Melissa,

I am writing to you in support of the HB4236 removal of the 1% cap on solar panel installations.

Please share with the energy committee, that I ask, that they all vote yes in favor of removing the 1% cap on solar installations.

We also need assistance in correcting verbiage in the State Energy Bill PA 0342, the correction is the definition of renewable energy. P.4 Sect. 11 (a)

We need help to address another travesty on what is listed as the definition of renewable energy.

See attached, State Energy Bill 2016 -PA-3042

Highlighted. P. 4 Section. 11 (a) "Renewable energy" means electricity or steam generated using a renewable energy system.

We need to get the correct definition of "Renewable Energy" into the energy bill, it should read something like the following.

Renewable energy is energy derived from natural processes that is replenished constantly. Natural resources that are unlimited, (Such as sunlight, wind, or thermal energy from within the earth, and also generated by the sun that is then stored in the earth.

We had geothermal heat pump technology included in the energy bill as a source of renewable energy, see P.5 Sect 11 (g) (vi) Highlighted.

Please Review,

See attached Suitability of renewable energy Technologies, P. 4 Sect 3, Renewable Energy Technology, RET's Classifications and types.

Also review attached article on "Michigan State Capital Goes Geothermal". Using Geothermal Heat Pumps in your very Capital.

Please see what you may be able to do and have the Energy Committee address the issue, and correct definition of Renewable Energy that is currently entered in our State Energy Bill PA 3042.

Please reach out if you may have any further questions.

Best Regards, Al

WaterFurnace International

Alan Waller

Territory Manager Michigan

Act No. 342
Public Acts of 2016
Approved by the Governor
December 21, 2016
Filed with the Secretary of State
December 21, 2016
EFFECTIVE DATE: April 20, 2017

STATE OF MICHIGAN
98TH LEGISLATURE
REGULAR SESSION OF 2016

Introduced by Senator Proos

ENROLLED SENATE BILL No. 438

AN ACT to amend 2008 PA 295, entitled "An act to require certain providers of electric service to establish renewable energy programs; to require certain providers of electric or natural gas service to establish energy optimization programs; to authorize the use of certain energy systems to meet the requirements of those programs; to provide for the approval of energy optimization service companies; to provide for certain charges on electric and natural gas bills; to promote energy conservation by state agencies and the public; to create a wind energy resource zone board and provide for its power and duties; to authorize the creation and implementation of wind energy resource zones; to provide for expedited transmission line siting certificates; to provide for a net metering program and the responsibilities of certain providers of electric service and customers with respect to net metering; to provide for fees; to prescribe the powers and duties of certain state agencies and officials; to require the promulgation of rules and the issuance of orders; and to provide for civil sanctions, remedies, and penalties," by amending the title, the headings of subparts B and C of part 2 and the heading of part 5, and sections 1, 3, 5, 7, 9, 11, 13, 29, 39, 41, 45, 47, 49, 71, 73, 75, 77, 81, 83, 85, 87, 89, 91, 93, 95, 97, 113, 173, 175, 177, and 179 (MCL 460.1001, 460.1003, 460.1005, 460.1007, 460.1009, 460.1011, 460.1013, 460.1029, 460.1039, 460.1041, 460.1045, 460.1047, 460.1049, 460.1071, 460.1073, 460.1075, 460.1077, 460.1081, 460.1083, 460.1085, 460.1087, 460.1089, 460.1091, 460.1093, 460.1095, 460.1097, 460.1113, 460.1173, 460.1175, 460.1177, and 460.1179), section 93 as amended by 2010 PA 269, and by adding subpart B to part 2, sections 22, 28, 54, 74, 78, 99, 183, and 185, and part 7; and to repeal acts and parts of acts.

The People of the State of Michigan enact:

TITLE

An act to require certain providers of electric service to establish and recover costs for renewable energy programs; to require certain providers of electric or natural gas service to establish energy waste reduction programs; to authorize the use of certain energy systems to meet the requirements of those programs; to provide for the approval of energy waste reduction service companies; to reduce energy waste by state agencies and the public; to create a wind energy resource zone board and provide for its power and duties; to authorize the creation and implementation of wind energy resource zones; to provide for expedited transmission line siting certificates; to provide for customer generation and net metering programs and the responsibilities of certain providers of electric service and customers with respect to customer generation and net metering; to provide for fees; to prescribe the powers and duties of certain state agencies and officials; to require the promulgation of rules and the issuance of orders; to authorize the establishment of residential energy improvement programs by providers of electric or natural gas service; and to provide for civil sanctions, remedies, and penalties.

Sec. 1. (1) This act shall be known and may be cited as the "clean and renewable energy and energy waste reduction act".

(2) The purpose of this act is to promote the development and use of clean and renewable energy resources and the reduction of energy waste through programs that will cost-effectively do all of the following:

(a) Diversify the resources used to reliably meet the energy needs of consumers in this state.

(b) Provide greater energy security through the use of indigenous energy resources available within the state.

(c) Encourage private investment in renewable energy and energy waste reduction.

(d) Coordinate with federal regulations to provide improved air quality and other benefits to energy consumers and citizens of this state.

(e) Remove unnecessary burdens on the appropriate use of solid waste as a clean energy source.

(3) As a goal, not less than 35% of this state's electric needs should be met through a combination of energy waste reduction and renewable energy by 2025, if the investments in energy waste reduction and renewable energy are the most reasonable means of meeting an electric utility's energy and capacity needs relative to other resource options. Both of the following count toward achievement of the goal:

(a) All renewable energy, including renewable energy credits purchased or otherwise acquired with or without the associated renewable energy, and any banked renewable energy credits, that counted toward the renewable energy standard on the effective date of the 2016 amendatory act that added this subsection, as well as renewable energy credits granted as a result of any investments made in renewable energy by the utility or a utility customer after that effective date.

(b) The sum of the annual electricity savings since October 6, 2008, as recognized by the commission through annual reconciliation proceedings, that resulted from energy waste reduction measures implemented under an energy optimization plan or energy waste reduction plan approved under section 73.

Sec. 3. As used in this act:

(a) "Applicable regional transmission organization" means a nonprofit, member-based organization governed by an independent board of directors that serves as the regional transmission organization approved by the Federal Energy Regulatory Commission with oversight responsibility for the region that includes the provider's service territory.

(b) "Biomass" means any organic matter that is not derived from fossil fuels, that can be converted to usable fuel for the production of energy, and that replenishes over a human, not a geological, time frame, including, but not limited to, all of the following:

(*i*) Agricultural crops and crop wastes.

(*ii*) Short-rotation energy crops.

(*iii*) Herbaceous plants.

(*iv*) Trees and wood, but only if derived from sustainably managed forests or procurement systems, as defined in section 261c of the management and budget act, 1984 PA 431, MCL 18.1261c.

(*v*) Paper and pulp products.

(*vi*) Precommercial wood thinning waste, brush, or yard waste.

(*vii*) Wood wastes and residues from the processing of wood products or paper.

(*viii*) Animal wastes.

(*ix*) Wastewater sludge or sewage.

(*x*) Aquatic plants.

(*xi*) Food production and processing waste.

(*xii*) Organic by-products from the production of biofuels.

(c) "Board" means the wind energy resource zone board created under section 143.

(d) "Carbon dioxide emissions benefits" means that the carbon dioxide emissions per megawatt hour of electricity generated by the advanced cleaner energy system are at least 85% less or, for an integrated gasification combined cycle facility or an integrated pyrolysis combined cycle facility, 70% less than the average carbon dioxide emissions per megawatt hour of electricity generated from all coal-fired electric generating facilities operating in this state on January 1, 2008.

(e) "Cogeneration facility" means a facility that produces both electricity and useful thermal energy, such as heat or steam, in a way that is more efficient than the separate production of those forms of energy.

(f) "Commission" means the Michigan public service commission.

(g) "Customer meter" means an electric meter of a provider's retail customer. Customer meter does not include a municipal water pumping meter or additional meters at a single site that were installed specifically to support interruptible air conditioning, interruptible water heating, net metering, or time-of-day tariffs.

(h) "Distributed generation program" means the program established by the commission under section 173.

Sec. 5. As used in this act:

(a) "Electric provider" means any of the following:

(*i*) Any person or entity that is regulated by the commission for the purpose of selling electricity to retail customers in this state.

(*ii*) A municipally owned electric utility in this state.

(*iii*) A cooperative electric utility in this state.

(*iv*) Except as used in subpart C of part 2, an alternative electric supplier licensed under section 10a of 1939 PA 3, MCL 460.10a.

(b) "Eligible electric generator" means a methane digester or renewable energy system with a generation capacity limited to the customer's electric need and that does not exceed the following:

(*i*) For a renewable energy system, 150 kilowatts of aggregate generation at a single site.

(*ii*) For a methane digester, 550 kilowatts of aggregate generation at a single site.

(c) "Energy conservation" means the reduction of customer energy use through the installation of measures or changes in energy usage behavior.

(d) "Energy efficiency" means a decrease in customer consumption of electricity or natural gas achieved through measures or programs that target customer behavior, equipment, devices, or materials without reducing the quality of energy services.

(e) "Energy star" means the voluntary partnership among the United States Department of Energy, the United States Environmental Protection Agency, product manufacturers, local utilities, and retailers to help promote energy efficient products by labeling with the energy star logo, educate consumers about the benefits of energy efficiency, and help promote energy efficiency in buildings by benchmarking and rating energy performance.

(f) "Energy waste reduction", subject to subdivision (g), means all of the following:

(*i*) Energy efficiency.

(*ii*) Load management, to the extent that the load management reduces provider costs.

(*iii*) Energy conservation, but only to the extent that the decreases in the consumption of electricity produced by energy conservation are objectively measurable and attributable to an energy waste reduction plan.

(g) Energy waste reduction does not include electric provider infrastructure projects that are approved for cost recovery by the commission other than as provided in this act.

(h) "Energy waste reduction credit" means a credit certified pursuant to section 87 that represents achieved energy waste reduction.

(i) "Energy waste reduction plan" means a plan under section 71.

(j) "Energy waste reduction standard" means the minimum energy savings required to be achieved under section 77 or 78(1), as applicable.

(k) "Federal approval" means approval by the applicable regional transmission organization or other Federal Energy Regulatory Commission-approved transmission planning process of a transmission project that includes the transmission line. Federal approval may be evidenced in any of the following manners:

(*i*) The proposed transmission line is part of a transmission project included in the applicable regional transmission organization's board-approved transmission expansion plan.

(*ii*) The applicable regional transmission organization has informed the electric utility, affiliated transmission company, or independent transmission company that a transmission project submitted for an out-of-cycle project review has been approved by the applicable regional transmission organization, and the approved transmission project includes the proposed transmission line.

(*iii*) If, after October 6, 2008, the applicable regional transmission organization utilizes another approval process for transmission projects proposed by an electric utility, affiliated transmission company, or independent transmission company, the proposed transmission line is included in a transmission project approved by the applicable regional transmission organization through the approval process developed after October 6, 2008.

(*iv*) Any other Federal Energy Regulatory Commission-approved transmission planning process for a transmission project.

Sec. 7. As used in this act:

(a) "Gasification facility" means a facility located in this state that, using a thermochemical process that does not involve direct combustion, produces synthesis gas, composed of carbon monoxide and hydrogen, from carbon-based feedstocks (such as coal, petroleum coke, wood, biomass, hazardous waste, medical waste, industrial waste, and solid waste, including, but not limited to, municipal solid waste, electronic waste, and waste described in section 11514 of the natural resources and environmental protection act, 1994 PA 451, MCL 324.11514) and that uses the synthesis gas or a

mixture of the synthesis gas and methane to generate electricity for commercial use. Gasification facility includes the transmission lines, gas transportation lines and facilities, and associated property and equipment specifically attributable to such a facility. Gasification facility includes, but is not limited to, an integrated gasification combined cycle facility and a plasma arc gasification facility.

(b) "Incremental costs of compliance" means the net revenue required by an electric provider to comply with the renewable energy standard, calculated as provided under section 47.

(c) "Independent transmission company" means that term as defined in section 2 of the electric transmission line certification act, 1995 PA 30, MCL 460.562.

(d) "Integrated gasification combined cycle facility" means a gasification facility that uses a thermochemical process, including high temperatures and controlled amounts of air and oxygen, to break substances down into their molecular structures and that uses exhaust heat to generate electricity.

(e) "Integrated pyrolysis combined cycle facility" means a pyrolysis facility that uses exhaust heat to generate electricity.

(f) "LEED" means the leadership in energy and environmental design green building rating system developed by the United States Green Building Council.

(g) "Load management" means measures or programs that target equipment or behavior to result in decreased peak electricity demand such as by shifting demand from a peak to an off-peak period.

(h) "Megawatt", "megawatt hour", or "megawatt hour of electricity", unless the context implies otherwise, includes the steam equivalent of a megawatt or megawatt hour of electricity.

(i) "Modified net metering" means a utility billing method that applies the power supply component of the full retail rate to the net of the bidirectional flow of kilowatt hours across the customer interconnection with the utility distribution system, during a billing period or time-of-use pricing period. A negative net metered quantity during the billing period or during each time-of-use pricing period within the billing period reflects net excess generation for which the customer is entitled to receive credit under section 177(4). Under modified net metering, standby charges for distributed generation customers on an energy rate schedule shall be equal to the retail distribution charge applied to the imputed customer usage during the billing period. The imputed customer usage is calculated as the sum of the metered on-site generation and the net of the bidirectional flow of power across the customer interconnection during the billing period. The commission shall establish standby charges under modified net metering for distributed generation customers on demand-based rate schedules that provide an equivalent contribution to utility system costs. A charge for net metering and distributed generation customers established pursuant to section 6a of 1939 PA 3, MCL 460.6a, shall not be recovered more than once. This subdivision is subject to section 177(5).

Sec. 9. As used in this act:

(a) "Natural gas provider" means an investor-owned business engaged in the sale and distribution at retail of natural gas within this state whose rates are regulated by the commission.

(b) "Pet coke" means a solid carbonaceous residue produced from a coker after cracking and distillation from petroleum refining operations.

(c) "Plasma arc gasification facility" means a gasification facility that uses a plasma torch to break substances down into their molecular structures.

(d) "Provider" means an electric provider or a natural gas provider.

(e) "PURPA" means the public utility regulatory policies act of 1978, Public Law 95-617.

(f) "Pyrolysis facility" means a facility that effects thermochemical decomposition at elevated temperatures without the participation of oxygen, from carbon-based feedstocks including, but not limited to, coal, wood, biomass, industrial waste, or solid waste, but not including pet coke, hazardous waste, coal waste, or scrap tires. Pyrolysis facility includes the transmission lines, gas transportation lines and facilities, and associated property and equipment specifically attributable to the facility. Pyrolysis facility includes, but is not limited to, an integrated pyrolysis combined cycle facility.

Sec. 11. As used in this act:

(a) "Renewable energy" means electricity or steam generated using a renewable energy system.

(b) "Renewable energy contract" means a contract to acquire renewable energy and the associated renewable energy credits from 1 or more renewable energy systems.

(c) "Renewable energy credit" means a credit granted under a certification and tracking program established under section 41, which represents generated renewable energy.

(d) "Renewable energy credit portfolio" means the sum of the renewable energy credits achieved by a provider for a particular year.

(e) "Renewable energy credit standard" means a minimum renewable energy credit portfolio required under section 28 or former section 27.

(f) "Renewable energy plan" or "plan" means a plan approved under section 22 or former section 21 or 23 or found to comply with this act under former section 25, with any amendments adopted under this act.

(g) "Renewable energy resource" means a resource that naturally replenishes over a human, not a geological, time frame and that is ultimately derived from solar power, water power, or wind power. Renewable energy resource does not include petroleum, nuclear, natural gas, or coal. A renewable energy resource comes from the sun or from thermal inertia of the earth and minimizes the output of toxic material in the conversion of the energy and includes, but is not limited to, all of the following:

(*i*) Biomass.

(*ii*) Solar and solar thermal energy.

(*iii*) Wind energy.

(*iv*) Kinetic energy of moving water, including all of the following:

(A) Waves, tides, or currents.

(B) Water released through a dam.

(*v*) Geothermal energy.

(*vi*) Thermal energy produced from a geothermal heat pump.

(*vii*) Any of the following cleaner energy resources:

(A) Municipal solid waste, including the biogenic and anthropogenic factions.

(B) Landfill gas produced by municipal solid waste.

(C) Fuel that has been manufactured in whole or significant part from waste, including, but not limited to, municipal solid waste. Fuel that meets the requirements of this subparagraph includes, but is not limited to, material that is listed under 40 CFR 241.3(b) or 241.4(a) or for which a nonwaste determination is made by the United States Environmental Protection Agency pursuant to 40 CFR 241.3(c). Pet coke, hazardous waste, coal waste, or scrap tires are not fuel that meets the requirements of this subparagraph.

(h) "Renewable energy standard" means the minimum renewable energy capacity portfolio, if applicable, and the renewable energy credit portfolio required to be achieved under section 28 or former section 27.

(i) "Renewable energy system" means a facility, electricity generation system, or set of electricity generation systems that use 1 or more renewable energy resources to generate electricity or steam. Renewable energy system does not include any of the following:

(*i*) A hydroelectric pumped storage facility.

(*ii*) A hydroelectric facility that uses a dam constructed after October 6, 2008 unless the dam is a repair or replacement of a dam in existence on October 6, 2008 or an upgrade of a dam in existence on October 6, 2008 that increases its energy efficiency.

(*iii*) An incinerator unless the incinerator is a municipal solid waste incinerator as defined in section 11504 of the natural resources and environmental protection act, 1994 PA 451, MCL 324.11504.

(j) "Revenue recovery mechanism" means the mechanism for recovery of incremental costs of compliance provided for under section 22.

Sec. 13. As used in this act:

(a) "Site" means a contiguous site, regardless of the number of meters at that site. A site that would be contiguous but for the presence of a street, road, or highway is considered to be contiguous for the purposes of this subdivision.

(b) "Transmission line" means all structures, equipment, and real property necessary to transfer electricity at system bulk supply voltage of 100 kilovolts or more.

(c) "True net metering" means a utility billing method that applies the full retail rate to the net of the bidirectional flow of kilowatt hours across the customer interconnection with the utility distribution system, during a billing period or time-of-use pricing period. A negative net metered quantity during the billing period or during each time-of-use pricing period within the billing period reflects net excess generation for which the customer is entitled to receive credit under section 177(4). This subdivision is subject to section 177(5).

(d) "Utility system resource cost test" means a standard that is met for an investment in energy waste reduction if, on a life cycle basis, the total avoided supply-side costs to the provider, including representative values for electricity or natural gas supply, transmission, distribution, and other associated costs, are greater than the total costs to the provider of administering and delivering the energy waste reduction program, including net costs for any provider incentives paid by customers and capitalized costs recovered under section 89.

(e) "Wind energy conversion system" means a system that uses 1 or more wind turbines to generate electricity and has a nameplate capacity of 100 kilowatts or more.

(f) "Wind energy resource zone" or "wind zone" means an area designated by the commission under section 147.

Sec. 22. (1) Renewable energy plans and associated revenue recovery mechanisms filed by an electric provider, approved under former section 21 or 23 or found to comply with this act under former section 25 and in effect on the effective date of the 2016 amendatory act that added this section, remain in effect, subject to amendments as provided for under subsections (3) and (4).

(2) For an electric provider whose rates are regulated by the commission, amended renewable energy plans shall establish a nonvolumetric mechanism for the recovery of the incremental costs of compliance within the electric provider's customer rates. The revenue recovery mechanism shall not result in rate impacts that exceed the monthly maximum retail rate impacts specified under section 45. The revenue recovery mechanism is subject to adjustment under sections 47(4) and 49.

(3) Within 1 year after the effective date of the 2016 amendatory act that added this section, the commission shall review each electric provider's plan pursuant to a filing schedule established by the commission. For an electric provider whose rates are regulated by the commission, the commission shall conduct a contested case hearing on the plan pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328. After the hearing, the commission shall approve, with any changes consented to by the electric provider, or reject the plan and any amendments to the plan. For all other electric providers, the commission shall provide an opportunity for public comment on the plan. After the applicable opportunity for public comment, the commission shall determine whether any amendment to the plan proposed by the provider complies with this act. For alternative electric suppliers, the commission shall approve, with any changes consented to by the electric provider, or reject any proposed amendments to the plan. For cooperative electric utilities and municipally owned utilities, the proposed amendment is adopted if the commission determines that it complies with this act.

(4) If an electric provider proposes to amend its plan after the review process under subsection (3), the electric provider shall file the proposed amendment with the commission. For an electric provider whose rates are regulated by the commission, if the proposed amendment would modify the revenue recovery mechanism, the commission shall conduct a contested case hearing on the amendment pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328. After the hearing and within 90 days after the amendment is filed, the commission shall approve, with any changes consented to by the electric provider, or reject the plan and the proposed amendment or amendments to the plan. For all other electric providers, the commission shall provide an opportunity for public comment on the amendment. After the applicable opportunity for public comment and within 90 days after the amendment is filed, the commission shall determine whether the proposed amendment to the plan complies with this act. For alternative electric suppliers, the commission shall approve, with any changes consented to by the electric provider, or reject any proposed amendments to the plan. For cooperative electric utilities and municipally owned utilities, the proposed amendment is adopted if the commission determines that it complies with this act.

(5) For an electric provider whose rates are regulated by the commission, the commission shall approve the plan or amendments to the plan if the commission determines:

(a) That the plan is reasonable and prudent. In making this determination, the commission shall take into consideration projected costs and whether or not projected costs in prior plans were exceeded.

(b) That the plan is consistent with the purpose and goal set forth in section 1(2) and (3) and meets the renewable energy credit standard through 2021.

(6) If the commission rejects a proposed plan or amendment under this section, the commission shall explain in writing the reasons for its determination.

Sec. 28. (1) An electric provider shall achieve a renewable energy credit portfolio as follows:

(a) In 2016 through 2018, a renewable energy credit portfolio that consists of at least the same number of renewable energy credits as were required under former section 27.

(b) In 2019 and 2020, a renewable energy credit portfolio of at least 12.5%, as calculated under subsection (2).

(c) In 2021, a renewable energy credit portfolio of at least 15%, as calculated under subsection (2).

(2) An electric provider's renewable energy credit portfolio shall be calculated as follows:

(a) Determine the number of renewable energy credits used to comply with this subpart during the applicable year.

(b) Divide by 1 of the following at the option of the electric provider as specified in its renewable energy plan:

(*i*) The number of weather normalized megawatt hours of electricity sold by the electric provider during the previous year to retail customers in this state.

(*ii*) The average number of megawatt hours of electricity sold by the electric provider annually during the previous 3 years to retail customers in this state.

(c) Multiply the quotient under subdivision (b) by 100.

(3) Subject to subsection (5), each electric provider shall meet the renewable energy credit standards with renewable energy credits obtained by 1 or more of the following means:

(a) Generating electricity from renewable energy systems for sale to retail customers.

(b) Purchasing or otherwise acquiring renewable energy credits with or without the associated renewable energy.

(4) For an electric provider whose rates are regulated by the commission, the electric provider shall submit a contract entered into for the purposes of subsection (3) to the commission for review and approval. If the commission approves the contract, it shall be considered consistent with the electric provider's renewable energy plan. The commission shall not approve a contract based on an unsolicited proposal unless the commission determines that the unsolicited proposal provides opportunities that may not otherwise be available or commercially practical through a competitive bid process.

(5) An electric provider may substitute energy waste reduction credits for renewable energy credits otherwise required to meet the renewable energy credit standards if the substitution is approved by the commission. Under this subsection, energy waste reduction credits shall not be used by a provider to meet more than 10% of the renewable energy credit standard. One renewable energy credit shall be awarded per 1 energy waste reduction credit.

Sec. 29. (1) Subject to subsection (2), a renewable energy system that is the source of renewable energy credits used to satisfy the renewable energy standards shall be either located outside of this state in the retail electric customer service territory of any provider that is not an alternative electric supplier or located anywhere in this state. For the purposes of this subsection, a retail electric customer service territory shall be considered to be the territory recognized by the commission on January 1, 2008 and any expansion of retail electric customer service territory recognized by the commission after January 1, 2008 under 1939 PA 3, MCL 460.1 to 460.11. The commission may also expand a service territory for the purposes of this subsection if a lack of transmission lines limits the ability to obtain sufficient renewable energy from renewable energy systems that meet the location requirement of this subsection.

(2) The renewable energy system location requirements in subsection (1) do not apply if 1 or more of the following requirements are met:

(a) The renewable energy system is a wind energy conversion system and the electricity generated by the wind energy system, or the renewable energy credits associated with that electricity, is being purchased under a contract in effect on January 1, 2008. If the electricity and associated renewable energy credits purchased under such a contract are used by an electric provider to meet renewable energy requirements established after January 1, 2008 by the legislature of the state in which the wind energy conversion system is located, the electric provider may, for the purpose of meeting the renewable energy credit standard under this act, obtain, by any means authorized under section 28, up to the same number of replacement renewable energy credits from any other wind energy conversion systems located in that state. This subdivision shall not be utilized by an alternative electric supplier unless the alternative electric supplier was licensed in this state on January 1, 2008. Renewable energy credits from a renewable energy system under a contract with an alternative electric supplier under this subdivision shall not be used by another electric provider to meet its requirements under this part.

(b) The renewable energy system is a wind energy conversion system that was under construction or operational and owned by an electric provider on January 1, 2008. This subdivision shall not be utilized by an alternative electric supplier.

(c) The renewable energy system is a wind energy conversion system that includes multiple wind turbines, at least 1 of the wind turbines meets the location requirements of this section, and the remaining wind turbines are within 15 miles of a wind turbine that is part of that wind energy conversion system and that meets the location requirements of this section.

(d) Before January 1, 2008, an electric provider serving not more than 75,000 retail electric customers in this state filed an application for a certificate of authority for the renewable energy system with a state regulatory commission in another state that is also served by the electric provider. However, renewable energy credits shall not be granted under this subdivision for electricity generated using more than 10.0 megawatts of nameplate capacity of the renewable energy system.

(e) Electricity generated from the renewable energy system is sold by a not-for-profit entity located in Indiana, Ohio, or Wisconsin to a municipally-owned electric utility in this state or cooperative electric utility in this state, and the electricity is not being used to meet another state's standard for renewable energy.

(f) All of the following requirements are met:

(*i*) The renewable energy system is a wind energy system, is interconnected to the electric provider's transmission system, and is located in a state in which the electric provider has service territory.

(*ii*) The electric provider competitively bid any contract for engineering, procurement, or construction of the renewable energy system, if the electric provider owns the renewable energy system, or for purchase of the renewable

energy and associated renewable energy credits from the renewable energy system, if the provider does not own the renewable energy system, in a process open to renewable energy systems sited in this state.

(*iii*) The renewable energy credits from the renewable energy system are only used by that electric provider to meet the renewable energy standard.

(*iv*) The electric provider is not an alternative electric supplier.

Sec. 39. (1) Except as otherwise provided in section 35(1), 1 renewable energy credit shall be granted to the owner of a renewable energy system for each megawatt hour of electricity generated from the renewable energy system, subject to all of the following:

(a) If a renewable energy system uses both a renewable energy resource and a nonrenewable energy resource to generate electricity or steam, the number of renewable energy credits granted shall be based on the percentage of the electricity or steam, or both, generated from the renewable energy resource.

(b) A renewable energy credit shall not be granted for renewable energy the renewable attributes of which are used by an electric provider in a commission-approved voluntary renewable energy program.

(2) The following additional renewable energy credits, to be known as Michigan incentive renewable energy credits, shall be granted under the following circumstances:

(a) 2 renewable energy credits for each megawatt hour of electricity from solar power generated by a renewable energy system that was approved in a renewable energy plan before the effective date of the 2016 amendatory act that amended this section.

(b) 1/5 renewable energy credit for each megawatt hour of electricity generated from a renewable energy system, other than wind, at peak demand time as determined by the commission.

(c) 1/5 renewable energy credit for each megawatt hour of electricity generated from a renewable energy system during off-peak hours, stored using advanced electric storage technology or a hydroelectric pumped storage facility, and used during peak hours. However, the number of renewable energy credits shall be calculated based on the number of megawatt hours of renewable energy used to charge the advanced electric storage technology or fill the pumped storage facility, not the number of megawatt hours actually discharged or generated by discharge from the advanced energy storage facility or pumped storage facility.

(d) 1/10 renewable energy credit for each megawatt hour of electricity generated from a renewable energy system constructed using equipment made in this state as determined by the commission. The additional credit under this subdivision is available for the first 3 years after the renewable energy system first produces electricity on a commercial basis.

(e) 1/10 renewable energy credit for each megawatt hour of electricity from a renewable energy system constructed using a workforce composed of residents of this state as determined by the commission. The additional credit under this subdivision is available for the first 3 years after the renewable energy system first produces electricity on a commercial basis.

(3) A renewable energy credit expires at the earliest of the following times:

(a) When used by an electric provider to comply with its renewable energy standard.

(b) When substituted for an energy waste reduction credit under section 77.

(c) When used by an electric provider whose rates are regulated by the commission to contribute to achievement of the goal under section 1(3).

(d) Five years after the end of the month in which the renewable energy credit was generated.

Sec. 41. (1) Renewable energy credits may be traded, sold, or otherwise transferred.

(2) An electric provider is responsible for demonstrating that a renewable energy credit used to comply with a renewable energy credit standard is derived from a renewable energy source and that the electric provider has not previously used or traded, sold, or otherwise transferred the renewable energy credit.

(3) The same renewable energy credit may be used by an electric provider to comply with both a federal standard for renewable energy and the renewable energy standard under this subpart. An electric provider that uses a renewable energy credit to comply with another state's standard for renewable energy shall not use the same renewable energy credit to comply with the renewable energy credit standard under this subpart.

(4) The commission shall establish a renewable energy credit certification and tracking program. The certification and tracking program may be contracted to and performed by a third party through a system of competitive bidding. The program shall include all of the following:

(a) A process to certify renewable energy systems, including all existing renewable energy systems operating on October 6, 2008 as eligible to receive renewable energy credits.

(b) A process for verifying that the operator of a renewable energy system is in compliance with state and federal law applicable to the operation of the renewable energy system when certification is granted. If a renewable energy system becomes noncompliant with state or federal law, renewable energy credits shall not be granted for renewable energy generated by that renewable energy system during the period of noncompliance.

(c) A method for determining the date on which a renewable energy credit is generated and valid for transfer.

(d) A method for transferring renewable energy credits.

(e) A method for ensuring that each renewable energy credit transferred under this act is properly accounted for under this act.

(f) If the system is established by the commission, allowance for issuance, transfer, and use of renewable energy credits in electronic form.

(5) A renewable energy credit purchased from a renewable energy system in this state is not required to be used in this state.

Sec. 45. (1) For an electric provider whose rates are regulated by the commission, the commission shall determine the appropriate charges for the electric provider's tariffs that permit recovery of the incremental cost of compliance subject to the retail rate impact limits set forth in subsection (2).

(2) An electric provider shall recover the incremental cost of compliance with the renewable energy standards. An electric provider shall not comply with the renewable energy standards to the extent that, as determined by the commission, recovery of the incremental cost of compliance will have a retail rate impact that exceeds any of the following:

(a) $3.00 per month per residential customer meter.

(b) $16.58 per month per commercial secondary customer meter.

(c) $187.50 per month per commercial primary or industrial customer meter.

(3) The retail rate impact limits of subsection (2) apply only to the incremental costs of compliance and do not apply to costs approved for recovery by the commission other than as provided in this act.

(4) The incremental cost of compliance shall be calculated for a 20-year period beginning with approval of the renewable energy plan and shall be recovered on a levelized basis.

Sec. 47. (1) Subject to the retail rate impact limits under section 45, the commission shall consider all actual costs reasonably and prudently incurred in good faith to implement a commission-approved renewable energy plan by an electric provider whose rates are regulated by the commission to be a cost of service to be recovered by the electric provider. Subject to the retail rate impact limits under section 45, an electric provider whose rates are regulated by the commission shall recover through its retail electric rates all of the electric provider's incremental costs of compliance during the 20-year period beginning when the electric provider's plan is approved by the commission and all reasonable and prudent ongoing costs of compliance during and after that period. The recovery shall include, but is not limited to, the electric provider's authorized rate of return on equity for costs approved under this section, which shall remain fixed at the rate of return and debt to equity ratio that was in effect in the electric provider's base rates when the electric provider's renewable energy plan was approved.

(2) Incremental costs of compliance shall be calculated as follows:

(a) Determine the sum of the following costs to the extent those costs are reasonable and prudent and not already approved for recovery in electric rates as of October 6, 2008:

(*i*) Capital, operating, and maintenance costs of renewable energy systems or advanced cleaner energy systems, including property taxes, insurance, and return on equity associated with an electric provider's renewable energy systems or advanced cleaner energy systems, including the electric provider's renewable energy portfolio established to achieve compliance with the renewable energy standards and any additional renewable energy systems or advanced cleaner energy systems that are built or acquired by the electric provider to maintain compliance with the renewable energy standards during the 20-year period beginning when the electric provider's plan is approved by the commission.

(*ii*) Financing costs attributable to capital, operating, and maintenance costs of capital facilities associated with renewable energy systems or advanced cleaner energy systems used to meet the renewable energy standard.

(*iii*) Costs that are not otherwise recoverable in rates approved by the Federal Energy Regulatory Commission and that are related to the infrastructure required to bring renewable energy systems or advanced cleaner energy systems used to achieve compliance with the renewable energy standards on to the transmission system, including interconnection and substation costs for renewable energy systems or advanced cleaner energy systems used to meet the renewable energy standard.

(*iv*) Ancillary service costs determined by the commission to be necessarily incurred to ensure the quality and reliability of renewable energy or advanced cleaner energy used to meet the renewable energy standards, regardless of the ownership of a renewable energy system or advanced cleaner energy technology.

(*v*) Except to the extent the costs are allocated under a different subparagraph, all of the following:

(A) The costs of renewable energy credits purchased under this act.

(B) The costs of contracts described in former section 33(1).

(*vi*) Expenses incurred as a result of state or federal governmental actions related to renewable energy systems or advanced cleaner energy systems attributable to the renewable energy standards, including changes in tax or other law.

(*vii*) Any additional electric provider costs determined by the commission to be necessarily incurred to ensure the quality and reliability of renewable energy or advanced cleaner energy used to meet the renewable energy standards.

(b) Subtract from the sum of costs not already included in electric rates determined under subdivision (a) the sum of the following revenues:

(*i*) Revenue derived from the sale of environmental attributes associated with the generation of renewable energy or advanced cleaner energy systems attributable to the renewable energy standards. Such revenue shall not be considered in determining power supply cost recovery factors under section 6j of 1939 PA 3, MCL 460.6j.

(*ii*) Interest on regulatory liabilities.

(*iii*) Tax credits specifically designed to promote renewable energy or advanced cleaner energy.

(*iv*) Revenue derived from the provision of renewable energy or advanced cleaner energy to retail electric customers subject to a power supply cost recovery clause under section 6j of 1939 PA 3, MCL 460.6j, of an electric provider whose rates are regulated by the commission. After providing an opportunity for a contested case hearing for an electric provider whose rates are regulated by the commission, the commission shall annually establish a price per megawatt hour. An electric provider whose rates are regulated by the commission may at any time petition the commission to revise the price. In setting the price per megawatt hour under this subparagraph, the commission shall consider factors including, but not limited to, projected capacity, energy, maintenance, and operating costs; information filed under section 6j of 1939 PA 3, MCL 460.6j; and information from wholesale markets, including, but not limited to, locational marginal pricing. This price shall be multiplied by the sum of the number of megawatt hours of renewable energy and the number of megawatt hours of advanced cleaner energy used to maintain compliance with the renewable energy standard. The product shall be considered a booked cost of purchased and net interchanged power transactions under section 6j of 1939 PA 3, MCL 460.6j. For energy purchased by such an electric provider under a renewable energy contract or advanced cleaner energy contract, the price shall be the lower of the amount established by the commission or the actual price paid and shall be multiplied by the number of megawatt hours of renewable energy or advanced cleaner energy purchased. The resulting value shall be considered a booked cost of purchased and net interchanged power under section 6j of 1939 PA 3, MCL 460.6j.

(*v*) Revenue from wholesale renewable energy sales and advanced cleaner energy sales. Such revenue shall not be considered in determining power supply cost recovery factors under section 6j of 1939 PA 3, MCL 460.6j.

(*vi*) Any additional electric provider revenue considered by the commission to be attributable to the renewable energy standards.

(*vii*) Any revenues recovered in rates for renewable energy costs that are included under subdivision (a).

(3) The commission shall authorize an electric provider whose rates are regulated by the commission to spend in any given month more to comply with this act and implement an approved renewable energy plan than the revenue actually generated by the revenue recovery mechanism. An electric provider whose rates are regulated by the commission shall recover its commission approved pre-tax rate of return on regulatory assets during the appropriate period. An electric provider whose rates are regulated by the commission shall record interest on regulatory liabilities at the average short-term borrowing rate available to the electric provider during the appropriate period. Any regulatory assets or liabilities resulting from the recovery of costs of renewable energy or advanced cleaner energy attributable to renewable energy standards through the power supply cost recovery clause under section 6j of 1939 PA 3, MCL 460.6j, shall continue to be reconciled under that section.

(4) If an electric provider's incremental costs of compliance in any given month during the 20-year period beginning when the electric provider's plan is approved by the commission are in excess of the revenue recovery mechanism as adjusted under section 49 and in excess of the balance of any accumulated reserve funds, subject to the minimum balance established under section 49, the electric provider shall immediately notify the commission. The commission shall promptly commence a contested case hearing pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328, and modify the revenue recovery mechanism so that the minimum balance is restored. However, if the commission determines that recovery of the incremental costs of compliance would otherwise exceed the maximum retail rate impacts specified under section 45, it shall set the revenue recovery mechanism for that electric provider to correspond to the maximum retail rate impacts. Excess costs shall be accrued and deferred for recovery. Not later than the expiration of the 20-year period beginning when the electric provider's plan is approved by the commission, for an electric provider whose rates are regulated by the commission, the commission shall determine the amount of deferred costs to be recovered under the revenue recovery mechanism and the recovery period, which shall not extend more than 5 years beyond the expiration of the 20-year period beginning when the electric provider's plan is approved by the commission. The recovery of excess costs shall be proportional to the retail rate impact limits in section 45 for each

customer class. The recovery of excess costs alone, or, if begun before the expiration of the 20-year period, in combination with the recovery of incremental costs of compliance under the revenue recovery mechanism, shall not exceed the retail rate impact limits of section 45 for each customer class.

(5) If, at the expiration of the 20-year period beginning when the electric provider's plan is approved by the commission, an electric provider whose rates are regulated by the commission has a regulatory liability, the refund to customer classes shall be proportional to the amounts paid by those customer classes under the revenue recovery mechanism.

(6) After achieving compliance with the renewable energy standard for 2015, the actual costs reasonably and prudently incurred to continue to comply with this subpart both during and after the conclusion of the 20-year period beginning when the electric provider's plan is approved by the commission shall be considered costs of service. The commission shall determine a mechanism for an electric provider whose rates are regulated by the commission to recover these costs in its retail electric rates, subject to the retail rate impact limits in section 45. Remaining and future regulatory assets shall be recovered consistent with subsections (3) and (4) and section 49.

(7) As used in this section:

(a) "Advanced cleaner energy" means electricity generated using an advanced cleaner energy system.

(b) "Advanced cleaner energy system" means any of the following:

(*i*) A gasification facility.

(*ii*) A cogeneration facility.

(*iii*) A coal-fired electric generating facility if 85% or more of the carbon dioxide emissions are captured and permanently geologically sequestered or used for other commercial or industrial purposes that do not result in release of carbon dioxide to the atmosphere.

(*iv*) A hydroelectric pumped storage facility.

(*v*) An electric generating facility or system that uses technologies not in commercial operation on October 6, 2008 and that the commission determines has carbon dioxide emissions benefits or will significantly reduce other regulated air emissions.

Sec. 49. (1) This section applies only to an electric provider whose rates are regulated by the commission. The commission shall commence an annual proceeding, to be known as a renewable cost reconciliation, for each electric provider whose rates are regulated by the commission. The renewable cost reconciliation proceeding shall be conducted as a contested case pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328. Reasonable discovery shall be permitted before and during the reconciliation proceeding to assist in obtaining evidence concerning reconciliation issues including, but not limited to, the reasonableness and prudence of expenditures and the amounts collected pursuant to the revenue recovery mechanism.

(2) At the renewable cost reconciliation, an electric provider may propose any necessary modifications of the revenue recovery mechanism to ensure the electric provider's recovery of its incremental cost of compliance with the renewable energy standards.

(3) The commission shall reconcile the pertinent revenues recorded and the allowance for the nonvolumetric revenue recovery mechanism with the amounts actually expensed and projected according to the electric provider's renewable energy plan. The commission shall consider any issue regarding the reasonableness and prudence of expenses for which customers were charged in the relevant reconciliation period. In its order, the commission shall do all of the following:

(a) Make a determination of an electric provider's compliance with the renewable energy standards.

(b) Adjust the revenue recovery mechanism for the incremental costs of compliance. The commission shall ensure that the retail rate impacts under this renewable cost reconciliation revenue recovery mechanism do not exceed the maximum retail rate impacts specified under section 45. The commission shall ensure that the recovery mechanism is projected to maintain a minimum balance of accumulated reserve so that a regulatory asset does not accrue.

(c) Establish the price per megawatt hour for renewable energy and advanced cleaner energy capacity and for renewable energy and advanced cleaner energy to be recovered through the power supply cost recovery clause under section 6j of 1939 PA 3, MCL 460.6j, as outlined in section 47(2)(b)(*iv*).

(d) Adjust, if needed, the minimum balance of accumulated reserve funds described in subdivision (b).

(4) If an electric provider has recorded a regulatory liability in any given month during the 20-year period beginning when the electric provider's renewable energy plan was approved by the commission, interest on the regulatory liability balance shall be accrued at the average short-term borrowing rate available to the electric provider during the appropriate period, and shall be used to fund incremental costs of compliance incurred in subsequent periods within the 20-year period beginning when the electric provider's plan was approved by the commission.

(5) As used in this section, "advanced cleaner energy" means that term as defined in section 47.

Sec. 54. Nothing in this subpart abrogates the powers granted to local units of government under the Michigan zoning enabling act, 2006 PA 110, MCL 125.3101 to 125.3702.

SUBPART B.

CUSTOMER-REQUESTED RENEWABLE ENERGY

Sec. 61. An electric provider shall offer to its customers the opportunity to participate in a voluntary green pricing program under which the customer may specify, from the options made available by the electric provider, the amount of electricity attributable to the customer that will be renewable energy. If the electric provider's rates are regulated by the commission, the program, including the rates paid for renewable energy, must be approved by the commission. The customer is responsible for any additional costs incurred and shall accrue any additional savings realized by the electric provider as a result of the customer's participation in the program. If an electric provider has not yet fully recovered the incremental costs of compliance, both of the following apply:

(a) A customer that receives at least 50% of the customer's average monthly electricity consumption through the program is exempt from paying surcharges for incremental costs of compliance.

(b) Before entering into an agreement to participate in a commission-approved voluntary green pricing program with a customer that will not receive at least 50% of the customer's average monthly electricity consumption through the program, the electric provider shall notify the customer that the customer will be responsible for the full applicable charges for the incremental costs of compliance and for participation in the voluntary renewable energy program as provided under this section.

SUBPART C.

ENERGY WASTE REDUCTION

Sec. 71. (1) A provider shall file a proposed energy optimization plan with the commission within the following time period:

(a) For a provider whose rates are regulated by the commission, by March 3, 2009.

(b) For a cooperative electric utility that has elected to become member-regulated under the electric cooperative member-regulation act, 2008 PA 167, MCL 460.31 to 460.39, or a municipally owned electric utility, by April 2, 2009.

(2) Energy optimization plans filed under subsection (1) remain in effect, subject to any amendments, as energy waste reduction plans.

(3) The overall goal of an energy waste reduction plan shall be to help the provider's customers reduce energy waste and to reduce the future costs of provider service to customers. In particular, an electric provider's energy waste reduction plan shall be designed to delay the need for constructing new electric generating facilities and thereby protect consumers from incurring the costs of such construction.

(4) An energy waste reduction plan shall do all of the following:

(a) Propose a set of energy waste reduction programs that include offerings for each customer class, including low-income residential. The commission shall allow a provider flexibility to tailor the relative amount of effort devoted to each customer class based on the specific characteristics of the provider's service territory.

(b) Specify necessary funding levels.

(c) Describe how energy waste reduction program costs will be recovered as provided in section 89(2).

(d) Ensure, to the extent feasible, that charges collected from a particular customer rate class are spent on energy waste reduction programs that benefit that rate class.

(e) Demonstrate that the proposed energy waste reduction programs and funding are sufficient to ensure the achievement of applicable energy waste reduction standards.

(f) Specify whether the number of megawatt hours of electricity or decatherms or MCFs of natural gas used in the calculation of incremental energy savings under section 77 will be weather-normalized or based on the average number of megawatt hours of electricity or decatherms or MCFs of natural gas sold by the provider annually during the previous 3 years to retail customers in this state. Once the plan is approved by the commission, this option shall not be changed.

(g) Demonstrate that the provider's energy waste reduction programs, excluding program offerings to low-income residential customers, will collectively be cost-effective.

(h) Provide for the practical and effective administration of the proposed energy waste reduction programs. The commission shall allow providers flexibility in designing their energy waste reduction programs and administrative approach, including the flexibility to determine the relative amount of effort to be devoted to each customer class based on the specific characteristics of the provider's service territory. A provider's energy waste reduction programs or any part thereof, may be administered, at the provider's option, by the provider, alone or jointly with other providers, by a state agency, or by an appropriate experienced nonprofit organization selected after a competitive bid process.

(i) Include a process for obtaining an independent expert evaluation of the actual energy waste reduction programs to verify the incremental energy savings from each energy waste reduction program for purposes of section 77. All such evaluations are subject to public review and commission oversight.

(5) Subject to subsection (6), an energy waste reduction plan may do 1 or more of the following:

(a) Utilize educational programs designed to alter consumer behavior or any other measures that can reasonably be used to meet the goals set forth in subsection (3).

(b) Propose to the commission measures that are designed to meet the goals set forth in subsection (3) and that provide additional customer benefits.

(6) Expenditures under subsection (5) shall not exceed 3% of the costs of implementing the energy waste reduction plan.

Sec. 73. (1) A provider's energy waste reduction plan shall be filed with, reviewed by, and approved or rejected by the commission. For a provider whose rates are regulated by the commission, the plan shall be enforced by the commission. For a provider whose rates are not regulated by the commission, the plan shall be enforced as provided in section 99. Notwithstanding any other provision of this subpart, the commission shall allow municipally owned electric utilities to design and administer energy waste reduction plans in a manner consistent with the administrative changes approved in the commission's April 17, 2012 order in case nos. U-16688 to U-16728 and U-17008.

(2) The commission shall not approve a proposed energy waste reduction plan unless the commission determines that the energy waste reduction plan meets the utility system resource cost test and, subject to section 78, is reasonable and prudent. In determining whether the energy waste reduction plan is reasonable and prudent, the commission shall review each element and consider whether it would reduce the future cost of service for the provider's customers. In addition, the commission shall consider at least all of the following:

(a) The specific changes in customers' consumption patterns that the proposed energy waste reduction plan is attempting to influence.

(b) The cost and benefit analysis and other justification for specific programs and measures included in a proposed energy waste reduction plan.

(c) Whether the proposed energy waste reduction plan is consistent with any long-range resource plan filed by the provider with the commission.

(d) Whether the proposed energy waste reduction plan will result in any unreasonable prejudice or disadvantage to any class of customers.

(e) The extent to which the energy waste reduction plan provides programs that are available, affordable, and useful to all customers.

(3) Every 2 years after initial approval of an energy waste reduction plan under subsection (2), the commission shall review the plan. For a provider whose rates are regulated by the commission, the commission shall conduct a contested case hearing on the plan pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328. After the hearing, the commission shall approve, with any changes consented to by the provider, or reject the plan and any proposed amendments to the plan.

(4) If a provider proposes to amend its plan at a time other than during the biennial review process under subsection (3), the provider shall file the proposed amendment with the commission. After the hearing and within 90 days after the amendment is filed, the commission shall approve, with any changes consented to by the provider, or reject the plan and the proposed amendment or amendments to the plan.

(5) If the commission rejects a proposed plan or amendment under this section, the commission shall explain in writing the reasons for its determination.

(6) After December 31, 2021, this section does not apply to an electric provider whose rates are not regulated by the commission.

Sec. 74. (1) This section applies only to a provider whose rates are regulated by the commission. Concurrent with the submission of each report under section 97, the commission shall commence an annual proceeding, to be known as an energy waste reduction cost reconciliation, for each provider whose rates are regulated by the commission. The energy waste reduction cost reconciliation shall be conducted as a contested case pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328. Reasonable discovery shall be permitted before and during the energy waste reduction cost reconciliation to assist in obtaining evidence concerning reconciliation issues including, but not limited to, the reasonableness and prudence of expenditures and the amounts collected pursuant to energy waste reduction charges set by the commission.

(2) At the energy waste reduction cost reconciliation, a provider may propose any necessary modifications of the energy waste reduction charges previously set by the commission to ensure the provider's recovery of its costs to comply with the energy waste reduction standards.

(3) The commission shall reconcile the pertinent revenues recorded with the amounts actually expensed and projected according to the provider's plan for compliance. The commission shall consider any issue regarding the reasonableness and prudence of expenses for which customers were charged in the relevant reconciliation period. In its order, the commission shall do both of the following:

(a) Make a determination of a provider's compliance with the energy waste reduction standards.

(b) Adjust, if necessary, the energy waste reduction charges previously set by the commission.

Sec. 75. (1) An energy waste reduction plan of a provider whose rates are regulated by the commission may authorize a commensurate financial incentive for the provider for exceeding the energy waste reduction standard. Payment of any financial incentive authorized in the energy waste reduction plan is subject to the approval of the commission.

(2) The total amount of a financial incentive for an electric provider that achieves annual incremental savings of greater than 1.5% of its total annual retail electricity sales in megawatt hours in the preceding year or a natural gas provider that achieves annual incremental savings of greater than 1% of its total annual retail natural gas sales in decatherms in the preceding year shall not exceed the lesser of the following amounts:

(a) 30% of the net present value of life-cycle cost reductions experienced by the provider's customers as a result of implementation, during the year for which the financial incentive is paid, of the energy waste reduction plan.

(b) 20% of the provider's actual energy waste reduction program expenditures for the year.

(3) The total amount of the financial incentive for an electric provider that achieves annual incremental savings of greater than 1.25% but not greater than 1.5% of its total annual retail electricity sales in megawatt hours in the preceding year or a natural gas provider that achieves annual incremental savings of greater than 0.875% but not greater than 1% of its total annual retail natural gas sales in decatherms in the preceding year shall not exceed the lesser of the following amounts:

(a) 27.5% of the net present value of life-cycle cost reductions experienced by the provider's customers as a result of implementation, during the year for which the financial incentive is paid, of the energy waste reduction plan.

(b) 17.5% of the provider's actual energy waste reduction program expenditures for the year.

(4) The total amount of a financial incentive for an electric provider that achieves annual incremental savings of at least 1.0% but not greater than 1.25% of its total annual retail electricity sales in megawatt hours in the preceding year or a natural gas provider that achieves annual incremental savings of at least 0.75% but not greater than 0.875% of its total annual retail natural gas sales in decatherms in the preceding year shall not exceed the lesser of the following amounts:

(a) 25% of the net present value of life-cycle cost reductions experienced by the provider's customers as a result of implementation, during the year for which the financial incentive is paid, of the energy waste reduction plan.

(b) 15% of the provider's actual energy waste reduction program expenditures for the year.

Sec. 77. (1) Except as provided in section 81 and subject to section 97, an electric provider's energy waste reduction programs under this subpart shall collectively achieve incremental energy savings each year through 2021 equivalent to 1.0% of total annual retail electricity sales in megawatt hours in the preceding year.

(2) If an electric provider uses load management to achieve energy savings under its energy waste reduction plan, the minimum energy savings required under subsection (1) shall be adjusted by an amount such that the ratio of the minimum energy savings to the sum of actual expenditures for implementing its approved energy waste reduction plan and the load management expenditures remains constant.

(3) Subject to section 97, a natural gas provider's energy waste reduction program under this subpart shall achieve annual incremental energy savings each year equivalent to 0.75% of total annual retail natural gas sales in decatherms or equivalent MCFs in the preceding year.

(4) Incremental energy savings under subsection (1) or (3) for a year shall be determined for a provider by adding the energy savings expected to be achieved by energy waste reduction measures implemented during that year under any energy waste reduction programs consistent with the provider's energy waste reduction plan. The energy savings expected to be achieved shall be determined using a savings database or other savings measurement approach as determined reasonable by the commission.

(5) For purposes of calculations under subsection (1) or (3), total annual retail electricity or natural gas sales in a year shall be based on 1 of the following at the option of the provider as specified in its energy waste reduction plan:

(a) The number of weather-normalized megawatt hours or decatherms or equivalent MCFs sold by the provider to retail customers in this state during the year preceding the year for which incremental energy savings are being calculated.

(b) The average number of megawatt hours or decatherms or equivalent MCFs sold by the provider during the 3 years preceding the year for which incremental energy savings are being calculated.

(6) For any year after 2012, an electric provider may substitute renewable energy credits associated with renewable energy generated that year from a renewable energy system constructed after October 6, 2008, load management that reduces overall energy usage, or a combination thereof for energy waste reduction credits otherwise required to meet the energy waste reduction standard, if the substitution is approved by the commission. The commission shall not approve a substitution unless the commission determines that the substitution is cost-effective.

(7) Renewable energy credits, load management that reduces overall energy usage, or a combination thereof shall not be used by a provider to meet more than 10% of the energy waste reduction standard. Substitutions for energy waste reduction credits shall be made at the rate of 1 renewable energy credit per energy waste reduction credit.

Sec. 78. (1) By January 1, 2022, and every 2 years thereafter, an electric provider whose rates are regulated by the commission shall file an energy waste reduction plan amendment with the commission under section 73 pursuant to a filing schedule established by the commission. The amendment shall detail the amount of energy waste reduction the electric provider proposes to achieve for the succeeding 2-year period. If the electric provider whose rates are regulated by the commission proposes a level of energy waste reduction that is higher than the level specified in the provider's current energy waste reduction plan, the commission may approve the proposed higher level if the commission finds that it is the most reasonable and prudent. If the electric provider whose rates are regulated by the commission proposes a level of energy waste reduction that is lower than the level specified in the provider's current energy waste reduction plan, the commission may approve the proposed lower level if the commission finds that it is the most reasonable and prudent. If the commission finds that the proposed lower level of energy waste reduction is not the most reasonable and prudent, the level of energy waste reduction to be achieved by the electric provider whose rates are regulated by the commission for the succeeding 2-year period under the energy waste reduction plan shall be the same as the level specified in the provider's current energy waste reduction plan.

(2) If over a 2-year period an electric provider whose rates are regulated by the commission cannot achieve the level of energy waste reduction provided for in the energy waste reduction plan pursuant to subsection (1) in a cost-effective manner, the provider may petition the commission in a contested case hearing under section 73 to establish an alternative energy waste reduction level for that provider.

(3) If over a 2-year period a natural gas provider cannot achieve the energy waste reduction standard in a cost-effective manner, the natural gas provider may petition the commission to establish an alternative energy waste reduction standard for that provider.

(4) A petition filed pursuant to subsection (3) shall do all of the following:

(a) Identify the efforts taken by the natural gas provider to meet the energy waste reduction standard.

(b) Explain why the energy waste reduction standard cannot reasonably and cost-effectively be achieved.

(c) Propose a revised energy waste reduction standard to be achieved by the natural gas provider.

(5) If, based on a review of the petition filed under subsection (3), the commission determines that the natural gas provider has been unable to reasonably and cost-effectively achieve the energy waste reduction standard, the commission shall revise the energy waste reduction standard as applied to the natural gas provider to a level that can reasonably and cost-effectively be achieved.

Sec. 81. (1) This section applies to electric providers that meet both of the following requirements:

(a) Serve not more than 200,000 customers in this state.

(b) Had average electric rates for residential customers using 1,000 kilowatt hours per month that were less than 75% of the average electric rates for residential customers using 1,000 kilowatt hours per month for all electric utilities in this state, according to the January 1, 2007, "comparison of average rates for MPSC-regulated electric utilities in Michigan" compiled by the commission.

(2) Beginning 2 years after a provider described in subsection (1) begins implementation of its energy waste reduction plan, the provider may petition the commission to establish alternative energy waste reduction standards. The petition shall identify the efforts taken by the provider to meet the electric provider energy waste reduction standards and demonstrate why the energy waste reduction standards cannot reasonably be met with energy waste reduction programs that are collectively cost-effective. If the commission finds that the petition meets the requirements of this subsection, the commission shall revise the energy waste reduction standards as applied to that electric provider to a level that can reasonably be met with energy waste reduction programs that are collectively cost-effective.

(3) This section is repealed effective January 1, 2022.

Sec. 83. (1) One energy waste reduction credit shall be granted to a provider for each megawatt hour of annual incremental energy savings achieved through energy waste reduction.

(2) An energy waste reduction credit expires as follows:

(a) When used by a provider to comply with its energy waste reduction standard.

(b) When substituted for a renewable energy credit under section 28.

(c) As provided in subsection (3).

(3) If a provider's incremental energy savings in any year exceed the applicable energy waste reduction standard, the associated energy waste reduction credits may be carried forward and applied to the next year's energy waste reduction standard. However, all of the following apply:

(a) The number of energy waste reduction credits carried forward shall not exceed 1/3 of the next year's standard. Any energy waste reduction credits carried forward to the next year shall expire that year. Any remaining energy waste reduction credits shall expire at the end of the year in which the incremental energy savings were achieved, unless substituted, by an electric provider, for renewable energy credits under section 28.

(b) Energy waste reduction credits shall not be carried forward if, for its performance during the same year, the provider accepts a financial incentive under section 75. The excess energy waste reduction credits shall expire at the end of the year in which the incremental energy savings were achieved, unless substituted, by an electric provider, for renewable energy credits under section 28.

Sec. 85. An energy waste reduction credit is not transferable to another entity.

Sec. 87. (1) The commission shall establish an energy waste reduction credit certification and tracking program. The certification and tracking program may be contracted to and performed by a third party through a system of competitive bidding. The program shall include all of the following:

(a) A determination of the date after which energy waste reduction must be achieved to be eligible for an energy waste reduction credit.

(b) A method for ensuring that each energy waste reduction credit substituted for a renewable energy credit under section 28 or carried forward under section 83 is properly accounted for.

(c) If the system is established by the commission, allowance for issuance and use of energy waste reduction credits in electronic form.

(2) One energy waste reduction credit shall be granted to an electric provider for each megawatt hour of annual incremental energy savings achieved through energy waste reduction.

Sec. 89. (1) The commission shall allow a provider whose rates are regulated by the commission to recover the actual costs of implementing its approved energy waste reduction plan. However, costs exceeding the overall funding levels specified in the energy waste reduction plan are not recoverable unless those costs are reasonable and prudent and meet the utility system resource cost test. Furthermore, costs for load management undertaken by an electric provider pursuant to an energy waste reduction plan are not recoverable as energy waste reduction program costs under this section, but may be recovered as described in section 95.

(2) Under subsection (1), costs shall be recovered from all natural gas customers and from residential electric customers by volumetric charges, from all other metered electric customers by per-meter charges, and from unmetered electric customers by an appropriate charge. Fixed, per-meter charges under this subsection may vary by rate class. Charges under this subsection may be itemized on utility bills but shall not be itemized on or after January 1, 2021.

(3) Upon petition by a provider whose rates are regulated by the commission, the commission shall authorize the provider to capitalize all energy efficiency and energy conservation equipment, materials, and installation costs with an expected economic life greater than 1 year incurred in implementing its energy waste reduction plan, including such costs paid to third parties, such as customer rebates and customer incentives. The provider shall also propose depreciation treatment with respect to its capitalized costs in its energy waste reduction plan, and the commission shall order reasonable depreciation treatment related to these capitalized costs. A provider shall not capitalize payments made to an independent energy waste reduction program administrator under section 91.

(4) The established funding level for low income residential programs shall be provided from each customer rate class in proportion to that customer rate class's funding of the provider's total energy waste reduction programs. Charges shall be applied to distribution customers regardless of the source of their electricity or natural gas supply.

(5) The commission shall authorize a natural gas provider that spends a minimum of 0.5% of total natural gas retail sales revenues, including natural gas commodity costs, in a year on commission-approved energy waste reduction programs to implement a symmetrical revenue decoupling true-up mechanism that adjusts for sales that are above or below the projected levels that were used to determine the revenue requirement authorized in the natural gas provider's most recent rate case. In determining the symmetrical revenue decoupling true-up mechanism utilized for each provider, the commission shall give deference to the proposed mechanism submitted by the provider. The commission may approve an alternative mechanism if the commission determines that the alternative mechanism is reasonable and prudent. The commission shall authorize the natural gas provider to decouple rates regardless of whether the natural gas provider's energy waste reduction programs are administered by the provider or an independent energy waste reduction program administrator under section 91.

Sec. 91. (1) Except for section 89(5), sections 71 to 89 do not apply to a provider that each year pays not less than 2.0% of total utility sales revenues for the second year preceding, including electricity or natural gas commodity costs, to an independent energy waste reduction program administrator selected by the commission.

(2) An alternative compliance payment received from a provider by the energy waste reduction program administrator under subsection (1) shall be used to administer energy efficiency programs for the provider.

(3) The commission shall allow a provider to recover an alternative compliance payment under subsection (1). This cost shall be recovered from residential customers by volumetric charges, from all other metered customers by per-meter charges, and from unmetered customers by an appropriate charge. Fixed, per-meter charges under this subsection may vary by rate class. Charges under this subsection may be itemized on utility bills, but shall not be itemized on or after January 1, 2021.

(4) A provider's alternative compliance payment under subsection (1) shall only be used to fund energy waste reduction programs for that provider's customers. To the extent feasible, charges collected from a particular customer rate class and paid to the energy waste reduction program administrator under subsection (1) shall be devoted to energy waste reduction programs and services for that rate class.

(5) Money paid to the energy waste reduction program administrator under subsection (1) and not spent by the administrator that year shall remain available for expenditure the following year, subject to the requirements of subsection (4).

(6) The commission shall select a qualified nonprofit organization to serve as an energy waste reduction program administrator under this section, through a competitive bid process.

(7) The commission shall arrange for a biennial independent audit of the energy waste reduction program administrator.

Sec. 93. (1) An eligible electric customer is exempt from charges the customer would otherwise incur as an electric customer under section 89 or 91 if the customer files with its electric provider and implements a self-directed energy waste reduction plan as provided in this section.

(2) Subject to subsection (3), an electric customer is not eligible under subsection (1) unless it is a commercial or industrial electric customer and had an annual peak demand in the preceding year of at least 1 megawatt in the aggregate at all sites to be covered by the self-directed plan.

(3) The eligibility requirements of subsection (2) do not apply to a commercial or industrial customer that installs or modifies an electric energy efficiency improvement under a property assessed clean energy program pursuant to the property assessed clean energy act, 2010 PA 270, MCL 460.931 to 460.949.

(4) The commission shall by order establish the rates, terms, and conditions of service for customers related to this subpart.

(5) The commission shall by order do all of the following:

(a) Require a customer to utilize the services of an energy waste reduction service company to develop and implement a self-directed plan. This subdivision does not apply to a customer that had an annual peak demand in the preceding year of at least 2 megawatts at each site to be covered by the self-directed plan or 10 megawatts in the aggregate at all sites to be covered by the self-directed plan.

(b) Provide a mechanism to recover from customers under subdivision (a) the costs for provider level review and evaluation.

(c) Provide a mechanism to cover the costs of the low-income energy waste reduction program under section 89.

(6) All of the following apply to a self-directed energy waste reduction plan under subsection (1):

(a) The self-directed plan shall be a multiyear plan for an ongoing energy waste reduction program.

(b) The self-directed plan shall provide for aggregate energy savings that each year meet or exceed the energy waste reduction standards based on the electricity purchases in the previous year for the site or sites covered by the self-directed plan.

(c) Under the self-directed plan, energy waste reduction shall be calculated based on annual electricity usage. Annual electricity usage shall be normalized so that none of the following are included in the calculation of the percentage of incremental energy savings:

(*i*) Changes in electricity usage because of changes in business activity levels not attributable to energy waste reduction.

(*ii*) Changes in electricity usage because of the installation, operation, or testing of pollution control equipment.

(d) The self-directed plan shall specify whether electricity usage will be weather-normalized or based on the average number of megawatt hours of electricity sold by the electric provider annually during the previous 3 years to retail customers in this state. Once the self-directed plan is submitted to the provider, this option shall not be changed.

(e) The self-directed plan shall outline how the customer intends to achieve the incremental energy savings specified in the self-directed plan.

(7) A self-directed energy waste reduction plan shall be incorporated into the relevant electric provider's energy waste reduction plan. The self-directed plan and information submitted by the customer under subsection (10) are confidential and exempt from disclosure under the freedom of information act, 1976 PA 442, MCL 15.231 to 15.246. Projected energy savings from measures implemented under a self-directed plan shall be attributed to the relevant provider's energy waste reduction programs for the purposes of determining annual incremental energy savings achieved by the provider under section 77 or 81, as applicable.

(8) Once a customer begins to implement a self-directed plan at a site covered by the self-directed plan, that site is exempt from energy waste reduction program charges under section 89 or 91 and is not eligible to participate in the relevant electric provider's energy waste reduction programs.

(9) A customer implementing a self-directed energy waste reduction plan under this section shall annually submit to the customer's electric provider a brief report documenting the energy efficiency measures taken under the self-directed plan during the previous year, and the corresponding energy savings that will result. The report shall provide sufficient information for the provider and the commission to monitor progress toward the goals in the self-directed plan and to develop reliable estimates of the energy savings that are being achieved from self-directed plans. The customer report shall indicate the level of incremental energy savings achieved for the year covered by the report and whether that level of incremental energy savings meets the goal set forth in the customer's self-directed plan. If a customer submitting a report under this subsection wishes to amend its self-directed plan, the customer shall submit with the report an amended self-directed plan. A report under this subsection shall be accompanied by an affidavit from a knowledgeable official of the customer that the information in the report is true and correct to the best of the official's knowledge and belief. If the customer has retained an independent energy waste reduction service company, the requirements of this subsection shall be met by the energy waste reduction service company.

(10) An electric provider shall provide an annual report to the commission that identifies customers implementing self-directed energy waste reduction plans and summarizes the results achieved cumulatively under those self-directed plans. The commission may request additional information from the electric provider. If the commission has sufficient reason to believe the information is inaccurate or incomplete, it may request additional information from the customer to ensure accuracy of the report.

(11) If the commission determines after a contested case hearing that the minimum energy waste reduction goals under subsection (6)(b) have not been achieved at the sites covered by a self-directed plan, in aggregate, the commission shall order the customer or customers collectively to pay to this state an amount calculated as follows:

(a) Determine the proportion of the shortfall in achieving the minimum energy waste reduction goals under subsection (6)(b).

(b) Multiply the figure under subdivision (a) by the energy waste reduction charges from which the customer or customers collectively were exempt under subsection (1).

(c) Multiply the product under subdivision (b) by a number not less than 1 or greater than 2, as determined by the commission based on the reasons for failure to meet the minimum energy waste reduction goals.

(12) If a customer has submitted a self-directed plan to an electric provider, the customer, the customer's energy waste reduction service company, if applicable, or the electric provider shall provide a copy of the self-directed plan to the commission upon request.

(13) By September 1, 2010, following a public hearing, the commission shall establish an approval process for energy waste reduction service companies. The approval process shall ensure that energy waste reduction service companies have the expertise, resources, and business practices to reliably provide energy waste reduction services that meet the requirements of this section. The commission may adopt by reference the past or current standards of a national or regional certification or licensing program for energy waste reduction service companies. However, the approval process shall also provide an opportunity for energy waste reduction service companies that are not recognized by such a program to be approved by posting a bond in an amount determined by the commission and meeting any other requirements adopted by the commission for the purposes of this subsection. The approval process for energy waste reduction service companies shall require adherence to a code of conduct governing the relationship between energy waste reduction service companies and electric providers.

(14) The department of licensing and regulatory affairs shall maintain on the department's website a list of energy waste reduction service companies approved under subsection (13).

Sec. 95. (1) Subject to subsection (2), the commission shall do all of the following:

(a) Promote load management in appropriate circumstances, including expansion of existing and establishment of new load management programs in which an electric provider may manage the operation of energy consuming devices and remotely shut down air conditioning or other energy intensive systems of participating customers, demand response programs that use time of day pricing and dynamic rate pricing, and similar programs, for utility customers that have

advanced metering infrastructure. Electric provider participation and customer enrollment in such programs are voluntary. However, electric providers whose rates are regulated by the commission and whose rates include the cost of advanced metering infrastructure shall offer commission-approved demand response programs. The programs may provide incentives for customer participation and shall include customer protection provisions as required by the commission. To participate in a program, a customer shall agree to remain in the program for at least 1 year.

(b) Actively pursue increasing public awareness of load management techniques.

(c) Engage in regional load management efforts to reduce the annual demand for energy whenever possible.

(d) Work with residential, commercial, and industrial customers to reduce annual demand and conserve energy through load management techniques and other activities it considers appropriate.

(2) Subsection (1) shall not be construed to prevent an electric utility from doing any of the following:

(a) Recovering the full cost associated with providing electric service and load management programs.

(b) Installing metering and retrieving metering data necessary to properly, accurately, and efficiently bill for the electric utility's services without manual intervention or manual calculation.

(3) The commission may allow a provider whose rates are regulated by the commission to recover costs for load management through base rates as part of a proceeding under section 6a of 1939 PA 3, MCL 460.6a, if the costs are reasonable and prudent and meet the utility systems resource cost test.

(4) The Michigan agency for energy shall do all of the following:

(a) Promote energy efficiency and energy conservation.

(b) Actively pursue increasing public awareness of energy conservation and energy efficiency.

(c) Actively engage in energy conservation and energy efficiency efforts with providers.

(d) Engage in regional efforts to reduce demand for energy through energy conservation and energy efficiency.

(5) This subpart does not limit the authority of the commission, following an integrated resource plan proceeding and as part of a rate-making process, to allow a provider whose rates are regulated by the commission to recover for additional prudent energy efficiency and energy conservation measures not included in the provider's energy waste reduction plan if the provider has met the requirements of the energy waste reduction program.

Sec. 97. (1) By a time determined by the commission, each provider shall submit to the commission an annual report that provides information relating to the actions taken by the provider to comply with the energy waste reduction standards. By that same time, a municipally owned electric utility shall submit a copy of the report to the governing body of the municipally owned electric utility, and a cooperative electric utility shall submit a copy of the report to its board of directors.

(2) An annual report under subsection (1) shall include all of the following information:

(a) The amount of energy waste reduction achieved during the reporting period.

(b) Expenditures made in the past year and anticipated future expenditures to comply with this subpart.

(c) Any other information that the commission determines necessary.

(3) Concurrent with the submission of each report under subsection (1), a municipally owned electric utility shall submit a summary of the report to its customers in their bills with a bill insert and to its governing body. Concurrent with the submission of each report under subsection (1), a cooperative electric utility shall submit a summary of the report to its members in a periodical issued by an association of rural electric cooperatives and to its board of directors. A municipally owned electric utility or cooperative electric provider shall make a copy of the report available at its office and shall post a copy of the report on its website. A summary under this section shall indicate that a copy of the report is available at the office or website.

(4) The commission shall submit to the standing committees of the senate and house of representatives with primary responsibility for energy issues an annual report that evaluates and determines whether this subpart has been cost-effective and makes recommendations to the legislature. The report may be combined with the annual report under section 5a of 1939 PA 3, MCL 460.5a.

(5) Subject to subsection (6), if the commission determines that a provider's energy waste reduction program under this subpart has not been cost-effective, the provider's program is suspended beginning 180 days after the date of the determination. If a provider's energy waste reduction program is suspended under this subsection, both of the following apply:

(a) The provider shall maintain cumulative incremental energy savings in megawatt hours or decatherms or equivalent MCFs in subsequent years at the level actually achieved during the year preceding the year in which the commission's determination is made.

(b) The provider shall not impose energy waste reduction charges in subsequent years except to the extent necessary to recover unrecovered energy waste reduction expenses incurred under this subpart before suspension of the provider's program.

(6) Subsection (5) does not apply to an electric provider on or after January 1, 2022.

Sec. 99. The attorney general or any customer of a municipally owned electric utility or a cooperative electric utility that is member-regulated under the electric cooperative member-regulation act, 2008 PA 167, MCL 460.31 to 460.39, may commence a civil action for injunctive relief against that municipally owned electric utility or cooperative electric utility if the municipally owned electric utility or cooperative electric utility fails to meet the applicable requirements of this subpart or an order issued or rule promulgated under this subpart. The attorney general or customer shall commence an action under this subsection in the circuit court for the circuit in which the principal office of the municipally owned electric utility or cooperative electric utility is located. The attorney general or customer shall not file an action under this subsection unless the attorney general or customer has given the municipally owned electric utility or cooperative electric utility at least 60 days' written notice of the intent to sue, the basis for the suit, and the relief sought. Within 30 days after the municipally owned electric utility or cooperative electric utility receives written notice of the intent to sue, the municipally owned electric utility or cooperative electric utility and the attorney general or customer shall meet and make a good-faith attempt to determine if there is a credible basis for the action. The municipally owned electric utility or cooperative electric utility shall take all reasonable and prudent steps necessary to comply with the applicable requirements of this subpart or an order issued or rule promulgated under this subpart within 90 days after the meeting if there is a credible basis for the action. If the parties do not agree as to whether there is a credible basis for the action, the attorney general or customer may proceed to file the suit.

SUBPART D.

MISCELLANEOUS

Sec. 113. (1) Notwithstanding any other provision of this part, natural gas used in the installation, operation, or testing of any pollution control equipment is exempt from the requirements of, and calculations of compliance required under, this part.

(2) This section, as amended by the act that added this subsection, takes effect January 1, 2021.

PART 5.

DISTRIBUTED GENERATION

Sec. 173. (1) The commission shall establish a distributed generation program by order issued not later than 90 days after the effective date of the 2016 act that amended this section. The commission may promulgate rules the commission considers necessary to implement this program. Any rules adopted regarding time limits for approval of parallel operation shall recognize reliability and safety complications including those arising from equipment saturation, use of multiple technologies, and proximity to synchronous motor loads. The program shall apply to all electric utilities whose rates are regulated by the commission and alternative electric suppliers in this state.

(2) Except as otherwise provided under this part, an electric customer of any class is eligible to interconnect an eligible electric generator with the customer's local electric utility and operate the eligible electric generator in parallel with the distribution system. The program shall be designed for a period of not less than 10 years and limit each customer to generation capacity designed to meet up to 100% of the customer's electricity consumption for the previous 12 months. The commission may waive the application, interconnection, and installation requirements of this part for customers participating in the net metering program under the commission's March 29, 2005 order in case no. U-14346.

(3) An electric utility or alternative electric supplier is not required to allow for a distributed generation program that is greater than 1% of its average in-state peak load for the preceding 5 calendar years. The electric utility or alternative electric supplier shall notify the commission if its distributed generation program reaches the 1% limit under this subsection. The 1% limit under this subsection shall be allocated as follows:

(a) No more than 0.5% for customers with an eligible electric generator capable of generating 20 kilowatts or less.

(b) No more than 0.25% for customers with an eligible electric generator capable of generating more than 20 kilowatts but not more than 150 kilowatts.

(c) No more than 0.25% for customers with a methane digester capable of generating more than 150 kilowatts.

(4) Selection of customers for participation in the distributed generation program shall be based on the order in which the applications for participation in the program are received by the electric utility or alternative electric supplier.

(5) An electric utility or alternative electric supplier shall not discontinue or refuse to provide electric service to a customer solely because the customer participates in the distributed generation program.

(6) The distributed generation program created under subsection (1) shall include all of the following:

(a) Statewide uniform interconnection requirements for all eligible electric generators. The interconnection requirements shall be designed to protect electric utility workers and equipment and the general public.

(b) Distributed generation equipment and its installation shall meet all current local and state electric and construction code requirements. Any equipment that is certified by a nationally recognized testing laboratory to IEEE 1547.1 testing standards and in compliance with UL 1741 scope 1.1A, effective May 7, 2007, and installed in compliance with this part is considered to be compliant. Within the time provided by the commission in rules promulgated under subsection (1) and consistent with good utility practice, and the protection of electric utility workers, electric utility equipment, and the general public, an electric utility may study, confirm, and ensure that an eligible electric generator installation at the customer's site meets the IEEE 1547 anti-islanding requirements or any applicable successor anti-islanding requirements determined by the commission to be reasonable and consistent with the purposes of this subdivision. If necessary to promote reliability or safety, the commission may promulgate rules that require the use of inverters that perform specific automated grid-balancing functions to integrate distributed generation onto the electric grid. Inverters that interconnect distributed generation resources may be owned and operated by electric utilities. Both of the following must be completed before the equipment is operated in parallel with the distribution system of the utility:

(*i*) Utility testing and approval of the interconnection, including all metering.

(*ii*) Execution of a parallel operating agreement.

(c) A uniform application form and process to be used by all electric utilities and alternative electric suppliers in this state. Customers who are served by an alternative electric supplier shall submit a copy of the application to the electric utility for the customer's service area.

(d) Distributed generation customers with a system capable of generating 20 kilowatts or less qualify for true net metering.

(e) Distributed generation customers with a system capable of generating more than 20 kilowatts qualify for modified net metering.

(7) Each electric utility and alternative electric supplier shall maintain records of all applications and up-to-date records of all active eligible electric generators located within their service area.

Sec. 175. (1) An electric utility or alternative electric supplier may charge a fee not to exceed $50.00 to process an application to participate in the distributed generation program. The customer shall pay all interconnection costs. The commission shall recognize the reasonable cost for each electric utility and alternative electric supplier to operate a distributed generation program. For an electric utility with 1,000,000 or more retail customers in this state, the commission shall include in that electric utility's nonfuel base rates all costs of meeting all program requirements except that all energy costs of the program shall be recovered through the utility's power supply cost recovery mechanism under section 6j of 1939 PA 3, MCL 460.6j. For an electric utility with fewer than 1,000,000 base distribution customers in this state, the commission shall allow that electric utility to recover all energy costs of the program through the power supply cost recovery mechanism under section 6j of 1939 PA 3, MCL 460.6j, and shall develop a cost recovery mechanism for that utility to contemporaneously recover all other costs of meeting the program requirements.

(2) The interconnection requirements of the distributed generation program shall provide that an electric utility or alternative electric supplier shall, subject to any time requirements imposed by the commission and upon reasonable written notice to the distributed generation customer, perform testing and inspection of an interconnected eligible electric generator as is necessary to determine that the system complies with all applicable electric safety, power quality, and interconnection, including metering, requirements. The costs of testing and inspection are considered a cost of operating a distributed generation program and shall be recovered under subsection (1).

(3) The interconnection requirements shall require all eligible electric generators, alternative electric suppliers, and electric utilities to comply with all applicable federal, state, and local laws, rules, or regulations, and any national standards as determined by the commission.

Sec. 177. (1) Electric meters shall be used to determine the amount of the customer's energy use in each billing period, net of any excess energy the customer's generator delivers to the utility distribution system during that same billing period. For a customer with a generation system capable of generating more than 20 kilowatts, the utility shall install and utilize a generation meter and a meter or meters capable of measuring the flow of energy in both directions. A customer with a system capable of generating more than 150 kilowatts shall pay the costs of installing any new meters.

(2) An electric utility serving over 1,000,000 customers in this state may provide its customers participating in the distributed generation program, at no additional charge, a meter or meters capable of measuring the flow of energy in both directions.

(3) An electric utility serving fewer than 1,000,000 customers in this state shall provide a meter or meters described in subsection (2) to customers participating in the distributed generation program at cost. Only the incremental cost above that for meters provided by the electric utility to similarly situated nongenerating customers shall be paid by the eligible customer.

(4) If the quantity of electricity generated and delivered to the utility distribution system by an eligible electric generator during a billing period exceeds the quantity of electricity supplied from the electric utility or alternative electric supplier during the billing period, the eligible customer shall be credited by their supplier of electric generation service for the excess kilowatt hours generated during the billing period. The credit shall appear on the bill for the following billing period and shall be limited to the total power supply charges on that bill. Any excess kilowatt hours not used to offset electric generation charges in the next billing period will be carried forward to subsequent billing periods. Notwithstanding any law or regulation, distributed generation customers shall not receive credits for electric utility transmission or distribution charges. The credit per kilowatt hour for kilowatt hours delivered into the utility's distribution system shall be either of the following:

(a) The monthly average real-time locational marginal price for energy at the commercial pricing node within the electric utility's distribution service territory, or for distributed generation customers on a time-based rate schedule, the monthly average real-time locational marginal price for energy at the commercial pricing node within the electric utility's distribution service territory during the time-of-use pricing period.

(b) The electric utility's or alternative electric supplier's power supply component, excluding transmission charges, of the full retail rate during the billing period or time-of-use pricing period.

(5) A charge for net metering and distributed generation customers established pursuant to section 6a of 1939 PA 3, MCL 460.6a, shall not be reduced by any credit or other ratemaking mechanism for distributed generation under this section.

Sec. 179. A customer shall own any renewable energy credits granted for electricity generated on the customer's site under the distributed generation program created in this part.

Sec. 183. (1) A customer participating in a net metering program approved by the commission before the commission establishes a tariff pursuant to section 6a(14) of 1939 PA 3, MCL 460.6a, may elect to continue to receive service under the terms and conditions of that program for up to 10 years from the date of enrollment.

(2) Subsection (1) does not apply to an increase in the generation capacity of the customer's eligible electric generator beyond the capacity on the effective date of this section.

Sec. 185. Notwithstanding any other provision of this act, this act does not limit or restrict an industrial customer's ability to build, own, or operate, or have a third party build, own, or operate 1 or more self-generation or cogeneration facilities, and none of the provisions of part 5 shall be construed or interpreted to apply to such facilities.

PART 7.

RESIDENTIAL ENERGY IMPROVEMENTS

Sec. 201. As used in this part:

(a) "Energy project" means the installation or modification of an energy waste reduction improvement or the acquisition, installation, or improvement of a renewable energy system.

(b) "Energy waste reduction improvement" means equipment, devices, or materials intended to decrease energy consumption, including, but not limited to, all of the following:

(*i*) Insulation in walls, roofs, floors, foundations, or heating and cooling distribution systems.

(*ii*) Storm windows and doors; multi-glazed windows and doors; heat-absorbing or heat-reflective glazed and coated window and door systems; and additional glazing, reductions in glass area, and other window and door modifications that reduce energy consumption.

(*iii*) Automated energy control systems.

(*iv*) Heating, ventilating, or air-conditioning and distribution system modifications or replacements.

(*v*) Air sealing, caulking, and weather-stripping.

(*vi*) Lighting fixtures that reduce the energy use of the lighting system.

(*vii*) Energy recovery systems.

(*viii*) Day lighting systems.

(*ix*) Electrical wiring or outlets to charge a motor vehicle that is fully or partially powered by electricity.

(*x*) Measures to reduce the usage of water or increase the efficiency of water usage.

(*xi*) Any other installation or modification of equipment, devices, or materials approved as a utility cost-savings measure by the governing body.

(c) "Home energy audit" means an evaluation of the energy performance of a residential structure that meets all of the following requirements:

(*i*) Is performed by a qualified person using building-performance diagnostic equipment.

(*ii*) Complies with American National Standards Institute-approved home energy audit standards.

(*iii*) Determines how best to optimize energy performance while maintaining or improving human comfort, health, and safety and the durability of the structure.

(*iv*) Includes a baseline energy model and cost-benefit analysis for recommended energy waste reduction improvements.

(d) "Property" means privately owned residential real property.

(e) "Record owner" means the person or persons possessed of the most recent fee title or land contract vendee's interest in property as shown by the records of the county register of deeds.

(f) "Residential energy projects program" or "program" means a program as described in section 203(2).

Sec. 203. (1) Pursuant to section 205, a provider whose rates are regulated by the commission may establish a residential energy projects program.

(2) Under a residential energy projects program, if a record owner of property in the provider's service territory obtains financing or refinancing of an energy project on the property from a commercial lender or other legal entity, including an independent subsidiary of the provider, the loan is repaid through itemized charges on the provider's utility bill for that property. The itemized charges may cover the cost of materials and labor necessary for installation, home energy audit costs, permit fees, inspection fees, application and administrative fees, bank fees, and all other fees that may be incurred by the record owner for the installation on a specific or pro rata basis, as determined by the provider.

(3) This act does not limit the right of a provider to propose a residential energy improvement program with elements that differ from those required for a residential energy projects program under this part or the authority of the commission to approve such a residential energy improvement program as reasonable and prudent.

Sec. 205. (1) A residential energy projects program may only be established and implemented pursuant to a plan approved by the commission. A provider seeking to establish a residential energy projects program shall file a proposed plan with the commission.

(2) A plan under subsection (1) shall include all of the following:

(a) The estimated costs of administration of the residential energy projects program.

(b) Whether the residential energy projects program will be administered by a third party.

(c) An application process and eligibility requirements for a record owner to participate in the residential energy projects program.

(d) An application form governing the terms and conditions for a record owner's participation in the program, including an explanation of billing under subdivision (f) and of the provisions of section 207.

(e) A description of any fees to cover application, administration, or other program costs to be charged to a record owner participating in the program, including the amount of each fee, if known, or procedures to determine the amount. A fee shall not exceed the costs incurred by the provider for the activity for which the fee is charged.

(f) Provisions for billing customers of the provider any fees under subdivision (e) and the monthly installment payments as a per-meter charge on the bill for electric or natural gas services.

(g) Provisions for marketing and participant education.

(3) The commission shall not approve a provider's proposed residential energy projects plan unless the commission determines that the plan is reasonable and prudent.

(4) If the commission rejects a proposed plan or amendment under this section, the commission shall explain in writing the reasons for its determination.

(5) Every 4 years after initial approval of a plan under subsection (1), the commission shall review the plan.

Sec. 207. (1) A baseline home energy audit shall be conducted before an energy project that will be paid for through charges on the utility bill under this part is undertaken. After the energy project is completed, the provider shall obtain verification that the energy project was properly installed and is operating as intended.

(2) Electric or natural gas service may be shut off for nonpayment of the per-meter charge described under section 205 in the same manner and pursuant to the same procedures as used to enforce nonpayment of other charges for the provider's electric or natural gas service. If notice of a loan under the program is recorded with the register of

deeds for the county in which the property is located, the obligation to pay the per-meter charge shall run with the land and be binding on future customers contracting for electric service or natural gas service, as applicable, to the property.

Sec. 209. (1) The term of a loan paid through a residential energy projects program shall not exceed the anticipated useful life of the energy project financed by the loan or 180 months, whichever is less. The loan shall be repaid in monthly installments.

(2) The lender shall comply with all state and federal laws applicable to the extension of credit for home improvements.

(3) If a nonprofit corporation makes loans to owners of property to be repaid under a residential energy projects program, interest shall be charged on the unpaid balance at a rate of not more than the adjusted prime rate as determined under section 23 of 1941 PA 122, MCL 205.23, plus 4%.

Sec. 211. (1) Pursuant to the administrative procedures act of 1969, 1969 PA 306, MCL 24.201 to 24.328, the commission shall promulgate rules to implement this part within 1 year after the effective date of this section.

(2) Every 5 years after the promulgation of rules under subsection (1), the commission shall submit a report to the standing committees of the senate and house of representatives with primary responsibility for energy issues on the implementation of this part and any recommendations for legislation to amend this part. The report may be combined with the annual report under section 5a of 1939 PA 3, MCL 460.5a.

(3) This act does not limit the right of a provider to propose a residential energy improvement program with elements that differ from those required for a residential energy projects program under this part or the authority of the commission to approve such a residential energy improvement program as reasonable and prudent.

Enacting section 1. Sections 21, 23, 25, 27, 31, 33, 37, 43, 53, 79, and 155 of the clean, renewable, and efficient energy act, 2008 PA 295, MCL 460.1021, 460.1023, 460.1025, 460.1027, 460.1031, 460.1033, 460.1037, 460.1043, 460.1053, 460.1079, and 460.1155, are repealed.

Enacting section 2. Section 51 of the clean, renewable, and efficient energy act, 2008 PA 295, MCL 460.1051, is repealed effective January 1, 2023.

Enacting section 3. Except as otherwise provided in this amendatory act, this amendatory act takes effect 120 days after the date it is enacted into law.

Enacting section 4. This amendatory act does not take effect unless Senate Bill No. 437 of the 98th Legislature is enacted into law.

Secretary of the Senate

Clerk of the House of Representatives

Approved .....

.....

Governor

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Suitability of Renewable Energy Technologies in the Public Realm

Analytical Framework

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Abstract

Renewable Energy Technologies (RETs) are considered as one of the main solutions for energy efficiency in face of the climate change issue. Urban areas should contribute to the reduction in consumption of non-renewable energy sources by emphasizing on energy efficient solutions, which can play a vital role in the field of urban design and the nature of the public realm in cities, communities and neighbourhoods.
This paper is concerned with the installation of RETs in the public realm. It aims to analyse the potentiality of installing RETs within the public spaces in addition to its effects and limitations. The paper sheds light on the physical aspects of the public realm, types of RETs and presents a framework identifying the RETs suitability to be used in the public spaces.

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Keywords: Climate change; Renewable energy; RETs; Public realm; Physical aspects.

1. Introduction

Climate change is certainly one of the greatest environmental threats the world is facing. Since the 1800s, scientists have realized the significant change in the earth temperature. The 1970s witnessed the beginning of the period of atmospheric warming known as "global warming" (1) [2]. 1992 witnesses the Earth Summit in Rio de Janeiro where Governments agree on the UN Framework Convention on Climate Change (UNFCCC), which commits them to preventing 'dangerous climate change'. In 2010:

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international climate policy picks up a push at the well-organized 16th Conference of the Parties in Cancun, Mexico which set a number of policies and strategies to reduce CO2 emissions [1].

The main problem in the case of climate change is an energy system based on fossil fuels that is no longer efficient and is mainly responsible for the rise in CO2 emissions [3]. However, renewable energy provides one of the leading solutions to the climate change issue. By providing a low CO2 emissions source of power, heat, cooling and transport fuels, renewable energy options such as wind, solar, biomass, hydro, wave and tidal energy offer a safe transition to a low emissions impact (Bank, 2011). Nowadays, many countries have considered a climate change program, including responsibility sharing of CO2 emissions reductions and renewable energy targets. Such energy offers safe, reliable and increasingly cost effective alternatives for all the energy needs- mainly heating, cooling, electricity and motive power for transport [3].

Urban areas contribute to the consumption of energy due to industrialization and urbanization activities. Yet, by considering energy-efficient solutions, urban areas can play a vital role in reducing per capita consumption through changes in the physical configuration of space. These solutions should consider the urban forms and patterns that revolve around the public spaces, because it involves and affects the city and its citizens. Renewable Energy Technologies (RETs) are considered as one of these solutions for energy generation.

The objective of this paper is to install the RETs in the public realm to make the space more energy efficient. Therefore, the paper aims to analyze the potentiality of installing RETs within the public spaces as well as its effect and limitations.

To achieve this aim the following methodology is adopted; first a definition of the public realm physical aspects, identifying its main criteria forming the initial axis of the framework (part A). Secondly, a definition of RETs and their classification, identifying different types used across the literature forming the horizontal axis of the framework (Part B). Finally, through a discussion of the required inputs and outputs of RETs, a refined framework is reached that consists of the physical aspects and the suitable RETs in the public realm.

2. The Public Realm and Its Physical Aspects

Public realm is defined as space that is shared communally by the public. As successful public spaces respond to societal changes, they encourage human growth and contribute to the survival of a culture. They are usually situated in a central location often near main circulation paths or the crossing of such routes and are well used by pedestrians [4]. Public spaces include parks, plazas, pedestrian pathways, streets, streetscape and building interfaces. The main three elements that influence the public realm are: the buildings that enclose and define the space, the space itself and the people that inhabit the public realm and the way they use the space [5]. Those elements indicate the integration between the physical and social aspects of the public realm [6].

Notwithstanding the social aspects of public realm, the research focuses on physical interventions to the public realm in so far as they pertain to the implementation of RETs. Hence, physical aspects can be defined through three main elements: the Enclosure (the space itself), Enclosing elements (defining the space), and elements within enclosure (enhancing the use of space).

2.1 Enclosure

Enclosure measures the degree to which streets and other public spaces are visually defined by buildings, walls, trees, and other vertical elements. Spaces where the height of vertical elements is proportionally related to the width of the space between them have a proper quality [7]. A cross-sectional design ratio of approximately one height to two width, or less, creates a proper scaled image along the street

[8]. Enclosure is formed by lining the street or plaza with unbroken building fronts of approximately equal height. The buildings become the walls of the outdoor room, the street and sidewalks become the floor, and if the buildings are approximately equal height, the sky line looks like an invisible ceiling [9]. Figure (1), shows the difference between a well-enclosed street and a poorly enclosed one. A pedestrian on the well-enclosed street is reached by a continuous row of pedestrian-scale storefronts, while a pedestrian on the poorly enclosed street is met by an excess of empty space, mostly parking lots, and is lacked by the vast distances between interesting elements [8].

Defining the space within the enclosure can be fulfilled by building mass, street trees, visual termination points and street network. Street trees can define the space both horizontally and vertically. Horizontally, by visually enclosing or completing an area of open space. Vertically, by creating an airy ceiling of branches and leaves. Rows of trees on both sides of a street can humanize the height–to-width proportions [10].

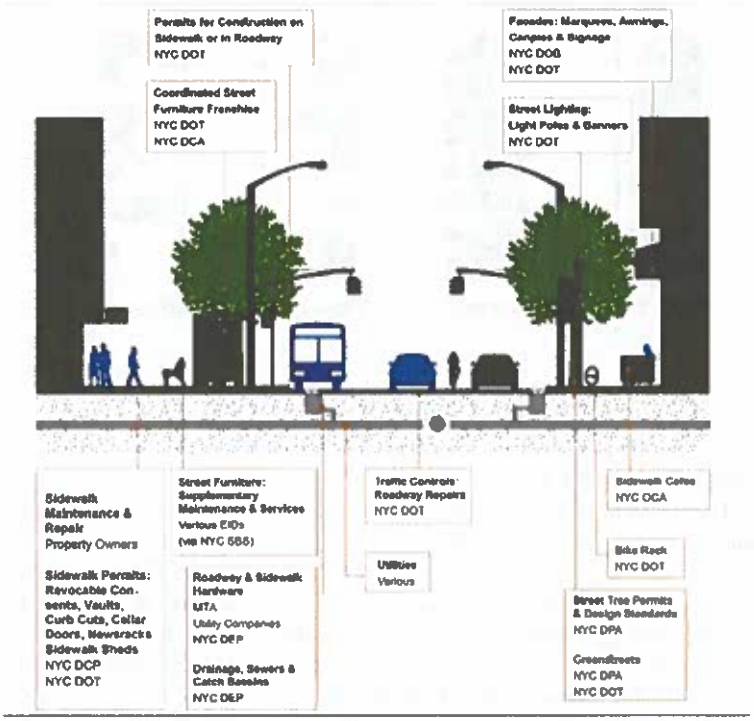

Figure :(1) Enclosure Types, Source: (Jaskiewicz, 2000)

2.2 Enclosing Elements

Enclosing elements are the way the surfaces a) form the horizontal planes of the public realm, b) form vertical and inclined planes that bound the place, and c) are penetrated by entrances or ports, largely defines the overall visual potential of particular places and links (Lang, 1994). They consist of specific materials of specific colors and other qualities, such as degree of opacity, hardness and durability. Natural elements can be used to define the limitations of behavior settings as much as artificial elements. Trees, hedges, and even air movement can be space enclosing elements as much as walls [11].

2.3 Elements within Enclosure

Outdoor open spaces for varying functions such as sidewalks, pedestrian ways, bikeways, bridges, plazas , nodes, squares, transportation hubs, gateways, parks, water fronts, natural features, view corridors, landmarks and building interfaces and articulations are considered as the public realm enclosing elements. With their multi-potential functions, they could make high quality public places which are vital for creating pleasant, socially inclusive communities (Lim, 2001). Figure (2) shows the main elements within a street section which are:

- Streetscape.
- Surfacing.
- Landscape.

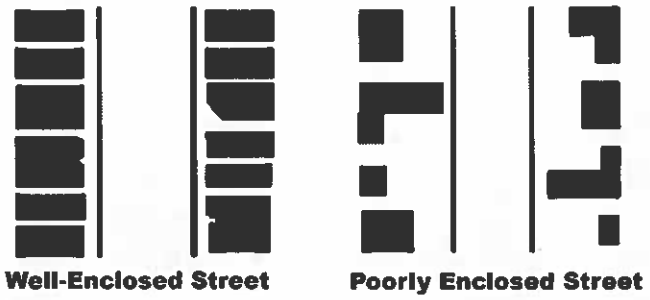

Figure (2) Enclosing elements & elements within the enclosure in the street section
source: (http://www.planetizen.com/node/39815)

3. RETs Classification and Types

Renewable Energy (RE) is a term for any useable energy that is harnessed from natural resources that is either basically unlimited (such as sunlight, or thermal energy generated and stored in the Earth) or naturally replaced in a suitable manner on a human timescale (such as energy derived from wood). A commonly cited definition is that provided by the International Energy Agency (IEA 2008): "Renewable energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biomass, geothermal, hydropower and ocean resources, and biofuels and hydrogen derived from renewable resources". This definition is used by the United Nations Environment Program [12].

3.1 RETs Classification:

While there is no single agreed on categorization to classify the RETs, in reference to several authors a general classification can be based on the following technologies:

RETs that harness the RE sources which are: Thermal energy technology, Kinetic/mechanical Energy technology, chemical energy technology and electrical energy technology. This classification is based on the primary technique of extracting the energy from renewable source e.g. solar energy thermal power plant, solar heaters, geothermal power plant, Ocean thermal energy. Another example is kinetic energy: wind turbine, hydro-turbine, footsteps tiles ... etc. [12]. Regarding to the scope of this research in studying the impact of the RETs implementation within the public realm, thermal energy technology, kinetic energy technology and electrical energy technology will be three considered in classifying the RETs used. Chemical energy is not included within this classification because of its specialties in intertwined with chemistry and environmental studies which concerns more with burners and chemical engines of all kinds,

grates and incinerators along with their energy efficiency, pollution and operational safety [13]. This kind of energy has less relevance in studying the impact of applying the RETs within the public realm. The systems mentioned below under each technology have been selected according to the potential of their implementation in an urban area in its wider capacity and scale.

Thermal energy technology:
- Solar water heating system.
- Roads energy system.

Kinetic/ Mechanical energy technology:
- Grid connected wind turbines.
- Stand alone wind turbines.
- Footsteps energy.

Electrical energy technology:
- Building integrated PV.
- PV lighting.

The framework which follows (Table 1) will include all the physical aspects in the public realm (Part A) and the RETs different systems that can be implemented in an urban area (Part B). RETs will be further analyzed in the next section in accordance to their suitability to the public realm in particular in order to reach the refined framework (Table 2) which will include the suitable RETs as they match the physical aspects of the public realm.

Table 1 Physical aspects and RETs (Part A & Part B)

Public Realm Aspects Part A			Renewable Energy Technology Part B						
			Thermal Energy Technology		Kinetic Energy Technology			Electrical Energy Technology	
			Solar water heating	Roads energy system	Grid-connected wind turbines	Stand-alone wind turbines	Footsteps energy	BIPV	PV lighting
	1) Scale/ratio	Building Mass							
		Street trees							
		Visual terminate points							
		Street network							
B) Enclosing Elements	3) Formatting the surface	Horizontal planes							
		Vertical & inclined							
		Penetrated by entrances							
C) Elements within enclosure		Streetspace							
		Surfacing							
		Landscape							

4. RETs Suitability to the Public Realm

Any system interacts with the environment by means of input and output. Input, is what enters the system from outside, and output, is what leaves the system to the environment [14] [15]. In order to analyze the RETs different systems, inputs and outputs shall be determined.

The inputs that will be considered in this section are the constraints that will affect the system installation which are: the technology installation tools and the public space installation land requirement whether it relates to the enclosure that forms the space, or the enclosing elements forming the surface or elements within enclosure that details the space and the surface. However, the output will be the end uses for each system and the energy produced. By analyzing each system according to its input and output, there will be a better understanding for each technology usage whether it has the potential to be deployed/utilized/installed within the public realm or not.

Determination of the inputs and outputs will assist in choosing the suitable RETs. Moreover, the choice of RET depends on the balance of the energy demand, the opportunity to install on site and the existing supply network in the site. The criteria to choose will be included within the following points and the technical conclusion at the end of this chapter will further explain these points in terms of the RETs mentioned below [16]:

- Determine the current mix of energy used, electricity, heating or cooling or a mixture of both.
- Determine whether the energy demand is constant or fluctuate between day and night and between seasons.
- Determine the intermittent nature of certain technologies.
- Is grid reinforcement needed to transfer power in and out the site?

4.1 Thermal energy technology:
Solar water heating

The principle of the solar water heating system is to heat water, usually in a special collector and store it in a tank until required.

The inputs for this system in the technology installation tools are the Collectors that are designed to collect the heat in the most efficient way, usually into a heat transfer fluid, which then transfers its heat to the water in the storage tank. The two main types of collector are: flat plate and evacuated tube. The cheapest technology available and the simplest to install is a thermosiphon system, which uses the natural tendency of heated water to rise and cooler water to fall to perform the heat collection task. As the sun shines on the collector, water inside the collector flow-tubes is heated. As it heats, this water expands slightly and becomes lighter than the cold water in the solar storage tank mounted above the collector. Gravity then pulls the heavier, cold water down from the tank and into the collector inlet. The cold water pushes the heated water through the collector outlet and into the top of the tank, thus heating the water in the tank. An example of a thermosiphon system is shown in figure (3). The other input of this system is fundamental requirement of land for a solar system is to have a sunny location where solar collectors can function properly. Locations were the sun is blocked from the collectors by the slope or aspect of the land, trees, neighboring buildings, or other obstructions will reduce efficiency. Solar collectors need to be placed where plenty of sunshine strikes the surface of the collectors, year round [12].

The outputs are the uses and the energy produced which is shown in this example, to heat 100 liters of water through a temperature rise of 40o C with a simple flat plate solar collector requires only approximately 2.5 m2 of collector area but saves approx. 10 kg of wood fuel that would normally be required to heat this quantity of water [17].

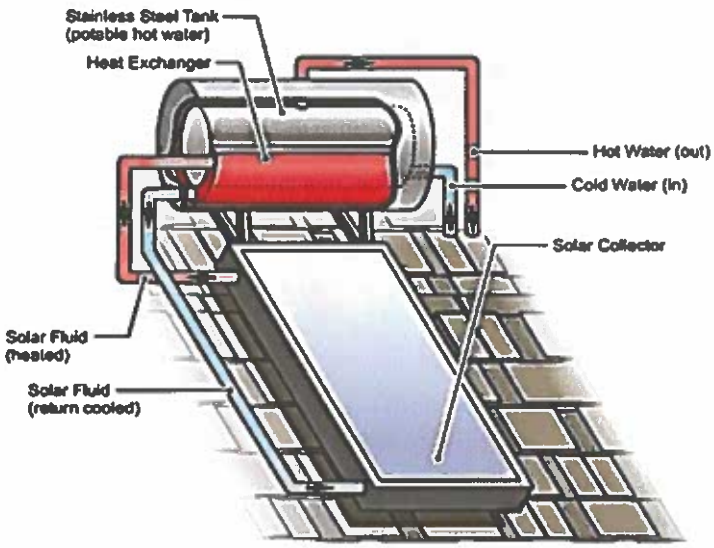

Figure: (3) , Source:(http://solarsystemindonesia.com/)

Generation and saving of energy via asphalt pavement surface

The technology uses the principle that at a certain underground level, the ground has the ability to store thermal energy for a substantial period of time. The inputs: technological inputs can be explained by

During the warm season, water from the cold store at around 7-10°C is passed through a heat exchanger providing direct cooling water to the building. The heat pump is available automatically as support in periods of peak demand. The warm store circuit water will pick up energy from the building and thus be raised in temperature to around 18-20°C (or higher for fresh air load). This water, the temperature of which is higher than the natural groundwater temperature, will be run to an underground „warm energy" store. The heat stored in the warm energy store is used for heating during the winter. Water from the store at around 20°C is passed through a heat exchanger and connected into a heat pump, which in turn provides water around 40-50°C for use in building heating. While the groundwater passes through the heat pump it cools to around 7°C. The cooled water is run to the underground „cold energy" store. The cold stored in the „cold energy" store is used for cooling, completing the annual cycle Any excess heat or cold in the system over a year is balanced using an external heat exchanger. In parallel, the road is the second major benefit, because with the movement of water through it for different seasons, it can avoid excessive temperatures [19] figure (4).. Land requirement: There is a certain classification of streets according to different levels of emphasis on motor vehicle movement versus direct access to property [20], this technology has been used in Belgium in a neighborhood street level and has a wide range of applications. In particular, it is suitable for large scale and mixed-use developments. Its benefits can also be used in commercial buildings, office buildings, and large residential estates, campus sites in educational or health sectors and for industrial cooling. The outputs: The main beneficiary uses of the this technology are buildings, houses or residencies that these will win an energy supplement as well as the streets that will be cooled therefore the outdoor environment will be better for the people who are using it [20].

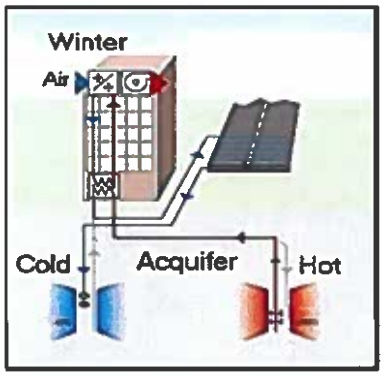

Figure (4), Source: (Pau Blaya, 2011)

4.2 Kinetic energy:
Wind turbines generating electricity

Several turbine types exist but presently the most common configuration has become the horizontal axis three bladed turbine (as shown in figure (5).

The inputs: technological inputs, The rotor may be positioned up or downwind (although the former is probably the most common). Land requirements depend on the wind turbine itself which varies in size with two market ranges: small units used mainly for rural and stand-alone power systems; and large units, from used for large-scale, grid-connected systems.

The outputs: energy produced the small units rated at just a few hundred watts up to 50-80 kW in capacity and large units, from 150 kW up to 5 MW in capacity.

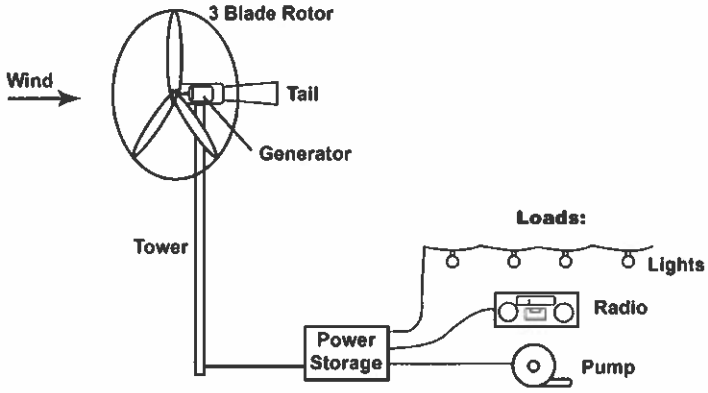

Figure: (5), Source: (http://www.intechopen.com/books/advances-in-wind-power/low-speed-wind-turbine-design)

Grid-connected wind turbines

Grid-connected wind turbines are certainly having a considerable impact in developed countries and in some developing countries, namely Argentina, China and India.

The inputs: same technological inputs like the previous system but different in land requirement. Mainly large-scale installations either on land (on-shore) or in the sea on the continental shelf (off-shore). Coastal locations, and flat rural areas without significant vegetation or buildings, offer the most laminar wind flow. Small wind systems should generally be installed only in these areas. Significant turbulence is caused by

terrain such as steep hills and cliffs as well as ground clutter such as trees and nearby buildings or structures. Urban areas have a poor wind resource that is usually extremely turbulent. In addition, in developed countries, more smaller machines are now being grid-connected [21] figure (6) shows the contents of the grid- connected wind turbines.

The outputs: this system can be used in developing countries to contribute to a more decentralized grid network and/or to support a weak grid. Wind turbines do, however, generate electricity irregularly in correlation to the underlying variation of the wind. The energy comes from wind turbines do not produce power constantly and at their rated power (which is only achieved at higher wind speeds) capacity factors (i.e. actual annual energy output divided by the theoretical maximum output) are typically between 20 per cent to 30 per cent [22].

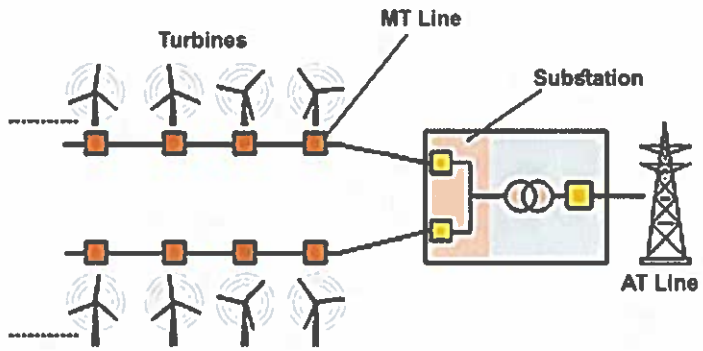

Figure: (6)

Source :(http://electrical-engineering-portal.com/download-center/books-and-guides/power-substations/wind-power-plants)

Stand-alone wind turbines

The inputs: technological inputs, the most common type of stand-alone small wind electric system involves the use of a wind generator to maintain an adequate level of charge in an electrical storage battery figure (7). The battery in turn can provide electricity on demand for electrical applications such as lights, radios, refrigeration, telecommunications, etc., irrespective of whether or not the wind is blowing. A controller is also used to ensure that the batteries are not damaged by overcharging (when extra energy is degenerate through a hole load) or excessive discharge, usually by sensing low voltage. Loads connected to the battery can either be DC or AC (via an inverter) [22]. Larger stand-alone systems, incorporating larger wind electricity generators and correspondingly larger battery banks (at an increased cost) are also available, these may include other renewable energy technologies, such as PV, as well as diesel generators to ensure that the batteries are always charged and that power availability is high. Less common is the stand-alone system which does not incorporate a battery back. This involves the use of a wind turbine with, at least, a diesel generator, which will automatically supply power when required. This has the advantage of not requiring a battery bank but the required control systems are complex. Land requirement, as a basic guide, areas on the coast or hills on exposed rural land have better wind resource, and areas in urban or heavily vegetated land, away from the coast, have less wind.

The outputs: Standalone systems are commonly used to power remote houses or remote technical applications, for example, rural telecommunication systems, and mechanical power for pumping water for the purpose of drinking and irrigation. The energy produced wind turbines used for such an applications may vary between a few watts to 50 kW. Thus, wind turbines of up to 300kW can be used for rural or village electrification systems [22].

Figure: (7) Source: (http://solarquip.com.au/off-grid-or-standalone-power-systems/)

Footsteps energy:

The inputs: technological input, when a person walks, he loses energy to the road surface in the form of impact, vibration, sound etc, due to the transfer of his weight on to the road surface, through foot falls on the ground during every step. This energy can be tapped and converted in the usable form such as in electrical form and can be temporarily stored for later use. In order to develop a technique to generate the energy from foot step one can use the pressure sensor. This can convert foot impact energy into electrical form. The working principle is simple. When a pedestrian steps on the top plate of the device, the plate will dip down slightly due to the weight of the pedestrian. The downward movement of the plate results in generation of electrical signal. The top plate reverts back to its original position due to negating springs provided in the device.

Land requirement, it is possible to implement the different device generators at different places where there is a frequent application of the pressure. This condition is fulfil by the places where large group of people wandering or where high frequency of vehicular movement takes place. The most common places for these conditions are roads, shopping malls, footpath, airport runways, railroad tracks, highways etc. Some of these are explained below.

Footpaths

Footpath in a high density spaces is the most common place where this device can be implemented to generate small amount of energy due to motion of the people. Some similar places are inside shopping malls, dance floor, subway, and outside walkways, etc. It has been used efficiently in UK in the Olympic Park. Technological inputs, The concept focuses on the large number of people moving in dense areas to step on tiles embedded in the floor which would use the device to generate electricity that could be saved and used figure (8).

The outputs: energy production, about 3 to 6 watts per step can be converted. Uses, If one consider the average energy generated per rush hour then it is possible to use that energy for powering the low power electronic devices such as display screens [23].

Figure: (8) source: (http://inhabitat.com/energy-generating-pavement/)

4.3 Electrical Energy :

PV lighting :

Photovoltaic (PV) lighting, or PV-powered lighting, is lighting that is at least partly powered by electricity generated from PV panels (often called solar panels) figure (17).

The inputs: technological input, A PV lighting system collects solar energy using one or more PV panels, stores that energy in a battery or series of batteries, and then releases the energy to power light sources at night. Typically, PV lighting system components include PV panels, batteries, electronics (including battery charge controller, inverter or ballast/driver, and timer or switch), light sources (lamps), and luminaires [24].

The outputs: Uses, a popular example of PV lighting is the solar garden or pathway light. Other examples include post-top luminaires and parking lot luminaires carrying a solar panel on top. These PV lighting systems are usually off-grid, or "stand-alone" systems, their only power source is solar energy. PV lighting technologies are intended for nighttime lighting applications [25].

Rooftop and building integrated systems:

The inputs: land requirement, rooftop PV arrays are often associated with buildings: either integrated into them, mounted on them or mounted nearby on the ground. Rooftop PV systems are most often retrofitted into existing buildings, usually mounted on top of the existing roof structure or on the existing walls. Technological input, an array can be located separately from the building but connected by cable to supply power for the building. Provided there is an open gap in which air can circulate, rooftop mounted solar panels can provide a passive cooling effect on buildings during the day and also keep accumulated heat in at night [26] figure (9).

The outputs: energy production, residential rooftop systems have small capacities of around 5–10 kW, while commercial rooftop systems often amount to several hundreds of kilowatts. Although rooftop systems are much smaller than ground-mounted utility-scale power plants, they account for most of the worldwide installed capacity.

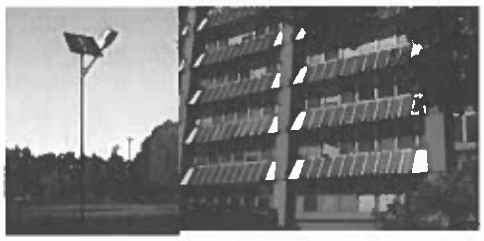

Figure (9) Source: (http://inhabitat.com/building-integrated-photovoltaics-market-projected-to-quadruple-to-2-4-billion-by-2017/)
Source: (http://oslasolar.co.nz/pv-system.php)

5. Conclusion:

Assessing the energy mix helps determine which renewable energy technology is suitable for use in any space. For example, some renewables such as wind and photovoltaic, just produce electricity. Others such as solar water heating, just produce heat. Otherwise, the major limitations in using RETs is the intermittent nature of certain technologies. For example, wind turbines will not provide electricity when it is not windy, just as solar electricity cannot generate at night. For this reason, a grid connection is required to provide back up and power storage. Batteries are also sometimes used for storage, although this is less common.

Once appropriate renewable energy technology has been identified, their inputs and outputs shall be undertaken to determine the suitability of the technology in terms of their usage in the public spaces. Starting with the thermal energy production, the solar thermal systems should only be installed on buildings

with a sufficient hot water demand to make them economically viable. Generation and savings via asphalt pavement, the main beneficiary uses of the this technology are buildings, houses or residencies that these will win an energy supplement as well as the streets that will be cooled down to help the outdoor environment to be better for the people who are using it.

Regarding the kinetic energy production that achieved by wind, urban areas present challenges for the utilization of wind energy technologies. Buildings, trees and other tall obstructions can badly impact wind direction and speed. The power generation potential of a wind turbine is determined by wind speed and consistency of the wind resource. Wind turbines are generally most effective in remote areas with proven and consistent high wind speeds and smooth airflows, where large turbines can generate significant amounts of electricity. As well as, avoid the visual and noise impact that can pollute the surrounded area. For coastal areas adjacent to urban areas, wind farms are gaining popularity. Foot pressure energy system has another technology that harness the kinetic energy. This energy can be tapped and converted in the usable form such as in electrical form and can be temporarily stored for later use. It is possible to implement the different device generators at different places where there is a frequent application of the pressure. This condition is fulfil by the places where large group of people walking or where high frequency of vehicular movement takes place. The most common places for these conditions are roads, shopping malls, footpath, airport runways, railroad tracks, highways and outdoor open spaces. About the electrical energy, many PV systems are retrofitted to buildings. However, it is becoming increasingly common for PV to be available that is integrated into building materials BIPV (for example roofing). PV arrays are connected into the building electrical system via an inverter. The visual impact of the system against the surrounding environment and the circumstances resulting in a broken roofscape- where the PV panels break the skyline are another criteria affect the PV panels installation. Sola PV lighting can work perfectly within the public spaces whenever the enclosure is a non-enclosed area which will permit great chance for unshaded areas.

According to the previous conclusion, the RETs suitability to the public realm usage framework (Table 2) concludes five out of seven systems of the RETs that have the potential to be utilized and influence the spaces of the public realm. These systems have different technology installation tools, energy production, land requirements and uses. The efficiency of the energy produced by these seven systems depends mostly on the tools that install the system and the location where it has been installed. Although, these systems have different public land requirement regarding to their usage and their installation place for example it can be used as Visual terminate points in defining the space, or mounted on the building itself, or it can be used as street furniture and other can be used as a landscape feature, but all of them can be installed within the public space. This refined framework can be applied in further studies on any example in order to check its validity or enhance it further more. After going through the examples the physical aspects can be narrowed down in terms of the relevance into the RETs and a more comprehensive framework can be achieved.

Table (2) RETs suitability to the public realm usage framework

Public Realm Aspects Part A				Renewable Energy Technology Part B						
				Thermal Energy Technology		Kinetic Energy Technology			Electrical Energy Technology	
				Solar water heating	Roads energy system	Grid-connected wind turbines	Stand-alone wind turbines	Footsteps energy	BIPV	PV lighting
Physical Systems	Elements	1) Scale/ratio	Building Mass							
			Street trees							
			Visual terminate points							
			Street network		✓					
	B) Enclosing Elements	1) Formatting the surface	Horizontal planes						✓	
			Vertical & Inclined							
			Penetrated by entrances							
	C) Elements within enclosure		Streetspace				✓			✓
			Surfacing					✓		
			Landscape							

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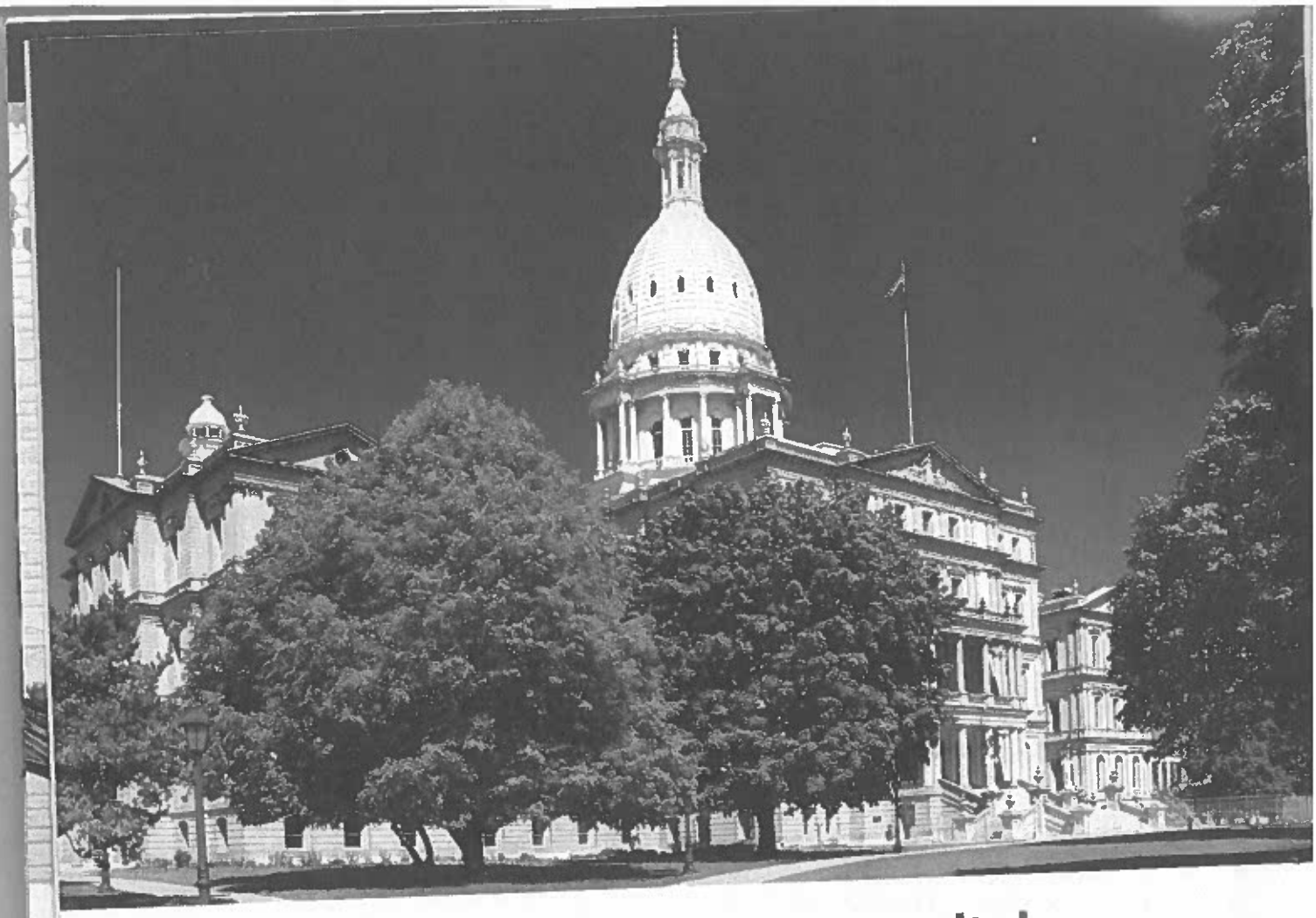


The Michigan State Capitol Went Geothermal—Should You?

By Larry Kaufmann, Michigan Geothermal Energy Association

The Michigan State Capitol in Lansing recently went geothermal. I was involved at the beginning of this process five years ago. The Capitol is 138 years old and probably had its original heating and cooling system, which had many problems. The system was blowing out hot and cold air at the same time, and it was costly. Most importantly, it was not providing proper circulation—especially in the dome, where it was causing damage to the artwork and artifacts in the Capitol.

A committee saw going "green" with geothermal heat pumps as the solution to all these problems. Geothermal will lower the cost of heating and cooling in the Capitol by an estimated $300,000 per year. It will provide more comfort to the people in the building. It will provide better air quality and humidity control to protect the valuable artwork and artifacts.

This 2½-year infrastructure project cost $70 million, with part of this cost being paid for by the Tobacco Settlement. This geothermal system design involved drilling 224 loops about 500 feet deep. Michigan now joins Colorado, Oklahoma, and Idaho as states with a geothermal Capitol. Notice that we are ahead of California and New York in going green.

Some of you may be unfamiliar with geothermal heat pumps, so this information will help you to understand the system and how it can be beneficial for your home. Geothermal has been installed in residential homes since the early 1970s. There are more than 1 million geothermal units in the United States and about 40,000 in Michigan. They work just like your refrigerator. On the bottom of the refrigerator is a coil. Geothermal uses a much bigger coil called a "loop," which "plugs" into the ground. The ground is a constant temperature between 50-60 degrees year-round, six feet below the soil. Geothermal uses this constant temperature to heat your home in the winter (with compression and a refrigerant) and cool it in the summer. Because the ground is heated by the sun, it is considered renewable energy in Michigan.

Homeowners primarily purchase geothermal systems for three reasons:

TO SAVE MONEY

TO PROTECT THE ENVIRONMENT

TO IMPROVE INDOOR AIR QUALITY

Because we are starting with a constant temperature, most geothermal units are four to five times more efficient than a gas, oil, or propane furnace and twice as efficient as an electric air conditioner. This results in big savings for you!

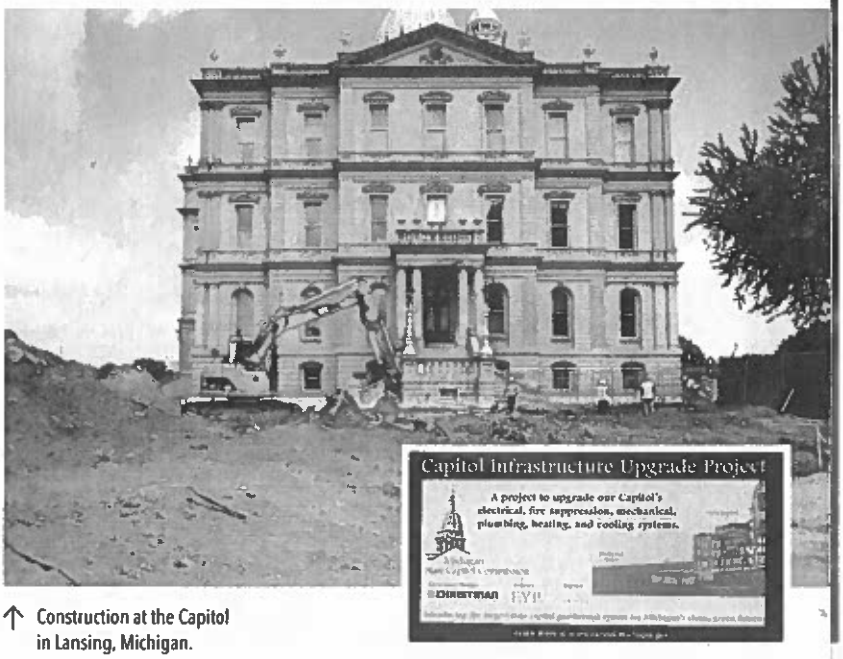
Geothermal costs more to install but saves you money every year. When included in the mortgage of a new home, the savings from geothermal will be larger than the increased cost of installation. Therefore, you will have a positive cash flow from Day 1. Once you install a geothermal system, you will have about a three- to five-year payback versus propane or oil heating. Against gas furnaces and air conditioning, geothermal will have a five- to 10-year payback. These are only estimates, and you should contact a Michigan Geothermal Energy Association (MGEA) approved geothermal contractor to get a quote for your home.

Many people are concerned about sustainability. Here is your chance to go green and save money! You will also reduce your carbon footprint. There is no open flame in geothermal, which is a great safety feature. You will also have better air quality with a more consistent temperature.

Some great recent news is that Congress has just renewed the Geothermal Tax Credit! **The tax credit will be 26% in 2021 and 2022** and will be reduced to 22% in 2023. So the time to act is now!

To find a qualified MGEA-approved geothermal dealer, go to earthcomfort.com. Click on the "Contractors" button at the top and enter your ZIP code. You will get a list of all approved MGEA contractors in your area. I do not recommend using a non-MGEA contractor. Many are not fully trained in geothermal, and MGEA cannot help you if the job goes wrong.

I have had a geothermal system in my home for over 20 years. The temperature in my 2,600-square-foot house plus 1,000-square-foot basement has always been 72 degrees. My average heating and cooling bill over these 20 years has been about $70 per month. Geothermal is cost saving for everyone.



↑ Construction at the Capitol in Lansing, Michigan.

↑ The Farmington City Hall complex in Farmington, Michigan, is all geothermal.