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City of Troy

MEMORANDUM

TO: Lori Grigg Bluhm, City Attorney LGB
FROM: Kenneth Christopher Scudder, Intern KCS
DATE: July 3, 2012
SUBJECT: Summary of MPSC's Case No. U-17000, Regarding AMI ("Smart") Meters

Under Michigan law, utilities are regulated by the Michigan Public Service Commission (MPSC). After Detroit Edison and Consumers started installing Smart meters (Advanced Metering Infrastructure a.k.a. AMI) for Michigan customers, complaints were filed with the MPSC. On January 12, 2012, the MPSC opened a new docket, case number U-17000 (see attached). With this Order, the MPSC ordered the utility companies to answer certain questions concerning smart meters. The order also provided that interested persons could file comments with the MPSC until April 16, 2012. Lastly, the order required the MPSC staff to complete a report and make recommendations on or before June 29, 2012.

The 30 page MPSC staff report was released on June 29, 2012 and is attached. Here is a summary of the report:

Background: *Smart meters are a digital upgrade to electromechanical readers, and are part of the nationwide smart grid initiative which is designed to assist in the prediction of future energy needs. They are digital devices capable of two way communication, and instantaneously convey accurate readings of a customers' actual electrical consumption using radio frequencies.*

After reviewing the public comments, municipal comments, and the responses of the utility companies, the MPSC Staff has made the following conclusions:

- *"Smart meters are the primary replacement to electromechanical readers because they are more accurate, enhance outage response, and offer opportunities for customer energy management." (Page 2)*
- *"The health risk from metering systems using radio transmitters is insignificant." (Page 2)*
- *"Data privacy and cyber security continue to be priorities for customers…Michigan utilities currently have large amounts of critical customer information that they have safeguarded for years and will continue to adequately safeguard." (Page 3)*

The MPSC Staff made the following recommendations.

- *"The Staff recommends that the Commission regulated utilities in Michigan continue to assess smart grid technologies as part of their efforts to improve the reliability and efficiency of the grid." (Page 3)*
- *"The Staff understands that some people remain opposed…and should be allowed to opt-out." (Page 3)*

- *If smart meters result in increased cost of service by the utility, this could be charged to the customers choosing to opt-out, or a discount can be given to the customers with a smart meter.*
- *The MPSC and the utilities should enact measures to ensure consistent protection of customer privacy and data, since consistent with state and federal laws.*

The below sections are summaries of the text from pages 4-30.

Customer Complaints: *The 397 complaints received primarily dealt with the opt-out policy, health concerns, privacy, and the legality of the meters.*

Opt-out Policy: *Both Consumer Energy and Detroit Edison project that customers will cover the additional costs of opting out of a smart meter.*

Financial Analysis: *"Detroit Edison estimates smart meter savings of $65 million per year…" (Page 6) They will pay $447 for deployment costs. They received some reimbursement from the Department of Energy.*

Health and Safety Concerns: *The MPSC Staff reviewed technical reports from numerous accredited sources regarding health and safety concerns, and opined that the health risk is "insignificant." (Page 28) The California Council on Science and Technology found "that smart meters, when installed correctly and with FCC certification, emit only a fraction of the level [of radio frequency radiation] that the FCC has determined to be safe." (Page 9)*

Fire Risk: *House fires starting from smart meters were also not major concern. "Less than 1% of all fires resulted from a measuring meter." (Page 12)*

Customer Education: *Many customer complaints referenced a lack of knowledge about the smart meters. Because of this, the MPSC Staff recommended that utility companies should create and enhance education programs.*

The Smart Grid Vision: *Smart meters are only a single component of a fully modernized grid. When fully implemented, however, "AMI presents a unique opportunity for Michigan ratepayers to take control of their energy consumption and energy bills. AMI meters, with the use of dynamic and time-of-use rates can reduce peak demand and increase energy conservation. This could curtail the need for future capital investment…this would lead to lower capital costs for all ratepayers." (Page 22-23)*

With the submission of the MPSC staff report, the next step is for the MPSC Commission to enter an order closing the case. Until that time, comments or resolutions could be filed, even though the date for public comment has technically expired. Since the utility companies have not yet provided the actual cost estimates for customers wishing to opt out, it is unlikely that an order would be entered on the opt-out costs without allowing additional comment and an opportunity for the utilities to submit supporting documentation calculating the costs of allowing an opt-out.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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In the matter, on the Commission's own motion, to review issues bearing on the deployment of smart meters by regulated electric utilities in Michigan.	))))	Case No. U-17000

At the January 12, 2012 meeting of the Michigan Public Service Commission in Lansing, Michigan.

PRESENT: Hon. John D. Quackenbush, Chairman
Hon. Orjiakor N. Isiogu, Commissioner
Hon. Greg R. White, Commissioner

ORDER OPENING DOCKET

In the past several months, the Commission has become aware of concern on the part of some individuals in this state and an increasing number of municipal officials regarding the deployment of smart meters by electric utilities operating in Michigan. During the Commission's annual consumer forums conducted at various locations during the fall of 2011, individual Commissioners on several occasions encountered vocal opponents to the deployment of smart meters in their communities. More recently, through direct submissions, media reports, and by other means, the Commission has learned that the elected governing bodies of at least nine local communities across Michigan have by resolution implored the Commission to either (1) make information about smart meters available to the public, (2) investigate the safety of the physical attachment of a smart meter to a residential dwelling house, (3) halt ongoing efforts by regulated electric utilities to deploy smart meters throughout their service territories, or (4) force these electric utilities to

allow concerned customers to "opt out" of having a smart meter attached to her or his own dwelling house.[1]

In hopes of increasing the Commission's and the public's understanding of smart meters, the Commission opens this docket for the purpose of addressing these concerns to the degree possible in light of the limits of the Commission's statutory authority and expertise.

Toward this end, the Commission directs all regulated electric utilities to submit information in this docket regarding the following topics: (1) The electric utility's existing plans for the deployment of smart meters in its service territory; (2) The estimated cost of deploying smart meters throughout its service territory and any sources of funding; (3) An estimate of the savings to be achieved by the deployment of smart meters; (4) An explanation of any other non-monetary benefits that might be realized from the deployment of smart meters; (5) Any scientific information known to the electric utility that bears on the safety of the smart meters to be deployed by that utility; (6) An explanation of the type of information that will be gathered by the electric utility through the use of smart meters; (7) An explanation of the steps that the electric utility intends to take to safeguard the privacy of the customer information so gathered; (8) Whether the electric utility intends to allow customers to opt out of having a smart meter; and 9) How the electric utility intends to recover the cost of an opt out program if one will exist.

The electric utility comments required by this order shall be submitted through the Commission's standard e-file system. Wherever possible, supplemental documentation may be referenced in the comments via the use of hyperlinks. All comments shall be submitted by 5:00 p.m. on March 16, 2012.

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[1]All such resolutions known to the Michigan Public Service Commission at this time are attached to this order.

After the submission of the information by the regulated electric utilities, all interested persons shall have until April 16, 2012 to examine those comments. Written and electronic comments by interested persons may be filed with the Commission, but must be received no later than 5:00 p.m. on April 16, 2012. Written comments should be sent to: Executive Secretary, Michigan Public Service Commission, P.O. Box 30221, Lansing, Michigan 48909. Electronic comments may be emailed to: mpscedockets@michigan.gov. Any person requiring assistance prior to filing comments, may contact Commission Staff at (517) 241-6180. All comments should reference Case No. U-17000. Comments and other documents received in this proceeding will become public information, posted on the Commission's website, and subject to disclosure.

Following the deadline for the submission of comments by members of the general public, the Commission Staff (Staff) shall prepare a report for the Commission's consideration. The Staff's report shall be given to the Commission and filed in this docket by 5:00 p.m. on June 29, 2012. In its report, the Staff shall summarize the filings in this docket, independently review the literature regarding smart meters, and identify any developments in other jurisdictions pertinent to this investigation. At the end of its report, the Staff shall make its recommendations, including suggestions regarding how best for the Commission to implement the Staff's recommendations.

THEREFORE, IT IS ORDERED that:

A. The Commission's Executive Secretary shall serve a copy of this order on all regulated electric utilities in this state.

B. Alpena Power Company, Consumers Energy Company, The Detroit Edison Company, Indiana Michigan Power Company, Northern States Power Company-Wisconsin, Upper Peninsula Power Company, Wisconsin Electric Power Company, Wisconsin Public Service Corporation, Alger Delta Cooperative Electric Association, Cherryland Electric Cooperative, Cloverland

Electric Cooperative, Great Lakes Energy Cooperative, Midwest Energy Cooperative, Ontonagon County Rural Electrification Association, Presque Isle Electric & Gas Co-op, Thumb Electric Cooperative, and Tri-County Electric Cooperative shall filed comments as described in this order by 5:00 p.m. on March 16, 2012.

C. Interested persons shall have until 5:00 p.m. on April 16, 2012 to file comments in this docket as described in this order.

D. The Commission Staff shall file a report and recommendations in this docket as described in this order by 5:00 p.m. on June 29, 2012.

The Commission reserves jurisdiction and may issue further orders as necessary.

MICHIGAN PUBLIC SERVICE COMMISSION

John D. Quackenbush

John D. Quackenbush, Chairman

Orjiakor N. Isiogu, Commissioner

Greg R. White, Commissioner

By its action of January 12, 2012.

Mary Jo Kunkle

Mary Jo Kunkle, Executive Secretary

U-17000 Report to the Commission

Prepared by the Staff of the Michigan Public Service Commission

June 29, 2012

EXECUTIVE SUMMARY

The smart grid encompasses technological improvements to the electric grid designed to increase reliability, reduce outage time, accommodate the integration of distributed generation sources, and improve electric vehicle charging capacity. Advanced Metering Infrastructure (AMI) systems "combine meters with two-way communication capabilities. These systems typically are capable of recording near-real-time data on power consumption and reporting that consumption to the utility at frequencies of an hour or less".[1] AMI meters are also known as smart meters, and they represent one component of an improved or smart grid.

On January 12, 2012, the Michigan Public Service Commission (Commission) issued an order in Case No. U-17000. This order directed the utilities to provide information by March 16, 2012, regarding their plans for smart meter deployment including proposed costs and benefits, scientific information addressing the safety of smart meter deployment, assurance of customer data privacy and other information. The order also allowed for public comments in response to the utilities' filings to be submitted by April 16, 2012.

Approximately 400 residential customer comments were received. The vast majority of these comments voice concerns about the installation of smart meters. The concerns can generally be categorized into the following topics: health and safety, privacy/data security, cyber security and bill impacts.

The Staff has engaged in a thorough review of resources in response to public concerns about smart meters. The resources fall into one or more of the following categories: technical in nature, relevant to smart meter technology, research focused, science based, peer reviewed, commentary and/or opinion.

The Staff's review supports the following conclusions:

- Smart meters are quickly becoming the primary replacement meter to the existing electromechanical meters because they are more accurate, enhance outage response and offer opportunities for customer energy management. The traditional electromechanical meter is obsolete and currently not in production.
- Smart meters are an important component to the success of a much larger picture, an emerging smart grid. As the United States Department of Energy (U.S. DOE) states "[a] smart grid uses digital technology to improve the reliability, security, and efficiency of the electricity system . . .."[2]
- After careful review of the available literature and studies, the Staff has determined that the health risk from the installation and operation of metering systems using radio transmitters is insignificant. In addition, the appropriate federal health and safety regulations provide assurance that smart meters represent a safe technology.

[1] Massachusetts Institute of Technology, *The Future of the Electric Grid*; An Interdisciplinary MIT Study, 2011, p.133. http://web.mit.edu/mitei/research/studies/documents/electric-grid-2011/Electric_Grid_Full_Report.pdf
[2] U.S. Department of Energy, *2010 Smart Grid System Report*, February 2012, Message from the Assistant Secretary. http://energy.gov/sites/prod/files/2010%20Smart%20Grid%20System%20Report.pdf

- Data privacy and cyber security continue to be priorities for customers, utilities and the Commission. Data protection procedures are continually being updated at the national and state levels. Michigan utilities currently have large amounts of critical customer information that they have safeguarded for years and will continue to adequately safeguard. Several national organizations are focused on monitoring and improving cyber security efforts that will continue to guide electric service providers' efforts.

The Staff's Recommendations

Smart Meter Implementation: Smart meters are part of the larger smart grid initiative that is being pursued by investor-owned and other utilities throughout the world. The smart grid initiative has been endorsed by federal laws and the technologies have been declared to be safe by accredited national agencies and industry councils. The Staff recommends that the Commission regulated utilities in Michigan continue to assess smart grid technologies as part of their efforts to improve the reliability and efficiency of the grid. AMI investments should continue to be reviewed by the Commission in contested rate cases.

Opt-out: A minority of customers have expressed concerns about smart meters. The Staff understands that some people remain opposed to the installation of smart meters for a number of reasons and should be allowed to opt-out. The Staff believes that ratemaking for the opt-out provision should be based on cost of service principles. If AMI meters result in a reduced cost of service, this could be accounted for by either an additional charge for those customers choosing to opt-out or a discount for those customers with an AMI meter.

Revised Rules and/or Tariffs: Several comments reflect concerns about customer privacy and data security. The Staff recommends there be additional consideration to ensure consistent protection of customer privacy and data.

Smart Grid Vision: The Staff has created a comprehensive smart grid vision which provides an all-inclusive perspective of the emerging smart grid. The vision will provide a framework for future grid modernization.

Details of these recommendations are contained in the body of this report.

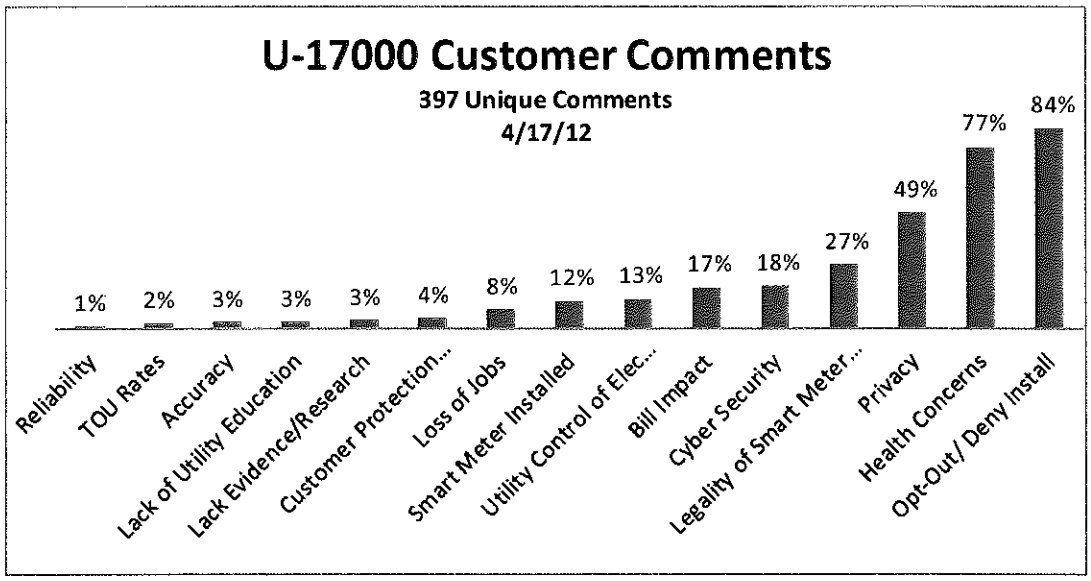
SUMMARY OF DOCKET FILINGS

The Staff logged 397 entries received from *unique parties* during the comment period. (Several people submitted multiple entries; however, these were counted as one comment for purposes of this report.) Three comments were received from non-Michigan residents.

Residential Customers

A number of topics were addressed in the comments. The dominant ones are shown in the chart below. Some customers addressed more than one topic in their submission. Of the customer commenters whose electric provider could be determined, the breakdown was: Detroit Edison (250), Consumers Energy (39), Cherryland Electric Cooperative (1), Clinton Board of Public Works (2), Indiana/Michigan Power Company (I&M) (4), Lansing Board of Water & Light (2), Upper Peninsula Power (4).

Chart 1: Residential Customer Comments



Reliability	TOU Rate	Accuracy	Lack of Education	Lack of Research	Customer Protection	Loss of Jobs	SM Installed	Utility Control of Power	Bill Impact	Cyber Security	Legality of SM Install	Privacy	Health	Opt-out/ Deny Install
4	9	10	11	13	17	32	46	50	69	71	106	193	304	334

Governmental Units

Seven resolutions were submitted by local governmental units:

- Townships of Harrison and Royal Oak,
- Villages of Almont and Grosse Pointe Shores,
- Cities of Farmington Hills and Madison Heights, and
- Macomb County Board of Commissioners.

Requested actions included: 1) further exploration into the health and safety of AMI meters, 2) delay/moratorium on further AMI installations until the Commission's review is completed, and 3) creation of an opt-out program for customers.

Although not formally submitted to the Case No. U-17000 docket, the Staff is aware of additional resolutions from other municipalities containing similar language to the resolutions filed in this docket.

Professional Organizations

Three professional organizations weighed in with submissions to the docket:

- American Academy of Environmental Medicine (AAEM) expresses concern with the levels of radio frequency (RF) radiation emitted by meters.
- Environmental Defense Fund (EDF) supports AMI deployment as a necessary element of grid modernization resulting in positive environmental impacts.
- TechNet also supports AMI deployment focusing on customer control of energy usage, data privacy and encouraging market innovation.

State of Michigan

A state agency and a state house representative filed comments:

- The Department of Attorney General asserts that smart meter benefits are not greater than the deployment costs for ratepayers.
- Representative Paul E. Opsommer states that filings for utilities with AMI meters were incomplete in the areas of meter function, cost and data privacy/protections.

Utilities

The order issued in Case No. U-17000 required utilities to provide specific information regarding smart meter deployment plans, investments, benefits, health and safety, data privacy, and opt-out options. The Commission received responses from investor-owned utilities (IOU) and Michigan electric cooperatives. Consumers Energy and Detroit Edison are the only Michigan utilities currently installing smart meters, so their responses are more thoroughly summarized.

Alpena Power plans to change to digital meters but does not intend to install smart meters. I&M has installed 10,000 AMI meters in South Bend, Indiana as a pilot. I&M has Automated Meter Reading (AMR)[3] at nearly all of its Michigan accounts and does not intend to replace those with smart meters. All of Northern States Power's Michigan customers have AMR, which send daily reads. Northern States

[3] Automated Meter Reading (AMR) "AMR technology allows utilities to read customer meters via short-range radio-frequency signals. These systems typically capture meter readings from the street using specially equipped vehicles." Massachusetts Institute of Technology, *The Future of the Electric Grid;* An Interdisciplinary MIT Study, 2011, p. 133. http://web.mit.edu/mitei/research/studies/documents/electric-grid-2011/Electric_Grid_Full_Report.pdf

Power does not intend to allow opt-out, but believes customers should pay for that option if an opt-out plan is required. Upper Peninsula Power uses electromechanical meters and is planning to continue this method. Wisconsin Electric Power Company (WEPCO) has installed AMR throughout its Michigan territory. WEPCO does not anticipate offering opt-out of AMR. Wisconsin Public Service Corporation has meters with both one and two-way communication. Its systems have been in place for over 10 years.

Alger Delta Cooperative, Cherryland Electric Cooperative, Cloverland Electric Cooperative, Great Lakes Energy Cooperative, HomeWorks Tri-county Cooperative, Midwest Energy Cooperative, Ontonagon County Rural Electrification Association, Presque Isle Electric & Gas Cooperative and Thumb Electric Cooperative filed a joint response and individual information. Most of the cooperatives have installed AMR that sends energy use data over power lines. Some of these meters have two-way communication. The cooperatives indicated they have experienced significant benefits from these meters. Presque Isle has a 10 meter AMI pilot. Cooperatives who have AMR do not intend to allow for opt-out.

Below are the responses from Consumers Energy and Detroit Edison regarding smart meter deployment plans as specified in the order in Case No. U-17000.

(1) The electric utility's existing plans for the deployment of smart meters in its service territory:

Consumers Energy Consumers Energy has completed Phase I of a four-phase pilot program, with the intention of full deployment by 2019 with 1.9 million total smart meters.
Detroit Edison Detroit Edison intends to install 2.6 million smart meters in a deployment plan that was initiated by a pilot in 2009. Detroit Edison currently has 650,000 meters installed and plans to have 1,000,000 installed by year end 2013.

(2) The estimated cost of deploying smart meters throughout its service territory and any sources of funding:

Consumers Energy The estimated cost is $750 million with no external funding (e.g., U.S. DOE ARRA grant); $398 million for smart meters and installation; $352 million for systems modifications, program management and other expenses.
Detroit Edison The estimated cost of smart meter deployment is $447 million for 2.6 million new electric meters, and the company received a U.S. DOE grant that reimbursed 50 percent of costs up to a pre-determined grant cap.

(3) An estimate of the savings to be achieved by the deployment of smart meters:

Consumers Energy Estimated savings over the anticipated 20-year life of the smart meters is $2 billion. Although benefits were described, no quantified breakdown of the savings total was provided.
Detroit Edison Detroit Edison estimates smart meter savings of $65 million per year, although this figure includes both electric and gas meters. Case No. U-16472, Exhibit A-18 was referenced for details.

(4) *An explanation of any other non-monetary benefits that might be realized from the deployment of smart meters:*

Consumers Energy Consumers Energy cited a U.S. DOE study (DOE/NETL-2010/1413) which summarizes the benefits tied to smart meter deployment. The study discusses societal benefits that include reduced outage times, as well as improvements in national security, environmental conditions, and economic growth.
Detroit Edison Proposed non-monetary benefits include an increase in customer satisfaction, the ability to identify voltage problems, new rate offerings, and the ability to expedite emergency disconnect response.

(5) *Any scientific information known to the electric utility that bears on the safety of the smart meters to be deployed by that utility:*

Consumers Energy Consumers Energy described its proposed system. No scientific information was provided.
Detroit Edison Detroit Edison provided a link to the report, *No Health Threat from Smart Meters*, Utilities Telecom Council, Q4 2010. The following studies were also included in an appendix:

Analysis of Radio Frequency Exposure Associated with Itron OpenWay® Communications Equipment, March 2011
Wireless Transmissions: An Examination of OpenWay® Smart Meter Transmissions in 24-Hour Duty Cycle, March 2011
Smart Meters and Smart Systems: A Metering Industry Perspective, Edison Electric Institute (EEI), Association of Edison Illuminating Companies (AEIC) and Utilities Telecom Council (UTC), March 2011
A Discussion of Smart Meters And RF Exposure Issues, Edison Electric Institute (EEI), Association of Edison Illuminating Companies (AEIC) and Utilities Telecom Council (UTC), March 2011

(6) *An explanation of the type of information that will be gathered by the electric utility through the use of smart meters:*

Consumers Energy The amount of kilowatt-hours (kWh) consumed each hour, kilovolts-ampere-reactive hours (kVARh) delivered, and actual voltage delivered will be collected every four-six hours. Some of this data is also added together and then sent once per day. Alarms and notification of field events will be sent out in real time.
Detroit Edison The data collected is accumulated Watt hour (Whr) consumption readings, load profile hourly interval watt-hour (Whr) and Volt Ampere hour (VAhr) energy data, load profile energy data, instantaneous voltage, meter messages, events, alarms, and network parameters. No customer-specific data such as addresses, phone numbers, account status or social security numbers will be gathered.

(7) *An explanation of the steps that the electric utility intends to take to safeguard the privacy of the customer information so gathered:*

Consumers Energy Safeguards for customer privacy include using data encryption and code division multiple access (CDMA). There is no personal customer information in the transmittal of data.

Detroit Edison Customer information is safeguarded through data encryption and internal confidentiality policies.

(8) Whether the electric utility intends to allow customers to opt out of having a smart meter:

Consumers Energy Consumers Energy proposes a future opt-out, but no details were provided.
Detroit Edison Detroit Edison is developing an opt-out for customers, but has yet to develop any details.

(9) How the electric utility intends to recover the cost of an opt-out program if one will exist:

Consumers Energy In accordance with utility cost of service principles, Consumers Energy suggests a future opt-out will be subject to a monthly maintenance fee. Fixed costs for opt-out would be recovered through a tariff-based, one-time charge and a monthly maintenance charge.
Detroit Edison Detroit Edison projects that customers choosing to opt-out will be responsible for all costs associated with an opt-out tariff provision.

Detroit Edison and Consumers Energy provided responses to the Commission's request in Case No. U-17000 regarding AMI deployment. The utilities could have provided additional details that would have been helpful for the Staff's analyses, including more specific information on savings calculations and privacy protections.

THE STAFF'S REVIEW OF AMI

The Staff reviewed the submitted comments, and the cited resources and literature provided by the electric utilities and the public. The Staff examined resources considered "technical" in nature. Many of these resources were published in reputable scientific or professional peer-reviewed journals or were based on reproducible, sound scientific methods and procedures. The Staff also examined many other resources and literature from a variety of sources. The Lawrence Berkeley National Laboratory (LBNL) document identifying resources was beneficial to the Staff in its review.[4] This report addresses some of the more frequently cited resources.

Safety and Health Concerns

The Federal Communications Commission (FCC) is charged with regulating international communications by radio, television, wire, satellite and cable within the United States and its territories. The FCC is responsible for providing licenses for RF emissions. The FCC regulations cover matters relating to public health and safety and have been designed to ensure that the levels of RF emissions that consumers are exposed to are not harmful.

[4] LBNL Website. http://smartresponse.lbl.gov/reports/sm-resourcelist041912.xlsx

In January 2011, the California Council on Science and Technology (CCST) completed a report titled *Health Impacts of Radio Frequency from Smart Meters*.[5] The CCST compiled a comprehensive overview of known information on human exposure to wireless signals, including the effectiveness of the FCC RF safety regulations. After evaluating numerous RF related publications and soliciting the opinions of technical experts in this and related fields, the CCST concluded that no additional standards are needed at this time and that FCC standards are adequate to ensure the health and safety of people from the known thermal effects of smart meters. The report also indicates that smart meters, when installed correctly and with FCC certification, emit only a fraction of the level that the FCC has determined to be safe.

In a recent report, *Radio-Frequency Exposure Levels from Smart Meters: A Case Study of One Model*,[6] the Electric Power Research Institute (EPRI) researched smart meter emission data that provides valuable insight into RF exposure scenarios for a widely used type of smart meter. There were three key findings: (1) exposure levels from individual meters declined rapidly as distance from the meter increased, (2) meters transmitted for only a small fraction of time, and (3) RF exposure levels remained well below the FCC exposure limits.

The Utilities Telecom Council (UTC), in an article titled *No Health Threat from Smart Meters*,[7] provided a review of the safety standards associated with RF emissions and stated that smart meters did not pose a health or safety threat. The UTC's research established that laptop computers using Wi-Fi transmit at levels similar to smart meters, although laptop transmitters are always "on" or transmitting and smart meters transmit for short intervals periodically throughout the day. After reviewing this and other common RF devices (cell phones, microwave ovens, etc.), the UTC concluded that the RF emissions from smart meters would not pose a threat to human health and safety.

The January 13, 2012, County of Santa Cruz Health Services Agency memorandum titled *Health Risks Associated with SmartMeters*[8] was drafted in response to the Santa Cruz County Board of Supervisors' request that the agency identify potential smart meter health effects and possible mitigation measures. The memorandum concluded that research addressing the health effects of electromagnetic fields (EMF) does not specifically address smart meters; there is no scientific data regarding non-thermal effects of smart meters; and government agencies should take precautionary avoidance measures. LBNL reviewed the agency's memorandum as part of the Smart Grid Technical Advisory Project.[9] LBNL's review focused on the objective of the memorandum, consistency of cited sources with agency established peer review criteria, and clarification of technical assumptions and claims. LBNL noted:

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[5] *Health Impacts of Radio Frequency from Smart Meters*, January 2011. http://www.ccst.us/publications/2011/2011smartA.pdf

[6] *Radio-Frequency Exposure Levels from Smart Meters: A Case Study of One Model*, February 2011. https://www.nvenergy.com/NVEnergize/documents/EPRI_1022270_caseStudy.pdf

[7] *No Health Threat From Smart Meters*, Fourth Quarter 2010 Issue of the UTC JOURNAL. http://www.utc.org/utc/no-health-threat-smart-meters-says-latest-utc-study

[8] County of Santa Cruz, *Health Risks Associated with SmartMeters*, http://emfsafetynetwork.org/wp-content/uploads/2009/11/Health-Risks-Associated-With-SmartMeters.pdf

[9] The Smart Grid Technical Advisory Project provides technical assistance and training to state regulatory commissions on topics related to smart grid. The Smart Grid Technical Advisory Project does not participate in litigated or contested regulatory or other proceedings.

> [T]he Agency memorandum does not appear to provide a balanced representation of research, the risks, or mitigation options. Instead the Agency memorandum is largely focused on scientifically unsupported claims related to "electromagnetic hypersensitivity" (EHS).

Individuals with EHS report real symptoms; however, health research has been unable to consistently attribute those symptoms to EMF exposure.[10] LBNL's review of the Santa Cruz memorandum highlighted concerns with the methodology of the agency memorandum cited sources.[11]

On April 12, 2012, the AAEM submitted their position paper, *Electromagnetic and Radiofrequency Fields Effect on Human Health*, to Case No. U-17000.[12] The paper supports AAEM's position that emissions from smart meters are potentially harmful. LBNL also provided a response to the AAEM position paper. LBNL's primary concerns with the paper's findings are a) the research used to establish a cause and effect relationship does not address smart meters, b) the research citations and references are unrelated to smart meters, c) conclusions are about EHS, and d) the minimal amount of RF smart meters actually contribute to total environmental RF. LBNL explains that RF is distinguished by a number of characteristics including frequency, intensity and proximity.[13] There are multiple sources of RF exposure in our everyday environment such as cellular phones, wireless devices such as laptops and routers, microwave ovens, baby monitors, garage door openers, "walkie talkies," computer monitors, fluorescent lighting, and electrical wires within the home.[14] [15] Smart meters are a small contributor to the total environmental RF emissions to which the general public is exposed. Eliminating smart meters would result in a minimal reduction of total emissions.[16]

Several comments submitted in Case No. U-17000 cited the World Health Organization's (WHO) classification of RF EMF as a class 2B carcinogen in support of their smart meter health concerns. This classification means that RF EMF has been deemed as *possibly* carcinogenic to humans.[17] RF EMF was designated as a class 2B carcinogen due to limited evidence associating glioma and acoustic neuroma, two types of brain cancer, with wireless telephone users. The Staff was unable to identify research that associates AMI meters with any type of cancer.

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[10] LBNL, *Review of the January 13, 2012 County of Santa Cruz Health Services Agency memorandum: Health Risks Associated with Smart Meters* http://smartresponse.lbl.gov/reports/schd041312.pdf
[11] LBNL, *et al.* http://smartresponse.lbl.gov/reports/schd041312.pdf
[12] American Academy of Environmental Medicine, *Electromagnetic and Radiofrequency Fields Effect on Human Health.* http://efile.mpsc.state.mi.us/efile/docs/17000/0391.pdf
[13] LBNL, *Review of the April 12, 2012 American Academy of Environmental Medicine (AAEM) submittal to the Michigan Public Service Commission*, http://smartresponse.lbl.gov/reports/aaem041812.pdf
[14] Federal Communications Commission: *Radio Frequency Safety* http://transition.fcc.gov/oet/rfsafety/rf-faqs.html.
[15] Federal Communication Commission: *Interference – Defining the Source* http://www.fcc.gov/guides/interference-defining-source.
[16] City of Naperville, Naperville Smart Grid Initiative (NSGI), Pilot 2 RF Emissions Testing – Summary Report-V2.0, *Smart Meters, Household Equipment, and the General Environment*, November 10, 2011. http://www.naperville.il.us/emplibrary/Smart_Grid/Pilot2-RFEmissionsTesting-SummaryReport.pdf
[17] International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans,* January 2006. http://monographs.iarc.fr/ENG/Preamble/currentb6evalrationale0706.php

In May 2011, members of the WHO's International Agency for Research on Cancer's (IARC) Monographs Working Group reviewed roughly 900 studies that involved RF EMF and cancer.[18] The group categorized the studies by the following RF EMF sources: occupational exposure (i.e., radar installations), personal exposure associated with the use of wireless telephones, and environmental exposure (i.e., radio/television signals). For occupational exposure to RF EMF, the group determined that there are "some positive but inconsistent signals." With respect to environmental sources of RF EMF, the group determined that there was no "solid data" to conclude a link between cancer and RF EMF exposure. Lastly, regarding personal exposure, the group found there to be limited evidence linking glioma and acoustic neuroma to wireless phone use, with inadequate evidence for other cancer types.

Experts in the field of RF EMF have testified in front of public utility commissions outside of Michigan as to how the IARC classification correlates with smart meter technology. For example, Baltimore Gas & Electric provided the expert opinion of Dr. Peter Valberg to the Public Service Commission of Maryland, who testified on how the category 2B classification of RF EMF should be interpreted. Dr. Valberg stated that the IARC has not found any ". . . adverse health consequences established from exposure to RF fields at levels below the international guidelines on exposure limits published by the International Commission on Non-Ionizing Radiation Protection."[19] He goes on to state that the 2B classification of RF EMF was ". . . made with reference to the quantity of exposure, *e.g.*, no quantitative estimate as to how various uses of RF contribute to human exposure. . . ."[20] and that ". . . smart meters constitute one of the weakest sources of our RF exposure."

Dr. Yakov Shkolnikov and Dr. William H. Bailey, engineers from the consulting firm Exponent, provided expert testimony to the Public Utility Commission of Nevada concerning NV Energy's smart meter deployment, and addressed smart meter RF EMF emission concerns. These witnesses pointed out that although RF EMF was classified in group 2B ". . . the evidence is limited that cancer develops from exposures from RF fields."[21] They also make it clear that ". . . the indications of potential risk derive almost entirely from statistical associations in some studies between the use of mobile phones and certain types of cancer."[22]

The WHO's decision to classify RF EMF in the group 2B category was based on studies involving wireless phones, not smart meters. While both wireless phones and smart meters emit RF EMF, the

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[18] International Agency for Research on Cancer, *Radiofrequency Electromagnetic Fields: evaluation of cancer hazards*. http://monographs.iarc.fr/ENG/Publications/REF_Poster2012.ppt

[19] *In the Matter of Baltimore Gas and Electric Company for Authorization to Deploy a Smart Meter Initiative and to Establish a Surcharge Mechanism for the Recovery of Cost*, Case No. 9208, Comments on an "Opt-Out" Option for Smart Meters, Testimony of Dr. Peter A. Valberg, April 6, 2012. http://webapp.psc.state.md.us/Intranet/Casenum/CaseAction_new1.cfm?CaseNumber=9208

[20] *In the Matter of Baltimore Gas and Electric Company for Authorization to Deploy a Smart Meter Initiative and to Establish a Surcharge Mechanism for the Recovery of Cost, et al.*

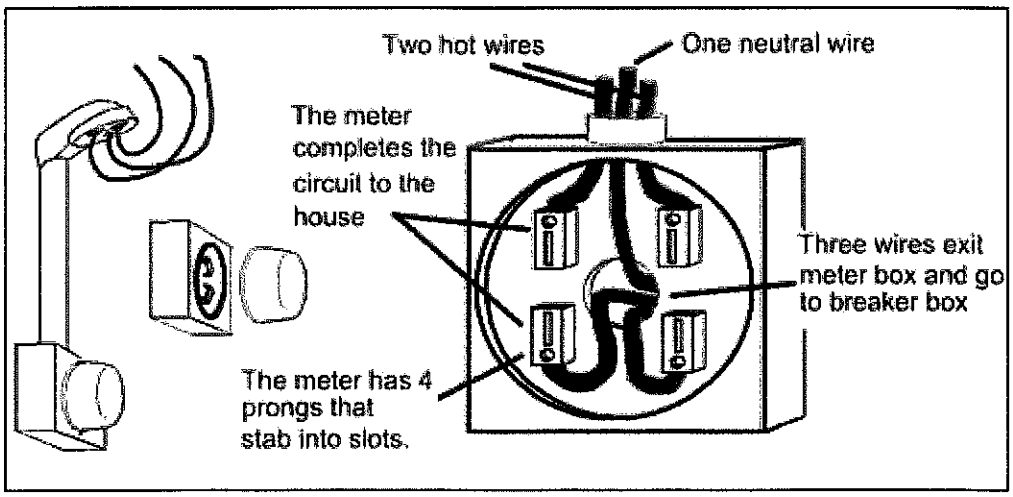
[21] *Investigation regarding NV Energy's Advanced Service Delivery Meter Program a/k/a Smart Meter and its implementation*, Docket No. 11-10007, Comment of S. Stirling, December 22, 2011.

[22] *Investigation regarding NV Energy's Advanced Service Delivery Meter Program a/k/a Smart Meter and its implementation, et al*

major difference between the two is the lower level of exposure to frequencies from smart meters. Low exposure levels from smart meters coupled with the fact that the IARC's classification is based on weak mechanistic evidence and limited evidence derived from different RF EMF emitting devices is important to consider when evaluating the substance of the group 2B classification. After careful review of the available literature and studies, the Staff believes that the health risk from the installation and operation of metering systems using radio transmitters is insignificant. In addition, the appropriate federal health and safety regulations provide assurance that smart meters represent a safe technology.

Some public comments stated a link between smart meters and house fires. Meter fires for any type of meter are a rare occurrence, according to the National Fire Protection Agency's 2012 annual report[23] on home electrical fires. This type of fire makes up only 1% of the average reported cause of home electrical fires. Factors associated with meter fires are not exclusive to smart meters but apply to all meters. Installation details for smart meters and electromechanical meters are the same. Both meter types have four prongs on the back. The four prongs attach to four slots known as stabs. These stabs, along with the wires from the power lines and meter itself, are housed inside a protective case known as a meter box. Once the meter is connected, the electrical circuit is complete. This is shown in the diagram below. Component failure (i.e. loose stab connection) can cause arcing, potentially resulting in a meter fire. It is the component failure, not the meter unit that is the cause of an arcing-induced fire.

Figure 1: Meter Connection



[23] *Home Electrical Fires*, National Fire Protection Association, January 2012. http://www.nfpa.org/assets/files//PDF/OS.electrical.pdf

Data Privacy

As smart meter deployments have become more prevalent throughout the United States, customer data privacy has become a priority issue. In order to address the concerns of the public regarding smart meter data privacy, multiple entities have engaged in efforts to identify and address the fundamental privacy issues. The Staff reviewed data privacy literature that specifically addressed or were clearly applicable to concerns arising from smart meters collection of customer electric usage information. Documents reviewed originated from the following entities: municipal utilities, state utility commissions, state legislation, standard development organizations, federal government and academia. The following table lists the literature reviewed in preparation of this section.[24]

Table 1: Data Privacy Policies

Entity:	*Document Name:*
Municipal Utilities	
City of Naperville	**Naperville Smart Grid Initiative Customer Bill of Rights**
State Utility Commissions	
State of California	**Privacy Protections For Energy Consumption Data**
State of Colorado	**Rules Regulating Electric Utilities**
State of New York	**Smart Grid Policy Statement**
State of Texas	**Customer Protection Rules For Retail Electric Service**
State Legislation	
State of Arizona	**Consumer Protections; Rules; Confidentiality; Unlawful Practice**
State of Oklahoma	**Electric Usage Data Protection Act**
State of Washington	**WAC 480-100-153 Disclosure of Private Information**
Standards Development Organizations	
NAESB	**Third Party Access To Smart Meter-Based Information**
NISTIR 7628	**Guidelines for Smart Grid Cyber Security**
Federal Government	
US Dept. of Energy	**Smart Grid Privacy Workshop Summary Report**
US Dept. of Homeland	**Fair Information Practice Principles**
Academia	
Vermont Law School	**A Model Privacy Policy for Smart Meter Data**

AMI necessitates a higher volume of data collected by utilities, therefore it is imperative that customer information be properly protected through appropriate regulations. Federal legislation protecting consumer data privacy is forthcoming;[25] however, it is important to identify ways to protect Michigan's ratepayers in the interim. States that feature more advanced AMI deployment such as California,

[24] Links to the table documents can be found in Appendix A.
[25] *U.S. Department of Energy Smart Grid Privacy Workshop Summary Report.* http://www.smartgrid.gov/sites/default/files/doc/files/Privacy%20report%202012_03_19%20Final.pdf

Colorado, Texas, Arizona, Oklahoma, and Washington have addressed customer data protection through state legislation or administrative rules adopted by the public utilities commissions. The Staff acknowledges that interim protections could be achieved through the development of utility tariffs that address customer data privacy. The Staff recommends including the following fundamental concepts when addressing privacy policy:

- Definitions of various types of data collected *(usage/billing, aggregate, customer identifiable),*
- Permitted usage of data types by utility *(sales, contractor work, emergency),*
- Customer consent and third-party disclosure rules *(notice, timeframe, records),*
- Availability of usage information to customer *(web portal, direct mail, email),* and
- Privacy breach requirements *(notification to customer/commission).*

The Staff recommends that there be further investigation into the most appropriate manner (administrative rules, legislation, tariffs, etc.) to ensure customer privacy. This process should include all relevant stakeholders. In the interim, the Staff recommends that utility tariffs include provisions to enhance customer privacy.

Cyber Security

As Michigan transitions to a more technologically advanced power grid, it is important that the proper actions are taken by utilities to address cyber security threats. Cyber security planning is defined as preventing damage to, unauthorized use of, or exploitation of electronic information and communications systems and the information contained therein to ensure confidentiality, integrity, and availability.[26] The attention cyber security has received at the national and state levels for many years indicates that utilities, regulators and consumers all share common concerns. Improving the electrical grid involves gathering more data and utilizing more technology. With every added piece of technology, the risk of vulnerabilities inherently increases. The U.S. DOE has stated that the smart grid of the future should be secure and resilient against all forms of attacks. A smarter grid includes more devices and connections that may become avenues for intrusions, error-caused disruptions, malicious attacks, destruction, and other threats.[27]

It is important to balance the need for a more digitally connected grid and the inherent risks of these new technologies and their interconnection. At the national level, several organizations are currently addressing this issue: North American Electric Reliability Corporation (NERC), National Institute of Standards and Technologies (NIST), Smart Grid Interoperability Panel Cyber Security Working Group (CSWG), National Electric Sector Cybersecurity Organization (NESCO), and the U.S. DOE. These

[26] National Association of State Energy Officials (NASEO), *Smart Grid and Cyber Security for Energy Assurance.* http://www.naseo.org/energyassurance/NASEO_Smart_Grid_and_Cyber_Security_for_Energy_Assurance_rev_November_2011.pdf

[27] Executive Office of the President, National Science and Technology Council, *A Policy Framework For The 21st Century Grid: Enabling Our Secure Energy Future*, June 2011. http://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc-smart-grid-june2011.pdf

groups have published reports and compliance programs to provide utilities guidance on cyber security in the electric industry.

The overall goal is to develop a framework that ensures effective cyber security is appropriately implemented and that all stakeholders contribute to the security and reliability of the electrical grid.[28] The goal is not a compliance-based culture in which companies are expected to stand alone in this effort. Instead it should be a proactive, responsible and collaborative culture in the state of Michigan. The Staff reviewed multiple cyber security related documents published by the leading cyber security associations and found the following commonalities:

- Cyber security efforts should concentrate on rigorous open standards and guidelines through public-private partnerships for security,
- Effective cyber security will rely on data sharing and cooperation between regulatory, private and electric industry entities,
- A risk-based approach to cyber security planning should be implemented,
- A cyber security performance accountability system should be created to fulfill risk-based planning, and
- Regulatory bodies should be in constant contact with asset owners regarding cyber security.

Several states have taken positions on cyber security including California and Texas. The Public Utility Commission of Texas enacted a cyber security rule requiring electric utilities to have an independent security audit of the mechanism for customer and Retail Electric Provider (REP) access to meter data conducted within one year of initiating such access and promptly report the results to the commission.[29]

The Federal Trade Commission (FTC) has studied how entities collect and use personal information. They have compiled their findings in the Fair Information Practices (FIP), which has been used successfully across many industries. The California Public Utilities Commission (CPUC) cited the FIP as a proven model for data security that the electric industry should utilize. In regards to cyber security, the CPUC stated upon any breach[30] affecting 1000 or more customers, an electric provider has two weeks to notify a commission appointed cyber security representative.[31] They also required IOU's to file a year-end cyber security breach report with the cyber security representative at the commission.[32]

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[28] Executive Office of the President, *et al.*
http://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc-smart-grid-june2011.pdf
[29] Public Utility Commission of Texas, Electric Substantive Rules.
http://www.puc.state.tx.us/agency/rulesnlaws/subrules/electric/Electric.aspx
[30] A breach is any unauthorized use or exploitation of customer information.
[31] Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of Smart Grid, *et al.*
[32] Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of Smart Grid, *et al.*

The Staff proposes that the following cyber security measures be implemented in Michigan:

- Each utility should adopt an annual independent security audit of the mechanisms of customer access, third party access and internal cyber risk-management practices. The independent auditor should be approved by the Staff.
- As outlined in the National Association of Regulatory Utility Commissioners' (NARUC) resolution regarding cyber security, the Staff should maintain a dialogue with regulated utilities to ensure that they are in compliance with standards, and that preparedness measures are employed to deter, detect and respond to cyber attacks and to mitigate and recover from them.[33]
- Utilities should adopt the same breach notification policies as other states have adopted, namely the notification of any breach affecting 1000 or more customers within two weeks of the breach.
- Each utility should be required to file a yearly breach notification summary with the Staff, detailing all breaches of customer information, including any third party breach information.

Customer Education

Customer education and participation is an important component of the successful implementation of the smart grid. A portion of the smart meter benefits rely upon customer engagement. To facilitate customer engagement, utilities must provide customers with clear and accurate information about programs and services available both prior to and *throughout* the deployment of smart meters.[34] Within the 397 unique comments submitted to Case No. U-17000, 360 comments reference a lack of communication with customers about the functionality and benefits of smart meters.[35] As the Maryland Public Service Commission[36] stated:

> The negative experiences in other states . . . illustrate vividly that poor customer education will magnify small-scale problems and create disproportionate customer skepticism and unhappiness.

For this reason, the Staff reviewed customer education efforts in various states. Several states have supported the importance of customer education through both legislation and orders.

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[33] NARUC, *Resolution Regarding Cybersecurity*, February 17, 2010. http://www.naruc.org/Resolutions/Resolution%20on%20Cybersecurity1.pdf

[34] Massachusetts Institute of Technology, *The Future of the Electric Grid*; An Interdisciplinary MIT Study, 2011, p. 164. http://web.mit.edu/mitei/research/studies/documents/electric-grid-2011/Electric_Grid_Full_Report.pdf

[35] Pg. 4, Chart 1 of this report (combined categories of lack of education, utility control of power, legality of smart meter install and privacy).

[36] *In the Matter of Baltimore Gas and Electric Company for Authorization to Deploy Smart Meter Initiative and to Establish a Surcharge Mechanism for the Recover of Cost*, Case No. 9208, Order No. 83531, pp. 42-43. http://webapp.psc.state.md.us/Intranet/Casenum/CaseAction_new1.cfm?CaseNumber=9208

- Colorado Public Utilities Commission concluded that utilities should submit a smart meter plan with a detailed customer education and outreach plan.[37]
- Nevada Public Utilities Commission concluded that NV Energy should enhance its consumer outreach efforts. The outreach efforts were to include a "media plan leading up to the deployment of smart meters that will frequently reach out into the community and use multiple channels to reach customers more effectively."[38]
- California Public Utility Commission (CPUC) was directed by California Public Utilities Code § 8360 (2009), to identify criteria to ensure that the utility smart grid deployment plans conform to best practices. Commission Rulemaking R 08-12-009 identifies the need for a smart grid strategy recognizing that customer participation is necessary for the demand-side benefits.[39] In addition, CPUC Decision 12-04-025 identifies metrics to use to track customer participation.[40]
- The Maryland Public Service Commission directly addressed customer education in Case No. 9208, Order No. 83531. The commission order states "[t]hat Baltimore Gas and Electric Company shall submit, for the Commission's approval, the Company's updated customer education plan and associated proposed messaging that it will provide customers prior to and during installation of the meters, before Peak Time Rebates begin, and before any other programmatic changes take effect. Baltimore Gas and Electric and other parties in the matter shall develop, and submit for Commission approval, a comprehensive set of metrics by which the Commission may measure the effectiveness of the customer education plan, . . ."[41]
- The Public Utility Commission of Texas met regularly with utilities to help develop radio ads, door hangers, billboards, etc. which were used to educate the public about smart meters. The education effort specifically targeted smart meter cost recovery, deployment, and implementation. The Texas Public Utility Commission also approved each utility's budget associated with smart meter customer education[42].
- Maine Public Utility Commission ordered Central Maine Power to ". . . develop and implement a customer communication plan that will explain the various opt-out options, describe the benefits of the AMI program, describe the functionality of the available meter options, describe the

[37] *In the Matter of the Investigation of the Issues Related to Smart Grid and Advanced Metering Technologies*, Docket No. 10I-099EG. Decision No. C11-0406, Order State Conclusions and Next Step, March 30, 2011, p. 5.
[38] *Investigation regarding NV Energy's Advanced Service Delivery Program a/k/a Smart Meters and its implementation*, Docket No. 11-10007, Interim Order, January 11, 2012, p. 8.
[39] California Public Utility Commission, R 08-12-009.
http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/119902-02.htm#P201_29007
[40] California Public Utility Commission, Decision 12-04-025, April 24, 2012.
http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/164808.htm
[41] *In the Matter of the Application of Baltimore Gas and Electric Company for Authorization to Deploy a Smart Grid Initiative and to Establish a Surcharge for the Recovery of Cost*, Case No. 9208, Order No. 83531, p. 50.
http://webapp.psc.state.md.us/Intranet/sitesearch/CN9208.pdf.
[42] Relevant Dockets include: Oncor Docket No. 35718, CenterPoint Docket No. 35639, AEP TX Docket No. 36928, TNMP Docket No. 38306.
http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgSearch.asp.

charges associated with the opt-out, and describe the process by which a customer may opt-out."[43]

- In 2008, the Ohio legislature enacted changes to the Ohio Revised Code – Title XLIX Public Utilities which required utilities file a customer education plan; the purpose of which is to ". . . educated [*sic*] Ohio's consumers about their new choices for electric service."[44]

The transition to smart meters and related infrastructure will provide customers access to current data about their energy usage, creating an opportunity to better control energy consumption. Smart meters also provide the basic infrastructure for aggregate benefits related to reliability, outage identification, and reduced peak demand. These benefits have a positive effect on all customers including those who choose to opt-out.[45] A smooth transition to smart meters can be accomplished only through customer education. A well thought out education strategy allows customers to develop a sense of trust with the utility and an understanding of the available benefits.

The Staff recommends utilities develop and implement a new education strategy similar to those used in other jurisdictions. Education program results should reflect high levels of customer engagement, acceptance and enthusiasm with their smart meter program. The strategy should include metrics to measure the overall effectiveness of the education program.

National Policy

The United States Congress has passed several laws that support the upgrade of the electric grid, including deployment of smart meters for residential and other types of customers. These laws have provided a framework for smart grid, including smart meter deployment in the United States. Basically, these laws encourage states to proceed with modernizing the electric grid in order to be ready for the electric demands of the 21st Century.

The Energy Policy Act of 2005 (EPAct 2005) was the first piece of federal legislation that discussed smart grid. The statute strongly encourages demand response. It calls upon utilities to offer time-based rates with a time-of-use meter to all customer classes. It also requests that state public utility commissions investigate the installation in their state of time-of-use meters and communication devices to enable time-based pricing rate schedules and other demand response programs. The statute also mandates that, by October 2012, all federal buildings be individually metered for electricity consumption and, to the extent feasible, use advanced meters that measure energy use on an hourly basis.[46]

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[43] Maine Public Utilities Commission, Docket No. 2010-345, Order (Part I), May 19, 2011, p. 2.
[44] *In the Matter of the Commission's Promulgation of Rules for Electric Transition Plans and of a Consumer Education Plan, Pursuant to Chapter 4928, Revised Code*, Case No. 99-1141-EL-ORD, Entry, June 8, 2000. http://www.puco.ohio.gov/emplibrary/files/docketing/ORDERS/2000/0604/99-1141.pdf
[45] Electric Power Research Institute *Advanced Metering Infrastructure*, February, 2007, p. 1. http://www.ferc.gov/eventcalendar/Files/20070423091846-EPRI%20-%20Advanced%20Metering.pdf
[46] Energy Policy Act of 2005, Pub. L. No. 109-58, 100 Stat. 567 (codified at 1 U.S.C. §§ 900-999).

The Energy Independence and Security Act of 2007 (EISA) is a major piece of federal legislation addressing smart grid and smart meters. Title XIII, Sections 1301 through 1309 supports modernizing the nation's electric grid and contains provisions giving the U.S. DOE a leadership role in all but two areas of smart grid advancement. Interoperability was assigned to the NIST and the Federal Energy Regulatory Commission (FERC), and recovery of smart grid investment was relegated to the state public service commissions. The statute contains a policy statement on United States' grid modernization that defines "smart grid;" establishes the Smart Grid Advisory Committee, the Smart Grid Task Force, and the Smart Grid Interoperability Framework; and institutes the Smart Grid Investment Matching Grant Program, which provides a 20% match for qualifying smart grid investments.[47]

The American Recovery and Reinvestment Act of 2009 (ARRA) amends EISA allowing U.S. DOE to provide financial support for smart grid demonstration projects and advanced grid technology investments, such as AMI. In total, the legislation provides $3.4 billion in funding for numerous smart grid projects across the nation, including smart meters, in-home energy management displays, smart thermostats, advanced transformers and load management equipment. The act establishes a smart grid information clearinghouse and requires that demonstration projects use open protocols and standards.[48]

In addition to federal laws, numerous prestigious agencies and institutions have considered the national outlook for the smart grid and indicate that installing smart grid technologies, including smart meters, will have a positive benefit on the United States' electric grid. These reports urge the United States to follow the directives of the federal law and update the electric grid.

In 2012, the U.S. DOE issued the 2010 Smart Grid System Report. The report, required by the EISA, outlines the current status of smart grid development, projects its future, and identifies obstacles to its progress. It describes the scope of smart grid, recognizes its stakeholders, and makes recommendations for future reports. The report states that recent progress has been significant due to funding from ARRA of 2009, including the provision of $812.6 million in federal grant awards for AMI deployments throughout the United States, the implementation or expansion of distributed resource interconnection policies in 14 states since 2008, and funding the deployment of 877 phasor measurement units. The report determines that correctly assessing the value proposition and obtaining capital for new technologies that communicate information between electricity sector participants are challenges that need to be overcome in order to continue development of the smart grid.[49]

Several NARUC initiatives support smart grid activities. NARUC and FERC have established the Smart Response Collaborative which provides a forum for federal and state regulators to share information about the smart grid to support the development of better and more effective policies. NARUC has also passed resolutions that address smart grid. A resolution passed on July 20, 2011, endorsed a foundational

[47] Energy Independence and Security Act of 2007 (EISA), Pub. L. No. 110-140, 121 Stat. 1492, 1783-84 (codified at 42 U.S.C. § 17381).
[48] American Recovery and Reinvestment Act of 2009 (ARRA), Pub. L. No. 111-5, 123 Stat. 115, 516.).
[49] *U.S. DOE 2010 Smart Grid System Report*, Report to Congress, Washington DC, February 2012. http://energy.gov/oe/downloads/2010-smart-grid-system-report-february-2012

set of principles related to advance metering and smart grid deployments. The principles encourage the continued installation of smart grid technologies including AMI, while also advising utility commissions to continue to assess the best strategies for their states.[50]

The Future of the Electric Grid was published by the Massachusetts Institute of Technology (MIT), the sixth in a series of reports that examine the "future of" energy and environmental issues. The report provides a snapshot of the current status of the United States' electric grid and a vision for the evolution of the grid over the next two decades. The study group, consisting of MIT professors and research assistants, with input from industry and government experts, reviewed and evaluated existing research and made recommendations that will help to ensure the future of the electric grid. One of the main findings is that regulatory policies and the technologies used to support the grid must change or it is likely to be difficult to maintain acceptable reliability and reasonable electric rates. An updated distribution system with the use of AMI is instrumental to a smarter grid. The study identifies the benefits of AMI including a reduced cost of meter reading, more accurate and timely billing, improved customer support, enhanced distribution monitoring and management, support for demand response and energy conservation, quicker response to outages and reduced outage times. With the decreasing availability of electromechanical meters, AMI will soon be the most viable metering option available to utilities. The study acknowledges that there have been health concerns raised by customers, but concludes that the scientific research does not suggest that radio waves from smart meters have adverse health effects. They acknowledge that utilities may have to consider these concerns when designing their programs by inclusion of opt-out or other provisions.

The study also reviewed the status of cyber security readiness on the United States' grid. The report recommends a heightened focus on detection, response, and recovery strategies, especially for the distribution system. Since there is currently more than one agency working on this issue, a single agency should be given responsibility to develop and enforce standards across the entire electric power system.[51]

A Policy Framework for the 21st Century was issued by the federal government to build on the policy directives set forth in the EISA and the ARRA by creating a pathway to a modernized grid. A smarter, modernized and expanded grid is pivotal to the United States, playing a lead role in a clean energy future. The electric grid in the United States is at an advanced age. This makes it imperative to upgrade the grid in three categories: advanced information and communication technologies that improve transmission and distribution; advanced metering; and equipment that accesses and leverages energy usage information. The study concludes that AMI can empower consumers to better manage their energy usage and reduce their energy bills.

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[50] National Association of Regulatory Utility Commissioners, Smart Grid Resources. www.naruc.org/smartgrid/

[51] Massachusetts Institute of Technology, *The Future of the Electric Grid*, An Interdisciplinary MIT Study, 2011. http://web.mit.edu/mitei/research/studies/documents/electric-grid-2011/Electric_Grid_Full_Report.pdf

Ensuring the privacy of energy use data is also of primary concern to the study participants. Existing agencies, such as state public service commissions, may be able to set privacy rules for regulated utilities. The FTC's FIP principles can provide a framework for developing codes of conduct to protect this data.[52]

Policies and Practices

AMI has the potential to provide increased electric reliability while providing customers with the information and choices necessary to reduce or shift their electric consumption. Customers can only realize these benefits if utilities begin to collect more detailed usage data. While AMI does not transmit personal customer information, it does gather usage data more frequently than a traditional meter. Although utilities have been protecting customer data for many years, the collection, storage, use, access, and disclosure of customer consumption data have generated concerns about privacy, utility transparency, customer choice, and security. Attention to system reliability standards, electric technical standards and utility billing practices are warranted when addressing customer protection, data collection, customer privacy, cyber security, and system reliability benefits.

Several areas of current rules and tariffs will be affected by AMI deployment in Michigan. In some cases, the topic of concern is not a direct result of AMI. One example is privacy. Customers are more sensitive to privacy with the deployment of AMI, but the requirement for documented and clearly communicated utility privacy policies existed prior to AMI deployment. Consistently documenting privacy policies creates transparency and accountability as new technologies continue to evolve.

Electric utilities regulated by the Commission follow rules and standards for electric service set forth in administrative rules, tariffs, and Commission orders. All of these regulatory mechanisms should be considered and the most effective chosen to ensure customers have adequate protections.

The Staff conducted a preliminary investigation into national recommendations, rules from other states, and utility best practices. This investigation revealed Michigan's current policies are in need of review in order to address on-going customer issues.[53] Michigan should consider the following areas as the utility systems and utility/customer relationships change due to AMI.

- Customer Consent – Customers should have the option to authorize data collection and services not related to core billing and operational services.
- Individual Access and Participation – Customers should have easy, timely access to their detailed usage data in a standard downloadable format.
- Customer Choice –Utilities should clearly, fully, and accurately describe all choices available to customers.
- Notice and Purpose – Utilities should provide a detailed description of all purposes for which customer data will be used.

[52] *A Policy Framework for the 21st Century: Enabling Our Secure Energy Future, et al* http://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc-smart-grid-june2011.pdf
[53] A complete list of research sources is available in Appendix A

- Collection and Scope – Only information that is required to fulfill the stated purpose specified under Notice and Purpose should be collected.
- Security – Personal information in all forms should be protected from loss, theft, unauthorized access, inappropriate disclosure, copying, use, or modification. Utilities should implement breach notification policies and independent third party privacy and security audits.
- Management and Accountability – Utilities should develop and appoint personnel to ensure that information security, privacy policies, and privacy practices exist and are followed, including ongoing training and audits.
- Utility Processes – Utilities should provide a process for individuals to see and easily correct inaccuracies in their information. Utilities should estimate customer bills only if they are able to demonstrate that there was an unavoidable circumstance. Prepayment is an option that may be preferred by some customers.
- Meter Accuracy – Standards that ensure the accuracy of AMI meters should be developed.
- Service Reliability – Performance measures should reflect system reliability and outage support provided through AMI implementation.

The Staff examined current Commission rules and technical standards and found that some AMI related areas are not covered. For example, there is no definition for AMI. There are, however, current rules that address AMI capabilities such as remote shutoff (2007 AACS R 460.142). In a larger review of methodologies, rules and standards should be evaluated further.

It is recommended that all stakeholders work to analyze and identify the most appropriate implementation methods for addressing the policy considerations listed above. Stakeholders should routinely review all policies related to smart grid as smart grid technologies continue to develop.

Smart Grid Vision

When considering the deployment of AMI in Michigan, it is important to recognize that smart meters and their supporting communications infrastructure represent a single component of a fully modernized grid. AMI introduces a communications platform that can support a multitude of smart grid applications resulting in improved efficiency and reliability, as well as increased longevity of Michigan's aging electric infrastructure. When properly designed and implemented, AMI presents a unique opportunity for Michigan ratepayers to take control of their energy consumption and their energy bills.

The smart grid will enhance electric service in Michigan. Real time outage identification, through AMI, will result in a quicker response to outage situations. Areas without service can be identified almost immediately and individual customers who are still out after their neighborhood has been restored will be easily located. The smart grid technologies will reduce operations and maintenance costs, primarily through reduced meter reading costs, more accurate billing, reduced outage time and monitoring tools that help the utility anticipate equipment failure. AMI meters, with the use of dynamic and time-of-use rates, can reduce peak demand and increase energy conservation. The result could curtail the need for future

capital investment in electrical system capacity and lead to other grid efficiencies. This would result in lower capital costs for all ratepayers.

A Michigan smart grid vision should provide direction to implement technology that will enhance the functionality of the electric grid. It is difficult to have all utilities, vendors, regulators and customers share a succinct vision of what the future electric grid will look like. Therefore, it is important to identify electric grid "objectives" that outline a more reliable grid, improve power quality and incorporate cleaner power sources for electricity generation. All components of electric grid improvements, including AMI installation, distribution infrastructure replacement, and electric generation should reflect the larger objectives of a smart grid vision.

The Staff proposes that future smart grid investments from utilities must correlate with the following objectives aimed at delivering transparent and identifiable benefits to ratepayers:

- Accommodate advanced generation and storage options
- Enable informed participation by all customers
- Support new products, services, and markets
- Optimize existing assets, increase efficiency and improve reliability
- Operate resiliently against physical and cyber attacks

Michigan's current electric grid is characterized by centralized fossil fuel generation plants delivering electricity over long distances to meet customer needs. This model has been dominant for over a century and has provided an economical and reliable means of providing energy to Michigan citizens. However, increased investment and technological advances in decentralized generation and storage options such as gas turbines, diesel engines, solar photovoltaic, wind turbines, biomass generators and plug-in electric vehicles present potential generation options in the future. The Staff supports future grid investments that promote a more flexible grid that is capable of integrating any and all generation, two-way power flows and storage options. These investments will help ensure that Michigan ratepayers have access to the most cost effective generation in the future.

The traditional relationship that has existed between the utility and its ratepayers was limited to customers consuming energy and then receiving a monthly bill for the service. As the smart grid takes form in Michigan, the Staff envisions a much more interactive relationship developing between utility and customer. Utilities need to develop communications avenues and program incentives capable of informing, engaging, empowering, and motivating customers to change their behavior. The Staff believes that an extensive customer education campaign that coincides with technology deployment is pivotal to a successful implementation strategy. The Staff also believes that in the future, piloting a variety of customer programs (dynamic rates, prepay, demand response) to measure their effectiveness will be key to realizing the full spectrum of utility and customer benefits.

Consistent standards are necessary for new products, services and markets to be successful. Effective implementation of a smart grid in Michigan will bring an abundance of new products, services, and

markets that accommodate a variety of customer needs. Michigan customers should have access to the full potential of these innovations. For this reason, smart grid deployment in Michigan should be standards based. Nationally and globally recognized standards play a critical role in the ongoing development of these products, services and markets. The development and adoption of smart grid standards can help investments made today remain valuable into the future, remove barriers to innovation, maximize customer choice, create economies of scale, emphasize best practices, and open global markets. A standard based framework will promote interoperability and accommodate advances in technology.

The two-way flow of system information made possible by the implementation of AMI has multiple applications outside of metering. In the future, the Staff expects to see numerous efficiency applications made possible by the availability of real-time information. Using this system information to recognize and avoid issues such as power line congestion, transformer overheating, and other detrimental grid conditions, will lower the cost of transporting energy from the power plant to the customer meter and improve reliability. Optimizing the efficiency of existing assets already in rate base will help meet increasing electric demand while minimizing investment in new generation facilities and distribution assets.

The transition to a modern grid utilizing digital technology will require a large emphasis on security. The modernized grid must be capable of providing a greater level of reliability to prevent cyber-attacks and sabotage of utility equipment. Grid modernization plans should be developed concurrently with cyber security and outage mitigation strategies. Providing adequate focus on these threats prior to their occurrence will help mitigate the overall effect on Michigan customers. The longevity of a digitalized grid will rely on a utility's ability to plan for and react to both physical and cyber-attacks. Developing robust risk based management strategies can mitigate, if not eliminate, the potential of these threats coming to fruition.

The above objectives provide a glimpse of the potential benefits of moving to a modernized electric grid. Many of the benefits outlined above are being achieved in other jurisdictions throughout the country and the world. These benefits could be realized in Michigan with proper utility implementation strategies. The Staff sees prudent utility investments in AMI as a first step toward realizing a modern grid. The Staff will continuously evaluate requests from utilities for recovery of advanced digital technology for consistency with prudency principles.

Opt-Out Policies in Other Jurisdictions

A few state commissions have adopted opt-out policies for their regulated utilities. California and Maine have the two most prominent examples of commission approved opt-out policies. Costs vary across jurisdictions and service providers. Generally, an initial fee is charged to cover the fixed costs of retaining or replacing an electromechanical meter along with a monthly fee associated with the ongoing meter reading costs. For example: there is a $75 up-front charge and a $10 monthly meter reading charge associated with the opt-out tariff of Pacific Gas and Electric in California. NV Energy of Nevada charges a monthly opt-out fee, which is higher for customers in the northern part of the state and lower to south Nevada customers.

States and municipalities feature a variety of opt-out meter choices. Some states allow customers to retain their electromechanical meter, while others provide a smart meter with the radio transmitter turned off. When more than one opt-out method is offered (such as in Maine), the charge for retaining an electromechanical meter is greater than the radio disabled smart meter to reflect the actual increased cost of maintenance incurred by the utility. Also, NV Energy offers AMR meters to those who choose to opt-out. Using AMR infrastructure, while not optimal, does reduce the cost of an opt-out policy for both the customer and utility.

Not all utilities or states with AMI have an opt-out policy. The Public Service Commission of Washington D.C. denied a request for an investigation into opt-out, and earlier in 2012, an order from the Idaho Public Utilities Commission dismissed a pair of complaints from customers who demanded that an opt-out policy be created. Opt-out plans are not offered in the Canadian provinces of British Columbia and Ontario, while Hydro-Québec proposed a radio-off option with an up-front and monthly charge.

Some state regulators are in the process of discussing whether or not to offer AMI opt-out, while others are working through the process of reviewing proposals for utility opt-out policies and evaluating costs. Commissions in Texas and Arizona are currently investigating smart meter opt-out options. Lawmakers in Georgia and Pennsylvania have introduced legislation that requires opt-out. A senate bill in New Hampshire aims to make smart meter deployment strictly opt-in. Vermont's opt-out legislation was signed into law in May, and requires opt-out and smart meter removal free of charge. Table 2 shows the status of opt-out policies across the United States and Canada as of June 2012. It is important to note that the opt-out debate is constantly changing in light of commission findings, legislative actions, and utility planning across the country. There is no universal opt-out program.

Table 2: Smart Meter Opt-Out Policies

Jurisdiction	Opt-Out Activity	Opt-Out Cost to consumers
Arizona E-00000C-11-0328	Opened a generic docket for the investigation of smart meters. (8/29/11)	
Colorado Docket 10R-799E	The commission intends to address opt-out in future proceeding. (10/17/11)	
California Decision #D1202014	California PUC approved opt-out. (2/9/12)	Analog meter: $75 initial fee, $10 monthly fee, low income customers pay reduced fees.
District of Columbia Order-16708	DC PSC denied Office of the People's Counsel's request for opt-out investigation. (4/13/12)	
Georgia Senate Bill 459	Opt-out bill passed Georgia senate. (3/13/12)	Proposes no fee.
Idaho Order-32500	Consumer request for opt-out is dismissed. (3/27/12)	
Illinois, City of Naperville	Municipal utility approved opt-out.	Radio-off smart meter: $68.35 + $24.75/mo.
Maryland Cases 9207, 9208	Interim order allows customers to defer smart meter installation pending the commission's final decision. (5/24/12)	
Maine Docket 7307	Maine PUC approved opt-out. (5/19/11)	Radio-off smart meter: $20+$10.50/mo. Electromechanical meter: $40+ $12/mo.
Nevada Docket 11-10007	NV Energy proposed opt-out tariff: AMR w/ monthly reporting. (5/1/12)	South Nevada: $98.75 + $7.61/mo. North Nevada: $107.66+$11.01/mo.
New Hampshire Senate Bill 266	Bill prohibiting electric utilities from installing smart meters without the property owner's consent. Passed by house and senate. (5/16/12)	
Oregon Advice # 11-15 Tariff Sheet # 300	Allows PGE customers to opt-out of a digital meter. Idaho Power has digital meters in Oregon with no opt-out option. (8/10/11)	Portland GE: $254 + $51/mo.
Pennsylvania House Bill 2188	A bill allowing opt-out is in committee. (2/8/12)	
Quebec	Régie de l'énergie considering Hydro-Québec's proposed opt-out rates. (3/14/12)	Hydro-Quebec: $98 + $17/mo.
Texas Filing 40190	Petition requesting an opt-out being considered by the PUC. (2/16/12)	
Vermont Act 170	Law does not allow opt-out fees or smart meter removal fees. (5/18/12)	No cost for opt-out.

Opt-out Options

The Staff concludes that providing an opt-out option is the best solution for customers who have concerns about smart meters. The Staff recommends that utilities investigate a variety of opt-out options. Electromechanical meters may be a viable opt-out option for some customers; however, maintaining electromechanical test facilities, inventory, and manual meter reading could result in higher incremental costs.[54] The traditional electromechanical meter is obsolete and currently not in production. Offering customers an electromechanical meter as an alternative to a smart meter is not a long-term solution.

Other options are the installation of a smart meter that does not have a communicating radio, relocating a smart meter on the customer's premise, or hard-wiring a smart meter into the network. A smart meter without a communicating radio allows the utility to maintain one type of meter. However, manual meter reading would still be required. Customers with a non-communicating meter will not receive some benefits of AMI, and would not, for example, be able to fully participate in new rate structures.

Smart meter relocation would allow customers to still receive all the benefits of AMI. Meter relocation may result in a higher initial cost and may not be feasible at some locations. Currently, administrative rules governing meter relocation allow the customer to request meter relocation at the customer's expense.[55]

A wired smart meter also permits opt-out customers to receive all AMI benefits by allowing two-way communication with the utility without using radio frequency (i.e. power line carrier, fiber optic cable, etc.). This option may be costly and may not be feasible within the confines of the utility infrastructure or of the customer's premises.

As discussed above, there are costs associated with allowing a customer to opt-out. Most states have acknowledged these costs by assessing charges that reflect the actual cost of maintaining a non-AMI meter.

No opt-out tariffs have been submitted to the Commission by any Michigan utilities as of June 2012. The Staff believes that ratemaking for the opt-out provision should be based on cost-of-service principles. If AMI meters result in a reduced cost of service, this could be accounted for by either an additional charge for those customers choosing to opt-out or a discount for those customers with an AMI meter.

[54] Commission billing rules allow for customers to read their own meters. However, the utility must verify the meter reading once a year. (Consumer Standards and Billing Practices for Electric and Gas Residential Services, R 460.115)

[55] Consumer Standards and Billing Practices For Electric and Gas Residential Services, 1999 AC, R 460.116

RECOMMENDATIONS AND CONCLUSIONS

Health and Safety

- After careful review of the available literature and studies, the Staff has determined that the health risk from the installation and operation of metering systems using radio transmitters is insignificant.

- The appropriate federal health and safety regulations provide assurance that smart meters represent a safe technology.

Data Privacy

- The Staff recommends that all stakeholders identify and implement privacy policy considerations through administrative rules, tariffs, orders and/or other means.

- Customer data privacy policies should include provisions addressing customer consent, individual access, customer choice, notice and purpose, collection and scope, data retention and management and accountability.

Cyber Security

- Each utility should adopt an annual independent security audit of the mechanisms of customer access, third party access and internal cyber risk-management practices.

- As outlined in the NARUC resolution regarding cyber security, the Staff intends to maintain a dialogue with regulated utilities to ensure that they are in compliance with standards, and that preparedness measures are employed to deter, detect and respond to cyber-attacks and to mitigate and recover from them.[56]

- Utilities should adopt the same breach notification policies as other states have adopted, namely the notification of any breach affecting 1000 or more customers within two weeks of the breach.

- Each utility should be required to file a yearly breach notification summary with the Staff, detailing all breaches of customer information, including any third party breach information.

Customer Education

- The Staff recommends utilities develop and implement a new education strategy similar to those used in other jurisdictions. Education program results should reflect high levels of customer engagement, acceptance and enthusiasm with their smart meter program.

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[56] NARUC, *Resolution Regarding Cybersecurity, et al.*

- The strategy should include metrics to measure the overall effectiveness of the education program.

National Policy

- The United States Congress has passed several laws that support the upgrade of the electric grid, including deployment of smart meters for residential and other types of customers. These laws have provided a framework for smart grid, including smart meter deployment in the United States.

- Numerous prestigious agencies and institutions have considered the national outlook for the smart grid and indicate that installing smart grid technologies, including smart meters, will have a positive benefit on the United States' electric grid. These reports urge the United States to follow the directives of the federal law and update the electric grid.

Policies and Practices

- Several areas of current rules and tariffs will be affected by AMI deployment in Michigan. Administrative rules, tariffs, and Commission orders should be considered, and the most effective methodology should be employed to ensure customers have adequate protections.

- It is recommended that all stakeholders work to analyze and identify the most appropriate implementation methods for addressing the policy considerations. Stakeholders should routinely review all policies related to smart grid as smart grid technologies continue to develop.

Smart Grid Vision

- A Michigan smart grid vision should provide direction to implement technology that will enhance the functionality of the electric grid. All components of electric grid improvements, including AMI installation, distribution infrastructure replacement, and electric generation should reflect the larger objectives of a smart grid vision.

- The Staff proposes that future smart grid investments from utilities must correlate with the following objectives aimed at delivering transparent and identifiable benefits to ratepayers: accommodate advanced generation and storage options; enable informed participation by all customers; support new products, services, and markets; optimize existing assets, increase efficiency and improve reliability; and operate resiliently against physical and cyber-attacks.

Opt-Out

- The Staff concludes that an opt-out option or options is the best solution for customers who have concerns about smart meters.
- The Staff believes that ratemaking for the opt-out provision should be based on cost of service principles. If AMI meters result in a reduced cost of service, this could be accounted for by either an additional charge for those customers choosing to opt-out or a discount for those customers with an AMI meter.

Appendix A

Additional Resources:

- *National Institute of Standards and Technology Interagency Report 7628, Guidelines for Smart Grid Cyber Security: Vol. 1, Privacy and the Smart Grid*, August 2010. http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol1.pdf
- *National Institute of Standards and Technology Interagency Report 7628, Guidelines for Smart Grid Cyber Security: Vol. 2, Privacy and the Smart Grid,* August 2010.
- http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf
- North American Energy Standards Board, *Third Party Access to Smart Meter-based Information*, April 20, 2012.
- Oklahoma Electric Usage Data Protection Act, H.B. 1079, May 20, 2011.
- C. Hagan & K. Thomas, *A Model Privacy Policy for Smart Grid Data Institute for Energy and the Environment*, Vermont Law School, November 4, 2011.
- Public Utility Commission of Texas, Electric Substantive Rules, Chapter 25 Rules. http://www.puc.state.tx.us/agency/rulesnlaws/subrules/electric/Electric.aspx
- Federal Trade Commission, Fair Information Practice Principles. http://www.ftc.gov/reports/privacy3/fairinfo.shtm
- Colorado Department of Regulatory Agencies Public Utilities Commission, 4 Code of Colorado Regulations 723-3 Part 3, Rules Regulating Electric Utilities, February 14, 2012.
- United States Code 47 §222, Privacy of Customer Information, January 7, 2011.
- Naperville Smart Grid Initiative, Naperville Smart Grid Customer Bill of Rights, Ordinance No. 11-029, February 16, 2011.
- Washington Administrative Code, Chapter 480-100, Electric Companies, February 15, 2012. http://apps.leg.wa.gov/wac/default.aspx?cite=480-100
- California Public Utility Commission, Public Utility Code Chapter 4-5. http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=puc
- NAESB Data Privacy Task Force, Team Five-State and Province Law. www.naesb.org/pdf4/data_privacy_042111w3.doc
- Arizona State Legislature, Consumer Protections; rules; confidentiality; unlawful practice http://www.azleg.gov/FormatDocument.asp?inDoc=/ars/30/00806.htm&Title=30&DocType=ARS
- California Public Utilities Commission, Decision Adopting Rules To Protect The Privacy And Security Of The Electricity Usage Data Of The Customers Of Pacific Gas And Electric Company, Southern California Edison Company, And San Diego Gas & Electric Company
- http://www.azleg.gov/FormatDocument.asp?inDoc=/ars/30/00806.htm&Title=30&DocType=ARS

- Colorado Department Of Regulatory Agencies, Public Utilities Commission, 4 Code of Colorado Regulations (CCR) 723-3, Part 3, Rules Regulating Electric Utilities. http://www.dora.state.co.us/puc/rules/723-3.pdf

- New York Department of Public Services, Smart Grid Privacy Statement. http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=10-E-0285

- Oklahoma State Legislature, Electric Usage Data Protection Act. http://www.oklegislature.gov/BillInfo.aspx?Bill=HB1079&Tab=0

- United States Department of Energy, Smart Grid Privacy Workshop Summary Report. http://www.smartgrid.gov/sites/default/files/doc/files/Privacy%20report%202012_03_19%20Final.pdf

- United States Department of Homeland Security, Privacy Policy Guidance Memorandum, December 29, 2008. http://www.dhs.gov/xlibrary/assets/privacy/privacy_policyguide_2008-01.pdf

- United States Department of Energy, Electricity Subsector cyber security risk management process, March 2012: Public Comment Draft. http://energy.gov/sites/prod/files/RMP%20Guideline%20Second%20Draft%20for%20Public%20Comment%20-%20March%202012.pdf

- Executive Office of the President, A Policy Framework For the 21st Century Grid, June 2011. http://www.whitehouse.gov/sites/default/files/microsites/ostp/nstc-smart-grid-june2011.pdf

- National Institute of Science and Technology, NIST Framework and Roadmap for Smart Grid Interoperability Standards Release 2.0. http://www.nist.gov/smartgrid/upload/NIST_Framework_Release_2-0_corr.pdf

- ASIS International, Utility and Smart Grid Security: The impact of NERC CIP Standards and NISTIR 7628 to the Utility Industry. http://www.asisonline.org/councils/documents/UtilitySmartGridSecurity.pdf