures in energy efficiency by regulated utilities. This policy recommendation develops the next generation of utility regulatory practices, and as such is key to successfully implementing all other energy efficiency policy options.

Efforts by the federal government to strengthen efficiency standards for appliances have been historically slow to evolve and do not cover many common energy-using household devices. Where allowed, MGA states should set the stage for the federal government to act by adopting standards for appliances and equipment that go beyond federal law and cover types of appliances and equipment not currently covered by federal law. An analysis performed for the MGA by the Center for Climate Strategies suggests that strengthened appliance standards for televisions alone could save more than 14 million megawatt-hours (MWh) in the Midwest region by 2025 — more than enough to power North Dakota or South Dakota for a year at 2007 use rates.

While much of the focus of energy efficiency programs is placed on the instrumental role that utilities play in capturing energy efficiency savings, the role of combined heat and power (CHP), a form of distributed generation, is often overlooked and underutilized. CHP generation involves systems located at or near the point of use that generate a portion of the electricity required at the site and simultaneously utilize system heat, which would otherwise be lost, for heating, cooling or dehumidification. Recognizing the significant efficiency gains associated with using CHP systems, EEAG recommends doubling the installed CHP capacity in the Midwest by 2030. Along with systemwide efficiency gains, CHP has significant GHG reduction potential. Revisions in regulatory policies and procedures, together with recognition of the energy efficiency benefits of CHP, will be required to encourage industry and utilities to expand the utilization of CHP.

[3] www.aceee.org, State Energy Efficiency Policy Database.
[4] www.hydro.mb.ca

C. Priority Recommendation: Strengthen Building Codes

Adopt residential and commercial building codes that meet or exceed the national model energy codes, with an automatic, statutorily required increase to coincide with the national model code review process.

Strengthening building energy codes and appliance efficiency standards is also key to improving the efficiency of energy use in the residential and commercial sectors in the Midwest. Where jurisdictions do not have statewide building energy codes, new legislation may be needed. Even where building codes do exist, full compliance is rare. One market-research report estimates that, nationwide, only 80 percent of new projects comply with commercial-code lighting requirements; that number drops to 76 percent when West Coast respondents are excluded.[5] Improving rates of compliance with building codes will require complementary commitments to more-active code enforcement and additional training for code officials, builders, building operators and homeowners. Options for improving the energy performance of rental properties should also be explored through existing codes and ordinances.

The cost savings associated with energy efficiency investments are substantial, and measures of energy efficiency should therefore be visible selling points for a much wider array of products in the region, including homes and rental units. Point-of-sale disclosure programs and greater application and adaptation of certification programs such as Leadership in Energy and Environmental Design (LEED) and ENERGY STAR® would be invaluable tools for increasing returns to energy efficiency investments and encouraging greater voluntary adoption of energy efficiency measures.

D. Priority Recommendation: Government Leading by Example

Demonstrate public sector leadership in applying energy efficiency technologies by reducing energy consumption in existing and new government buildings by 15 percent by 2015, 20 percent by 2020 and 25 percent by 2025, relative to forecasted levels. Furthermore, 20 percent of all government buildings should be recommissioned and improved to meet or exceed current energy codes by 2015, with an additional 3 percent of buildings improved annually in each subsequent year.

Many states, along with the federal government, have taken the lead in establishing challenging energy-use reduction goals for state and federal buildings. These programs provide leadership, reduce expenditure of tax dollars over time, and set an example for the private sector. These initiatives also represent opportunities for testing innovative energy-management programs, shared savings contracts, and other technical and programmatic plans that show the private sector how these programs work in an applied setting. These programs often make good business sense for governments to pursue because they reduce energy costs for state and provincial governments. Furthermore, monitoring and tracking those savings in new and retrofitted public buildings is an effective way to demonstrate the payback to the private sector. It also helps to build capacity within the industry to deliver those services long-term.

[5] Zing Communications, 2007. http://www.aboutlightingcontrols.org/education/pdfs/2007 percent20Commercial percent20Energy percent20Code percent20Compliance percent20Study.pdf

RENEWABLE ELECTRICITY

While readily available energy efficiency measures represent a cost-effective foundation for the Midwest's lower-carbon energy economy, additional steps will be required to move the region's remaining energy supply away from its historical reliance on GHG-intensive technologies. These steps will be especially critical in the region's two largest carbon-emitting sectors: electricity generation and transportation. Although these sectors rely on distinctly different fuel sources and supply frameworks, they face remarkably similar barriers to adoption of new technologies, including policy, institutional, and marketing obstacles.

The Energy Platform calls for 30 percent of the electricity consumed in the region in 2030 to come from renewable sources. Achieving this ambitious increase over the 2.4 percent renewable electricity generated in 2005 will require the MGA jurisdictions to develop and implement a coordinated regionwide planning process for renewable energy build-out that addresses the wide range of obstacles described above and includes significant commitment to developing the regional electricity transmission necessary to support such renewable energy goals.[6] The objective of the process will be to establish a stable regulatory environment for electricity generation from wind, biomass, hydropower, solar and other renewable sources at the state and provincial level, and to promote similar stability in the federal renewable regulatory structure and in federal incentive programs.

E. Priority Recommendation: Enact/Enhance Renewable Energy Standards/Objectives

Enact or enhance existing renewable energy standards or objectives so that they are sufficient to ensure that 10 percent of electricity consumed in the region comes from renewable sources by 2015 and 30 percent by 2030.

Renewable energy standards and objectives already exist in most MGA jurisdictions and are being considered at the federal level as well. Strengthened state-level efforts will likely be required, however, to ensure that the MGA objectives are met. Planning at the regional level will facilitate cooperative achievement of those objectives through improved use of high-potential wind areas and other parts of the Midwest rich in potential for other renewable resources, as well as integrated regional transmission planning that supports a good local/regional plan for renewable electricity generation in the Midwest.

F. Priority Recommendation: Support Key Midwest ISO Transmission

Support the Midwest ISO's Phase I and II Regional Generator Outlet Study, which outlines the transmission investments needed to meet the Energy Platform goal of 10 percent renewable energy by 2015 and estimates the transmission investment needed for achieving subsequent targets in a coordinated fashion.

[6] Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009).

To effectively stimulate development of renewable electricity markets, regulations such as renewable energy standards (RESs) and objectives (REOs) must be accompanied by a host of additional policies and programs designed to overcome existing cost, technical, and infrastructure obstacles to widespread deployment of new electricity technologies. Such requirements include comprehensive siting principles and policies for wind farms, workforce development programs, and streamlined permitting and approval processes for multi-state regional transmission improvements to accommodate energy from nontraditional renewable sources.

In the Midwest, collaborative regional transmission planning and routing will be particularly important for enabling the widespread, near-term development of the region's extensive wind power resource and other opportunities for distributed generation alternatives. The MGA states are estimated to possess wind capacity in excess of 5.7 million MWh, or roughly 53 percent of the nation's onshore wind capacity.[7] Development of that wind resource has been hampered by the fact that existing transmission capacity does not extend into areas of high wind capacity. To address this issue, the Midwest Independent System Operator (Midwest ISO) is conducting a Phase I and II Regional Generator Outlet Study (RGOS) to explore options and costs associated with modifications to the existing transmission grid that will be necessary to enable the Midwest states to meet their total RES and REO targets and potentially provide renewable energy outside the Midwest market as well. This project is working with several of the MGA states to formally recognize high-wind-capacity areas as "renewable energy zones" and to identify the best local and regional options for linking those zones with an integrated regional transmission plan approved by Midwest ISO members.

G. Priority Recommendation: Complete Regional Transmission Cost Allocation Formula

Support efforts to deliver a recommended formula for equitable and effective cost allocation in financing regional transmission by December 2009. MGA should continue to coordinate these efforts with Midwest ISO, the Organization of Midwest ISO States' Cost Allocation Recovery Program and the Upper Midwest Transmission Development Initiative.

H. Priority Recommendation: Increase Capacity to Integrate Wind Energy on the Grid

Work with Midwest ISO and other regional transmission operators to ensure further development of additional grid-integration capacity for the region's wind resources through design, demonstration and deployment of engineering and operating strategies for grid management, energy storage and advancement of new-technology demonstration.

Collaborative regional transmission planning can provide long-term relative cost savings and more-efficient delivery of electricity than jurisdiction-by-jurisdiction approaches by more effectively anticipating needs and avoiding duplication or absence of services. Nevertheless, individual jurisdictions are typically resistant to supporting regional planning and transmission projects beyond those that provide direct benefit to their customers and utilities. An equitable cost-allocation framework is therefore a critical component in developing support, and funding, for regional transmission

[7] Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009).[8]

projects. The MGA, together with other regional transmission efforts, is working to develop a proposed cost-allocation formula that equitably distributes some percentage of total costs among Midwest ISO electricity customers, generators and transmission operators.

While transmission capacity is a near-term obstacle to the cost-effective establishment of wind farms and other forms of renewable electricity generation located far from load centers, additional grid issues associated with the variability of wind power arise as wind generation is scaled up. Unless linked to a storage technology, wind energy is generated, and enters the grid, on a variable basis determined by wind conditions. Accommodating this flux in supply requires a sophisticated ability to balance the sources of electricity that are entering the grid and to regulate the response of other energy sources as the wind energy production changes with wind speed. These "grid integration" challenges become increasingly difficult as the size and scale of wind generation in a concentrated geographic area increase. Absorbing the levels of wind power called for by the Energy Platform will require advancements in and innovative approaches to next-generation grid management, wind forecasting, electricity and potential energy storage, and alternative applications of wind-generated electricity such as hydrogen or fertilizer production. Support is also needed for further development and integration of distributed wind and smaller-scale projects that do not require bulk transmission over long distances.

ADVANCED COAL WITH CARBON CAPTURE AND STORAGE

Renewable electricity policies will be critical for stimulating innovation in the renewable technologies of the future, but a practical, comprehensive strategy for the transformation of the Midwest's energy system also requires large-scale deployment of advanced coal technologies with carbon capture and storage (CCS) in order to address adequately both climate and energy security concerns. The development of advanced coal technologies combined with CCS could significantly lower the emissions associated with utilizing the region's abundant coal resources. CCS also can be deployed with natural-gas processing, biomass fermentation and gasification, and other industrial activities. The Energy Platform calls for demonstration of a wide range of CCS technologies in the region by 2015, integration of CCS into all new coal power plants by 2020, and a long-term goal to transition the region's entire fleet of coal plants to CCS by 2050.

I. Priority Recommendation: Develop Legal and Regulatory Framework for CCS

Develop, or enhance as needed, statutes and rules to have a comprehensive statutory and regulatory framework for CO_2 transport and storage in place by 2010.

J. Priority Recommendation: Lay the Groundwork for a Geologic Storage Utility

Cooperatively develop design recommendations to allow for the establishment of geologic carbon-sequestration utilities operating on a state and provincial, or inter-jurisdictional, geologic basin-wide scale.

To achieve this objective, the MGA jurisdictions must take the lead in developing the foundations for the CCS industry in the United States and Canada. Development and wide-scale deployment of CCS technologies will require jurisdiction-by-jurisdiction establishment of a consistent commercial, legal and regulatory framework for the transport and storage of CO_2 (including requirements for monitoring, mitigation, and verification of storage) that provides clear direction about ultimate liability for stored CO_2. This framework should address issues related to regulatory oversight, siting and permitting processes, property ownership structures, environmental protection, and long-term liability associated with CO_2 transportation and storage. Federal programs regulating components of the CCS process are also being developed or existing programs are being adapted. However, many of the issues associated with regulation of transporting and storing CO_2 are within the jurisdiction of state and provincial governments, and federal programs regulating CCS should not pre-empt the regulatory programs developed at the state or provincial level.

This effort should include development of comprehensive regulatory programs for CO_2 transport and storage as well as creation of the legal and regulatory framework necessary to allow development of state and provincial or inter-jurisdictional geologic storage utilities. Such a utility could facilitate the development of the commercial CCS industry in the region by taking responsibility for the planning, development, financing, management and long-term site stewardship associated with multiple projects developed in storage formations such as deep saline formations that may cross jurisdictional boundaries. Centralized coordination of such projects would reduce the complexity of managing multiple geologic storage projects in the same geologic formation and provide certainty and transparency to accelerate scale-up of the industry.

MGA jurisdictions can play a critical role in laying the foundation of the CCS industry in the Midwest by encouraging scaled-up deployment of those CCS technologies that are already demonstrated and commercially available. Such technologies include CO_2 capture from coal gasification to produce substitute natural gas or capture from natural-gas processing plants, followed by storage of that CO_2 in depleted oil and gas formations or in deep saline formations. Additional deployment milestones include the successful integration of integrated gasification combined-cycle (IGCC) technology for electric power production with CCS in a commercial setting. An IGCC plant under development by Duke Energy in Indiana is expected to be the first such facility in North America, but CCS projects with IGCC are also under development in Australia, China and Europe.

K. Priority Recommendation: Incent CO_2 Storage in Enhanced Oil Recovery

Allow for tax credits per ton of CO_2 captured for commercial enhanced oil recovery (EOR) operations and enhanced coal bed methane recovery operations using anthropogenic CO_2 that result in net storage of CO_2. These credits should supplement expected federal per-ton payments for CO_2 stored in EOR and deep saline operations, if deemed necessary for a project to be commercially viable.

Once CO_2 is captured from an industrial source, the transport and injection of such CO_2 for the purposes of enhanced oil recovery (EOR) is an established commercial practice in the United States. Since the 1970s, millions of tons of CO_2 have been captured, transported and injected for this purpose annually. The U.S. Department of Energy estimates that with conventional EOR practices, current storage capacity in oil and gas formations in the United States and Canada is

sufficient to store approximately 21 years' worth of U.S. stationary-source emissions, while simultaneously extending oil production from depleted domestic oil reserves at a significant net CO_2 emissions reduction over imported oil.[8] Further analysis, commissioned by MGA for the Midwest specifically, suggests the potential to use 530 million metric tons of captured CO_2 to produce 2.2 billion barrels of otherwise unrecoverable domestic oil in the region. Industry experts are also commercially deploying next-generation EOR practices and reservoir management strategies that will significantly increase that potential.[9]

Within the Midwest, the greatest potential for EOR is concentrated in oil and gas formations in Illinois, Kansas and North Dakota, while other MGA states such as Michigan, Indiana and Ohio have significant potential for developing CO_2 EOR projects as well. Deep saline formations also provide a storage option with a larger geographic range and much greater storage capacity over the long term. Commercial-scale CCS in deep saline formations has been demonstrated for years in the North Sea.[10] While early Midwestern demonstrations of CO_2 storage in deep saline formations show promise, these porous rock formations still need to be thoroughly mapped and studied.

While considerable additional geological assessments are needed to get a full picture of the Midwest's CO_2 storage potential, all but three MGA jurisdictions — Iowa, Minnesota and Wisconsin — are endowed with oil and gas formations or deep saline formations, or both, that are suitable for commercial geologic storage. Given the excellent geographic distribution of potential CO_2 storage formations in the Midwest, and that transporting CO_2 through pipelines is the best understood and least costly aspect of industrial-scale CCS systems, all MGA jurisdictions should be able to participate in and benefit from regionwide deployment of a CCS infrastructure.

L. Priority Recommendation: Reduce Capital Costs of CCS Projects and CO_2 Pipelines

Allow for tax credits or tax abatement for new or expanded carbon capture and storage project development to reduce the capital costs of investments in capture and compression components and in the build-out of the transportation infrastructure.

Although the pipeline transport phase is often cited as the biggest hurdle to CCS deployment, the major cost of operating an advanced coal plant with CCS is actually incurred during the capture and compression phases of a project. To assist with such capital costs, several states, including Illinois, Indiana, Kansas, Michigan, Minnesota, North Dakota and Ohio, are in the process of developing or have passed legislation that provides a range of financial incentives for deployment of advanced coal with CCS in their jurisdictions. Financial incentives support the capital investment in capture and compression components and in the build-out of the transportation infrastructure.

[8] National Energy Technology Lab, 2007. "Carbon Sequestration Atlas of the United States," http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/.

[9] U.S. DOE, NETL (January 9, 2009), "Storing CO_2 and Producing Domestic Crude Oil with Next Generation CO_2-EOR Technology. Prepared by Vello Kuuskra et al. for the U.S. DOE, NETL.

[10] Bellona Foundation, "Security of CO_2 Storage in Norway," available at http://www.bellona.org/factsheets/1191928198.67 [accessed August 17, 2009]

BIOECONOMY AND TRANSPORTATION

The task of reducing emissions and energy use in the transportation sector has been described as a three-legged stool: 1) reducing the carbon intensity of fuels, 2) increasing the fuel efficiency of vehicles, and 3) creating conditions that reduce the need to drive. The Energy Platform focused on the first of these strategies, emphasizing the need for accelerated development and regional deployment of sustainable biomass-based fuels such as ethanol. BTAG broadened the transportation objectives with recommendations to achieve better fuel mileage, mileage-based insurance pricing, more-efficient driving, improved freight efficiency and expanded transportation choices, including passenger rail, transit, bicycling and walking.

The Energy Platform commits to "create a uniform, regional low-carbon fuels policy —implemented at the state or provincial level as a standard, objective or incentive." Deployment of low-carbon fuels in the region will require a coordinated strategy for addressing multiple issues related to production and supply, distribution infrastructure, vehicle technology, and consumer vehicle and fuel choice. Regional jurisdictions should therefore rely on a mix of "market pull" strategies that create demand for pulling new fuels into the market, and "market push" strategies that support the development of the supply infrastructure required to ensure that demand is met smoothly and without radical price or supply disruption.

M. Priority Recommendation: Develop Model Regional Low Carbon Fuel Standard

Work with affected stakeholders to develop a model regional low-carbon fuel standard that will decrease the greenhouse gas (GHG) intensity of transportation fuels by 10 percent in 10 years from the start of the program.

Market-pull strategies that are existing or proposed at the federal level, such as the Renewable Fuel Standard and potentially a low-carbon fuel standard (LCFS), operate within regional markets to increase demand for fuels qualifying as "low carbon" under the federal definitions. Similar policies, such as Minnesota's biofuel blend requirements, exist or have been proposed at the state level in several MGA jurisdictions. Whether or not individual MGA jurisdictions choose to implement an LCFS or similar policy, biofuels producers, farm organizations, environmental and conservation groups, and other participating MGA stakeholders support developing a regional consensus around appropriate LCFS design considerations, so that the Midwest can more effectively shape the federal LCFS debate going forward.

To expedite market penetration of low-carbon fuels and development of new lower-carbon fuel technologies, a set of push policies may also be required to overcome logistical and technical obstacles related to available vehicle technology and fuel-distribution infrastructure. The range of potential push policies includes, but is not limited to: tax incentives and technical standards for refueling infrastructure for a range of low-carbon fuels, including electricity and hydrogen; funds for public education efforts on definitions of, and availability of, low-carbon fuel options; and consumer vehicle choice incentives.

Many advanced transportation technologies are not yet "shovel ready," and additional support policies are required to expedite passage over the remaining scientific, technical and cost hurdles to commercialization. Policies such as technical assistance, financial support and workforce training should be designed to expedite development and commercialization of low-carbon fuels (e.g., advanced biofuels, electricity and hydrogen), advanced energy-storage technologies for vehicles (e.g., batteries), and advanced drivetrains (e.g., plug-in and fuel-cell electric). Complementary policies that attract advanced-technology entrepreneurs and facilitate the development of funding and investment sources for new technologies should be pursued to encourage regional supply-chain development so that as much as possible of the emerging industries' value stays within the region.

N. Priority Recommendation: Support Biomass Feedstock Demonstration Projects

Identify and support regional demonstration projects for the production, harvest, transport and storage of biomass feedstocks for utilization by a variety of low carbon bioenergy technologies.

The Midwest's extensive agricultural base has already allowed it to emerge as the heart of the nation's biofuel industry, and the region can build on its market advantage as new biofuel and biopower technologies come online. The Midwest leads the nation in biomass production potential, but a strategic effort will be required to cost-effectively and sustainably develop a supply chain for the new feedstocks required to support these energy industries, including perennial biomass, agricultural residues and forestry residues. The MGA can be instrumental in identifying and addressing obstacles related to production, harvest, transportation and storage of new biomass feedstocks. It can also expedite the development of the demonstration projects, technical assistance and regulatory frameworks necessary to support this emerging industry.

O. Priority Recommendation: Implement Transportation System Efficiency Strategies and Investments

Implement a range of strategies including investment in transit, bicycle and pedestrian infrastructure, building and expanding the Midwest Regional Rail network and enabling development that promotes transportation system efficiency.

Reductions in vehicle miles driven are possible simply by allowing the market to provide compact, mixed-use development in response to consumer choice, and by building complete streets suitable for driving, walking, bicycling and transit. Jurisdictions should adopt goals to reduce per-capita vehicle miles driven, as an indicator of increased efficiency, and direct their agencies to incorporate that goal in transportation planning. While emphasizing consumer choices, jurisdictions should make resources available to cities and regions that choose to create compact new development that complements investments in intercity rail, transit, and bike and pedestrian infrastructure.

Another way to reduce energy use and emissions from the transportation sector is to provide people with greater access to more-efficient transportation modes, such as passenger rail, van pools, local transit, walking and bicycling. A mix of transportation modes, together with transit-oriented development that capitalizes on the proximity to transportation infrastructure, help to make bicycling and walking attractive travel options, particularly for nearby destinations. To increase access to such alternative modes, the MGA jurisdictions should commit to increasing the share of travel in non-single-occupancy vehicle modes by building improved passenger rail as articulated by the Midwest Regional Rail Initiative; resolving the existing regulatory obstacles to ensuring adequate funding for local transit systems; and adopting strong "complete streets" policies to ensure that streets are suitably designed for pedestrian and bicycle use.

P. Priority Recommendation: Enable the Offering of Mileage-Based Insurance to Drivers

Eliminate regulatory barriers that prevent insurers from offering mileage-based insurance.

When transportation costs vary by use, they provide individuals and businesses with opportunities to save. Because insurance is a major cost of vehicle operation, and because accident risk varies with mileage, mileage-based insurance can be very powerful in fostering transportation efficiency. MGA states should eliminate regulatory hurdles where they exist to insurance companies offering mileage-based insurance as an option in the marketplace for drivers to choose.

I INTRODUCTION

The Energy Security and Climate Stewardship Platform for the Midwest

In November 2007, Midwestern governors and a Canadian premier released the *Energy Security and Climate Stewardship Platform for the Midwest* (Energy Platform). The Energy Platform articulates a commitment on the part of Midwestern leaders to transform the region's energy economy, strengthen Midwestern energy security, reduce greenhouse gas (GHG) emissions and stimulate job creation. The Energy Platform includes a series of cooperative regional initiatives intended to develop and implement a comprehensive set of renewable and low-carbon energy technologies and strategies. The Energy Platform also articulates a set of measurable milestones against which progress toward stated goals should be assessed.

The Energy Platform's goals and objectives are divided into four themes: energy efficiency; bioeconomy and transportation; renewable electricity; and advanced coal with carbon capture and storage. Each theme is associated with a set of measurable goals and a list of potential policy options for achievement of those goals. Midwestern Governors Association (MGA) leadership appointed diverse representatives to three advisory groups charged with developing a comprehensive set of regionally coordinated but individually customized policy approaches to achievement of the Energy Platform objectives. The advisory groups are: Energy Efficiency (EEAG), Renewable Electricity and Advanced Coal with Carbon Capture and Storage (REACCCS), and Bioeconomy and Transportation (BTAG). They have been meeting since the spring of 2008 to develop and reach consensus on a set of policy recommendations for regional leaders.

The extraordinary commitment of Midwestern leaders to the energy and climate objectives reflected in these efforts uniquely positions the Midwest to emerge as a leader in energy policy and technology and a vital and influential voice on energy and climate issues.

The Midwestern Energy Context

The rich array of states comprising "the Midwest," together with the province of Manitoba, represents a vital part of the North American economy and a major player in both national and international markets. In 2008, economic activity in the Midwestern states accounted for 21 percent of U.S. national economic output, with production spread broadly across agricultural, forestry, and industrial products.[11] The states and provinces of the region are highly diverse, with variation across economic base, development patterns, natural resource endowments and available energy resources, but they share a reputation for ingenuity and for agricultural and manufacturing prowess, which will be invaluable as the region confronts its energy security and climate challenges. In fact, these characteristics have positioned the Midwest well to emerge as a leader in developing strategies for transforming energy vulnerabilities into economic advantages.

[11] BEA, 2009, "Economic Slowdown Widespread Among States in 2008," http://www.bea.gov/newsreleases/regional/gdp_state/gsp_newsrelease.htm

Midwestern energy security concerns mirror those of the country more broadly. The United States imports 58 percent of its oil supply, 70 percent of which is consumed in the transportation sector.[12] Rising energy prices in 2004-2005 prompted an economist at the Federal Reserve Bank in Chicago to caution that the energy intensity of Midwest manufacturing makes the region's economy disproportionately vulnerable to the impacts of rising energy prices.[13] The region's cold winters also expose residential consumers to fluctuating prices for natural gas and, to a lesser extent, heating oil. The huge fluctuations experienced within domestic and international energy markets over the past several years have highlighted these risks to the region's economy. Even before the soaring energy prices of 2008, the Chicago PMI — an index of the health of Midwestern business — began to show signs that the region's economy was responding negatively to the pressure of high energy prices and the loss of manufacturing jobs to overseas producers (Figure 1).[14]

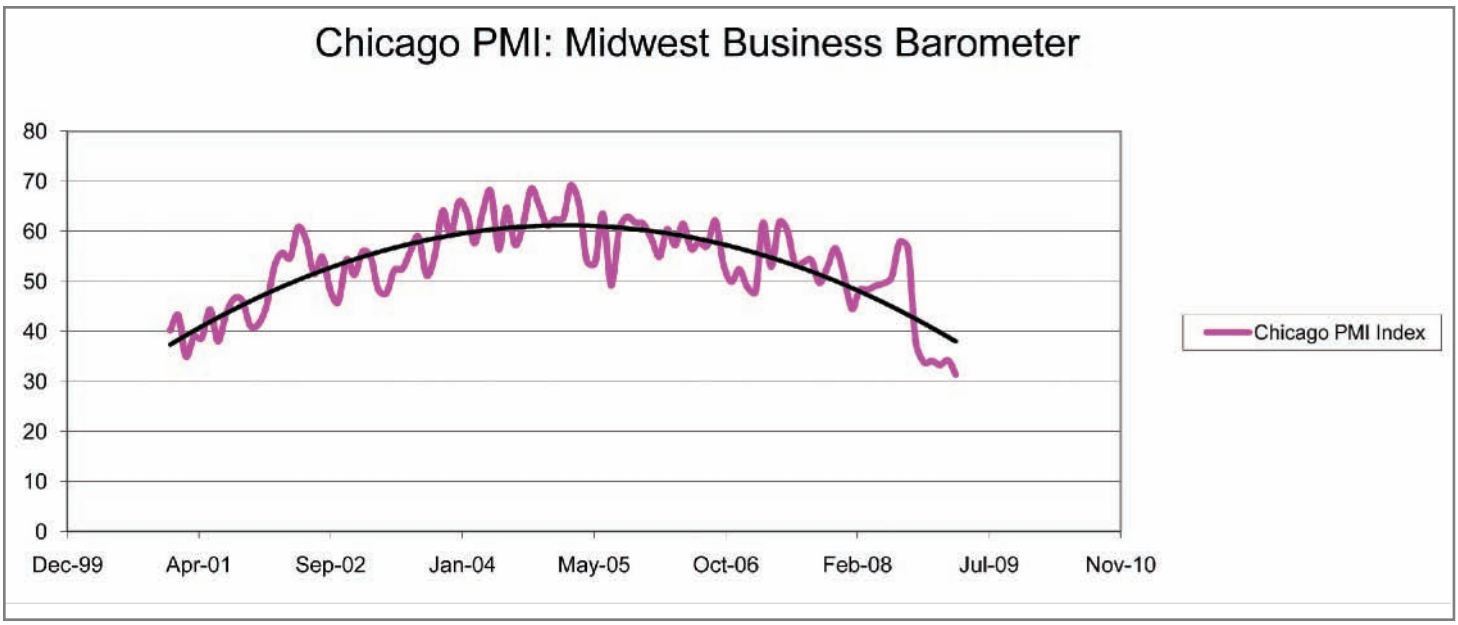


Figure 1: An index of the health of Midwestern business showing the negative response to high energy prices from 2001 to 2009.

The Midwest's abundant and reliable supply of coal has given it some measure of regional energy security in electricity supply. Prices of coal have historically been stable and inexpensive relative to other sources of energy, and 72 percent of the region's electricity supply relies on coal (Figure 2). This dependence has significant environmental implications, however. The Midwest is home to 20 percent of the nation's population, but it produces 27 percent of the nation's GHG emissions, in large part due to the high carbon impact of conventional methods of generating electricity from coal. Although coal pricing has not historically reflected its carbon content, policies that will put a price on carbon dioxide (CO_2) emissions in the future are likely to make traditional uses of coal more expensive, as they will involve some form of additional cost to carbon emitters.

[12] EIA, http://www.eia.doe.gov/basics/quickoil.html, http://tonto.eia.doe.gov/energy_in_brief/foreign_oil_dependence.cfm
[13] Energy Markets and the Midwest Economy, http://www.chicagofed.org/publications/economicperspectives/ep_4qtr2005_part2_mattoon.pdf
[14] Relief from high energy prices came in late 2008 as the more generalized domestic and global economic downturn reduced demand for energy worldwide. The projected future of energy markets in the Midwest and in the United States as a whole is quite sensitive to assumptions made about the depth and persistence of the current downturn (AEO, 2009).

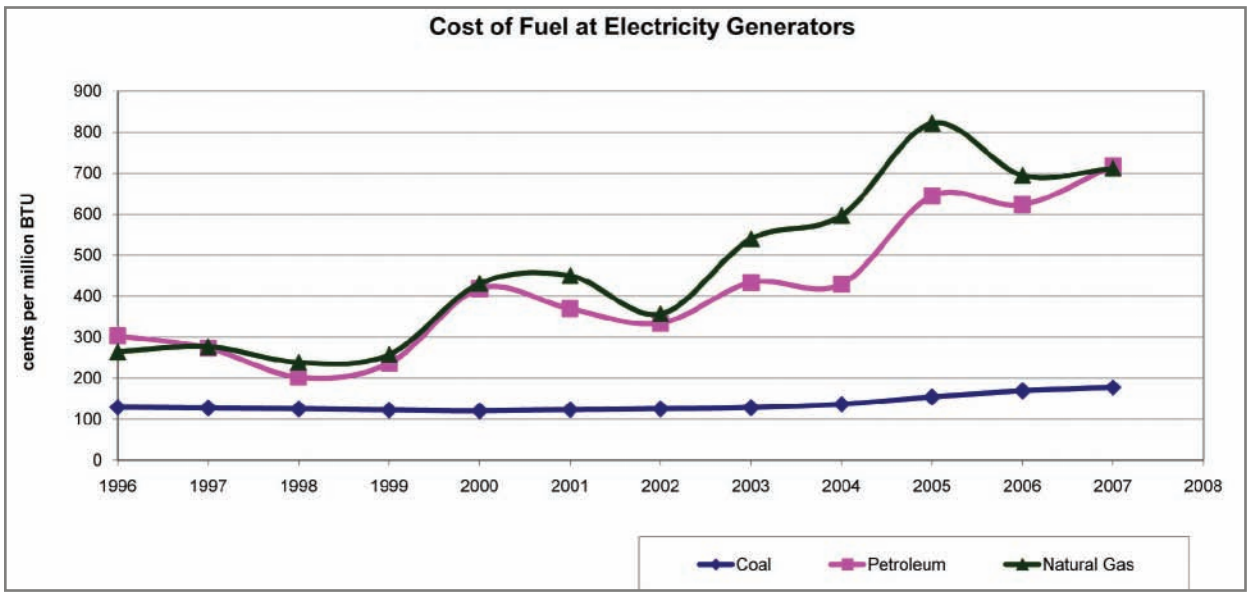
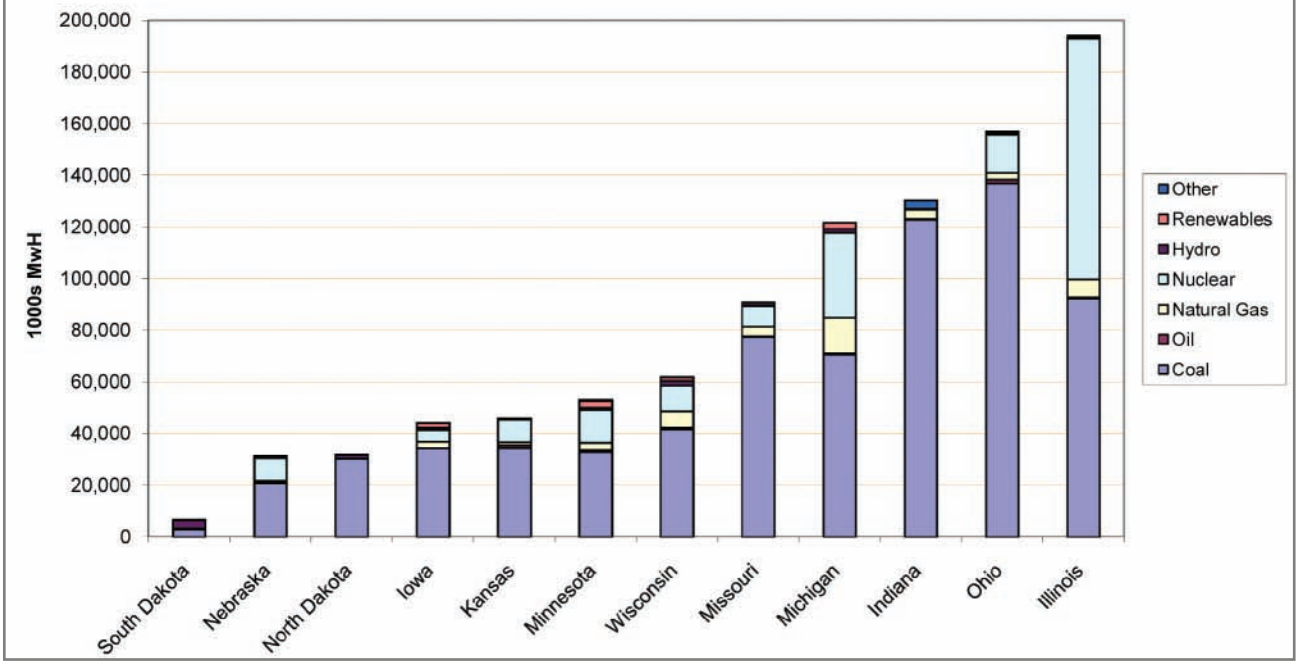


Figure 2: EIA data reporting the rising cost of three major fossil fuels — coal, petroleum and natural gas — from 1996 to 2007.

Figure 3: Electricity Feedstocks in the Midwest. *Source: Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009).*

Despite the overall heavy reliance on coal, some variation exists across electricity-supply technologies among states. Indiana relies upon its vast coal resources for 95 percent of its electricity, whereas South Dakota gets 50 percent of its electricity from hydropower, compared to respective averages of 50 percent and 7 percent nationwide. Only four states in the region rely on greater than average (19 percent) amounts of nuclear in their energy portfolio, including Illinois (48 percent), Nebraska (28 percent), Michigan (27 percent) and Minnesota (24 percent.)



The Midwest, however, is well equipped to turn its energy challenges into opportunities. Faced with the climate and energy challenges common to developed economies worldwide, the Midwest is already positioning itself to capitalize on its broad array of resources and expertise in the establishment of a new energy economy built around the development and adoption of low-carbon energy technologies. According to a recent report, Midwest states are among the top 10

job-creating states in all five categories of the new energy economy: clean energy (Minnesota, Ohio, Michigan), energy efficiency (Ohio, Wisconsin), environmentally friendly production (Minnesota, Ohio, Iowa, Illinois), conservation and pollution mitigation (Ohio, Illinois, Michigan), and training and support for clean-energy jobs (Illinois).[15]

The diverse natural resources of the Midwest have created fertile ground for the emergence of new energy technologies. The region dominates the nation's biofuel production, has a rapidly expanding wind industry, and boasts significant underground storage potential for carbon captured from a range of energy facilities and other industrial sources. Midwestern colleges, universities and private manufacturers have been leveraging the talents of entrepreneurs, inventors and engineers to research, develop and bring to market a range of new energy technologies. The Midwest as a region has also been aggressive in establishing programs to capture energy efficiency potential: six Midwest jurisdictions have current or pending energy efficiency standards, and those of Wisconsin, Illinois and Ohio are among the most ambitious in the nation.

While the Midwest is rapidly emerging as a leader in renewable energy and energy efficiency development, it has barely scratched the surface of the region's potential. The American Wind Energy Association estimates that 10 of the top 20 states with wind-energy resource potential are in the Midwest — North Dakota, Kansas, Nebraska, South Dakota, Minnesota, Iowa, Michigan, Illinois, Wisconsin and Missouri.[16] Manitoba has enormous wind resource potential as well. The Midwest ISO and Southwest Power Pool's footprint currently has more than 9,000 MW of wind generation capacity, but there is the potential to develop as much as 90,000 MW.[17] Seven Midwestern states — Illinois, Indiana, Kansas, Michigan, Nebraska, North Dakota and South Dakota — have oil and gas reservoirs with significant potential for CO_2 storage and oil recovery using currently available enhanced oil recovery techniques. The U.S. departments of Agriculture and Energy (USDA/DOE) also estimate that the Midwest region will be a significant source of biomass in the future to support commercial biopower and biofuel production with renewable forestry residue, agricultural residue and dedicated energy crops such as switchgrass.[18] The resources of the region therefore provide an ample foundation on which to build the new energy economy envisioned by the Energy Platform.

Following endorsement of the 2007 Energy Platform, the MGA governors confirmed their commitment to achieving the Energy Platform's ambitious goals by asking the region's experts to develop this *Energy and Security and Climate Stewardship Roadmap: Advisory Group Recommendations* (Energy Roadmap)–a flexible but comprehensive strategy for tapping the region's low-carbon energy resources and technology opportunities.

Outcomes of the MGA process

Several documents and tools have emerged from the MGA advisory group process, including a "policy options document" developed by each advisory group and multiple supplementary documents and tools such as the Carbon Capture and Storage Toolkit and a white paper summarizing national and Midwest studies of energy efficiency potential. The following sections of this Energy Roadmap distill much of the material found in those individual documents but frequently refer back to the originals, which provide much greater detail and explanation. All are available on the MGA Web site.[19] Advisory group achievements to date also include the launch of several complementary policy initiatives, including a smart grid initiative, a "Relighting the Midwest" initiative and a bioproduct task force.

[15] "The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America," Pew Charitable Trusts, http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf
[16] http://www.awea.org/newsroom/pdf/Top_20_States_with_Wind_Energy_Potential.pdf
[17] http://www.nationalwind.org/pdf/MoellerClair.pdf
[18] U.S. Department of Agriculture and U.S. Department of Energy, 2005. "Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply." DOE/GO-102995-2135. Washington, DC. Online at http://www.osti.gov/bridge.
[19] http://www.midwesterngovernors.org/Energy.htm

ADVISORY GROUP WORK TO DATE:

Energy Efficiency Advisory Group (EEAG)

- Reached consensus on a full range of policy options that flesh out the governors' energy efficiency goals and strategies.
- Completed quantification on cost to the economy and GHG savings of the three quantifiable policy options: utility energy efficiency standards; building codes and appliance standards; and public- sector lead-by-example policies.
- Completed a final draft of a white paper on Midwest and national studies of energy efficiency potential studies.
- Developed draft policy recommendations for combined heat and power.
- Developed a smart grid regional initiative described in the MGA's Midwestern Energy Infrastructure Accord. The initiative was developed by participants attending an MGA-sponsored smart grid forum, "Accelerating Energy Efficiency with Smart Grid," in the summer of 2009.
- Developing a "Relighting the Midwest" initiative to encourage and support regionwide commercial lighting improvements.
- Working with Midwest Energy Efficiency Alliance and the Wisconsin Energy Conservation Corp. to assist Midwestern states in developing similar approaches to implement the appliance rebate program in the 2009 American Recovery and Reinvestment Act.

Bioeconomy and Transportation Advisory Group (BTAG)

- Developed consensus principles for designing a Midwestern low-carbon fuel standard, and making recommendations on a federal policy, by diverse group of stakeholders. Policy goal is to reduce average GHG emissions per unit of fuel by 10 percent in 10 years relative to baseline. Recommendations were adopted by the MGA Governors Steering Committee, and next steps are being developed.
- Established a Bioproduct Task Force resulting in the formation of a Midwestern Biobased Product Procurement System to support growth of the region's bioeconomy, syncing up with adoption of bioproduct preferences in most Midwestern states, and following the outlines of the U.S. Department of Agriculture's BioPreferred program.
- Expanded scope of the BTAG to include policies and expertise to develop strategies related to transportation pricing, transit, bicycle/pedestrian travel, high-speed rail, freight efficiency, and development and planning.

Renewable Electricity &Advanced Coal with Carbon Capture and Storage Advisory Group (REACCCS)

Carbon Management Infrastructure Partnership Resolution

- Developed a "Regional Commercial Plan for Carbon Capture and Storage" in the Midwest.
- Completed analysis of the "CO_2 Enhanced Oil Recovery Potential for the MGA Region," prepared for the MGA by Robert Ferguson, Advanced Resources International.
- Developed the "Carbon Capture and Storage Policy Principles Statement."
- Developed the concept and design recommendations for a Geologic Storage Utility (or Utilities).
- Released the "MGA Toolkit for Carbon Capture and Storage (CCS): Statutory and Regulatory Issues."
- Released the "MGA Legal and Regulatory Inventory for Carbon Capture and Storage (CCS) & Analogues."
- Developed the "Carbon Capture and Storage and Enhanced Oil Recovery Fact Sheet."
- Developed the "Project Developer Interviews: Regulatory measures and financial incentives to accelerate the commercial deployment of advanced coal with carbon capture and storage."
- Developed the "Carbon Management Infrastructure Partnership Discussion Paper."

Regional Electricity Transmission Adequacy Initiative

- Completed MGA Survey of Regulatory Commissions on Transmission Authority.
- Initiated Midwest ISO Regional Generator Outlet Study (RGOS) Phase I, with completion in August 2009.
- Initiated Upper Midwest Transmission Development Initiative with five states to complete cost allocation for RGOS Phase I study results.
- Achieved agreement with Midwest ISO on RGOS Phase II transmission study and survey to complete transmission plans for other MGA/Midwest ISO states, beginning May 2009.

The Energy Choice Simulator

The MGA strategy development process initiated in support of the Energy Platform included a number of activities designed to complement the work of the advisory groups. One such effort has been the design and development of the Energy Choice Simulator. Developed by a collaborative team including the University of Minnesota, Forio, the Great Plains Institute and the World Resources Institute, and with extensive input from MGA stakeholders, the Energy Choice Simulator is a systems-dynamic model that simulates energy supply and demand relationships, associated GHG emissions, and other economic variables in multiple sectors within the Midwest. The model tracks the major emitting sectors, including electricity generation, transportation, and commercial, residential, and industrial heating.

The Energy Choice Simulator was specifically designed to explore the economy-wide impacts of various forms of policy intervention and to estimate the impact of those policies on the energy choices within, and emissions from, the Midwestern region. It allows the user to explore how energy demand and supply choices respond to a wide variety of underlying assumptions about how energy markets behave, as well as to various policies designed to influence that behavior through mechanisms such as taxes, regulations, voluntary incentives, etc. The model captures complex relationships and constraints that exist within sectors and potentially influence energy choices, such as competition between fuel producers and electricity generators for limited biomass resources, or the feedback on demand for electric cars that arises when the price of electricity generation goes up. Where possible throughout this document, results from the Energy Choice Simulator will be used to illustrate such dynamics in the application of policies recommended by the MGA advisory groups.[20]

Documentation on the technical aspects of the Energy Choice Simulator and information on the data and assumptions used are available online.[21]

Baseline energy case in the Midwest

To illustrate the impact of regional policy choices on energy supply and demand in the Midwest, a "baseline" energy case is generated that represents the model's projections about how energy markets and emissions would behave in the absence of state, provincial and regional policies to advance the MGA objectives. This baseline scenario includes federal energy-relevant policies such as the Renewable Fuel Standard (RFS) and the scheduled tightening of the Corporate Average Fuel Economy (CAFE) standards introduced in March 2009. The impacts of recently enacted state and provincial policies that are projected to impact energy-generation portfolios in the future, however, are not included as part of the baseline scenario. The baseline case is therefore not a baseline projection that freezes current state and provincial policy conditions, but a projection of behavior in the absence of any jurisdictional commitment to transform the energy sector. The model is used to illustrate how state- and provincial-level policies such as renewable energy standards, if strategically planned and applied across the region, influence the baseline behavior described below.

Total energy use in the Midwest in the absence of state-level energy policy is projected to stay roughly constant in the near term but to again trend upward by 2030 (Figure 4); longer simulations project sustained increases in energy demand beyond 2030. These increases are driven largely by increases in electricity demand and in transportation fuel demand. The near-term declines in transportation energy demand are caused by the tightened CAFE standards, but those declines are eventually offset and reversed by population growth and increased miles traveled by existing vehicles.

[20] Energy Choice Simulator results are critically dependent on assumptions made about highly uncertain variables such as the expected price paths of oil and coal and estimates of growth in demand for electricity and fuel. While the results of the model are therefore useful for illustrating the complexity of economic response to a given policy or policies, they should not be interpreted as predictions about absolute levels of impact unless accompanied by extensive sensitivity analysis around these uncertain but influential variables. This document does not provide such sensitivity analysis, and presents the model results to illustrate the dynamics of the response and the relative impact of policy efforts rather than to predict the absolute magnitude of impact.

[21] http://forio.com/wiki/mga/index.php/Main_Page

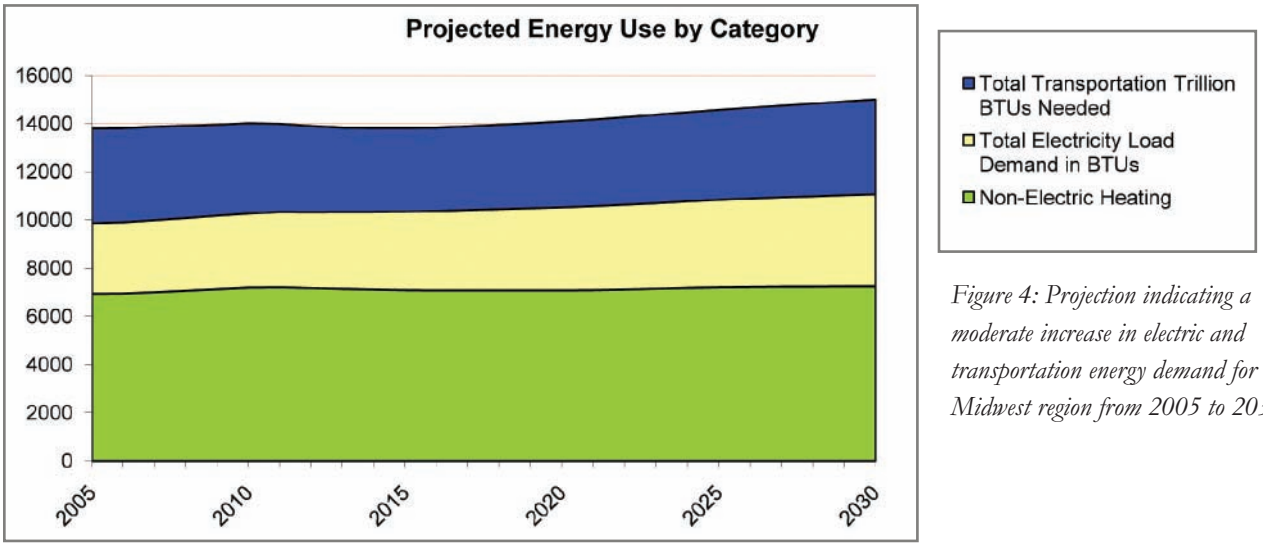


Figure 4: Projection indicating a moderate increase in electric and transportation energy demand for the Midwest region from 2005 to 2030.

The Midwest's emissions pathway under this scenario steadily increases despite the near-term stability of energy demand (Figure 5). These increases are largely attributable to projected increases in emissions from the electricity sector. In the baseline case, increases in electricity demand are projected to be met largely through construction of pulverized-coal plants, which produce high carbon emissions and largely drive the emissions increases shown in Figure 5. Emissions from the transportation sector initially decline due to the effect of the tightened CAFE standards, but eventually again begin to rise as total transport fuel demand increases as shown in Figure 4. Although lower-carbon fuels such as ethanol and biodiesel are drawn into the market through federal policies such as the RFS, high-carbon fuels such as coal-to-liquids are also projected to enter the transportation fuel mix, offsetting many of the emissions gains from the RFS.

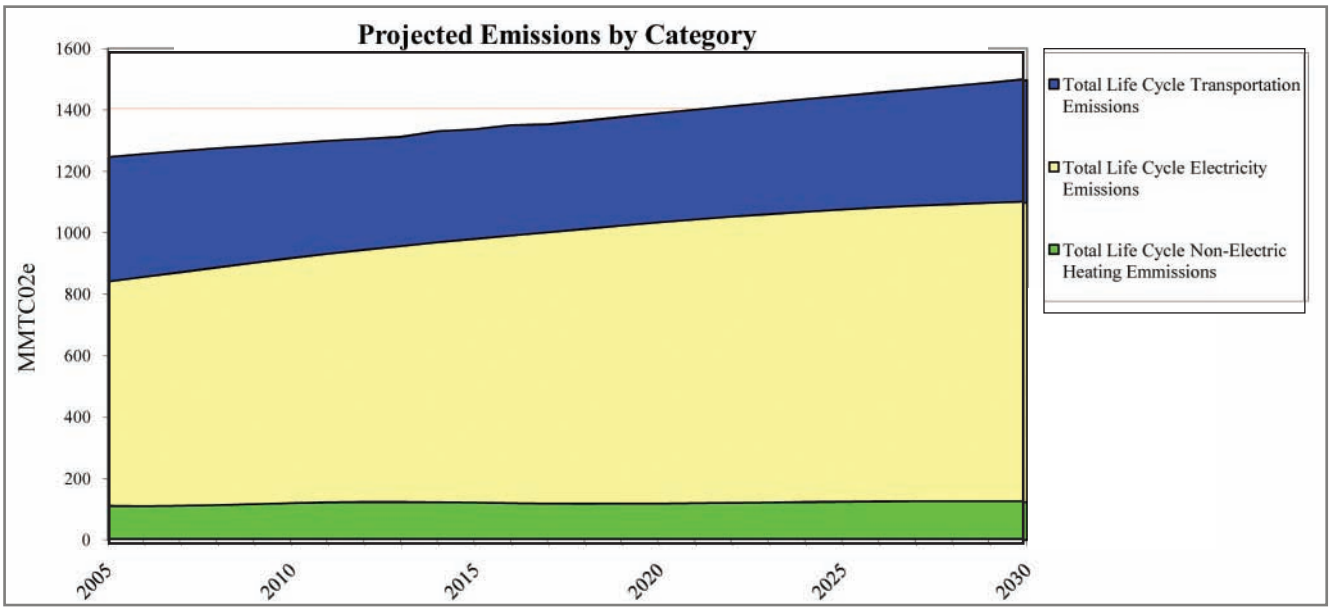


Figure 5: Projection revealing that moderate increases in electric demand result in significant emissions increases due to new demand being met by pulverized-coal generation in the Midwest from 2005 to 2030.

The Energy Platform reflected a joint commitment among Midwestern governors and a premier to implement policies designed to influence the energy and emissions trajectories described above. The chapters that follow explore the policy recommendations of the advisory groups formed during the Energy Roadmap development process in support of that commitment. The Energy Choice Model is used throughout the document to illustrate how such policies influence the behavior of the region's energy sectors and its GHG impacts.

ENERGY EFFICIENCY II

Energy efficiency is a practical and effective way to temper growing energy demand. Energy efficiency technologies are available, tested and ready for immediate and widespread deployment. Numerous studies have shown that energy efficiency measures have already been effective in meeting a significant portion of the new demand for energy since the energy crises of the 1970s.[22] One study, in particular, reports that during this time, energy efficiency can be credited with meeting three-fourths of all new demand for energy services.[23] These gains have been significant, and assessments of achievable potential of energy efficiency show that further benefits are still available and within reach.[24] Capturing these savings is an essential component in achieving the Energy Platform goals.

The governors' and premier's regional energy efficiency goal is to *"meet at least 2 percent of regional annual retail sales of natural gas and electricity through energy efficiency improvements by 2015, and continue to achieve an additional 2 percent in efficiency improvements every year thereafter."*[25]

The scale of potential for reducing energy losses through energy efficiency measures is huge. Estimates by Lawrence Livermore National Laboratory suggest that only 33 percent of the energy contained in electricity feedstocks makes it as electricity to end users; the rest is lost in the process of electricity generation, transmission and distribution. Furthermore, only 80 percent of the energy that reaches residential, commercial and industrial end-users is put to productive use.

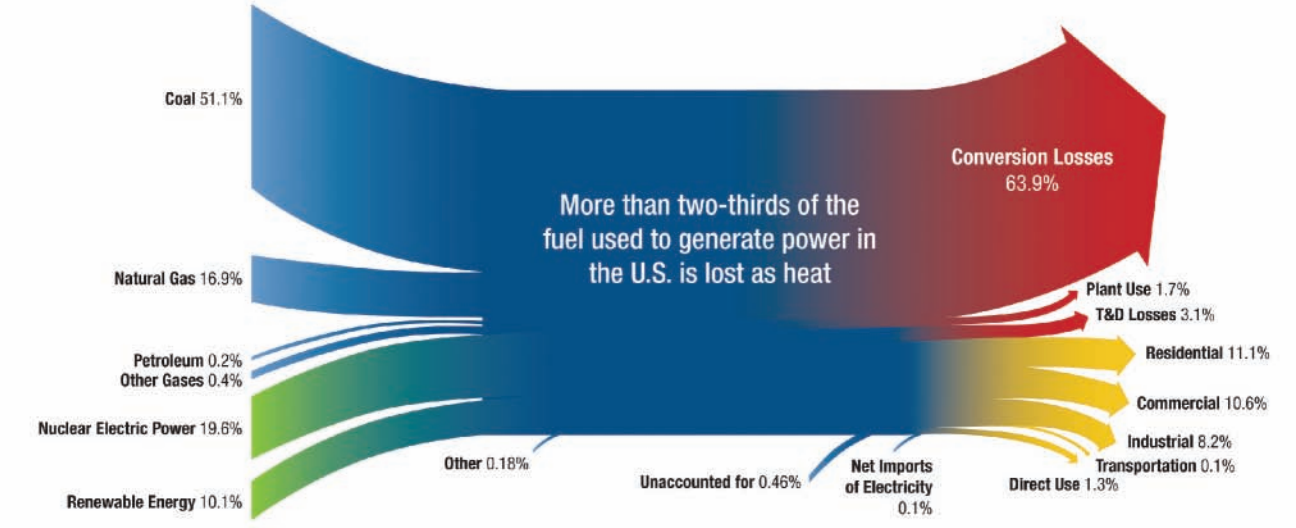


Figure 6: More than two-thirds of the fuel used to generate power in the U.S. is lost as heat. Source: DOE Energy Information Administration (EIA). Annual Energy Review 2007.

Using energy efficiency measures to achieve early gains in the new energy economy makes sense for a number of reasons. The technologies required to reduce the end-use energy losses described above are readily available and can be quickly deployed across all consumer sectors. The most common forms of these technologies include: more-efficient lighting; improvements to the building envelope such as insulation and window upgrades; more-efficient heating, ventilation and air conditioning systems; more-efficient industrial processes and building controls; and a variety of tools, including the "smart grid," to help consumers reduce their energy use through behavior changes.

[22] "Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S. 2010-2030," EPRI.
[23] Leitner, J., K. Ehrhardt-Martinez, W. Prindle, "The American Energy Efficiency Investment Market," A White Paper prepared for the Energy Efficiency Finance Forum, April 2007.
[24] "A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest," prepared by the Energy Center of Wisconsin with assistance of ACEEE and EEAG of the MGA, and with support from Energy Foundation. http://www.midwesterngovernors.org/EnergyInitiatives.htm
[25] EEAG interpreted the Energy Platform language to mean "*ramp up* energy efficiency programs to save at least 2 percent of regional annual retail sales of natural gas and electricity per year by 2015, and continue to achieve an additional 2 percent in efficiency improvements every year thereafter." They further interpreted the goal to apply to non-transportation-sector gas and electricity use. If 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.

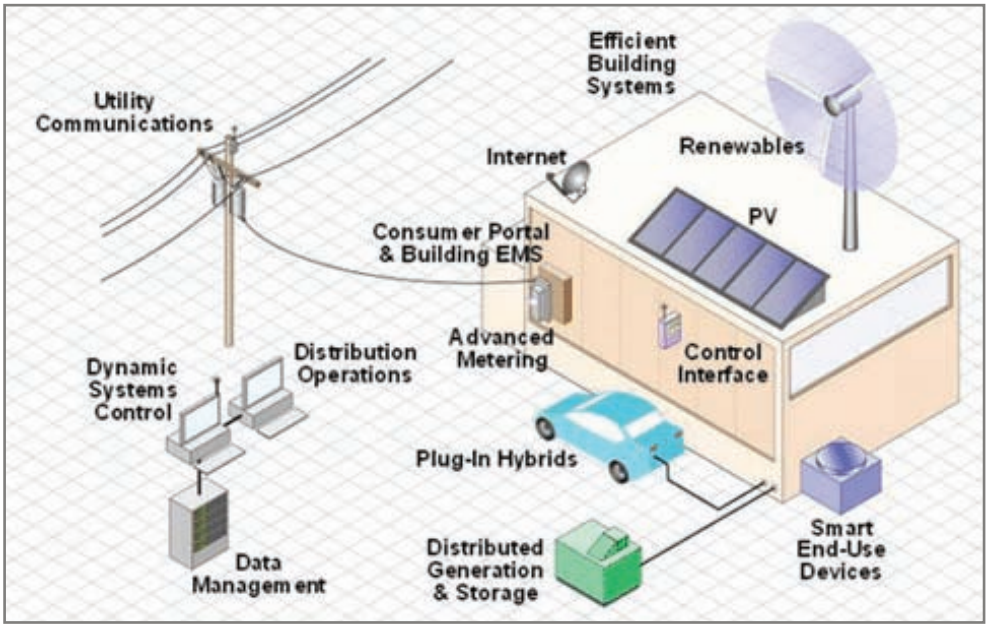


Figure 7: Components of a smart grid system.[26]

Furthermore, energy efficiency measures keep consumer energy costs low. In the short run, consumers are able to control energy costs simply by reducing their demand through more-efficient use. In the long run, reduced end-use demand avoids the conversion, distribution and end-use losses associated with existing production. It also defers the need for new generation and transmission, so consumers are protected against rising energy rates that result from new utility capital investment, rising fuel costs and potential carbon regulation. A variety of studies have shown that the initial investments required for efficiency improvements are recovered through lower future energy costs, and that energy efficiency overall has a net positive return.[27]

RELIGHTING THE MIDWEST

***Relighting the Midwest*, an emerging initiative of EEAG, has identified huge potential efficiency gains from replacing outdated lighting fixtures with state-of-the-art technology in commercial buildings. An analysis by the Minnesota non-profit Center for Energy and Environment shows that across the Midwest, this retrofit activity could save 2,000 megawatts of power, or the equivalent of several large coal plants. This effort would also directly create 1,300 well-paid jobs and 1,860 indirect jobs, while avoiding 1.2 million tons of CO2 annually. The competitiveness of Midwestern businesses will be increased, as they are able to produce more goods and services with less energy input. All of this could happen very quickly, propelled by utility programs in states that require utilities to run energy efficiency programs.**

[26] Image courtesy of Electric Power Research Institute, http://www.smartgrid.epri.com/
[27] "Pathways to a Low Carbon Economy," A McKinsey Report. http://www.mckinsey.com/clientservice/ccsi/pathways_low_carbon_economy.asp

Energy efficiency also has the potential to reduce CO_2 emissions significantly and keep emission allowance prices lower in any future carbon-trading programs. This is particularly true in the Midwest because of the high percentage of electricity currently generated from pulverized coal without carbon capture and storage. Moreover, implementing energy efficiency reduces near-term GHG emissions in the electrical sector and buys time for other advanced lower-carbon energy technologies to be commercially scaled up to meet new energy demand and simultaneously meet potential GHG emission requirements. Finally, energy efficiency programs can lead to local job creation for the region, which is vitally important in the face of a struggling economy.

Laying the Groundwork for Success with Energy Efficiency: Commitment, Assessment and Planning Ahead

To achieve the Energy Platform's energy-savings goal, EEAG recommends that all jurisdictions pursue policies and programs that result in annual 2 percent savings in energy use from natural gas and electricity each year from a three-year rolling average base period, if cost-effective. In addition, jurisdictions should consider policies that would capture additional cost-effective savings beyond 2 percent each year. Cost-effectiveness is defined here as those measures whose benefits outweigh their total resource costs — assessments that, it is recommended, should include some monetary measure of CO_2 emissions in the evaluation.

The 2 percent savings in energy use will come from application of a full suite of policy options, including policies that require retail energy providers to make energy efficiency a priority, regulatory reform to remove disincentives and increase incentives for utility energy efficiency, building energy codes, appliance standards, government lead-by-example programs, and aggressive new partnerships to engage all stakeholders in increasing energy efficiency. Jurisdictions should also commit to investing in research, development and demonstration programs that help to identify future cost-effective energy efficiency measures.

Jurisdictions should establish a long-term mechanism for regional coordination and tracking of progress toward meeting the Energy Platform goals. Energy savings should be, to the extent possible, measurable and verifiable in a transparent and consistent manner across states and provinces to provide consistent reporting and full compliance with energy efficiency goals. EEAG recommends that jurisdictions continue to use "bottom-up"[28] methods to determine the achievement of goals and further suggests that all efficiency achievements measured should be counted toward goals without attribution adjustments. Verified savings from large-volume electricity and natural-gas customers should also be counted toward meeting jurisdictional goals.

It is essential for each jurisdiction to establish baseline energy use and then to be able to assess energy efficiency potential from that baseline. Jurisdictions should conduct comprehensive efficiency and conservation market assessments and potential assessments that can be used in resource planning and in energy efficiency program planning. The potential for improved efficiency is expected to change over time, so assessments must be carried out periodically to make sure the best practices are being used. These assessments should produce cost curves for conservation potential that allow for a dynamic assessment in relation to various avoided-cost estimates. These assessments should be regularly performed by utilities, energy offices or other entities.

[28] "Bottom-up" methods assess the impacts of energy efficiency initiatives and policies through measurement and verification of measures installed, programs, and policy changes.

Support for the 2 Percent Goal

To investigate the feasibility of the governors' and premier's 2 percent annual energy-savings goal, the Energy Center of Wisconsin and the American Council for an Energy-Efficient Economy (ACEEE) worked with EEAG on a study to collect, catalog and analyze information about the electrical and natural-gas energy efficiency potential in the region.[29] The study examined recent energy efficiency potential studies and program achievements from the Midwest and United States to gauge the achievability of the MGA efficiency goal.

The Energy Center of Wisconsin analysis of existing programs supports the 2-percent-per-year goal as realistic, albeit aggressive and challenging. There is a reasonable probability that the goal can be achieved if adequate resources are applied. Likewise, sustaining a 2 percent annual rate year-after-year will require an unprecedented level of resources compared to past efficiency programs.

The absolute potential represented by the 2-percent-per-year MGA goal is in the top quartile of potential magnitudes of several other states as reported in potential studies. While past studies lacked consistency in how potential was measured and the time periods of the data varied widely, the analysis found that almost half of the programs had achievable or economic potential of 1.9 percent per year or higher, despite the appearance of conservative biases that likely underestimated the achievable potential. The 2-percent-per-year efficiency rate exceeds the rate actually achieved by any Midwest state so far but is within reason based on the review of potential studies and recent achievements in the Northeast. Energy savings actually achieved have been a result of explicit decisions in the past to limit energy efficiency program funding to very small percentages of utility revenues. Such limits are not indicative of actual potential. With adequate resources, it seems clear that the 2 percent annual electricity savings goal is achievable and economically sound.

Energy Efficiency Policy Recommendations

To achieve the regional goal of a 2 percent annual savings in energy use per year by 2015 and every year thereafter, EEAG recommends a suite of policies to encourage the adoption of energy-efficient technologies across multiple sectors. An analysis by the Center for Climate Studies, performed in cooperation with EEAG, estimates that the recommended policies, described below, are sufficient to achieve the governors' and premier's energy efficiency goal if implemented across the region. Midwestern leadership will need to successfully engage both energy consumers and providers in the following policies to capture the benefits that energy efficiency programs and measures can provide.

1. Require retail energy providers to make energy efficiency a priority.

2. Increase utility incentives to support energy efficiency.

3. Strengthen building codes and appliance standards.

5. Increase use of combined heat and power.

6. Establish additional policies to accelerate adoption of energy efficiency technologies.

[29] "A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest," prepared by the Energy Center of Wisconsin with assistance of ACEEE and EEAG of the MGA, and with support from Energy Foundation. http://www.ecw.org/resource_detail.php?resultid=396

1. REQUIRE RETAIL ENERGY PROVIDERS TO MAKE ENERGY EFFICIENCY A PRIORITY

Retail energy providers are in the best position to drive energy efficiency across their customer bases. EEAG recommends that each jurisdiction establish a target of 2 percent annual savings for electricity utilities and 1.5 percent for natural-gas utilities. Jurisdictions should apply the proposed efficiency standards consistently to investor-owned, cooperative and municipal utilities, while recognizing regulatory and other differences in customers served and service territories and making appropriate adjustments to individual goals. EEAG emphasizes that the variation among the types of energy providers across the region must be recognized, and all must play a role in implementing energy efficiency programs and measures in order to achieve the energy savings goal.

Consistent with the goals expressed for the region as a whole, the savings targets for each retail energy provider should be calculated from the rolling average of weather-normalized retail sales in the previous three years.[30] Ramping up to the percentage goal should start as soon as possible,[31] beginning at existing levels of savings in each jurisdiction, and increasing so that the annual savings target rises to 2 percent for electric utilities and 1.5 percent for natural-gas utilities by 2015. The annual savings goals should continue as long as there are cost-effective measures available and should be re-evaluated periodically based on new market-potential studies and program experience.

EEAG recommends that these savings come from demand-side energy efficiency and conservation, with an additional goal of pursuing available supply-side savings.[32] Demand-side measures address energy use on the "customer side of the meter," like switching to more-efficient appliances and improved building retrofits. Supply-side measures include, but are not limited to, transformer upgrades, transmission and distribution line replacements to reduce losses, and efficiency improvements at existing power plants for electricity providers, and reduction of transmission and distribution losses for gas utilities.

The region is well on the way to implementation of this recommendation. Iowa, Minnesota and Wisconsin have established energy efficiency programs that are among the most ambitious in the nation and that provide examples of many award-winning programs. Illinois, Iowa, Michigan, Minnesota, Ohio and Wisconsin all have policies or regulatory proceedings under way to ramp up energy savings to between 1 and 2 percent by 2015.[33] South Dakota recently included energy efficiency as an eligible activity in new renewable energy standards or objectives. In addition, Manitoba Hydro has programs that provide energy efficiency assistance to Manitoba's residential, commercial and industrial customers.[34]

EEAG further recommends that jurisdictions establish goals of 1.5 percent annual savings for stationary use of delivered fuels, oil, propane and liquefied petroleum gas. EEAG recognizes that programs to provide energy efficiency measures to the users of these fuels may need to be designed and funded differently than programs serving electricity and natural-gas customers. EEAG also recognizes that there are significant and not-fully-resolved issues that exist in implementing energy efficiency in jurisdictions where energy markets have been partially or substantially deregulated or restructured. In addition, cooperative and municipal utilities and delivered-fuel dealers are generally not subject to regulation by public utility commissions. In these jurisdictions, other design approaches may need to be implemented.

In addition to energy efficiency resource standards, jurisdictions also have other regulatory tools to ensure that retail energy providers make energy efficiency a priority. EEAG recommends that all jurisdictions adopt resource planning processes to ensure that each utility's energy efficiency resources receive equal consideration with supply-side resources when choosing

[30] 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.
[31] For purposes of quantification, "as soon as possible" was taken to be 2010.
[32] A minority of EEAG members felt that supply-side savings should count toward the 2 percent efficiency savings goal.
[33] www.aceee.org, State Energy Efficiency Policy Database.
[34] www.hydro.mb.ca

options to manage the needs of their customers. In addition, state regulatory approval to build new supply facilities using conventional carbon-emitting resources should be given only if the regulatory authority determines that cost-effective energy efficiency and renewable energy cannot meet the projected electricity and natural-gas energy demand needs at a lower cost.

2. INCREASE UTILITY INCENTIVES TO SUPPORT ENERGY EFFICIENCY

Regulatory practices and rate designs can result in barriers to efficiency investments. Jurisdictions should examine their regulatory frameworks to identify the changes needed to provide appropriate incentives for prudent expenditures in energy efficiency by regulated utilities. The revision of practices for regulating energy utilities should be designed to send a message to all involved parties — regulators, utilities and consumers — that energy efficiency is a supportable, profitable and viable means of providing consumers' energy needs. This policy recommendation develops the next generation of utility regulatory practices, and as such is key to successfully implementing all other energy efficiency policy options.

Policy and regulatory revisions to encourage utilities to aggressively pursue the MGA energy efficiency goals should consider several major elements:

- Providing for cost recovery, including recovery of both long-term and operations and maintenance costs associated with providing energy efficiency programs and services. Projects eligible for cost recovery should include research, development and demonstration programs and energy-efficient pilot and training programs.
- Considering rate design changes, including decoupling (this has historically had more consideration in natural-gas markets) of sales from revenues, with the purpose of implementing regulatory policies that reduce the utilities' disincentive to promote energy efficiency.
- Providing new opportunities for utility earnings associated with the successful achievement of energy efficiency goals and with business related directly to providing efficiency services.

The mix of rewards, design parameters and incentives that will effectively spur utilities to significant investments will vary by utility companies and their different circumstances. Jurisdictions should choose from the menu of options to find a portfolio of revisions appropriate to their utility mix, keeping in mind that any policy changes should carefully balance the interests of consumers and utility shareholders.

Federal incentives that will help accelerate and support these policies have recently been put into place. The 2009 American Recovery and Reinvestment Act (ARRA) requires state regulatory authorities to seek to implement policies that align utility financial incentives with helping customers to use energy more efficiently.

3. STRENGTHEN BUILDING CODES AND APPLIANCE STANDARDS

Strengthening building energy codes and appliance standards is a key ingredient in reaching the MGA energy efficiency goals. EEAG recommends that all jurisdictions adopt residential and commercial building codes that meet or exceed the appropriate national model energy codes, with an automatic, statutorily required increase in code stringency to coincide with the national model code review process. States and provinces should regularly update building codes to reflect the

latest in proven conservation and building technology. States should do this at least every three years, based on the International Energy Conservation Code (IECC) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) code update process, and provinces should update every five years, based on the Model National Energy Code of Canada.

The region is already moving forward with implementing this recommendation. ARRA required states or applicable local units of government to adopt residential and commercial building energy codes that meet EEAG recommended goals. It further requires development of a plan for jurisdictions to achieve compliance with the code within eight years in at least 90 percent of new and renovated residential and commercial buildings.

Where jurisdictions do not have statewide building energy codes, new legislation may be needed to establish them. Even where building codes do exist, full compliance is rare. One market-research report estimates that, nationwide, only 80 percent of new projects comply with commercial-code lighting requirements; that number drops to 76 percent when West Coast respondents are excluded.[35]

Improving rates of compliance with building codes will require complementary commitments to more-active code enforcement and additional training for code officials, builders, building operators and homeowners. Obligatory training should be provided for code officials in the implementation of energy codes for existing and new buildings, and funding should be provided for jurisdictions to train and hire additional full-time personnel if needed for inspection and plan review. Training should also be required for all builders when jurisdictions implement new building energy codes and should be provided for architects and engineers. Training programs should be promoted for building operators and should be available to homeowners to manage mechanical equipment, indoor air quality and indoor moisture issues.

Other, market-based approaches to increasing adoption of energy efficiency measures are also recommended by EEAG. Owners may be encouraged to improve a building's energy performance at the time of sale, for instance, if jurisdictions adopt incentive programs such as point-of-sale disclosure programs that allow for consistent measurement of energy performance. Jurisdictions should also encourage use of "green" building programs for both private-sector and government buildings, such as Leadership in Energy and Environmental Design (LEED) and ENERGY STAR®. Finally, jurisdictions should encourage development of zero-energy building design and construction. The Architecture 2030 Challenge is one such standard that is 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.

Jurisdictions, including states, provinces and local governments, should also 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 rental property.

Appliances are another area where substantial energy efficiency savings can be achieved. Jurisdictions should encourage the federal government to increase standards for covered appliances and expand standards and certification to all major energy-using devices, particularly home electronics, and to set a standard for furnaces of 90 percent annual fuel utilization efficiency. 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. The advisory group recommends using incentives, including rebates from utility programs and tax credits, to encourage the retirement of inefficient appliances and their replacement with ENERGY STAR® appliances.

[35] Zing Communications, 2007. http://www.aboutlightingcontrols.org/education/pdfs/2007 percent20Commercial percent20Energy percent20Code percent20Compliance percent20Study.pdf

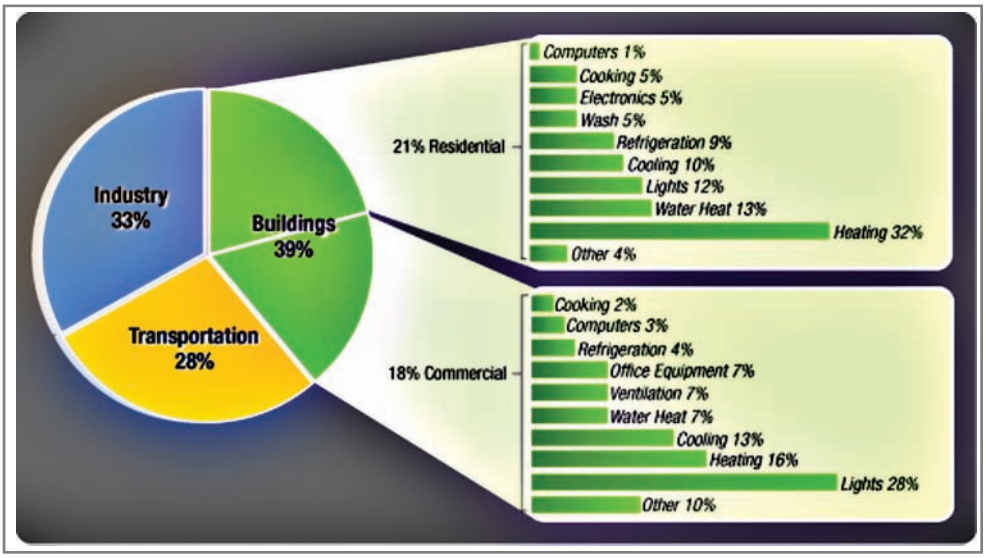


Figure 8: Breakdown of total U.S. energy consumption by buildings and appliances.[36]

MGA APPLIANCE PARTNERSHIP

The MGA along with the Midwest Energy Efficiency Alliance and the Wisconsin Energy Conservation Corp. is assisting Midwestern states in developing similar approaches to implement the appliance rebate program in the ARRA. Similar program approaches will benefit consumers and states by:

- Reducing the administrative efforts required by state energy offices, manufacturers and retailers, potentially resulting in increased investment in the Midwestern region; and
- Making it easier for communities that straddle state borders to accurately access the rebates.

4. HAVE THE PUBLIC SECTOR LEAD BY EXAMPLE

The U.S. federal government and most of the Midwestern 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 represent opportunities for testing more-effective energy management programs, shared savings contracts and other technical and programmatic plans which demonstrate that these programs reduce per-capita energy use. State and provincial programs are often models for local government and private-sector action. These programs make good business sense for governments because they cut energy costs for state and provincial governments, reducing taxpayer expenditure over time.

Public-sector energy efficiency also provides an opportunity to train a workforce in improving and maintaining buildings' energy performance. These trained workers can fill a niche in the job market by taking their knowledge and skills out and applying them in the private market. EEAG recommends that jurisdictions reduce energy consumption in existing and new government buildings, including public housing, by 15 percent in 2015, 20 percent in 2020, and 25 percent in 2025, relative to forecast levels. This should apply to buildings that are government-owned, government-leased, or nongovernment buildings with at least 20 percent of their construction costs state-funded.

[36] http://newscenter.lbl.gov/feature-stories/2009/06/02/working-toward-the-very-low-energy-consumption-building-of-the-future/

To achieve these goals, jurisdictions should require all new government facilities commissioned to substantially exceed the minimum energy efficiency codes in force at the time of construction. Furthermore, jurisdictions should benchmark the energy performance of all existing government facilities by 2013. They should set a goal of having 20 percent of all government buildings, including publicly funded housing, recommissioned to meet or exceed current energy codes by 2015, with an additional 3 percent of buildings in each subsequent year.[37] In addition, jurisdictions should analyze, improve and encourage the use of laws pertaining to Energy Savings Performance Contracts and ensure that the energy efficiency procurement guidelines for equipment purchases already in place in many states are adopted regionwide.

5. INCREASE USE OF COMBINED HEAT AND POWER

Combined heat and power (CHP) is 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 system that would otherwise be lost to the atmosphere for heating, cooling and dehumidification.[38] More than two-thirds of the energy in the fuel used to generate power in the United States is lost as heat; CHP systems make productive use of this heat and are capable of reaching fuel efficiencies in excess of 80 percent. CHP plants provide energy security in the form of consistent power supply when a renewable or waste fuel is available on site. They also provide additional security for systems at risk of interruption of the power supply from the grid. Furthermore, the true efficiency gains of CHP occur at the system scale and include avoiding or decreasing more-GHG-intensive utility operation.

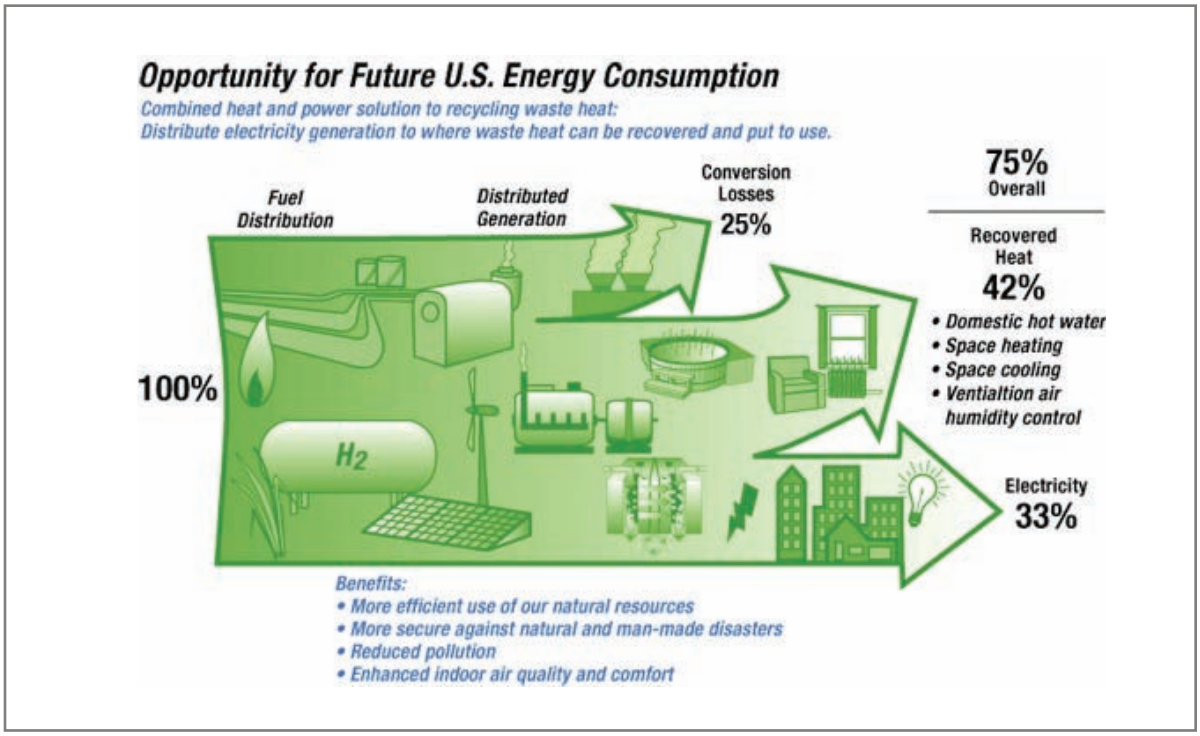


Figure 9: Energy flow diagram depicting sites for waste heat recovery through CHP.[39]

Without additional policy support, CHP installations are expected to increase to 16,700 MW of capacity in the Midwest in 2030.[40] Recognizing the significant efficiency advantages of CHP systems, the EEAG goal is to double the installed CHP capacity in the Midwest from 10,600 MW (2008) to 21,200 MW in 2030. This would represent approximately 7.5 percent of the total electricity-generating capacity in the Midwest in 2030.

[37] Recommissioning involves evaluating to ensure that buildings perform and are operated as they were originally designed to.
[38] District energy systems and waste heat recovery systems that produce both electricity and useful heat are included under the definition of CHP.
[39] http://www.nrel.gov/dtet/images/photo_future_5_w-txt_01-27-05.gif
[40] 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 "Combined Heat and Power: Effective Energy Solutions for a Sustainable Future" to estimate the benefits of an aggressive but realistic program to promote CHP in the Midwest (Oak Ridge National Laboratory, December 2008, http://apps.ornl.gov/~pts/prod/pubs/ldoc13655_chp_report____final_web_optimized_11_25_08.pdf). The UIC/ERC also assisted the EEAG to define policy options that would assist in realizing the benefits.

Given the proper incentives, electric utilities could play a pivotal role in the accelerated adoption of CHP and the GHG reductions it can provide. The broad implementation of CHP both in the Midwest and nationally, however, is hindered by regulated electric fees and tariffs, high start-up costs, expensive grid-interconnect requirements, exclusion from state energy efficiency resource and renewable portfolio standards, lack of output-based emission standards, and less favorable tax treatment. Often these disincentives persist because the benefits of CHP are not recognized by policymakers, regulators and end users. Revisions in regulatory policies and procedures, including establishment of standardized grid-interconnection procedures, together with recognition of the energy efficiency benefits of CHP, should assist in encouraging utilities to recognize and expand the utilization of CHP.

In addition, states should consider including combined heat and power as an eligible resource when developing energy efficiency standards. However, because CHP is qualitatively different from other efficiency measures usually included in an efficiency resource standard, some additional policy issues need to be addressed to ensure that energy efficiency and emission-reduction impacts are realized. These may include the following:

- A consideration of what fuel is used in CHP systems and what fuels would be granted credit for an energy efficiency resource standard;
- Establishing qualifying efficiency levels and quantifying the resulting impact on GHG emissions;
- Protocols for measuring and verifying CHP system efficiencies; and
- Rules for calculating the overall GHG impact when CHP systems utilize a renewable fuel in conjunction with both a renewable-portfolio standard and an energy efficiency resource standard.

Combined heat and power should be recognized as a valuable GHG-reduction option in any GHG trading system, and care should be taken to ensure that any regional or federal cap-and-trade system does not discriminate against CHP or other similar technologies. Likewise, any state, regional or federal alternative to cap-and-trade designed to reduce CO_2 emissions should acknowledge the systemwide benefits of CHP in reducing overall GHG emissions even though on-site emission may increase.

6. ESTABLISH ADDITIONAL POLICIES TO ACCELERATE ADOPTION OF ENERGY EFFICIENCY TECHNOLOGIES

The Midwest region has some of the longest-running and most effective energy efficiency programs in the country, as well as some of the newest. Initially, the MGA energy efficiency goal could be met with widespread deployment of existing technologies and programs. Over time, market transformation and program and technological innovation will be required to continue to meet the efficiency goal. The MGA should facilitate the establishment of forums for multiple stakeholders from different jurisdictions to share information and collaborate to accelerate implementation of best practices; new, more effective programs; and emerging technologies.

Since utilities cannot meet the MGA's 2 percent annual energy efficiency goal without the consent and cooperation of consumers in all customer classes, any successful effort must have more than just utilities promoting energy efficiency; energy efficiency must become the cultural norm. New partnerships and education at all levels is critical. Early education at the K-12 level has the additional benefit of raising awareness of career options in the new energy economy. Contractors, builders, retailers and manufacturers all influence customer behavior and should be enlisted as partners in

advancing energy efficiency. Smart grid, rate-design changes, and other technology options to support conservation and demand-response programs are emerging areas where the Midwest can accelerate adoption of the best technologies with ongoing regional cooperation.

SMART GRID INITIATIVE

State and federal policymakers, utilities, academics, industry suppliers, local governments and environmental advocates are all interested in the potential of the emerging smart grid to help consumers better manage their electricity usage and control costs. In addition, it may be essential to maximize the potential for electric vehicles and distributed renewable energy generation. Yet, since it is very early in the technology development, many questions remain.

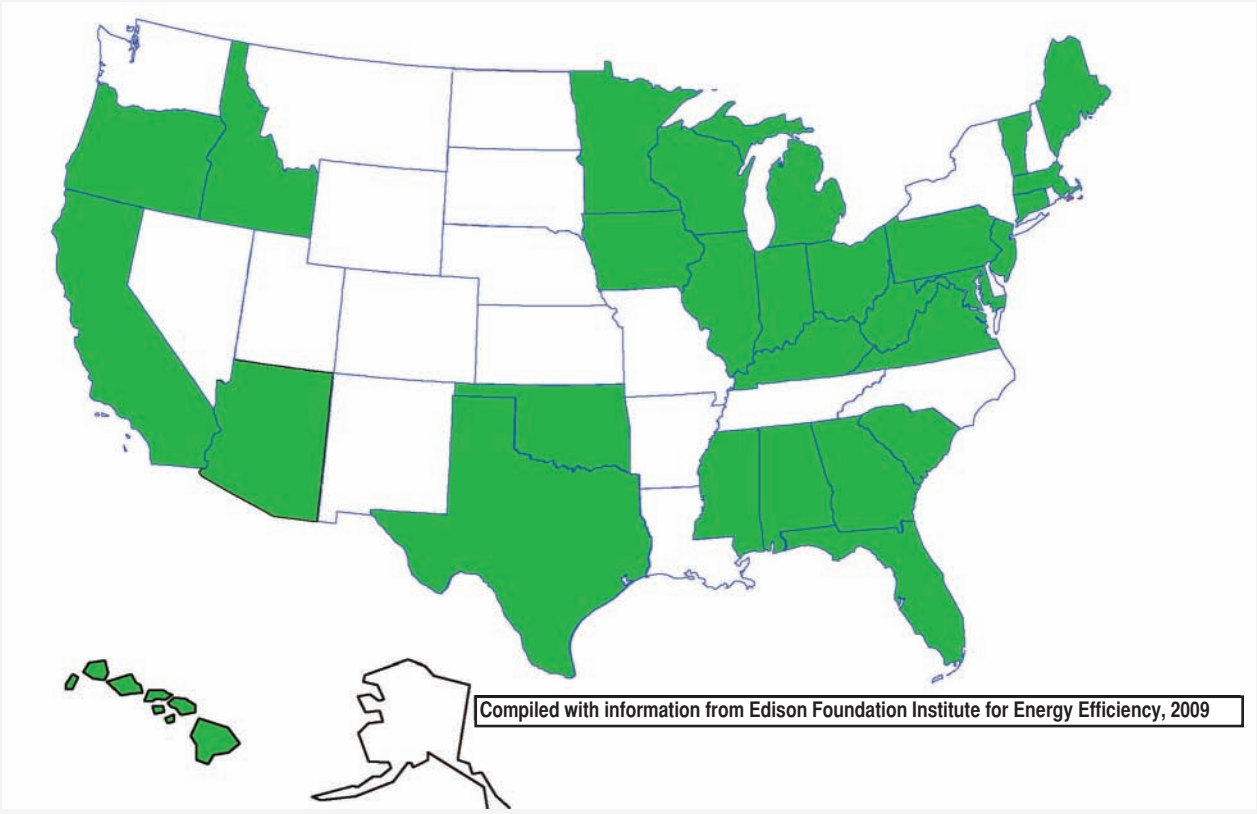


Figure 10: States with Smart Grid Pilots or Programs Proposed or in Place: April, 2009.

The EEAG explored the potential of the smart grid to enhance energy efficiency with the help of a white paper, "The Smart Grid: What is it and what do policymakers need to know about it?" prepared by Conover Brown. In addition, the group hosted a smart grid forum, "Accelerating Energy Efficiency with Smart Grid," for multiple stakeholders in July 2009. The 20-plus regulators, local government officials, consumer environmental advocates, and utility and industry representatives in attendance provided important input in the development of a proposal for a MGA Smart Grid Regional Collaborative, described in the MGA's *Midwestern Energy Infrastructure Accord.*

Effective financial incentives for energy efficiency investments in buildings, appliances and equipment are also key elements of success. Jurisdictions have many financing options available to promote energy efficiency, including tax incentives, loans, grants and rebates, and programs that combine several of these financing elements. Development of a Midwestern "tool kit" for energy efficiency that describes the types of financial incentive programs, the pros and cons of each, and lessons from the financing already in place would enable policymakers and regulators to design options that best suit their situation.

Whatever combination of "carrots and sticks" policymakers use to encourage greater efficiency, low-income customers will need programs to assist them with the front-end costs of efficiency improvements.

Energy Choice Simulator: Energy Efficiency

As illustrated in Figure 4 in the description of the baseline case, total electricity demand in the baseline case is projected to increase steadily. Emissions associated with that production are also projected to increase steadily. The emissions increase is attributable to the type of new electricity capacity that is projected to meet the increased demand. While lower-carbon electricity-generation technologies such as wind and solar are available, the baseline case projects that, in a world that is not influenced by climate-sensitive production restrictions and incentives, most new electricity generation will be high-carbon coal generation (Figure 11).

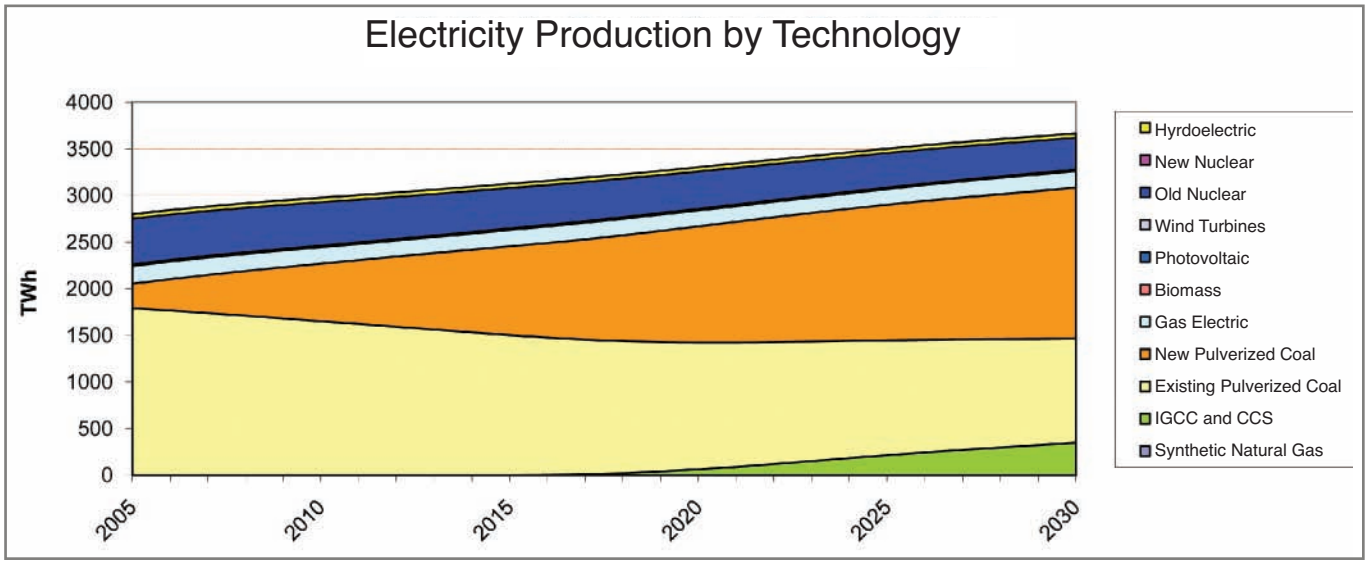


Figure 11: Projection of Midwestern electricity production showing the increased role that pulverized coal will play, absent state and regional energy policies, from 2005 to 2030.

While cleaner coal technologies such as integrated gasification combined-cycle (IGCC) with CCS begin to appear in the electricity production portfolio, adoption of the technology is limited by the rate of technological development and the speed with which new capacity can be constructed. The adoption of currently available wind technologies stalls in the baseline case, as the federal production tax credit for wind is assumed to expire, as currently scheduled, at the end of 2012. In the absence of incentives otherwise, traditional pulverized coal without carbon capture remains the predominant generation technology for meeting projected increases in electricity demand in the region.

Meeting projected increases in electricity demand through energy efficiency programs and technologies is therefore a potentially effective strategy for both energy demand containment and emissions reductions. The Center for Climate Strategies, working with EEAG, explored the energy and emissions implications of a set of energy efficiency policies including:

- requiring utilities to enact and ramp up efficiency programs so that by 2015 they are sufficient to achieve annual savings equivalent to 2 percent of total electricity use and 1.5 percent of total natural-gas use, and then continue that level of annual savings each year thereafter;
- strengthening building energy codes and adopting improved appliance standards for a range of appliances and equipment not sufficiently covered by federal law; and
- enacting public "lead by example" initiatives such that new public buildings improve efficiency performance by 35 percent above existing code, and existing buildings are retrofitted to the same performance standard at the rate of 2 percent per year.

The results of the independent EEAG quantification suggest that, taken together and adjusted for a certain amount of overlap, the impacts of these policies result in sufficient reductions to meet an aggregate reduction target of 2 percent per year for electricity and natural gas by 2015.

This analysis also calculated all of these policies to be "cost-effective" in the sense that they actually save money in the long run, even without considering potential carbon costs associated with emissions. In each case, the up-front cost of adopting the technology was more than compensated for by the net present value of savings in energy costs generated over the period 2009 to 2025. On average, every ton of CO_2e reductions was actually associated with an energy cost savings of $27.

Applying that set of policies in the regional Energy Choice Simulator shows their impact on projected electricity-generation choices for the region (Figure 12). For the period 2010-2030, the policies are more than sufficient to meet new demand for electricity; in fact, the cost-effective savings are high enough to cause overall electricity demand to decline.[41] This reduction in demand stabilizes the amount of new coal generation that enters the production portfolio after 2015, and is therefore also successful at reducing emissions from the electrical sector as existing coal plants are phased out without the need to replace them (Figure 13).

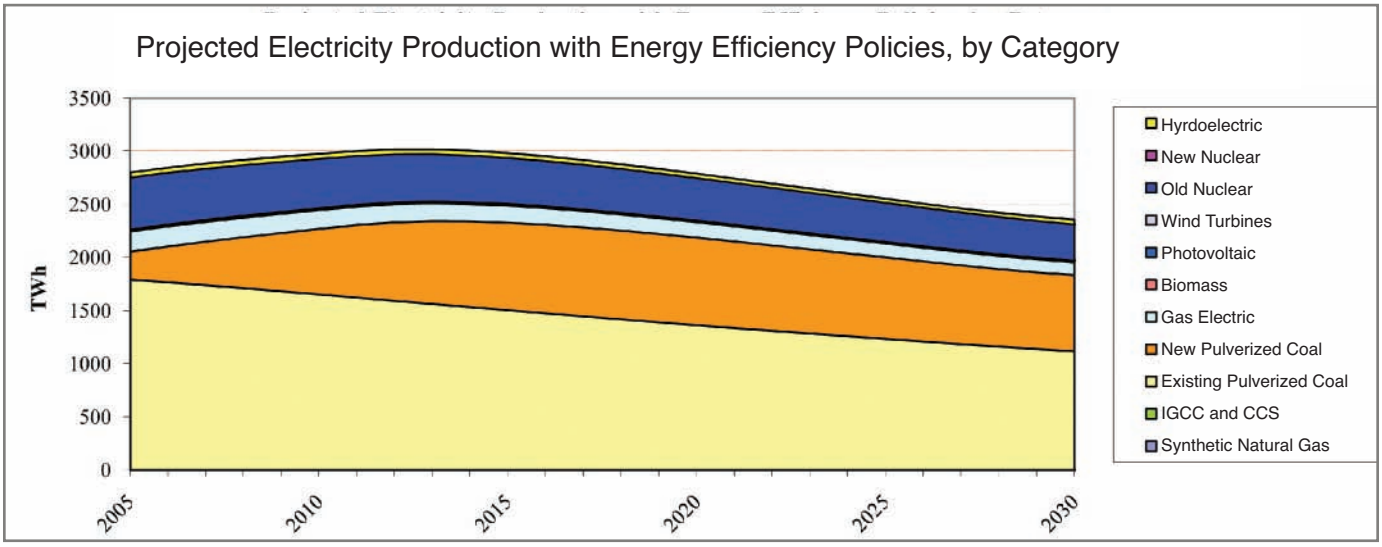


Figure 12: Projection depicting an overall decrease in Midwestern electricity production due to demand reduced by energy efficiency policies, from 2005 to 2030.

[41] This projection is sensitive to assumptions about how electricity demand will increase in the future in the absence of efficiency policies. DOE estimates produced after the economic downturn suggest that national electricity demand will increase by an average of 1.0 percent per year prior to 2030 (DOE, AEO, 2009). Using that figure, energy efficiency-related reductions of 1 percent in the Midwest would meet new energy demand, and reductions in excess of 1 percent would bring energy demand, and emissions, down in the electricity sector.

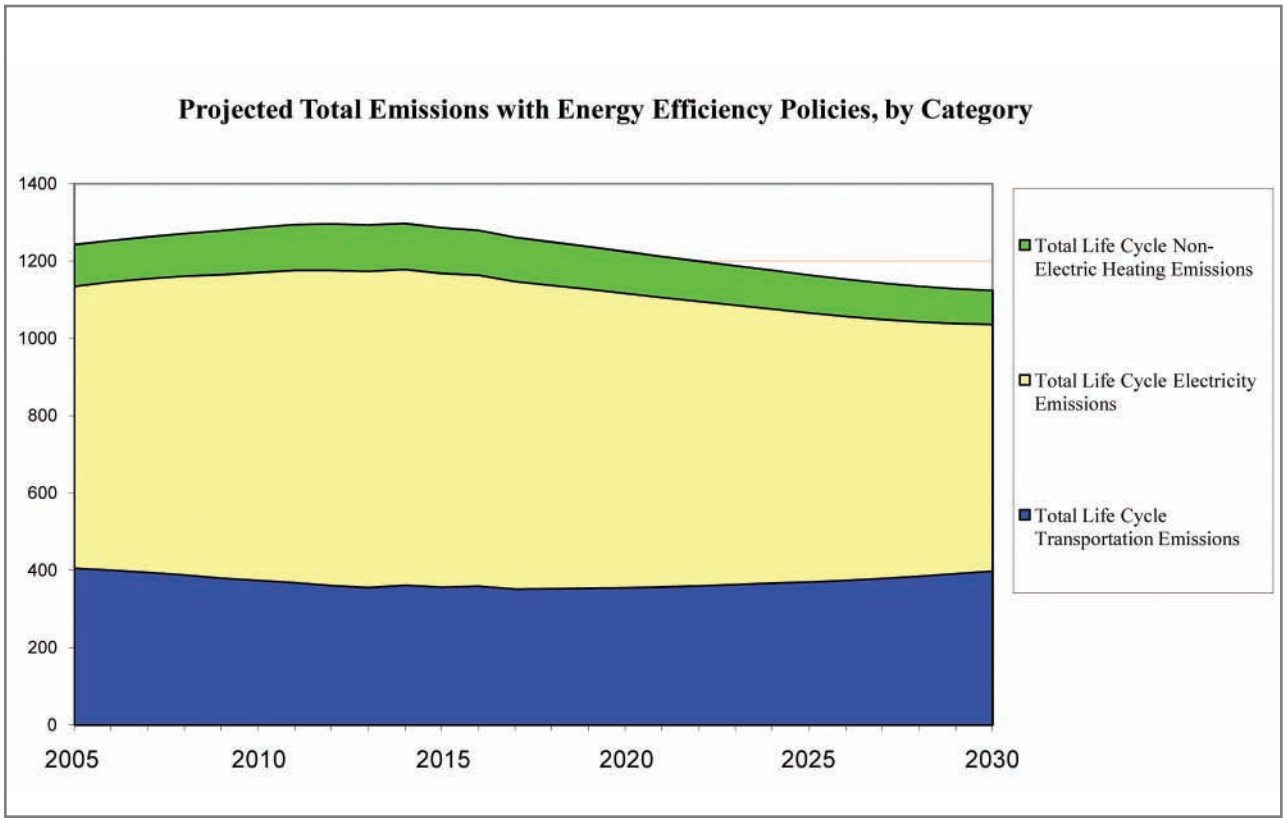


Figure 13: Projection showing a total reduction in Midwestern emissions after energy efficiency policies reduce demand and stabilize the amount of new pulverized coal, from 2005 to 2030.

Energy efficiency measures are therefore an effective way to achieve early reductions in demand and emissions while other low-carbon electricity technologies are being developed and scaled up. However, energy efficiency policies are not an effective way to stimulate or accelerate development of alternative low-carbon electricity technologies. As shown in Figure 12, the electricity production portfolio does not change much when efficiency policies are in place. In fact, the figure illustrates that development of new, lower-carbon technologies (in this case IGCC with CCS) may in fact be slowed when reduced demand for energy leads to a reduced focus on alternative technology development for new capacity.

Thus, while they effectively lower demand and emissions in the short term, energy efficiency policies do not advance our ability to achieve the additional carbon benefits associated with switching base energy reliance over to even lower-carbon technologies. Policies directed specifically at incentivizing lower-carbon electricity-generation technologies are therefore a critical component of any climate-sensitive regional energy strategy.

RENEWABLE ELECTRICITY III

Achieving energy independence and energy security will require the MGA region to significantly increase the use of renewable energy, together with its other energy resources.[42] The Energy Platform goals for renewable electricity boldly commit the region to take advantage of its renewable energy resources, while providing considerable manufacturing, construction and service-sector jobs to the region. Additional policies are required to stimulate expansion of renewable electricity generation and of new transmission capacity to accommodate it.

In an effort to bring more renewable electricity into the region's energy portfolio, Midwestern governors and the premier of Manitoba have set goals to significantly expand the generation of renewable electricity to meet the region's energy needs in the coming decades. The Energy Platform includes a commitment to ensure that 10 percent of annual electricity consumed in the region in 2015 comes from renewable sources, followed by 20 percent in 2020 and 30 percent in 2030.

The Midwestern region boasts some of the most extensive onshore wind resources in the nation. Capturing this wind resource will constitute a large part of achieving the MGA renewable energy objectives; satisfying a 30 percent renewable energy objective for 2030 could require over 90,000 MW of wind energy capacity, together with other renewable generation sources, compared to the region's current wind generation capacity of approximately 9,000 MW.

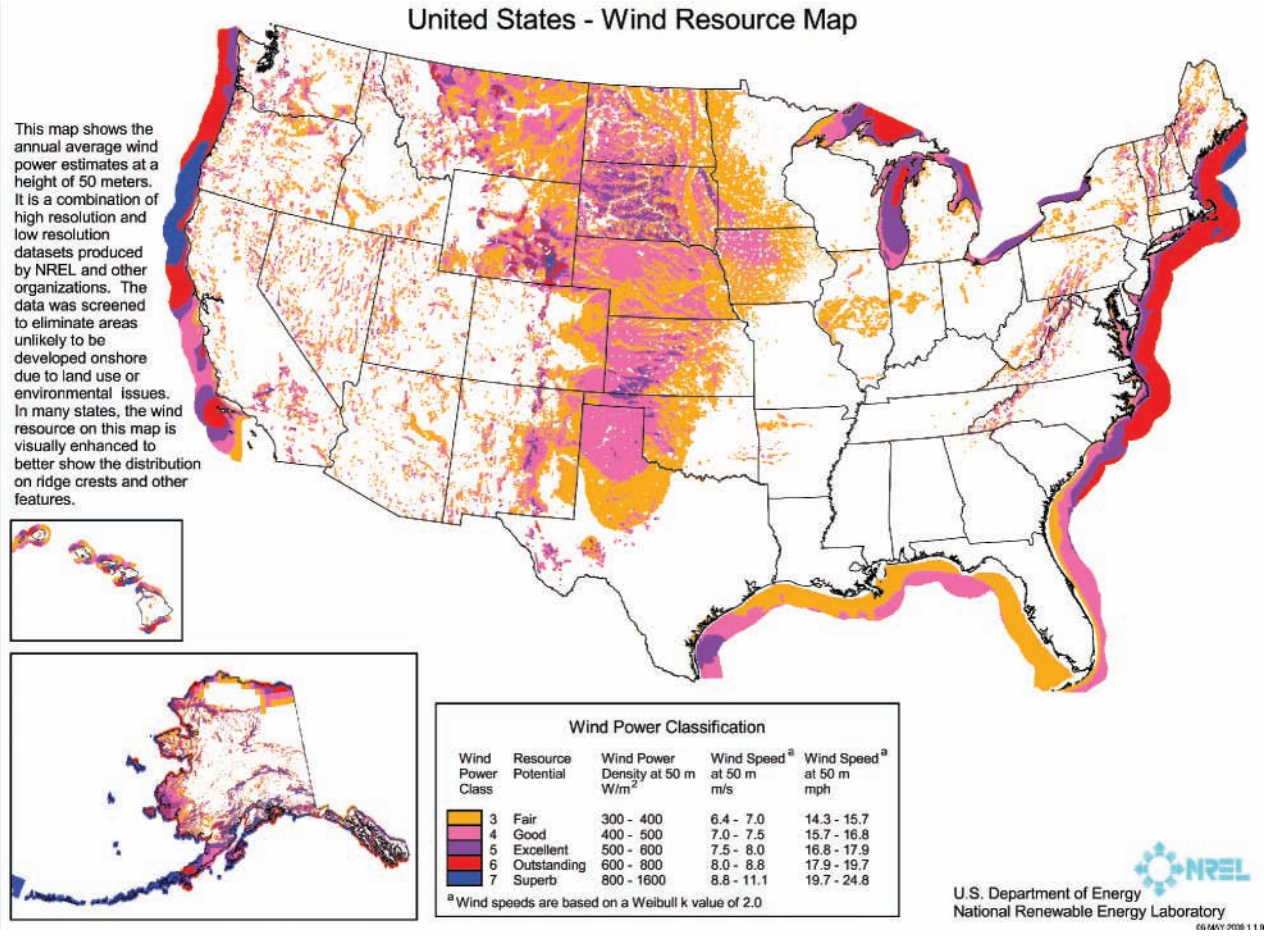


Figure 14: U.S. wind power potential.[43]

[42] For the purposes of MGA goals and recommendations, renewable electricity includes electric power generated from wind, biomass, solar, and geothermal energy sources, from new hydroelectric facilities and new hydroelectric capacity obtained through re-powering of existing facilities, and from hydrogen produced from the preceding renewable energy sources.

[43] Source: USDOE http://www.windpoweringamerica.gov/wind_maps.asp

RENEWABLE ELECTRICITY GENERATION IN THE MIDWEST

Images of windswept plains often highlight the Midwest's significant wind potential for satisfying renewable electricity objectives. There are, however, other renewable electricity technologies with significant potential in the highly diverse Midwest region. Hydroelectric generation is already substantially deployed in certain Midwest jurisdictions, and there are several hydropower expansions using innovative low-impact technologies under consideration.

Midwest. Parts of the region have solar capacity that is comparable to areas of Texas and Florida. Furthermore, while geothermal heat pumps can be used across the Midwest, large regions of South Dakota and Iowa also have potential for more-intensive geothermal development.

The production of hydrogen for use in fuel cells, internal combustion engines and power generation presents an excellent emerging opportunity for utilization of the Midwest's renewable energy resources. Use of wind and hydropower for electrolysis, re-formation of ethanol and

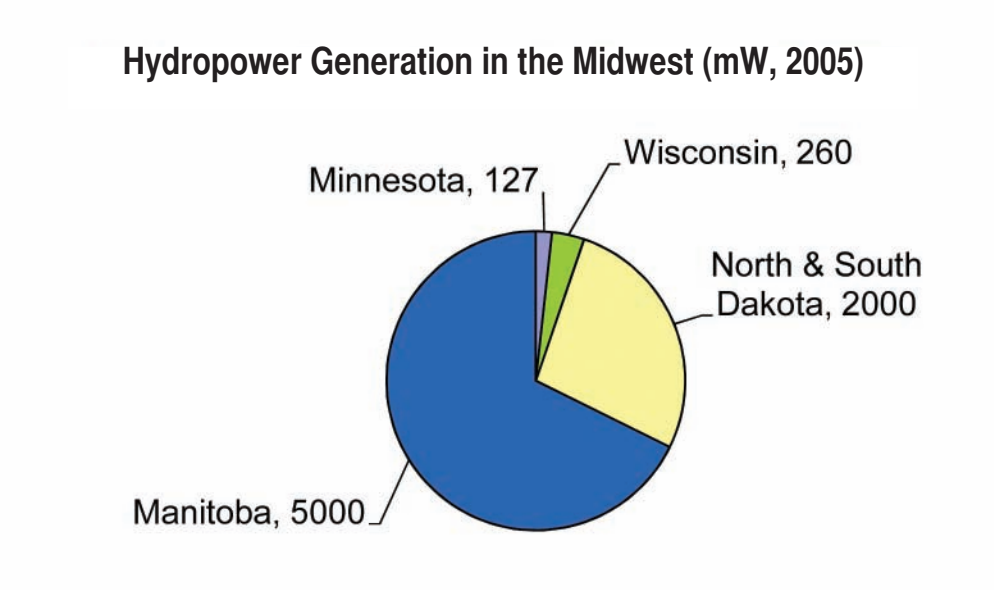


Figure 15: Hydropower Generation in the Midwest

Technologies that burn or gasify biomass to replace a portion of coal in electricity generation also have significant potential in the region. The Chariton Valley Biomass Project in southern Iowa was established in 1995 to demonstrate how switchgrass — a native grass species — can be sustainably produced and co-fired with coal to reduce the carbon intensity of the electricity produced. The USDA/USDOE estimate that the Midwest region will be a significant source of biomass in the future to support scaled-up versions of such biopower and biofuel projects with forestry residue, agricultural residue, and dedicated energy crops such as switchgrass.

Harnessing solar and geothermal energy for distributed electricity generation is also an option throughout the

biogas, and gasification of biomass, among others, all offer resource and technology pathways to produce renewable hydrogen. In addition, biomass and coal can be co-gasified with CO_2 capture and storage to produce hydrogen with the potential for very low and even negative CO_2 emissions. Finally, hydrogen obtained from renewable energy sources holds promise for the low-carbon manufacture of commercial fertilizer for use by the region's agricultural producers.

A strategic approach to transforming the energy economy in the Midwest will involve capturing opportunities associated with each of these resources and customizing policies as needed to allow regional flexibility in how renewable energy objectives are met.

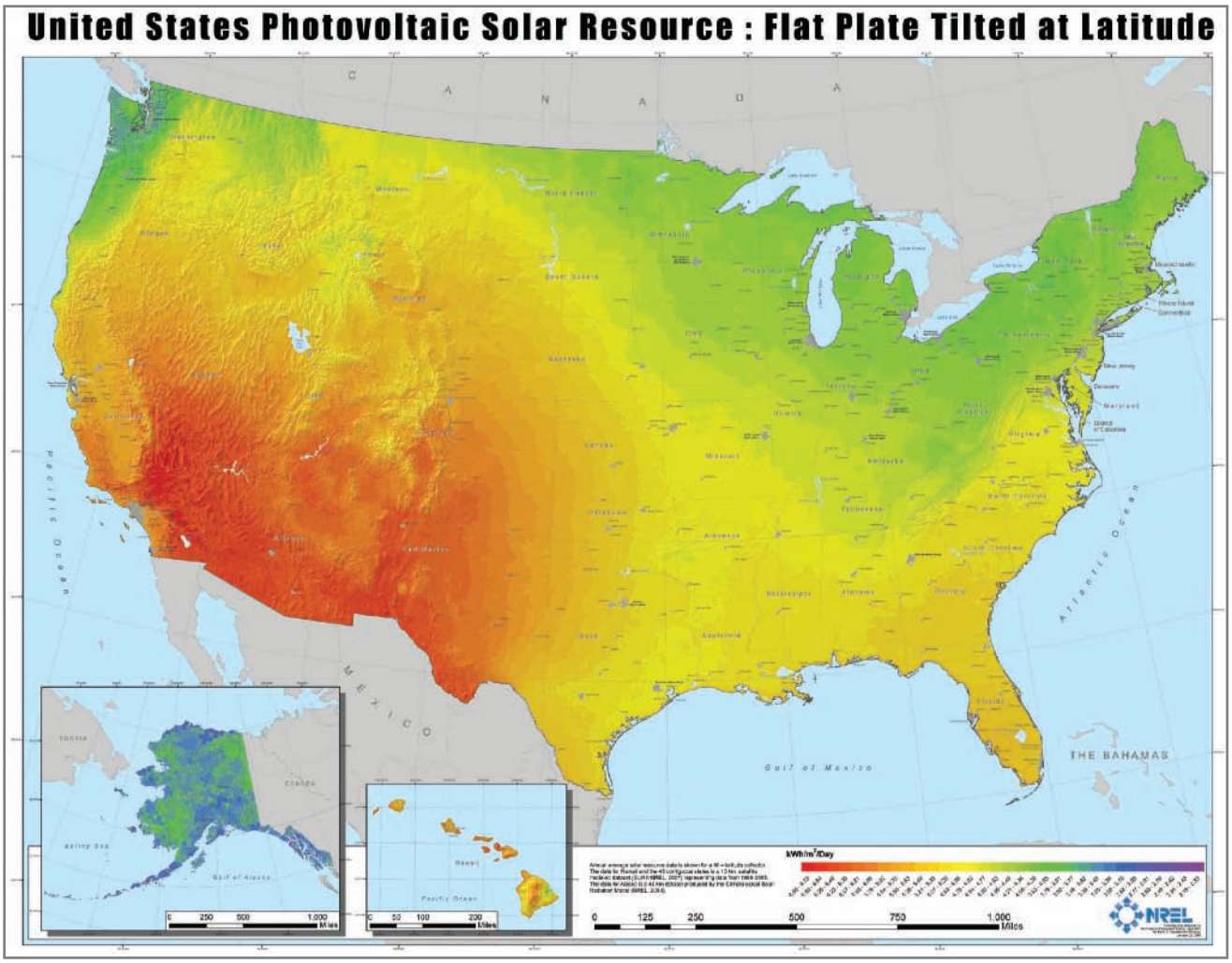


Figure 16: U.S. solar radiation map.

The Midwest also has the greatest biomass potential of any region in the United States, with forestry biomass dominant in some MGA jurisdictions and agricultural residuals and non-woody-perennial biomass feedstocks dominant in others. While biomass utilization for power generation is more costly than wind in much of the region, given its baseload characteristics and significant resource potential, biomass is an important component of renewable electricity generation.

Finally, the province of Manitoba has the ability to add substantial new hydropower capacity to supply the Midwest with renewable electricity, and MGA states could also add smaller-scale hydropower capacity, especially in a local distributed-generation context. While new hydro generation potential is small, relative to wind and biomass, it has valuable load-following capabilities to respond to the variability of wind generation on the grid, thus enabling increased grid penetration of wind energy.

Coupled with the expanded capacity to produce energy, increased use of renewable electricity generation will lead to reductions in criteria air pollutants and, consequently, lower health impacts and reduced costs associated with those pollutants. Deployment of renewable generation technologies will, in most cases, also dramatically reduce water use compared to conventional fossil generation technologies. Finally, investment in the expanded use of these technologies will spur economic development and corresponding job growth, and to the extent the renewable energy is derived from Midwest-based capital projects, it will also generate additional local tax revenues.

Policies to advance renewable energy development in the Midwest, however, are often hindered by "chicken and egg" development obstacles, where one component of the renewable energy supply system cannot move forward unless another is in place and vice versa. In the Midwest, for instance, most of the highest-capacity renewable energy zones (REZ) for wind production are located far from areas of electricity demand and will increasingly require significant investment in regional high-voltage transmission to connect to consumers. Development of those renewable resources is often stalled by lack of agreement on the part of developers, transmission operators and other regional stakeholders on how to pay for the needed transmission capacity to distribute the power. Likewise, without development of the resource, there is reluctance to build or improve the transmission capacity needed for such distribution.

Renewable Electricity Policy Recommendations

To stimulate the regional market for renewable electricity and reduce existing barriers to its development, REACCCS recommends a suite of mechanisms to promote comprehensive resource planning, infrastructure development and technology adoption.

1. State and provincial renewable energy standards/objectives and federal incentives
2. Completion of regional transmission studies to inform needed transmission build-out
3. Removing regulatory barriers to regional transmission planning, siting and approval
4. Identification of and agreement on REZs in each jurisdiction
5. Developing a new regional transmission cost-sharing agreement and cost-allocation tariff
6. Coordinated planning and siting of wind energy facilities
7. Development and deployment of grid integration, wind forecasting and electricity storage

1. STATE AND PROVINCIAL RENEWABLE ENERGY STANDARDS/OBJECTIVES AND FEDERAL INCENTIVES

A cornerstone in the region's push to achieve the MGA renewable energy goals should be enactment or enhancement of state- and provincial-level standards or objectives to ensure sufficient ramp-up of renewable electricity generation capacity. Renewable energy standards (RES) are requirements to use a specified percentage of renewable electricity in a jurisdiction's energy mix, similar to a renewable portfolio standard (RPS), while renewable energy objectives (REO) have no legal compliance obligation, but are often accompanied by additional incentives or reporting requirements designed to ensure that the objectives are met.

Most Midwestern jurisdictions have already implemented renewable energy standards and objectives to stimulate the development of renewable electricity (Figure 17). Satisfaction of the regional goal will require that all remaining jurisdictions adopt them as well. While most jurisdictions' short-term goals coincide with the MGA schedule, their timelines and objectives should be extended to meet the longer-term goals as well.

In meeting their respective RES/REO goals, some jurisdictions with less renewable-resource potential may choose to develop some renewable electricity generation in their jurisdiction, while relying on renewable electricity imports, and the necessary transmission infrastructure to deliver them, for the remainder of their needs. Adoption of common standards and objectives will help smooth the transmission planning process. A common method of credit-market tracking will also be critical to regional planning and assessment. Several jurisdictions within the MGA currently support the Midwest Renewable Energy Tracking System (M-RETS), including Manitoba, North Dakota, South Dakota, Minnesota, Iowa, Wisconsin and Illinois. The governors and premier should support regionwide adoption of M-RETS to provide a reliable system for certification of renewable energy credits and for common tracking of the generation, exchange and retirement of those credits.

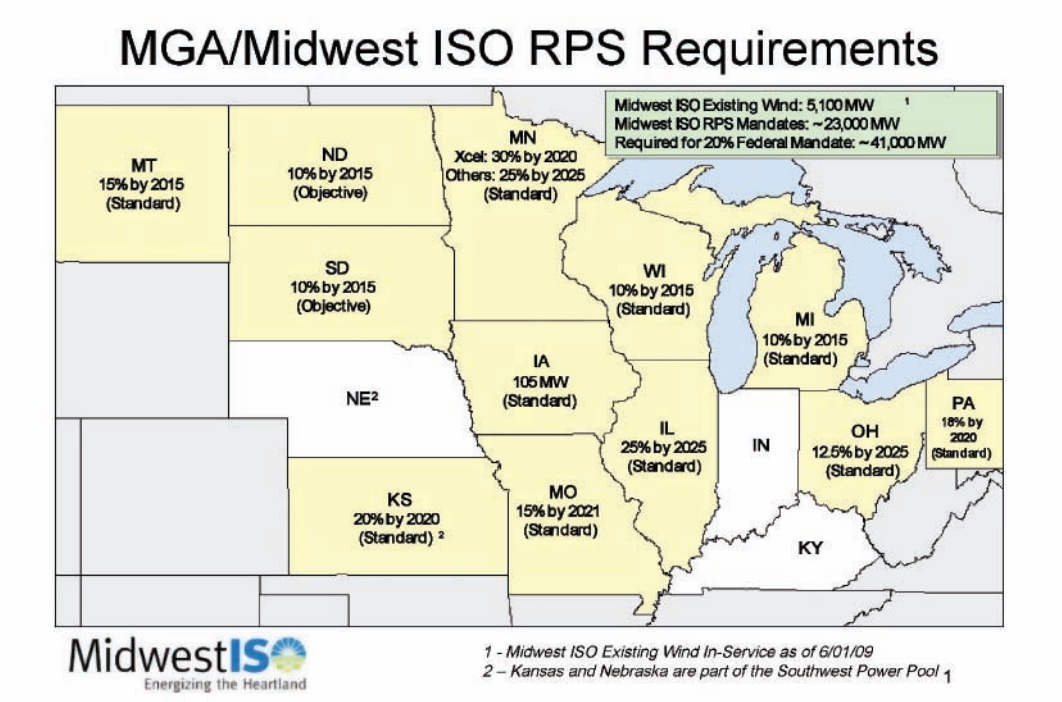


Figure 17: Existing renewable energy standards in the Midwest.

The advisory group also encourages the MGA leadership to back extension of federal incentive programs that have proven effective historically in spurring growth in renewable electricity markets. This is especially critical at this time because of the present financial situation, the limited access to long-term loans for capital investments, and a decreased demand for electricity. The federal production tax credit (PTC) is one such program. It is generally acknowledged that periods of rapid commercial scale-up of wind energy, as well as past slowdowns, have closely followed the expiration and renewal of the PTC. Congress has now extended the PTC in the form of a 30 percent energy investment tax credit or a production tax credit of up to 2.1 cents per kilowatt-hour until the end of 2012. The governors and premier should support a longer-term extension to provide consistency for the industry. Such an extension should expressly include provisions to ensure that federal incentives are available to encourage renewable electricity development in all segments of the electric utility industry, including electric cooperatives and municipal utilities.

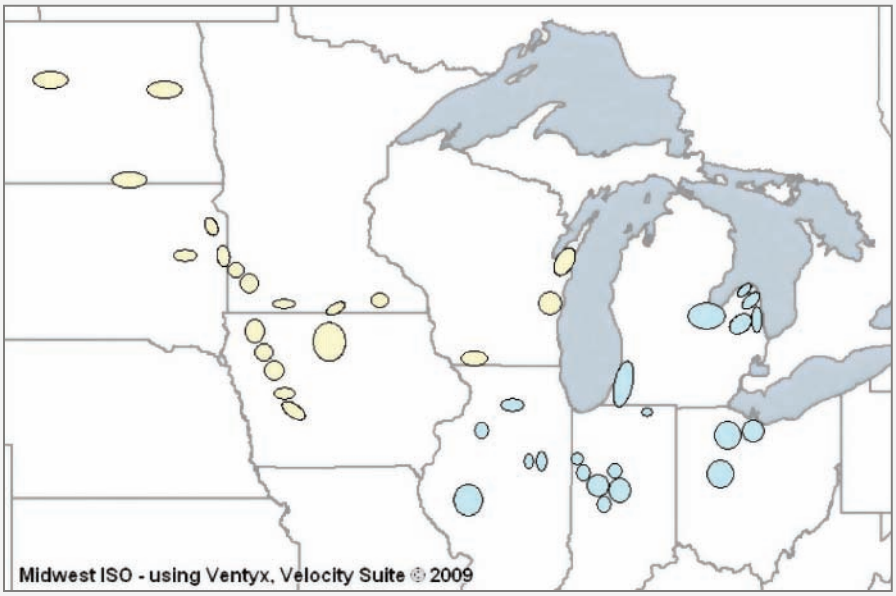
2. COMPLETION OF REGIONAL TRANSMISSION STUDIES TO INFORM THE NEEDED TRANSMISSION BUILD-OUT

To expedite development of regional transmission plans, REACCCS has worked with the Midwest ISO and Southwest Power Pool (SPP) to reach agreement on the timing and details of the RGOS Phase I and Phase II transmission studies (see box). These studies are critical for the MGA to complete plans on how to reach Energy Platform goals. Upon their completion, MGA should adopt the transmission plans from those studies, which will help identify transmission resources for each jurisdiction to reach the first Energy Platform goal of 10 percent by 2015. Upon adopting the transmission plans, jurisdictions will need to identify entities to sponsor and construct the transmission segments. Jurisdictions should work with the Midwest ISO, SPP and PJM to support and manage transmission permitting and construction so that renewable energy obligations will be met in the most economical and timely manner.

To further facilitate integrated transmission and energy technology development, the MGA worked with the Midwest ISO to survey all electric load-serving entities in the Midwest and each jurisdiction's utility regulatory commissions on planned renewable electricity development. This information has provided the Midwest ISO transmission planners with better data on renewable- energy development needed to meet each jurisdiction's RES or REO target.

REGIONAL GENERATION OUTLET STUDY (RGOS), PHASES I AND II

RGOS Phase I includes the states of North Dakota, South Dakota, Minnesota, Iowa and Wisconsin. Renewable energy zones (REZ) for each state have been determined and approved at the state level. Illinois is included in the study because of the large influence on the transmission grid from that state's load. The study is looking at 15,000 MW, 25,000 MW and an "indicative" study for 40,000 MW of wind capacity in the region. The initial study results will be completed by September 2009, with more-detailed system studies by October 2009.



RGOS Phase II includes the rest of the MGA states with RPS requirements and will build on the results from Phase I. REZs have been identified for each state and will be used in the different planning scenarios. The study will look at 25,000 MW of wind, representing the total RPS and REO targets for the Midwest ISO states, as well as 40,000 MW. The study will include three scenarios with options for both 345 kV and 765 kV transmission solutions. The first will be a local scenario in which all renewable energy requirements are met with resources within the same state. The second scenario will examine RPS requirements being met with resources within the RGOS II states and those outside of the RGOS II states with the highest capacity factor ranking. The third scenario will feature a regional plan in which RPS goals are met with resources located in the highest ranking REZs.

Figure 18: Renewable energy zones (REZs). Source: Midwest ISO.

3. REMOVING REGULATORY BARRIERS TO REGIONAL TRANSMISSION PLANNING, SITING AND APPROVAL

Collaborative regional transmission planning and siting are necessary enablers for the widespread, near-term development of renewable and other electricity generation. Areas of electricity demand in the region need to have better access to the significant wind and other renewable resource potential that exists at locations distant from population centers. Often renewable resources are found across jurisdictional lines from the load centers where the energy is needed. Expanding and upgrading the region's grid infrastructure to meet MGA goals, and ensuring overall system reliability more generally, will require substantial new investments. However, a collaborative regional transmission plan can provide long-term relative cost savings and more-efficient electricity delivery compared to a jurisdiction-by-jurisdiction approach.

While the fundamental importance of regional planning has been recognized by MGA, a primary barrier in the development of regional transmission projects for renewable energy is the existing jurisdiction-by-jurisdiction siting and approval process. Without specific authority to coordinate efforts, or even to recognize the regional benefits of a proposed transmission investment, many jurisdictions will not be able to participate in the large-scale regional transmission build-out that is critical to achieving MGA renewable and transmission adequacy goals. Jurisdictions need the ability across the region to collaborate as extensively as possible.

Toward that end, REACCCS completed a survey of MGA state utility commissions and the province of Manitoba to determine the ability of utility regulatory commissions to deal with multi-jurisdictional regional transmission projects. The survey found that three states — Kansas, Minnesota and Ohio — all have similar existing language that specifically authorizes coordination.

Based on the survey results, REACCCS prepared model legislation incorporating some of the statutory language from the three states, which would enhance the ability of each MGA jurisdiction's utility regulatory commission to consider and approve multi-jurisdictional transmission projects. Jurisdictions are encouraged to adopt similar language to provide more ability to cooperate on such projects and facilitate implementation of an inter-jurisdictional transmission plan.

4. IDENTIFICATION OF AND AGREEMENT ON RENEWABLE ENERGY ZONES (REZ) IN EACH JURISDICTION

Increasing the generation of wind energy is instrumental to achieving MGA's renewable electricity goal by 2030, but that will not be accomplished without a corresponding expansion of transmission capacity. The fact that wind farms are built more quickly than transmission lines presents a major challenge in that regard. A wind farm can be built in a year, but given transmission siting and other concerns, it takes considerably longer to plan for and build the transmission lines needed to deliver the power to electricity load centers.

For this reason, REACCS lent support to a coordinated approach already under way to identify REZs for wind generation specifically in each MGA state. Agreement on each jurisdiction's REZ designations is critical to long-term regional renewable electricity transmission plans for the MGA and to ensuring that transmission upgrades are targeted and accomplished in advance of new wind energy development as it is needed to meet jurisdictional RES and REO obligations. REACCCS worked with the Midwest ISO and the Upper Midwest Transmission Development Initiative (UMTDI) to finalize high-capacity REZs for the five states (Iowa, Minnesota, Michigan, North Dakota and Wisconsin) involved in UMTDI and the RGOS Phase I transmission study. This work continues through the Midwest ISO Phase II

study to reach agreement on the high-capacity REZs for the eastern states in the MGA that have RES or REO targets. Agreement on these zones will allow Midwest ISO transmission planners to proceed with the necessary transmission studies.

5. DEVELOPING A NEW REGIONAL TRANSMISSION COST-SHARING AGREEMENT AND COST-ALLOCATION TARIFFS

An effective multi-jurisdictional transmission initiative must include a regional planning component and associated cost-allocation plan that is perceived as equitable and is broadly supported by affected parties that often bring very different interests to the table. Thus, cost allocation for regional transmission has proven to be the most difficult issue for most of the regional transmission organizations such as Midwest ISO, SPP and PJM. Texas provides the exception to the rule because all interested parties participating in the ISO are within a single jurisdiction.

REACCCS determined that resolving transmission cost allocation requires coordination with other non-MGA parties that are decision-makers in the transmission cost-sharing issue. MGA is thus actively engaged in three efforts aimed at securing a new regional transmission cost-sharing agreement that can support Energy Platform goals.

UMTDI involves MGA, Midwest ISO and the governors and utility commissions of North Dakota, South Dakota, Minnesota, Iowa and Wisconsin working together to reach agreement among the five states on how best to provide a shared cost-sharing agreement for the RGOS Phase I transmission plans required to meet the state RES and REO targets. This effort should provide the basis for a larger Midwest ISO/MGA regionwide agreement on regional transmission cost allocation. A joint proposal is expected in October 2009.

The Organization of Midwest ISO States (OMS) Cost Allocation Regional Planning (CARP) task force is also working to provide recommendations on cost sharing for regional transmission projects. OMS CARP hopes to complete its work in the fall of 2009 and to make recommendations to the Midwest ISO Regional Expansion and Criteria Benefit (RECB) Task Force.

Finally, the Midwest ISO RECB Task Force is working on longer-term cost-allocation recommendations that can inform the Midwest ISO's application to the U.S. Federal Energy Regulatory Commission (FERC) for a new transmission tariff for regional wind energy transmission projects. The Midwest ISO RECB Task Force is expected to continue work into early 2010, using the input from UMTDI and OMS CARP to reach agreement among task force members on new tariff recommendations.

Despite the difficult nature of regional transmission cost-sharing agreements, especially with regard to transmission for renewable electricity, these three regional efforts should soon have results that have been widely vetted by key stakeholders in the Midwest. It is anticipated that these results, in turn, will help the Midwest ISO propose an effective transmission cost-sharing formula in a tariff application that Midwestern governors and the premier of Manitoba can support and that is capable of securing regulatory approval by FERC.

6. COORDINATED PLANNING AND SITING OF WIND ENERGY FACILITIES

Comprehensive siting principles and policies for wind farms must be developed and implemented to encourage orderly growth and expansion of infrastructure. Deploying wind energy generation on a scale sufficient to meet MGA's renewable electricity goals will require sustained public acceptance, yet conflicts over siting and wind rights are growing

as development proceeds. Failure to implement effective and equitable siting policies could exacerbate those conflicts, putting at risk achievement of MGA targets over time. Therefore, adequate and consistent state/provincial policies and procedures should be crafted cooperatively and inter-jurisdictionally to ensure that wind development proceeds in ways that foster long-term public support for the industry and avoids pitting jurisdictions against one another or impeding regional approaches to development.

REACCCS recommends specifically the development of siting guidelines for the region and of a toolkit of resources to help with rational and equitable wind development that promotes the industry over the long term. REACCCS suggests using Minnesota's existing wind siting statutes, rules and guidelines as a starting point to guide formulation of regional policy.

7. DEVELOPMENT AND DEPLOYMENT OF GRID INTEGRATION, WIND FORECASTING AND ELECTRICITY STORAGE

To expedite the ambitious commercial scale-up required to meet MGA targets, policy makers should also support the development and deployment of technologies to help manage the increased system variability that will result from significantly expanded wind generation through a series of demonstration projects. Wind generation is a very reliable but also a variable generation resource, with production fluctuating as wind speeds increase and decrease. This variability adds to the existing variability that is inherent on the grid between system generation and system load. Adequate transmission capacity and robust access to dispatchable resources on the system, such as natural-gas peaking generation, will go a long way toward managing that system variability. In addition, Canadian hydropower resources could contribute toward meeting the challenges of integrating significant wind-generated electricity, if transmission capacity is increased.

However, the deployment of technologies such as next-generation grid management, wind forecasting and electricity storage will be critical to reliably and cost-effectively managing and integrating the expected 90,000 MW of wind on the Midwest ISO system needed to meet the MGA's goal of 30 percent renewable electricity by 2030. Alternative applications of wind-generated electricity, such as production of hydrogen and ammonia for fertilizer, will also be important. Clearly, technology advances that show specifically how high percentages of wind power can be incorporated reliably into the electric power system will help the Midwest ISO, SPP and PJM economically integrate more wind energy into the region's electrical grid. Many of these technologies can also increase the commercial value of wind energy, by enhancing its dispatchability or schedulability.

Next-generation grid management — typically referred to as a "smart grid" in a consumer setting, but also applicable at generation and distribution levels — could contribute substantially to increasing the portion of electricity demand met by variable wind and solar energy generation. Advanced grid management will allow the variability of the wind resource to be used more efficiently and better integrated with distributed generation and storage to make the electricity distribution system more efficient. MGA recently held a smart grid forum to explore how smart grid technologies can support MGA's energy efficiency and renewable electricity goals. To accelerate efforts to develop smarter grids and more-reliable wind integration, the governors and premier should support the development of better software for system wind-load forecasting and load following for use by operations centers in estimating expected wind generation.

Development of energy storage capacity also has significant potential to support more- intermittent renewable energy resources. Xcel Energy, the Iowa Stored Energy Park and the University of Minnesota Morris are three examples of Midwestern initiatives to advance energy storage technologies.

ADVANCED COAL WITH CARBON CAPTURE AND STORAGE IV

The Midwest relies heavily on traditional coal plants to provide affordable electricity generation. Indeed, 73 percent of electricity production in the MGA states is based on coal-fired generation. The region has an abundant supply of coal that can continue to provide a secure electricity fuel for decades to come. The reliance on coal also results in carbon-intensive electricity generation, with Midwestern power plants emitting 10 percent of the total CO_2 emissions in the United States.[44] To reduce the emissions profile associated with coal use, advanced coal technologies coupled with carbon capture and storage (CCS) are key to the Midwest's transition to a lower-carbon energy economy. The MGA jurisdictions are uniquely positioned to play a leadership role in developing CCS. The MGA region has vast coal reserves, depleted oil and gas fields that can both use CO_2 to effectively recover domestic oil resources and store CO_2 over the long term, and deep saline formations across the region that are capable of storing even larger volumes of CO_2.

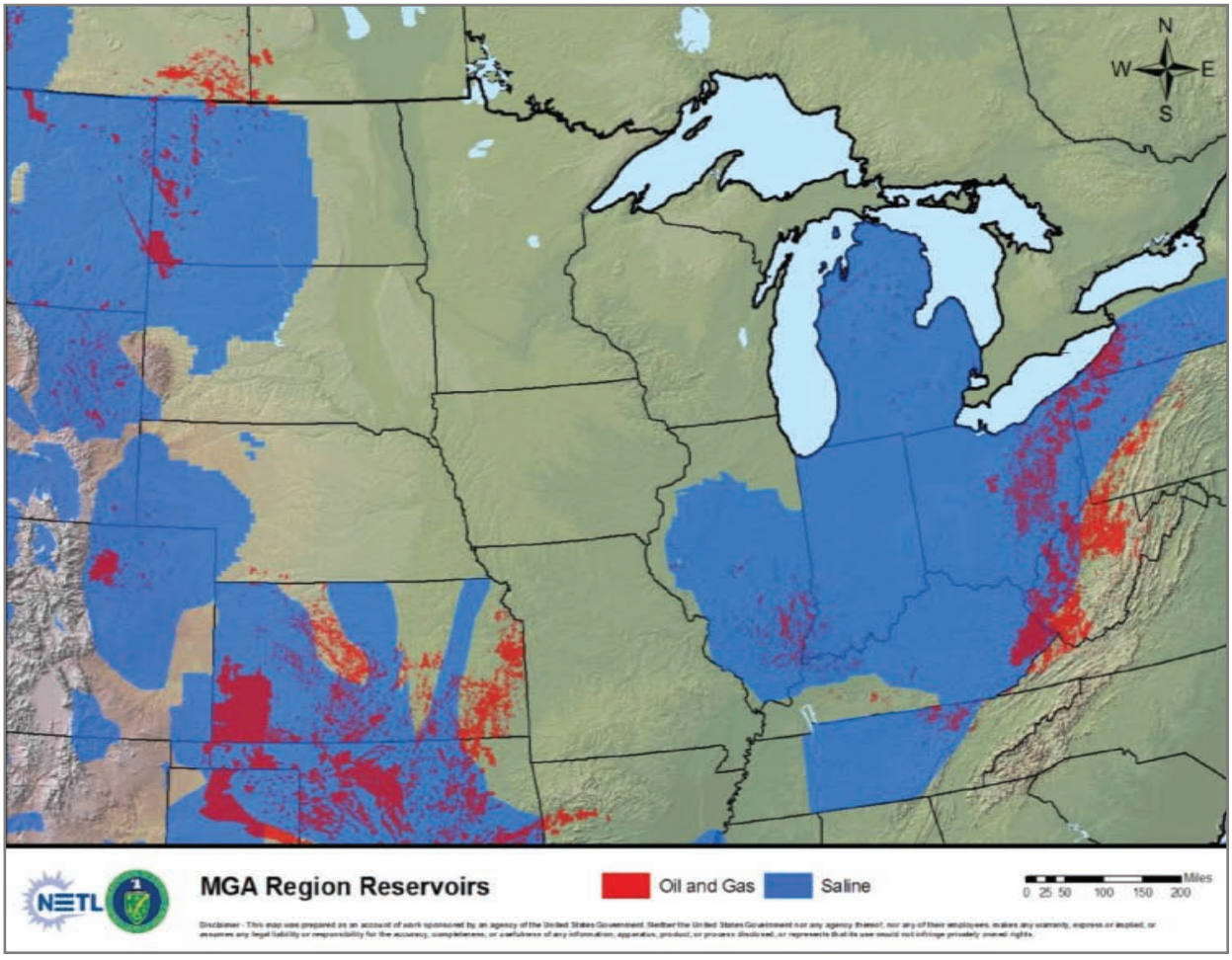


Figure 19: Oil and Gas Reservoirs and Saline Formations.

[44] Data from 2005. Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009).

CCS refers to the process of capturing CO_2, compressing it into an easily transportable form, conveying it by pipelines to a CO_2 storage site, and either injecting it into porous rock formations that are "capped" by non-porous rock for secure storage,[45] or alternatively by carbonation with mineral material to produce a solid product. Each component of CO_2 capture, transport and storage is proven and commercially demonstrated by multiple projects in the Midwest, the United States and around the world.[46] In terms of geologic storage, long-term, commercial-scale CO_2 storage of a million tons or more per year has been technically and scientifically demonstrated in oil and gas formations in a number of locations around the world. CO_2 storage in deep saline formations has been demonstrated at a million-ton annual scale by Statoil of Norway at Sleipner in the North Sea.

Gasification technology has been used on a commercial scale for more than 50 years,[47] and the technology to capture CO_2 from a coal gasification platform has been available commercially for years and can today be used to capture CO_2 from the production of substitute natural gas (SNG) from coal. For example, 13 million metric tons of CO_2 have been stored since 2000 at the Weyburn oil field of Saskatchewan. The CO2 is transported through a 205-mile-long pipeline from Dakota Gasification Company's (DGC) lignite-coal gasification plant in North Dakota, which captures CO_2 from the production of SNG. The same technology is also used to capture millions of tons of CO_2 annually at natural-gas processing plants worldwide.

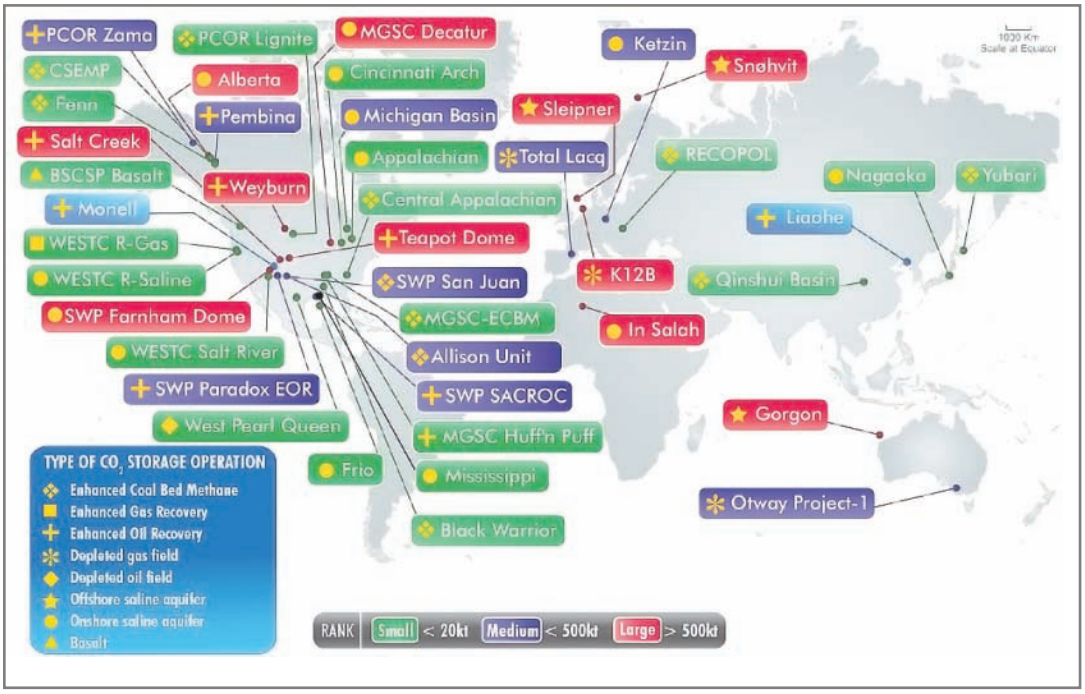


Figure 20: Current CO_2 storage sites.[48]

[45] U.S. Department of Energy (DOE), National Energy Technology Lab (NETL), "Carbon Sequestration FAQs." available at http://www.netl.doe.gov/technologies/carbon_seq/FAQs/carbon-seq.html [accessed August 10, 2009]
[46] Pew Climate Center on Global Climate Change, "Carbon Capture and Storage Fact Sheet," available at http://www.pewclimate.org/technology/factsheet/ccs [accessed August 10, 2009]
[47] Gasification Technologies Council (GTC), "What is Gasification?" http://www.gasification.org/what_is_gasification/state-of-gasification.aspx [accessed August 10, 2009]. The GTC also states that there are more than 140 gasification plants — with more than 420 gasifiers — operating worldwide.
[48] Source: CO_2CRC, http://www.co2crc.com.au/imagelibrary2/general.html

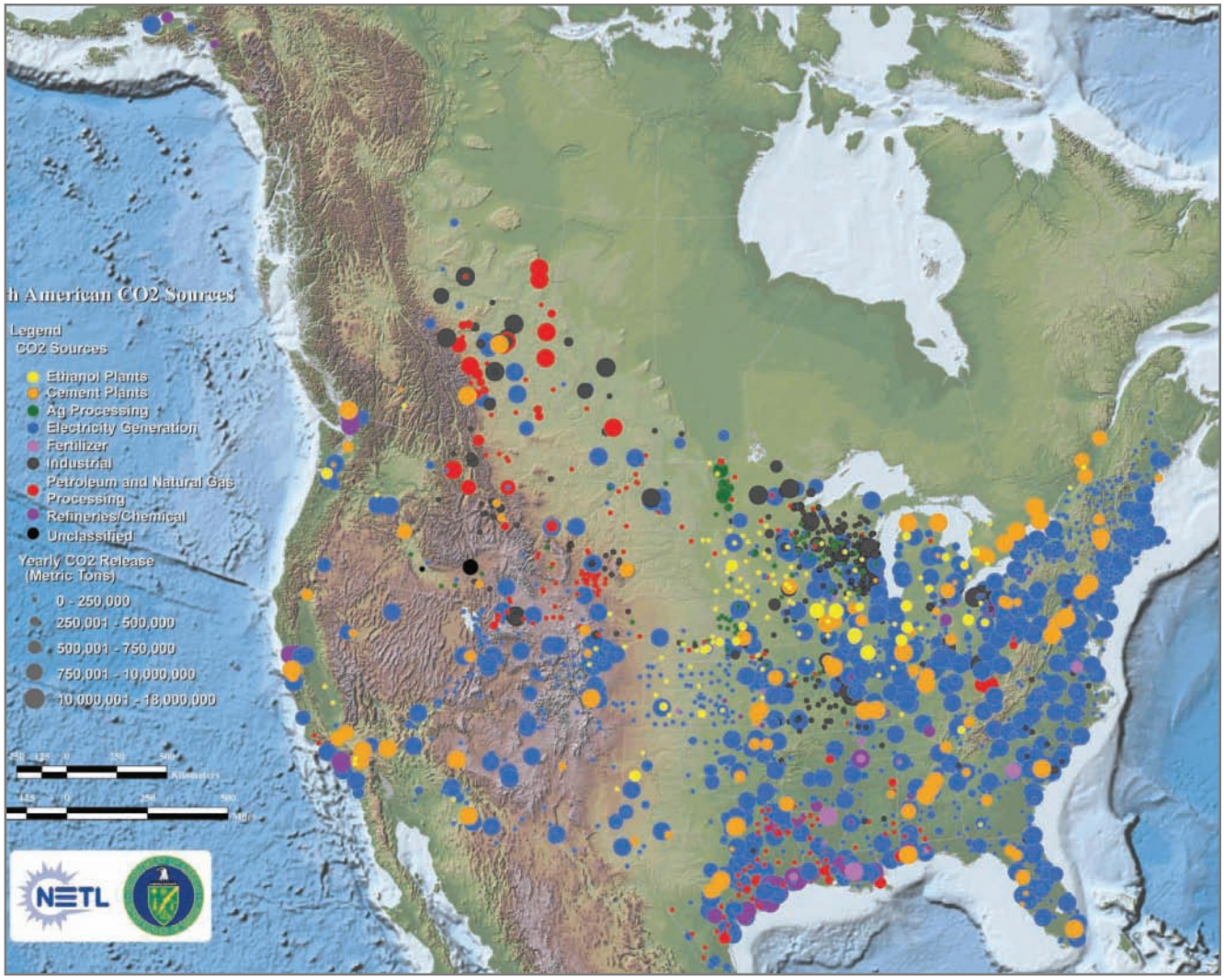


Figure 21: Current CO_2 sources. Source: National Energy Technology Lab, 2007. "Carbon Sequestration Atlas of the United States."[49]

In the realm of electric power generation, an integrated commercial-scale deployment of CCS has yet to occur. Although production of electric power from the gasification of coal using integrated gasification combined-cycle (IGCC) technology and each component of CCS exists commercially, they have yet to be integrated in a commercial setting.[50] Multiple IGCC plants operate commercially without CCS, and the first IGCC plants with CO_2 capture at scale will come online over the next few years around the world. For example, Duke Energy has broken ground on a 630-MW IGCC in Edwardsport, Ind., and has a proposal before the Indiana Utility Regulatory Commission that could make this project North America's first commercial power plant with CCS. Including CCS at Edwardsport would also meet one of the key milestones for CCS advancement established by the MGA. In addition, the FutureGen project, to be sited in Mattoon and Tuscola, Ill., is in the project development stage and would be a commercial-scale, fully integrated, near-zero-emissions plant with CCS that will produce electricity and hydrogen.

Still other CO_2 capture technologies for power generation have yet to be proven at commercial scale, but have promising pilot-scale applications. These include capturing CO_2 from the flue gas of existing coal-fired power plants, otherwise known as post-combustion capture, and burning coal in a pure stream of oxygen, or oxyfuel combustion.[51]

[49] http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/.

[50] For a description of how gasification and applications such as integrated gasification combined-cycle work, see the U.S. DOE, "How Gasification Power Plants Work," available at http://fossil.energy.gov/programs/powersystems/gasification/howgasificationworks.html [accessed August 10, 2009]

[51] U.S. DOE, "Retrofitting the Existing Coal Fleet with Carbon Capture Technology," available at http://www.fossil.energy.gov/programs/powersystems/pollutioncontrols/Retrofitting_Existing_Plants.html [accessed August 16, 2009]

Large-scale commercial deployment of a regional CCS infrastructure will require developing the technological, legal and regulatory foundations for the CCS industry in the United States and Canada over the next decade. The Midwest has already demonstrated CCS innovation and leadership that has drawn national and international attention, including the Dakota Gasification lignite gasification plant in North Dakota; Core Energy's commercial enhanced oil recovery (EOR) operations in northern Michigan that use CO_2 captured from gas processing plants; CO_2 captured from an ethanol plant in southwestern Kansas that may be used for EOR; a DOE-funded demonstration project using CO_2 from an ethanol plant for EOR at a mature oil field in central Kansas; and Archer Daniels Midland's demonstration project in Illinois to capture and store CO_2 from a corn ethanol plant in a deep saline formation. To expand and accelerate commercial deployment of such technologies in the Midwest, the MGA governors and premier adopted in 2007 the long-term goals to have all new coal power plants in the region incorporate CCS by 2020 and for the entire fleet of coal plants to transition to CCS by 2050. They also established key regulatory and technology milestones, including a multi-jurisdiction CO_2 pipeline to be sited and permitted by 2012.

Advanced Coal with Carbon Capture and Storage Policy Recommendations

The Energy Platform outlines specific objectives and commercialization milestones to support the achievement of these long-term goals. To accomplish these objectives, MGA jurisdictions must adopt policies to support and incentivize deployment of CCS technologies and supporting infrastructure to transport and store CO_2 over the long term.

1. Accelerating adoption of commercially proven technologies
2. Promoting a stable regulatory environment for CCS development in the region
3. Promoting required pipeline infrastructure for CCS deployment
4. Providing incentives to promote advanced coal and CCS technologies in the region

1. ACCELERATING ADOPTION OF COMMERCIALLY PROVEN TECHNOLOGIES

While CO_2 EOR is often portrayed as a near-term step on the path to CO_2 storage in deep saline formations, which have much greater storage potential, it represents an important energy security and climate stewardship strategy in its own right. The U.S. Department of Energy's National Energy Technology Laboratory (DOE-NETL) estimates that storage capacity in oil and gas formations in the United States and Canada is sufficient to store approximately 21 years' worth of U.S. stationary-source CO_2 emissions.[52] According to analysis undertaken for MGA by Advanced Resources International, the Midwest has the potential to use 530 million metric tons of CO_2 captured from energy facilities and other industrial sources to recover 2.2 billion barrels of oil, depending on the market price of oil and the EOR practices employed.[53] This volume of potentially recoverable oil suggests that EOR using anthropogenic CO_2 could breathe new life into the oil and gas industry in regions of the Midwest where it is otherwise largely mature, while significantly reducing net CO_2 emissions.[54]

[52] U.S. DOE-NETL, "Carbon Sequestration Atlas of the United States and Canada," available at http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/ [accessed August 10, 2009]

[53] Ferguson, Robert (June 22, 2009), "CO2-Enhanced Oil Recovery Potential for the MGA Region," prepared for the MGA by Robert Ferguson, Advanced Resources International. This represents the base-case scenario of $70 per barrel of oil, $45 per metric ton of CO2, using state-of-the-art technology. Report available at http://www.midwesterngovernors.org/MGA percent20Energy percent20Initative/Renewable percent20Electricity, percent20Advanced percent20Coal percent20with percent20Carbon percent20Capture/ARI_CO2-EOR.pdf [accessed August 17, 2009].

[54] For more information on the geologic storage of CO2 in enhanced oil recovery projects, see: U.S. DOE-NETL (January 9, 2009), "Storing CO2 with Next Generation CO2-EOR Technology," prepared by Vello Kuuskra et al., Advanced Resources International. Findings from the first phase of the Weyburn-Midale project to monitor and verify the suitability of the formations used in EOR for storage (initial results show these formations are highly suitable) can be found at: http://www.ptrc.ca/weyburn_first.php [accessed September 14, 2009]; and the DOE-NETL Carbon Sequestration Accounting Protocols at: http://www.netl.doe.gov/technologies/carbon_seq/measure/accounting.html [accessed September 14, 2009].

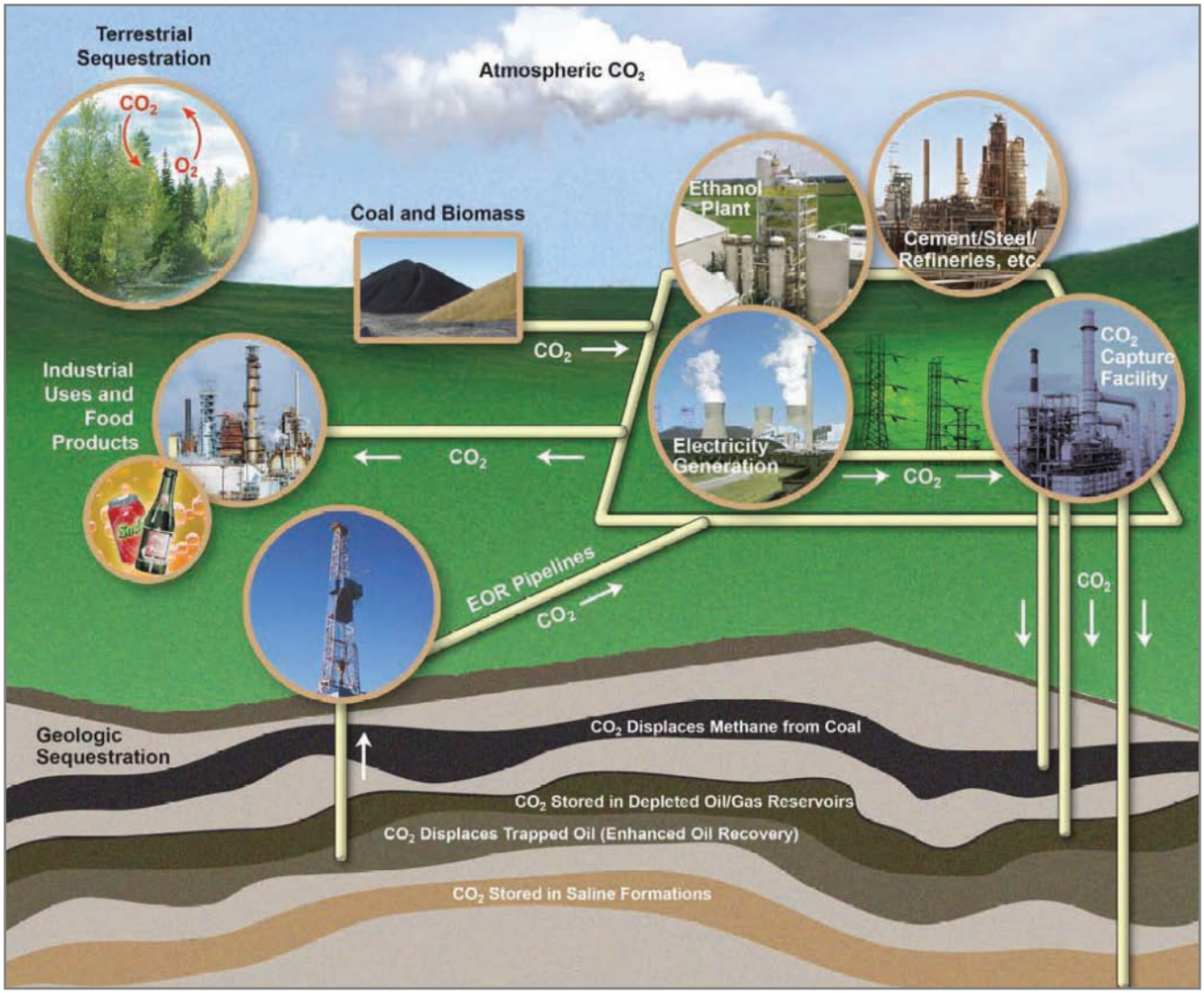


Figure 22: CCS and EOR process diagram.[55]

In addition to the multiple benefits of energy security, a lower carbon footprint for fossil energy production in the Midwest, and increased regional economic activity in coal- and petroleum-based energy sectors, policies in support of CO_2 EOR will also advance the build-out of a commercial CCS pipeline network and related infrastructure that can support deep saline storage that would result in even greater CO_2 reduction benefits over time. Depending on the project, EOR operators will pay suppliers of CO_2 per ton captured and/or invest in the transportation infrastructure to transport captured CO_2 — say from a coal gasification plant or natural-gas processing plant — to EOR operations. Currently, the demand for CO_2 used in EOR exceeds supply. Therefore, revenue from EOR can help underwrite the cost of pipelines and other infrastructure needed over the long term for deep saline storage. By contrast, in the near to medium term, absent policies that put a price on CO_2 emissions, deep saline storage of CO_2 cannot generate a revenue stream needed to finance the requisite infrastructure development.

[55] Source: National Energy Technology Lab, 2007. "Carbon Sequestration Atlas of the United States" http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/.

To expedite the accomplishment of the MGA CCS goals, governors and the premier of Manitoba established the Carbon Management Infrastructure Partnership (Partnership) as part of the Cooperative Regional Initiatives in the Energy Platform. This Partnership developed a Regional Commercial Plan for Carbon Capture and Storage that identifies specific strategies to support commercial deployment of CCS and sketches the regional build-out of supporting infrastructure to enable such deployment.

Deliverables of the Partnership that were implemented to inform the development of the advanced coal with CCS policy recommendations and the development of the Commercial Plan include:[56]

- "CO_2 Enhanced Oil Recovery Potential for the MGA Region," June 2009. Analysis completed by Advanced Resources International for the MGA examines the technical and economic potential of using CO_2 for EOR in eight Midwestern states.

- "Legal and Regulatory Inventory for Carbon Capture and Storage (CCS) & Analogues," March 2009. The MGA Inventory compiles relevant regulations and statutes that may be applied to, or are analogous to, advanced coal and other CCS projects in the MGA region. The inventory also highlights significant legislation and regulations emerging from MGA jurisdictions that support the development of a regulatory framework for CCS and provide incentives for commercial deployment.

- MGA "Toolkit for Carbon Capture and Storage (CCS): Statutory and Regulatory Issues," March 2009. The Toolkit provides background on the major legal and regulatory issues (transporting CO_2, ownership issues, and liability and financial responsibility) that states and provinces will likely address to develop CCS projects. Further, the Toolkit outlines a menu of actions for addressing the issues that each jurisdiction may evaluate and consider applying or adapting to its own circumstances.

- Geologic Storage Utility. Design recommendations were developed for the establishment of a geologic storage utility (or utilities) that would be responsible for reliably receiving and distributing CO_2 to geologic storage sites, which it would also manage in perpetuity (concept described further below).

- "Carbon Capture and Storage Policy Principles," June 2009. The MGA released a set of policy principles and recommendations for the state, provincial and federal levels to facilitate wide-scale deployment of CCS.

A broader set of policy recommendations was also developed to establish the necessary foundation for a multi-jurisdictional CCS system and infrastructure that can be rapidly deployed in pursuit of the MGA goals and commercialization milestones.

[56] All deliverables and supporting documents are available at http://www.midwesterngovernors.org/Energy.htm

2. PROMOTING A STABLE REGULATORY ENVIRONMENT FOR CCS DEVELOPMENT IN THE REGION

A regulatory framework and supportive financial structure must be in place to provide a stable and predictable environment within which CCS technologies can be integrated and deployed. It has proven difficult for developers to get CCS projects off the ground without such regulatory and financial stability and predictability. The governors and premier recognized the importance of addressing these barriers and established the goal of implementing a consistent regional regulatory framework by 2010 to enable long-term geologic storage of CO_2.

A comprehensive set of statutes and regulations should complement federal policies and must address CO_2 transportation (including authority for pipeline siting) and long-term storage in depleted oil and gas formations and deep saline formations, and potentially other types of geologic formations. To provide long-term regulatory certainty, such statutes must fully address property-rights issues for storage operations and management, enable the acquisition of corridors for transporting CO_2 through pipelines, and financial responsibility and liability for long-term stewardship of storage sites.[57]

In many cases, the most cost-effective path between the origin and the destination of the CO_2 will cross jurisdictional boundaries. Cost-effective regional infrastructure and system development will require coordination among MGA jurisdictions. Greater compatibility among statutes and regulations will enable project planning and completion to occur more quickly and efficiently. Thus, MGA jurisdictions should strive for consistency in regulations and requirements across jurisdictions to the extent possible. Therefore, REACCCS recommends establishing a regional inter-agency CCS regulatory task force to recommend specific statutory and regulatory changes and additions that each jurisdiction ought to make to ensure compatibility between jurisdictions for project siting, permitting and oversight.

One mechanism to create an environment of certainty and predictability for developing CCS projects is to establish a geologic storage utility (GSU) or utilities to manage the CO_2. A GSU could be established at the state and/or inter-jurisdictional level (for jurisdictions sharing a geologic basin that crosses jurisdictional boundaries) that would be responsible for reliably receiving and distributing CO_2 to storage sites that it would manage in perpetuity. An inter-jurisdictional GSU could be developed at the scale of a geologic basin where multiple projects would likely need to be managed in a coordinated way. A GSU would reduce the complexity and create transparent oversight of managing multiple projects in a region, selecting and characterizing storage sites, acquiring property rights and addressing liability issues. This is a potential pathway for jurisdictions to take a leadership role, address several of the barriers to CCS development, and to move toward achievement of the MGA commercialization goals.

[57] For an overview of the regulatory issues and a menu of actions for states and provinces, see MGA "Toolkit for Carbon Capture and Storage (CCS): Statutory and Regulatory Issues."

CO-UTILIZATION OF COAL AND BIOMASS WITH CARBON CAPTURE AND STORAGE

Combustion and gasification of coal with biomass has been demonstrated at commercial scale in multiple locations around the world. The combustion of switchgrass with coal in Iowa or the gasification of a range of biomass feedstocks with coal in the Netherlands are prominent examples. For several years, the Dutch utility Nuon has co-gasified 30 percent biomass with coal in a 250 MW integrated gasification combined-cycle power plant that uses commercially available technology. The company is now taking the additional step of installing equipment to capture a stream of CO_2 for geologic storage.

The incorporation of CO_2 capture and storage (CCS) with utilization of biomass in a gasification or combustion process to produce electricity, substitute natural gas and liquid fuels has the potential to achieve very low CO_2 emissions. Depending on the mix of technologies, fuel types and energy products, even net-negative CO_2 emissions are possible because the carbon stored in the biomass through photosynthesis can be captured, rather than released back to the atmosphere. Furthermore, very low emissions profiles can be achieved even when coal represents the majority fuel source because the majority of CO_2 emissions from coal can be avoided and additional atmospheric carbon is withdrawn from circulation via use of the biomass as a feedstock and its subsequent capture.

While some coal and biomass co-utilization options are commercially viable today, a number of important challenges need to be addressed in order to enable widespread deployment, especially of facilities that incorporate CCS. Barriers include:

- Availability of sustainable and affordable biomass feedstock supply, including potentially adverse agricultural and land-use impacts;
- Cost and performance guarantees for key conversion technologies suitable for biomass feedstocks; and
- The lack of a policy framework to reward CO_2 emissions reductions and help bring down additional costs of CCS and of biomass relative to fossil energy feedstocks.

REACCCS recommends that MGA jurisdictions actively support demonstration projects regionwide that can effectively test different conversion technologies, alternative biomass and coal feedstocks, and various low-carbon energy products.

The Midwest is uniquely positioned to lead the demonstration and commercialization of co-utilization of coal and biomass with CCS. This presents an economic opportunity to harness energy resources and geologic storage potential that the region has in abundance, an environmental opportunity for potentially much deeper reductions in the carbon footprint of energy production, and a political opportunity to align important industries and constituencies behind a common and mutually beneficial strategy.

3. PROMOTING PIPELINE INFRASTRUCTURE NEEDED FOR CCS DEPLOYMENT

Achievement of MGA commercialization goals for CCS deployment will require a significant build-out of supporting infrastructure. The "chicken and egg" scenario that plagues strategic development of wind and its transmission requirements also applies to CCS deployment. While it is difficult for CCS projects to move forward without supporting pipelines in place, it is also a challenge to procure financing for a CO_2 pipeline without guaranteed availability of captured CO_2 and of commercial EOR opportunities to market that CO_2. Therefore, building advanced technology facilities with CO_2 capture, CO_2 pipelines and the development of commercial EOR and CO_2 storage opportunities must be pursued simultaneously.

Building on the comprehensive enabling regulations for CO_2 management described above, the Energy Platform also calls for the siting and permitting of a multi-jurisdictional pipeline by 2012 to transport CO_2 captured from one or more new advanced coal plants (and possibly other industrial facilities) to an appropriate formation for use in EOR or in deep saline formations for storage. The MGA recommends a phased approach to the build-out of a regional pipeline infrastructure that capitalizes on the near- to mid-term opportunities across the region (see box).

BUILDING OUT A REGIONAL PIPELINE INFRASTRUCTURE:

Phase I through 2015 features a two-pronged approach:

1) Develop and deploy individual commercial-scale capture projects with associated pipeline transport to reservoirs for CO_2 EOR and storage in the jurisdictions of Kansas, Manitoba, Michigan, Missouri; and

2) Site and build a major CO_2 trunk pipeline connecting a cluster of commercial capture projects in Illinois, Indiana, Kentucky and Ohio to the Gulf Coast for EOR and storage.

Phase II from 2015-2025:

1) Continue expansion of CO_2 EOR storage and deep saline storage within the Midwest itself through pipeline network expansion enabled by Phase I development; and

2) Connect all Midwestern jurisdictions to CO_2 trunk pipelines, so that commercial capture projects in states such as Minnesota and Wisconsin, which lack adequately confirmed suitable geologic reservoirs, have access to viable CO_2 transport and storage options.

Fortunately, as the Weyburn project described above illustrates, transporting CO_2 by pipeline represents a well-understood and fully commercial enterprise. The DGC-Weyburn pipeline is only one of many CO_2 pipelines operating around the world. The United States has significant experience in safely transporting CO_2 through a network of over 3,900 miles of CO_2 pipelines. Pipeline transport of CO_2 is decades old and represents the least costly and most conventional aspect of CCS from a technology perspective. MGA jurisdictions can support and accelerate the safe and efficient development of an inter-jurisdictional pipeline network through the development of mechanisms to enable acquisition of transportation corridors for those pipelines and coordinating and streamlining efforts where appropriate. The build-out of a regional infrastructure can also be supported by increased efforts to assess and determine potential pathways for pipeline networks that best utilize regional resources.

4. PROVIDING INCENTIVES TO PROMOTE ADVANCED COAL AND CCS TECHNOLOGIES IN THE REGION

Experience with commercial-scale projects and the development of new technologies will expand options and lower costs over the long term. In the near term, states and provinces can develop market structure rules and incentives to facilitate commercial development in the CCS industry. Financial incentives for the deployment of CCS projects, as well as leadership on research, demonstration and commercial deployment to reduce costs and increase technology options must come from the federal level.

REACCCS has developed several key recommendations to incentivize the needed investment to develop commercial advanced coal and other CCS projects. One recommended mechanism is to provide state tax credits per ton of CO_2 captured for commercial EOR operations using anthropogenic CO_2 that result in net storage of CO_2. These credits should supplement expected federal per-ton payments for CO_2 stored in EOR and deep saline operations, if needed for

projects to be commercially viable. MGA jurisdictions could recoup these costs through revenue earned from additional oil recovered that is otherwise unobtainable through traditional extraction practices. Additional potential financial incentives include tax abatements for new or expanded CCS project development to reduce the capital cost of investments in capture and compression components and transport infrastructure. Such incentives would not result in additional expenditure by MGA jurisdictions because they would support new economic activity.

To assist with such capital costs, several states, including Illinois, Indiana, Kansas, Michigan, Minnesota, North Dakota and Ohio, are in the process of developing or have passed legislation that provides a range of financial incentives for deployment of advanced coal with CCS in their jurisdictions. Significant incentives and tax credits to support advanced coal with CCS projects that are being proposed or have been passed include cost recovery for the inclusion of CCS components, enhanced returns on shareholder equity, portfolio standards that include advanced coal and CCS as an option for meeting a standard, and property tax exemptions.

PROGRAMS AND POLICIES FAVORING ADVANCED CO_2-LIMITING GENERATION TECHNOLOGIES

The Energy Platform suggested several regulatory programs and policies favoring advanced CO_2-limiting generation technologies with CCS over conventional pulverized-coal units that remain possible mechanisms for deployment support in the region. These policies include:

1) A low-carbon electricity portfolio standard or objective that combines fossil electricity-generation resources (such as IGCC with CCS) with traditional renewable resources;

2) A CCS portfolio standard for electricity providers;

3) A CO_2 performance standard for all new electric power plants;

4) Innovative, long-term power purchase agreements to provide developers with higher rates of return and reduced risk in exchange for price stability that benefits ratepayers (allowing regulators to qualify more-stable prices as a benefit);

5) Specific incentives and financing assistance to replace or re-power existing coal plants in favor of advanced generation technologies with CCS;

6) Market-based environmental regulatory programs to provide incentives to invest in low-CO_2-emission technologies with flexibility and certainty for achieving reductions;

7) Three-party covenants in which the federal government provides credit, the state regulatory commission provides an assured revenue stream from the syngas to protect the federal credit, and a project developer provides equity and initiative to build the project; and

8) Expanded state support for front-end engineering and design (FEED) studies, which provide the project cost estimates needed to secure private investment in advanced technology projects. State tax credits or grants can help offset FEED study costs and allow utilities and developers to recoup the initial engineering costs, which are among the most difficult components of a project to finance.

Because of the current financial situation, the limited access to long-term loans for capital investments and a decrease in demand for electricity, federal programs and incentives will be critical for achieving the long-term goal of transitioning the Midwest's coal fleet to CCS. Measures to implement at the federal level include:

- Expanding federal loan guarantees available to CCS projects; and
- Providing an incentive for storing CO_2 through a federal storage tax credit program that covers the cost of CCS on potential commercial projects and, like the wind production tax credit, is: large enough to stimulate many projects, self-executing, transferable, and able to provide enough certainty to facilitate project finance (credits should be available to developers on a reserved basis, prior to financing, in order to provide certainty for project financing). This could be achieved through improvement of the new federal credit for CO_2 sequestration that is part of the Energy Improvement and Extension Act of 2008.[58]

Measures to leverage or expand programs at the federal level that support commercial deployment of CCS projects include:

- Implementing existing programs: The U.S. Department of Energy (DOE) should move forward expeditiously to implement existing programs such as FutureGen and increase funding for the Clean Coal Power Initiative (CCPI) and other programs that facilitate project construction.
- Commercializing new technology: The DOE should work with Congress to create a comprehensive program that leverages the development of CCS through full-scale commercial deployment and operations.
- Developing the geologic carbon storage industry: The DOE should extend and expand comprehensive research, demonstration and commercial deployment programs for geologic carbon storage. This should include support for improved characterization of geologic storage formations and the preservation of existing data on such formations.

Despite important investments in the federal stimulus package, current federal funding remains inadequate, given the scale of the task and the urgency of commercializing advanced coal technologies with CCS. These programs and incentives can provide immediate and near-term support that will accelerate commercial deployment.

While CCS is often considered a "long-term" option for emissions reduction, there are both significant short-term benefits achievable through deployment of existing technologies and immediate policy requirements to establish a regulatory and financial environment conducive to long-term development of the industry. Meeting the MGA goals of full CCS deployment in the region over the long term requires a significant expansion of technology options and lowering of barriers to cost-effective technology and infrastructure development. Federal programs will help in those efforts, but committed state and provincial leadership will be the key determinant of success.

[58] The federal tax credit for carbon dioxide storage is codified at Section 45Q of the tax code (26 U.S.C. 45Q), enacted October 3, 2008, as part of the Energy Improvement and Extension Act of 2008 (Public Law 110-343).

Energy Choice Simulator: Renewable Electricity and Advanced Coal with Carbon Capture & Storage

The baseline electricity-production scenario shown in Figure 11 suggests that very little regional renewable development would occur in the absence of policies designed specifically to advance their development. This demonstrates the positive impact of leadership to date by MGA jurisdictions in implementing renewable energy standards and objectives. It also underscores the critical importance of extending existing RES and REO policies consistent with MGA renewable electricity targets, and for those MGA jurisdictions that lack an RES or REO to implement such a policy. Renewable energy standards are requirements to use a minimum percentage of renewable energy in a jurisdiction's energy mix, while renewable energy objectives have no legal compliance obligation, but are often accompanied by additional incentives or reporting requirements designed to ensure that the objectives are met. Figure 23 illustrates the impacts on the regional electricity-production portfolio if state standards are strengthened to meet the MGA renewable energy objectives and implemented region wide.

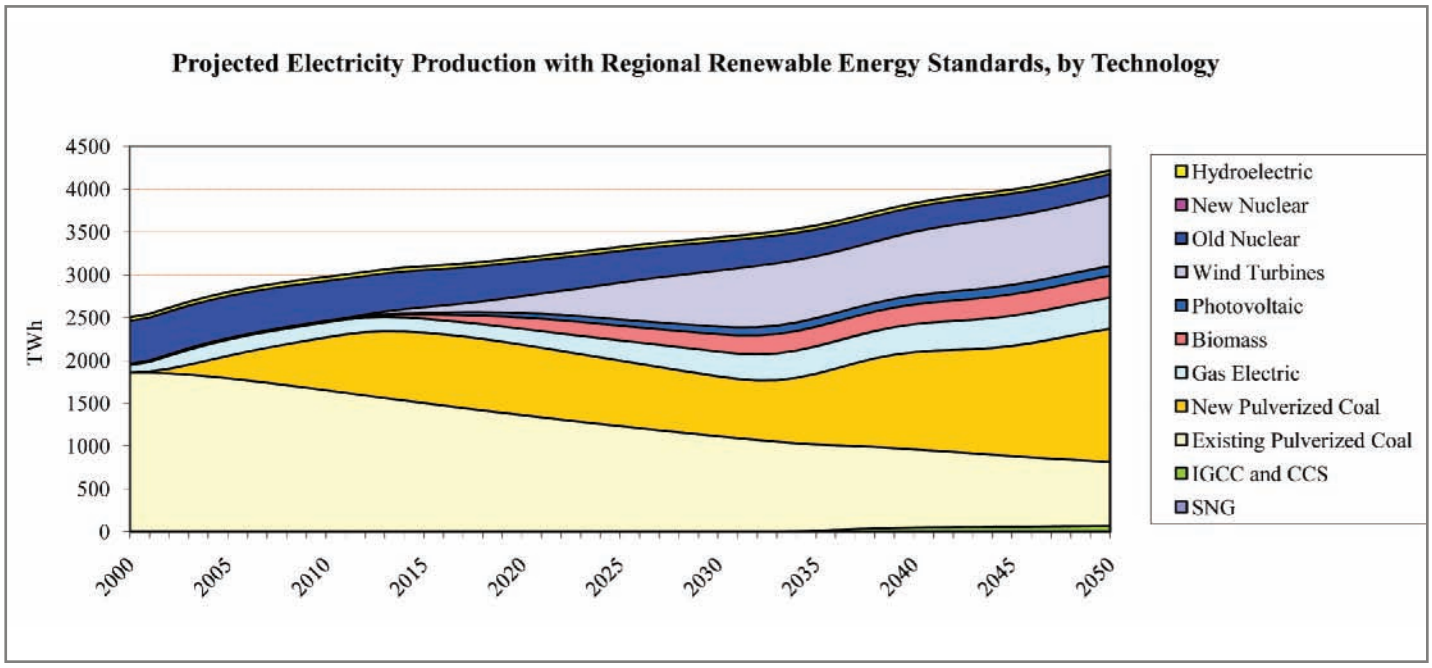


Figure 23: Projection illustrating an increased role for renewable energy under regionwide RESs and REOs in the Midwest, from 2000 to 2050.

Renewable energy technologies such as wind, biomass and solar enter the production portfolio as required by the state/provincial policies, and in the near term displace production of conventional pulverized-coal facilities. However, as electricity demand continues to rise, and to outpace the generation requirements of RES and REO policies, the additional demand is again met through construction of conventional pulverized-coal capacity.

Note that while regionwide RES or REO policies are effective at advancing development of those renewable technologies that are specifically incentivized, development of other technologies that are critical for the region, such as CCS, may be delayed if policies are not specifically and strategically targeted at them. The IGCC combined with CCS

technology that appears in the baseline energy scenario in Figure 11 appears even more prominently when that baseline scenario is projected over a longer time horizon and the maturing technology is able to deploy more extensively. That technology all but disappears from the electricity generation portfolio, however, when utilities are required to use specific renewable technologies to absorb new electricity demand (Figure 23). Complementary methods of supporting IGCC with CCS must be used to promote the near-term investment in CCS technology and infrastructure development that will be necessary to benefit from its long-term energy security and emissions benefits.

REACCCS suggests a number of possible regional policies that can be used to support development of advanced CO_2-limiting generation technologies with CCS over conventional pulverized-coal units. IGCC with CCS can be incorporated into policies that have traditionally been reserved for renewable resources, such as renewable energy standards or production tax credits. Alternatively, IGCC facilities can be rewarded for carbon that they capture and store through state/provincial-supplied carbon credits or through establishment of a market for carbon storage through such mechanisms as federal or regional GHG "cap and trade" legislation.

Consider, for instance, a scenario where, in addition to the regional establishment of a system of RES and REOs, a carbon storage credit is provided to IGCC with CCS facilities in the amount of $30 per ton of CO_2. Assuming that the necessary legal and regulatory frameworks and regional research and demonstration efforts are established in the near term, the additional financial incentive associated with CCS is effective at bringing the CCS technology back into the electricity generation portfolio in a substantial way over the long term (Figure 24). Under this scenario, IGCC and CCS replace new conventional pulverized-coal generation in absorbing new demand beyond that covered by the RES and REO technologies.

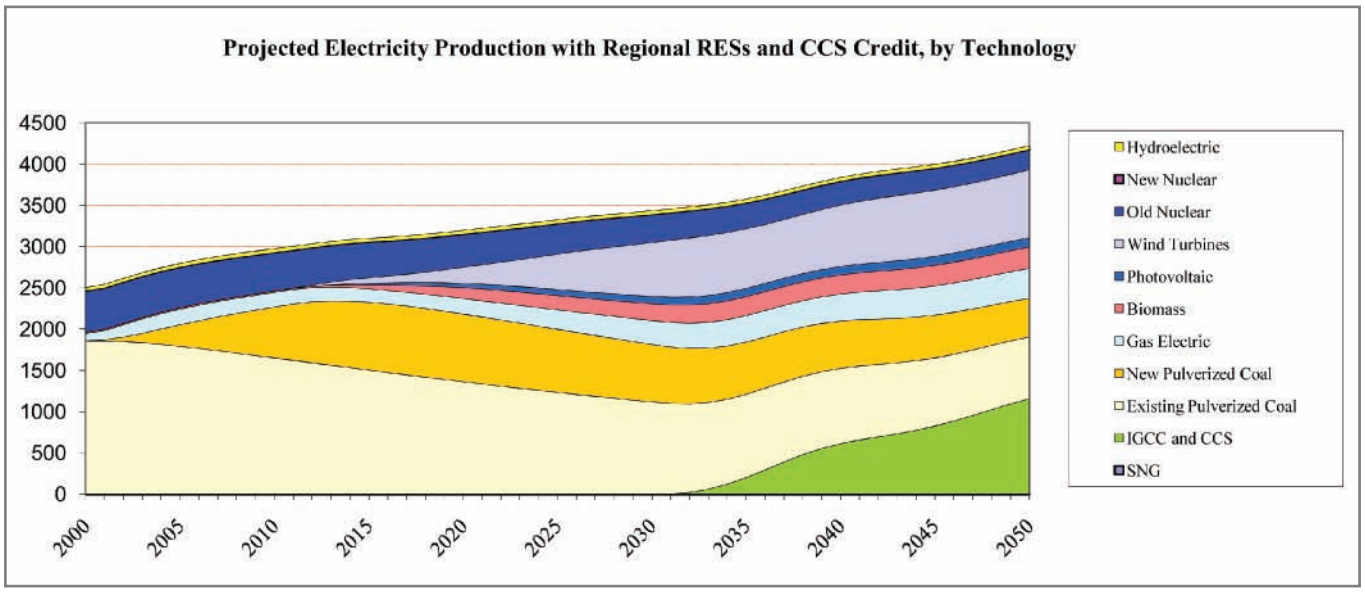


Figure 24: Projection illustrating a more rapid deployment of IGCC and CCS when a $30/ton CO_2 storage credit is added to a regional RES in the Midwest, from 2000 to 2050. Although this chart does not report significant levels of IGCC and CCS until the year 2033, the Energy Platform calls for a wide range of CCS demonstration projects by 2015 in order to enable wide-scale deployment later. The platform also calls for integration of CCS into new coal plants by 2020, which is not shown in this chart.

The emissions impacts of the policies reflect the underlying electricity-generation technologies. In displacing near-term conventional coal generation, the RES and REO policies stabilize emissions from the electricity sector in the near term. However, under these policies alone, the emissions again begin to rise when construction of conventional coal facilities resumes due to increasing energy demand. Complementing the RES and REO policies with an incentive for IGCC and CCS development, on the other hand, provides the long-term incentive needed to substitute low-carbon energy technologies as conventional coal plants are decommissioned, which achieves sustained reductions in emissions from the electrical sector (Figure 25).

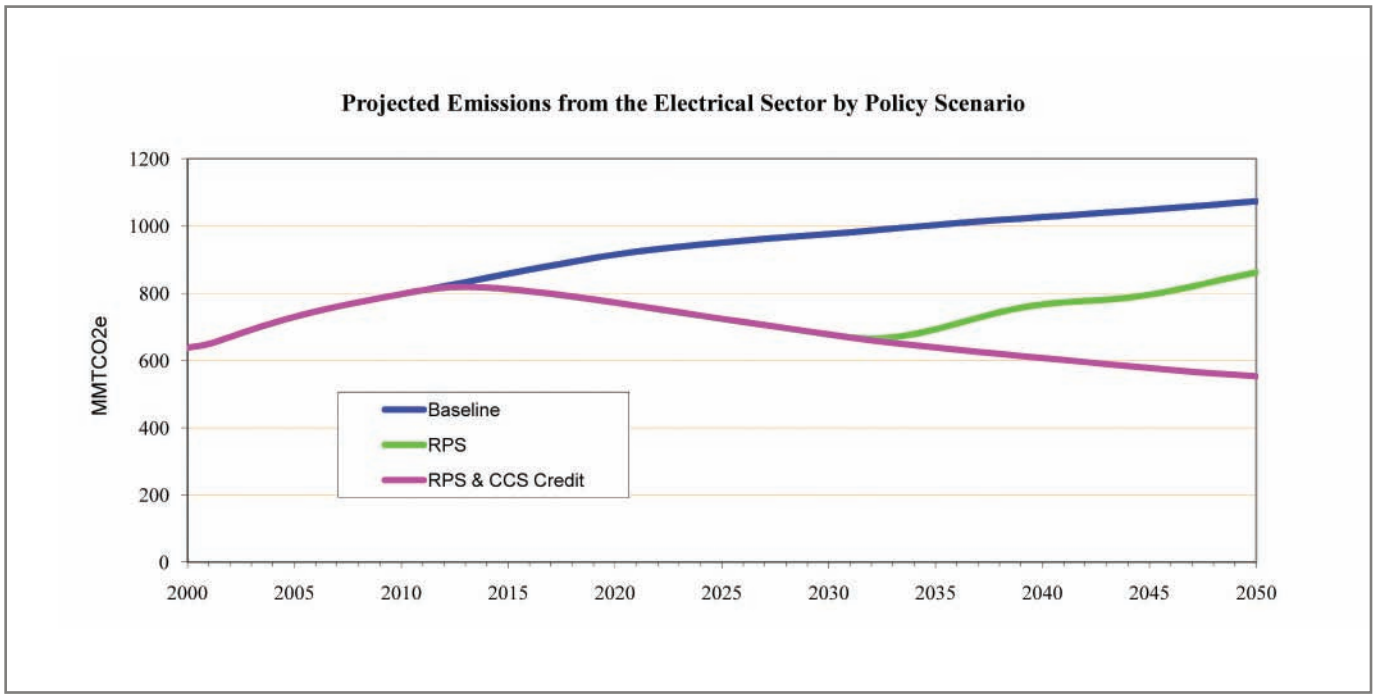


Figure 25: Comparison of projected electric sector emissions in the Midwest by RPS scenario from 2000 to 2050.

As described in earlier chapters, these policies cannot be applied in isolation. A number of enabling policies to overcome legal, technical and regulatory obstacles in the near term are required to ensure that jurisdictions can adequately expand renewable energy capacity and infrastructure to meet RES and REO objectives and lay the foundation necessary for long-term expansion of a comprehensive CCS system in the Midwest region. MGA leadership will be critical in that effort.

V BIOECONOMY AND TRANSPORTATION

Midwestern states have led the nation in adopting policies to expand the bioeconomy. Early policy incentives at the state level for biofuels ramped up the demand for alternative fuel production in the region. The Midwest is now the heart of the biofuel industry in the United States, with approximately 88 percent of the nation's ethanol operating capacity located within the 12 Midwestern states.[59] Current ethanol production relies heavily on corn for a feedstock, but the region is also projected to be a major source of biomass feedstocks when the next generation of commercial ethanol technologies — cellulosic ethanol — comes online. Stimulating the advanced biofuels industry and promoting a reliable perennial biomass supply in the region is an important component of the MGA vision for a low-carbon transport system in the region. These initiatives will invigorate the regional manufacturing base, revitalize rural economies, reduce carbon emissions associated with the transportation sector, and lessen our dependence on foreign sources of energy.

The transportation sector has the highest GHG emissions among the Midwest's end-use sectors. In 2005, transportation was responsible for 430.4 million metric tons of CO_2 equivalent emissions, with the majority of those emissions coming from gasoline combustion in passenger vehicles.[60] Trends in the region's transportation energy demand mirror those of the nation more broadly; steady increases in total vehicle miles traveled reflect increases in both vehicle miles traveled per capita and population-driven increases in total vehicles on the road. Among the states and provinces, however, a great deal of variability persists. Over the period 1990-2005, states such as Indiana and Kansas had experienced transportation-related emissions growth rates lower than that of the national average, while, at the other end of the spectrum, Minnesota's rate of emissions growth was approximately twice that of the regional average.[61]

Policy efforts to address energy and emissions issues in the transport sector have largely occurred at the federal level. The primary regulatory mechanism designed to control growth in transport energy demand has been the federal Corporate Average Fuel Economy (CAFE) standard — a vehicle technology standard that establishes minimum standards for manufacturers' fleet average fuel consumption per mile. These standards were first passed in 1975 following the 1973-1974 disruptions in oil imports, in an attempt to prevent further increases in dependence on foreign oil. While the policy resulted in initial improvements in new fleet efficiency, those improvements stalled in the mid-1980s, and the fuel economy standard for passenger vehicles remained virtually constant between 1985 and 2007. As a result, states in the Midwest and elsewhere began to look beyond the federal CAFE mechanism to explore alternative policies addressing transport-related energy-use and emissions issues within their borders.

Policies to address transportation energy use and emissions tend to focus on three areas — vehicle fuel economy, fuel technology, and efficiencies in the built environment. The former two policy categories focus on methods for achieving lower carbon emissions per mile traveled through 1) improved drivetrain fuel efficiency or better driving techniques and 2) a transition to lower-carbon transport fuels such as biofuels. The latter category has focused on reducing per-capita vehicle miles traveled through compact development, more-rational pricing, and expansion of travel choice options (public transit, bike paths, etc.), and options that reduce the need to drive.

Tackling the problem of emissions from the transport sector will require a comprehensive approach that captures opportunities for energy demand and emissions reductions in each of these areas simultaneously. The Energy Platform focused attention on the need for accelerated development and regional deployment of sustainable biomass-based fuels,

[59] From the Renewable Fuels Association's online list of ethanol plants, http://www.ethanolrfa.org/industry/locations/ Based on current version as of August 4, 2009.
[60] Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009)
[61] Climate Analysis Indicators Tool (CAIT US) Version 3.0. (Washington, DC: World Resources Institute, 2009)

and the ensuing stakeholder process broadened the bioeconomy and transportation objectives to explore additional opportunities related to transportation system efficiency.

The Energy Platform calls for several measurable milestones related to regional deployment of low-carbon fuels. These goals scale up over time, culminating in the following levels for the year 2025:

- Average fossil fuel inputs in the production of conventional biofuels in the region will be reduced by 50 percent.
- At least 50 percent of all transportation energy consumed in the region will be supplied by regionally produced biofuels and other low-carbon advanced transportation fuels.

BTAG also used the following numeric goals to guide the development of policies in other transportation areas:

- Assume market penetration of mileage-based insurance of 15 percent in 2015 and 75 percent in 2025.
- Increase transit ridership per capita 3.5 percent annually from 2010 to 2030.
- Increase overall share of all trips taken by biking or walking (bike-walk mode share) to 25 percent by 2030.
- Fully build out Midwestern rail systems, including the Midwest Regional Rail Initiative (MWRRI) by 2030. This would translate to an increase in ridership from 1.6 million rides per year in 2000 to roughly 15 million rides per year in 2030 and would represent an increase to 50 percent share of all transportation modes (mode-share) for rail, currently 12 percent, among all public modes.
- Reduce vehicles miles traveled (VMT) per capita — in other words, the number, frequency and distance of trips made — by 40 percent from a 2005 baseline by 2050, with incremental goals for intervening years of 15 percent reduction in per-capita VMT by 2020, 28 percent by 2035, and 40 percent by 2050.
- Reduce the GHG intensity per ton-mile of freight by 20 percent by 2025.
- Implement Chicago Region Environment and Transportation Efficiency (CREATE) projects to remove bottlenecks that impede mode-shifting, to address shortages of dock space, and to foster technological improvements to increase utilization.

Impact of Federal Policies

Federal efforts in pursuit of transportation objectives similar to those of the MGA have accelerated in the past five years. Two particularly significant initiatives are the Renewable Fuel Standard (RFS), which was passed in 2005 and expanded in 2007,[62] and the CAFE standards described above. The federal CAFE standards were also strengthened in the 2007 Energy Independence and Security Act, and according to rules introduced in 2009, are scheduled to be progressively tightened until model year 2020. The administration announced in May 2009 its intention to implement a single national standard[63] that meets the requirements of the federal fuel-economy standards and of GHG standards that have been proposed by California and other states. That program will replace current CAFE standards by essentially moving the model year 2020 deadlines to model year 2016, but until a final rule for implementation is adopted, the current standards remain in effect.

[62] http://energy.senate.gov/public/_files/RL342941.pdf

[63] Regulatory Announcement, EPA Office of Transportation and Air Quality. http://epa.gov/otaq/climate/regulations/420f09028.pdf

The RFS, which requires the use of an increasing amount of renewable fuel in the nation's fuel supply through 2022, has had a particularly powerful impact on the Midwest because of the region's strong existing and potential ethanol production capacity. The RFS is currently met largely through corn-based ethanol, with increasing requirements for biomass-based ethanol kicking off in 2010. Potential sources of biomass feedstocks include annual crop residues, forestry residue, and perennial crops such as switchgrass and short-duration wood species. According to two studies, the Midwestern states could potentially provide around 50 percent of the nation's cellulosic biomass resource,[64, 65] including more than 70 percent of the nation's perennial energy crops and crop residues.[66]

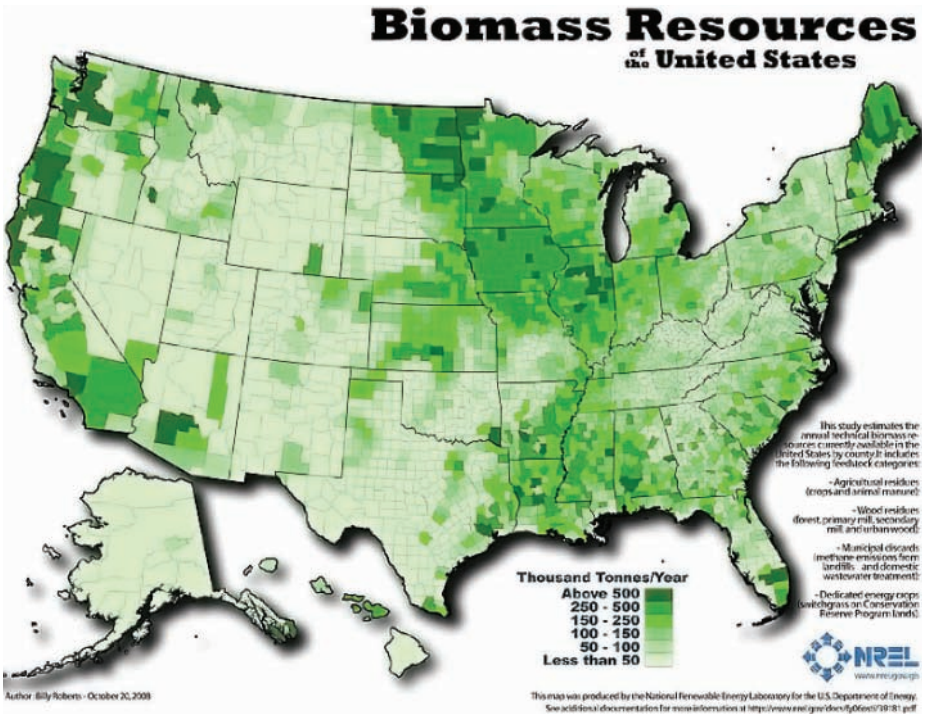


Figure 26: Modeled annual biomass supply.

The continued strengthening of regional and national capacity to satisfy these federal requirements in a timely way is vital to the Midwest's transportation objectives, as well as to the transformation of the nation's transportation sector as a whole. BTAG therefore advises that the MGA aggressively support these policies and the provision of federal resources required to ensure that the schedule of CAFE increases is timely and that the ambitious renewable-fuel requirements of the 2007 RFS are able to be met.

To encourage regional development of biofuels and further the objectives of these federal programs, some Midwestern states, including Iowa and Minnesota, have adopted versions of a state-level RFS. The Iowa standard is not a requirement like the federal RFS; the program aims to meet 25 percent of the state's motor fuel needs in 2020 with renewable fuels, and offers retailers tax incentives to try to reach that target. The program relies on statewide adoption of E10 and an aggressive expansion of E85 to meet its objectives. Minnesota has an existing 2008 requirement for 20 percent renewable fuel in all diesel fuel sold in the state (B20), and a proposed requirement for a 20 percent renewable fuel blend in gasoline (E20) that would take effect in 2013.

[64] Walsh, M.E., R.L. Perlack, A.T. Turhollow, D. de la Torre Ugarte, D.A. Becker, R.L. Graham, S.E. Slinsky, D.E. Ray, 1999 Biomass Feedstock Availability in the United States: 1999 State Level Analysis.
[65] Milbrandt, Anelia, 2005: "A Geographic Perspective on the Current Biomass Resource Availability in the United States," National Renewable Energy Laboratory, Golden, CO.
[66] Ibid.

ETHANOL BLENDS AND THE "BLEND WALL"

When used as a transport fuel in the United States, ethanol is blended into gasoline in volumetric proportions ranging from less than 10 percent (denoted E10) to as high as 85 percent (denoted E85). The Environmental Protection Agency is the regulatory agency tasked with determining what ethanol blends are approved for use in which vehicles and engines. Currently, only an E10 blend is approved for use in all vehicles; all blends higher than E10 are approved for use only in specially configured "flex-fuel" vehicles. This restriction creates what is called the "blend wall" in the ethanol market. The blend wall refers to the maximum amount of ethanol that can be absorbed into gasoline at a low-level E10 blend. Depending on assumptions about annual national fuel consumption, that volume is projected to be approximately 12 billion to 15 billion gallons.

The federal RFS, however, calls for use of 36 billion gallons of biofuels in the nation's fuel supply by 2022, and it is anticipated that most of that requirement will be met through ethanol. Alternative strategies must therefore be developed to absorb the additional ethanol into the fuel market. One such strategy is to increase the use of higher ethanol blend levels in the vehicle fleet. Because currently only 3 percent of the U.S. light-duty fleet qualifies as "flex-fuel" and only 1.5 percent of U.S. gasoline retailers carry E85 fuel or other high blends, this strategy involves both increasing the availability of flex-fuel vehicles and providing incentives for retailers to carry the high-level ethanol blends they can run on.

An alternative, or complementary, strategy is to raise the regulatory restriction on ethanol blends. In May 2009, several ethanol producers filed a formal request with the EPA to raise the blend level approved for use in all engines to E15. In July 2009 the MGA submitted a letter to the EPA in support of that request. The EPA has been conducting vehicle tests to determine, based on tests of engine performance and air quality, whether to approve use of higher blends in all vehicles, and is due to reach a decision by December 2009.

Minnesota's proposed E20 RFS creates a conflict between the state-level requirement and the federal "blend wall" (described in box); unless the state receives a waiver from the EPA, it cannot legally use ethanol blends as high as E20 in its transport fuel for all vehicles. While the Energy Platform calls for expansion of retail incentives to carry E85 blends, in July 2009 the MGA also submitted a letter to EPA Administrator Lisa Jackson urging the EPA to increase the approved alcohol-gasoline blend to 15 percent ethanol by volume in unleaded gasoline from its current level of 10 percent.

There are a host of additional state and regional policies that are available to advance the MGA transport objectives and milestones. BTAG's regional policy recommendations largely fall into the policy categories described above. Many of the technologies envisioned to help transform the transport sector are advanced transportation technologies such as advanced biofuels and electric vehicles; however, because such technologies are not immediately available for deployment, even with incentives for their production or use, an additional category of supporting policies to expedite commercialized advanced transportation technology production in the region is also discussed.

Bioeconomy and Transportation Policy Recommendations

BTAG was tasked with developing a set of policies in support of these goals and of the BTAG objectives more broadly.

1. Increase fleet fuel efficiency.
2. Lower the carbon content of transport fuels used.
3. Develop strategies for more-efficient driving.
4. Develop policies to expand travel choices.
5. Develop policies in support of regional development and deployment of advanced transportation techniques.
6. Develop policies in support of perennial biomass supply and feedstock supply logistics.
7. Develop and enhance freight policies.

1. STRATEGIES TO INCREASE FLEET FUEL EFFICIENCY

In addition to support for application of the federal fuel-efficiency standards, there are state and provincial actions that can be taken to improve the average fuel efficiency of passenger vehicles on the road in the Midwest. Because states and provinces are themselves vehicle consumers, they can adopt fleet-procurement standards for their own fleets or for acquisitions supported through state contracts. They can also provide broader financial incentives through programs such as tax incentives to producers or consumers of high-efficiency vehicles and engines; "feebate" systems through which owners of vehicles below a certain threshold of fuel efficiency pay a fee while those above it receive a rebate; or production tax credits for hybrid electric or other advanced-technology vehicles. In addition, states can promote more-efficient mileage-per-gallon driving techniques through driver education courses and other types of marketing and outreach, including programs to educate and monitor drivers of their own state fleets.

2. STRATEGIES TO LOWER THE CARBON CONTENT OF TRANSPORT FUELS USED

The Energy Platform calls for the creation of "a uniform, regional low-carbon fuels policy — implemented at the state or provincial level as a standard, objective or incentive — and report annually on progress." The objective of low-carbon fuels policies is to reduce emissions of CO_2 in the transport sector by encouraging the substitution of low-carbon-intensive fuels for traditional fossil fuels. While some low-level ethanol blends can be integrated easily into existing distribution systems, other lower-carbon fuels, such as E85 or electricity, require moderate to extensive modification of such systems. Successful large-scale deployment of low-carbon fuels in the region will require a coordinated strategy for addressing issues related to low-carbon fuel production and supply, distribution infrastructure, vehicle technology, and in some cases, consumer vehicle choice. States should consider adopting a low-carbon fuel standard (LCFS) to create demand to pull low-carbon fuels into the market.

LOW-CARBON FUELS STANDARD (LCFS)

An LCFS ensures that the mix of fuel sold in the market contains sufficient levels of low-carbon fuels to meet a requirement for average carbon content overall. The carbon content of a given fuel is estimated based on extensive life-cycle analysis that accounts for all sources of GHG emissions arising throughout the production, transport and consumption of that fuel.[67] LCFS policies are now being considered in several states in the Midwest, and in jurisdictions outside the region, as a potential tool for reducing GHG emissions in the transportation sector. To further the objectives of the Energy Platform, an LCFS advisory group has been established to develop a proposed model LCFS framework for the region. Over 2008 and part of 2009, MGA has hosted stakeholder discussion and consensus-building meetings, which have also served as valuable opportunities for shared learning. Based on recommendations from those discussions, both BTAG and the Governors Steering Committee agreed to a set of basic principles on LCFS policy (see box below for a summary of these principles) and established a new, expanded stakeholder effort that began in the summer of 2009 and will continue at least into 2010. The expanded Phase II LCFS advisory group has two major objectives:

- Offer regional input on any federal LCFS that is proposed.
- Develop design considerations to aid Midwestern jurisdictions considering an LCFS to ensure integration and consistency across the region.

Although many issues remain to be resolved, the group reached consensus on a set of preliminary recommendations (see box).

KEY CHARACTERISTICS OF RECOMMENDED MIDWESTERN LCFS:

- The program should use the average carbon intensity of the 2005 fuel supply as the baseline against which future reductions are measured.
- The overall intensity reduction should be at least 10 percent within 10 years after implementation by Midwestern jurisdictions.
- The timeline for yearly reductions should be set by the jurisdictions.
- The program should develop mechanisms for encouraging the commercialization and deployment of "very low carbon fuels," which are defined as having GHG emissions that are at least 50 percent lower than the baseline.
- The program should include default values for fuels based on their life-cycle characteristics. These default values should capture a variety of production practices for the same fuel type.
- Firms should also be able to provide their own GHG values based on a site-specific life-cycle assessment that is verified by an approved party.
- The program should rely on a modified version of the existing system of Renewable Information Numbers (RINs) to track information about GHG emissions.

[67] Disagreement over the appropriate scope of a life-cycle assessment has resulted in vigorous national debate over whether carbon emissions arising from certain types of indirect land-use change should be included in the measurement of fuel carbon content under the Renewable Fuel Standard.

POLICIES TO SUPPORT LOW-CARBON FUEL INFRASTRUCTURE AND TECHNOLOGY

Policies such as the LCFS and the federal RFS create demand that pulls lower-carbon fuels into the marketplace. However, in cases where new technologies require development of additional or modified infrastructure, as is the case with high-level biofuel blends such as E85 or with electric vehicles, it may also be necessary to simultaneously provide incentives to stimulate the development of that infrastructure in order to ensure that the additional demand can be met smoothly. To facilitate adoption of hybrid electric vehicles in the region, for instance, MGA should support a host of additional enabling infrastructure developments, including working with utilities to add an electric vehicle component to "smart grid" development plans, promoting demonstration projects among Midwestern auto manufacturers, and establishing "end of life" buyback programs for electric car batteries to help with waste recovery. BTAG also recommends that MGA states create a "Clean Fuel Retailers" program to facilitate the development of low-carbon fuel and vehicle infrastructure.

SAMPLE INCENTIVES AND MECHANISMS FOR A CLEAN FUEL RETAILERS PROGRAM

- Create a "Clean Fuel Retailers" program that recognizes retail and wholesale outlets that attain benchmarks in the sale of low-carbon fuels.
- Provide clear definitions of what constitutes low-carbon fuels and vehicles.
- Provide incentives for the installation of refueling infrastructure, including E85 pumps, blender pumps, hydrogen refueling infrastructure, and electric vehicle recharging infrastructure. Incentives could include reimbursements for investments or tax rebates.
- Reduce payment of motor fuel tax on all fuel sold at facilities that achieve a minimum level of low-carbon fuel sales (e.g. 5 percent of all fuel sales).
- Create a fund that would provide Clean Fuel Retailers with an incentive (rebate) for sales of low-carbon fuels. One option would be an increase in state motor fuel tax, initially starting at $0.01 per gallon and increased as needed to achieve the program's goal.
- Encourage Underwriters Laboratories (UL) to develop standards for low-carbon fuel refueling infrastructure. All new fueling systems being installed throughout the region should be UL-certified to be able to legally dispense any fuel blend ratio up to E85.
- Provide incentive payments for consumers, both individuals and fleet managers.
- Fund public education efforts that include mapping low-carbon fuel refueling stations throughout the Midwest, creating a common program brand and promoting the program.

3. STRATEGIES FOR A MORE EFFICIENT TRANSPORTATION SYSTEM

Policies designed to foster transportation efficiency to reduce per-capita VMT operate through a variety of mechanisms, ranging from offering drivers more transit alternatives to promoting more-informed choices in the marketplace.

MILEAGE-BASED PRICING

Research at the University of Minnesota (2000)[68] found that drivers are often not aware of the full costs of driving for the following three reasons:

- A substantial portion of the costs drivers face are not variable (e.g., insurance, cost of ownership, etc.), so driving less does not save the driver money.
- A substantial portion of the costs of driving are paid for by revenue streams that are not directly related to automobile-use decisions. Property taxes, for instance, pay for a large portion of the costs of maintaining local roads.
- Drivers may not see the negative externalities associated with driving, including the negative impacts of CO_2 emissions or of increased vulnerability to imported oil.

As a fundamental cornerstone of policies targeting driver VMT decisions, Midwestern states and provinces should strive to create price signals that reflect true costs and incentivize more-efficient travel, while incorporating measures to avoid disproportionate impacts on rural and lower-income drivers.

Many policy options exist to ensure that, while bearing greater responsibility for the full costs of driving, drivers can reduce their own costs by simply driving less. Good options range from direct user fees to mileage-adjusted costs for related expenses such as registration and insurance. Mileage-based insurance is an innovative approach that varies the cost of auto insurance coverage based on miles traveled. Instead of facing a single, flat insurance fee, a family under a mileage-based insurance policy has the ability to pay less for insurance by traveling fewer vehicle miles. BTAG recommends that MGA jurisdictions study their laws and regulations to determine what barriers exist that prevent insurers from offering mileage-based insurance, and take steps to eliminate those barriers.

In some jurisdictions, regulations exist that make mileage-based insurance options difficult to implement. MGA states should conduct a survey of insurance commissioners to determine regulations that prohibit mileage-based insurance options from being implemented. Such prohibitive regulations should be revisited. Insurance commissioners or other regulatory agencies should provide guidance to carriers and encourage them to offer such policies. A one-time tax incentive, paid for through taxes already levied against insurance companies, could establish a powerful incentive for insurers. For state vehicle fleets, states should pursue mileage-based contracts with their own insurance carriers.

4. POLICIES THAT EXPAND TRAVEL CHOICES

One way to reduce energy use and GHG emissions from transportation is to provide people with greater access to more-energy-efficient transportation modes, such as passenger rail, van pools, local transit, walking and bicycling.

[68] "The Full Cost of Transportation in the Twin Cities Region," http://www.cts.umn.edu/trg/research/reports/TRG_05.html

Midwestern states have been very active individually in their pursuit of travel choice options. To harmonize those efforts across the region, MGA states should commit to raising the share of travel on modes other than non-single-occupancy vehicle. Success in meeting this goal can be tracked through the U.S. Census Bureau's journey-to-work measure, or through other, more robust measures. Percentages of people traveling by more-energy-efficient transportation means should increase annually as people's access to alternatives improves through implementation of the following recommended travel choice policies.

COST PER AVOIDED VEHICLE-MILE DRIVEN FROM VARIOUS INVESTMENTS

Transit:	**$2.20/mile reduced**
Bike Lanes:	**$0.71/mile reduced**
Van Pools:	**$0.48/mile reduced**
High-Speed Rail:	**$0.16/mile reduced**
Intercity Rail:	**$0.16/mile reduced**

Source: Transportation Research Record 1641, Paper No. 98-1100.

INTERCITY PASSENGER RAIL

In the late 1990s and continuing through 2004, nine Midwest state departments of transportation joined forces to design a hub-and-spoke rail network serving the Midwest, with Chicago at its hub. The resulting Midwest Regional Rail Initiative (MWRRI) is a critical component of a unified vision of improved passenger rail in the region. MGA states should commit to fully implementing the MWRRI by 2015.

LOCAL TRANSIT

Cities large and small around the country have expanded rail transit or built new systems from scratch in the last 20 years. Nationally, transit ridership in 2008 was at a 52-year high. The Midwest, however, has fallen behind other regions in public transit development, leaving billions of dollars in federal construction aid for rail transit on the table at a time when amenities such as good transit are crucial in attracting workers and new businesses to the region's metropolitan areas. A handful of Midwestern places that have embraced rail, such as Cleveland and Minneapolis, have been successful. Minneapolis's Metropolitan Council reports that the Hiawatha Light Rail Transit line provided 9.1 million rides in 2006, reaching levels not predicted for the system until 2020.

Existing bus systems in the Midwest have been strained by tight state budgets, and in many cases have been in the perverse situation of having to cut service despite increased ridership in recent years. In addition to maintaining and expanding high-quality bus service, opportunities to increase efficiency exist in the form of new diesel-electric hybrid

buses. With several manufacturers in the Midwest, these offer long-term savings and manufacturing jobs for the region, both in MGA states and in the province of Manitoba.

To improve access to both federal and regional sources of support for transit systems, MGA states should provide adequate governance and taxing authority for local transit systems to qualify for federal construction assistance such as that available under the New Starts program.[69] States should work with members of Congress and the U.S. Department of Transportation to ensure that the reauthorization of the federal surface transportation legislation provides better support for transit, especially to cover operating costs.

BICYCLE AND PEDESTRIAN EXPANSION

Most transit trips and many vehicle trips require a walk or bicycle ride at the beginning or end, so the availability of bike and pedestrian infrastructure and accessibility can be beneficial for almost anyone. Bike and pedestrian infrastructure has become an increasingly popular amenity that is often considered a quality-of-life enhancement that contributes to local economic and business development. Walking and biking can also save money and energy, while reducing emissions. Yet even though walking and biking facilities cost a small fraction of what car facilities cost, this essential link is often overlooked. Federal surface transportation program funding may be used for bicycle and pedestrian facilities, but typically states and local governments use only the small portion set aside for such "enhancements." Consequently, much of the Midwest's road and street network is inhospitable to walking and biking. A few places have made a concerted effort to provide pedestrian and bike facilities, and these have paid off. Although some cities have been active for years and have dramatically increased the percentage of trips taken by walking or biking (such as Minneapolis at 10 percent and Madison, Wis., at 14 percent), cities all over the Midwest — from Cincinnati to Sioux Falls, S.D. — can point to successful and popular pedestrian and bike trails.

To build on early progress and improve access to walking and biking, MGA states should adopt strong statewide "complete streets" policies such as the one laid out in Illinois' Public Act 095-0665 and adopted in 2008 that requires state and local governments to ensure that streets are suitably designed for pedestrian and bicycle traffic, as well as other users. Furthermore, states should use enhancement funding as a floor for bicycle and pedestrian facility funding, and consider moving other surface transportation program funding, as well as state support, into these projects.

TRANSPORTATION SYSTEM EFFICIENCIES

Reductions in vehicle miles driven are possible simply by allowing the market to provide compact, mixed-use development in response to consumer choice, and by building complete streets suitable for driving, walking, biking and transit. MGA states should make resources available to cities and regions that choose to create compact new development that complements investments in intercity rail, transit, and bike and pedestrian infrastructure. Options that states may deploy to accommodate new consumer choices include utilizing state aid to municipalities, and economic development programs. States may choose a system preservation approach, showing a preference for repair and maintenance of existing road infrastructure. States should also consider evaluating the GHG impacts of new transportation projects as part of the Environment Impact Statement process. Finally, states should utilize federal funding for complete streets and roadway maintenance whenever possible.

[69] "New Starts" is a federal-aid category describing projects that involve the construction of new public transportation systems, or the expansion of existing fixed-guideway public transportation systems, related vehicles, stations, and other infrastructure associated with fixed-guideway services and busways and bus rapid-transit systems.

5. POLICIES IN SUPPORT OF REGIONAL DEVELOPMENT AND DEPLOYMENT OF ADVANCED TRANSPORTATION TECHNOLOGIES

The Midwest has many advantages in pursuing a low-carbon transportation system, including a rich agricultural land base for producing biofuels and a large existing biofuels industry, a large automotive manufacturing industry, a network of elite research universities, and a variety of other manufacturers. The policies described above to stimulate demand for low-carbon transportation technologies will give the region an opportunity to capitalize on those strengths in building an economically diverse set of alternative transportation technology industries. However, a comprehensive strategy for bringing advanced transportation technologies to commercialization will also be required within the region to ensure that supply is able to respond to the demand incentives in a timely way and to evolve as new low-carbon technologies come online. The Midwest must aggressively develop policy alternatives that will capture the companies and technologies that can add high value in the emerging transportation-fuel and vehicle markets.

Many advanced transportation technologies are not yet "shovel ready," and additional support policies are required to expedite passage over the remaining scientific, technical and cost hurdles to commercialization. Such policies may support commercialization of low-carbon fuels (e.g., advanced biofuels, electricity, hydrogen), advanced energy-storage technologies suitable for transportation vehicles (e.g., batteries and hydrogen storage), advanced drivetrains (e.g., electric and fuel cell), and other vehicle technologies enabling decreased fuel consumption or adoption of lower-carbon fuels. Support policies to be considered include, but are not limited to, technical assistance, financial support and workforce training.

The success of a coordinated strategy for commercialization will depend upon effectively leveraging public, private and university resources and expertise within the region and creating an environment in which industry feels secure in making capital investments in advanced transportation technology supply chains. The MGA should establish a mechanism by which formal partnerships are developed between state and local governments, universities and private industry for the purpose of developing intellectual property with regional benefits. Jurisdictions should facilitate the advancement of technologies that are ready to move from pilot into commercial demonstration phase by: establishing public and private funding mechanisms to help offset the high risk cost of new technologies; adopting regional regulatory policies to streamline the permitting approval process for advanced conversion projects to allow for faster development of these plants; and establishing regional training programs to develop a skilled workforce capable of operating and maintaining advanced technology facilities.

The timing of the Midwestern push for renewable energy and advanced transportation technologies coincides well with a renewed federal interest in such development. A large amount of money has become available through ARRA for the development and deployment of renewable energy and advanced transportation technologies. MGA jurisdictions should develop a coordinated strategy to leverage such federal funding for the regional development of advanced transportation technology components such as advanced batteries for electric vehicles.

In decisions on whether to support commercialization of specific low-carbon fuels in the region, analysis should be based on the same life-cycle GHG criteria developed as part of the regional low-carbon fuel-standard effort described earlier, and support should be offered to those fuels offering the greatest GHG reduction. The same should be true for advanced vehicle technologies, with policy support being given to those technologies offering the greatest GHG reduction potential and the potential to be competitive in the low-carbon marketplace of the future.

6. POLICIES IN SUPPORT OF PERENNIAL BIOMASS SUPPLY AND FEEDSTOCK SUPPLY LOGISTICS

The Midwest leads the nation in biomass production potential, and developing that potential promises to enhance the economic vitality of the region. However, technical and logistical challenges exist in the regional vision of a cellulosic biofuels industry. Remaining challenges range from the logistics of production, harvest, transportation, and storage of high volumes of biomass to identifying regionally appropriate biomass feedstocks and methods of production that protect soil and water quality (including protecting soil from erosion), wildlife habitat and carbon storage. In addition, there must be a legislative commitment to this initiative that provides incentives for manufacturers to invent and build new biomass equipment, and for farmers to be comfortable investing in that equipment to collect, transport and store biomass.

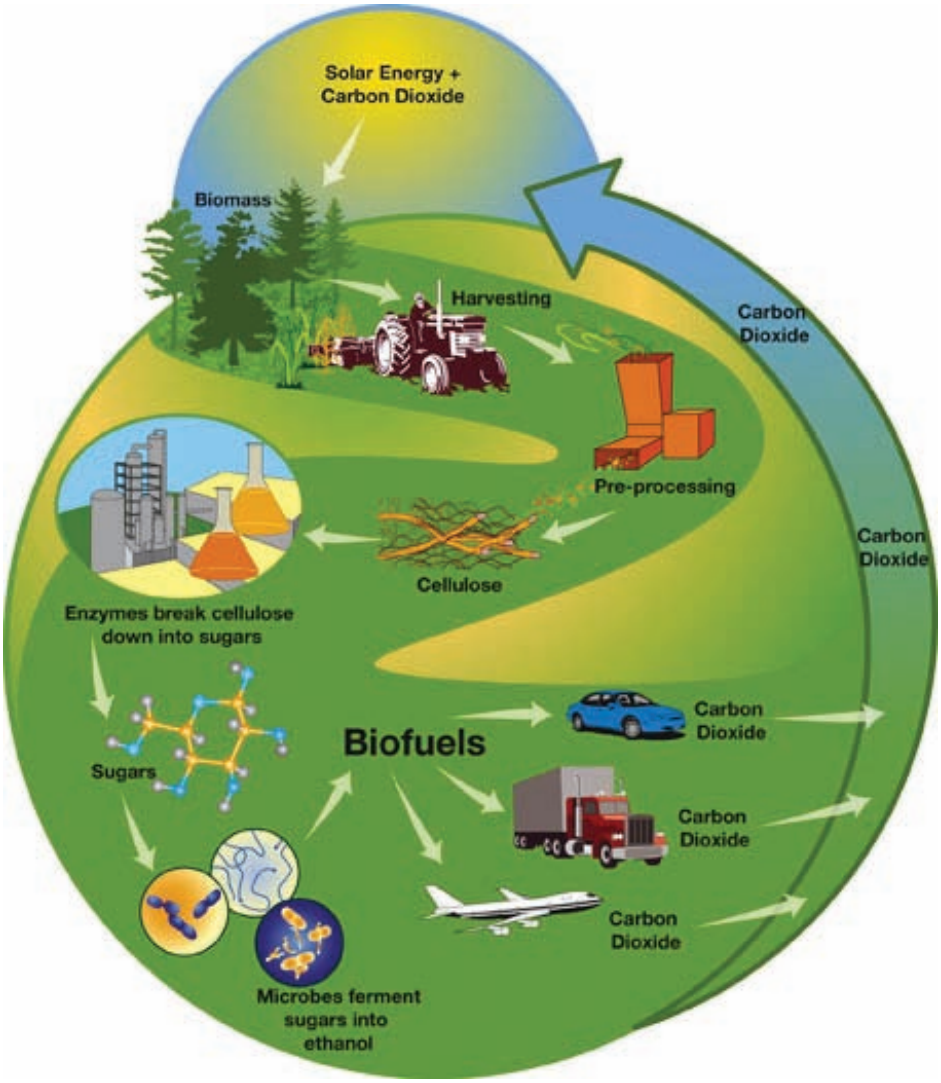


Figure 27: Biomass supply cycle.[70]

[70] Source: DOE, JGI. http://www.jgi.doe.gov/education/bioenergy/co2cycle.jpg

To facilitate development of sustainable and reliable biomass supply systems in the region, the MGA should actively participate in efforts to overcome these obstacles, and take the lead where necessary and appropriate. An inventory of biomass potential is critical for the region; jurisdictions, or the region as a whole, should conduct assessments to determine how much land is available for biomass development and what mechanisms are available to develop the supply and collaborate in development of a database to disseminate that information. Such assessments should include research collaborations between land-grant colleges and producers that identify regionally appropriate and effective biomass feedstocks. To enable an assessment of sustainable biomass potential, the MGA should support the development of clear sustainability guidelines and best-management practices for biomass production and harvest, such as those currently being developed by the Council for Sustainable Biomass Production and the Roundtable on Sustainable Biofuels, and coordinate strategies for regional customization, if needed, and adoption of such standards.

The MGA should also take a leadership role in seeking solutions to the logistical problems associated with production, harvest, transportation and storage of high volumes of biomass. In particular, BTAG advises the MGA to identify and support regional demonstration projects for the production, harvest, transport and storage of biomass feedstocks; ensure development of regulations for aggregators and regional collection centers for biomass densification; and implement policies and funding mechanisms to fill gaps in federal programs for support of research on equipment and storage for biomass feedstock production.

Various sources of funding do exist at the federal level for the support of research and development activities at specific points along the biomass supply chain. The MGA should aggressively pursue such resources and leverage funding available through federal programs that are targeted to create and/or increase perennial biomass feedstock supply. Additionally, on a state, provincial or regional level, the MGA should explore innovative loan programs to provide additional financial support for biomass shipping and handling facilities and other transport infrastructure.

7. FREIGHT POLICIES

Due to the large impact of passenger vehicles within the transport sector, many familiar policies focus on methods to reduce energy use and emissions from those vehicles. However, the freight sector is also a significant energy user and source of emissions in the Midwest, and the U.S. Department of Transportation estimates an 80 percent increase in tons of freight shipped nationwide by 2035.[71] Because the freight sector is at or near capacity for every mode of transportation, an excellent opportunity exists to improve efficiency by strategically addressing capacity constraints and investing in energy efficiency improvement. The region should commit to a comprehensive strategy for building the sector's capacity while adopting a goal of reducing the GHG intensity per freight ton-mile by 20 percent by 2025.

Various policies can help achieve these simultaneous goals through improved vehicle efficiency in trucks, electrification of truck stops to reduce idling, rail technology upgrades, rail infrastructure improvements, and elimination of chokepoints and other barriers to mode-switching.

Many opportunities exist to build on ongoing efforts within the region to improve freight efficiency. The CREATE Program, for instance, has developed an unfunded three-year plan for improving the region's freight transportation system that includes multiple rail and highway improvement projects to increase both rail and truck efficiency. MGA jurisdictions should support the CREATE program to secure the additional necessary funding from regional, state and federal agencies to implement the remaining rail improvement projects.

[71] http://bottomline.transportation.org/SummaryBottomLineReport.pdf

Additional infrastructure improvements are also recommended for freight trucking, waterways, and intermodal points such as yards, ports, locks and airports. The MGA jurisdictions should begin regional planning to identify such opportunities for efficiency improvement and develop a funding plan to implement them. The MGA should also push for a federally dedicated funding mechanism for rail improvements, upgrades, or new projects to improve the Midwest rail system, which forms the hub for the entire nation's rail system.

Finally, states should help improve freight efficiency by taking into account energy use and carbon emissions from transportation in their purchasing — incorporating these criteria in bidding processes for shipped goods and other ordering. Third-party firms, at least one of which is based in the Midwest, can audit emissions from shipping to ensure compliance with promised results.

Energy Choice Simulator: Bioeconomy and Transportation

The fuel mix projected for the transportation sector under the baseline scenario is illustrated in Figure 28. The baseline case assumes that the regional transportation sector would be subject to the RFS, the CAFE standard revisions proposed in March 2009,[72] and a federal blend wall that is annually adjusted to accommodate the renewable-fuel use required under the RFS. As seen in Figure 28, transportation fuel demand temporarily declines in the near term, due in part to recent changes in consumer demand arising from current economic conditions, and in part to the impact of compliance with the new CAFE standards. Eventually, however, fuel-demand increases arising from assumed increases in population and in miles traveled per vehicle are sufficient to outweigh fuel economy improvements, and fuel demand again increases steadily until 2030 and beyond.

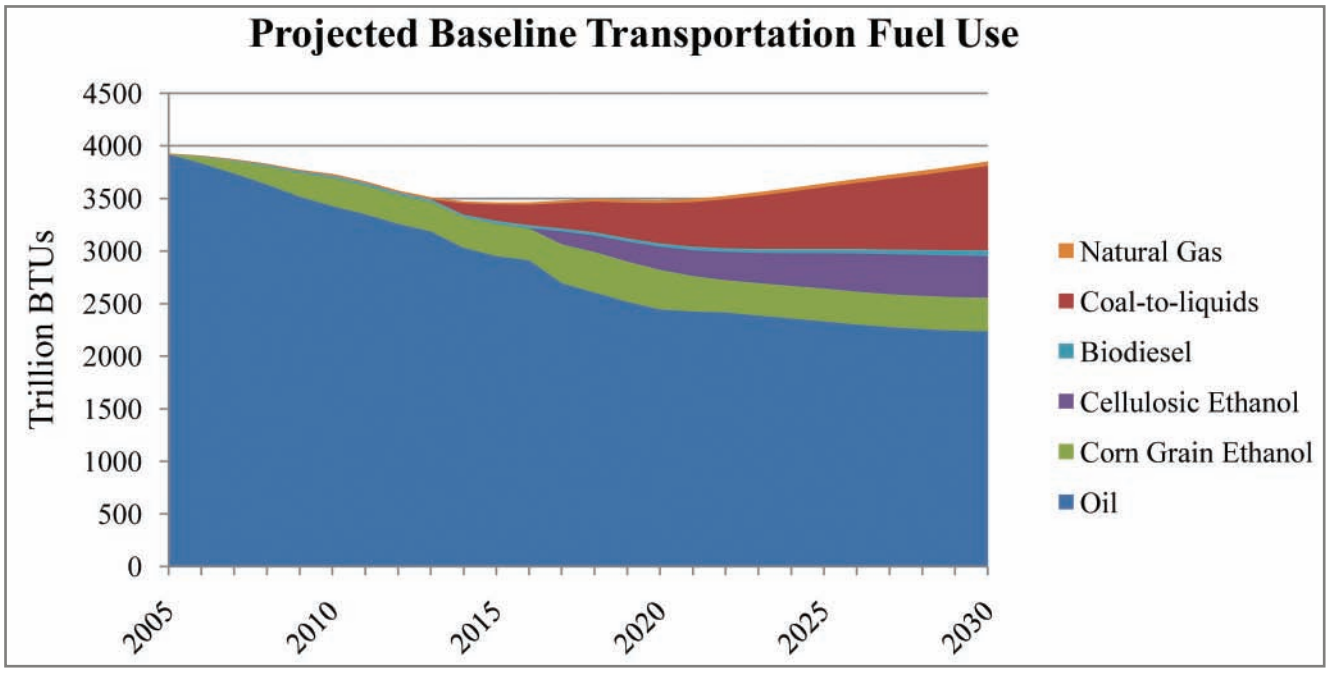


Figure 28: Projection of changing fuel mix due to federal policy and changing fuel technology cost and availability, absent state and regional policies, in the Midwest region from 2000 to 2030.

With no regional transportation sector environmental policies in place, the Energy Choice Simulator projects a steady production level of corn grain ethanol until 2030. Cellulosic ethanol also becomes available, as required by the RFS, and

[72] http://www.nhtsa.dot.gov/portal/nhtsa_static_file_downloader.jsp?file=/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated percent20Files/Joint_CAFE_GHG_Emissions.pdf

scales up production until, by 2030, it is produced in quantities comparable to that of corn grain ethanol. In the absence of additional GHG regulatory policies, cellulosic ethanol does not completely supplant corn grain ethanol, despite having a significantly lower life-cycle assessment estimate for GHG impact. The blending of biodiesel with conventional diesel increases as biodiesel becomes more cost-competitive with traditional petroleum diesel, and coal-to-liquids (CTL) synthetic fuel also emerges as a substitute for conventional diesel at significant levels.

The impacts of four potential transportation policies were explored using the Energy Choice Simulator model. These include: a LCFS that requires a 10 percent reduction of the GHG emission intensity of liquid transportation fuels; a mileage-based insurance option that converts insurance costs from a fixed cost of driving into a variable cost; a large-scale investment in VMT-reducing options to meet a VMT per-capita reduction goal of 15 percent by 2020, 28 percent by 2035, and 40 percent by 2050; and an efficient driver education program that improves each driver's mileage by 10 percent at an assumed driver adoption rate of 1 percent per year. Modeling analysis indicates that a regional annual investment of approximately $5 billion in VMT-reducing options is necessary to achieve the VMT reduction goal.[73]

As depicted in Figure 29, the full complement of policies, including an LCFS, mileage-based insurance, VMT investments and an efficient-driver education program, results in a sustained decline in transportation fuel use in the near to mid-term. The use of CTL synthetic diesel and traditional oil fuel sources are also significantly reduced in this scenario.

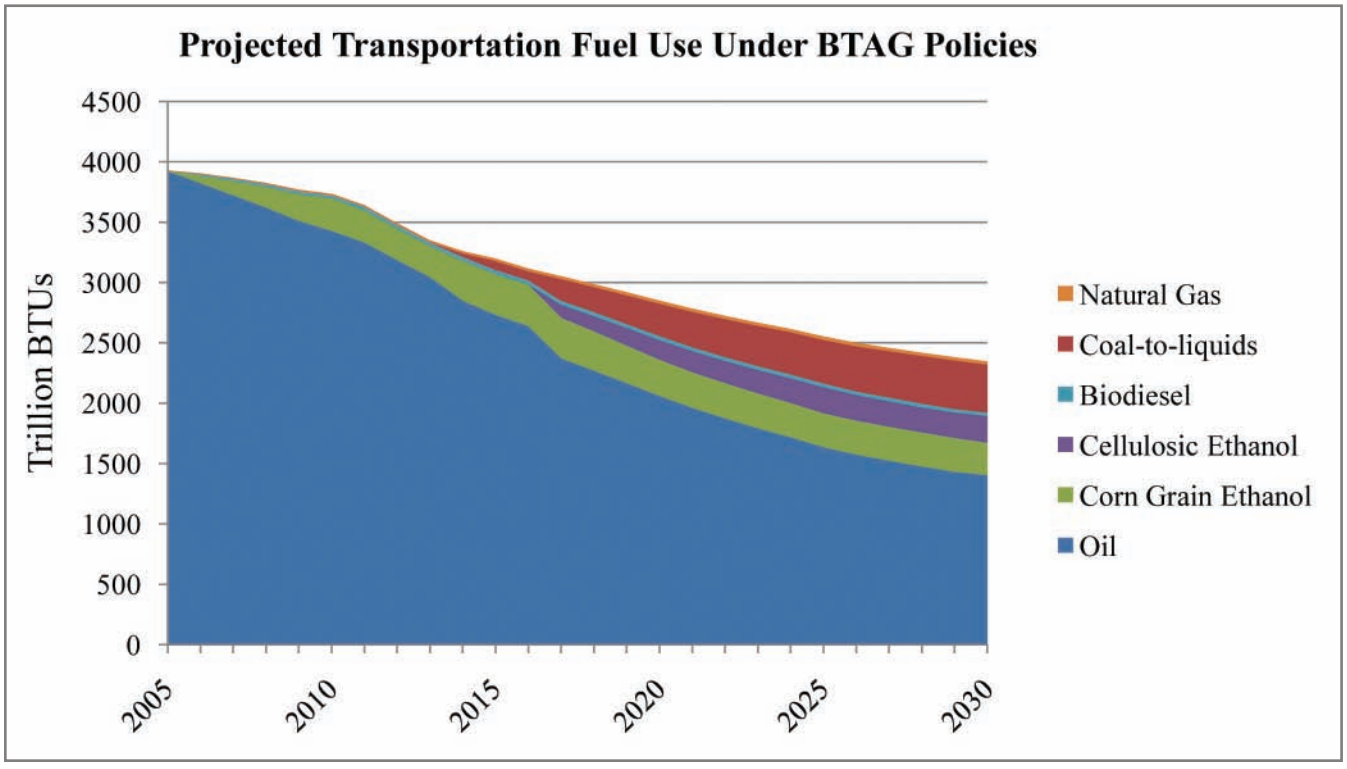


Figure 29: Projection showing overall decline of fuel use as well as a change in the fuel mix in the Midwest region from 2000 to 2030 under the full complement of transportation policies proposed by BTAG.

[73] Modeled here as: transit, bike lanes, van pools, high-speed rail and intercity rail.

The projected decline in fuel use after 2015 is largely due to a reduction of estimated annual VMT per vehicle as a result of two of the policies applied. Figure 30 compares the baseline-case VMT projection to reductions achieved through the VMT goal investment, mileage-based insurance, and a scenario of the VMT investment, mileage-based insurance and a regional LCFS combined.

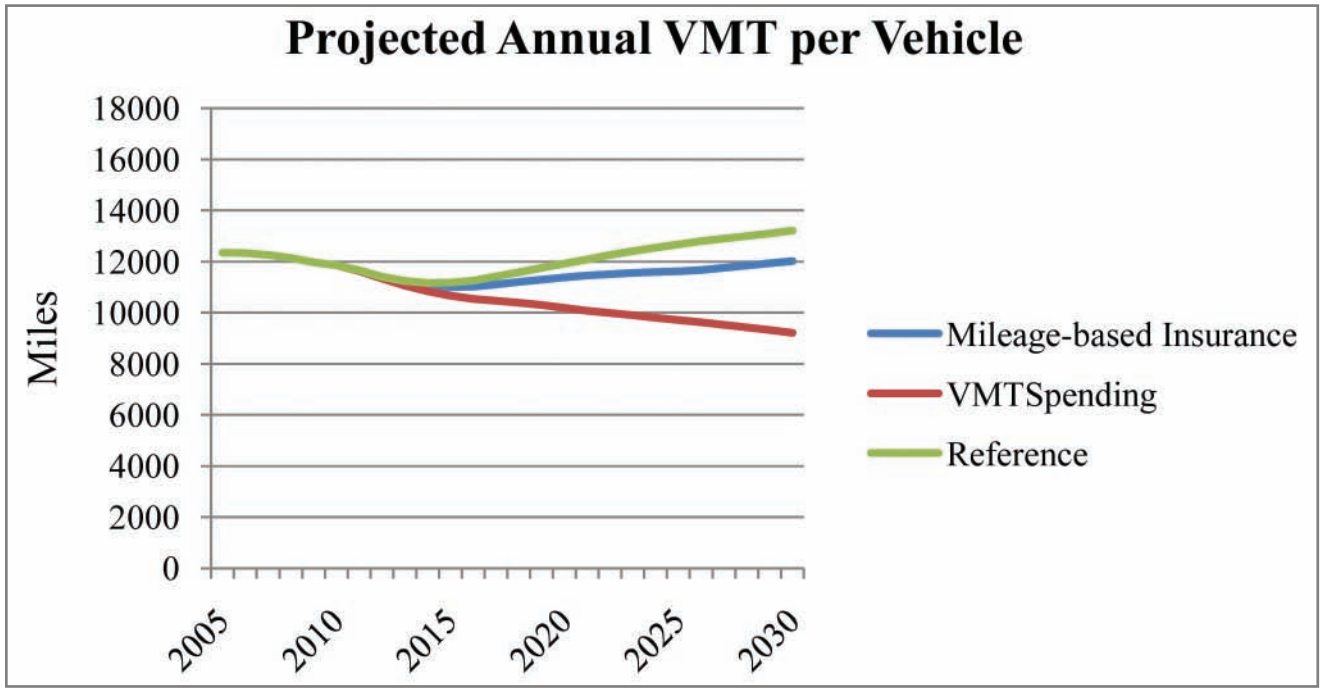


Figure 30: Projection of annual VMT per vehicle under a baseline scenario with no state or regional policies, with implementation of two different BTAG policies in the Midwest region from 2010 to 2030.

Both mileage-based insurance and the VMT investment are effective at providing options and incentives for saving money by driving less. The efficient driver policy, on the other hand, reduces energy use by reducing the amount of energy required to travel the same distance, through adoption of more-fuel-efficient driving techniques. The low-carbon fuel standard applied alone does not result in a significant reduction in demand for transportation energy, but it is very effective at pulling lower-carbon fuels into the market, and therefore has a significant impact on the emissions associated with that fuel use.

The combined effect of the policies on annual emissions is shown in Figure 31. As shown, each policy produces significant reductions in annual GHG emissions, and in aggregate they are sufficient to produce sustained and significant reductions in emissions from the transport sector.

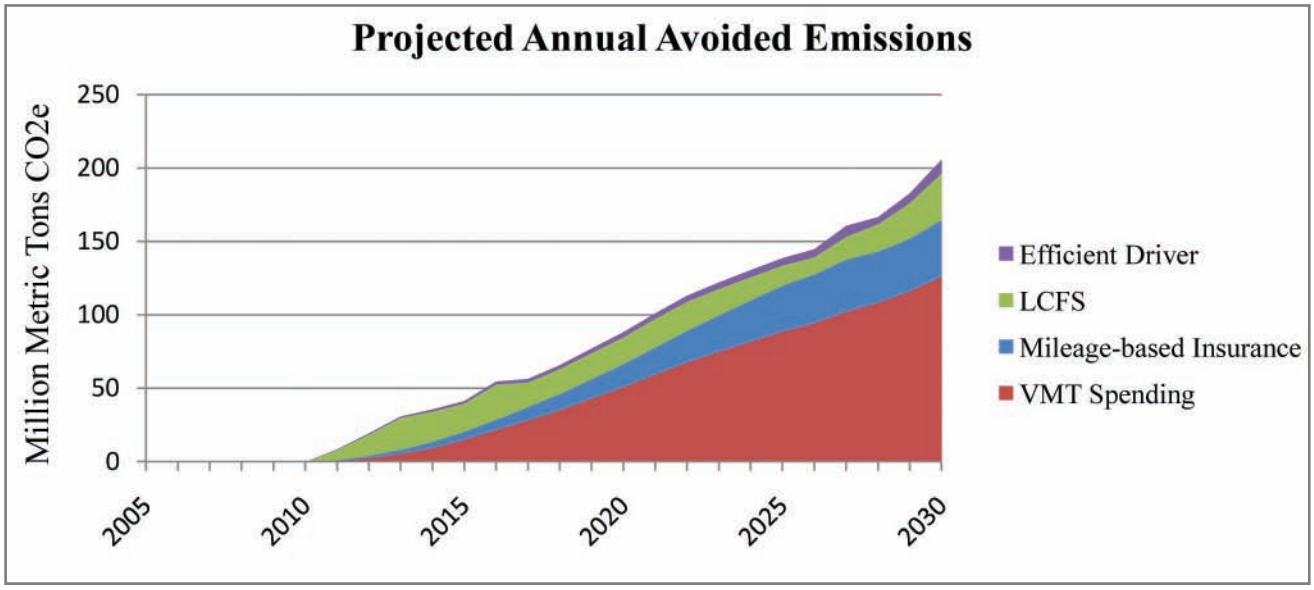


Figure 31: Projection of annual emissions avoided by the implementation of four separate BTAG policies in the Midwest region from 2010 to 2030.

A portfolio of complementary policies is therefore necessary to achieve both MGA energy security goals and climate stewardship goals through reductions of transportation energy use and diversification into lower-carbon energy sources. Some of these policies incentivize the production of lower-carbon fuels, others reduce miles traveled and energy demand, and yet others improve the efficiency with which those miles are traveled. To fully capture the reductions possible in the transportation sector, a combination of policies, addressing each of these avenues, must be applied.

THE ROAD AHEAD VI

Midwestern states and provinces are not alone in wrestling with their energy future. States and nations around the world face similar hard choices about which policies and investments to make today in order to foster the clean, reliable and affordable (and ultimately inexhaustible) energy system we will need tomorrow. This document demonstrates that leaders in the Midwest see a new energy economy as an urgent and vital goal to which we must commit ourselves over the next two generations.

The process of developing this Energy Roadmap through MGA provided a regional framework and context within which individual states and organizations could make their contribution to the whole. A similar level of partnership across jurisdictions will be needed to turn many of the ideas in this Energy Roadmap into reality. MGA can play a critical role in that effort by fostering collaboration on those issues where regional partnerships can eliminate duplication, leverage jurisdiction-specific strengths, and speed adoption of "best-in-class" technologies and approaches.

Any policy report is only meaningful if those in leadership positions work together to enact its recommendations. It is not enough that governors and premiers find the recommendations in this Energy Roadmap compelling. Transitioning our energy system will require equal commitment from legislators, regulators, civil servants, energy executives, entrepreneurs and non-profit leaders, to name only a few. This Energy Roadmap demonstrates that commitment exists across a spectrum of interests, but leadership will be required to bring those interests together under a common vision and channel that commitment into continued movement toward change.

What is most needed now is for key decision-makers in each jurisdiction to step forward to host briefings on this Energy Roadmap, and then to develop action plans for implementing the relevant recommendations in their state or province. Our energy future is not destiny, but a choice.

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