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(FORM UPDATED: 08/11/2010)

WISCONSIN STATE LEGISLATURE ...
PUBLIC HEARING - COMMITTEE RECORDS

2009-10

(session year)

Assembly

(Assembly, Senate or Joint)

Special Committee on Clean Energy Jobs...

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* Contents organized for archiving by: Stefanie Rose (LRB) (December 2012)

Public Service Commission of Wisconsin

Eric Callisto, Chairperson
Mark Meyer, Commissioner
Lauren Azar, Commissioner

610 North Whitney Way
P.O. Box 7854
Madison, WI 53707-7854

February 19, 2010

Assembly Special Committee on Clean Energy Jobs
Wisconsin State Assembly
State Capitol
Madison, WI 53702

Re: Utility and Ratepayer Costs Associated with the Clean Energy Jobs Act

Dear Committee Members:

I am writing in response to a letter dated February 9, 2010 from Representatives Huebsch, Montgomery, and Gunderson requesting a Commission analysis of the expected costs to utilities and ratepayers of meeting a 25% by 2025 Renewable Portfolio Standard (RPS) as proposed in the Clean Energy Jobs Act. As I have testified to both the Assembly and Senate Select Committees, the electric utility sector policies in the proposed legislation – namely, the enhanced RPS and energy efficiency provisions – represent sound energy policy for Wisconsin. The Commission's analysis shows that if we continue with business as usual, if we decide to do nothing, we are taking on great financial risk in a changing world, and our ratepayers will be leaving substantial dollars on the table.

As our nation recovers from the worst economic crisis since the Great Depression, we of course must continue to support Wisconsin's bedrock industries like agriculture and manufacturing. But we must also position Wisconsin to lead in emerging sectors like clean energy. Numerous third party reviews, independent studies, and industry recognized research all show that the Clean Energy Jobs Act will create more than 15,000 net new jobs in Wisconsin, not just in new fields, but in construction, manufacturing, forestry, and agriculture.

Four years ago, the Wisconsin legislature passed renewable portfolio standards with strong bipartisan support. As a result, the state has seen a rapid expansion in renewable energy production and real growth in clean energy jobs. Wisconsin is now the seventh leading producer of ethanol, and there are more than 300 companies and thousands of jobs in the state's wind industry.

Across the state, companies like Virent, Johnson Controls, Orion Energy, Wind Capital Group, Waukesha Electric, ZBB Energy, Helios USA, Cardinal Glass, Renewegy, Nature Tech, Energy Performance Specialists, Tower Tech and many others provide good jobs for people producing alternative forms of energy. None of these companies would be producing these jobs without good public policy, aggressive energy efficiency efforts, and renewable energy standards.

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Seizing the opportunity to build on our successes and continue fostering a clean energy economy cannot be a partisan issue. We cannot afford to hold back the economic development and job creation that is possible with a clean energy economy.

Much has been said about what will happen to the cost of electricity if the Clean Energy Jobs Act (CEJA) becomes law. As I said in my recent testimony before both relevant committees, electricity costs likely will rise over time, whether or not the CEJA is enacted into law. Virtually every commodity in commerce increases in cost over time, and electricity is no different. It is also true that enhanced renewable portfolio standards will require new capital investments in renewable facilities construction, and those investments will be significant.

However, understanding the true cost of the proposed legislation is far more complicated than simply estimating the capital costs associated with new renewable facilities and multiplying that estimate by an amount of new capacity needed to meet the standards. What must be considered is what the future cost of doing nothing is versus the future cost of the CEJA. The cost difference between those two futures is what matters, viewed against the likely benefits. That is the question for policy-makers.

Public Service Commission (PSC) staff has modeled two of the major policies included in the CEJA, in particular the potential cost implications of both the energy efficiency and RPS components of the legislation. It is critical to consider these policies in tandem, as they both influence the cost picture for electricity customers. The legislation also provides several new compliance options associated with an enhanced RPS, and those too are an appropriate part of any responsible cost analysis.

At the Commission, we use an electricity forecasting tool called EGEAS to model various electricity futures. The EGEAS model was developed not by the government but by the electric utility industry's research group, the Electric Power Research Institute (EPRI). Computer modeling, especially of something as complicated as today's partially regulated electricity markets, is an inexact science. The EGEAS model, like any other model, cannot predict the future. However, EGEAS is the best tool currently at our disposal for forecasting future costs and wholesale prices for electricity. When we start talking about future retail rates, forecasting becomes even more speculative because rates are influenced by an even larger set of variables. As you know, retail electric rates are subject to continuing regulatory oversight and the CEJA includes a variety of "off ramps" that ensure the PSC can, if necessary, relax or delay RPS requirements if the rate impacts become unacceptable.

Preliminary modeling suggests that while future electricity costs are dependent on many variables, the one variable that is probably more important than all others is the demand for electricity. All of the cost calculations can change dramatically, depending on whether we assume electric demand will grow at historic levels, grow more slowly, remain constant, or decrease.

Another critically important variable is the potential cost of complying with greenhouse gas (GHG) regulations. When federal regulation of GHGs takes effect, electricity generated from fossil fuel plants that are subject to regulation will become more expensive, and utilities may seek to build or buy renewable generation not just to satisfy RPS laws, but also to reduce their GHG compliance costs. The net effect of this phenomenon is that the higher the price on GHG emissions, the more renewable capacity we will see, and the more beneficial energy efficiency spending becomes.

Some argue that electric sector modeling should not monetize carbon (or GHG emissions) until Congress enacts cap and trade legislation or some type of carbon tax. That view ignores the regulatory effort that is already underway at the U.S. Environmental Protection Agency (EPA). PSC staff assumes that electric generators will face future GHG regulatory compliance costs in light of the U.S. Supreme Court's decision in *Massachusetts v. EPA* and, more importantly, the EPA's subsequent final determination that GHG emissions endanger human health.[1] Barring a change in federal law – or the U.S. Supreme Court overruling itself – GHG emissions from electric generators will be regulated through performance standards and those regulations will impose costs. Accordingly, status quo assumptions include carbon monetization.

With that in mind, what follows is a summary of preliminary PSC cost modeling of the RPS and energy efficiency components of the CEJA. PSC staff modeled the costs of the RPS and energy efficiency policies together, because the RPS requirements are expressed as a percentage of retail electricity sales. It would be unrealistic to estimate the costs of the RPS requirements in the proposed legislation while ignoring that the same legislation seeks to reduce the growth in demand for electricity. The two policies are inherently connected.

The modeling shows that in every case in which GHGs are monetized (i.e., there is a compliance cost associated with emitting GHGs), the cost of the CEJA is *less* than the cost of the status quo over the long run. **<u>That is, we will in all likelihood be spending more on electricity in the long run if we don't act now and enact enhanced renewable portfolio standards and take more aggressive action on energy efficiency.</u>**

<u>Modeling Assumptions</u>

The EGEAS model is detailed and comprehensive. It requires that dozens (if not hundreds) of assumptions be made about the costs of different technologies, costs of fuels, inflation rates, etc. PSC relied on recent dockets, construction applications, rate cases, and utility industry reports to select values for each variable. It would not be practical to list all of PSC's modeling

[1] The PSC is not an outlier in taking this approach. The Edison Electric Institute, the trade association for the country's investor-owned utilities, is advocating for a comprehensive energy bill in Congress, one that will significantly reduce carbon emissions by placing a regulatory price on carbon (*Electricity 2010: Opportunity Dressed as Hard Work*, remarks of Thomas R. Kuhn, President, and David Owens, Executive Vice President, Edison Electric Institute, February 10, 2010). Moody's Investor Service, in a report released this month, concluded that greenhouse gas regulation is "inevitable" (Moody's Investor Service, *Special Report*, February 2010).

assumptions in this response, nor would it be possible to do so without divulging some confidential information provided to PSC by utilities. The modeling was conducted by PSC professional staff who collectively have decades of experience forecasting electricity futures for Wisconsin.

At the most fundamental level, PSC considered two sets of modeling assumptions as follows:

1) If the Clean Energy Jobs Act is not enacted (**Status Quo**):
    a. 10% by 2025 RPS
    b. Annual average demand growth = 0.7%[2]

2) If the Clean Energy Jobs Act is enacted (**CEJA**):
    a. 25% by 2025 RPS
    b. Annual average demand growth = -0.2%[3]

Summary of Preliminary Modeling Results

Using the EGEAS model, PSC forecasted electric generation production costs sufficient to meet Wisconsin demand for every year through 2025.[4] This was done for both the Status Quo and the CEJA assumptions. Under each set of assumptions, PSC forecasted how generation production costs might vary depending on whether the cost of compliance with GHG regulations equals $10 per ton of emissions or $20 per ton.[5] The results are summarized below.

Table 1 compares the forecasted electric generation production costs under the CEJA assumptions to the costs under the Status Quo assumptions. Values are shown for the years 2015, 2020, and 2025 under each assumed GHG emission price. Positive numbers indicate that statewide costs in that year would be higher under CEJA than under the Status Quo. Negative numbers indicate that costs in that year would be lower under CEJA than under the Status Quo.

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[2] The U.S. Department of Energy forecasts approximately 1.2% average annual growth nationally from 2008-2025. Wisconsin's status quo energy efficiency programs have historically shaved approximately 0.5% off of the growth rate in our state. The value used for modeling is 1.2%-0.5%=0.7%.

[3] The CEJA would require the PSC to set efficiency program goals based on studies of achievable potential, with a nonbinding goal of 2%. The most recent such study indicated that savings of 1.6% were achievable, but for modeling purposes PSC conservatively assumed that actual results would be only 1.4%. The value used for modeling is thus 1.2%-1.4%=-0.2%.

[4] These production cost forecasts include the estimated costs of building additional transmission lines to integrate new out-of-state wind farms into the grid.

[5] For simplicity, GHG compliance costs are expressed as a cost per ton of GHG emitted. This value represents the total costs to comply with GHG regulations, averaged over the total number of tons emitted. The $10/ton and $20/ton scenarios represent possible values for compliance costs based on available data. Specifically, GHG emission allowances traded in Europe for almost $19/ton at the end of 2009. Recent EPA estimates of proposed cap and trade legislation passed by the House of Representatives include per ton emission prices of between $13 and $33 for the 2012 to 2030 timeframe. Also note that virtually all observers have concluded that compliance costs for electric utilities will be higher if emissions are regulated through performance standards than if they are regulated through a cap and trade system.

For example, generation production costs in 2025 will be 1.4% lower under CEJA than under the Status Quo if GHG emissions cost $10/ton.

Table 1: Approximate Change in Total Statewide Electric Generation Production Costs

	Assumed GHG Emission Price	
	$10/ton	$20/ton
2015	**0.1%**	**0.0%**
2020	**3.9%**	**-5.2%**
2025	**-1.4%**	**-9.0%**

For Table 2, PSC calculated the cumulative present value of all of the generation production costs statewide through 2025.

Table 2: Present Value of Cumulative Generation Costs through 2025 (in 2008 $)

	Assumed GHG Emission Price	
	$10/ton	$20/ton
Status Quo	$66.1 billion	$79.8 billion
CEJA	$65.6 billion	$74.4 billion
Incremental Cost of CEJA	**-$0.5 billion**	**-$5.4 billion**
% Change in Generation Costs	**-0.7%**	**-6.8%**

Generation costs (which include fuel and transmission costs) are only one of the utility costs that ultimately determine ratepayer bills, comprising about two-thirds of what is included on electric utility bills. Ratepayers also have to cover the costs of the utility's distribution system, customer services, and many other things that are unaffected by the proposed legislation. By adding those costs to the modeled generation costs, PSC staff has completed a preliminary analysis of the impact of CEJA on customer bills. Those results are summarized below.

Table 3 shows the forecasted difference in bills under the CEJA assumptions as compared to the Status Quo assumptions. Positive numbers indicate that bills in that year would be higher under CEJA than under the Status Quo. Negative numbers indicate that bills in that year would be lower under CEJA than under the Status Quo. For example, bills in 2020 will be 2.8% lower under CEJA than under the Status Quo if GHG emissions cost $20/ton.

Table 3: Approximate Change in Ratepayer Bills for All Customer Classes[6]

	Assumed GHG Emission Price	
	$10/ton	$20/ton
2015	**0.0%**	**0.0%**
2020	**2.0%**	**-2.8%**
2025	**-0.7%**	**-5.4%**

Table 4 shows the forecasted impact of the proposed legislation on monthly electricity bills for an average residential customer. As in previous tables, these values show the incremental impact of the CEJA compared to the Status Quo. For example, the table indicates that monthly bills will be $1.08 lower under CEJA than under the Status Quo if GHG emissions cost $10/ton. Monthly bill impacts were not calculated for commercial and industrial customers because bills in those customer classes vary more widely than residential bills. Note once again that the percentage changes in Table 3 could be applied to any type of customer to estimate monthly bill impacts.

Table 4: Approximate Monthly Residential Bill Impacts (in 2008 $)

	Assumed GHG Emission Price	
	$10/ton	$20/ton
2015	**+$0.05/month**	**$0.00/month**
2020	**+$2.41/month**	**-$3.80/month**
2025	**-$1.08/month**	**-$9.09/month**

Tables 1 through 4 all demonstrate that a status quo future (i.e., doing nothing) is more expensive for electricity customers than a CEJA future in the long run, assuming some regulation of GHG emissions. This is because as Wisconsin adds more renewable capacity, the need for new fossil fuel capacity and the proportion of fossil fuel generation that contributes to Wisconsin's generation mix will both decrease. That translates into an incremental cost savings, particularly when coupled with aggressive energy efficiency efforts, because Wisconsin is spending less on coal and natural gas fuel (both volatile commodities), GHG compliance costs fall because the fossil fuel units are being dispatched at a lower rate, costly environmental upgrades may be avoided, and customers are using less energy.

[6] EGEAS modeling allows PSC to estimate total utility costs, but not rates. PSC makes decisions in every utility rate case about how to apportion total utility costs among customer classes. To simplify this analysis, a 1% decrease in total utility costs (for example) was assumed to translate into a 1% decrease in costs for each customer class. In practice, a 1% change in total utility costs might translate into different changes for each customer class. For example, in the 2009 rate case for Wisconsin's largest utility, the Commission approved rate increases that averaged 3.3% across all customer classes, but the increase for most residential customers was 4.9% while the increase for large industrial customers was 1.6%. In recent cases, industrial customers generally have seen lower rate increases than residential customers.

Other Issues Raised in the February 9 Letter

In addition to requesting a PSC cost analysis of the CEJA, Representatives Huebsch, Montgomery, and Gunderson, in their February 9, 2010 letter, appear to have made cost estimates of their own. They cite the WPRI/Beacon Hill Institute estimate, as well as a previous PSC Strategic Energy Assessment (SEA), in support of claims that the CEJA's RPS provisions would cost between $13.9 billion and $16.2 billion. As I have testified to both Committees, those claims are wrong.

First, regarding the WPRI/Beacon Hill Institute study: 8 of the 13 policies it analyzed are not included in the CEJA; it modeled a 30% RPS instead of a 25% RPS; it didn't account for the 5% of electricity that Wisconsin is already getting from renewable resources; it didn't account for the fact that Wisconsin already requires 10% renewable energy by 2015; it assumes that all new renewable generation will be built in Wisconsin; it apparently doesn't take into account the costs that would be avoided by an enhanced RPS; and it assumes electricity demand growth that is remarkably inconsistent with both U.S. Department of Energy estimates as well as the energy efficiency, conservation, and demand-side management requirements of the CEJA. As a result, the WPRI/Beacon Hill Institute study is of near zero value in evaluating the CEJA's utility sector policies.[7]

Second, regarding our most recent SEA, PSC did estimate the average cost of wind generation at $2.3 million per MW, and the SEA did say that installing 400 MW of wind generation per year (which would equal 6400 MW over 16 years) would be adequate to meet a 25% by 2025 RPS. But the PSC's Strategic Energy Assessment is in no way an analysis of the CEJA's electric utility sector policies.[8] Using only estimates for capital costs associated with constructing new wind facilities neglects to consider all of the avoided costs that otherwise would be associated with doing business as usual (e.g., building new fossil fuel generation, purchasing fossil fuels, installing environmental upgrades, complying with GHG regulations, etc.). Such an approach also assumes the RPS is met entirely through wind generation, thus ignoring the CEJA's many and varied RPS compliance options (e.g., biomass, Canadian hydro,[9] solar, combined heat and power and other non-electric renewable energy applications), not to mention the legislation's preservation of RPS "off ramps" and its authorization of a more robust use of renewable energy credits.

Additionally, the SEA estimates an amount of new generation that is far in excess of what will be needed if the CEJA becomes law. For example, the 400 MW per year figure cited in the SEA

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[7] The PSC is not alone in this conclusion. Others, including a coalition of Wisconsin companies – CREWE (Clean, Responsible Energy for Wisconsin's Economy) – have also discounted the WPRI/Beacon Hill Institute study. For reference, see http://wicrewe.com/wp-content/uploads/2009/07/wpri-report-fact-sheet.pdf.

[8] The SEA is a statutorily required report that PSC produces every two years. It was published prior to the existence of even the earliest draft of the CEJA, and the assumptions PSC used were not based on the actual provisions of the CEJA. Stated simply, the SEA was not an analysis of the cost of the RPS policy as proposed in the CEJA.

[9] One Wisconsin utility has already publicly expressed an interest in purchasing 500 MW of capacity of Canadian hydro power that could equal the output of more than 1000 MW of wind power and cost much less.

was based on status quo assumptions about demand growth. When the RPS policy is coupled with aggressive energy efficiency policies, as proposed in the CEJA, far less renewable generation is required.

As I said at the outset, to evaluate the cost of the CEJA's electric utility sector policies, the appropriate question is what the cost difference is between doing nothing and enacting legislation. Adding up the capital costs of new wind generation is only one piece of the answer. The modeling results I have included in this letter supply a fuller and more complete analysis.

Wisconsin is at a crossroads. If we continue down a path that values old ideas before new, we are destined to spend ratepayer dollars on infrastructure that is outdated before it is even operational. I reject that flawed route, and so should you. The electric utility sector policies in the CEJA will provide the necessary avenue to ensure that Wisconsin's energy future remains flexible, reliable, and affordable. I hope you find this response to be clear, informative and useful as you confront the very important challenge before you. Please let me know if you have any questions or if there is anything I can do to further support the Committee's work.

Sincerely,

Eric Callisto
Chairperson

cc: Senate Select Committee on Clean Energy


FORWARD
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WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Matthew J. Frank, Secretary

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Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
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February 19, 2010

Representative Mike Huebsch
State Capitol, 115 West
Madison, WI 53708

Representative Phil Montgomery
State Capitol, 129 West
Madison, WI 53708

Representative Scott Gunderson
State Capitol, 7 West
Madison, WI 53708

Dear Representatives Huebsch, Montgomery and Gunderson:

As our nation recovers from the worst economic crisis since the Great Depression we must continue to support our bedrock industries like agriculture, forestry and manufacturing, but we must also position Wisconsin to lead in emerging sectors like clean energy. Third party reviews and industry recognized research have shown that the Clean Energy Jobs Act will create more than 15,000 net new jobs in Wisconsin, not just in new fields, but in construction, manufacturing, and agriculture.

Four years ago the Wisconsin legislature passed renewable portfolio standards with strong bipartisan support. As a result the state has seen a rapid expansion in renewable energy production and real growth in clean energy jobs. Wisconsin is now the seventh leading producer of ethanol, and there are more than 300 companies and thousands of jobs in the state's wind industry.

Across the state, companies like Virent, Johnson Controls, Orion Energy, Wind Capital Group, Waukesha Electric, ZBB Energy, Helios USA, Cardinal Glass, Renewegy, Nature Tech, Energy Performance Specialists, Tower Tech and many others provide good jobs for people producing alternative forms of energy. None of these companies would be producing these jobs without good government policy and renewable energy standards.

Seizing the opportunity to build on our successes and continue creating clean energy jobs cannot be a partisan issue. We cannot afford to hold back the economic development and job creation possible in a clean energy economy.

Sincerely,

Matt Frank
Secretary


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Jim Doyle, Governor
Richard J. Leinenkugel, Secretary

February 19, 2010

Representative Mike Huebsch
State Capitol, 115 West
Madison, WI 53708

Representative Phil Montgomery
State Capitol, 129 West
Madison, WI 53708

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State Capitol, 7 West
Madison, WI 53708

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Seizing the opportunity to build on our successes and continue creating clean energy jobs cannot be a partisan issue. We cannot afford to hold back the economic development and job creation possible in a clean energy economy.

I am pleased to enclose a copy of the third-party review that I referenced while I was in Manitowoc highlighting jobs created by renewable energy technologies supported in Clean Energy Jobs Act.

This independent review clearly reinforces what Gov. Doyle and I have been saying all along: Bottom-line, this legislation will create jobs in Wisconsin.

I wholeheartedly agree with your assertion that "[c]ost-benefit analyses predicated on false assumptions are useless." To that end, I would counsel you not to continue perpetuating flawed results from the WPRI study.

To be clear, the WPRI study modeled thirteen polices, 8 of which are not included in the Clean Energy Jobs Act. Further, the WPRI piece was conducted and released before the legislation was even drafted.

Unlike the WPRI study, both the state's REMI model and this third-party review are based on actual provisions in the law.

The Clean Energy Jobs Act is a legislative document and I have no idea what provisions will ultimately remain in the document, but I do know that crossing your legislative fingers and placing our state's collective head in the sand will do nothing to prepare us for this eventual reality.

Make no mistake about it, there is a price for doing nothing.

Sincerely,

Dick Leinenkugel
Secretary

Center for Climate Strategies

Helping States and the Nation Tackle Climate Change

www.climatestrategies.us

MICHIGAN STATE UNIVERSITY

USC UNIVERSITY OF SOUTHERN CALIFORNIA

The Macroeconomic Impact of the Wisconsin Clean Energy Jobs Act on the State's Economy

by

Dr. Steven Miller

Center for Economic Analysis Michigan State University

Dr. Dan Wei and Dr. Adam Rose

The Center for Climate Strategies and the University of Southern California

February 18, 2010

The authors are, respectively, Director, Center for Economic Analysis, Michigan State University, East Lansing, MI; Postdoctoral Research Associate, School of Policy, Planning and Development (SPPD), University of Southern California (USC), Los Angeles, CA; and Research Professor, SPPD, USC. The authors wish to thank June Taylor, Lewison Lem and Jeff Wennberg of CCS for their assistance. The contents and opinions expressed in this report are those of the authors, who are solely responsible for any errors and omissions.

*The Center for Climate Strategies (CCS) is a nonpartisan, nonprofit partnership organization that helps public officials, private stakeholders, and technical experts develop and implement strategies to reduce greenhouse gas pollution and adapt to a changing climate.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report summarizes the macroeconomic impact of salient components of the Wisconsin Clean Energy Jobs Act (CEJA) as introduced in the 2009 Wisconsin Assembly Bill 649 and Senate Bill 450. This evaluation is largely informed by assessments conducted by the Governor's Task Force on Global Warming as reported in *Wisconsin's Strategy for Reducing Global Warming* (Governor's Task Force, 2008). This task force, instituted with Executive Order 191 of 2007, included broad representation of Wisconsin's interests with assistance of the Wisconsin Department of Natural Resources (DNR) and the Public Service Commission (PSC). The 29-member task force inventoried Wisconsin's greenhouse gas (GHG) emissions and explored viable policy options for mitigating climate change, while promoting Wisconsin as a leader in the implementation of global warming solutions.

The Task Force report identified over 50 actionable policy recommendations that formed the bases of the CEJA. Explicit targets of the CEJA include reducing Wisconsin's GHG emissions in 2014 to 2005 levels, reducing 2020 emissions to at least 22 percent less than 2005 levels and reducing 2050 emissions to at least 75 percent less than 2005 levels. The emissions reduction targets in the bill are goals, not statutory mandates. Additionally, the bill sets the goal that by 2030 all new residential and commercial structures will use no more energy than is generated onsite using renewable resources. Finally, the bill sets out to reduce overall energy consumption in the state, with target goals specified by fuel type and monitored by the Wisconsin PSC.

The State of Wisconsin retained the Center for Climate Strategies (CCS) to carry out this analysis. CCS researchers applied well-recognized methodologies along with the Regional Economic Modeling, Inc. Policy Insight Plus (REMI PI$^+$) model for Wisconsin to estimate macroeconomic impacts for nine major policy segments of the CEJA. Impact estimates take into consideration the public and private implementation costs, cost savings, price impacts and associated transactions arising from passage of the CEJA.

Findings suggest that the CEJA will stimulate economic growth for Wisconsin. The CEJA is expected to have immediate and positive net impacts on state employment. Over time, the CEJA is expected to increase gross state product (GSP) by $250 million in 2015, by $710 million in 2020, and by $1.41 billion in 2025 with a net present value of $4.85 billion valued in constant 2000 dollars. Similar results are expected for employment as over 16,221 net new Wisconsin jobs are expected in 2025 as a direct or indirect outcome of CEJA.

Table A. Aggregate Gross State Product and Employment Impacts of Enacting the Clean Energy Jobs Act

	2011	2015	2020	2025	NPV*
Gross State Product (billions of fixed 2000$)	0.01	0.25	0.71	1.41	4.85
Employment (full-time equivalent)	449	3,799	9,453	16,221	n.a.

**Discount factor is five percent*

I. INTRODUCTION

On April 5, 2007, Governor Doyle signed Executive Order 191 establishing the Task Force on Global Warming (Task Force), consisting of 29 members representing a diverse cross-section of Wisconsin's economy and its communities. It was charged with:

1. Presenting viable, actionable policy recommendations to the Governor to reduce greenhouse gas (GHG) emissions in Wisconsin and make Wisconsin a leader in implementation of global warming solutions;
2. Advising the Governor on ongoing opportunities to address global warming locally while growing the state's economy, creating new jobs, and utilizing an appropriate mix of fuels and technologies in Wisconsin's energy and transportation portfolios; and
3. Identifying specific short-term and long-term goals for reductions in GHG emissions that are, at a minimum, consistent with the Wisconsin's proportionate share of the reductions that are needed to occur worldwide to minimize the impacts of global warming.

To accomplish these tasks, the Task Force created eleven standing and ad-hoc work groups assigned to topical areas for consideration of policy formation. The Task Force and all work groups were aided by a Technical Advisory Group (TAG) with representatives from the Department of Natural Resources (DNR), the Public Service Commission of Wisconsin (PSC), experts from other state agencies, and technical consultants retained by the Task Force. All policy recommendations were scrutinized to assess feasibility. Throughout this process, members of the public were encouraged to provide input via the Task Force's web site that documented all meetings and topics as well as through two public input sessions at four locations throughout the state.

The Task Force's final report was delivered July 24, 2008 to Governor Doyle. This report detailed over 50 policy recommendations aimed at reducing Wisconsin's GHG emissions to 2005 levels by 2014, by 22 percent of 2005 levels by 2022 and by 75 percent of 2005 levels by 2050, with minimal costs and high potential for cost savings. In that report, policy recommendations were delineated along five topical categories, an overarching category and a miscellaneous category. These include, *Utility-Related Policies, Including Residential and Commercial Emissions*, *Transportation*, *Agriculture/Forestry*, *Industry*, *Carbon Tax/Cap and Trade Program*, *Overarching Policies* and *Other Areas*. Those recommendations that lend themselves to calculation were modeled to estimate public and private implementation costs and contributions to the reduction in Wisconsin GHG emissions, as detailed in the Task Force's final report.

In March of 2009, four legislators that served as co-chairs of the Task Force – two from the State Assembly and two from the State Senate – worked together to draft and introduce legislation under the title the "Clean Energy Jobs Act" (CEJA: AB 649 and SB 450). This legislation, introduced identically in the Assembly and Senate, establishes administrative and legislative mandates that largely replicate Task Force recommendations with the exception that the CEJA excludes from the bill Task Force recommendations that will generate direct fiscal liabilities to the state.

Policies and law under the CEJA encourage energy conservation in production and use and emphasize policy options for reducing GHGs. The bill explicitly sets goals to reduce public and private GHG emissions to those recommended by the Task Force. In addition, the bill establishes the goal that all newly constructed residential and commercial buildings will use no more energy than is generated on-site using renewable resources by 2030. It further establishes oversight of the state's progress toward reaching CEJA objectives with the Wisconsin DNR and mandates that the PSC establish and monitor energy conservation goals.

Table 1: Modeled Policy Segments of the Clean Energy Jobs Act

Conservation and Energy Efficiency Policies
Enhanced Energy Efficiency (EEE)
Residential and commercial building codes
State appliance efficiency standards
Utility Supply Side Policies
Enhanced renewable portfolio standard (RPS)
Modify moratorium on construction of new nuclear plants
Advanced renewable tariff development
Overarching Policies
Industrial development revenue bond (IDB) allocation
Transportation Policies
Freight idle reduction
Agriculture and Forestry Policies
Energy Crop Reserve Program

The State of Wisconsin retained the Center for Climate Strategies (CCS) to carry out a macroeconomic analysis of the CEJA. The Center for Climate Strategies (CCS) is a nonpartisan, nonprofit partnership organization that helps public officials, private stakeholders, and technical experts develop and implement strategies to reduce greenhouse gas pollution and adapt to a changing climate. CCS researchers applied well-recognized methodologies in modeling the expected macroeconomic outcomes of the CEJA. The CEJA contains several policy actions, or segments, for consideration of this analysis. Several policy segments are not readily quantifiable because either estimating the true value of the direct implementation costs or benefits would require conjectures, or the substance of the policy segment has yet to be determined. Nine policy segments were identified as quantifiable without requiring subjective assumptions.[1] The Regional Economic Modeling, Inc. Policy Insight Plus (REMI PI$^+$) Model for Wisconsin was used to estimate the macroeconomic impacts of these nine policy segments over the research horizon from 2011 to 2025.

This report documents the modeling approach and conclusions using well-established economic modeling principles for simulating expected macroeconomic impacts of the CEJA policy

[1] Six additional segments were initially considered: *Growth accommodation incentives*; *Low carbon fuel standard*; *Surface transportation planning*; *Incentives for industrial boiler efficiency improvements*; *and two Government demand-side management segments*. These segments lack benchmarks, targets and/or other policy specifics necessary to form qualified direct effects under the CEJA.

segments. To motivate the discussion, macroeconomic impacts of the CEJA start with direct responses to policy segments. Direct responses, or direct effects, are expenditures and cost-savings that accrue to individuals, business and government responding to CEJA mandates. Such direct effects may proceed from mandates, as with a renewable portfolio standard (RPS), or from behavior changes in response to incentives, as with most enhanced energy efficiency (EEE) policies and the Energy Crop Reserve Program (ECR). Direct effects are limited to considerations of businesses, governments, and households that alter behavior in response to the CEJA and may include expenditures that generate benefits to other sectors of Wisconsin's economy. These direct effects give rise to secondary effects that ripple across all sectors of the economy; regardless of these sectors' responses to the policy change. Such secondary transactions occur at an arms-length from initial responses to the legislation and include secondary transactions and price responses of commodities across all economic sectors. For example, an increase in the demand for wind turbines built within the state will create demand for material used to make wind turbines. Additionally, businesses producing wind turbines will increase purchases of freight transportation services for shipping to customers. These secondary transactions create further ripples throughout the economy that grow in size; much like a rock dropped into a calm lake generates concentric circles that expand from the initial point of change.

Calculating macroeconomic impacts requires the use of a sophisticated model that captures the major structural features of an economy, the workings of its markets, and all of the interactions between them. This study uses the Regional Economic Models, Inc. Policy Insight Plus (REMI PI^+) model (REMI, 2009) to simulate the indirect and induced impacts of the CEJA. Direct effects for modeling macroeconomic outcomes are guided by the TAG, the Wisconsin DNR, the Wisconsin PSC, and various Wisconsin commissioned and third-party studies of the costs and cost savings of implementing various policies around GHG emission reductions. Direct implementation costs and cost savings of reviewed policy segments are quantified and simulated over the research horizon.

The findings suggest that implementing the CEJA will generate positive net macroeconomic outcomes. Positive macroeconomic outcomes are generally attributed to policy segments where implementation costs do not exceed cost savings. However, this alone is not a comprehensive measure of the potential macroeconomic outcomes of policy segments. Policy segments, where implementation costs exceed direct cost savings, may still generate positive macroeconomic outcomes, especially where negative impacts take place in other states. To exemplify, policies that increase the cost of energy generation, but also increase in-state expenditures on energy feedstocks may generate positive economic outcomes if the state captures a greater share of total energy purchases after the policy is implemented.

The analyses described in this report are based on CCS's best estimates of the costs and savings of various mitigation recommendations. However, these costs and savings, and some conditions relating to the implementation of these recommendations are not known with full certainty. Examples include the net cost or cost savings of the recommendations themselves and the extent to which investment in new equipment will simply displace investment in other equipment in the state or will attract new capital from elsewhere.

The report is divided into six sections. Section II summarizes the REMI PI^+ model used to estimate the macroeconomic impacts. Section III presents an overview of the policy segments analyzed and discusses the process of policy quantification for modeling the policy segments. Section IV summarizes the set-up process of policy simulations in the REMI PI$^+$ model. The simulation results are discussed in section V, and Section VI provides a summary of the process and findings and provides some policy implications of our findings.

II. REMI MODEL ANALYSIS

Several modeling approaches were considered for this analysis including input-output (I-O), computable general equilibrium (CGE), mathematical programming (MP), and macro-econometric (ME) models. Each model approach has it own strengths and weaknesses. The choice of which model to apply depends on the purpose of the analysis and various other considerations as accuracy, transparency, manageability, and cost. After careful consideration of modeling options, we chose a hybrid-model option provided by Regional Economic Models, Inc. – REMI PI$^+$. This model integrates features of I-O, CGE and ME models. This combination affords it greater accuracy and completeness than would be afforded by a single modeling approach in isolation.

The 169-sector REMI PI$^+$ Model is a packaged program built around region-specific data. It has been refined and peer-reviewed over the course of thirty years, and applied to a host of policy questions. Government agencies in practically every state in the U.S. have used a REMI Model for a variety of purposes, including evaluating the impacts of the change in tax rates, the exit or entry of major businesses or economic programs, and, more recently, the impacts of energy and/or environmental policy actions (Rose and Wei, 2009; Miller, Wei and Rose, 2010). The Wisconsin Department of Transportation uses a variant of the REMI PI$^+$ model in assessing economic and transportation impacts of transportation policy. Because the REMI PI$^+$ model has been widely adopted for addressing state and local policy questions, it is well documented.

A detailed discussion of the major features of the REMI PI$^+$ model is presented in Appendix A. We simply provide a summary for general readers here. REMI PI$^+$ combines the detailed, economic structure found in cross-sectional I-O models and CGE models with time-series econometric models that statistically estimate relationships over time. Doing so provides that the REMI PI$^+$ model is based on statistical relationships measured over time with known statistical properties, rather than based on a single year's fit of the state data. The REMI PI$^+$ model is capable of generating accurate forecasts of economic impacts that fully account for feedback effects and the timing of economic change. The major limitation of the REMI PI$^+$ model versus custom ME or CGE models is that it is pre-packaged and not readily adjustable to any unique features of the case in point. The other models, because they are based on less data and a less formal estimation procedure, can more readily accommodate data changes in technological representations of associations that might be inferred, for example from engineering data. However, our assessment of the REMI model is that these adjustments were not needed for the purpose at hand.

The REMI PI$^+$ model is complete in its coverage of the state economy. Unlike most macroeconometric models that provide limited economic detail, this model makes use of the finely-grained sectoring detail of I-O and CGE models; dividing the economy into 169 sectors. This sectoring detail is important in a context like the CEJA, where various policy recommendations were fine-tuned to a given sector or where they directly affect several sectors differently. Similar to a CGE model, but unlike I-O models, the REMI PI$^+$ model is able to accommodate price responses to changes in supply and demand. Economic sectors interact with institutions such as government and households and local labor and capital markets when setting prices. Relative prices with respect to the national and international economies determine the state's competitiveness in the global marketplace.

III. Input Data

A. The Wisconsin Clean Energy Jobs Act

The Wisconsin Clean Energy Jobs Act specifies multiple policy segments for generating employment growth and reducing the state's GHG emissions. These policy segments largely mirror select policy options in the final report of the Governor's Task Force on Global Warming, entitled *Wisconsin's Strategy for Reducing Global Warming*. Nine of the policy segments are quantified and simulated. This section of the report describes these nine policy segments.

Table 2 shows the nine policy segments and provides two common measures of direct program costs relative to direct benefits. These measures ignore secondary impacts. The Net Costs column measures the differences between the estimated present values of implementation costs from direct cost savings. Negative net costs entries signify programs where savings exceed the costs of implementation. These cost-negative programs also exhibit benefit-cost ratios greater than one, as shown in the Ratio: Cost Savings to Cost column of Table 2. A ratio greater than one suggests the implementation returns more dollars in savings than used to implement. In other words, a ratio of 2.00 indicates that every one dollar in implementation cost generates two dollars in direct savings, while a ratio of 0.50 indicates that the program returns $0.50 in savings for every one dollar in implementation cost. All entries in Table 2 only consider direct public and private costs and savings that accrue to those directly responding to CEJA mandates and incentives. Future costs and cost savings are discounted at five percent per annum. Secondary impacts are not considered at this point.

As shown in Table 2, three of the five policy categories are cost-negative in that direct savings exceed implementation costs. Industrial development revenue bond (IDB) allocation has zero net implementation costs, because the direct implementation costs equal the direct savings.

However, this does not forestall this policy from having macroeconomic implications, as it suggests potential changes in the industrial make-up of Wisconsin's economy by favoring carbon neutral industries and industries providing GHG mitigating technologies. Below, we discuss each of the nine policy segments and direct effect calculations separately.

Table 2. Estimated Direct Costs and Savings of Wisconsin Policies*
Direct program savings relative to implementation costs*

Description	Net Costs** (millions of 2008$)	Ratio: Cost Savings to Cost**
Conservation and Energy Efficiency Policies (Energy Efficiency, Building Codes, Appliance Standards)	-$6,806.16	3.25
Utility Supply Side Policies (RPS, New Nuclear, Advanced Renewable Tariff)	$2,115.43	0.35
Overarching Policies (Industrial development revenue bond allocation)	$0.00	1.00
Transportation Policies (Freight idle reduction)	-$427.72	3.41
Agriculture and Forestry Policies (Energy Crop Reserve Program)	-$51.38	2.00

* *Direct implementation costs and cost savings exclude secondary impacts associated with macroeconomic impacts. Costs and savings of each policy segment are estimated in isolation of other CEJA segments and all cash flows are discounted at five percent per annum.*
** *Includes public and private implementation costs and savings, without consideration of secondary (macroeconomic) impacts, discounted five percent annually.*

Conservation and Energy Efficiency Policies

1. Enhanced Energy Efficiency (EEE)

EEE policies seek to reduce GHG emissions by enhancing residential, commercial and industrial energy efficiency. The CEJA sets out mandates and administrative policies to strengthen PSC- and utility-sponsored energy efficiency programs to reduce the usage or increase the efficiency of the usage of energy by customers. The bill adds liquid petroleum (LP) gas and heating oil users to existing programs that currently only target efficiency gains for natural gas and electricity users. In addition, the CEJA changes the fixed proportion formula for program funding to one that incentivizes savings achievement. The EEE policies set out under the CEJA are generally expected to increase energy savings of Wisconsin's Focus on Energy conservation program.

The Energy Center of Wisconsin conducted a study of potential energy consumption outcomes of enhanced EEE programs for electricity, natural gas, and liquefied natural gas (Energy Center of Wisconsin, 2009). That study documents incremental program implementation costs and cost savings expected under program enhancements consistent with the requirements of the CEJA. We apply their cost and savings estimates to the EEE segment impact estimates. Accordingly, about 86.5 percent of EEE-related expenditures are generated through replacing and retrofitting with energy saving options; 10 percent for equipment replacement and 3.5 percent for new construction. EEE implementation cost of electricity saving is estimated at $160 million per year, and $73.7 million for natural gas. These costs are allocated across residential, industrial and commercial sectors, weighted by percent of total statewide expenditures on electricity and natural gas respectively.[2] Electricity cost savings are set to $0.02 per year per dollar of capital

[2] REMI PI$^+$ estimates of sector expenditures are used in allocating implementation costs.

investment in electricity saving, while natural gas cost savings are set to $0.038 per year per dollar of capital investment.

A top-down approach was used to estimate the implementation cost of the enhanced EEE program for heating oil users. Here, CEJA goals target reductions in total heating oil consumption by 0.5% in 2011, 0.75% in 2012, and 1% each year thereafter. Savings are estimated based on price of MMBTU use mitigated. Implementation costs are estimated using the cost benefit ratio of 5.35:1 from a similar program study in Michigan (Governor's Task Force on Global Warming. 2008).

Successful implementation of EEE programs reduces household and business energy costs. Households who spend less on energy have more spending power for other goods and services. As energy purchases tend to follow energy commodities out of the state, lower energy expenditures allow Wisconsin to capture a greater proportion of total household expenditures. Additionally, low energy costs afford greater competitiveness of Wisconsin's businesses in the global economy, and cost savings provide resources for business expansion.

With that in mind, the ratio of cost savings to implementation cost of the EEE policy is 3.30:1, suggesting a lifetime cost saving of $3.30 for every dollar expended on the EEE program. Compared to some state estimates and estimates of other programs, this ratio may be high. The methods of measuring the benefits/cost ratios here are much broader than those generally applied to EEE program outcomes. In a macroeconomic sense, some direct costs are benefits to other sectors in the state economy. Additionally, the recent study by the Energy Center of Wisconsin suggests there remain many low-cost options for energy conservation and efficiency gains in Wisconsin and that economies of scale still exist in state EEE programs. The cost savings of LP gas and heating oil users, who have not benefited from energy conservation programs in the past, are likely to exceed the average savings indicated by benefit/cost ratios of existing programs.

2. Residential and Commercial Building Codes

The CEJA requires the State Department of Commerce to adopt energy conservation codes for commercial and residential buildings that are at least as effective as the International Energy Conservation Code (IECC). Under this policy, implementation costs and cost savings only accrue to new structures. Hence, the analysis uses construction forecasts and compares the energy cost savings of IECC – compliant structures to conventional structures and the additional construction costs required to meet those standards.

Residential energy savings estimates are provided in a report by the U.S. Department of Energy that estimates residential structures meeting the IECC 2009 standards will use 10 percent less energy than those meeting current Wisconsin building codes.[3] Similar estimates are derived for commercial structures.[4] Data from the Wisconsin Builders'

[3] See Pacific Northwest National Laboratory. 2009. Impacts of the 2009 IECC for Residential Buildings at State Level. Springfield, VA: U.S. Department of Energy.
[4] See Pacific Northwest National Laboratory. 2009. Impacts of Standard 90.1-2007 for Commercial Buildings at State Level. Springfield, VA: U.S. Department of Energy.

Association provides a basis for forecasting new structures in Wisconsin, while incremental changes in the cost of construction that meets IECC standards were based on cost data for meeting LEED standards.[5]

3. State Appliance Efficiency Standards

The bill prohibits the sale of certain consumer electronic devices that use more than a specified threshold of electricity in standby mode. Most modern residential entertainment systems remain in standby, or sleep mode, when not in use. This mode allows them to awaken with a remote control and/or retain in memory user specified settings. The maximum threshold of standby energy use varies by appliance type.

Research suggests that this segment will have minimal impact on the overall economy. Program implementation costs to purchasers will likely be minimal to zero as most consumer electronics currently meet these standards or are trending toward meeting these standards. Cost savings are likely minimal as well, as the threshold set out in CEJA is not binding relative to the baseline case. Cost savings are estimated by first estimating the number of new devices purchased each year as 10 percent of the current stock of televisions and stereos. For the baseline case, 5 percent of consumers purchase a device that uses twice as much power in standby mode as the proposed threshold.

Utility Supply Side Policies

4. Enhanced Renewable Portfolio Standards (RPS)

The CEJA enhances Wisconsin's existing RPS provisions, increasing the current RPS percentages for electricity sales that must be from renewable resources to:

- 10% by 2013-19
- 20% by 2020-24
- 25% by 2025

Under the CEJA, electric utilities will be required to generate at least 25 percent of their electricity sales from renewable sources. The bill also establishes a minimum in-state percentage of 40 percent by 2025. Other enhancements to the current RPS provisions are included, including conditional allocation of hydro-electricity,[6] and solid waste to the renewable energy percentage calculations.

Estimates of electricity generation costs under the enhanced RPS are informed by analyses of Wisconsin's public utility sector under mandates set out in CEJA. The Wisconsin PSC used the Electric Power Research Institute's Electricity Generation Expansion Analysis System (EGEAS) model that generates average cost of electricity based on levelized costs per kilowatt hour of electricity by the most probable mix of generating sources (i.e. wind, biogas, biomass, natural gas, coal, etc.) required to meet

[5] See Matthiessen, Lisa Fay, and Peter Morris. 2004. Costing Green: A Comprehensive Cost Database and Budgeting Methodology. Washington, D.C.: Davis Langdon.

[6] For purposes of this analysis, the CEJA will have no direct impact on new construction of hydro power. This is informed by knowledge of a prior-established hydro-electric project, with consideration of existing peak-load capacity margins that will likely be increased if CEJA reaches goals for energy use reductions.

expected generation needs. Total costs for each generating technology were split into capital costs, operations and maintenance (O&M), and fuel costs for inclusion in the REMI model. Estimated fuel costs do not take into consideration state or federal subsidies for bio-feedstocks. In-state sources are assumed to supply 85% of the biomass feedstocks where wood and wood waste makes up 40 percent of the in-state supply respectively, and energy crops supply the remaining 20 percent. Approximately 60% of the avoided costs will come from reduced generation of coal-fired plants, and 40% of gas-fired plants.

5. Modify Moratorium on Construction of New Nuclear Plants

The CEJA relaxes the existing moratorium on the construction of new or expansion of existing nuclear facilities in Wisconsin. As Wisconsin has excess capacity for electricity generation over the analysis horizon, the CEJA proposed changes to nuclear power regulation would not likely generate new investment in nuclear capacity through 2025. Since no new nuclear plants are likely to be built within the evaluation horizon, the expected economic outcome of this policy segment is negligible and omitted from the analysis.

6. Advanced Renewable Tariffs (ART)

The Advanced Renewable Tariffs policy segment builds on the RPS segment, establishing directives for the PSC to establish fixed feed-in tariffs to stimulate the deployment of small renewable generation projects. Under this policy, utilities will be required to enter into long-term, fixed-price contracts to purchase electricity produced by customer-owned renewable generation systems at rates commensurate with the production costs of each generation technology. Total purchases are allowed to be capped to protect against substantial rate increases.

Estimates of total volume of distributed renewable electricity generation are derived by linear extrapolation from zero to capacity caps as specified in PSC Briefing Memo REF#:114021.[7] Average incremental costs of generating from small-scale (less than 15 MW) photovoltaic, wind and biofuel relative to conventional fuels provide cost of program implementation. Cost savings are specified as reductions in the purchase of coal and natural gas as feedstocks for electricity supplanted with earnings from distributed energy generation in state.

Overarching Policies

7. Industrial Development Revenue Bonds (IDB) Allocation

Under the CEJA, 25 percent of the private activity bonds issued under Wisconsin's current Industrial Development Bond (IDB) Program[8] would be earmarked for approved clean-energy manufacturing and renewable power generating facilities. The bill does not increase or decrease the overall funding levels, which are currently capped at $248 million.

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[7] See Norcross, 2009 at http://psc.wi.gov/apps/erf_share/view/viewdoc.aspx?docid=114021

[8] IDBs are often referred to as industrial revenue bonds (IRBs)

IDBs reduce the cost of capital for Wisconsin businesses. Tax considerations of municipal bonds generally reduce the yield of such financial instruments by 1.5 to 2.5 percent. However, the CEJA does not change the volume cap on Wisconsin's IDB. Under this policy segment, 25 percent of the volume cap allocated to municipalities to private revenue bonds will be set aside to finance clean energy manufacturing and renewable power generating facilities. In practice, this policy affects investment in green production only when the total volume of IDB proceeds exceeds 75 percent of the cap. Beyond this lower bound, IDB financing is restricted to clean-energy manufacturing and renewable power generating facilities.

To model the direct impacts of the proposed change in the IDB program, costs of capital of clean-energy manufacturing and renewable power generating facilities are reduced by the cumulative value of interest savings through municipal bond financing equal to 25 percent of current program caps. This savings is then reallocated to all industrial and commercial segments such that there is no change in total cost of capital taken together.

Transportation Policies

8. Freight Idle Reduction

The CEJA limits truck idling practices at depots, overnight rest areas and other truck parking locations to no more than five minutes under most circumstances. This policy will provide direct fuel and GHG emission savings. However, mitigating idling practices will likely generate investment and operating costs to the freight trucking industry that include installing and operating auxiliary power units for cab environmental controls. Estimates of the total number of transportation units impacted were provided by the Wisconsin Department of Natural Resources, while U.S. EPA[9] provided estimates of idle-time reductions, fuel savings, and costs of auxiliary power units. Auxiliary power units have an expected life of 15 years.

Agriculture and Forestry Policies

9. Energy Crop Reserve Program

The Energy Crop Reserve policy segment provides cost-sharing payments, income replacement payments, or production payments to farmers for establishing or harvesting energy crops. This program will be administered by the Wisconsin Department of Agriculture, Trade and Consumer Protection, and will target land withdrawing from the federal Conservation Reserve Program (CRP) and fallow land not enrolled in conservation programs. Program details are not specified under SB 450, but are assigned for administrative rules under the Department of Agriculture, Trade and Consumer Protection.

Currently, CRP land commands federal payments of about $77 per acre per year while fallow lands are assumed to earn no income. This analysis assumes a subsidy payment of $100/acre/year, adjusted for inflation with a 10-year commitment for eligible land enrolled in the Wisconsin Energy Crop Program. Total program annual acreage added to

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[9] See http://www.epa.gov/smartway/transport/calculators/index.htm

the program is estimated as 10 percent of projected CRP land renewals. The total amount of fallow-land acreage that will be expected to enter the program has not been studied. For this analysis, enrollment of fallow land acreage is projected to equal CRP acreage enrollment. Implementation costs are limited to subsidy consideration and include both federal and state investments. Federal programs are assumed to pay half the incentives, while state programs will account for the second half. Farm proprietor net income trends with total number of acres enrolled in the ECR program. Hence direct cost savings accrue from the federal share of payments and farm proprietor income per acre, while implementation costs accrue to the state government share of incentives and to purchases of machinery and equipment for the harvesting and processing of biomass.

REMI model inputs are generated for each of the nine policy segments modeled, as described in the next section. Each policy segment is analyzed individually. Additionally, an aggregate run of all policy segments is generated to assess the overall macroeconomic impact of the CEJA in its entirety. The sum of the individual macroeconomic impacts of the nine policy segments may not add up to a single simultaneous analysis of all nine policy segments because REMI PI$^+$ takes into account interactive effects across policy options when they are analyzed together. If the simultaneously estimated macroeconomic impacts exceed the sum of the individual impacts, the interaction of policy options is complementary, and the positive impact of one expands the positive impact of another. Alternatively, if the sum of the parts exceeds the simultaneously estimated impacts, the interactions offset some of the potential gains.

B. REMI PI$^+$ Model Input Development

Estimating the macroeconomic impacts of the nine policy segments starts with specifying the direct effects. Direct effects are those costs and savings summarized in Table 2 that are directly attributed to the policy being modeled. Only incremental changes in costs and savings from the baseline case are relevant to direct effect calculations. These direct cash flows only account for a portion of the expected economic impact of the CEJA. Understanding the macroeconomic impacts requires modeling how changes in these initial costs and savings impact other sectors. The direct changes in expenditures generate ripple effects throughout the economy in response to changes in purchases and in relative prices, including production costs. Direct impacts are specified and inserted into the REMI PI$^+$ model, which simulates the policy changes to produce estimates of secondary effects.

Quantifying the policy segments into model inputs compatible with the REMI PI$^+$ model involves selecting appropriate variables referred to as "policy levers" in the model. The input data include sectoral spending and costs or savings over the full time horizon (2011-2025) of the analysis. Multiple policy levers are specified for each policy segment to reflect investment, cost of production, energy usage, and other factors relevant to the policy segment. This section describes the process of specifying policy levers used in the REMI PI$^+$ model using three example policy segments. Appendix D of this report provided detailed breakouts of all REMI PI$^+$ policy variables by policy segments used in this analysis.

Table 3 shows how the microeconomic results of enhanced energy efficiency (EEE) are translated, or mapped, into REMI PI$^+$ economic variable inputs. EEE refers to programs implemented by the utility sectors and the PSC aimed at reducing electricity, natural gas, and other fuel consumption in the business and household sectors.

The first set of inputs in Table 3 is the increased cost to the commercial, industrial, and residential sectors due to the purchases of energy efficient equipment and appliances. For the commercial and industrial sectors, this is simulated in REMI by increasing the value of the "Capital Cost" variable of individual commercial sectors and individual industrial sectors under the "Compensation, Prices, and Costs Block." For the residential sector, the program costs are simulated by increasing the "Consumer Spending" on "Kitchen & Other Household Appliances" (and decreasing all the other consumptions correspondingly). The "Consumer Spending (amount)" and "Consumption Reallocation (amount)" variables can be found in the "Output and Demand Block" in the REMI Model.

Table 3. Mapping the Quantification Results of Enhanced Energy Efficiency Segment into REMI PI^{+} Inputs

Quantification Results		Policy Variable Selection in REMI
Customer Outlay on Energy Efficiency (EE)	Businesses (Commercial and Industrial Sectors)	Compensation, Prices, and Costs Block →Capital Cost (amount) of individual commercial sectors→Increase
	Households (Residential Sector)	Output and Demand Block→Consumer Spending (amount)→Kitchen & other household appliances→Increase
		Output and Demand Block→Consumer Spending (amount)→ Bank service charges, trust services, and safe deposit box rental→Increase
		Output and Demand Block →Consumption Reallocation (amount)→All Consumption Sectors →Decrease
Investment on EE Technologies		Output and Demand Block →Exogenous Final Demand (amount) for Ventilation, Heating, Air-conditioning, and Commercial Refrigeration Equipment Manufacturing sector; Electric Lighting Equipment Manufacturing sector; Electrical Equipment Manufacturing sector; Other Electrical Equipment and Component Manufacturing sector; Industrial Machinery Manufacturing sector; and Commercial and Service Industry Machinery Manufacturing sector→Increase
Interest Payment of Financing Capital Investment		Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→Increase
Administrative Outlays		Output and Demand Block →Exogenous Final Demand (amount) for Management, Scientific, and Technical Consulting Services sector→Increase
Energy Savings of the Customers	Businesses (Commercial and Industrial Sectors)	Compensation, Prices, and Costs Block→ Electricity and Natural Gas, and Residual (Commercial Sectors) Fuel Cost (share) of All Commercial Sectors→Decrease
		Compensation, Prices, and Costs Block→ Electricity, Natural Gas, and Residual (Industrial Sectors) Fuel Cost (share) of All Industrial Sectors→Decrease
	Households (Residential Sector)	Output and Demand Block→Consumer Spending (amount)→Electricity, Gas, and Fuel Oil→Decrease
		Output and Demand Block →Consumption Reallocation (amount)→All Consumption Sectors →Increase
Energy Demand Decrease from the Energy Supply Sectors		Output and Demand Block →Exogenous Final Demand (amount) for Electric Power Generation, Transmission, and Distribution sector; Natural Gas Distribution sector; and Petroleum and Coal Products Manufacturing sector→Decrease

The second set of inputs is the corresponding stimulus effect of spending on efficient equipment and appliances, i.e., the increase in the final demand for goods and services from the industries that supply energy efficient equipment and appliances. This is simulated in REMI by increasing the "Exogenous Final Demand" (in the "Output and Demand Block") of the following sectors: Ventilation, Heating, Air-conditioning, and Commercial Refrigeration Equipment Manufacturing sector; Electric Lighting Equipment Manufacturing sector; Electrical Equipment Manufacturing sector; Other Electrical Equipment and Component Manufacturing sector; Industrial Machinery Manufacturing sector; and Commercial and Service Industry Machinery Manufacturing sector. The interest expense for financing capital expenditures is simulated as the "Exogenous Final Demand" increase of the Monetary Authorities, Credit Intermediation sector, while administrative costs of the EEE program is simulated as the "Exogenous Final Demand" increase of the Management, Scientific, and Technical Consulting Services sector.

The third set of inputs to the REMI PI^+ model is the energy savings of the commercial, industrial, and residential sectors resulted from the EEE program. For the commercial and industrial sectors, the energy savings are simulated in REMI by decreasing the value of the "Electricity/Natural Gas/Residual Fuel Cost of All Commercial/Industrial Sectors" variables. These variables can be found in the "Compensation, Prices, and Costs Block." For the residential sector, the energy savings are simulated by decreasing the "Consumer Spending" on "Electricity," "Gas," and "Fuel Oil" (and increasing all the other consumption categories correspondingly). Again, the "Consumer Spending (amount)" and "Consumption Reallocation (amount)" variables can be found in the "Output and Demand Block" in the REMI model.

The last set of inputs is the corresponding damping effects to the energy supply sector due to the decrease in the demand from the customer sectors. These effects are simulated by reducing the "Exogenous Final Demand" of the Electric Power Generation, Transmission, and Distribution sector; Natural Gas Distribution sector; Coal Mining sector; and Petroleum and Coal Products Manufacturing sector in REMI.[10]

Table 4 shows the microeconomic policy levers used to simulate the macroeconomic outcomes of the Renewable Portfolio Standard (RPS) policy segment. The proposed RPS requires that utilities supply a determined proportion of retail sales from eligible renewable energy sources on a progressive scale over time. The CEJA moves the existing 10 percent RPS requirement up from 2015 to 2013, and then goes on to require a 20 percent RPS by 2020 and 25 percent by 2025. In addition, the bill specifies maximum standards for purchasing renewable resources from out of state. By 2025, electric providers are required to purchase at least 40 percent of its renewable feedstock within the state under the CEJA; assuring benefits of the RPS retained to the state.

The direct effect on producers' cost of generating electricity is the incremental costs in capital, and operations and maintenance, and reduction on fuel costs of renewable electricity generation relative to the conventional processes. The REMI PI^+ model captures these costs as the

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[10] In this step, the final demand change is only modeled for the non-residential sectors, i.e., only the decreased demand from the commercial and industrial sectors needs to be manually entered into the REMI Model as final demand change for the energy supply sectors. For the Residential sector, the model will internally convert the change in the Consumer Spending (amount) policy variable into changes in final demand for the corresponding sectors.

incremental difference in capital costs and production costs of electricity generation, and reduction in fuel costs of generation. These policy levers are shown in the first three rows of Table 4. The REMI policy variable "Capital Cost" for "Electric power generation, transmission, and distribution" is used to capture incremental costs of capital and equipment, while the "Production Cost" variable is used to capture those of operations and maintenance, and fuel cost changes.

Table 4. Mapping the Quantification Results of Renewable Portfolio Standard into REMI PI+ Inputs

Quantification Results	Policy Variable Selection in REMI
Incremental Capital Cost of Electricity Generation (Renewable minus Avoided Traditional)	Compensation, Prices, and Costs Block →Capital Cost (amount) of Electric Power Generation, Transmission, and Distribution sectors→Increase
Incremental O&M Cost of Electricity Generation (Renewable minus Avoided Traditional)	Compensation, Prices, and Costs Block →Production Cost (amount) of Electric Power Generation, Transmission, and Distribution sectors→Increase
Decrease in Fuel Cost of Electricity Generation	Compensation, Prices, and Costs Block →Production Cost (amount) of Electric Power Generation, Transmission, and Distribution sectors →Decrease
Incremental Investment in Generation Technologies (Renewable minus Avoided Traditional)	Output and Demand Block →Exogenous Final Demand (amount) for Construction sector→Increase Output and Demand Block →Exogenous Final Demand (amount) for Engine, Turbine, and Power Transmission Equipment Manufacturing sector→Increase Output and Demand Block →Exogenous Final Demand (amount) for Semiconductor and other electronic component manufacturing sector→Increase
Interest Payment of Financing Capital Investment	Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→Increase
Renewable (Biomass) Fuel Inputs	Output and Demand Block →Industry Sales/Exogenous Production (amount) for Forestry; Fishing, hunting, trapping → Increase Output and Demand Block →Industry Sales/Exogenous Production (amount) for Logging → Increase Output and Demand Block →Industry Sales/Exogenous Production (amount) for Sawmills and wood preservation → Increase Output and Demand Block →Industry Sales/Exogenous Production (amount) for Veneer, plywood, and engineered wood product manufacturing → Increase Output and Demand Block →Industry Sales/Exogenous Production (amount) for Other wood product manufacturing → Increase Output and Demand Block → Farm Proprietors' Income (amount) →Increase Output and Demand Block →Industry Sales/Exogenous Production (amount) for Other wood product manufacturing → Increase
Fossil Fuel Savings	Output and Demand Block →Exogenous Final Demand (amount) for Coal Mining sector, Oil and Gas Extraction sector, and Pipeline Transportation sector→Decrease
Land-Lease Payments	Output and Demand Block → Farm Proprietors' Income (amount) →Increase

Investment in plant and equipment and upgrades will increase construction demand and demand for turbines and transmission capital. Based on assumptions discussed below, up-front investments are paid through debt financing; increasing the demand for financial services and interest payments. The REMI PI$^+$ model uses "Exogenous Final Demand" increases in "Construction," in "Engine, Turbine, and Power Transmission Equipment Manufacturing", in "Semiconductor and Other Electronic Component Manufacturing" (manufacturing sector of solar PV), and in "Monetary Authorities, Credit Intermediation" to capture these additional expenditures.

Cost savings are incurred through reductions in the use of coal and natural gas as a feedstock to electricity power generation. This is captured by reducing the policy level "Exogenous Final Demand" for "Coal Mining," "Oil and Gas Extraction," and "Pipeline Transportation."

Finally, Table 5 shows the REMI policy levers for the Biomass and Biofuel, Energy Crop Reserve policy segment. This policy segment seeks to increase the availability and use of renewable bioenergy for electricity, heat and transportation. To increase the supply of low-carbon bioenergy in Wisconsin, this policy segment will create an Energy Crop Reserve Program that will pay an incentive to landowners willing to grow perennial grasses and energy crops on marginal land that would otherwise be at risk of intensive cropping. The program targets ten percent of the land coming out of enrollment in the federal Conservation Reserve Program, and existing fallow land. In addition to federal programs, this segment will provide state financial support to biomass producers for the purchase of new equipment needed to harvest, process and transport biomass feedstocks, will modify crop insurance programs, and will interact with other policy segments to encourage the use of biomass feedstocks for energy and heat generation.

The first row of Table 5 specifies REMI PI$^+$ policy levers used to estimate the direct impacts of state and federal program incentives and of payments for feedstocks generated using these participating properties. This is captured in the REMI PI$^+$ model as compensation revenues to landowners and increased final demand for sectors that provide supporting activities to the farm sector. The second row represents the public share of incentives to producers. The state is assumed to provide only 50 percent of total public incentives; the remainder is allocated to federal transfers to landowners. Government expenditures are lowered by the amount of projected expenditures representing the limiting funds available for other government expenditures. The last row projects investment in harvesting and processing equipment of feedstocks, as specified as increases in the exogenous demand for "Agriculture, Construction, and Mining Machinery Manufacturing".

Table 5. Mapping the Quantification Results of Energy Crop Reserve into REMI PI$^+$ Model Policy Levers

Quantification Results	Policy Variable Selection in REMI
Payments to agricultural producers	Compensation, Prices, and Costs Block→Proprietors' Income of the Farm sector (amount)→Total→Increase Output and Demand Block →Exogenous Final Demand (amount) for Agriculture and Forestry Support Activities sector →Increase
State government share of cropland conversion incentive	Output and Demand Block → State Government Spending (amount)→Decrease
Farmgate investment in equipment	Output and Demand Block →Exogenous Final Demand (amount) for Agriculture, Construction, and Mining Machinery Manufacturing sector →Increase

C. CEJA Modeling Assumptions

All economic models entail some level of assumptions to facilitate modeling. Several modeling assumptions went into the analysis of the CEJA policy segments. These assumptions simplify the modeling process and in some cases make the modeling process possible. This section discusses the assumptions used for this analysis.

The major data sources of the analysis below are the TAG and PSC quantification results or their best estimation of the cost/savings of various recommended policy segments. However, we supplement this with some additional data and assumptions in the REMI analysis where these costs and some conditions relating to the implementation of the segments are not specified by the TAG and PSC or are not known with certainty. Below is the list of major assumptions we adopted in the analysis:

1. In the base case analysis, for all the policy segments that involve capital investment, we simulated a stimulus from only 50 percent of the capital investment requirements. This is based on the assumption that 50 percent of the investment in new equipment will simply displace other investment in new technology that would have occurred in the absence of the CEJA.

2. Capital investment in power generation is split 60:40 between sectors that provide generating equipment and the construction sector for large power plants (such as coal-fired power plants), and 80:20 for smaller installations (mainly renewables).

3. For the EEE segments, the energy consumers' participant costs of energy efficiency programs are computed for the residential, commercial, and/or industrial sectors by the Energy Center of Wisconsin's 2009 Potential Study.[11] Starting from total achievable reductions and associated costs in 2012, modeling direct effects assumes that the same reductions and savings (in constant dollars) will be achieved for all years of the analysis. However, Wisconsin already has an efficiency program based on a fixed level of funding. Therefore, only incremental implementation costs and savings are distributed among the 169 REMI sectors based on the Input-Output data provided in the REMI model in relation to the delivery of utility services to individual sectors.

4. The interest payment and the administrative cost are split out from the levelized cost using the assumption that 50 percent of the EEE costs will be covered by private sector financing and 50 percent will be covered by the utility expenditure such as public benefit charges. The administrative costs are assumed to account for 10 percent of the 50 percent utility portion of the capital costs.

5. Total RPS investment in wind, solar and biomass energy, in pursuit of the CEJA mandates, is extrapolated linearly from 2014 to 2025 goals based on PSC estimates of capital investment requirements. Investment in renewable capacity required to reach RPS goals is equally allocated across time. Savings are calculated as reduced

[11] See Energy Efficiency and Customer-sited Renewable Resource Potential in Wisconsin at http://www.ecw.org/ecwresults/WI-PS-ExecSum-Aug09.pdf, sited on January 20, 2010.

conventional generation purchases of coal and natural gas. Avoided fossil fuel electricity costs were estimated by multiplying the projected amount of increased renewable generation by the projected blended production cost from all types of generation. Land-lease payments for hosting wind generation are estimated based on existing rates and accrue to the agricultural sector. Payments to farm sector for energy crops are split between farm proprietor income and farm-related services.

6. The residential and commercial building code standards segment assumes 20,000 new residential structures and 30 million square feet of new commercial construction per year. Energy cost savings for residential structures are estimated based on electricity savings of $88 and natural gas savings of $100 per residential unit. Energy cost savings for new commercial square footage are estimated on the bases of energy savings of 0.47 kWh/sq. ft./year for electricity and of 1280 BTU/sq. ft./year for natural gas using current prices.

7. Setting aside a proportion of Industrial Development Bonds (IDB) represents a potential to reallocate low interest financing opportunities to those industries meeting the requirements under CEJA. Capital financing costs are reduced by 1.5 percent for clean-energy manufacturing and renewable power generating sectors as the annual interest savings from financing through IDB. This is offset by an equal increase in financing costs for all other manufacturing sectors that have reduced access to industrial revenue bonds. Appendix B lists sectors assumed to benefit directly under this policy segment.

8. Ten percent of land eligible for CRP renewal per year will be placed in ECRP, and an equal number of fallow land acres will enroll per year. The state will incur costs equal to 50 percent of $100 per acre in incentives, while federal programs will cover the remaining 50 percent.

9. Direct impact estimates of truck idling policies start with Wisconsin DNR estimates of the number of long-haul freight trucks operating in Wisconsin at 12,500. Fuel use savings are calculated on a typical hourly fuel consumption basis between the baseline and CEJA. EIA informed diesel price forecasts at the pump and auxiliary power unit prices are set at $8,500 per unit. According to the Vehicle Inventory and Use Survey data, about 45% of the miles accumulated by heavy trucks are for the "For-Hire" transportation and 55% are for the "Own Account Transportation" (U.S. Census Bureau, 2002). Therefore, 45% of the costs and savings of this policy segment are distributed to the Truck Transportation sector and 55% are distributed across other commercial and industrial sectors in proportion to the petroleum inputs for each sector.

10. Direct cost of implementing the fixed cost ART segment entails consideration of the contribution of distributed renewable energy generation to ratepayers' rates. The cost of generation is contingent on the source of electricity. Approximately 95 percent of distributed generation is projected to come from bio sources, three percent from wind and two from photovoltaic. For this analysis, only bio sources and wind are

considered. PSC estimates of relative production costs[12] are allocated on a percentage of load generation based on program caps for each generation source. The incremental increase in production cost from biomass and biogas is assumed to equal 0.72 cents/kWh while wind is 2.52 cents/kWh.

11. State appliance efficiency standard savings estimates are based on current average electricity rate of 8.42 cents/kWh. Savings equal the reduction of reducing to zero the number of new units per year (10 percent of existing stock of consumer electronics) that use twice the threshold set out in the CEJA on a 24-hour day basis.

IV. REMI Simulation Set-Up

Figure 1 shows a schematic description of the REMI modeling process. A first step of modeling macroeconomic impacts in REMI is to form a policy question such as, "What would be the economic impact of a RPS." Second, the policy question guides selection of relevant policy variables within the REMI PI+ model. For the RPS example, relevant policy variables may include incremental costs and investment in renewable electricity generation; avoided generation of conventional electricity; and electricity price changes. Third, baseline values for all policy variables are used to generate the control forecast – baseline forecast. Fourth, an alternative forecast is generated by changing policy variables to represent direct effects guided by the policy question. For the RPS example, the costs to the ratepayers, the investments to the renewable

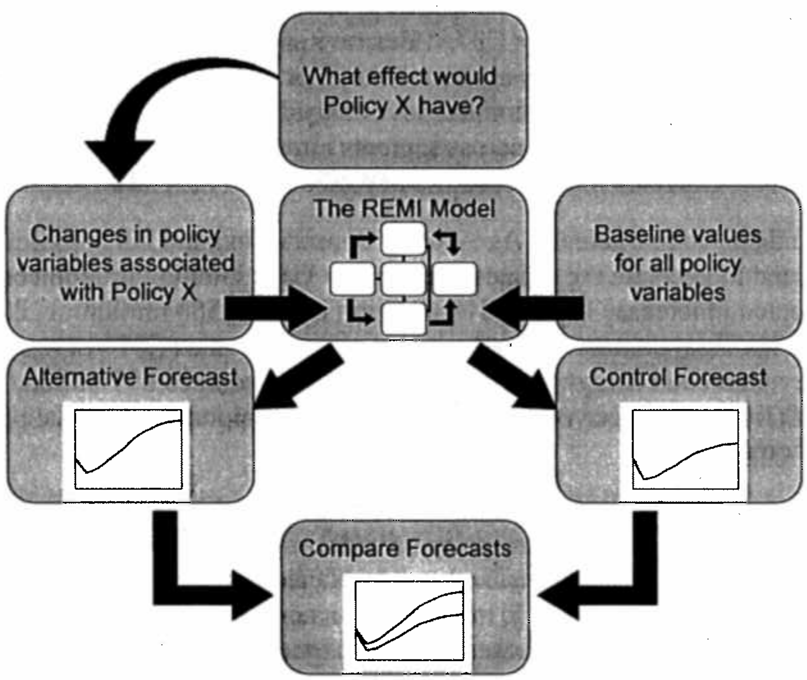

Figure 1: Process of Policy Simulation using REMI PI$^+$
Source: REMI Policy Insight 9.5 User Guide

[12] See Norcross, 2009 at http://psc.wi.gov/apps/erf_share/view/viewdoc.aspx?docid=114021

electricity generation, and avoided investment in conventional electricity generation represents direct impacts to be entered into the model. Fifth, the effects of the policy scenario are measured by comparing the baseline forecast and the alternative forecast. Sensitivity analysis can be undertaken by running a series of alternative forecasts with different assumptions on the values of the policy variables.

In this study, we first run the REMI model for each of the nine policy segments *individually*. Next, we run a *simultaneous* simulation in which we assume that all the policy segments are implemented together. Then the simple summation of the effects of individual segments is compared to the simultaneous simulation results to determine whether the "whole" is different from the "sum" of the parts. Differences can arise from non-linearities and/or synergies. The latter would stem from complex functional relationships specified in the REMI Model.

V. Simulation Results

Forecasts from simulations of each policy segment are compared to baseline forecasts. The difference between policy simulation forecasts from the baseline provides estimated macroeconomic impacts of the policy segment that entails direct and secondary effects. Impacts on gross state product (GSP) are reported over four periods (2011, 2015, 2020 and 2025) in constant dollar terms valued at 2000. In addition, a discounted value of GSP is calculated for each policy segment that values the stream of state product to its value today. Impacts on total state employment are also calculated and reported over four periods. Each policy segment is first modeled in isolation of other policy segments. These individual policy simulations provide estimates of how each individual segment would impact the state economy without consideration of other policy segments outlined in the CEJA. Because individual policy segments are likely to interact with other policy segments, a single simulation that models all policy segments simultaneously is also provided. This simultaneous analysis fully captures the extent to which cost savings and implementation costs across segments interact. As such, the simultaneous total impacts best reflect the expected macroeconomic impact of the CEJA as a whole.

GSP impacts are displayed in Table 6. As evident, Conservation and Energy Efficiency Policies policy segments tend to generate the greatest impact on GSP. Holding inflation constant, these policies are expected to increase GSP by $108 million in 2015, $563 million in 2020 and $1,224 million by 2025. The final column reports that the net present value (NPV) of projected GSP impacts of conservation and energy efficiency policies is valued at $3.577 billion, in 2000 dollars and discounted at five percent per year. NPV represents the importance the state places on the future stream of output today.

Table 7 shows corresponding impacts in employment. In this table, each entry represents the difference in total employment under the policy simulation relative to the baseline employment. Rather than suggesting that conservation and energy efficiency policies will add 2,501 jobs in 2015 alone, this table shows that in 2015, there will be a cumulative total of 2,501 more jobs than there would be under the baseline case and 14,328 more jobs in 2025 than there would be under the baseline case. As reflected in Table 6, conservation and energy efficiency policies tend to generate the largest economic impacts in terms of employment.

As evident in Tables 6 and 7, conservation and energy efficiency policies outlined in the CEJA have the greatest potential in terms of positive economic outcomes. Results reflect how reductions in household, commercial and industrial fuel expenditures generate cost savings that are the reallocated to other sectors of the economy. Since Wisconsin is a net importer of conventional fuels, replacing expenditures on fuels with expenditures on other goods may generate relatively more economic activity within the state. To illustrate, expenditures for fossil fuels to generate electricity in Wisconsin go to fossil energy producing states. If, on the other hand, these expenditures stay in the state, they will tend to re-circulate; generating still more multiplier effects.

Table 6: Gross State Product Impacts of the Clean Energy Jobs Act
(Billions of fixed 2000 dollars)

Scenario	2011	2015	2020	2025	NPV
Conservation and Energy Efficiency Policies (Energy Efficiency, Building Codes, Appliance Standards)	-0.023	0.108	0.563	1.224	3.577
Utility Supply Side Policies (RPS, New Nuclear, Advanced Renewable Tariff)	0.028	0.120	0.082	0.104	0.889
Overarching Policies (Industrial development revenue bond allocation)	0.001	0.006	0.010	0.009	0.064
Transportation Policies (Freight idle reduction)	0.003	0.020	0.046	0.057	0.287
Agriculture and Forestry Policies (Energy Crop Reserve Program)	-0.001	0.000	0.000	0.000	-0.001
Summation Total	**0.008**	**0.254**	**0.701**	**1.394**	**4.817**
Simultaneous Total	**0.008**	**0.254**	**0.706**	**1.407**	**4.852**

Individual scenarios do not take into consideration interactions across policy segments

Table 7: Employment Impacts of the Clean Energy Jobs Act

Scenario	2011	2015	2020	2025
Conservation and Energy Efficiency Policies (Energy Efficiency, Building Codes, Appliance Standards)	153	2,501	8,114	14,328
Utility Supply Side Policies (RPS, New Nuclear, Advanced Renewable Tariff)	234	950	640	1,094
Overarching Policies (Industrial development revenue bond allocation)	10	79	121	109
Transportation Policies (Freight idle reduction)	24	210	433	440
Agriculture and Forestry Policies (Energy Crop Reserve Program)	23	40	58	77
Summation Total	**444**	**3,780**	**9,366**	**16,048**
Simultaneous Total	**449**	**3,799**	**9,453**	**16,221**

Individual scenarios do not take into consideration interactions across policy segments

Utility Supply-side Policy segments also are expected to generate substantial macroeconomic impacts as shown in Tables 6 and 7. Such supply-side policies are expected to generate substantial production and employment impacts early with new investment in low GHG generation technology. As efficiencies build around alternative fuel sources, the potential for local supply of energy leads to greater economic opportunities and gains. Supply-side policies are expected to expand GSP by $120 million in 2015, mostly through investment expenditures. After executing initial investments, supply-side segments are expected to continue to prop up state production through production of feedstocks and continued investment in capacity. By 2025, supply-side policies will expand GSP by $104 million and support an additional 1,094 jobs. The cumulative contribution to GSP is expected to be $889 million discounted to today.

Other policy categories are generally expansionary. Overarching Policies, Transportation Policies and Agriculture and Forestry Policies all contribute to employment expansion. While Overarching Policies and Transportation Policies anticipate expanding production, Agriculture and Forestry category will not likely impact state production. While GSP and employment of the prior two categories tend to move together, they don't do so in the agricultural sectors. One sector impacted by Agriculture and Forestry Policies in particular, – Support activities for agriculture and forestry – tends to be more labor intensive than other sectors, generating a disconnect between GSP and Employment. Additionally, total contribution to GSP of agricultural biomass production is limited in that biomass feedstocks compete with other state-generated energy feedstocks, such that net impacts to state production is limited.

The last two rows of Tables 6 and 7 provide total Macroeconomic impacts of the nine policy segments of the CEJA modeled. The rows entitled "Summation Total" represents the addition of the individual policy segment impacts, while the rows entitled "Simultaneous Total" provides best estimates of the overall macroeconomic impacts of the CEJA by taking into consideration interactions of the economic impacts across all policy segments. The simultaneous totals suggest that the CEJA is economically expansionary through 2025. Employment is likely to increase by 16,221 new jobs in 2025, and GSP is likely to increase by $1.41 billion. This represents a 0.56 percent increase in employment and a 0.62 percent increase in Wisconsin's 2025 GSP. These outcomes take into consideration residential, commercial and industrial responses to changes in direct and secondary prices, changes in exports outside the state, and all interrelated transactions within the state economy.

Greater detail of the economic impacts from the simultaneous policy segment simulation can be found in Appendix E. Table E1 shows GSP impacts by sector, while Table E2 shows employment impacts by sector. The top portion of the tables shows the economic impact in absolute numbers, while the lower portion shows the same in percent change from the baseline.

VI. CONCLUSIONS

This report summarizes the analysis of the macroeconomic impacts of the Wisconsin Clean Energy Jobs Act using the well-established GHG impact modeling approaches within the REMI PI^+ modeling framework. The analysis was based on direct impact estimates from the Governor's Task Force on Global Warming, Technical Advisory Group, the Wisconsin Department of Natural Resources, the Wisconsin Public Service Commission, and various Wisconsin commissioned and third-party studies of the costs and cost savings of implementing various policies around GHG emission reductions.

The results take into consideration the costs and cost savings of implementing nine policy segments under the CEJA. They indicate that the majority of the GHG mitigation options have positive impacts on the state's economy. On net, the combination of options will increase gross state product by a discounted present value of $4.85 billion and will increase employment by

16,221 full-time equivalent jobs by the Year 2025. Conservation and Energy Efficiency policies have the greatest potential for positive statewide economic impacts, followed by the utilities supply-side and building codes policy.

Findings from this study are consistent with other studies that have found positive macroeconomic outcomes of statewide GHG mitigation efforts. A recent study of Michigan's Climate Action Plan (2009) using similar modeling approaches showed their proposed policies would likely generate positive and significant macroeconomic impacts as well. Like the current study, that study found that Conservation and Energy Efficiency policies tend to generate the largest potential economic impacts, while supply-side policies tend to generate relatively lower impacts. When comparing policy-by-policy impacts in terms of percent change from the baseline GSP products, the two studies are comparable. Table 8 shows impact comparisons across the Wisconsin EEE segment and the Michigan demand-side management policy segments and between the Wisconsin and Michigan RPS policy segments. These comparisons are measured in percent change in GSP and employment from baseline values in 2025.

The Wisconsin EEE segment is expected to increase GSP by 0.51 percent of its baseline projection in 2025. Michigan's is expected to generate a 0.41 percent increase. However, Wisconsin's RPS program is only expected to increase GSP by 0.01 percent over 2025 projections compared to 0.07 percent for Michigan. The difference is that Wisconsin already has a RPS law in effect, while Michigan does not.

Looking at the studies as a whole, three primary differences arise. Michigan is a relatively larger economy than is Wisconsin. GHG mitigation impacts are spread across 10 million Michigan residents compared to 5.6 million in Wisconsin. Michigan's 2008 GSP was $382.5 billion in current dollars while Wisconsin's was $240.4. The differences in the sizes of the two economies contribute to the differences in impacts.

A second difference between the two economic impact reports is the breadth of policy segments afforded the Michigan Study relative to the Wisconsin study. The Michigan study provided a comprehensive analysis of most all policy segments outlined in their Climate Action Plan. Wisconsin's study focused on a subset of CEJA policy proposals. Hence, the Michigan study scanned a much larger terrain of policy segments than the Wisconsin study.

Finally, Wisconsin has been historically more pro-active in the implementation of effective GHG measures than has Michigan, as noted above in the discussion about the RPS. This means that Wisconsin's economy is already experiencing the positive macroeconomic benefits of a number

**Table 8: Comparisons of EEE and RPS Impacts:
Wisconsin and Michigan**

(Percent change from baseline projections)

	WI (2025)		MI (2025)	
	GSP	Emp.	GSP	Emp.
EEE	.51%	.46%	.41%	.45%
RPS	.01%	.02%	.07%	.05%

Compares estimated program impacts. Differences in outcomes are attributed to differences in underlying economies and policies modeled of climate policy actions, which for Michigan appear as yet-unrealized future opportunities.

The macroeconomic impact evaluation does not consider several other potential drivers of economic outcomes. These include indirect environmental health impacts, such as the public health savings from lowered incidence of respiratory disease due to lower emissions of combustion-related pollutants other than CO_2. They do not include savings associated with the avoidance of damage caused by climate change, nor do they include benefits or costs of the reduction in the use of natural resources, the reduction in traffic congestion, or other similar indirect outcomes.

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APPENDIX A: DESCRIPTION OF THE REMI POLICY INSIGHT MODEL

REMI Policy Insight is a structural economic forecasting and policy analysis model. It integrates input-output, computable general equilibrium, econometric and economic geography methodologies. The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to wage, price, and other economic factors.

The REMI model consists of thousands of simultaneous equations with a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, demand, and other detail in the model. The overall structure of the model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Wages, Prices and Costs, and (5) Market Shares. The blocks and their key interactions are shown in Figures A1 and A2.

REMI Model Linkages

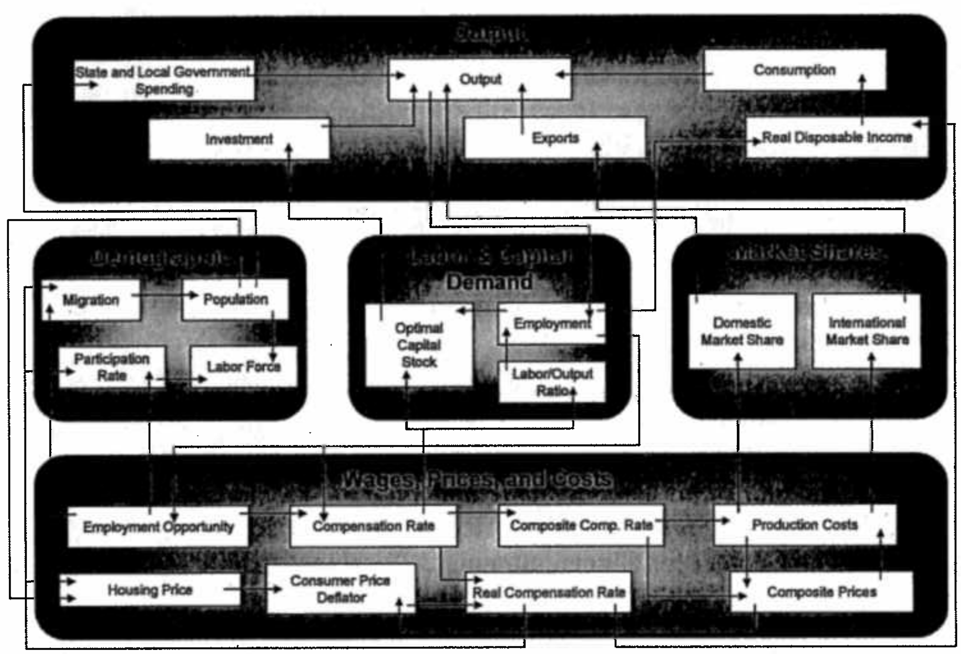

Figure A.1: REMI Policy Insight Linkages (Excluding Geographic Linkages

The Output and Demand block includes output, demand, consumption, investment, government spending, import, product access, and export concepts. Output for each industry is determined by industry demand in a given region and its trade with the US market, and international imports and exports. For each industry, demand is determined by the amount of output, consumption, investment, and capital demand on that industry. Consumption depends on real disposable income per capita, relative prices, differential income elasticities and population. Input productivity depends on access to inputs because the larger the choice set of inputs, the more likely that the input with the specific characteristics required for the job will be formed. In the capital stock adjustment process, investment occurs to fill the difference between optimal and actual capital stock for residential, non-residential, and equipment investment. Government spending changes are determined by changes in the population.

REMI Geography Linkages

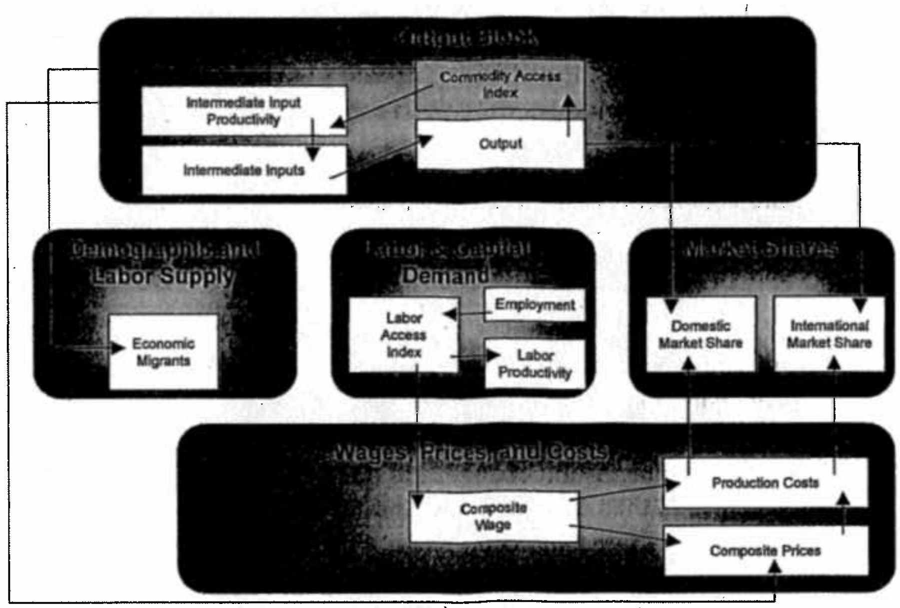

Figure A.2: REMI Policy Insight Geography Linkages

The Labor and Capital Demand block includes the determination of labor productivity, labor intensity and the optimal capital stocks. Industry-specific labor productivity depends on the availability of workers with differentiated skills for the occupations used in each industry. The occupational labor supply and commuting costs determine firms' access to a specialized labor force.

Labor intensity is determined by the cost of labor relative to the other factor inputs, capital and fuel. Demand for capital is driven by the optimal capital stock equation for both non-residential capital and equipment. Optimal capital stock for each industry depends on the relative cost of labor and capital, and the employment weighted by capital use for each industry. Employment in private industries is determined by the value added and employment per unit of value added in each industry.

The Population and Labor Supply block includes detailed demographic information about the region. Population data is given for age and gender, with birth and survival rates for each group. The size and labor force participation rate of each group determines the labor supply. These participation rates respond to changes in employment relative to the potential labor force and to changes in the real after tax compensation rate. Migration includes retirement, military, international and economic migration. Economic migration is determined by the relative real after tax compensation rate, relative employment opportunity and consumer access to variety.

The Wages, Prices and Cost block includes delivered prices, production costs, equipment cost, the consumption deflator, consumer prices, the price of housing, and the wage equation.

Economic geography concepts account for the productivity and price effects of access to specialized labor, goods and services.

These prices measure the value of the industry output, taking into account the access to production locations. This access is important due to the specialization of production that takes place within each industry, and because transportation and transaction costs associated with distance is significant. Composite prices for each industry are then calculated based on the production costs of supplying regions, the effective distance to these regions, and the index of access to the variety of output in the industry relative to the access by other uses of the product.

The cost of production for each industry is determined by cost of labor, capital, fuel and intermediate inputs. Labor costs reflect a productivity adjustment to account for access to specialized labor, as well as underlying compensation rates. Capital costs include costs of non-residential structures and equipment, while fuel costs incorporate electricity, natural gas and residual fuels.

The consumption deflator converts industry prices to prices for consumption commodities. For potential migrants, the consumer price is additionally calculated to include housing prices. Housing price changes from their initial level depend on changes in income and population density. Regional employee compensation changes are due to changes in labor demand and supply conditions, and changes in the national compensation rate. Changes in employment opportunities relative to the labor force and occupational demand change determine compensation rates by industry.

The Market Shares equations measure the proportion of local and export markets that are captured by each industry. These depend on relative production costs, the estimated price elasticity of demand, and effective distance between the home region and each of the other regions. The change in share of a specific area in any region depends on changes in its delivered price and the quantity it produces compared with the same factors for competitors in that market. The share of local and external markets then drives the exports from and imports to the home economy.

As shown in Figure A2, the Labor and Capital Demand block includes labor intensity and productivity, as well as demand for labor and capital. Labor force participation rate and migration equations are in the Population and Labor Supply block. The Wages, Prices, and Costs block includes composite prices, determinants of production costs, the consumption price deflator, housing prices, and the wage equations. The proportion of local, interregional and international markets captured by each region is included in the Market Shares block.

APPENDIX B: CLEAN-ENERGY MANUFACTURING AND RENEWABLE POWER GENERATING SECTORS

- Other wood product manufacturing
- Glass and glass product manufacturing
- Architectural and structural metals manufacturing
- Boiler, tank, and shipping container manufacturing
- Agriculture, construction, and mining machinery manufacturing
- Industrial machinery manufacturing
- Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing
- Engine, turbine, power transmission equipment manufacturing
- Electric lighting equipment manufacturing
- Household appliance manufacturing
- Electrical equipment manufacturing
- Other electrical equipment and component manufacturing
- Motor vehicle manufacturing
- Motor vehicle body and trailer manufacturing
- Motor vehicle parts manufacturing
- Sawmills and wood preservation
- Veneer, plywood, and engineered wood product manufacturing
- Animal food manufacturing
- Grain and oilseed milling
- Sugar and confectionery product manufacturing
- Fruit and vegetable preserving and specialty food manufacturing
- Dairy product manufacturing
- Animal slaughtering and processing
- Beverage manufacturing
- Pulp, paper, and paperboard mills
- Converted paper product manufacturing

APPENDIX C: REMI PI+ MODEL BASELINE PROJECTIONS

Category	Units	2009	2010	2011	2012	2013	2014	2015	2016	2017
Gross Domestic Product (Chained)	Billions of Chained (2000) Dollars	190.89	194.81	194.68	194.87	195.15	196.01	196.98	198.23	200.38
	Growth Rate (Percent)	*-1.7*	*2.1*	*-0.1*	*0.1*	*0.1*	*0.4*	*0.5*	*0.6*	*1.1*
Value-Added	Billions of Fixed (2000) Dollars	172.40	176.73	176.81	177.26	177.79	178.91	180.14	181.64	183.99
	Growth Rate (Percent)	*-1.7*	*2.5*	*0.0*	*0.3*	*0.3*	*0.6*	*0.7*	*0.8*	*1.3*
Wage and Salary Disbursements	Billions of Current Dollars	89.73	91.81	91.98	92.45	93.06	94.08	95.27	96.70	98.74
	Growth Rate (Percent)	*-1.9*	*2.3*	*0.2*	*0.5*	*0.7*	*1.1*	*1.3*	*1.5*	*2.1*
Total Earnings by Place of Work	Billions of Current Dollars	144.70	147.69	148.27	149.26	150.49	152.31	154.38	156.83	160.21
	Growth Rate (Percent)	*-1.4*	*2.1*	*0.4*	*0.7*	*0.8*	*1.2*	*1.4*	*1.6*	*2.2*
Average Annual Wage Rate	Thousands of Current Dollars	31.77	32.61	33.36	34.16	35.01	35.91	36.87	37.88	38.98
	Growth Rate (Percent)	*1.8*	*2.6*	*2.3*	*2.4*	*2.5*	*2.6*	*2.7*	*2.7*	*2.9*
Total Employment	Thousands (Jobs)	3,346.81	3,332.52	3,271.01	3,215.50	3,162.94	3,119.89	3,079.23	3,043.34	3,020.89
	Growth Rate (Percent)	*-3.1*	*-0.4*	*-1.8*	*-1.7*	*-1.6*	*-1.4*	*-1.3*	*-1.2*	*-0.7*
Private Non-Farm Employment	Thousands (Jobs)	2,824.31	2,815.40	2,757.30	2,706.22	2,658.23	2,619.87	2,584.11	2,552.97	2,533.02
	Growth Rate (Percent)	*-3.6*	*-0.3*	*-2.1*	*-1.9*	*-1.8*	*-1.4*	*-1.4*	*-1.2*	*-0.8*
Personal Income	Billions of Current Dollars	204.14	210.95	216.23	222.14	228.62	236.10	244.17	253.14	263.18
	Growth Rate (Percent)	*1.1*	*3.3*	*2.5*	*2.7*	*2.9*	*3.3*	*3.4*	*3.7*	*4.0*
Real Personal Income	Billions of Fixed (2000) Dollars	171.58	172.78	172.72	173.09	173.58	174.83	176.24	178.02	180.20
	Growth Rate (Percent)	*-1.3*	*0.7*	*0.0*	*0.2*	*0.3*	*0.7*	*0.8*	*1.0*	*1.2*
Real Disposable Personal Income	Billions of Fixed (2000) Dollars	153.61	154.82	154.97	155.51	156.16	157.49	158.98	160.80	162.92
	Growth Rate (Percent)	*-1.1*	*0.8*	*0.1*	*0.3*	*0.4*	*0.9*	*0.9*	*1.1*	*1.3*

Continued:

Category	Units	2018	2019	2020	2021	2022	2023	2024	2025
Gross Domestic Product (Chained)	Billions of Chained (2000) Dollars	202.67	205.08	207.25	209.89	212.50	215.50	218.71	222.19
	Growth Rate (Percent)	*1.1*	*1.2*	*1.1*	*1.3*	*1.2*	*1.4*	*1.5*	*1.6*
Value-Added	Billions of Fixed (2000) Dollars	186.47	189.07	191.46	194.30	197.10	200.30	203.68	207.36
	Growth Rate (Percent)	*1.4*	*1.4*	*1.3*	*1.5*	*1.4*	*1.6*	*1.7*	*1.8*
Wage and Salary Disbursements	Billions of Current Dollars	100.81	102.96	105.06	107.47	109.93	112.67	115.60	118.78
	Growth Rate (Percent)	*2.1*	*2.1*	*2.0*	*2.3*	*2.3*	*2.5*	*2.6*	*2.7*
Total Earnings by Place of Work	Billions of Current Dollars	163.64	167.23	170.73	174.70	178.76	183.25	188.04	193.18
	Growth Rate (Percent)	*2.1*	*2.2*	*2.1*	*2.3*	*2.3*	*2.5*	*2.6*	*2.7*
Average Annual Wage Rate	Thousands of Current Dollars	40.07	41.17	42.31	43.49	44.71	45.98	47.30	48.67
	Growth Rate (Percent)	*2.8*	*2.8*	*2.8*	*2.8*	*2.8*	*2.8*	*2.9*	*2.9*
Total Employment	Thousands (Jobs)	3,001.77	2,984.82	2,964.76	2,950.74	2,936.18	2,926.35	2,918.48	2,913.10
	Growth Rate (Percent)	*-0.6*	*-0.6*	*-0.7*	*-0.5*	*-0.5*	*-0.3*	*-0.3*	*-0.2*
Private Non-Farm Employment	Thousands (Jobs)	2,515.98	2,500.90	2,483.37	2,471.36	2,458.83	2,450.72	2,444.32	2,440.55
	Growth Rate (Percent)	*-0.7*	*-0.6*	*-0.7*	*-0.5*	*-0.5*	*-0.3*	*-0.3*	*-0.2*
Personal Income	Billions of Current Dollars	273.63	284.72	295.97	308.29	321.18	335.16	350.16	366.01
	Growth Rate (Percent)	*4.0*	*4.1*	*4.0*	*4.2*	*4.2*	*4.4*	*4.5*	*4.5*
Real Personal Income	Billions of Fixed (2000) Dollars	182.44	184.78	186.89	189.45	191.92	194.79	197.81	201.02
	Growth Rate (Percent)	*1.2*	*1.3*	*1.1*	*1.4*	*1.3*	*1.5*	*1.5*	*1.6*
Real Disposable Personal Income	Billions of Fixed (2000) Dollars	165.11	167.40	169.48	171.98	174.41	177.21	180.14	183.26
	Growth Rate (Percent)	*1.3*	*1.4*	*1.2*	*1.5*	*1.4*	*1.6*	*1.7*	*1.7*

APPENDIX D: MODEL INPUTS

DSM: Demand-side management		2011	2015	2020	2025
Consumer Spending (amount)	Kitchen & other household appliances	15.262	15.908	15.908	15.908
Consumer Spending (amount)	Bank service charges, trust services, and safe deposit box rental	3.344	3.492	3.492	3.492
Consumer Spending (amount)	Electricity	-25.259	-59.767	-102.902	-146.036
Consumer Spending (amount)	Gas	-3.761	-11.529	-21.238	-30.948
Consumer Spending (amount)	Fuel oil & coal	-10.640	-21.673	-35.464	-49.255
Consumption Reallocation (amount)	All Consumption Categories	20.075	72.548	139.183	205.819
Electricity (Commercial Sectors) Fuel Cost (amount)	All Commercial Sectors	-57.766	-136.684	-235.331	-333.979
NG (Commercial Sectors) Fuel Cost (amount)	All Commercial Sectors	0.000	0.000	0.000	0.000
Residual (Commercial Sectors) Fuel Cost (amount)	All Commercial Sectors	-7.696	-15.763	-25.847	-35.931
Electricity (Industrial Sectors) Fuel Cost (amount)	All Industrial Sectors	-48.322	-114.337	-196.855	-279.374
NG (Industrial Sectors) Fuel Cost (amount)	All Industial Sectors	0.000	0.000	0.000	0.000
Residual (Industrial Sectors) Fuel Cost (amount)	All Industrial Sectors	-45.529	-93.193	-152.772	-212.352
Electricity (Commercial Sectors) Fuel Cost (share)	All Commercial Sectors	0.000	0.000	0.000	0.000
Natural Gas (Commercial Sectors) Fuel Cost (share)	All Commercial Sectors	-2.502	-7.670	-14.130	-20.590
Residual (Commercial Sectors) Fuel Cost (share)	All Commercial Sectors	0.000	0.000	0.000	0.000
Electricity (Industrial Sectors) Fuel Cost (share)	All Industrial Sectors	0.000	0.000	0.000	0.000
Natural Gas (Industrial Sectors) Fuel Cost (share)	All Industrial Sectors	-4.995	-15.313	-28.210	-41.107
Residual (Industrial Sectors) Fuel Cost (share)	All Industrial Sectors	0.000	0.000	0.000	0.000
Exogenous Final Demand (amount)	Ventilation, heating, air-conditioning, and commercial refrigeration equipm	19.636	21.095	21.095	21.095
Exogenous Final Demand (amount)	Electric lighting equipment manufacturing	16.790	16.790	16.790	16.790
Exogenous Final Demand (amount)	Electrical equipment manufacturing	16.790	16.790	16.790	16.790
Exogenous Final Demand (amount)	Other electrical equipment and component manufacturing	16.790	16.790	16.790	16.790
Exogenous Final Demand (amount)	Industrial machinery manufacturing	14.718	16.006	16.006	16.006
Exogenous Final Demand (amount)	Commercial and service industry machinery manufacturing	4.917	5.089	5.089	5.089
Exogenous Final Demand (amount)	Electric power generation, transmission, and distribution	-106.088	-251.021	-432.187	-613.353
Exogenous Final Demand (amount)	Natural gas distribution	-77.520	-237.629	-437.765	-637.900
Exogenous Final Demand (amount)	Petroleum and coal products manufacturing	-53.225	-108.956	-178.620	-248.283
Exogenous Final Demand (amount)	Monetary Authorities, Credit Intermediation	19.071	19.175	19.175	19.175
Exogenous Final Demand (amount)	Management, scientific, and technical consulting services	6.701	6.902	6.902	6.902
Natural Gas (Commercial Sectors) Fuel Cost (share)	All Commercial Sectors	-2.502	-7.670	-14.130	-20.590
Natural Gas (Industrial Sectors) Fuel Cost (share)	All Industrial Sectors	-4.995	-15.313	-28.210	-41.107
Capital Cost (amount)	to be distributed among commercial sectors	47.804	48.247	48.247	48.247
Capital Cost (amount)	to be distributed among industrial sectors	66.629	69.368	69.368	69.368

BC: Residential and commercial building codes		2011	2015	2020	2025
Consumer Spending (amount)	Electricity	-1.616	-8.081	-16.162	-24.243
Consumer Spending (amount)	Gas	-1.844	-9.220	-18.440	-27.659
Consumer Spending (amount)	Bank service charges, trust services, and safe deposit box rental	0.158	0.789	1.578	2.367
Consumption Reallocation (amount)	All Consumption Categories	2.700	13.502	27.004	40.506
Electricity (Commercial Sectors) Fuel Cost (amount)	All Commercial Sectors	-1.398	-6.992	-13.984	-20.976
NG (Commercial Sectors) Fuel Cost (amount)	All Commercial Sectors	-0.382	-1.912	-3.824	-5.735
Electricity (Industrial Sectors) Fuel Cost (amount)	All Industrial Sectors	-0.155	-0.777	-1.554	-2.331
NG (Industrial Sectors) Fuel Cost (amount)	All Industial Sectors	-0.042	-0.212	-0.425	-0.637
Exogenous Final Demand (amount)	Construction	0.860	4.302	8.604	12.907
Exogenous Final Demand (amount)	Electric power generation, transmission, and distribution	-1.554	-7.769	-15.538	-23.307
Exogenous Final Demand (amount)	Natural gas distribution	-0.425	-2.124	-4.248	-6.373
Exogenous Final Demand (amount)	Monetary Authorities, Credit Intermediation	0.083	0.415	0.829	1.244
Exogenous Final Demand (amount)	Management, scientific, and technical consulting services	0.058	0.290	0.580	0.869
Capital Cost (amount)	to be distributed among commercial sectors	0.359	1.797	3.594	5.391
Capital Cost (amount)	to be distributed among industrial sectors	0.040	0.200	0.399	0.599

AS: State appliance efficiency standards		2011	2015	2020	2025
Consumer Spending (amount)	Electricity	-0.250	-1.000	-1.000	-1.000
Consumption Reallocation (amount)	All Consumption Categories	0.250	1.000	1.000	1.000

ART: Advanced renewable tariff development		2011	2015	2020	2025
Production Cost (amount)	Electric power generation, transmission, and distribution	9.696	38.777	38.777	38.777
Production Cost (amount)	Electric power generation, transmission, and distribution	-7.870	-31.470	-31.470	-31.470
Exogenous Final Demand (amount)	Construction	0.422	1.688	1.688	1.688
Exogenous Final Demand (amount)	Engine, turbine, and power transmission equipment manufacturing	1.591	6.361	6.361	6.361
Exogenous Final Demand (amount)	Monetary Authorities, Credit Intermediation	1.064	4.253	4.253	4.253
Proprietors' Income (amount)	Farm (crop and animal production)	3.956	15.819	15.819	15.819
Exogenous Final Demand (amount)	Water, sewage, and other systems	1.274	5.094	5.094	5.094
Exogenous Final Demand (amount)	Fruit and vegetable preserving and specialty food manufacturing	0.000	0.000	0.000	0.000
Exogenous Final Demand (amount)	Dairy product manufacturing	0.000	0.000	0.000	0.000
Exogenous Final Demand (amount)	Animal slaughtering and processing	0.000	0.000	0.000	0.000
Consumption Reallocation (amount)	All Consumption Categories	0.019	0.077	0.077	0.077
Exogenous Final Demand (amount)	Coal Mining	-3.542	-14.162	-14.162	-14.162
Exogenous Final Demand (amount)	Oil and gas extraction	-1.940	-7.759	-7.759	-7.759
Exogenous Final Demand (amount)	Pipeline transportation	-0.956	-3.822	-3.822	-3.822
Exogenous Final Demand (amount)	Electric power generation, transmission, and distribution	-1.432	-5.728	-5.728	-5.728
Electricity (Commercial Sectors) Fuel Cost (share)-->percent	All Commercial Sectors	0.017	0.071	0.071	0.068
Electricity (Industrial Sectors) Fuel Cost (share)-->percent	All Industrial Sectors	0.017	0.071	0.071	0.068
Exogenous Final Demand (amount)	Semiconductor and other electronic component manufacturing	0.098	0.390	0.390	0.390

RPS: Enhanced renewable portfolio standard		2011	2015	2020	2025
Capital Cost (amount)	Electric power generation, transmission, and distribution	0	91.8	125.2	382.93
Production Cost (amount)	Electric power generation, transmission, and distribution	0	7.96	13.46	30.01
Production Cost (amount)	Electric power generation, transmission, and distribution	0	-42.78	-56.51	-217.6
Exogenous Final Demand (amount)	Construction	0	10.06	13.59	41.63
Exogenous Final Demand (amount)	Engine, turbine, power transmission equipment manufacturing	0	37.12	47.15	145.16
Exogenous Final Demand (amount)	Semiconductor and other electronic component manufacturing	0	3.1	7.23	21.36
Exogenous Final Demand (amount)	Monetary authorities, credit intermediation	0	41.52	57.23	174.78
Exogenous Final Demand (amount)	Coal mining	0	-23.53	-38.93	-139.97
Exogenous Final Demand (amount)	Oil and gas extraction	0	-12.89	-21.33	-76.69
Exogenous Final Demand (amount)	Pipeline transportation	0	-6.35	-10.51	-37.77
Exogenous Final Demand (amount)	Electric power generation, transmission, and distribution	0	7.36	12.86	29.41
State Government Spending (amount)	Total	0	0	0	0
Industry Sales / Exogenous Production (amount)	Forestry; Fishing, hunting, trapping	0	0	2.42	6.26
Industry Sales / Exogenous Production (amount)	Logging	0	0	2.42	6.26
Industry Sales / Exogenous Production (amount)	Sawmills and wood preservation	0	0	0.64	1.66
Industry Sales / Exogenous Production (amount)	Veneer, plywood, and engineered wood product manufacturing	0	0	0.67	1.73
Industry Sales / Exogenous Production (amount)	Other wood product manufacturing	0	0	3.54	9.13
Proprietors' Income (amount)	Farm	0	0	1.21	3.13
Industry Sales / Exogenous Production (amount)	Support activities for agriculture and forestry	0	0	1.21	3.13
Proprietors' Income (amount)	Farm	0	0.6	0.6	0.6
Electricity (Industrial Sectors) Fuel Cost (share)	All Industrial Sectors	0	0.5	0.73	1.52
Electricity (Commercial Sectors) Fuel Cost (share)	All Commercial Sectors	0	0.5	0.73	1.52

IDB: Industrial development revenue bond allocation	2011	2015	2020	2025
Available upon request				

Tran: Freight idle reduction		2011	2015	2020	2025
Capital Cost (amount)	Truck transportation and couriers and messengers	7.141	0.000	0.000	0.000
Production Cost (amount)	Truck transportation and couriers and messengers	2.813	2.813	2.813	2.813
Residual Fuel Cost for Individual Industry (amount)	Truck transportation and couriers and messengers	-21.441	-25.463	-28.422	-29.564
Exogenous Final Demand (amount)	Petroleum and coal products manufacturing	-47.631	-56.566	-63.138	-65.675
Exogenous Final Demand (amount)	Motor vehicle parts manufacturing	13.281	0.000	0.000	0.000
Exogenous Final Demand (amount)	Monetary Authorities, Credit Intermediation	2.583	0.000	0.000	0.000
Capital Cost for Individual Industry (amount)	Distributed among commercial sectors	4.361	0.000	0.000	0.000
Capital Cost for Individual Industry (amount)	Distributed among industrial sectors	4.361	0.000	0.000	0.000
Production Cost for Individual Industry (amount)	Distributed among commercial sectors	1.718	1.718	1.718	1.718
Production Cost for Individual Industry (amount)	Distributed among industrial sectors	1.718	1.718	1.718	1.718
Residual Fuel Cost for Individual Industry (amount)	Distributed among commercial sectors	-13.095	-15.551	-17.358	-18.056
Residual Fuel Cost for Individual Industry (amount)	Distributed among industrial sectors	-13.095	-15.551	-17.358	-18.056

ECR: Energy Crop Reserve Program		2011	2015	2020	2025
Proprietors' Income (amount)	Farm (crop and animal production)	2.555	3.785	5.323	6.860
Exogenous Final Demand (amount)	Agriculture and forestry support activities; Other	2.555	3.785	5.323	6.860
State Government Spending (amount)	Total	-3.075	-4.305	-5.843	-7.380
Exogenous Final Demand (amount)	Agriculture, construction, and mining machinery manufacturing	1.039	1.039	1.039	1.039

APPENDIX E: IMPACTS BY INDUSTRY

Table E1: Gross State Product Impacts by Industry

Category	Units	2011	2015	2020	2025
Forestry, Fishing, Related Activities	Billions of Fixed (2000) Dollars	0.001	0.002	0.006	0.012
Mining	Billions of Fixed (2000) Dollars	0.000	0.001	0.001	0.003
Utilities	Billions of Fixed (2000) Dollars	-0.058	-0.152	-0.273	-0.392
Construction	Billions of Fixed (2000) Dollars	-0.014	-0.016	0.009	0.037
Manufacturing	Billions of Fixed (2000) Dollars	0.022	0.089	0.237	0.451
Wholesale Trade	Billions of Fixed (2000) Dollars	0.004	0.021	0.050	0.087
Retail Trade	Billions of Fixed (2000) Dollars	0.005	0.031	0.085	0.165
Transportation and Warehousing	Billions of Fixed (2000) Dollars	0.001	0.010	0.025	0.044
Information	Billions of Fixed (2000) Dollars	0.000	0.007	0.022	0.047
Finance and Insurance	Billions of Fixed (2000) Dollars	0.014	0.051	0.087	0.170
Real Estate and Rental and Leasing	Billions of Fixed (2000) Dollars	0.006	0.049	0.129	0.237
Professional and Technical Services	Billions of Fixed (2000) Dollars	0.002	0.008	0.025	0.048
Management of Companies and Enterprises	Billions of Fixed (2000) Dollars	0.002	0.011	0.029	0.053
Administrative and Waste Services	Billions of Fixed (2000) Dollars	0.001	0.009	0.024	0.044
Educational Services	Billions of Fixed (2000) Dollars	0.000	0.002	0.005	0.010
Health Care and Social Assistance	Billions of Fixed (2000) Dollars	0.005	0.033	0.077	0.133
Arts, Entertainment, and Recreation	Billions of Fixed (2000) Dollars	0.000	0.004	0.011	0.021
Accommodation and Food Services	Billions of Fixed (2000) Dollars	0.002	0.010	0.024	0.041
Other Services, except Public Administration	Billions of Fixed (2000) Dollars	0.002	0.010	0.023	0.040
Farm	Billions of Fixed (2000) Dollars	0.004	0.052	0.136	0.234
Government	Billions of Fixed (2000) Dollars	-0.001	0.022	0.067	0.136

Category	Units	2011	2015	2020	2025
Forestry, Fishing, Related Activities	Percent Change	0.33%	0.95%	3.01%	5.96%
Mining	Percent Change	0.02%	0.22%	0.57%	0.95%
Utilities	Percent Change	-1.55%	-4.03%	-6.93%	-9.41%
Construction	Percent Change	-0.17%	-0.21%	0.13%	0.51%
Manufacturing	Percent Change	0.05%	0.20%	0.49%	0.85%
Wholesale Trade	Percent Change	0.03%	0.15%	0.34%	0.58%
Retail Trade	Percent Change	0.03%	0.19%	0.46%	0.76%
Transportation and Warehousing	Percent Change	0.02%	0.13%	0.29%	0.46%
Information	Percent Change	0.00%	0.08%	0.23%	0.42%
Finance and Insurance	Percent Change	0.11%	0.40%	0.69%	1.36%
Real Estate and Rental and Leasing	Percent Change	0.04%	0.32%	0.80%	1.37%
Professional and Technical Services	Percent Change	0.02%	0.10%	0.30%	0.54%
Management of Companies and Enterprises	Percent Change	0.03%	0.18%	0.44%	0.75%
Administrative and Waste Services	Percent Change	0.02%	0.17%	0.45%	0.78%
Educational Services	Percent Change	0.02%	0.14%	0.37%	0.66%
Health Care and Social Assistance	Percent Change	0.03%	0.18%	0.41%	0.65%
Arts, Entertainment, and Recreation	Percent Change	0.02%	0.19%	0.49%	0.83%
Accommodation and Food Services	Percent Change	0.04%	0.24%	0.57%	0.95%
Other Services, except Public Administration	Percent Change	0.04%	0.24%	0.53%	0.85%
Farm	Percent Change	0.01%	0.11%	0.31%	0.56%
Government	Percent Change	-0.01%	0.08%	0.22%	0.43%

Table E2: Employment Impacts by Industry

Category	Units	2011	2015	2020	2025
Forestry, Fishing, Related Activities	Thousands (Jobs)	0.079	0.192	0.399	0.696
Mining	Thousands (Jobs)	0.000	0.001	0.001	0.000
Utilities	Thousands (Jobs)	-0.164	-0.390	-0.621	-0.809
Construction	Thousands (Jobs)	-0.316	-0.389	0.016	0.377
Manufacturing	Thousands (Jobs)	0.181	0.528	1.131	1.755
Wholesale Trade	Thousands (Jobs)	0.033	0.140	0.265	0.373
Retail Trade	Thousands (Jobs)	0.103	0.528	1.133	1.769
Transportation and Warehousing	Thousands (Jobs)	0.015	0.097	0.203	0.329
Information	Thousands (Jobs)	0.009	0.060	0.121	0.164
Finance and Insurance	Thousands (Jobs)	0.139	0.475	0.719	1.251
Real Estate and Rental and Leasing	Thousands (Jobs)	0.041	0.309	0.764	1.317
Professional and Technical Services	Thousands (Jobs)	0.030	0.141	0.386	0.700
Management of Companies and Enterprises	Thousands (Jobs)	0.011	0.058	0.133	0.209
Administrative and Waste Services	Thousands (Jobs)	0.024	0.213	0.514	0.839
Educational Services	Thousands (Jobs)	0.009	0.071	0.189	0.344
Health Care and Social Assistance	Thousands (Jobs)	0.093	0.533	1.197	1.974
Arts, Entertainment, and Recreation	Thousands (Jobs)	0.015	0.103	0.253	0.429
Accommodation and Food Services	Thousands (Jobs)	0.091	0.428	0.918	1.451
Other Services, except Public Administration	Thousands (Jobs)	0.071	0.336	0.682	1.049
Farm	Thousands (Jobs)	0.000	0.000	0.000	0.000
Government	Thousands (Jobs)	-0.017	0.368	1.048	2.004

Category	Units	2011	2015	2020	2025
Forestry, Fishing, Related Activities	Percent Change	0.55%	1.51%	3.40%	6.31%
Mining	Percent Change	0.00%	0.02%	0.04%	0.01%
Utilities	Percent Change	-1.65%	-4.37%	-7.53%	-10.28%
Construction	Percent Change	-0.18%	-0.24%	0.01%	0.25%
Manufacturing	Percent Change	0.04%	0.15%	0.36%	0.61%
Wholesale Trade	Percent Change	0.03%	0.13%	0.29%	0.47%
Retail Trade	Percent Change	0.03%	0.17%	0.38%	0.61%
Transportation and Warehousing	Percent Change	0.01%	0.09%	0.18%	0.28%
Information	Percent Change	0.02%	0.13%	0.29%	0.44%
Finance and Insurance	Percent Change	0.09%	0.35%	0.59%	1.13%
Real Estate and Rental and Leasing	Percent Change	0.04%	0.32%	0.77%	1.29%
Professional and Technical Services	Percent Change	0.02%	0.09%	0.26%	0.46%
Management of Companies and Enterprises	Percent Change	0.03%	0.15%	0.35%	0.56%
Administrative and Waste Services	Percent Change	0.02%	0.14%	0.35%	0.59%
Educational Services	Percent Change	0.01%	0.12%	0.30%	0.53%
Health Care and Social Assistance	Percent Change	0.02%	0.14%	0.31%	0.50%
Arts, Entertainment, and Recreation	Percent Change	0.02%	0.16%	0.38%	0.62%
Accommodation and Food Services	Percent Change	0.04%	0.19%	0.42%	0.68%
Other Services, except Public Administration	Percent Change	0.04%	0.21%	0.43%	0.65%
Farm	Percent Change	0.00%	0.00%	0.00%	0.00%
Government	Percent Change	0.00%	0.10%	0.30%	0.57%