

MIDDLETOWN TOWNSHIP 2020 ENERGY PLAN

**1/31/2020
DRAFT**

Prepared by

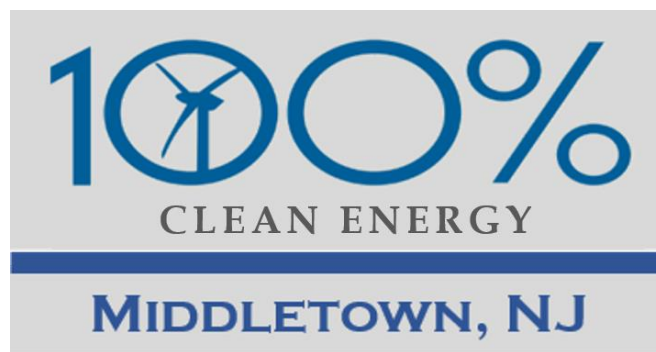


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Appendices E through Q are preliminary Action Plans. An assigned “Project Champion” should consult these Action Plans when starting to plan activities.

These Appendices are referenced in specific sections of the Energy Plan, and a link is shown to a supplementary document. For reference, the supplement is archived at

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

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Middletown Township 2020 Energy Plan

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1. The Energy Plan

This energy plan for Middletown Township, NJ outlines Middletown's goals and key actions to save costs, reduce energy usage, and reduce carbon emissions. This plan is informed by New Jersey's Energy Master Plan (EMP)¹, which provides a road map to meet the mandates of NJ's Global Warming Response Act (GWRA)². The EMP directives apply to cities and towns statewide.

Both the EMP and this energy plan are informed by the scientific consensus in reports such as the International Panel on Climate Change's 2018 report, "Global Warming of 1.5°C".³ This report states that "Without ... urgent [action] ... leading to a sharp decline in greenhouse gas emissions by 2030, global warming will surpass 1.5°C in the following decades", threatening a livable world for our children. We know that the Jersey Shore is on the front lines of this crisis and is, in fact, experiencing sea level rise more quickly than the global average.⁴ Furthermore, adaptation plans for the shore area may include large expensive sea wall projects, e.g. a \$119 billion sea wall among other alternatives.⁵

Increasing global temperatures continue to be measured⁶: "The past decade was the hottest on record", "2019 was the second warmest year ever", and "...the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration showed global average surface temperatures last year [2019] were 1.8 degrees Fahrenheit higher than the average from the middle of the last century, driven mostly by emissions of the dominant Greenhouse Gas (GHG) carbon dioxide (plus water vapor feedback) resulting from human burning of fossil fuels.

Modeling for the NJ EMP, completed by the expert Rocky Mountain Institute (RMI), has determined that the least-cost responsible solution for meeting the goals and mandates of the GWRA would increase the state's annual energy costs by only 0.2% of state GDP over the period 2020-2050. The RMI model conservatively assumes NO benefit to offset the cost, NO decrease in the price of renewable energy over time, and NO technological advances. Taking any of these into account would *reduce* solution cost well below usual costs, thus saving considerable taxpayer money.

This document is developed in conjunction with Middletown for Clean Energy⁷ for the benefit of Middletown, N.J. residents. It currently serves as resident input to Middletown Township for its energy planning initiatives. It builds upon a draft plan prepared for Middletown Township in 2010⁸, with substantial updates that reflects today's imperatives. This document is also developed in consideration of the NJ EMP, the New Jersey Integrated Energy Plan⁹ with input from the RMI, along with Sustainable Jersey¹⁰, and Project Drawdown¹¹.

Appendix A contains additional background information about need for action.

2. Middletown's Goals

- Substantially reduce energy usage and carbon dioxide emissions, helping to achieve the result that Middletown will remain a great place to live and work in the forefront of rapid world change.
- Do its part responsibly to help avoid the worst of global warming impacts.
- Expedite deployment of projects to reduce carbon dioxide emissions.
- Meet statewide goals for energy reduction and clean energy.
- Reduce Middletown Greenhouse Gas (GHG) emissions from all sources for all sectors by 50% by

2030.

- Achieve 100% clean energy (carbon neutral) for all Middletown energy consumers by 2050.
- Obtain the Sustainable Jersey Gold Star in Energy.
- Provide net cost and energy savings via an energy efficiency focus and the switch to 100% renewable sources.
- Create and retain good jobs.
- Demonstrate proactive and strong township-wide leadership role in energy efficiency management and carbon emission reduction.

3. Key Recommendations for Middletown Township

This section outlines recommended high priority actions/projects for Middletown Township governance to officially take. (Also see subsequent sections for further information).

A. Implement Renewable Government (Community Choice) Energy Aggregation (R-GEA) (electricity) made available for the community by September 2020, with the following recommended steps:

- Appoint Middletown Township R-GEA champion by February 2020.
- Enact ordinance (see Appendix B – Example R-GEA Ordinance) for R-GEA by vote of Middletown Township committee by March 2020.
- Appoint R-GEA consultant by March 2020.
- Team with other towns as appropriate to reduce the cost through bulk bid process.
- Notify Middletown residents about R-GEA program early in the year.
- Complete RFP, Bid review, and R-GEA Supplier Determination to meet 2020 implementation timeline.

B. Act as Champion and Leader for Residence, Business, School, and Municipal Solar, use of 100% clean electricity, Energy Efficiency, as well as EV transit.

C. Implement Community Solar at Middletown Train Station and Electric Vehicle (EV) Transportation Hub.

D. Transition Middletown Township Facilities to 100% Clean Energy (i.e. 100% clean electricity), and electrify space and water heating including heat pump technology.

E. Convert Middletown's Municipal Vehicle Fleet to Electric Vehicles (EV).

F. Convert School Buses to Electric Buses (together with Middletown Township School System).

4. Obtain Middletown Gold Star in Energy, Carbon Footprint, and Publish Energy Plan

Middletown Gold Star in Energy:

The primary goal of “Gold Star Standard in Energy” is reducing Greenhouse Gas (GHG) emissions.¹² Sustainable Jersey will award Gold Star in Energy when Middletown meets two standards:

- Municipal Operations: Demonstrate GHG reduction from municipal operations and facilities at an average rate of at least 3.6% per year for 3 years (10.8% over 3 years or less). The “Municipal Carbon Footprint Action”¹³ is completed as a baseline for the beginning of the emission evaluation period.

The carbon footprint is again completed to conclude the evaluation, to demonstrate the required 3.6%, per year reduction in emissions.

- Community-wide emissions: Demonstrate that GHG reduction is a minimum of 1% per year from the entire community- residents, schools, businesses, industries, and municipal operations. In addition, 6 specific Sustainable Jersey actions (or pre-approved substitutes) must be completed. Similar to “Municipal Operations”, a “Community Carbon Footprint”¹⁴ is completed at the beginning of the evaluation. The Carbon Footprint Calculator is available on-line.¹⁵ The year the Gold Star in Energy Action is approved - expected to be 2020 - is considered the base year for the evaluation. After 6 years, Sustainable Jersey will audit to determine if Middletown has met a minimum 1% annual reduction.^{16, 17}

Carbon Footprint

The Community Carbon Footprint, described above, is used to increase awareness of GHG emissions, while serving to track year to year progress in reducing those emissions and thus helping to mitigate global warming. It is fundamental to assessing progress of the actions in the Middletown Energy Plan.

Middletown Energy Plan:

The Middletown Energy Plan will be issued during 2020 and updated frequently thereafter. A thorough review, every five years, should consider current carbon footprint, the actual and planned trajectory, and the advent of new technologies. The Middletown Master Plan will be reviewed, and appropriate sections updated, to reflect the Middletown Energy Plan.

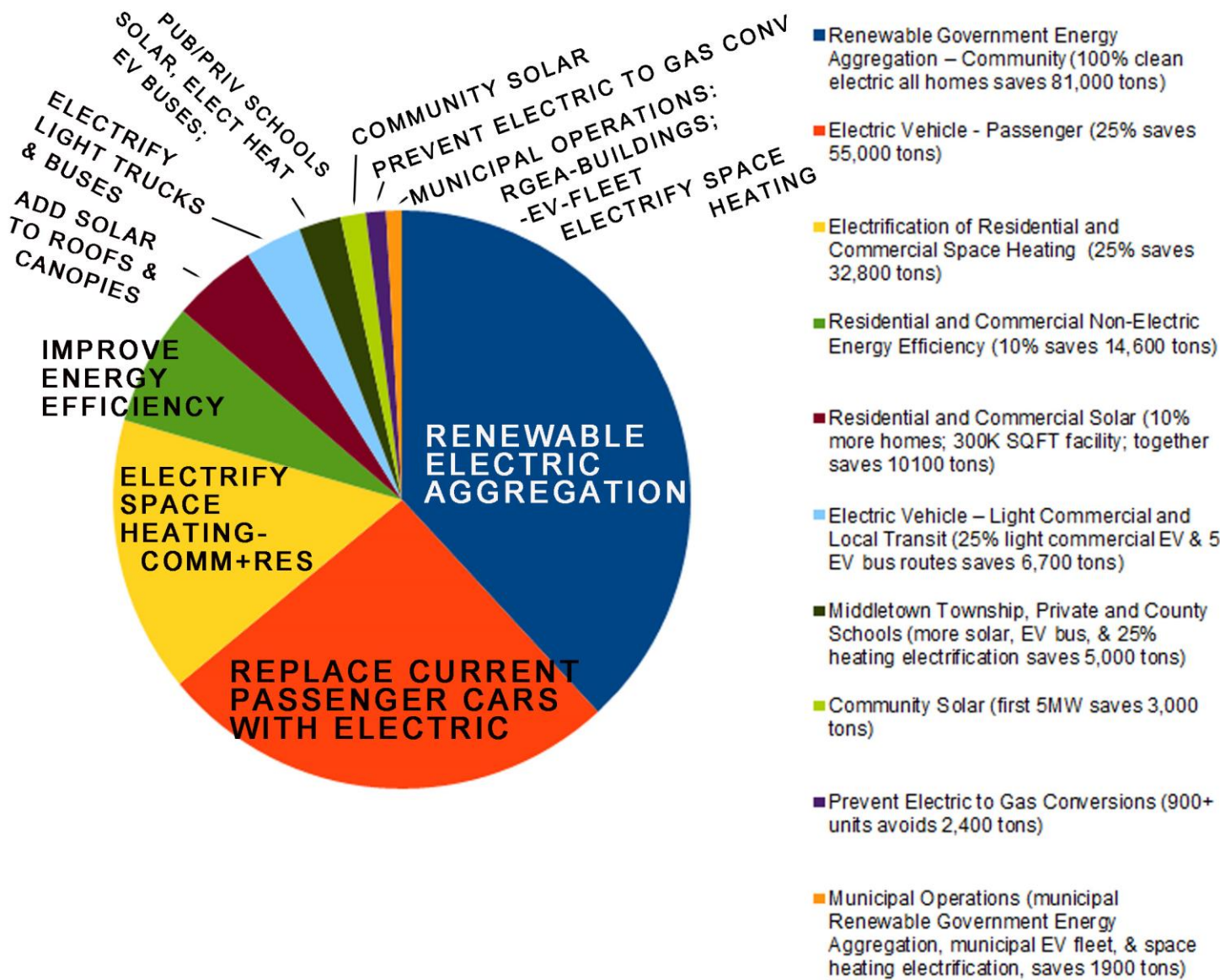
Also see Appendix E - Gold Star in Energy, Carbon Footprint, and Energy Plan Proposed Actions.

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

5. Key Energy Saving and Carbon Footprint Reduction Scenarios

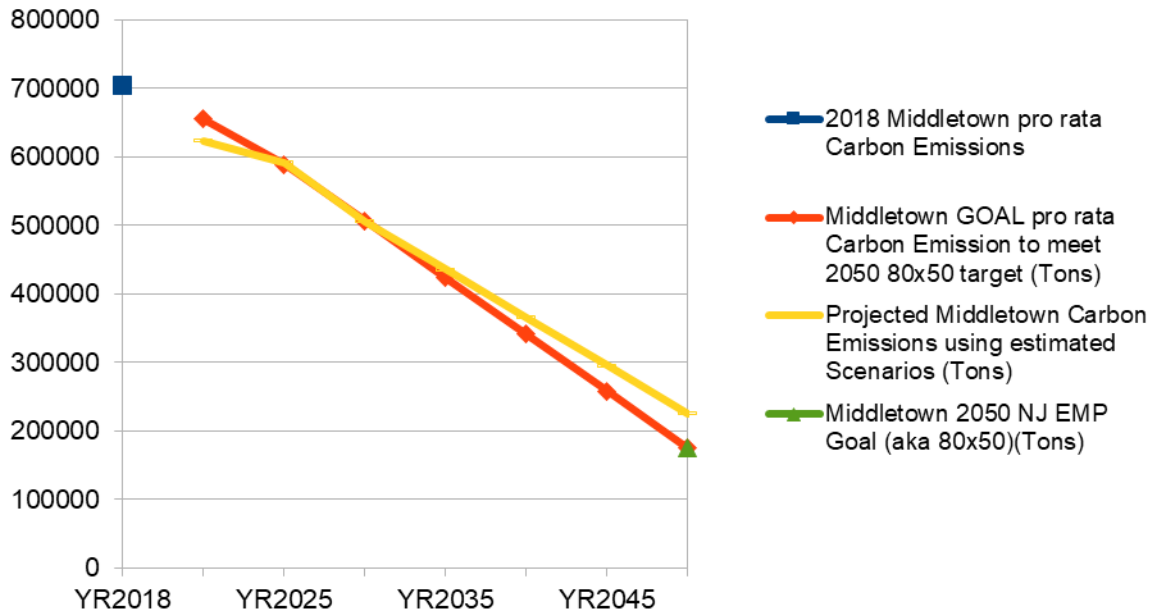
This section summarizes Middletown's key energy saving and estimated GHG reduction scenarios projected to have significant impact in the first 10 years of the plan. GHG (carbon) reduction is expressed in terms of carbon dioxide equivalent. Estimates may change based on changes in assumptions and information. Not all possible savings are currently included; others may be added during the initial 10-year period or later. Rationales for each scenario are provided in Table 1 and subsequent sections. Appendices contain proposed action plans.

Chart 1 Representative Scenarios for Annual Middletown GHG (Carbon) Emission Reduction
 Pie chart shows estimated cumulative tons of GHG emission reduction, by 2030, for each reduction activity.



Calculations are stored at <http://climate.smiller.org/energy-plan/2020/ClimateAction-1-30-20.xls>

Figure 1 Combined Middletown GHG (Carbon) Emission Reduction Scenarios Compared to New Jersey EMP Goal¹⁸ (Pro Rata Middletown)



Notes:

1. The quasi-linear modeled future projection is based on the adoption of the initial set of scenarios only. We expect that many positive forces over the next 30 years will combine to “bend” this line downward toward zero emissions: the addition of more carbon reduction actions, market forces, and state and federal policies and incentives.

2. Middletown’s share of NJ total annual emissions is calculated to be 660,000 tons in 2021. (This is calculated from Middletown’s per capita share, about 0.7%, of NJ total emissions.)

3. Carbon reduction scenarios are not always independent. For example, using rooftop, community or other solar to generate electricity means that the Energy Aggregation scenario will not reduce the amount of carbon already reduced by rooftop or community solar electricity. Energy efficiency measures reduce electric, heating, or fuel demands and thus corresponding carbon emissions, so switching to clean electricity does not offset carbon emissions for electricity, heating, or fuel that is no longer needed.

4. Calculations are stored at <http://climate.smiller.org/energy-plan/2020/ClimateAction-1-30-20.xls>

Table 1 Middletown Scenarios for Estimated GHG (Carbon) Emission Reduction

Energy or Carbon Emission Saving Item	Estimated Annual Middletown Carbon Emission Savings	Rationale in Addition to Carbon Emission Reductions	Primary Impacted Parties	Cost Estimates for Township
Renewable Government (Community Choice) Energy Aggregation (electricity) – Community, to Reduce Cost <i>See Section 6</i>	Up to ~81,000 tons spanning all residential electricity (based on 100% renewable energy sources; potentially phased in over several years)	Reduce costs for residents as renewable electric rates fall, e.g. at \$100 savings per home per year ~ \$2.4 million per year, or \$24 million over 10 years. Assist NJ pro rata to meet 50% renewable electric 2030 goal. ¹⁹	Middletown Township; Selected Consultant; Selected Third Party Electric Supplier; Residents (automatic opt-in for many)	“Renewable Government Energy Aggregation” ²⁰ “Few (if any) costs”. Staff time to hire consultant, review bid responses, and outreach to public.
EV – Passenger (private cars) <i>See Section 7</i>	Up to ~55,000 tons upon 25% Resident EV. Expecting rapid future EV increase saving up to ~220,000 tons.	Phase out fossil fuels as quickly as possible to meet New Jersey goal of 100% clean energy by 2050. ²¹ Note, 24% EV expected by 2030. ²² Replace aging cars with plug-in hybrids or full electric	Many: Car Owners; Multifamily and Senior Housing Owners/Occupants; Businesses; Government Entities; Middletown; EV Vehicle Dealers; EV Charging Facility Owners/Operators	“Make Your Town EV Friendly” ²³ 8-12 months staff time for ordinance; charger standards; 1 st responder training; modify Master Plan for charger location ²⁴
Electrification of Space Heating				
Electrification: Residential Space and Water Heating <i>See Section 8</i>	Up to ~19,800 tons upon 25% conversion of fossil fuel (e.g. gas) space and water heating to clean electricity. Conversion to 100% by 2050.	Phase out fossil fuels as quickly as possible to meet New Jersey goal of 100% clean energy by 2050. Replace aging HVAC/water heater/appliances with high efficiency electric versions.	Homeowners; HOA; Utilities; Contractors; Middletown standards for new construction in Master Plan	Staff and volunteers provide outreach to encourage heat pumps. Use customary building codes, permitting, and inspection procedures
Electrification: Commercial Space and Water Heating <i>See Section 8</i>	Up to ~13,000 tons upon 25% conversion of fossil fuel (e.g. gas) space and water heating to clean electricity. Conversion to 100% by 2050.	See prior item.	Commercial Business Owners; Utilities; Contractors; Middletown Master Plan for new construction	Staff and volunteers provide outreach to encourage heat pumps. Use customary building codes, permitting, and inspection procedures
Energy Efficiency Savings				
Residential Energy Efficiency Savings (Nonelectric fossil fuel cutback) <i>See Section 9</i>	Up to ~8800 tons from 10% energy savings spanning Middletown residences. Each additional 10% saves up to ~8100 tons.	Save costs. Reduce energy usage and promote energy-efficiency. Replace aging HVAC/water heater/appliances with high efficiency electric versions.	Homeowners; HOA; Utilities; Contractors; Middletown as champion	Continue green team “Residential Energy Efficiency outreach” ²⁵ to reach 10% participation
Commercial Energy Efficiency Savings (Nonelectric fossil)	Up to ~5800 tons from 10% energy savings spanning estimated Middletown commercial	Save costs. Reduce energy usage and promote energy-efficiency. Replace aging	Businesses; Contractors; Middletown Township as champion	Underway. Continue green team “Commercial Energy Efficiency Outreach” ²⁶

fuel cutback) <i>See Section 10</i>	space (assumes natural gas). Each additional 10% saves up to ~5800 tons.	HVAC/water heater/appliances with high efficiency electric versions.		campaign to reach 10% participation
Solar				
Residential Solar (Electricity) <i>See Section 11</i>	Up to ~7700 tons if solar installations are deployed to 10% more Middletown homes. Each additional 10% saves up to ~7700 more tons.	Reduce resident costs. Assist NJ to meet 50% renewable electric 2030 goal. ²⁷	Homeowners; Solar Contractors; Middletown to expedite permitting	1.“Make your Town Solar Friendly” ²⁸ ; 6 months. Staff time: create solar ordinance ²⁹ ³⁰ ; amend permit fee. 2.“Community-Led Solar Initiatives” ³¹ min 6-8 months; Create group solar purchasing. Outreach.
Commercial Solar (Electricity) <i>See Section 12</i>	Up to ~2400 tons for ~300,000 SQFT building, parking or vacant land facility generating ~6,300,000 KWH annually with ~16,000 solar panels. Additional same sized project saves up to ~2400 more tons.	Reduce electricity costs for businesses. Generate renewable electricity on commercial premises, thus growing renewable footprint. Assist NJ to meet 50% renewable electric 2030 goal. ³²	Commercial Businesses; Solar Contractors; Middletown Township as champion and to expedite	Same as residential (above). Outreach to Eastern Mon Chamber of Commerce and to owners of large business roofs, parking or vacant land.
Electric Vehicle – Light Commercial and Local Transit				
EV – Delivery and Light Commercial <i>See Section 13</i>	Up to ~3,850 tons upon 25% EV for delivery/light truck vehicles. Expecting rapid future EV increase saving up to ~15,400 tons.	See prior EV-passenger reference. Also improve health by eliminating diesel emissions.	Local delivery and commercial light truck operators; EV Vehicle Dealers; EV Charging Owners/Operators; Middletown champion for EV charger deployment	“Make Your Town EV Friendly ³³ ” (see “EV-passenger”). Outreach to owners of delivery services.
EV – Local Transit <i>See Section 14</i>	Up to ~2,870 tons – EV for 5 bus routes. (NJT local bus route; commercial bus route to NYC port authority; 3 bus routes associated with Brookdale)(Note: ride share and commercial bus not included in this estimate)	See prior EV reference. Also improve health by eliminating diesel emissions.	Middletown Township; Bus/EV transit operators; Ride Share Owners/Operators; Brookdale; EV Charging Facility Owners & Operators; NJ Transit	“Make Your Town EV Friendly ³⁴ ” (see “EV – passenger”). Outreach to NJT, Brookdale, senior centers which operate buses.
Middletown Schools, Private, Religious and County Schools				
More School Solar (Electricity) <i>See Section 15</i>	Up to ~3600 tons if solar deployed to more school roofs currently without solar, parking lots, and unused fields (assumes only 25% area utilization and without all parking/unused fields considered yet)	See prior solar rationale.	Middletown School System; Brookdale, CBA, Oak Hill Academy, other religious and private schools, County Vocational HSs	Staff and volunteers provide outreach to Middletown Township Public Schools and other schools

Electrification: School Space and Water Heating <i>See Section 8</i>	Up to ~1100 tons upon 25% conversion of fossil fuel (e.g. gas) space and water heating to clean electricity. Conversion to 100% by 2050.	See prior Electrification reference.	Middletown School System; Brookdale, CBA, Oak Hill Academy, other religious and private schools, County Vocational HSs	Staff and volunteers provide outreach to Middletown Township Public Schools and other schools
EV – School Bus <i>See Section 16</i>	Up to ~300 tons upon 25% School Bus EV	See prior EV reference. Also improve children's health by eliminating diesel emissions.	Middletown Township; Educational Institutions; School Bus operators	Staff and volunteers provide outreach to Middletown Township Public Schools, other schools, and bus owners/operators
Community Solar (Electricity) Municipal Project <i>See Section 17</i>	Up to ~3,000 tons for an initial 5MW project generating ~ 8,000,000 KWH per year. Each additional 5MW project saves up to ~3,000 more tons.	Generate renewable electricity with community participation. Benefit Low to Moderate Income participants. Assist NJ to meet 50% renewable electric 2030 goal. ³⁵	Middletown Township (or alternate responsible entity); selected Implementer/Operator; Landowner/Landlord; Subscribers (e.g. Middletown residents)	Underway. ³⁶ Solar consultant is evaluating Train Station canopy to supply electricity to Arts Center and Senior Housing.
Prevent More Gas Conversions <i>See Section 18</i>	Avoid up to ~2400 tons by preventing electric to gas conversions	Avoid gas; move towards full electrification.	Homeowners; HOA; Utilities; Contractors	Underway by Shadow Lake Village residents.
Municipal Operations				
EV – Municipal Fleet <i>See Section 19</i>	Up to ~700 tons upon 25% conversion of patrol and other vehicles to EV. Save ~2800 tons upon 100% EV.	See prior EV reference. Also, eventually improves health by eliminating diesel emissions. Replace aging cars with plug-in hybrids or full electric	Middletown Township; Fleet EV Dealers; EV Charging Facility Owners/Operators	Same as “EV-Personal” - above
Renewable Govt Energy Aggregation (electricity) – Municipal Operations <i>See Section 20</i>	Up to 1100 tons	Reduce costs for Middletown and, thus, taxpayers	Municipal Operations	“Buy Electricity from a Renewable Source” ³⁷ Underway. Staff costs to contract through an aggregation pool.
Electrification: Municipal Space and Water Heating <i>See Section 8</i>	Up to ~65 tons upon 25% conversion of fossil fuel (e.g. gas) space and water heating to clean electricity. Conversion to 100% by 2050. See prior item.	See prior Electrification reference. Replace aging HVAC/water heater/appliances with efficient electric versions	Middletown Township, HVAC contractors	Monitor market conditions, apply when it becomes cost-effective. Select 100% clean solutions during upgrades at end of life,

6. Renewable Government (Community Choice) Energy Aggregation (electricity) - Community

Middletown will establish a Renewable Government (Community Choice) Energy Aggregation (R-GEA)³⁸ program to reduce cost for the benefit of Middletown electricity consumers. To meet planning goals, this must be established within one year.

An R-GEA program enables a New Jersey community to aggregate substantial customer electricity consumption and thus offer a lower cost (e.g. 5 to 10% cost reduction) with a small or no carbon footprint

electricity source to the community. The community (via a consultant) obtains bids from third-party power suppliers and then contracts for an electricity cost reduction and carbon savings, making use of renewable energy sources including solar and wind power. A community notification program (via a consultant) includes notifying customers of both automatic opt-in and the right to opt out. Customers who previously retained the Basic Generation Service (BGS) provider and who do not opt out are automatically converted to the new power offering as per contract with the selected third-party supplier, thus achieving the anticipated cost savings and carbon reduction. All converted customers retain the right to opt out of the program in the future with advance notification to the electricity supplier. (Usually customers who already have personal or community solar are not automatically opted in, though they may opt in for any difference in electric needs. Small businesses may also choose to opt in.)

The BGS provider continues its responsibility for the existing and future community physical electrical infrastructure. This responsibility includes infrastructure maintenance and reliability within the serving area up to the existing utility connection point at each consumer regardless of which electricity provider provides the electrical power source. The billing continues nearly the same, with the BGS line item on the electric bill replaced with the third-party supplier at the contracted rate.

The City of New Brunswick³⁹, NJ and South Orange⁴⁰, NJ are two examples of NJ communities that have currently established energy aggregation programs to benefit their residents. Further information and other examples, e.g. Glen Rock, NJ, is spotlighted at Sustainable New Jersey.^{41 42}

Appendix B contains an example renewable energy aggregation ordinance.

Following is the list of project actions to be completed over the next few months to offer this service to residents within one year.

Proposed Project Actions

- Middletown Project Champion assigned
- Township ordinance prepared
- Township ordinance approved
- Engage an R-GEA consultant
- Legal Review
- Initial community notifications completed
- RFP for third-party suppliers issued requesting low cost, both low and no carbon bids, and implementation dates.
- RFP response final date
- Township decision on selected electric supplier
- Supplier contract signed with project dates and costs
- Community notification of supplier, project dates and general customer conversion dates
- Communicate option of opt-in to Middletown small businesses
- Middletown R-GEA cutover. Complete customer conversions to new supplier including supplier notification to individual customers. Detailed dates as per project plan
- Publish (including on web) project status information to Middletown residents throughout project

Also see Appendix F - Middletown Renewable Government (Community Choice) Energy Aggregation - Proposed Actions, for more information.. <http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

7. Electric Vehicles – Passenger (Private)

In addition to providing a substantially greener future via powering from renewable electricity sources, EVs offer lower per mile energy costs at the equivalent of \$1.00 to \$1.50 per gallon⁴³. A utility serving Middletown currently offers a range of EV and EV charging information⁴⁴. EV maintenance and eventually manufacturing is expected to be lower than fossil fuel engines due to the replacement of fuel based engines

and associated components such as fuel and exhaust systems with electric motor based drive trains.

New Jersey has a goal (new electric vehicle bill S-2252⁴⁵ ⁴⁶) of registering 330,000 zero emission vehicles (ZEV) by 2025, 2 million by 2035, and 80% of light vehicles by 2040. (Middletown's per-capita share would be 2,310 by 2025, and 14, 000 by 2035.) Under S-2252, New Jersey intends to provide certain rebates for purchasing EV and installing EV chargers, and also intends to advance state fleet EVs, EV charging infrastructure and EV deployment.

Numerous manufacturers (see reference⁴⁷ for example) have announced plans to increase manufacturing and availability of EV in their product lines, including possible transitions away from fossil fuel vehicles. They are also redirecting capital from fossil fuel research, development, and manufacturing to EVs. Countries such as Germany are grappling with the rapid change resulting from EV deployment and manufacture. Already almost 10% of new car registrations in Europe are either EV or hybrid vehicles with sales up 40% from a year early.⁴⁸

Manufacturer and government incentives may be available to help purchase certain EV.

Appendix B contains further information about EVs along with information on other impacts including social justice concerns.

Appendix C contains an example list of EVs currently available, announced, or transitioning to EV.

Also see Appendix M - Electric Vehicles: Passenger - Proposed Actions.

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

8. Electrification of Space Heating (Residential, Commercial, School, Municipal, Religious Buildings, & County Park Facilities)

Electrification of space and water heating (residential, commercial, and government) is a key aspect of New Jersey energy plan 2050 alternatives⁴⁹. This will be accomplished primarily via reduction in natural gas usage, as well as any remaining oil or propane usage, and replacement with clean energy.⁵⁰

New Jersey incentive programs exist for installation of residential electric energy saving heating equipment⁵¹. Facilities with aging HVAC systems should be encouraged to replace the HVAC with high efficiency electric heat pumps. Widespread conversions from fossil fuel heating to electricity based systems may depend in part on future expanded Federal and State incentive programs, as well as in part on resident and commercial business assessment of the relative cost for upfront HVAC equipment replacement and relative ongoing operating expense of fossil fuel versus electric space and water heating going forward, e.g. as the cost of clean energy continues to drop relative to fossil fuel.

A recent limited study⁵² calculated the cost of heating with a gas furnace compared to heating with an electric heat pump (reference example⁵³). Calculations show that the cost of space heating with a late model, high efficiency heat pump (HSPF 9.7) approaches the cost of heating with a 95% efficient natural gas furnace. The study determined that:

- Heating via electrical heat pump in JCP&L territory is currently 19% more expensive than heating via gas heat in NJNG territory

- Future changes will likely reduce cost of operating a heat pump to less than the cost of operating a gas furnace.
- Electric baseboard heating is over 3 times more expensive than heating with natural gas.

Middletown will keep abreast of Federal and State policies and incentives, technology, replacement and installation transition intervals, and costs. As these evolve, Middletown will develop an information program for residents and for publication on the web to encourage residents, businesses, and religious facilities to convert to electric space and water heating, while also tracking Middletown's overall conversion status.

Middletown will develop its own plan and schedule for converting 100% of Middletown Township's space and water heating to clean energy. Middletown will reach out to Monmouth County about its plans for conversion of facilities in Middletown to clean energy.

School administrations, including Brookdale and both private and religious school operators would also develop plans for transition of 100% of their buildings from fossil fuel consumption to clean energy.

Heat Pump Examples

- Trane 3, 4, and 5 ton⁵⁴ commercial high efficiency (HSPF 9.0) heat pumps
- Mitsubishi duct-less heat pumps.⁵⁵
- Mitsubishi heat pumps deliver heat to -13 degrees F.⁵⁶

There may be other alternatives towards reducing carbon emissions, e.g. Renewable Sources for Natural Gas.⁵⁷

9. Residential Energy Efficiency Savings

The annual energy consumption of the average home in New Jersey is 127 million BTU⁵⁸ (2009). Space heating accounts for nearly half of the energy⁵⁹ used in a New Jersey home (estimated at ~ 45% or 57 million BTU; or ~570 therms). About 80% of the residential space heating in New Jersey uses natural gas.

As previously mentioned, Middletown, in conjunction with utilities and the Middletown Green Team, conducts outreach energy savings events for businesses and residences.

The State of New Jersey also offers numerous programs⁶⁰ for residential energy savings, including COOLadvantage, WARMadvantage, Comfort Partners, Appliance Rebates and Lighting, ENERGY STAR programs both for home upgrades and new homes, refrigerator and freezer recycling, and programs for Oil, Propane & Municipal electric users. The state also registers Solar Renewable Energy Certificates (SRECs) earned from solar projects.

State utilities offer energy saving (and thus money saving) information and programs. As an example, one utility serving Middletown includes “Energy Saving Tips for Your Home”⁶¹. Another utility also serving Middletown also provides “More Than 100 Ways to Improve Your Energy Bill”⁶². For example, it suggests replacing incandescent lighting with LED lights, which drastically reduces energy usage, thus reducing carbon emissions and electricity bills, while saving on long term bulb replacement costs. Insulating a home using relatively low-cost caulking, weather stripping, and insulation can also drastically reduce energy usage. Upgrading (replacing) older appliances and equipment with Energy Star appliances and high efficiency heating and cooling equipment also provides drastic energy savings.

Low cost programs to help identify home energy savings are available. As of the time of this document,

homeowners can obtain a home energy analysis for \$49 along with some reduced cost product offerings.⁶³ Residents should be encouraged to replace aging equipment with high efficiency electric appliances and HVAC systems

Proposed Action steps are shown in Appendix K – Residential Energy Savings
<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

10. Commercial Energy Efficiency Savings

Middletown will continue to reach out to local businesses to identify energy savings programs they have underway, suggest benchmarking programs, and provide additional encouragement towards establishing energy savings actions. Middletown will continue to communicate with and also conduct outreach events for business and residences. For example, Middletown communicates on energy efficiency programs with local businesses.⁶⁴ As a further example, in February, 2019, the Middletown Green Team and Township Officials held an outreach event⁶⁵ for residents and businesses to learn about programs that help make energy-efficiency improvements more affordable.

The State of New Jersey Clean Energy Program⁶⁶ offers numerous programs aimed at energy-efficiency for commercial, industrial, local government and multifamily homes, e.g. including Benchmarking, SmartsStart Buildings program, New Jersey Commercial and Industrial incentive programs (i.e., CTEEP), Direct Install for lighting replacement, HVAC and other outdated operational equipment replacements, Large Energy Users Program, and Food Service Equipment. Businesses should be encouraging to replace with high efficiency electric appliances and HVAC systems.

Proposed Action steps are shown in Appendix J – Commercial Energy Savings.
<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

11. Residential Solar

As of September 2019, more than 116,744⁶⁷ homes and businesses in New Jersey have installed a solar electric system.

The typical New Jersey residence uses 8,902 kWh⁶⁸ per year. For solar to generate this amount of electricity requires a system of about 22 solar panels at 250 watts per panel (using Newark⁶⁹ sunlight factor of an average of 4.5 sunlight hours per day). With this solar installation, a residence would save about 3.2 carbon tons per year.

Deploying full solar installations to an additional 10% of Middletown's 23,962 homes (e.g., 2,396 homes) would amount to saving ~7,700 carbon tons per year.

Middletown will encourage residents to add solar installations via Middletown resident communications, mentioning solar benefits in appropriate forums, and developing statistics on Middletown's residential solar penetration and growth rates.

Note also that California is the first state to require solar panels on new homes, starting 1/1/20.⁷⁰

12. Commercial Solar

Middletown will encourage solar projects at businesses through an active program of community outreach. Potential businesses amenable to rooftop, carport (parking lot) and/or vacant commercial land solar will be identified. Further outreach to businesses will follow to encourage solar project planning, installation, and operation.

Middletown will consider requiring new commercial buildings of defined size to install rooftop solar panels (or alternate ground based solar supply) and also provide a carport solar feasibility assessment for associated parking. As an example, New York City has a new law⁷¹ requiring new buildings to install rooftop solar (or green roof).

An example large commercial solar project⁷² is at Great Adventure in Jackson, NJ. As another example, a large solar project of 166 acres to provide enough power (35 MW) for 6500 homes is planned for Toms River.⁷³ A rooftop solar panel installation can be seen at 641 Shrewsbury Ave in Shrewsbury. A carport parking solar panel installation can be seen at 655 Shrewsbury Ave in Shrewsbury. Numerous other commercial solar installations are now deployed in NJ.

Proposed Action steps are shown in Appendix H – Commercial Solar <http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

13. Electric Vehicles – Delivery and Light Truck

This section describes actions to convert local delivery and light trucks used for commercial delivery, utilities, and residential services to electric trucks. Vehicles include four well known package/mail delivery services (Amazon, UPS, FEDEX, and USPS), supermarket delivery, fast food delivery, furniture delivery, floral delivery, and trucks dispatched for home services, contracting, and maintenance such as plumbing, electrical, cable, telephone, lawn, and other similar services.

Commercial package delivery services are starting to employ EV⁷⁴. Also see commercial examples, e.g. EV truck technology and delivery of initial EV trucks to USPS, and EV truck “Workhorse”.^{75, 76}

EV conversion for delivery and light trucks is anticipated to provide significant health⁷⁷ and air pollution benefits, including reducing gas and diesel exhaust fumes for other vehicle drivers, pedestrians, those residing near major roads, and everyone in the community.

Also see Appendix N - Electric Vehicles: Delivery and Light Truck - Proposed Actions. <http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

14. Electric Vehicles - Local Transit

Local transit, primarily bus routes, would be converted to EV. The carbon emission reduction estimate includes coverage of several NJ transit bus routes traversing Middletown.

Example local transit electric vehicles, information, and EV needs include (not a complete list):

- There are numerous EV bus manufacturers⁷⁸
- The Port Authority of NY and NJ has a transition to airport shuttle bus EV well underway with full conversion by 2020.⁷⁹

- NJ Transit has recently applied to purchase three autonomous self-driving EV shuttle buses which would initially be used in Fort Monmouth⁸⁰
- Advocates are seeking complete electrification of all 3700+ NJ buses by 2040⁸¹
- NJ Transit is in the process of trialing 8 EV buses in Camden⁸²
- EV transit consideration includes NJ Transit local bus route, bus routes associated with Brookdale, commercial passenger bus (e.g. trips to/from NYC port authority), senior citizen, special needs, commercial bus operators, and ride for hire (ride share, taxi, limousine).
- Replacing diesel vehicles will result in significant health improvements and address global warming (via greenhouse gas reduction) through reduced emissions and reduction of “black carbon”⁸³

New paradigms for enhancing local transit may also be considered in order to provide comprehensive local transportation using clean energy, e.g. bus EV. This would also encourage reduced Vehicle Miles Traveled (VMT). For example, Sioux Falls, SD is shifting to an “on demand” bus^{84 85} based local transportation service (Sioux Falls is also starting to budget for electric buses⁸⁶). A similar service concept could apply to Middletown, including rides for those without cars, rides to the Middletown train station, and rides to shopping.

Also see Appendix O – Electric Vehicle: Local Transit – Proposed Actions.
<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

15. More School Solar

Most Middletown Township schools now have rooftop solar installations, a testament to rapid, essential action undertaken by Middletown Township Schools. At least one private school in Middletown has solar rooftop.

Middletown will identify remaining unused Middletown Township school building rooftops suitable for solar if any remain, as well as areas for deploying solar parking lot canopy and unused field solar panels during a review of all Middletown Township Schools.

Middletown will also reach out to Brookdale, CBA, Oak Hill Academy and other schools within the township to identify their plans for solar installations among roof top, parking lots (i.e. for solar canopy), and unused fields.

Also see Appendix I – School Solar - Proposed Actions.
<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

16. Electric Vehicle – School Bus

School Buses will be converted to EV. The carbon emission reduction is an estimate based on considering conversion of Middletown school bus routes to EV.

The NJ State legislature is looking into school bus electrification.^{87 88}

EV school buses are anticipated to provide significant health benefits for children and bus drivers, as well as other vehicle drivers, pedestrians, and residents near or on school bus routes.

Also see Appendix P – Electric Vehicle: School Bus – Proposed Actions.
<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

17. Community Solar at Middletown Train Station

Middletown will establish an initial Community Solar project of 5 MW, thus enabling residents to lower costs and more fully reduce carbon emissions through their direct active participation including possible direct ownership of solar panel shares. For example, establish the first Middletown Community Solar project at the Middletown Train Station (or another suitable location). Additional projects can be subsequently considered.

New Jersey Community Solar⁸⁹ projects enable utility customers to participate in a solar energy project located remotely from their property. Currently, an individual project is limited to 5 MW per the State of New Jersey. All New Jersey projects are also subject to a combined power limit. An application needs to be prepared and submitted for approval.

An example Community Solar project is Sussex Solar Gardens⁹⁰ located in Sussex County, New Jersey. NJ Clean Energy gave conditional approval to 45 community solar projects in December 2019.⁹¹

An additional recommendation is to implement an Electric Vehicle Transportation Hub at the Middletown Train Station along with Community Solar; see a Section 31 for further information.

Also see Appendix G - Middletown Community Solar - Proposed Actions.

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

18. Prevent More Electric to Gas Conversions

Gas utilities continue to actively market gas conversions in New Jersey. Converting existing electric to natural gas raises the prospect of significantly increased carbon emissions compared to a future where electricity is based on 100% clean energy. This plan recommends that no additional electric to natural gas conversions occur. It also encourages converting existing oil installations to electricity rather than gas. This section pertains to space heating, water heating, and other fossil fuel based applications such as gas cooking and dryers.

Also see Appendix L - Prevent More Gas Conversions - Proposed Actions.

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

19. Electric Vehicle – Municipal Fleet

The Middletown municipal fleet would be converted to EV. Prior sections covered both passenger and light truck EVs, also applicable to the Middletown fleet.

The State of New Jersey is in the process of transitioning its light duty fleet to EV, as per NJ bill S-2252 and the 2019 NJ Energy Master Plan.^{92, 93}

Municipal first responder vehicles are starting to become available, e.g. police cars, electric fire truck.^{94 95 96} An example possible initial application for police EV vehicles in Middletown is for traffic control during road and utility maintenance.

Reduction in vehicle size by sizing to purpose at hand would also reduce carbon emissions and save money on an interim basis by cutting fossil fuel consumption, e.g. using small cars for basic traffic control. Purchase of Hybrid vehicles may also provide an interim step saving carbon emissions and money, while retaining the legacy advantage of fossil fuel engines, pending subsequent full transition to EVs. For example, there are

police interceptor Hybrid utility vehicles.⁹⁷

Also see Appendix Q – Electric Vehicle: Municipal Fleet – Proposed Actions.

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

20. Renewable Government Energy Aggregation (electricity) – Municipal Operations

Middletown is already looking for bids from third party electricity service providers for its municipal operations. It will be looking to increase the amount of renewable electricity from 27% in 2020 to 100% over the next few years. The process is similar to that described for RGEA – Community, and Middletown has an existing contract so is experienced in this process.

21. Municipal Solar (municipal buildings and parking lots)

Deriving electricity from solar is important to reduce both the cost of electricity used to power municipal facilities and reduce carbon emissions, as well as provide leadership via example projects. Middletown is currently working with an energy consultant to determine cost/benefit and feasibility studies for both a solar canopy project at the Middletown train station and municipal energy aggregation. Middletown has also contracted for some rooftop solar for the new municipal complex that is under development.

Upcoming proposals and analyses, expected by early 2020, are intended to lead to subsequent projects to benefit Middletown residents for both cost and carbon reductions. When implemented, project work should result in potential electric bill cost savings to low income Middletown residents, including those at senior citizen facilities.

22. Religious Building Solar

(Section for future development)

23. Multifamily and Senior Housing Solar

(Section for future development)

Future section for parking lot and rooftop solar facilities at Middletown's senior citizen housing, 55+ housing, condo complexes, and apartment buildings.

24. Municipal Energy Efficiency (municipal buildings)

(Section for future development)

25. School Energy Efficiency

(Section for future development)

26. Religious Building Energy Efficiency

(Section for future development)

27. Multifamily and Senior Housing Energy Efficiency

(Section for future development)

28. Monmouth County Park and Sandy Hook Facility Solar and Energy Efficiency

(Section for future development)

29. Mowing (Residential, Commercial Landscaping, Middletown Township, County Parks, Sandy Hook)

In recent years, numerous battery powered lawn tools have become available including lawn mowers, trimmers and leaf blowers. At least one substantial battery snow thrower is available.⁹⁸

Purchasing battery (or electric) versions of lawn and residential landscape equipment rather than gas versions is recommended to further reduce carbon emissions and air pollution.

30. Water and Sewer Usage and Energy Efficiency

(Section for further development)

31. Electric Vehicle Transportation Hub at Middletown Train Station

Middletown Township will create a Electric Vehicle (EV) Transportation Hub at the Middletown Train Station (or other suitable location), possibly in conjunction with the aforementioned community solar project also at the train station. Proposed Project Actions are itemized in Appendix O

<http://climate.smiller.org/energy-plan/2020/appendix-E-to-Q.doc>

The EV Transportation Hub will consider the following:

- EV bus transit hub
- “On demand” EV buses using smartphone, computer, and telephone for EV bus requests for pick up within a short distance of request origination. Example services are at references.^{99 100} Also consider fixed EV bus routes.
- Enable efficient EV for all residents with a wide range of demographics including commuters, shoppers, medical patients, employees, high density housing residents, senior citizens, disability, and those without cars.
- Fast EV charging infrastructure, available for commuters, others, buses, and delivery vehicles.
- Solar canopy at train station, e.g. via Community Solar
- Reduce Vehicle Miles Traveled (VMT) along with EV carbon emission reduction.
- Improve health with reduced diesel emissions associated with VMT reductions.
- Regional transit EV leadership, including for commuter parking lots, Middletown and Red Bank train stations, Bayshore and Riverview Hospitals, Brookdale college, Sandy Hook (e.g. during summer months), shopping centers, High School North and High School South, and involve surrounding towns including Red Bank, Rumson, Sea Bright, Holmdel, Shrewsbury, Atlantic Highlands, Keansburg, Keyport, and Hazlet.
- Coordination with New Jersey Transit regarding train stations, bus routes, and plans for bus electrification. Request that Middletown be among the first receiving NJT EV bus routes.
- Consider EV bus transit to airports, transportation hubs, major office locations, Newark, and New York City.

- Consider EV bus transit to Belford ferry and Seastreak ferries in Atlantic Highlands.
- EV delivery vehicle hub, i.e. via coordination with major package delivery services.
- Emergency micro grid interconnection and support.
- The estimated carbon emission savings for this EV Transportation Hub proposal consist of a combined portion of estimated savings listed for each of Community Solar, Electric Vehicle – Local Transit, Electric Vehicle – Delivery and Light Truck, and Electric Vehicle – Passenger together with VMT reductions.

32. Develop Plan for EV Charging Station Siting and Deployment

Middletown will develop as part of its Master Plan a plan for deploying EV charging stations throughout the Township. These can be operated by the Township (e.g., at the Train Station Hub, Municipal Complex, Kaness Lane or other municipal properties) for its own or residents’ use. Or other owner/operators could be contracted with a lease agreement on municipal properties.

Also, charging stations will be required in commercial properties such as shopping malls, gas stations, hotels, and large businesses for their employees, as well as multi-family housing. There are grant opportunities for the Township, businesses and residents under the state’s new EV Incentive Bill.

33. Hydrogen and Fuel Cells for Heavy Vehicles

Hydrogen, Hydrogen/Ammonia, and Fuel Cells may be available in the future to fuel heavy vehicles such as dump trucks, loaders, garbage trucks, as well as for fuel cell electric generation. For example, construction manufacturers are interested in fuel cells.¹⁰¹ Farmers are interested in hydrogen and hydrogen/ammonia fueled vehicles, where the original energy source is solar.¹⁰² Farming concepts might be extended to other heavy vehicles. (There is now little to no focus on farming in Middletown itself.) Hydrogen passenger cars are also available.¹⁰³ Middletown will keep abreast of advances in these technologies for heavy vehicles, fleet vehicles, and fuel cell electricity generation so as to ensure timely incorporation of carbon emission free vehicles into the Middletown-owned and -contracted vehicle fleets, and for fuel cell electricity generation, when both technically feasible and cost effective.

APPENDICES

A. Appendix A – Background for Action

The importance of reducing energy usage for cost savings and national economic security has long been recognized, including efforts that date back to the 1970's. During the oil embargoes of that era.¹⁰⁴ Consequently, homeowners, businesses and government entities have sought for decades to reduce energy costs through energy efficiency measures. Measures such as the deployment of LED lights, far more energy efficient HVAC equipment, appliances and homes including the federal government energy STAR program¹⁰⁵, home insulation improvements, and drastic vehicle mileage improvements due to everyday actions by Americans, government standards, and manufacturer technology improvements have led to far more efficiency and substantially reduced costs that benefit everyone.

However, as early as 1965 at the presidential level¹⁰⁶ it became widely known that the emission of the greenhouse gas carbon dioxide – e.g. from fossil fuel emissions for transportation (cars, trucks, and airplanes), electricity generation from coal and natural gas plants, industrial production, and deforestation - along with other pollutants such as methane, nitrous oxide, and carbon black, were primary drivers of the planet wide “greenhouse effect”¹⁰⁷. The greenhouse effect has led to rapid global warming¹⁰⁸ and climate change thus jeopardizing planet earth. Ample testimony regarding global warming is available, e.g. the famous testimony of James Hansen, NASA scientist, to Congress in 1988.^{109 110}

The effect of global warming has become far more obvious in recent decades and years, with the hottest global average temperatures occurring in recent years¹¹¹, rising sea levels^{112 113} due to ice melt and thermal expansion, depletion of ocean oxygen¹¹⁴, species extinction, increasing ocean acidification¹¹⁵ with impact on shellfish, coral and other marine species including potential extinction, and the potential for more numerous strong storms worldwide. Numerous reports of direct impacts abound, e.g. “State Birds Face a Focused Exodus”¹¹⁶ which reports that “New Jersey: Goldfinch could lose 100% of its summer range in the state”. And glacier loss in Glacier National Park¹¹⁷, Montana is an average of 39% since 1966 with some having lost as much as 85% by 2015. Plants are growing higher up in Mount Everest.¹¹⁸ Drastic impacts on many hundreds of millions of people living in low lying areas in the USA and worldwide, on agriculture, from storm damage, and on world economies are expected unless immediate drastic steps are taken to reduce and eliminate carbon dioxide (and methane) emissions, aka pollution.

Having mostly postponed substantial action for decades, countries and localities world-wide need to take drastic action now¹¹⁹.

Corporations are taking action, e.g. Microsoft's President Brad Smith¹²⁰ indicates that the planet needs to be carbon neutral by 2050, and towards this, Microsoft plans to be 20 years early. Microsoft plans to have its own electricity supply 100% renewable for all buildings and campuses by 2025, to be net carbon negative by 2030 including suppliers, and by 2050 compensate for all carbon Microsoft has emitted into the atmosphere since its founding in 1975. And the world's banks are preparing for climate risk¹²¹.

Countries are taking action, e.g. Denmark now sources 47%¹²² of its power from wind as of 2019. States are taking action, e.g. Maine and Vermont exceed 40%¹²³ of power from renewables (excluding hydro power) as of 2017, and several states have high fractions of renewables including hydro power.

B. Appendix B – Example Renewable Energy Aggregation Ordinance

**MIDDLETOWN TOWNSHIP, NEW JERSEY
ORDINANCE NO. [NNN] AN ORDINANCE OF MIDDLETOWN TOWNSHIP ESTABLISHING A
RENEWABLE ELECTRIC AGGREGATION PROGRAM**

WHEREAS, the State of New Jersey has been engaged in a process to establish a competitive market place through deregulation and restructuring the electric utility market;
and WHEREAS, the establishment of a government aggregator and an energy aggregation program to purchase electric generation service to N.J.S.A. 48:3-93.1 et seq. and N.J.A.C. 14:4-6.1 et seq. will increase competition for the provision of electric power to residential and non-residential users, thereby increasing the likelihood of lower electric rates for these users without causing any interruption in service;
and WHEREAS, under the aggregation process the residential and non-residential ratepayers may likely receive a direct reduction in their electric bills;
and WHEREAS, the realization of energy cost savings is in the interests of the health, safety and welfare of the residents and non-residents of Middletown Township (the “Township”);
and WHEREAS, the Township hereby finds that it is in the best interests of residential and non-residential ratepayers for the Township to create the opportunity for them to enter into an aggregation agreement in order to seek substantial savings on electric rates;
and WHEREAS, renewable energy suppliers can select electricity production with renewable mixtures between the minimum NJ mandated Renewable Portfolio Standard (RPS) up to 100% renewable sources with no greenhouse gas emissions;
and NOW, THEREFORE BE IT ORDAINED, by the Township Committee of Middletown Township in the County of MONMOUTH and the State of New Jersey, duly assembled in public session, as follows:

- 1. The Township publicly declares its intent to become an aggregator of electric power on behalf of its residential users of electricity pursuant to the Government Energy Act of 2003, N.J.S.A. 48:3-91.3 to -98, and implementing regulations.**
- 2. The Township will utilize approved vendor, [VENDOR], Reverse Energy Auction Platform pursuant to the NJ E-PROCUREMENT Pilot program (P.L. 2001, c.30) under the NJ Department of Community Affairs. The Reverse Energy auction will seek bids from licensed and appropriate third party suppliers. If such winning bid is selected and agreement executed, individual residential consumers would retain the option not to participate and to choose any alternatives they desire.**
- 3. The Mayor and Township Clerk are hereby authorized and directed to execute any documents necessary to carry out the purpose of the Ordinance.**
- 4. All ordinances and parts of ordinances inconsistent herewith are hereby repealed.**
- 5. If any portion of this ordinance shall be deemed invalid by any court of competent jurisdiction, the remainder shall survive in full force and effect.**
- 6. This ordinance shall be effective immediately upon adoption and publication in accordance with law.**

NOTICE IS HEREBY GIVEN THAT THE FOREGOING Ordinance was introduced at a meeting of the Township Committee of the Township of MIDDLETOWN, in the County of MONMOUTH and State of New Jersey, held on [DATE] and will be further considered for final passage after public hearing thereon at a regular meeting of said Township Committee to be held at the Municipal Building, [ADDRESS], New Jersey on [DATE] at [TIME].

C. Appendix C – Electric Vehicle Social Justice, Health, Characteristics and Hybrids

Health and Social Justice¹²⁴:

- Ensure that EVs are affordable for lower-income people, especially during the transition from gas to EV. EV may especially impact if used fossil fuel vehicles become obsolete quickly, and if shortages of gasoline, gasoline stations (due to closures), and maintenance for fossil fuel vehicles occurs while newer EVs take over the bulk of the market.
- Ensure suitable and equitable EV charging facilities for multifamily housing, especially low income multifamily housing, and senior housing. (Better off homeowners and homeowner's associations are much more likely to be able to afford EV chargers and enhanced electrical outlets to support rapid EV charging.)
- Resident health is expected to benefit from the drastic reduction in automobile and bus exhaust, as well as from area reduction in pollutants from retired fossil fuel plants, especially retired coal plants, including those west of New Jersey. While health impacts may not be measurable for years, tangible cost reductions in health care cost should materialize in the decades ahead, thus adding to the benefits of EVs. (And from the shift to clean energy in general)
- Diesel tanker truck fuel deliveries will decline to gas stations, residences, and businesses, thus lowering these carbon emissions while also resulting in improved health, as well as reducing oil spills and consequent remediation.
- EV reliability and usage is likely to reduce the number of maintenance and gas station employees required to maintain and fuel vehicles over the long term. While employment impacts may be limited within Middletown itself, state and national employment and training impacts are significant. EVs may also reduce the number of vehicle sales staff required if the marketing of new EV shifts more to the internet or if vehicle usage shifts more to corporate-owned fleets and away from individual ownership. However it should be noted that numerous manufacturers offer EVs today in their showrooms via existing marketing paradigms.

EV Characteristics:

- In general, typical EV range per charge is currently much shorter than gas vehicle range per tank. Owners must take EV charge capacity, EV range, and EV charging station locations and type of EV charger/fitting into account when planning vehicle trips and charging times.
- Governments and electric utilities will need to ensure sufficient electric utility infrastructure to serve residences and businesses for EV charging.
- In general, current EV original purchase costs are typically higher than gas vehicles, even with government subsidies (which eventually expire by vehicle make based on sales volume).
- However, the operational cost of EV over several years is lower, both regarding per mile electricity costs and maintenance costs due to less complex power trains.
- Reduction in gasoline vehicles and thus gasoline taxes means that governments will need to increase revenues in other ways to continue to fund required road maintenance.
- Today's gas vehicles hold fuel that can be used for vehicle trips after major storms. Today, the vehicle may be filled in advance with gas, and later driven to gas stations not impacted by electric grid failures to get more gas. However, the time required to charge EVs, EV range, and working EV charging station availability after storms may limit the availability of EVs, especially residential EVs, after storms, compared to gas vehicles.

EV Risks and Training:

- Emergency personnel (fire and personnel rescue) need to be trained and equipped to handle the high-voltage power trains used by EV in the event of accidents, to avoid personal injury, including electrocution. Middletown should set up and review training programs for all emergency staff regarding EVs. (Since EVs are already in use, this training should already be in progress.) In some cases, rescue may take longer. Clearly the risk of fossil fuel fires and explosions is eliminated for the EV itself, although not the risk of other types of vehicle fires, nor the risk in case EVs and fossil fuel vehicles are involved in the same accident. The risk of EV battery fire is a new fire risk (reference reports of EV fires during increased usage of EV today).
- Other new risks are possible, such as the increased risk of EV charging facility usage during storms, cable accidents, and EV charging system failures. At the same time, risks associated with conventional fossil fuel usage and infrastructure will gradually diminish as EV usage takes its place.

Other Selected EV Information:

- The first electric car in the USA was developed circa 1890-91.¹²⁵
- An average passenger vehicle emits 4.6 carbon tons per year (11,500 miles)¹²⁶
- A typical suburban police vehicle is estimated to emit 6.9 carbon tons per year (est. 50 miles per day based on low end of city versus highway police car driving, or 18,000 miles per year).¹²⁷
- See references for examples^{128 129} of charging station information.
- Volta¹³⁰ charging station use recently observed at Cinema Hazlet 12 (October 2019)
- Charging stations can also be observed at area car dealers
- Electric boat and ferry¹³¹ implementation, e.g. “Electric Maids” at Maid of the Mist in Niagara Falls.¹³²
- Electric plane implementation, e.g. vintage seaplane conversion of a de Havilland Beaver seaplane, which were first airborne in 1956.¹³³

Hybrid Vehicles:

- A possible interim vehicle is the hybrid vehicle combining both gas and electric power trains, and combining certain characteristics of both types of vehicles. Hybrid vehicles have been readily available from several manufacturers for several years and thus represent a well-honed vehicle technology, which is widely deployed. However, hybrid vehicles may not achieve the carbon emission reductions considered necessary within the decades immediately ahead.¹³⁴ But hybrids are clearly better than full fossil fuel vehicles in this regard, while avoiding EV range limitations. Many hybrids are comparable in price to similar gas vehicles.
- A plug-in hybrid combines somewhat larger battery and an external charging port. Battery range is typically 50 miles or less (as of 2020).. An ideal owner would drive the car less than the battery range each day, and charge the battery overnight (a 120volt or 240 volt, 15 amp outlet would suffice).. Yearly green house gas emission from the plug-in hybrid use of electricity could be zero (if the internal combustion engine was never needed, and if the owner always charged with 100% renewable electricity from a renewable R-GEA supplied by the owner’s city, or purchase of 100% renewable electricity from a third party. The least expensive 100% renewable third party is almost always priced less than electricity supplied by JCP&L¹³⁵ .

D. Appendix D – List of Passenger EVs (not a complete list)

- Audi e-tron¹³⁶
- Bollinger Motors¹³⁷
- BMW i3¹³⁸
- Chevrolet Bolt¹³⁹
- Fiat 500e¹⁴⁰
- Ford¹⁴¹
- Ford Mustang SUV¹⁴²
- GM¹⁴³
- GMC electric truck¹⁴⁴
- Honda Clarity Electric¹⁴⁵
- Hyundai IONIQ Electric¹⁴⁶ & Kona Electric¹⁴⁷
- Infiniti QX Inspiration (concept)¹⁴⁸
- Jaguar I-PACE¹⁴⁹
- Kia Soul EV¹⁵⁰
- Mercedes Benz EQC¹⁵¹
- Nissan Leaf¹⁵²
- Porsche Taycan¹⁵³
- Rivian¹⁵⁴
- Tesla¹⁵⁵
- Volkswagen e-Golf^{156 157}
- Volvo XC40 Recharge¹⁵⁸

References

¹ <https://www.nj.gov/emp/>

² <https://www.state.nj.us/dep/aqes/oce-publications.html>

³ <https://www.ipcc.ch/sr15/>

⁴ <https://www.app.com/story/news/local/land-environment/2019/12/13/new-jersey-ground-zero-sea-level-rise-says-scientist/4411122002/>

⁵ “\$119 Billion Sea Wall Could Save New York...”, New York Times, 1/18/20

⁶ “2nd-Hottest Year Ever Closes Out Warmest Decade”, New York Times, 1/16/20

⁷ <http://climate.smiller.org/>

⁸ https://www.middletonnj.org/DocumentCenter/View/2695/Middletown_Energy-Plan--8-4-10?bidId=

⁹ <https://nj.gov/emp/pdf/NJ%20IEP%20Public%20Webinar%20Nov1%20Final.pdf>

¹⁰ <http://www.sustainablejersey.com/actions-certification/actions/>

¹¹ <https://www.drawdown.org/>

¹²

http://www.sustainablejersey.com/fileadmin/media/Actions_and_Certification/Gold_Star_Standard/Overview_of_Gold_Star_Standard_In_Energy_FINAL_12-4-17_.pdf

¹³ <http://www.sustainablejersey.com/actions-certification/actions/#open/action/24>

¹⁴ <http://www.sustainablejersey.com/actions-certification/actions/#open/action/25>

¹⁵

http://www.sustainablejersey.com/fileadmin/media/Actions_and_Certification/Actions/Community_Carbon_Footprint/Community_Carbon_Footprint_Calculator_Updated_2017_2_.xlsx

¹⁶ <http://www.sustainablejersey.com/actions-certification/gold-star-standards/#open/action/564>

¹⁷ http://www.sustainablejersey.com/fileadmin/media/Events_and_Trainings/Sustainability_Summit/2016/Energy_Technical_Document.pdf

18 Figure 2 of 2019 NJ EMP indicates 97 MMTCO_{2e} emitted in 2018 for all of NJ. The EMP indicates that 24.1
MMTCO_{2e} is the NJ 2050 goal per Global Warming Response Act, aka 80x50. The Figure 1 Middletown goal is based on
Middletown's pro rata share based on Middletown population versus New Jersey state wide, linearly declining from 2018 to 2050

19 https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf Page 26

20 <http://www.sustainablejersey.com/actions-certification/actions/#open/action/517>

21 https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf Page 11

22 https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF_EVO_2017_ExecutiveSummary.pdf

23 <http://www.sustainablejersey.com/actions-certification/actions/#open/action/520>

24 <https://legiscan.com/NJ/text/S606/id/2062152> , approved Nov 6, 2019

25 <http://www.sustainablejersey.com/actions-certification/actions/#open/action/566>

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