Comments of the Natural Resources Defense Council

Re the Draft LARA/MEO "Readying Michigan to Make Good Energy Decisions: Energy Efficiency" Report

November 6, 2013

On behalf of our nearly 14,000 members in the State of Michigan, the Natural Resources Defense Council advocates for cleaner, safer, more affordable and reliable energy through the greater use of renewable energy and energy efficiency. We welcome the opportunity to provide comments on the October 22, 2013 draft energy efficiency component of the "Readying Michigan to Make Good Energy Decisions" paper (LARA/MEO draft), and on the GDS potential study, which was included in draft form as an appendix to the LARA/MEO draft and has since been circulated in final form. Our comments cover the extent to which the GDS study represents the full cost-effective potential for energy efficiency in Michigan, and the policy implications of its findings. It is evident that Michigan has only scratched the surface of its energy efficiency opportunities and these three areas will greatly impact Michigan's ability to capture its full potential.

Achievable Potential in Michigan --
The final GDS study concludes that Michigan's utilities could reduce electricity demand by 9.4% over five years between 2014 and 2018, or roughly 1.9% per year, under the utility cost test (UCT), which is the mandated cost-benefit test used to assess cost-effectiveness of efficiency programs in Michigan. The GDS study also concludes Michigan's utilities could cost-effectively reduce demand by another 5.6% over the next five year period between 2018 and 2023. Achieving this level of savings over 10 years of programs would, according to the study, result in net benefits of more than $10 billion dollars for Michigan's electricity customers (p. 9, Table 1-10)

For a number of reasons, we believe this estimated potential is significantly understated.

- First, the study inappropriately limits the level of incentives that program administrators could offer customers to participate in an energy efficiency program. This means that programs expected to deliver cost-effective (ie, saving customers more money than the cost of the programs) savings with incentive levels at 60%, 70% or 80% of the incremental costs of the measure were eliminated from consideration in this study. The final GDS study therefore does not provide actual estimates of all of the savings that could be cost-effectively captured.

    - Since, as acknowledged in the study itself, none of the three scenarios could be considered a "maximum" achievable scenario, NRDC contracted with GDS to analyze the potential without the arbitrary limit on incentive levels. GDS provided that data on November 6, 2013. This analysis concludes that the cost-effective potential for electricity savings under the TRC in 2018 and 2023 would be 11.2% and 17.6%

respectively. The net benefits of achieving this level of savings over 10 years of programs would be $12.9 billion, almost 3 billion more dollars than both the achievable TRC and UCT scenarios and almost 10 billion more dollars than the constrained UCT. The ratio of benefits to cost under this more aggressive energy efficiency scenario remains robust, at 2.55, compared to 2.71 to 2.79 for the less aggressive scenarios. The GDS analysis of the Maximum Achievable Potential scenario is attached to these comments as Appendix A.

- Second, the study does not adequately take into consideration emerging LED technology, which is one area that presents a substantial energy savings opportunity. LED alternatives to linear recessed ceiling fixtures, can, by current estimates, provide 70% more savings than the retrofit of a standard T8 with an HPT8. These savings are expected to increase to more than double the savings by 2015 and approach triple the savings by 2020. [1] Another area that leading states are capitalizing on is the commercial and industrial sector (C&I). These states are planning to achieve a greater percentage of their savings from the C&I sector as savings potential from measures like residential CFLs diminishes.

- Third, the study does not include any estimate of the potential for combined heat and power (CHP) to play a role in achieving industrial or commercial savings. ICF International estimates[2] that there is more than 4700 MW of capacity for CHP in Michigan. As the draft LARA/MEO paper notes, the Michigan Energy Innovation Business Council raised the importance of capturing the potential for cost-effective CHP systems among the state policy objectives.

Spending Caps Costs Electric Customers Billions in Higher Electricity Bills

Despite its shortcomings, the GDS draft study does illuminate an important insight about energy efficiency spending caps[3], namely that they are a penny-wise-but-pound-foolish strategy that ultimately costs electricity customers billions of dollars. On page nine of the GDS Study, Table 1-10 presents three estimates of the net benefits that would be passed on to customers as a result of achieving the identified cost-effective potential for savings under the three alternative cost/benefit tests. That table shows clearly that the effect of the cap on energy efficiency budgets of 2% of revenues (which is the "constraint" in the "Constrained UCT" scenario) is to slash the net benefits of a 10-year investment from $10.1 billion under the unconstrained UCT test, to $3.7 billion, costing customers $6.4 billion. Put simply, capping the investment on the cheapest resource available to utilities will force investment in more expensive resources, and doing so for 10 years will cost Michigan customers $6.4 billion (or nearly $10 billion when you consider the Maximum Achievable Scenario under which total net benefits would be nearly $13 billion).

Utilities argue that the cap is meant to help balance short and long-term costs and benefits, but in reality the cap pushes utilities toward short-term savings in place of deeper, longer-term savings.

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[1] Direct Testimony of Chris Neme on Consumers Energy Company for Approval of a Certificate of Necessity for the Thetford Generating Plant, Michigan Docket U-17429, http://efile.mpsc.state.mi.us/efile/docs/17429/0256.pdf

[2] [ICF citation]

[3] Our reference to a spending cap for the purpose of this memo refers to Section 89(3) of P.A. 295 which limits recovery of costs exceeding 1.7% of revenues for primary customer and 2.2% of revenues for secondary and residential customers. These limits apply to the amount of money the utilities can recover to meet the targets set out in section 77 of the statute. There is no limit on the extent to which a utility may choose energy efficiency as a resource above and beyond those statutorily required amounts in the context of an IRP proceeding or when otherwise making resource choices.

Another claim is that spending caps are a protection mechanism for ratepayers, but this fails to recognize that energy efficiency is no longer a new concept and its costs have repeatedly come in lower than new and existing fossil power plants. As a result, spending caps act as nothing more than an artificial barrier to obtaining the lowest cost energy. Ultimately, to ensure energy efficiency equal opportunity as a resource option, the spending cap should be eliminated.

The goal of the policy should be to capture all of the potential for savings that is cost-effective. In other words, if the savings is cheaper to acquire than it would be to meet that same electricity demand by generating power in a power plant, transmitting it to a community and distributing it to customers, then the utility should not be restricted from capturing that savings. If there is a cap at all, it should be set at a level that enables pursuit of all cost-effective potential.

Constrained Potential Estimates Are Unrealistically Low

The GDS study concludes that under the current 2% of revenues limit on energy efficiency budgets, utilities would be able to achieve only a 0.6% savings per year, well below even the current 1% requirement. This flies in the face of historical energy efficiency performance both in Michigan and in other states, and controverts Consumers Energy's own testimony regarding its anticipated savings over the next decade.

The electric utilities have exceeded their targets in every year since the programs began, by amounts ranging from 16% to 49%. More importantly, both Consumers Energy and Detroit Edison have submitted biennial energy optimization plans this year which project that they will exceed their 1% targets within the budget caps in future plan years.

Moreover, Consumers Energy has testified before the Michigan Public Service Commission in recent months that it can achieve a 1% target under the 2% budget cap for at least the next 9 years. Specifically, a recent Consumers Energy Integrated Resource Plan (IRP) states that "The Company's comprehensive energy optimization program will continue to produce 1% per year in savings through 2022 when program spending caps imposed by PA 295 are expected to be reached."[4] Consumers' testimony further affirms that a 1% savings target is not only feasible, but consistent and even below the median for other Midwestern states. A table entitled Summary of Midwestern EE Potential Studies clearly shows that the median achievable potential for percent savings per year is 1.1% and this is according to data from 2008 and 2009.[5] In general, Consumers also notes that factors influencing a utility's ability to reach the 1% target include technological advancement, economic growth, regulatory/statutory spending limits, and program rebates amounts.[6] All of which are areas we identify to be underestimated and undervalued, and that if corrected could only push the annual savings potential higher.

Under current law, the obligation to meet the target is subject to the restrictions on recovery of program spending. There has obviously been no occasion in which a utility has been unable to meet the

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[4] Application of Consumers Energy Company for Approval of a Certificate of Necessity for the Thetford Generating Plant, Michigan Docket U-17429, http://efile.mpsc.state.mi.us/efile/docs/17429/0003.pdf

[5] Exhibit A-84 Testimony of Teri L. Van Sumeren, Application of Consumers Energy Company for Approval of a Certificate of Necessity for the Thetford Generating Plant, Michigan Docket U-17429, http://efile.mpsc.state.mi.us/efile/docs/17429/0003.pdf

[6] Testimony of Teri L. Van Sumeren, Application of Consumers Energy Company for Approval of a Certificate of Necessity for the Thetford Generating Plant, Michigan Docket U-17429, http://efile.mpsc.state.mi.us/efile/docs/17429/0003.pdf

target within the caps on recovery of program spending. In fact, the utilities project that they will continue to exceed the target and earn performance incentives accordingly.

Conclusion:

NRDC appreciates the opportunity to comment on the draft study. We reiterate our earlier recommendation that the energy efficiency target for Michigan be increased to 2% of sales per year, from the current target of 1% per year. The final GDS potential study demonstrates that this target is consistent with a conservative estimate of the cost-effective potential for at least the next five years, and that achieving that potential over five years would result in a net benefit to the state's consumers of more than $5 billion. The targets for later years could be reassessed in 2017 for years after 2018, and could be adjusted either upward or downward based on analysis that could take into consideration the development of new programs, new technologies and new federal policies in place at that time.

GDS Associates, Inc.
Engineers and Consultants

MICHIGAN ELECTRIC AND NATURAL GAS ENERGY EFFICIENCY POTENTIAL STUDY

ADDITIONAL SCENARIO MEMO

Prepared for:

NATURAL RESOURCES DEFENSE COUNCIL

November 6, 2013

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1 EXECUTIVE SUMMARY

1.1 BACKGROUND

The Michigan Public Service Commission (MPSC), DTE Energy and Consumers Energy worked together to complete a 2013 study of energy efficiency potential in the state of Michigan. The energy efficiency potential study provides a roadmap for policy makers and identifies the energy efficiency measures having the greatest potential savings and the measures that are the most cost effective.

In addition to technical and economic potential estimates, the development of achievable potential estimates for a range of feasible energy efficiency measures is useful for program planning and modification purposes. Unlike achievable potential estimates, technical and economic potential estimates do not include customer acceptance considerations for energy efficiency measures, which are often among the most important factors when estimating the likely customer response to new programs. For this study, GDS Associates, the consulting firm retained to conduct the study, produced the following estimates of energy efficiency potential:

- Technical potential
- Economic potential
- Achievable potential

At various times throughout the completion of the study, the MPSC, DTE and Consumers Energy invited the various stakeholders in Michigan to provide their insights and suggestions with respect to the methodology and assumptions GDS should use to complete the study. GDS led a series of stakeholder meetings to discuss these insights and suggestions. All comments from the stakeholders were carefully reviewed. Ultimately, the MPSC made the final decision regarding whether or not to incorporate any stakeholder suggestions into the development of modeling assumptions and various methodological approaches.

One methodological approach which the MPSC approved for the statewide study was an assumption that participant incentives would be equal to 50% of the incremental measure cost when estimating the economic and achievable potential. Due to the fact that none of the achievable potential scenarios included in the statewide study assumed that participant incentives would be equal to 100% of the incremental measure cost, none of the scenarios included in the study is considered a "maximum achievable potential" scenario.

Chris Neme, a representative speaking on behalf of The Natural Resources Defense Council (NRDC), contacted the MPSC and GDS to request that GDS evaluate an additional TRC achievable potential scenario which incorporates the assumption of participant incentives equal to 100% of the incremental measure cost. GDS agreed to conduct this scenario as a sub-contractor to the NRDC representative. The purpose of this document is to provide the results of this additional maximum achievable potential scenario.

Some of the content of the Executive Summary chapter from the final report of the Michigan Electric and Natural Gas Energy Efficiency Potential Study is reproduced below. There are descriptions of the types of energy efficiency potential, a description of the three achievable potential scenarios in the final report, plus the additional scenario conducted at the request of the NRDC, a brief description of the study scope, a presentation of the final report results, and a comparison of the final report results to the results of the additional scenario requested by the NRDC.

Definitions of the types of energy efficiency potential are provided below.

1. **TECHNICAL POTENTIAL** is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end-users to adopt the efficiency measures. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy

saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.

2. **ECONOMIC POTENTIAL** refers to the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources. Both technical and economic potential are theoretical numbers that assume immediate implementation of efficiency measures, with no regard for the gradual "ramping up" process of real-life programs. In addition, they ignore market barriers to ensuring actual implementation of efficiency. Finally, they only consider the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration) that would be necessary to capture them.

3. **ACHIEVABLE POTENTIAL** is the amount of energy use that efficiency can realistically be expected to displace assuming different market penetration scenarios for cost effective energy efficiency measures. An aggressive scenario, for example, could, provide program participants with payments for the entire incremental cost of more energy efficient equipment). This is often referred to as "maximum achievable potential". Achievable potential takes into account real-world barriers to convincing end-users to adopt cost effective energy efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.[1] Achievable savings potential savings is a subset of economic potential.

This potential study evaluates three achievable potential scenarios:

1) **Scenario #1**: For the first scenario, achievable potential represents the amount of energy use that efficiency can realistically be expected to displace assuming incentives equal to 50% of the incremental measure cost and no spending cap. Cost effectiveness of measures was determined with the Utility Cost Test.
2) **Scenario #2**: For the second scenario, achievable potential is based on measure cost effectiveness screening using the Total Resource Cost Test with utility incentives again equal to 50% of measure costs.
3) **Scenario #3**: The third scenario is a subset of Achievable Scenario #1(based on UCT). While scenario #1 assumed no spending cap on efficiency measures, Achievable Scenario #3 assumed a spending cap of approximately 2% of annual utility revenues. The third scenario assumes a spending cap of 2% of annual utility revenue in order to align the scenario with the existing legislation in the state of Michigan. According to Public Act 295 of 2008, gas and electric utilities are not permitted (without specific approval from the Commission) to spend more than 2.0% of retail sales in attempting to comply with the energy optimization performance standard.
4) **Scenario #4 (requested by the NRDC)**: For the fourth scenario, achievable potential is based on measure cost effectiveness screening using the Total Resource Cost Test with utility incentives equal to 100% of measure cost. This scenario was evaluated at the special request of the National Resources Defense Council and is not included in the Michigan Electric and Natural Gas Energy Efficiency Potential Study final report. The key feature of this scenario is the 100% incentives assumption. When this assumption is used, the achievable potential is typically called "Maximum Achievable" potential because the participant cost barrier has been completely removed.

The purpose of this energy efficiency potential study is to provide a foundation for the continuation of utility-administered energy efficiency programs in Michigan and to determine the remaining opportunities for cost effective electricity and natural gas energy efficiency savings for the state of Michigan. This detailed report presents results of the technical, economic, and achievable potential for electric and natural gas efficiency measures in Michigan for two time periods:

[1] These definitions are from the November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies"

- The five-year period from January 1, 2014 through December 31, 2018
- The ten-year period from January 1, 2014 through December 31, 2023

All results were developed using customized residential, commercial and industrial sector-level potential assessment analytic models and Michigan-specific cost effectiveness criteria including the most recent Michigan-specific avoided cost projections for electricity and natural gas. To help inform these energy efficiency potential models, up-to-date energy efficiency measure data were primarily obtained from the following recent studies and reports:

1) Michigan Energy Measures Database (MEMD)
2) Energy efficiency baseline studies conducted by DTE Energy and Consumers Energy
3) 2009 EIA Residential Energy Consumption Survey (RECS)
4) 2007 American Housing Survey (AHS)
5) 2003 EIA Commercial Building Energy Consumption Survey (CBECS)[2]

The above data sources provided valuable information regarding the current saturation, costs, savings and useful lives of electric and natural gas energy efficiency measures considered in this study.

The results of this study provide detailed information on energy efficiency measures that are the most cost effective and have the greatest potential electric and natural gas savings for the State of Michigan. The data used for this report were the best available at the time this analysis was developed. As building and appliance codes and energy efficiency standards change, and as energy prices fluctuate, additional opportunities for energy efficiency may occur while current practices may become outdated.

1.2 STUDY SCOPE

The study examines the potential to reduce electric consumption and peak demand and natural gas consumption through the implementation of energy efficiency technologies and practices in residential, commercial, and industrial facilities in Michigan. This study assesses electric and natural gas energy efficiency potential in Michigan over ten years, from 2014 through 2023.

The study had the following main objectives:

- Evaluate the electric and natural gas energy efficiency technical, economic and achievable potential savings in the State of Michigan;
- Calculate the economic and achievable potential energy efficiency savings based upon cost effectiveness screening with both the TRC and UCT benefit/cost ratios.

As noted above, the scope of this study distinguishes among three types of energy efficiency potential; (1) technical, (2) economic, and (3) achievable potential. The definitions used in this study for energy efficiency potential estimates were obtained directly from a 2007 National Action Plan for Energy Efficiency (NAPEE) report. Figure 1-1 below provides a graphical representation of the relationship of the various definitions of energy efficiency potential.

[2] This is the latest publicly available CBECS data released by the Energy Information Administration (EIA).

Figure 1-1: Types of Energy Efficiency Potential[3]

<table>
<tr><td>Not Technically Feasable</td><td colspan="3">Technical Potential</td></tr>
<tr><td>Not Technically Feasable</td><td>Not Cost Effective</td><td colspan="2">Economic Potential</td></tr>
<tr><td>Not Technically Feasable</td><td>Not Cost Effective</td><td>Market & Adoption Barriers</td><td>Achievable Potential</td></tr>
</table>

Limitations to the scope of study: As with any assessment of energy efficiency potential, this study necessarily builds on a large number of assumptions and data sources, including the following:

- Energy efficiency measure lives, measure savings and measure costs
- The discount rate for determining the net present value of future savings
- Projected penetration rates for energy efficiency measures
- Projections of Michigan specific electric and natural gas avoided costs
- Future changes to current energy efficiency codes and standards for buildings and equipment

While the GDS Team has sought to use the best and most current available data, there are many assumptions where there may be reasonable alternative assumptions that would yield somewhat different results. Furthermore, while the lists of energy efficiency measures examined in this study represent most commercially available measures, these measure lists are not exhaustive.

With respect to non-energy benefits of energy efficiency programs, GDS did include an adder of $9.25 per ton of carbon for reduced emissions of CO2. This is the expected value for reduced carbon emissions based upon equal weighting of a scenario with no carbon taxes and a scenario where a carbon tax of $18.50 per ton is implemented in the future.

Finally there was no attempt to place a dollar value on some difficult to quantify benefits arising from installation of some measures, such as increased comfort or increased safety, which may in turn support some personal choices to implement particular measures that may otherwise not be cost-effective or only marginally so.

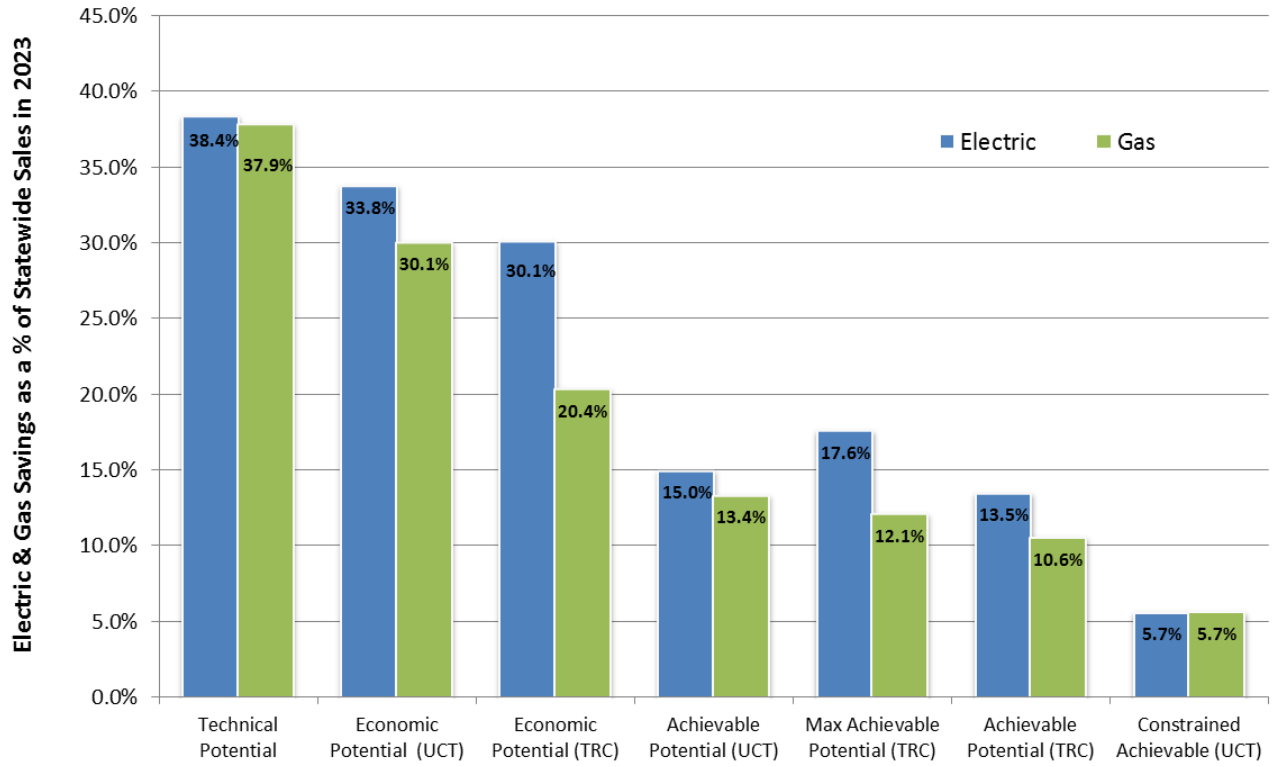
1.3 SUMMARY OF RESULTS

This study examined 1,417 electric energy efficiency measures and 922 natural gas measures in the residential, commercial and industrial sectors combined.

Figure 1-2 below shows that cost effective electric energy efficiency resources can play a significantly expanded role in Michigan's energy resource mix over the next five and ten years. For the State of Michigan overall, the achievable potential for electricity savings based on the UCT in 2023 is 15.0% of forecast kWh sales for 2023. For the State overall, the achievable potential for natural gas savings based on the UCT in 2023 is also 13.4% of forecast MMBtu sales for 2023. The achievable potential for electricity savings based on the TRC with 100% participant incentives, is 17.6% of forecast kWh sales for 2023. The achievable potential for natural gas savings based on the TRC with 100% participant incentives, is 12.1% of forecast MMBtu sales in 2023.

[3] Reproduced from "Guide to Resource Planning with Energy Efficiency" November 2007. US EPA. Figure 2-1.

Figure 1-2: Electric & Gas Energy Efficiency Potential Savings Summary



Tables 1-1 and 1-2 present additional detail, providing the energy efficiency savings potential for all scenarios over a period of 5 and 10 years, respectively.

Table 1-1: Summary of Technical, Economic and Achievable Electric and Gas Energy Savings for 2018

END USE	TECHNICAL POTENTIAL	ECONOMIC POTENTIAL (UCT)	ECONOMIC POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (UCT)	MAX ACHIEVABLE POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (TRC)	CONSTRAINED ACHIEVABLE (UCT)
Electric Sales MWh							
Savings % - Residential	45.8%	41.3%	39.8%	10.7%	15.1%	10.5%	4.3%
Savings % - Commercial	48.5%	44.9%	37.4%	12.2%	12.8%	10.5%	3.1%
Savings % - Industrial	27.0%	21.0%	19.3%	4.9%	5.5%	4.5%	2.3%
Savings % - Total	**40.7%**	**36.1%**	**32.4%**	**9.4%**	**11.2%**	**8.6%**	**3.2%**
Savings mWh - Residential	15,481,730	13,967,946	13,466,463	3,622,394	5,108,570	3,549,596	1,465,036
Savings mWh - Commercial	18,525,217	17,186,647	14,282,862	4,651,994	4,899,354	4,004,548	1,188,821
Savings mWh - Industrial	9,180,717	7,133,458	6,568,017	1,674,490	1,873,345	1,537,639	785,903
Savings mWh - Total	**43,187,664**	**38,288,051**	**34,317,341**	**9,948,878**	**11,881,269**	**9,091,783**	**3,439,760**
Electric Demand MW							
Savings % - Residential	42.7%	38.9%	41.0%	8.4%	12.8%	8.9%	3.4%
Savings % - Commercial	53.8%	49.9%	42.3%	12.2%	13.1%	10.6%	3.1%
Savings % - Industrial	40.6%	30.8%	27.5%	6.7%	7.5%	6.3%	3.1%
Savings % - Total	**47.0%**	**42.1%**	**39.2%**	**9.7%**	**12.0%**	**9.2%**	**3.2%**
Savings MW - Residential	4,274	3,895	4,106	839	1,287	892	340
Savings MW - Commercial	5,715	5,300	4,496	1,292	1,390	1,127	334
Savings MW - Industrial	1,790	1,360	1210.49	296	331	278.5	138
Savings MW - Total	**11,779**	**10,555**	**9,812**	**2,426**	**3,008**	**2,298**	**812**
Natural Gas Sales MMBtu							
Savings % - Residential	45.9%	34.8%	19.4%	9.4%	7.5%	7.1%	3.8%
Savings % - Commercial	34.6%	29.8%	24.2%	6.1%	7.0%	5.4%	3.1%
Savings % - Industrial	16.1%	13.0%	12.1%	2.7%	3.2%	2.5%	0.7%
Savings % - Total	**35.2%**	**27.8%**	**18.8%**	**6.8%**	**6.3%**	**5.5%**	**2.8%**

END USE	TECHNICAL POTENTIAL	ECONOMIC POTENTIAL (UCT)	ECONOMIC POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (UCT)	MAX ACHIEVABLE POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (TRC)	CONSTRAINED ACHIEVABLE (UCT)
Savings MMBtu - Residential	136,706,666	103,587,007	57,885,592	27,930,065	22,375,986	21,296,093	11,332,060
Savings MMBtu - Commercial	58,904,392	50,760,002	41,188,176	10,382,936	11,842,309	9,274,379	5,309,780
Savings MMBtu - Industrial	26,183,022	21,190,526	19,611,597	4,451,220	5,213,321	3,986,192	1,070,312
Savings MMBtu - Total	**221,794,080**	**175,537,535**	**118,685,365**	**42,764,221**	**39,431,615**	**34,556,665**	**17,712,153**

Table 1-2: Summary of Technical, Economic and Achievable Electric and Gas Energy Savings for 2023

END USE	TECHNICAL POTENTIAL	ECONOMIC POTENTIAL (UCT)	ECONOMIC POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (UCT)	MAX ACHIEVABLE POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (TRC)	CONSTRAINED ACHIEVABLE (UCT)
Electric Sales MWh							
Savings % - Residential	39.7%	35.2%	33.7%	14.7%	21.0%	14.3%	5.9%
Savings % - Commercial	48.0%	44.5%	37.0%	20.8%	21.6%	17.6%	6.0%
Savings % - Industrial	26.4%	20.5%	18.9%	8.9%	9.9%	8.1%	5.0%
Savings % - Total	**38.4%**	**33.8%**	**30.1%**	**15.0%**	**17.6%**	**13.5%**	**5.7%**
Savings mWh - Residential	13,697,929	12,146,247	11,644,006	5,070,834	7,240,643	4,946,942	2,044,561
Savings mWh - Commercial	18,601,147	17,251,862	14,344,326	8,057,699	8,381,561	6,835,102	2,326,054
Savings mWh - Industrial	9,180,717	7,133,458	6,568,017	3,087,742	3,428,837	2,816,429	1,735,830
Savings mWh - Total	**41,479,793**	**36,531,567**	**32,556,350**	**16,216,275**	**19,051,040**	**14,598,473**	**6,106,445**
Electric Demand MW							
Savings % - Residential	40.5%	36.7%	38.9%	13.1%	20.8%	14.1%	5.3%
Savings % - Commercial	53.2%	49.3%	41.9%	22.6%	24.3%	19.7%	6.8%
Savings % - Industrial	39.7%	30.2%	26.9%	12.7%	14.2%	12.0%	7.4%
Savings % - Total	**45.7%**	**40.9%**	**38.0%**	**17.0%**	**21.1%**	**16.1%**	**6.3%**
Savings MW - Residential	4,138	3,758	3,980	1,338	2,125	1,447	540

END USE	TECHNICAL POTENTIAL	ECONOMIC POTENTIAL (UCT)	ECONOMIC POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (UCT)	MAX ACHIEVABLE POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (TRC)	CONSTRAINED ACHIEVABLE (UCT)
Savings MW - Commercial	5,741	5,325	4,519	2,433	2,624	2,128	737
Savings MW - Industrial	1,790	1,360	1210	571	639	539.2	335
Savings MW - Total	**11,669**	**10,442**	**9,709**	**4,342**	**5,388**	**4,114**	**1,613**
Natural Gas Sales MMBtu							
Savings % - Residential	51.0%	38.9%	22.1%	18.9%	14.8%	14.0%	7.7%
Savings % - Commercial	34.9%	30.1%	24.4%	12.3%	14.0%	11.0%	6.3%
Savings % - Industrial	17.1%	13.8%	12.8%	4.4%	5.2%	3.9%	1.3%
Savings % - Total	**37.9%**	**30.1%**	**20.4%**	**13.4%**	**12.1%**	**10.6%**	**5.7%**
Savings MMBtu - Residential	143,271,591	109,298,652	62,091,152	53,178,705	41,622,424	39,326,470	21,495,414
Savings MMBtu - Commercial	59,047,573	50,950,115	41,298,436	20,766,093	23,684,617	18,548,759	10,743,415
Savings MMBtu - Industrial	26,183,022	21,190,526	19,611,597	6,677,438	7,916,107	6,013,211	2,038,818
Savings MMBtu - Total	**228,502,186**	**181,439,293**	**123,001,185**	**80,622,236**	**73,223,149**	**63,888,440**	**34,277,647**

Last, the five-year and ten-year budgets and acquisition costs for the achievable potential scenarios for electric and natural gas energy efficiency savings are shown in Table 1-3 and 1-4.

GDS is providing the information on the projected acquisition per first year unit of energy saved in order to provide program planners and decision-makers with the expected cost to utilities to acquire the electric and natural gas savings for the three achievable potential scenarios examined in this report. It is important for program planners and other decision-makers to have a good understanding of the cost to utilities to acquire these levels of energy efficiency savings.

Table 1-3: Achievable Potential Scenarios; Budgets and Acquisition Costs Per Unit of Energy Saved – Electric Savings (Budgets Are Not in Present Value Dollars)

ALL SECTORS COMBINED	5 - YEAR EE BUDGET	10-YEAR EE BUDGET	ACQUISITION COST PER FIRST YEAR KWH SAVED - 5 YEARS	ACQUISITION COST PER FIRST YEAR KWH SAVED - 10 YEARS
Achievable UCT	$2,644,861,311	$5,019,681,110	$0.24	$0.22
Max. Achievable TRC	$4,079,030,372	$8,011,335,248	$0.31	$0.29
Achievable TRC	$1,678,655,015	$3,285,131,139	$0.16	$0.16
Constrained UCT	$860,355,319	$1,774,960,027	$0.22	$0.20

Table 1-4: Achievable Potential Scenarios; Budgets and Acquisition Costs Per Unit of Energy Saved – Natural Gas Savings (Budgets Are Not in Present Value Dollars)

ALL SECTORS COMBINED	5 - YEAR EE BUDGET	10-YEAR EE BUDGET	ACQUISITION COST PER FIRST YEAR MMBTU SAVED - 5 YEARS	ACQUISITION COST PER FIRST YEAR MMBTU SAVED - 10 YEARS
Achievable UCT	$1,256,502,449	$2,506,262,004	$26.37	$25.57
Max. Achievable TRC	$1,456,241,396	$2,894,750,866	$31.94	$30.70
Achievable TRC	$698,817,669	$1,395,301,521	$17.56	$16.86
Constrained UCT	$506,943,484	$1,031,893,201	$25.87	$24.92

Table 1-5 presents the sum of the utility energy efficiency budgets (not present valued) for five and ten years for each achievable potential scenario for electric and natural gas measures combined. The net present value budgets for five and ten years are provided in Tables 1-9 and 1-10.

Table 1-5: Achievable Potential Scenarios; Total Budgets for Electric and Natural Gas Savings Combined (Budgets Are Not in Present Value Dollars)

ALL SECTORS COMBINED	5 - YEAR EE BUDGET	10-YEAR EE BUDGET
Achievable UCT	$3,901,363,759	$7,525,943,114
Max. Achievable TRC	$5,535,271,768	$10,906,086,114
Achievable TRC	$2,377,472,684	$4,680,432,660
Constrained UCT	$1,367,298,803	$2,806,853,228

Tables 1-6, through 1-9 present the annual utility budgets in total and by sector required to achieve the savings levels in each achievable potential scenario. These tables also present annual information on the percent of annual utility revenues needed each year to fund acquiring the energy savings levels for each achievable potential scenario.

Table 1-6: Annual Program Budgets Associated with the Achievable UCT Scenario (in millions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Residential	$310.3	$335.5	$339.7	$343.3	$344.6	$345.8	$345.6	$346.9	$346.1	$345.3
Commercial	$299.8	$363.6	$367.5	$367.6	$311.8	$318.5	$293.3	$298.1	$308.0	$307.0
Industrial	$72.4	$107.8	$125.1	$124.5	$87.7	$88.0	$69.4	$69.5	$70.4	$72.8
Total Budgets	***$682.5***	***$807.0***	***$832.4***	***$835.4***	***$744.1***	***$752.2***	**$708.3**	**$714.5**	**$724.5**	**$725.1**
% of Annual Revenue	*5.1%*	*6.0%*	*6.1%*	*6.1%*	*5.3%*	*5.3%*	*5.0%*	*5.0%*	*5.0%*	*4.9%*

Table 1-7: Annual Program Budgets Associated with the Maximum Achievable TRC Scenario (in millions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Residential	$470.6	$626.6	$624.6	$617.8	$617.7	$617.4	$616.0	$617.2	$614.6	$611.8
Commercial	$295.0	$395.3	$432.1	$433.6	$350.6	$363.8	$327.2	$336.8	$355.9	$356.5
Industrial	$100.1	$137.5	$156.0	$156.7	$121.3	$122.4	$104.7	$105.1	$107.3	$114.1
Total Budgets	***$865.7***	***$1,159.4***	***$1,212.6***	***$1,208.1***	***$1,089.5***	***$1,103.6***	**$1,048.0**	**$1,059.1**	**$1,077.8**	**$1,082.4**
% of Annual Revenue	*6.4%*	*8.6%*	*8.9%*	*8.8%*	*7.8%*	*7.8%*	*7.4%*	*7.4%*	*7.4%*	*7.4%*

Table 1-8: Annual Program Budgets Associated with the Achievable TRC Scenario (in millions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Residential	$211.2	$236.4	$239.8	$242.6	$243.1	$243.7	$243.0	$243.8	$242.7	$241.7
Commercial	$138.8	$182.3	$198.1	$198.2	$162.8	$168.9	$152.9	$157.3	$166.2	$166.3
Industrial	$50.4	$66.2	$74.2	$74.3	$59.1	$59.6	$55.5	$52.0	$53.1	$56.2
Total Budgets	***$400.4***	***$484.9***	***$512.1***	***$515.0***	***$465.0***	***$472.2***	**$451.3**	**$453.1**	**$462.1**	**$464.2**
% of Annual Revenue	*3.0%*	*3.6%*	*3.8%*	*3.7%*	*3.3%*	*3.4%*	*3.2%*	*3.1%*	*3.2%*	*3.2%*

Table 1-9: Annual Program Budgets Associated with the Constrained UCT Scenario (in millions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Residential	$136.3	$135.2	$135.5	$136.3	$137.0	$137.8	$138.6	$139.4	$140.2	$141.0
Commercial	$92.8	$93.7	$95.4	$96.9	$98.4	$100.0	$101.6	$103.2	$104.9	$106.5
Industrial	$40.7	$41.2	$42.0	$42.7	$43.2	$43.9	$44.5	$45.2	$46.0	$46.7
Total Budgets	***$269.8***	***$270.1***	***$272.9***	***$275.8***	***$278.7***	***$281.7***	**$284.7**	**$287.8**	**$291.0**	**$294.2**
% of Annual Revenue	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*

1.4 ENERGY EFFICIENCY POTENTIAL SAVINGS DETAIL BY SECTOR

Sections 6, 7 and 8 of the final report include additional detail about the electric and natural gas energy efficiency savings potential in Michigan by 2023.

1.5 COST EFFECTIVENESS FINDINGS

This study examines economic potential scenarios using the Total Resource Cost (TRC) test and the Utility Cost Test (UCT). This energy efficiency potential study concludes that significant cost effective electric and natural gas energy efficiency potential remains in in Michigan. Tables 1-10 and 1-11 show the preliminary present value benefits, costs and benefit-cost ratios for the Achievable Potential scenarios examined in this study.

Table 1-10: Benefit-Cost Ratios for Achievable Potential Scenarios For 2014 to 2018 Time Period

ACHIEVABLE POTENTIAL SCENARIOS	NPV $ BENEFITS	NPV $ COSTS	BENEFIT/COST RATIO	NET BENEFITS
Achievable UCT	$8,819,456,909	$3,452,121,731	2.55	$5,367,335,178
Max Achievable TRC	$11,804,061,879	$4,888,281,404	2.41	$6,915,780,476
Achievable TRC	$9,090,916,601	$3,542,860,326	2.57	$5,548,056,275
Constrained UCT	$3,134,114,985	$1,212,231,599	2.59	$1,921,883,386

Table 1-11: Benefit-Cost Ratios for Achievable Potential Scenarios For 2014 to 2023 Time Period

ACHIEVABLE POTENTIAL SCENARIOS	NPV $ BENEFITS	NPV $ COSTS	BENEFIT/COST RATIO	NET BENEFITS
Achievable UCT	$15,854,685,097	$5,807,771,171	2.73	$10,046,913,925
Max Achievable TRC	$21,353,470,657	$8,379,998,633	2.55	$12,973,472,023
Achievable TRC	$16,434,033,885	$6,063,428,268	2.71	$10,370,605,616
Constrained UCT	$6,033,320,972	$2,162,990,204	2.79	$3,870,330,768

In addition, GDS did calculate TRC and UCT benefit/cost ratios for each individual energy efficiency measure considered in this study. Only measures that had a benefit/cost ratio greater than or equal to 1.0 were retained in the economic and achievable potential savings estimates. It is important to note that energy efficiency measures for low income households do not need to be cost effective in Michigan. However, for consistency in this report, GDS has excluded all non-cost effective measures from estimates of economic and achievable potential energy efficiency savings.

1.6 COMPARISON OF MAX ACHIEVABLE TRC TO OTHER SCENARIOS

The Max Achievable TRC scenarios can be compared to the other achievable potential scenarios from several vantage points including the relative amount of electric and gas savings across the 5-yr and 10-yr timeframes, the relative amount of total spending required to achieve the savings, the relative acquisition costs of each of the scenarios, as well as the relative value of the benefits and costs of each of the scenarios. It is most appropriate to compare the Max Achievable TRC scenario first to the Achievable TRC scenario, because the only difference between these scenarios is the percentage of measure incremental cost assumed to be covered by incentives (100 % vs. 50%). Table 1-12 below provides a comparison of the Max Achievable TRC scenario to the Achievable TRC scenario.

MAX vs. AP-TRC	Total Savings			
	5-yr		10-yr	
Scenario	**Electric (MWh)**	**Gas (MMBtu)**	**Electric (MWh)**	**Gas (MMBtu)**
Max Achievable	11,881,269	39,431,615	19,051,040	73,223,149

Achievable TRC	9,091,783	34,556,665	14,598,473	63,888,440
% Difference between Max Achievable and Achievable TRC	30.7%	14.1%	30.5%	14.6%
Budgets and Acquisition Costs - Electric				
Scenario	**5-yr Budget**	**Acq. Cost Per 1st-Year kWh Saved - 5 yrs**	**10-yr Budget**	**Acq. Cost Per 1st-Year kWh Saved - 10 yrs**
Max Achievable	$4,079,030,372	$0.31	$8,011,335,248	$0.29
Achievable TRC	$1,678,655,015	$0.16	$3,285,131,139	$0.16
% Difference between Max Achievable and Achievable TRC	143.0%	87.6%	143.9%	88.8%
Budgets and Acquisition Costs - Gas				
Scenario	**5-yr Budget**	**Acq. Cost Per 1st-Year MMBtu Saved - 5 yrs**	**10-yr Budget**	**Acq. Cost Per 1st-Year MMBtu Saved - 10 yrs**
Max Achievable	$1,456,241,396	$31.94	$2,894,750,866	$30.70
Achievable TRC	$698,817,669	$17.56	$1,395,301,521	$16.86
% Difference between Max Achievable and Achievable TRC	108.4%	81.9%	107.5%	82.1%
Benefit-Cost Ratios and Net Present Benefits				
Scenario	**5-yr Benefit / Cost Ratio**	**Net Benefits – 5 yrs**	**10-yr Benefit / Cost Ratio**	**Net Benefits – 10 yrs**
Max Achievable	2.41	$6,915,780,476	2.55	$12,973,472,023
Achievable TRC	2.57	$5,548,056,275	2.71	$10,370,605,616
% Difference between Max Achievable and Achievable TRC	-5.9%	24.7%	-6.0%	25.1%

In terms of the total savings, the 5 and 10 year electric potential is approximately 30% greater in the Max Achievable scenario compared to the Achievable TRC scenario. The 5 and 10 year gas potential is approximately 15% greater in the Max Achievable scenario compared to the Achievable TRC scenario.

In terms of the cost to achieve these additional savings, the budgets needed to acquire the Max Achievable electric potential are more than double the magnitude of the budgets for the Achievable TRC scenario. The 5 and 10 year electric budgets for the Max Achievable TRC scenario are more than 140% greater than the Achievable TRC scenario. The corresponding acquisition costs in terms of dollars per first year kWh saved are nearly 90% greater in the Max Achievable TRC scenario compared to the Achievable TRC scenario. The gap in budgets and acquisition costs for gas savings are slightly less pronounced. The 5 and 10 year gas budgets for the Max Achievable TRC scenario are more than 100% greater than the Achievable TRC scenario. The corresponding acquisition costs in terms of dollars per first year MMBtu saved are more than 80% greater in the Max Achievable TRC scenario compared to the Achievable TRC scenario.

In terms of the cost-effectiveness of the Max Achievable scenario compared to the Achievable TRC scenario, the 5 and 10 year benefit-cost ratios decrease by about 6%. The 5 and 10 year net benefits increased by about 25%.

MICHIGAN ELECTRIC AND NATURAL GAS ENERGY EFFICIENCY POTENTIAL STUDY

ADDITIONAL SCENARIO MEMO

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