Economic Impact of Energy Optimization Program Scenarios in Michigan, 2014 to 2023

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EXECUTIVE SUMMARY

Energy efficiency programs provide states with the opportunity to reduce the energy required to heat homes, run businesses and fuel their economies. In 2008, the Michigan Legislature passed Public Act 295 (PA 295) requiring electric and natural gas utility providers to implement energy optimization programs. Activities associated with these programs reduce energy waste and include the purchase of EnergyStar lighting, appliance recycling, HVAC and water heating system retrofits, installation of new insulation, measurement and evaluation services, energy efficient new construction, and other energy efficient activity. These programs engage Michigan businesses throughout the state in the manufacturing, transportation, construction, and installation activities necessary for the implementation of the energy optimization programs.

Since implementation, energy optimization program investments have exceeded $736 million and saved Michigan residents and businesses more than 3.4 million megawatt hours (MWh) of electricity and nearly 11 million MCF[1] of natural gas.[2] This equates to $3.55[3] in benefit for each dollar spent in 2011 and $4.07 for each dollar spent in 2012.[4] Given the success of the current energy optimization programs, policymakers should consider expanding the programs as they draft a forward-looking state energy policy.

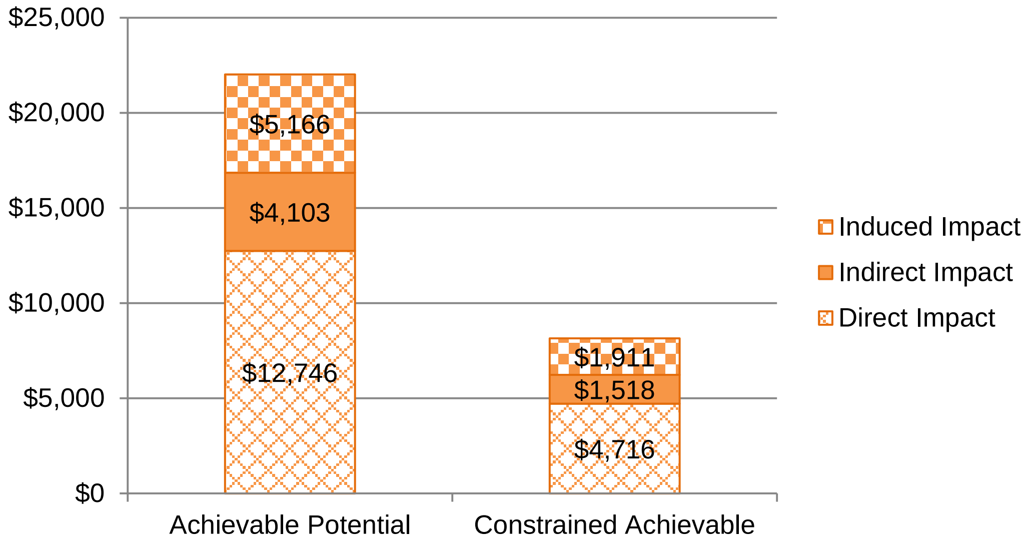
Two scenarios representing different levels of efficiency-related investment in Michigan were modeled and evaluated to demonstrate the impact of changes to the energy optimization program. The two models were based on Michigan studies commissioned to define attainable scenarios of energy optimization program implementation and related environmental impacts.[5, 6] Models depict the energy optimization program activity necessary to meet realistic levels of energy savings over a 10-year timeline, given the ability of service providers to effectively implement and promote the program and estimated consumer adoption rates. Input-output analysis was used to estimate the economic impact of the activities associated with energy optimization program scenarios. Shifts in demand and estimates of supply are used to calculate direct, indirect and induced economic impacts including total economic impact, employee compensation and job-years supported.

Input-output economic impact analysis of two energy optimization program scenarios, the "*Achievable Potential*" scenario and the "*Constrained Achievable Potential*" scenario, indicates that the associated activities could positively impact Michigan. The Achievable Potential scenario models energy optimization program implementation with rebates covering 50 percent of the incremental cost of efficiency measures without a spending cap. Under this scenario, electric and natural gas service providers cover 50 percent of the incremental cost[7] of an efficiency measure through rebates or other programs, and the consumer covers the remaining expense. This Achievable Potential scenario could result in $22 billion in total output, including more than 163,000 job-years supported and $7.6 billion in employment compensation.

[1] Note: An MCF is equal to 1,000 cubic feet of natural gas
[2] Michigan Department of Licensing and Regulatory Affairs, 2013a
[3] Michigan Department of Licensing and Regulatory Affairs, 2012
[4] Michigan Department of Licensing and Regulatory Affairs, 2013a
[5] GDS Associates, 2013a
[6] GDS Associates, 2013b
[7] Incremental cost is the difference in price between an energy efficient option and a baseline non-efficient choice (e.g. difference between the cost of an LED light bulb and a halogen light bulb)

The Constrained Achievable scenario assumes an incentive rebate of 50 percent of incremental cost but caps program spending at two percent of utility revenues. This cap on program spending aligns the Constrained Achievable scenario with current Michigan legislation. Under this scenario, electric and natural gas service providers would cover 50 percent of the incremental cost of an efficiency measure through rebates or other programs, but their annual program budget would be capped at two percent of the utility's annual revenue. This Constrained Achievable Potential scenario could impact Michigan through $8.1 billion of total output, including over 60,000 job-years supported, and $2.8 billion in employment compensation. Scenario impacts from energy optimization program investments are gross estimates over a 10-year period (Figure 1).

Figure 1. Net Present Value of Total Economic Output by Scenario, 2014 to 2023 (in millions)



In Michigan, there is opportunity to leverage the current momentum related to the implementation of PA 295. Continuing the current policies of capping program spending at two percent of utility revenues over the next 10 years will have a sustained impact on Michigan and enable further energy savings by Michigan service providers and utility customers. However, increased investment in the state's energy efficiency program, as modeled in the Achievable Potential scenario, has the ability to significantly reduce the state's dependence on imported energy, save ratepayers money, and increase economic vitality by supporting jobs for Michigan's workforce and creating value-added output for its strong industrial supply chain.

While environmental benefits often dominate energy policy dialogue, this study presents evidence of economic impact that should be considered in the context of likely return on investment. Study results are not intended to advocate for or against any particular policy, strategy, or investment, but rather serve as an assessment of the impacts a set of investments could have on Michigan's economy. **Equipped with this analysis and others, policymakers will be better informed to make decisions regarding the state's energy future, including investments in energy efficiency and long-term strategies to advance Michigan's energy economy.**

INTRODUCTION

Public Act 295 (PA 295) passed in 2008, required electric and natural gas utility providers to implement energy optimization programs, thereby encouraging investment in energy efficient measures. Energy optimization programs incentivize the reduction of energy waste through rebates, grants, and direct investment in energy efficient measures to residential, commercial, and industrial consumers. Investments include the purchase of EnergyStar lighting, appliance recycling, HVAC and water heating system retrofits, installation of new insulation, measurement and evaluation services, energy efficient new construction, and other energy efficient activity. These activities occur in homes, businesses, and buildings across Michigan and engage companies throughout the state.

Since the enactment of PA 295, Michigan service providers have saved consumers more than 3.4 million megawatt hours (MWh) of electricity and close to 11 million MCF[8] of natural gas.[9] This equates to $3.55 in benefit for each dollar spent in 2011[10] and $4.07 for each dollar spent in 2012.[11] Given the success of the current energy optimization programs, policymakers should consider the future of the state's energy policy and potential strategies to reduce the energy required to fuel Michigan's economy.

Previous studies and reports estimated the impact of the energy optimization programs based on net benefit and cost-benefit ratios. These are important and valuable measures of energy efficiency investments but do not provide the total impact on the state economy. This study begins to quantify the economic impact resulting from potential changes to the state's energy optimization program that Michigan may examine to increase future investments in energy efficiency. The two scenarios analyzed are based upon Michigan studies commissioned by the Michigan Economic Development Corporation, and the Michigan Department of Licensing and Regulatory Affairs to define attainable scenarios of energy optimization program implementation and related environmental impacts.[12, 13]

These scenarios represent the energy savings and activity that investment in energy efficient measures could realistically displace over a 10-year timeline given estimated consumer adoption rates and the ability of service providers to effectively implement the program. The Achievable Potential scenario models energy optimization program implementation with rebates covering 50 percent of the incremental cost of measures without a spending cap. The Constrained Achievable Potential scenario also assumes a rebate of 50 percent of incremental cost, but caps program spending at two percent of utility revenues, which aligns with current law.

This study is meant to inform state-level conversations already occurring in Michigan by providing objective evidence that investment in energy efficiency can create direct, indirect, and induced gross economic benefit for the state. It is not intended to exclusively promote nor deter any particular policy, strategy, or investment in energy efficiency measures.

[8] Note: An MCF is equal to 1,000 cubic feet of natural gas
[9] Michigan Department of Licensing and Regulatory Affairs, 2013a
[10] Michigan Department of Licensing and Regulatory Affairs, 2012
[11] Michigan Department of Licensing and Regulatory Affairs, 2013a
[12] GDS Associates, 2013a
[13] GDS Associates, 2013b

Economic Impact of Energy Optimization Program Scenarios in Michigan, 2014 to 2023 uses input-output analysis to assess the economic impact of energy optimization program scenarios on the Michigan economy. The Minnesota IMPLAN Group's IMPLAN model was used to estimate the regional impact of the activities associated with the implementation of the energy optimization program. Direct, indirect, and induced economic impacts from energy optimization program activities are combined to estimate total economic impact.[14]

Input-output economic impact modeling calculates the direct, indirect, and induced economic impact on a regional economy based on a shift in economic activity such as increased sales of energy efficient lighting due to a shift in final demand. The model developed for this study calculates impact based on:

- Forecasted energy optimization program budgets
- Estimates of costs for energy efficient measures
- Estimates of administrative costs associated with energy optimization programs
- Estimates of costs for energy efficient measure installation and construction
- Estimates of costs for evaluation and measurement services
- Estimates of sector-to-sector trade based on IMPLAN software and data

This information is essential to the development of an input-output economic impact model and for the analysis of direct, indirect, and induced impacts. Modeled scenarios are an illustration of potential energy policies and portfolios Michigan may pursue. This study does not consider the impact of energy savings or ancillary impacts including social or environmental externalities.

[14] Minnesota IMPLAN Group, 2013

CURRENT STATE OF ENERGY EFFICIENCY IN MICHIGAN

To promote increased investment in energy efficiency, Michigan adopted PA 295 of 2008.[15] According to the Michigan compiled law, this act is intended to:

> *"…promote the development of clean energy, renewable energy, and energy optimization through the implementation of a clean, renewable, and energy efficient standard that will cost-effectively do all of the following:*
>
> > *(a) Diversify the resources used to reliably meet the energy needs of consumers in this state.*
> >
> > *(b) Provide greater energy security through the use of indigenous energy resources available within the state.*
> >
> > *(c) Encourage private investment in renewable energy and energy efficiency.*
> >
> > *(d) Provide improved air quality and other benefits to energy consumers and citizens of this state."*[16]

PA 295 requires providers of electric and natural gas services in Michigan to establish energy optimization programs. Electric companies include Investor Owned Utilities (IOUs), Electric Cooperatives (Coops), and Municipal Service Providers (Municipals). Investments by providers in energy efficiency measures are required to achieve yearly energy savings targets.

Savings targets were designed to increase annually from 2009 to 2015 and were set separately for electric and natural gas providers. Table 1 provides annual energy savings targets by provider type. After 2015, program savings targets will continue at the level of one percent of previous year sales for electric providers and at 0.75 percent of previous year sales for natural gas providers.

Table 1. Annual Energy Savings Targets for Energy Optimization by Provider Type[17]

Utility	2008 – 2009	2010	2011	2012	2013	2014	2015
Electric	0.3% of 2007 Sales	0.5% of 2009 Sales	0.75% of 2010 Sales	1.0% of 2011 Sales	1.0% of 2012 Sales	1.0% of 2013 Sales	1.0% of 2014 Sales
Natural Gas	0.1% of 2007 Sales	0.25% of 2009 Sales	0.5% of 2010 Sales	0.75% of 2011 Sales	0.75% of 2012 Sales	0.75% of 2013 Sales	0.75% of 2014 Sales

[15] Michigan Legislature, 2008
[16] Ibid.
[17] Ibid.

Since PA 295's implementation, Michigan electric and natural gas service providers have deployed energy optimization programs to reduce energy waste and boost energy efficiency investment in the state. These programs spent $463.5 million between 2009 and 2011. Table 2 provides program spending by provider type and customer category. Activities associated with the implementation of energy optimization programs include investments in energy efficient measures, installation activities and retrofits, measurement and evaluation services, energy efficient new construction, and energy optimization program administration in Michigan by service providers.

Table 2. Energy Optimization Program Spending 2009 – 2011[18]

Category	Electric IOUs	Electric Coops	Municipals	Gas Companies	Total
Residential	$81,115,840	$3,446,462	$4,543,184	$69,297,846	$158,403,332
Low Income	$16,245,109	$761,258	$780,064	$37,486,409	$55,272,840
Commercial & Industrial	$110,135,677	$2,050,234	$9,179,976	$23,296,968	$144,662,855
Administration & Evaluation/Carryover	$41,370,759	$2,477,562	$2,645,047	$58,707,262	$105,200,630
Total	$248,867,385	$8,735,516	$17,148,271	$188,788,485	$463,539,657

In 2012 providers invested $272.8 million into energy optimization programs. Table 3 provides program spending by provider type and customer category.

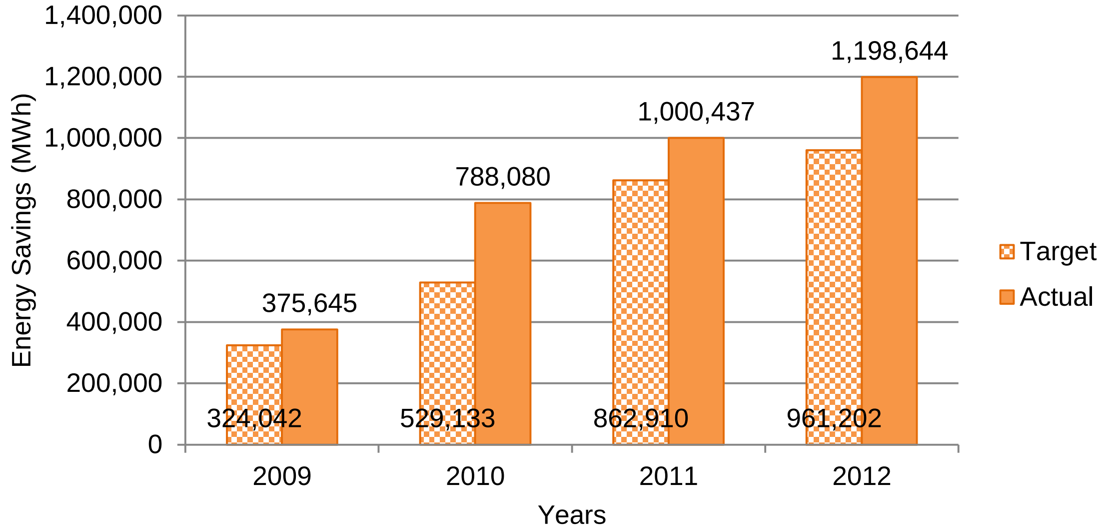
Table 3. Energy Optimization Program Spending 2012[19]

Category	Electric IOUs	Electric Coops	Municipals	Gas Companies	Total
Residential	$61,415,331	$1,963,667	$2,685,009	$56,214,482	$122,278,489
Low Income	$8,257,742	$167,545	$493,088	$17,518,040	$26,436,415
Commercial & Industrial	$63,202,916	$1,391,353	$5,471,157	$18,492,717	$88,558,143
Administration & Evaluation/Carryover	$20,795,702	$1,184,702	$1,429,379	$12,155,593	$35,565,376
Total	$153,671,690	$4,707,267	$10,078,633	$104,380,832	$272,838,422

Electric and gas utility provider program spending has resulted in energy savings greater than benchmarked targets. The $274.8 million spent by electric utilities from 2009 to 2011 resulted in 2.2 million MWh of electricity savings, surpassing targets by 448,000 MWh. In 2012, consumers saved 1.2 million MWh due to a $168.5 million investment in energy efficiency measures. This savings was an estimated 237,000 MWh over established targets. Annual targets and yearly electricity savings achieved are provided in Figure 2.

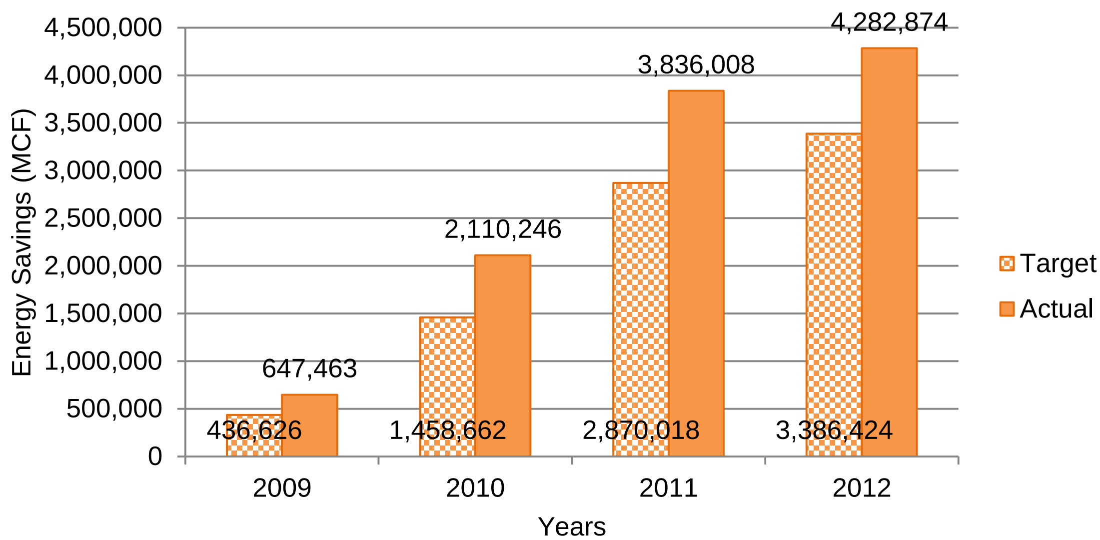
[18] Michigan Department of Licensing and Regulatory Affairs, 2013a
[19] Ibid.

Figure 2. Annual Program Electric Savings Targets and Actual Savings by Year (MWh)[20]



Annual energy savings targets set by PA 295 were also exceeded by Michigan's natural gas providers. Between 2009 and 2011, 6.6 million MCF of natural gas was saved through provider investments in energy efficiency measures totaling $188.8 million, surpassing savings targets by 1.8 million MCF. Residential, commercial, and industrial investments totaling $104.4 million saved customers 4.3 million MCF in 2012, an estimated 896,000 MCF over targets. Natural gas annual targets and the yearly savings attributable to utility energy optimization programs are displayed in Figure 3.

Figure 3. Annual Program Natural Gas Savings Targets and Actual Savings by Year (MCF)[21]



[20] Michigan Department of Licensing and Regulatory Affairs, 2013a
[21] Ibid.

FUTURE ENERGY OPTIMIZATION PROGRAM SCENARIOS

The two scenarios modeled in the *Economic Impact of Energy Optimization Program Scenarios in Michigan, 2014 to 2023* report are based upon the *Michigan Electrical and Natural Gas Energy Efficiency Potential Study: Additional Scenario Memo* released November 6, 2013.[22] This report considers two scenarios estimating Michigan's energy efficiency potential.

Scenario 1 – Achievable Potential

Scenario 1 represents the amount of energy use that efficiency can realistically displace assuming rebates equal to 50 percent of the incremental measure cost and no spending cap.[23] This means that electric and natural gas service providers cover 50 percent of the incremental cost of an efficiency measure through rebates or other programs, and the consumer covers the remaining expense. Incremental cost is the additional expense of selecting an energy efficient option over a baseline non-efficient choice (e.g. difference in cost between an LED light bulb and a halogen light bulb).

This scenario uses the Utility Cost Test (UCT), also known as the Program Administrator Cost Test, to assess the economic validity of investments in energy efficiency measures. The UCT compares the utility or service provider's savings due to higher efficiency to the expenditures associated with the energy optimization program investments including rebates, installation costs and administrative overhead.[24]

Program budget projections from 2014 to 2023 were developed for the Achievable Potential scenario. Budgets were segmented by customer type which included residential, commercial, and industrial consumers. Given scenario assumptions, Michigan utilities could spend $6.2 billion on energy optimization programs over a 10-year timeline. Table 4 provides the cumulative budget by customer segments from 2014 to 2023 for service providers.

Table 4. Program Budget for Achievable Potential Scenario (NPV in millions)[25]

Customer	Budget (2014 – 2023)
Residential	$2,828.15
Commercial	$2,707.05
Industrial	$748.98
Total	$6,284.18

[22] GDS Associates, Inc., 2013b
[23] Ibid.
[24] Energy Center of Wisconsin, 2009
[25] GDS Associates, Inc., 2013b

Given the projected budget for energy optimization programs from 2014 to 2023, the following expenditures were estimated based on a review of state efficiency programs and past Michigan spending:

- Program rebates
- Private and institutional spending
- Program administration.

Electric and natural gas utilities fund program rebates and cover program administration expenses. Through the implementation of the energy optimization program residential, commercial, and industrial utility customers cover 50 percent of the incremental costs of the efficiency measure and installation expenses. The net present value (NPV) of utility and customer costs are detailed by spending category in Table 5.

Table 5. Program and Participant Costs for Achievable Potential Scenario (NPV in millions)[26]

Category	Spending (2014 – 2023)
Efficiency Measure and Installation	$12,568.37
Program Rebates	$5,027.35
Private and Institutional Spending	$7,541.02
Program Administration	$1,256.84
Total	$13,825.20

Investments modeled in Scenario 1 over the next 10 years result in savings of 17 percent of projected electricity demand and 13.4 percent of projected demand for natural gas in Michigan.[27] The net present value of this energy savings equates to a monetary savings of $15,854,685,097 from 2014 to 2023.[28]

Scenario 2 – Constrained Achievable Potential

Scenario 2 is a subset of Scenario 1. It assumes a spending cap of approximately two percent of annual utility revenues compared to Scenario 1 which does not assume a spending cap.[29] By limiting energy optimization program spending to two percent of a utility's retail sales, Scenario 2 reflects the current spending caps required by PA 295. Scenario 2 also uses UCT to assess the economic validity of investments in energy efficiency measures.

Program budget projections from 2014 to 2023 were developed for the Constrained Achievable Potential scenario. Budgets were segmented by customer type which included residential, commercial, and industrial consumers. Given Scenario 2 assumptions, Michigan utilities could spend $2.3 billion on energy optimization programs over a 10-year timeline. Table 6 provides the cumulative budget by customer segments from 2014 to 2023.

[26] GDS Associates, Inc., 2013b
[27] Ibid.
[28] Ibid.
[29] Ibid.

Table 6. Program Budget for Constrained Achievable Scenario (NPV in millions)[30]

Customer	Budget (2014 – 2023)
Residential	$1,145.71
Commercial	$823.79
Industrial	$361.68
Total	$2,331.19

Given the projected budget for energy optimization program costs from 2014 to 2023, estimated expenditures related to program rebates, private and institutional spending, and program administration were developed. Utility and customer costs are detailed by spending category in Table 7.

Table 7. Program and Participant Costs for Constrained Achievable Scenario (NPV in millions)

Category	Spending (2014 – 2023)
Efficiency Measure and Installation	$4,662.38
Program Rebates	$1,864.95
Private and Institutional Spending	$2,797.43
Program Administration	$466.24
Total	$5,128.61

Investments modeled in Scenario 2 over the next 10 years could result in savings of 6.3 percent of projected electricity demand and 5.7 percent of projected demand for natural gas in Michigan.[31] The net present value of this energy savings equates to a monetary savings of $6,033,320,972 from 2014 to 2023.[32]

[30] Ibid.
[31] GDS Associates, Inc., 2013b
[32] Ibid.

ECONOMIC IMPACT FINDINGS

Overview of Model

The economic impact of the energy optimization program scenarios were estimated using IMPLAN to quantify direct, indirect, and induced economic effects. IMPLAN is a software and data package which enables development of input-output economic impact models for a particular geography or study area. Michigan state-level data for the year 2011 (the most recent data available) is used to build the model for this study. The models are developed to quantify the gross direct, indirect, and induced economic impacts based on spending changes in defined industries. Here is how these impacts are defined:

> **Direct** economic impact includes changes in production that result from final demand changes. In this case, direct impact may include increases in spending that result from additional purchases and installation of lighting, HVAC, refrigeration, water heating, insulation, and other equipment related to energy efficiency.[33]
>
> **Indirect** economic impact includes changes in production of inputs resulting from changes in demand for a final product. In this case, indirect impact may include new purchases of steel and plastics by firms producing components for energy efficient equipment and material.[34]
>
> **Induced** economic impact includes the changes in household spending patterns as a result of altered household income from direct and indirect impacts. In this case, induced impact may include increased spending by individuals employed by steel, plastic, and electronics manufacturing companies or other supply chain component or final product manufacturers.[35]
>
> **Total** economic impact is the sum of direct, indirect, and induced gross economic impacts for the energy efficient investments included in the scope of this study.[36]

[33] Minnesota IMPLAN Group, 2013
[34] Ibid.
[35] Ibid.
[36] Ibid.

Results

Program budget estimates were analyzed by the IMPLAN model for their direct, indirect, and induced impacts. Results were computed for the two scenarios on projected job-years supported, labor income, and total output. Results are defined below:

Employment (Job-years Supported) is the total number of jobs supported by the estimated program spending. This study examines employment impacts in the context of job-years. One job-year is equivalent to one year of employment for one person, or two people working for six months each, or three people working for four months each. The actual headcount will vary depending on the intensity and duration of employment.[37]

Labor Income is the sum total of all forms of employment income, including employee compensation (wages and benefits) and proprietor income.[38]

Output represents the total value of industry production. In IMPLAN, these are annual production estimates for the year of the data set and are in producer prices. For service providers, production is equal to sales.[39]

Summary of Impacts

Scenario summaries show the potential impact additional investment in energy efficient measures has on the Michigan economy. Results are cumulative gross job-years and economic impact estimates from the investments in energy efficient measures, installation activities and retrofits, measurement and evaluation services, energy efficient new construction, and energy optimization program administration.

Analysis of the Achievable Potential scenario indicates that program spending at this level has the potential to create a total gross impact of $22 billion on Michigan's economy, including more than 163,000 job-years supported and $7.6 billion in employee compensation over 10 years. Table 8 provides direct, indirect, and induced impacts for Scenario 1.

Table 8. Net Present Value of Impacts for Achievable Potential Scenario

Impacts	Job-Years	Labor Income (in millions)	Output (in millions)
Direct	83,451.40	$4,501.24	$12,745.64
Indirect	31,187.00	$1,473.25	$4,103.24
Induced	48,568.00	$1,674.07	$5,166.33
Total	163,206.40	$7,648.56	$22,015.21

[37] Minnesota IMPLAN Group, 2013
[38] Ibid.
[39] Ibid.

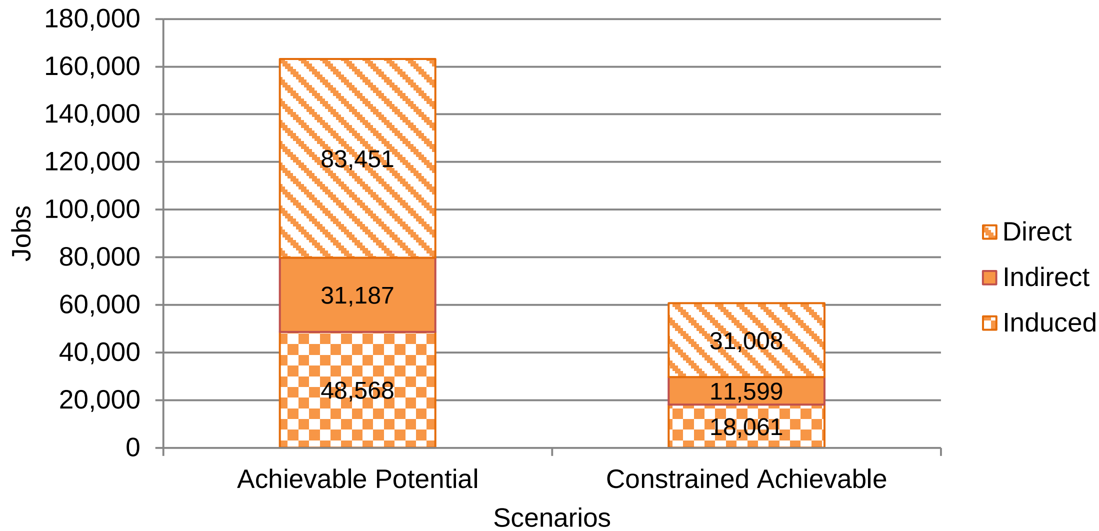
The summary of gross impacts for the Constrained Achievable Potential scenario shows a total output of $8.1 billion, including more than 60,000 job-years supported and $2.8 billion in employee compensation over 10 years. Table 9 provides direct, indirect, and induced impacts for Scenario 2.

Table 9. Net Present Value of Impacts for Constrained Achievable Potential Scenario

Impacts	Job-Years	Labor Income (in millions)	Output (in millions)
Direct	31,007.70	$1,665.12	$4,715.96
Indirect	11,598.50	$545.08	$1,518.21
Induced	18,061.00	$619.30	$1,911.23
Total	60,667.30	$2,829.50	$8,145.40

During the modeled 10-year timeframe, between 60,000 and 163,000 cumulative job-years may be supported in attaining the two energy optimization program scenarios. Figure 4 shows the gross job-years supported by additional investment in energy efficiency programs.

Figure 4. Job-years Supported from Energy Optimization Program Scenarios 2014 to 2023



CONCLUSION

The conversation about energy efficiency is most often in the context of environmental stewardship. While this conversation is important and worthwhile, it often fails to acknowledge the economic impacts that arise from investments in energy efficiency. As this study shows, there are economic benefits derived from investment in energy efficient measures, installation activities and retrofits, measurement and evaluation services, energy efficient new construction, and energy optimization program administration.

Input-output economic impact analysis of the two scenarios indicates that the activities associated with program investments could positively impact Michigan. The Achievable Potential scenario could result in $22 billion in total output, including more than 163,000 job-years supported and $7.6 billion in employment compensation. The Constrained Achievable Potential scenario could impact Michigan through $8.1 billion of total output, including more than 60,000 job-years supported, and $2.8 billion in employment compensation. These results are gross estimates over a 10-year period.

Continuing the policies of capped program spending at two percent of utility revenues over the next 10 years will have a sustained impact on Michigan and enable further energy savings by Michigan service providers and utility customers. However, increased investment in the state's energy efficiency program, as modeled in the Achievable Potential scenario, has the ability to significantly decrease the state's dependence on imported energy by reducing energy waste and increase economic vitality by supporting jobs for Michigan's workforce and creating value added output for its strong industrial supply chain.

These results are not intended to advocate for or against any particular policy, strategy, or investment but rather serve as an assessment of the impacts that investments in energy efficiency may have on Michigan's economy. As policy makers, industry leaders, and other stakeholders begin to understand the economic impact of additional investments in improving Michigan's energy efficiency and plan for the future of Michigan's economy, the following are potential considerations:

1. A state-level strategy for energy efficiency development and state policy changes should be developed in the context of the likely return on investment these programs will have on the economic environment of the state.
2. Investments in energy efficiency at the state level, combined with the development of additional renewable energy sources, may significantly decrease Michigan's dependence on imported energy and increase local and regional economic investment.
3. Though not modeled in this report, the energy savings attributed to energy optimization programs may have additional economic impacts on residential, commercial, and industrial customers. By decreasing electricity and natural gas energy expenditures, the end consumer will have more disposable income to invest in Michigan.
4. Impacts on Michigan's economy may increase if Michigan businesses are able to meet the demand from energy optimization program investments to a degree higher than modeled. Efforts to encourage the use of local supply chains may help attract new investment from out-of-state firms and increase efficiencies in infrastructure development.

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APPENDIX A: PROJECTED ANNUAL PROGRAM BUDGETS

Given situational assumptions, annual budgets for two potential energy optimization program scenarios were developed for 2014 to 2023. The annual budgets for the two scenarios are presented in Table 10.

Table 10. Projected Energy Optimization Program Budget (in millions)[40]

Scenario	Customer Type	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Achievable Potential UTC	Residential	$310.30	$335.50	$339.70	$343.30	$344.60	$345.80	$345.60	$346.90	$346.10	$345.30
	Commercial	$299.80	$363.60	$367.50	$367.60	$311.80	$318.50	$293.30	$298.10	$308.00	$307.00
	Industrial	$72.40	$107.80	$125.10	$124.50	$87.70	$88.00	$69.40	$69.50	$70.40	$72.80
	Total	$682.50	$807.00	$832.40	$835.40	$744.10	$752.20	$708.30	$714.50	$724.50	$725.10
Constrained Achievable Potential UTC	Residential	$136.30	$135.20	$135.50	$136.30	$137.00	$137.80	$138.60	$139.40	$140.20	$141.00
	Commercial	$92.80	$93.70	$95.40	$96.90	$98.40	$100.00	$101.60	$103.20	$104.90	$106.50
	Industrial	$40.70	$41.20	$42.00	$42.70	$43.20	$43.90	$44.50	$45.20	$46.00	$46.70
	Total	$269.80	$270.10	$272.90	$275.80	$278.70	$281.70	$284.70	$287.80	$291.00	$294.20

[40] GDS Associates, 2013b

APPENDIX B: INDUSTRY SECTORS

Once spending was quantified by category, models were developed to estimate the economic impact of investment in specific products and sectors utilizing IMPLAN to calculate economic inputs and outputs. Michigan state-level data for the year 2011 (the most recent data available) was used to build the model for this study. The models were developed to quantify the direct, indirect, and induced economic impacts based on spending changes in defined industries. The industry sectors used in the study are listed in Table 11.

Table 11. Program Equipment and Labor Investments to IMPLAN Industry Sectors

IMPLAN Number	IMPLAN Industry
34	Construction of new nonresidential commercial and health care structures
35	Construction of new nonresidential manufacturing structures
36	Construction of other new nonresidential structures
37	Construction of new residential permanent site single- and multi-family structures
38	Construction of other new residential structures
39	Maintenance and repair construction of nonresidential structures
40	Maintenance and repair construction of residential structures
216	Air conditioning, refrigeration, and warm air heating equipment manufacturing
259	Electric lamp bulb and part manufacturing
260	Lighting fixture manufacturing
261	Small electrical appliance manufacturing
275	All other miscellaneous electrical equipment and component manufacturing
322	Retail stores - Electronics and appliances
369	Architectural, engineering, and related services
385	Office administrative services

APPENDIX C: RESEARCH LIMITATIONS

The following are additional considerations to be consulted while reviewing the results of this study.

- Data used for this report is cited from current, reliable sources. When conflicts in data arose, the most conservative estimates were utilized to avoid overestimation.

- The study relies heavily on secondary data since a lack of primary data was available to researchers. Assumptions made by researchers in the development of source data are reflected in the results of this study.

- Import and export figures for the state of Michigan are calculated by the IMPLAN model. IMPLAN's default values and percentages were used to quantify the Michigan trade flows. Modification of the IMPLAN industry margins, ratios, and percentages may allow for the creation of a more exact model should primary data become available. Impacts on Michigan's economy may increase if Michigan businesses are able to meet the increased activity from investments in energy efficiency to a degree higher than modeled.

- Researchers originally intended to model impacts of policy changes to Michigan's energy optimization program in conjunction with modifications to the state's renewable portfolio standard (RPS). This energy optimization program report serves as an addendum to the previously completed RPS report, *Economic Impact of Two Renewable Portfolio Standard Scenarios in Michigan, 2015 to 2025*.

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