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# USAID MUNICIPAL ENERGY REFORM PROJECT IN UKRAINE

## MASTER CATALOG OF LOW EMISSIONS DEVELOPMENT (LEDS) POLICIES & ACTIONS

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### **DISCLAIMER**

The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development (USAID) or the United States Government.

## Master Catalog of Low Emissions Development (LEDS) Policies & Actions

A catalog of sub-national, greenhouse gas (GHG)–reducing actions and policy options prepared by the Center for Climate Strategies (CCS) based on policies or actions undertaken or considered in subnational climate change action plans by multi-stakeholder groups in a wide cross-section of U.S. States, Mexican States, Chinese Provinces/cities, and by other state, local and private participants.

### Tables of Policy/Action Options:

Table	Sector Covered
1	Energy Supply (ES)
2	Residential, Commercial, Institutional & Industrial (RCII)
3	Transportation and Land Use (TLU)
4	Agriculture, Forestry and Other Land Use (AFOLU)
5	Waste Management (WM)

***Important Note: The actions are numbered in this catalog solely for convenience in referencing them. Their numbers do NOT reflect a ranking or prioritization of the actions.***

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**Table 1. Energy Supply (ES)**

*This catalog will be reviewed, revised, and expanded during the ES Technical Working Group (TWG) process. TWG members are encouraged to provide input on policies and programs in place in [State] to assist in defining baselines.*

*(Note: There is some overlap with and repetition with the RCII sector.)*

Option No.	LEDS Policy/Action Option	Description
<b>ES-1</b>	<b>RENEWABLE ENERGY</b>	
ES-1a	Renewable or Environmental Portfolio Standard	A renewable portfolio standard (RPS) requires utilities to supply a certain, generally fixed percentage of electricity from an eligible renewable energy source(s). In some cases, utilities can also meet their portfolio requirements by Brief Descriptions of State Policy Actions E-17 purchasing renewable energy certificates (RECs) from eligible renewable energy projects. With REC “trading,” it may be beneficial to consider a variety of renewable resources. Similar to an RPS, an environmental portfolio standard (EPS) requires utilities to supply a certain, generally fixed percentage of electricity from both eligible renewable energy source(s) and energy efficiency or other GHG emission-reducing technologies.
ES-1b	Green Power Purchases and Marketing	Green power refers to electricity produced by environmentally benign sources, such as wind, solar, biomass, and hydroelectric generating resources. These programs allow consumers to purchase “green tags” along with their electricity, ensuring that a quantity of electricity equal to their purchase contributed to the development and support of renewable resources. Generally voluntary, these programs can be implemented on a statewide or regional basis.
ES-1c	Grid Based Renewable Incentives or Barrier Removal	Policies can be developed to help overcome barriers for renewable energy development. Institutional and market barriers include price distortions, failure of the market to value the public benefits of renewables and the social cost of fossil fuel technologies, inadequate information, institutional barriers to grid interconnection, high transaction costs because of small projects, high financing costs because of lender unfamiliarity, and perceived risk. These barriers can be overcome through a suite of financial and regulatory redresses, as well as through information and public education campaigns. Financial obstacles can be addressed through property tax exemptions, exclusions, and credits; personal income tax credits or deductions to cover the expense of purchasing and installing renewable energy equipment; loan programs to aid in financing the purchase of renewable energy equipment; and grant programs designed for R&D or to help a project achieve commercialization. Regulatory policies can include solar or wind easements of access rights; development guidelines at the local level to enhance renewable energy generation (e.g., requiring proper street orientation); and requirements that utilities provide information and utility leasing programs for renewable energy production to customers in remote regions.

Option No.	LEDS Policy/Action Option	Description
ES-1d	Offshore Wind Development Issues	Many areas are well-situated to develop off-shore wind facilities. Offshore wind development can provide low carbon energy to meet electricity demand. Regulatory agencies and public energy authorities could work with national and state agencies and governments to optimize the process for successfully dealing with the complex environmental, economic and logistic issues associated with the planning and review of these large-scale projects. Such efforts could be explored for development in a number of areas, including state and national waters.
<b>ES-2 ADVANCED FOSSIL ENERGY</b>		
ES-2a	Advanced Fossil Fuel Technology incentives, support, or requirements (IGCC, CCSR, etc.)	Advanced fossil technologies include more efficient—and thus lower-emitting—generation technologies. Advanced fossil technologies combined with carbon capture and sequestration or reuse (CCSR) may have the potential to significantly lower CO2 emissions associated with fossil fuel-based electricity generation. Advanced fossil technologies that could be considered include integrated gasification combined-cycle (IGCC), advanced pulverized coal, and advanced circulating fluidized-bed (CFB) technology. Policies to encourage the development of these technologies may include mandates or incentives to use advanced coal technologies for new coal plants, such as a mandate that requires new fossil fuel-fired power plants to achieve a specific low net CO2 emission rate. Alternatively, a mandate might require that all or a portion of new coal plants be of a certain type, such as IGCC. Incentives may take the form of direct subsidies or assistance in securing financing, and/or offtake agreements. A combination of mandates and incentives is also possible. Policies to encourage CCSR could include a state agency or department within an existing agency tasked with promoting CCSR, evaluation studies to identify geologically sound reservoirs, R&D funding to improve CCSR technologies, and/or financial incentives or mandates to capture and store or capture and reuse carbon.
ES-2b	Support Efficiency Improvements at Existing Fossil Fuel Power Plants	Efficiency improvements refer to increasing generation efficiency at power stations through incremental improvements at existing plants (e.g., more efficient boilers and turbines, improved control systems, or combined-cycle technology). Policies to encourage efficiency improvements and repowering of existing plants could include incentives or regulations as described in other actions, with adjustments for financing opportunities and emission rates of existing plants.
ES-2c	Support Repowering of Existing Plants (incentives/barrier removal)	Repowering existing power plants refers to switching to lower- or zero-emitting fuels at existing plants, or for new-capacity additions, including use of biomass or natural gas in place of coal or oil. Policies to encourage efficiency improvements and repowering of existing plants could include incentives or regulations as described in other actions, with adjustments for financing opportunities and emission rates of existing plants.
ES-2d	Biofuel Co-firing at New and Existing Fossil Fuel Power Stations	This action would promote the co-firing of biomass at new fossil fuel power stations to reduce GHG emissions and the use of fossil fuels in general.
ES-2e	Ramp-Up Decommissioning of Inefficient Thermal Plants	Policies to encourage more rapid decommissioning of inefficient thermal power plants with subsequent replacement of capacity using more efficient technologies. Use of renewable technologies and/or advanced fossil technologies with CCSR offer the best GHG reduction opportunities.
ES-2f	Create Policies and Incentives to Support Carbon Capture and	Policies to encourage development of CCSR technology could include a state agency or department within an existing agency tasked with promoting CCSR, financial incentives to capture and store or capture and re-use

Option No.	LEDS Policy/Action Option	Description
	Storage or Reuse (CCSR) and Supporting Infrastructure	carbon, and/or mandates—coupled with technical feasibility and cost- and investment-recovery mechanisms, if appropriate—to capture and store or re-use CO <sub>2</sub> from power plants. Creating incentives to build and operate the rather complex infrastructure for CCSR is also part of the incentive system.
<b>ES-3</b>	<b>FUEL SUPPLY, DELIVERY AND DISPOSAL</b>	
ES-3a	Fossil Fuel Production: GHG Emission Reduction Incentives, Support, or Requirements	Emissions of both methane (CH <sub>4</sub> ) and CO <sub>2</sub> can be reduced in oil and gas production. Natural gas consists primarily of CH <sub>4</sub> , a potent GHG. Any reduction in leaks during production, processing, and transportation/distribution avoids GHG emissions. Stopping these leaks may also be economically beneficial because it can prevent the waste of valuable product. The EPA Natural Gas STAR program offers numerous methods of preventing leaks, including preventive maintenance (improving the overall efficiency of the gas production and distribution system); reducing flashing losses (releases when pressure drops at storage tanks, wells, compressor stations, or gas plants); and changing and replacing parts and devices to reduce leaks and improve efficiency.
ES-3b	Natural Gas Transmission and Distribution	As with leaks of CH <sub>4</sub> in oil and gas operations, any reduction of leaks during production, processing, and transportation/distribution reduces GHG emissions to the atmosphere and prevents the waste of valuable product.
ES-3c	Low-GHG Hydrogen Production Incentives and Support	Hydrogen is not an energy source, but rather an energy carrier. It must be produced from other energy resources, such as fossil fuels (coal, oil, gas), renewable electricity (wind, solar), renewable fuels (biofuels, landfill gas), or nuclear power. However, it may facilitate the avoidance of GHG emissions by storing energy produced when and where available to be used when needed. The net GHG implications of producing hydrogen depend on the energy resource from which it is produced. To produce hydrogen from fossil fuels with low-GHG emissions, it would be necessary to do it in conjunction with CCS. Policies in support of this action would provide incentives to projects that help develop or deploy low-GHG hydrogen production technologies, as well as advance the technology of efficiently storing electric energy as hydrogen and converting it back to electricity.
ES-3d	Sustainable Biomass Production: Provide Incentives and Support	See related actions in the AFOLU and WM sectors.
<b>ES-4</b>	<b>NUCLEAR POWER</b>	
ES-4a	Relicensing/ Up-rating/ Efficiency Upgrades at Existing Nuclear Power Plants, Including Wholesale Market Incentives	Nuclear plant relicensing allows a nuclear power plant to extend the life of the facility for 20 years past its original 40-year license term. This is considered a low-cost and low-emission source of energy because there are limited additional capital costs or additional embodied emissions associated with extending the life of fully depreciated and operating nuclear plants. The US Nuclear Regulatory Commission (NRC), the nation's regulatory authority for nuclear power, considers the relicensing program one of its major cornerstones of current regulatory activity. A nuclear power plant up-rating is a process whereby a licensee receives approval from the NRC to operate a plant at a higher power level than the level authorized in the original license.
ES-4b	New Nuclear Energy Capacity	Nuclear power has historically been a low-GHG source of electricity. However, other considerations regarding nuclear power internationally include high capital costs, the difficulty of siting waste repositories and of developing and implementing technologies for permanent disposal of nuclear waste, and public concerns for

Option No.	LEDS Policy/Action Option	Description
		<p>safety. The federal government has been supportive of nuclear expansion, emphasizing its importance in maintaining a diverse energy supply and its reputation for producing electricity with negligible pollutant emissions during operation. Congress has also offered significant financial subsidies for new nuclear plants in an effort to jump-start the industry, including limitations on liability for nuclear accidents. Steps to encourage nuclear power Actions in the region could include the provision of streamlined siting review and a streamlined appeals process. The region could develop finance authority to assume the developer role (and potentially an equity ownership role) for new nuclear resources. Under such a scenario, the region would not need to be an operator of nuclear facilities. Instead, it could serve as a facilitator in developing a new nuclear facility, recognizing the cost and financing burdens such a facility could impose on existing utility companies. Small-scale nuclear power actions could also be considered.</p>
<b>ES-5</b>	<b>TRANSMISSION AND DISTRIBUTION</b>	
ES-5a	Transmission System Upgrading to Reduce Line Losses	<p>Several energy efficiency measures can be implemented to reduce T&amp;D line losses of electricity. Utilities use a variety of components throughout the T&amp;D system to manage losses. Increasing the efficiency of these components can further reduce losses and associated GHG emissions. For example, Vermont offers a rebate to encourage the installation of energy-efficient transformers. Regulations, incentives, and/or support programs can be applied to achieve greater efficiency of T&amp;D system components.</p>
ES-5b	Distribution Network Upgrading to Reduce Line Losses	<p>Several energy efficiency measures can be implemented to reduce T&amp;D line losses of electricity. Utilities use a variety of components throughout the T&amp;D system to manage losses. Increasing the efficiency of these components can further reduce losses and associated GHG emissions. For example, Vermont offers a rebate to encourage the installation of energy-efficient transformers. Regulations, incentives, and/or support programs can be applied to achieve greater efficiency of T&amp;D system components.</p>
<b>ES-6</b>	<b>CROSS-CUTTING</b>	
ES-6a	Environmental/GHG Emissions Disclosure	<p>Emission disclosure requires GHG emitters to publish their estimated GHG emissions on a regular (e.g., annual) basis. In addition to emissions, disclosure can include an accounting of business risks due to climate change, such as assets in danger of weather-related damage, threats to market share, and risks of future regulation. Environmental disclosure allows investors and consumers to obtain information regarding a firm's GHG emissions and climate risks, so as to make more informed purchasing and investment decisions, and provide an incentive for firms to reduce risk in these areas by, among other actions, reducing their CO2 footprints. In the case of energy supply, environmental disclosure would take the form of providing consumers and stockholders with information on carbon emissions per kWh in a manner that would help them make informed decisions about electricity purchases and consumption, as well as evaluate investment risks. Environmental disclosure is effective particularly in areas where consumers have an opportunity select their electricity provider.</p>
ES-6b	GHG Cap and Trade and the Expansion of Emissions Offset Categories	<p>A cap-and-trade system is a market mechanism in which GHG emissions are limited or capped at a specified level and those participating in the system are required to hold permits for each unit of emissions. Through trading, participants with lower costs of compliance can choose to over-comply and sell their additional reductions to participants for whom compliance costs are higher. In this fashion, overall costs of compliance are lower than they would otherwise be. The initial allocation of the allowances is a crucial policy decision.</p>

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		<p>They can be auctioned (with the proceeds used to benefit consumers who will pay higher costs), or allocated to existing sources, or some combination of the two. Participants can range from a small group within a single sector to the entire economy. As with carbon taxes, the compliance obligation can be imposed “upstream” at the fuel extraction or import level, or “downstream” at points of fuel consumption. Among the important considerations with respect to a cap-and-trade program are the sources and sectors to which it would apply; the level and timing of the cap; how allowances would be distributed (whether load-based or generation-based, how new market entrants are accommodated, how leakage is addressed, etc.); and what, if any, offsets would be allowed. Other issues to consider include which GHGs are covered; whether there is linkage to other trading programs; banking and borrowing; early reduction credit; what, if any, incentive opportunities may be included; use of any revenue accrued from permit auctions; and provisions for encouraging energy efficiency. The principal example of a GHG cap-and-trade system in the U.S. today is the Northeast and Mid-Atlantic states’ Regional Greenhouse Gas Initiative (<a href="http://www.rggi.org/">http://www.rggi.org/</a>).</p>
ES-6c	Carbon (GHG) Tax	<p>A GHG tax would be a tax on each ton of carbon dioxide equivalent (CO<sub>2</sub>e) emitted from certain sources. The tax could be imposed upstream, based for example on the carbon content of fuels (e.g., fossil fuel suppliers), or at the point of combustion and emission. Although taxed entities would pass some or all of the cost on to consumers, there would be competitive pressure to find cost-effective ways to lower (or offset) emissions. Consumers who see the implicit cost of GHG emissions in products and services could adjust their behavior to lower emissions and reduce costs. The program can be designed to be “revenue neutral” (not a net tax increase), for example, by offsetting costs with a corresponding tax reduction (income, payroll, business, etc.); can fund policies and programs to assist with reducing GHG emissions; or can be directed to helping the competitiveness of industries or assisting communities affected by the tax.</p>
ES-6d	GHG Emissions Standards	<p>It establishes emissions limits for the in-state fossil-fuel generation fleet.</p>
ES-6e	Technology Research, Development, Demonstration & Deployment	<p>It includes activities for renewables; includes advanced fossil fuel technology incentives, support or requirements (IGCC, CCSR, advanced pulverized coal, CFB). Research and development (R&amp;D) funding can be targeted toward a particular technology or group of technologies as part of a state initiative to build an industry around that technology in the state, and/or to set the stage for action of the technology for use in the state. For example, an agency can be established with a mission to help develop and deploy energy storage technologies. R&amp;D funding can also be made available to any renewable or other advanced technology through an open bidding procedure (i.e., driven by bids received rather than by a focused strategy to develop a particular technology). Funding can also be given for demonstration projects to help commercialize technologies that have already been developed, but that are not yet in widespread use. Finally, funding could be targeted to increase collaboration among existing institutions in the state for R&amp;D. Technology R&amp;D is necessary for the preservation of a reliable electricity supply under the carbon constraints that are being contemplated as a matter of public policy. A single technology will not accomplish the broad objectives; rather, technologies of various types and that now exist at various points along the technology development curve will require consideration.</p>
ES-6f	Generation Permitting and Siting	<p>Expedited government review and support for low-GHG generation sources. Typically applies to multiple agency support at national and subnational levels.</p>

Option No.	LEDS Policy/Action Option	Description
ES-6g	Energy Storage: Incentives, Business Models, and Barrier Removal	<p>One of the obstacles to increased reliance on renewable power sources—such as wind and solar—is that the intermittent nature of those sources limits their ability to provide power on demand. This shortcoming can be reduced by development and deployment of mechanisms for storage of renewable power. Storage technologies can include batteries (including electric vehicle batteries,) and physical means of storage, such as pump storage facilities and compressed air energy storage. To the extent that deployment of cost-effective energy storage technologies can satisfy the demand for peak power and reserves, these approaches can provide financial benefits to the public and to ratepayers. Regulatory policies to encourage the development and deployment of energy storage include subsidies, rate recovery and other financial incentives. Another means to enhance the utility of intermittent sources of renewable power worth exploring further is clean fast start technology deployment. These could involve utilizing quick-starting, efficient natural gas turbines to help meet system load when electricity supply from renewable sources drops (such as when wind velocity suddenly drops). In some cases, deployment of new, much more efficient fast-start facilities could reduce emissions of local and regional concern, as well as GHGs. This concept would require natural gas distribution infrastructure to serve the efficient fast-start technologies in locations where they can effectively support intermittent resources. Because the full costs of these turbines would not likely be supported by current market pricing, incentives may be needed to help support the viability of this concept.</p>

**Table-2. Residential, Commercial, Institutional & Industrial (RCII)**

*This catalog will be reviewed, revised and expanded during the RCII TWG process. TWG members are encouraged to provide input on policies and programs in place in [Jurisdiction] to assist in defining baselines.*

*(Note: Some RCII policies overlap with or are repeated in ES.)*

Option No.	LEDS Policy/Action Option	Description
<b>RCII-1</b>	<b>ENERGY EFFICIENCY (EE) AND RENEWABLE ENERGY (RE) PROGRAMS</b>	
RCII-1a	Electricity-specific and/or Fuel-specific Energy Efficiency Efforts	Efficiency efforts can include programs for one or many sectors, may be funded by utilities (for example, through "efficiency program adders" to tariffs) or public entities, and may be delivered to consumers by utilities, public entities, or third parties.
RCII-1b	All-Fuels Funding and Approach to Energy Efficiency Efforts	All-fuels approach allows switching between fuels to achieve greater savings or lower costs, but makes program provision more appropriate to be carried out by a third party, using funds collected by utilities or governments.
RCII-1c	Low-Cost Private and Public Financing for Energy Efficiency Improvements	This action typically refers to revolving low-interest loan fund(s) for energy efficiency investments in distribution service areas that are not covered by similar existing utility programs. Often included are programs to reduce the financial barrier to investing in more energy-efficient (but often more expensive) equipment and buildings, and/or in customer-sited renewable energy systems.
RCII-1d	Area-wide Effort to Retrofit Existing Buildings for Energy Efficiency	This policy provides incentives and targets to induce the owners of existing buildings to improve the efficiency of their use of energy and other resources, along with provisions for raising targets periodically (all buildings sectors). This policy can include elements to encourage the improvement and review of energy use goals over time, and target renovated and/or existing buildings.
RCII-1e	Encourage Energy Efficiency in Building Design and Construction	This action the adoption and enforcement of more stringent building codes to achieve energy efficiency or voluntary approaches to achieving higher energy efficiency in new residential and public buildings.
RCII-1f	Distributed Generation Renewable Energy Applications	This action covers programs to support higher levels of renewable energy use in residential and public buildings, including solar thermal, solar photovoltaic, small-scale wind, and other technologies. Could include a number of different renewable energy technologies and configurations, with different costs in different locations.
<b>RCII-2</b>	<b>TRAINING OF PROFESSIONALS AND BEHAVIORAL CHANGE</b>	
RCII-2a	Training and Education for Designers, Builders, Contractors, and Renewable Energy Equipment Installers	This option refers to an education and outreach program for building professionals to encourage incorporation of energy-efficiency and GHG emission-reduction considerations. Examples include: <ul style="list-style-type: none"> <li>• Programs to train builders and contractors on proper heating and air conditioning sizing and installation (including duct sealing).</li> <li>• Mandates that state boards of licensing for building professionals include in licensing exams knowledge of the improved building codes and building energy performance requirements reflected in various policy</li> </ul>

		<p>options.</p> <ul style="list-style-type: none"> <li>• Code training and technical assistance programs for builders and architects.</li> </ul>
RCII-2b	Energy Management Training/ Training of Building Operators and Multi-family Building Maintenance Staff	Training, provided through government certification programs, trade associations, or educational institutions, leads to the operation of more efficient public buildings and lower GHG emissions.
RCII-2c	Regional Market Transformation Through Alliances, Technology Development Programs and Education	<p>Market transformation alliances use voluntary efforts, typically implemented by non-utility organizations, to encourage greater uptake by consumers (residential, commercial, and institutional, as well as the professionals who service energy-using equipment) of cost-effective energy efficiency technologies and practices. A market transformation program is designed to create a situation where the bulk of the private market automatically adopts or incorporates technologies or techniques that result in improved energy efficiency. The goal of a market transformation and technology development program is to put energy efficiency technologies and practices into a position where they are demanded by the public, chosen by builders and manufacturers, and provided by retailers and contractors. Methods of transformation can be different for each technology or technique, but often revolve around public and private review of quality and effectiveness, including partnerships between government agencies, retailers, manufacturers, and nongovernmental organizations. Market transformation programs can be statewide or regional. Market transformation also seeks to ensure sufficient supplies of technologies and practitioners to meet the subsequent increased demand for energy efficiency. Potential elements of a market transformation program include:</p> <ul style="list-style-type: none"> <li>- Specific measures, such as ground-source heat pumps, solar water heater/photovoltaic (PV), or other important technologies.</li> <li>- Support for commercialization of promising technologies.</li> <li>- Bulk-purchasing programs (public/private) or arrangements with retailers.</li> <li>- Consumer education is a significant supporting measure for market transformation programs.</li> </ul>
RCII-2d	Consumer Education Programs and Energy Efficiency School Curriculum	<p>The ultimate effectiveness of emission reduction activities depends in many cases on providing information and education to consumers regarding the energy and GHG emission implications of consumer choices. Public education and outreach is vital to fostering a broad awareness of climate change issues and effects (including co-benefits, such as clean air and public health) among the state's citizens. Such awareness is necessary to engage citizens in actions to reduce GHG emissions in their personal and professional lives. Public education and outreach efforts should integrate with and build upon existing outreach efforts involving climate change and related issues in the city/province. Ultimately, public education and outreach will be the foundation for the long-term success of all of the mitigation actions proposed, as well as those that may evolve in the future. The green-raising efforts including reduced-cost or free residential energy audits, represent a specific door-to-door education campaign approach for raising awareness of energy efficiency and money-saving opportunities among households. The development of accessible materials, videos, and other educational information can support these efforts. Support for program management and coordination activities can also help to ensure that outreach efforts are effectively planned and implemented.</p> <p>The long-term effectiveness of emission reduction activities depends on providing information and education not only to present consumers, but to future consumers as well. This action can also include the education of primary and secondary school students regarding the energy and GHG emission implications of consumer and</p>

		societal choices. Public education and outreach is vital to fostering a broad awareness of climate change issues and effects (including co-benefits, such as clean air and public health) among the state's young citizens. As with adult consumers, public education and outreach efforts should integrate with and build upon existing outreach efforts involving climate change and related issues.
RCII-2e	Consumer Education Programs and Energy Efficiency School Curriculum	As a complement to consumer education programs (see action above), a variety of actors can provide tools and information ranging from informational posters on the benefits of energy conservation to software designed to help businesses reduce GHG emissions to technical people that help organizations to identify GHG reduction opportunities.
<b>RCII-3</b>	<b>IMPROVING BUILDING, PLUG LOAD, AND APPLIANCE CODES, STANDARDS, AND BEST PRACTICES</b>	
RCII-3a	Improved Building Codes for Energy Efficiency	<p>Building energy codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation. Given the long lifetime of most buildings, amending state and/or local building codes to include minimum energy efficiency requirements and periodically updating energy efficiency codes could provide long-term GHG savings. Implementation of building energy codes, particularly when much of the building occurs outside of urban centers, can require additional resources. Potential elements of a policy that includes building codes are:</p> <ul style="list-style-type: none"> <li>- Require high-efficiency appliances in new construction and retrofits.</li> <li>- Train building code and other officials in energy code enforcement.</li> </ul> <p>Potential measures supporting this option can include consumer education, improved enforcement of building codes, training for builders and contractors, and development of a clearinghouse for information on and to provide access to software tools to calculate the impact of energy efficiency and solar technologies on building energy performance. Building codes could also be supported by such models as ENERGY STAR's Building Design Guidance, which is a strategic approach for improving energy performance in the building design process.</p>
RCII-3b	Performance-based Building Energy Codes	As opposed to prescriptive codes, performance-based building energy codes allow designers and builders flexibility in choosing which approaches are used to meet a certain level of performance (e.g. --standards for per unit floor area consumption without prescriptive compliance pathways). Performance of proposed designs is often assessed beforehand via computer modeling, with post-construction performance verified through "commissioning" or similar monitoring/calculations. In addition, performance-based codes require analytical tools and standards to assure compliance.
RCII-3c	Improvements in Energy Code Enforcement: Expansion and Training of Building Energy Code	This option refers to an education and outreach program for building inspectors to encourage incorporation in inspection key toward achieving effective savings. Most current code officials are not adequately trained in enforcing energy codes at local institutions and professional trade organizations. Many building inspection departments will require additional resources of local and state infrastructure and experience in enforcing energy codes. Using national and regional energy code enforcement/compliance approaches will provide needed support and technical assistance. The ambassadors will provide ambassadors will be adept in using available energy code resources and will act as grassroots code adoption and implementation updates.
RCII-3d	Building Commissioning and Re-commissioning Including Energy Tracking and Benchmarking	Building commissioning is the process of improving the operation and maintenance of building systems to meet operational needs, while using only as much energy as necessary. Recommissioning may be needed in existing buildings for several reasons. For example, they may need to meet a higher level of performance today

		than when first built; energy prices may be significantly higher when they were first built, and the opportunity for savings may exist; and in many buildings, such as schools, there is increased attention to indoor air quality and ventilation. This option would explore how commissioning and recommissioning could be incorporated into existing retrofitting and approval processes. For the residential subsector, includes Home Energy Rating System at sale/lease.
RCII-3e	New Construction and Retrofit Requirements	Building commissioning is the process of improving the operation and maintenance of building systems to meet operational needs, while using only as much energy as necessary. Recommissioning may be needed in existing buildings for several reasons. For example, they may need to meet a higher level of performance today than when first built; energy prices may be significantly higher when they were first built, and the opportunity for savings may exist; and in many buildings, such as schools, there is increased attention to indoor air quality and ventilation. This option would explore how commissioning and recommissioning could be incorporated into existing retrofitting and approval processes. For the residential subsector, includes Home Energy Rating System at sale/lease.
RCII-3f	Expansion of Provincial-Level Appliance Efficiency Standards and Support for Higher National Efficiency Standards	Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby creating economies of scale. Appliance efficiency standards can be implemented at the provincial level for appliances not covered by federal standards, or where higher-than-federal standard efficiency requirements are appropriate. Regional coordination in state appliance standards can help avoid concerns that retailers or manufacturers may (1) resist supplying equipment to one state that has advanced standards, or (2) focus sales of lower-efficiency models on a state with less stringent efficiency standards. Potential elements of an appliance efficiency standards policy include: <ul style="list-style-type: none"> <li>• Establishing and enforcing higher-than-federal provincial-level appliance and equipment standards (or standards for devices not covered by federal standards).</li> <li>• Joining with other states in adopting higher standards.</li> <li>• Requiring high-efficiency appliances in new construction and retrofits.</li> </ul>
<b>RCII-4</b>	<b>GOVERNMENT AND COMMERCIAL REQUIREMENTS AND BEST PRACTICES</b>	
RCII-4a	Improved Design and Construction, "Government Lead-by-Example" for Carbon-Neutral Requirement	This policy provides incentives and targets to induce the owners and developers of new and existing buildings to improve the efficiency of the use of energy and other resources in those buildings, along with provisions for raising targets periodically and providing resources to building industry professionals to help achieve the desired building performance. This policy can include elements to encourage the improvement and review of energy use goals over time, and flexibility in contracting arrangements to promote integrated energy- and resource-efficient design and construction. Additional potential elements of this option include: <ul style="list-style-type: none"> <li>- Target new, renovated, and/or existing buildings (retrofits);</li> <li>- Set a cap on consumption of energy per unit area of floor space for new buildings;</li> <li>- Encourage building commissioning and recommissioning, including energy tracking and benchmarking;</li> <li>- Provide incentives, in the form of tax credits, DSM program support, financing incentives (such as "green mortgages"), or other inducements for retrofit of existing residential and commercial buildings;</li> <li>- Encourage the use of alternative and local building materials and practices.</li> </ul> Potential supporting measures for this option include training and certification of building professionals, consumer and primary/secondary education, performance contracting/shared savings arrangements, and

		setting up a clearinghouse for information on and access to software tools to calculate the impacts of energy efficiency and solar technologies for buildings.
RCII-4b	Bulk Purchasing Programs for EE Equipment	<p>Bulk purchasing of appliances and equipment with higher-than-standard energy efficiency by public agencies, and state transformation, or state lead-by-example programs. In this option, a government agency or nongovernmental organization (e.g., home weatherization services) and/or services (e.g., home weatherization services) at a low bulk price. The organization then either uses to develop markets for energy efficient or low-GHG goods and services more rapidly than would otherwise occur.</p> <ul style="list-style-type: none"> <li>- Municipal or state government programs, possibly including training in the use of existing bulk-purchasing tools.</li> <li>- Programs for schools.</li> <li>- Private-sector programs (possibly in coordination with market transformation programs).</li> </ul>
<b>RCII-5</b>	<b>CROSS-CUTTING ISSUES WITH OTHER SECTORS</b>	
RCII-5a	Support and Enhance Research and Development (R&D) of Next-Generation Clean Energy Technologies and Companies	In addition to greater funding for R&D efforts, this action includes an increase in private-public partnerships.
RCII-5b	Green Power Purchasing for Consumers	<p>Production and delivery of low-GHG power sources, above and beyond levels achieved through Renewable Portfolio Standards and other mandatory programs.. Possible elements of green power programs include:</p> <ul style="list-style-type: none"> <li>• A definition of what power sources qualify as green power sources by a relevant authority.</li> <li>• Regulatory encouragement for utilities to develop green power tariff structures.</li> <li>• Implementation of “environmental disclosure”—regulatory requirements that power sources and emissions data be reported in consumer utility bills.</li> <li>• State goals or mandates for green power purchases, or for the renewable fraction of standard purchased electricity, that would apply to all nonfederal government buildings, including local government buildings, public schools, and public universities. This could also be a part of state “lead-by-example” programs.</li> <li>• Promotion by the state and/or other entities of voluntary green power purchases through provision of information and promotional materials.</li> <li>• Safeguards and/or consumer protections against seller misrepresentation or mislabeling.</li> </ul>
RCII-5c	Support for Energy-Efficient Communities Planning, "Smart Growth"	<p>“Smart growth” aims to create communities that, among other attributes, are livable, are designed for reduced use of energy both within homes and businesses and in the transport sector, and have a reduced environmental impact relative to typical developments. Variants on the smart growth concept exist, but many call for clustering living units with easy access (often walking distance) to shops, schools, and entertainment and recreational facilities, incorporating elements of energy-efficient design and renewable energy in buildings, sharing energy facilities between buildings (for example, district heating systems), and preserving open spaces. Due to its importance in reducing transportation energy use, this option is commonly addressed as a Transportation &amp; Land Use action.</p>
RCII-5d	Encourage Combined Heat and Power (CHP) and District Energy (Includes Cooling)	<p>Combined heat and power (CHP) can reduce GHG emissions by increasing the overall efficiency of fuel use. However, there are numerous barriers to CHP, including inadequate information; institutional barriers; high transaction costs because of small projects; high financing costs because of lender unfamiliarity and perceived risk; "split incentives" between building owners and tenants; and utility-related policies, like interconnection requirements, high standby rates, exit fees, etc. The lack of standard-offer or long-term contracts, lack of payment at avoided-cost levels, and lack of recognition for emission reduction value provided also create</p>

		obstacles. Policies to remove these barriers can include improved interconnection policies, improved rates and fees policies, streamlined permitting, recognition of the emission reduction value provided by CHP and clean distributed generation (DG), financing packages and bonding programs, power procurement policies, education and outreach, etc. Financial incentives for CHP could include (1) direct subsidies for purchasing/selling CHP systems given to the buyer/seller; (2) tax credits or exemptions for purchasing/selling CHP systems given to the buyer/seller; (3) tax credits or exemptions for operating CHP systems; (4) an REP, which is a direct payment to CHP owners for each kWh of electricity or British thermal unit (Btu) of heat generated from a qualifying CHP system; and (5) tax credits for each kWh or Btu generated from a qualifying CHP system.
RCII-5e	Net Metering for Distributed Generation	<p>This policy option involves the consideration and adoption by state regulatory authorities of rate designs, coupled with the necessary metering technology, that promote reduction in GHG emissions by encouraging consumers to install distributed generation (DG) systems—especially those based on renewable fuels—and combined heat (and/or cooling) and power (CHP) systems that offer the opportunity to improve the overall efficiency of fuel use and reduce GHG emissions. For example, Kentucky allows net metering for generators up to 30 kilowatts (KRS 278.465 et seq.). Potential elements of this option include:</p> <ul style="list-style-type: none"> <li>- Review existing net-metering policies, including policies that affect electricity consumers who install on-site CHP or DG fueled with renewable or fossil fuels. Consider the impact of nitrogen oxides (NOx) and power factor requirements on net metering and the availability of information for small customers.</li> <li>- Review rate issues, including decoupling of utility revenues from kilowatt-hour sales, and consider a specific focus on the impacts of rate design on GHG emissions. This could include an exploration of the impacts of time-of-use rates on GHG emissions.</li> <li>- Review and consider utility and other technical rules related to the interconnection of consumer-sited power sources to the electricity grid to ensure that they offer equitable treatment of potential DG hosts, while providing adequate safeguards for the public and for power sector workers.</li> </ul>
RCII-5f	Time-of-Use (TOU) and Inverted Block Rates	Time-of-use rates typically price electricity higher at times of higher power demand, and thus better reflect the actual cost of generation. Though these rates may or may not have a significant impact on total GHG emissions, they affect on-peak power demand and, thus, both the need for peaking capacity and fuel for peaking plants.
RCII-5g	Increase Water Use Efficiency	Reducing water use reduces energy requirements for water pumping, treatment, distribution, and wastewater treatment. This action is analogous to WM-3b (see that action for more details including screening procedures).
RCII-5h	Carbon or Fossil Energy Consumption Taxes	Carbon or consumption-based taxes increase the effective prices of fuels to reduce demand. The amount of reduction depends on level of tax and alternatives available to the consumer.

**Table-3. Transportation & Land Use (TLU)**

*This catalog will be reviewed, revised and expanded during the TLU TWG process. TWG members are encouraged to provide input on policies and programs in place in [Jurisdiction] to assist in defining baselines.*

Option No.	LEDS Policy/Action Option	Description
<b>TLU-1</b>	<b>VEHICLE TECHNOLOGY LIGHT DUTY VEHICLES</b>	
TLU-1a	Low-Greenhouse Gas Vehicle Technology such as the Development of Fuel Cell Vehicles	Support research and development of low-GHG vehicle technology to encourage technological innovation in the field. This would be technology neutral. Examples would be: fuel cells, hydrogen technology, etc.
TLU-1b	Add-on Technologies such as Low Friction Oil and Low-Rolling Resistance Tires, Single-Wide Tires and Automatic Tire Inflation	Add-on technologies can be made to passenger vehicles to improve fuel efficiency, such as low friction oil or low-resistance tires (fuel efficient tires). This could be done by encouraging, creating incentives or mandating requirements. Fuel-efficient tires may also be referred to as low rolling resistance tires. Fuel economy can be improved on light-duty vehicles by setting minimum energy efficiency standards for replacement tires. Typically, energy efficient tires are used on new models. But lower rolling resistant replacement tires may not be readily available to consumers and there is little information regarding the fuel economy of replacement tires.
TLU-1c	Build Infrastructure for Plug-in Hybrids and Electric Cars	Provide facilities for plug-in hybrids to recharge, at a metered rate equal to the local market cost per kilowatt-hour for electricity, at all rest areas and at least one fueling station per exit on limited access highways. The availability of plug-in facilities at private fueling stations shall be auctioned, with additional facilities able to opt-in at the same highest bid auction price.
TLU-1d	Hybrid Engine Technologies such as the Split-Cycle Engine and Turbosteamer Engine	Provide support for the development of more efficient hybrid engine technologies such as the split cycle engine and the turbosteamer engine. The state may also promote the use of these technologies by investing in vehicles using these types of engines for the vehicle fleet of public agencies.
TLU-1e	Vehicle Purchase Incentives such as Feebates, Cash for Clunkers and Car Vouchers	Adopt a variety of programs to move purchases of vehicles toward a lower-GHG fleet mix (including pure electric, hybrid, plug-in hybrid, and/or other alternative fuel vehicles).

Option No.	LEDS Policy/Action Option	Description
<b>TLU-2</b>	<b>VEHICLE OPERATION LIGHT DUTY VEHICLES</b>	
TLU-2a	Implement Low Carbon Fuel Standard similar to United States 2010 and European Union VI standards	This Action would reduce GHG emissions by decreasing the carbon intensity of all passenger vehicle fuels sold in the State. The Low Carbon Fuel Standard (LCFS) would require all fuel providers in the state to ensure that the mix of fuel they sell into the state market meet, on average, a declining standard for GHG emissions measured in CO2 equivalent grams per unit of fuel energy sold. The State should regulate quality standards for low-carbon fuels. Low-carbon fuels include, but are not limited to, biodiesel, cellulosic ethanol, hydrogen, compressed natural gas, liquefied petroleum gas, electricity, and low-carbon blends such as E10 or E85. The standard would be measured on a life cycle basis in order to include all emissions from fuel production to consumption. Actions for compliance may include blending or selling increasing amounts of lower carbon fuels, using previously banked credits, and purchasing credits from fuel providers who earned credits by exceeding the standard. This Action could also promote R&D related to biofuels production, such as the use of enzymes for breaking down cellulose to produce ethanol (as opposed to corn-based ethanol, which has a lower life cycle benefit).
TLU-2b	Enforce Speed Limits using Speed Cameras and Police	Lower vehicle speeds can improve fuel economy, reduce GHG emissions, and improve safety. One potential implementation method for this enforcement includes speed-detection cameras on intercity highways and urban roads, which have been shown to be an effective and cost-effective means of achieving compliance with posted speed limits. Enforcement measures could be combined with measures to lower the speed limit on interstates, freeways, and major arterial roads. Significant enforcement resources may be needed for this measure to achieve the expected reductions.
TLU-2c	Vehicle Maintenance, Tire Pressure Maintenance, Driver Training, this includes Eco-Driving and Fuel-Efficient Shifting	Better driver information and education can lead to improvements in fuel efficiency. Drivers need to be aware of maintenance issues that cause an increase in pollution and heavy-duty vehicle operating costs. In addition, driver education programs can encourage energy-efficient driving habits, such as speed control and reductions in idling.
TLU-2d	Driver Information Technologies such as Pay-As-You-Drive Insurance	The state would pass necessary legislation to allow, encourage, and support the provision of pay-as-you-drive auto insurance, possibly including state support for additional pilot programs. This measure converts vehicle insurance from a relatively fixed annual amount (which varies little by mileage), to a mostly mileage-based rate. Thus, instead of paying \$480, \$600, or \$720 annually, depending on one's actuarial bracket, one would pay \$.04, \$.05, or \$.06 per mile (based on the national average of 12,000 annual miles), plus perhaps a fixed amount to reflect theft or certain other largely mileage-independent risks. This measure has been shown to be a more accurate and equitable reflection of actual risks, and has already been adopted as an insurance Action in several U.S. states.
TLU-2e	Transportation System Management that includes Intelligent Transportation Systems –This includes Signal Synchronization, Variable Message Signs and Real-Time Driver Information and Feedback	Transportation system management improves smooth vehicle flow on the roadway system, which reduces fuel use and GHG emissions. Coordinated operation of the regional transportation network can improve system efficiency, reliability, and safety. Tools to reduce traffic congestion include HOV lanes, roundabouts at appropriate intersections, synchronized signals, incident clearing and management, variable message signs, 511 and other real-time driver information, ramp metering, and other forms of intelligent transportation systems (ITS).

Option No.	LEDS Policy/Action Option	Description
TLU-2f	Passenger Vehicle Anti-Idling Program	This would limit the number of minutes that a passenger vehicle could idle.
<b>TLU-3 INCREASING LOW-GREENHOUSE GAS TRAVEL ACTIONS</b>		
TLU-3a	Improve Transit Service by Increasing Capacity, Frequency and Assuring Convenience and Quality.	Greater use of public transit and reduction in automobile travel can be achieved by improving existing transit service (e.g., expanded hours or coverage of bus service, higher frequency bus routes. This Action also could include expansion of intercity bus service. Use of DOT data on travel origins and destinations could help determine if there are intercity regional routes that need prioritization.
TLU-3b	Expand Transit Infrastructure by Building Additional Tracks for Rail and Supporting Bus Lanes and Bus Rapid Transit	This Action would increase funding for new public transit infrastructure (e.g., rail lines, bus rapid transit routes). Greater use of public transit and reduction in automobile travel can be achieved by expanding public transit infrastructure. This Action also could include expansion of intercity bus service (e.g., by providing centrally located urban bus terminals or pickup areas). New transit lines increase the population base served by a transit system, extend system coverage for existing riders, and expand the overall commercial, residential, and retail markets served. Infrastructure improvements, such as physical track upgrades or the conversion of mixed-traffic lanes to dedicated bus or light-rail lanes, can significantly aid level-of-service measures.
TLU-3c	Promote Car Pooling and Van Pooling for Work Trips	This Action would provide financial incentives or preferential treatment for van pools and carpools, and fund supporting regional ride-matching programs. These transportation Actions reduce vehicle miles traveled (VMT) associated with workplace commuting, as well as rush-hour traffic congestion and the GHG emissions associated with traffic. Regional ride-matching programs provide a centralized database for matching drivers with others with similar commute schedules, origins, and destinations. Because of registration requirements, participant identities are known, addressing safety concerns.
TLU-3d	Transit Prioritization Measures such as Signal Prioritization and Building Additional Bus and High-Occupancy Vehicle Lanes	This Action would improve transit level of service (travel time, reliability, and frequency) for urban buses and light rail through prioritization measures, such as signal prioritization (where a transponder on the transit vehicle accelerates or extends the green cycle on traffic lights, allowing the vehicle to avoid many red lights), or lane-specific prioritization (preemptively turning a red light green in a lane occupied by a bus or in an appropriate turn lane, thus allowing the bus to merge or turn several seconds in advance of other traffic). Prioritization can also be achieved for buses through HOV lanes, which offer higher travel speeds.

Option No.	LEDS Policy/Action Option	Description
TLU-3e	Telecommuting, Live-Near-Your-Work and Tele-education Incentives	This Action would provide incentives to employers to provide such Actions as telecommuting, live near your work, and compressed work weeks to reduce automobile commutes. The telecommuting Action includes the development and utilization of neighborhood telecommuting centers that offer office-type services in locations close to commuters' residences. The live-near-your-work Action, also known as "proximate commute," encourages organizations with multiple locations (e.g., banks, fast-food restaurants) to transfer employees, such that the maximum number work at the branch location closest to their homes. A compressed work week (for example, four 10-hour days of work) can reduce the number of commute trips at organizations that are able to accommodate this.
TLU-3f	Park-and-Ride Facilities	This Action would provide additional state funding for park-and-ride lots. This strategy will expand the construction of well-lit, police-patrolled parking locations for car poolers and others to interface with buses, light and heavy rail, and commuter trains in the state. It is most effective when implemented jointly with HOV lanes as well as transit service. While participants still must drive to the lot location, each facility still significantly decreases VMT—especially the portion on the more congested radial commute routes.
<b>TLU-4 TRANSIT INCENTIVES &amp; DISINCENTIVES</b>		
TLU-4a	Require Commuter Choice Measures and Parking Cash Out Programs	This Action would provide incentives for employers to offer Commuter Choice programs. These programs encourage employers to provide actions, such as telecommuting, transit subsidies, pretax transit fare program, parking cash-out, and guaranteed ride home service, to reduce automobile commutes. Parking cash-out is a tax programs that allows employees to receive a cash payment as an alternative to receiving employer-paid parking. Transit benefits are a parking cash-out variant that allows employees to receive a tax-exempt payment valid on local transit systems. Commuter Choice programs can also provide a ride-matching service solely within the employer's workforce, arrange and/or subsidize van pools, and provide preferential parking and other amenities to car poolers or others who do not drive alone to work. As an incentive to develop and provide such services, a tax credit can be offered to companies. Government spending to encourage commuter choice can stimulate a large private private-sector match.
TLU-4b	Congestion Pricing or Similar Cordon Tolls with Targeted Use of Revenue towards Travel Alternatives	This Action would increase the introduction of tolls and road pricing that varies with congestion levels (congestion pricing). This measure can be particularly effective at reducing congestion and thus can significantly improve vehicle fuel economy and reduce VMT. Roadway pricing revenues can help fund needed highway improvements and help manage system-wide demand. In addition, pricing revenues can be used to fund transit and other transportation alternatives within a corridor or region.
TLU-4c	Transit Pricing Incentives such as Reduced Fares and Rebates	This Action would provide a subsidy to transit agencies and universities to reduce their fares. It would include various incentives that give discretionary travelers reasons to choose transit, such as reduced fares (for populations [such as seniors] or for specific times [such as off-peak travel]) or discounts. Reducing fares is one important means to increase transit ridership; however, it is neither the only nor necessarily the most cost-effective means.
TLU-4d	Benefits for Low Greenhouse Gas Vehicles such as Preferential or Free Parking and the Use of High Occupancy Vehicle Lanes	This Action would provide incentives to drivers of vehicles with low-GHG emission rates. This would be both vehicles using alternative fuels and those with high fuel economy. Depending on effectiveness, these incentives could include preferential vehicle access to metered parking spaces or HOV lanes.

Option No.	LEDS Policy/Action Option	Description
<b>TLU-5</b>	<b>VEHICLE TECHNOLOGY HEAVY DUTY VEHICLE AND FREIGH</b>	
TLU-5a	Vehicle Technology Improvements: These include increased Aerodynamics, Weight Reductions, Reduced Engine Friction, Improved Engine and Transmission Designs, more Efficient Tires, and more Efficient Accessories.	The fuel efficiency of freight trucks can be improved using a variety of equipment modifications (e.g., aerodynamic devices on both tractors and trailers, speed governors, wide-base tires, fuel efficient lubricants, low-rolling-resistance radial tires, automatic tire-inflation devices, auxiliary power units). EPA's SmartWay transport program offers a number of alternatives that could be used to improve the fuel efficiency of existing freight trucks. These technology Actions might include installation of aluminum wheels for single-wide tires to reduce vehicle weight and rolling resistance. Another Action might be to install fairings to improve vehicle dynamics. There is evidence that implementation of SmartWay truck transport initiatives has been more successful via loan programs than by grants. Government agencies can promote truck fuel efficiency improvements with financial incentives for equipment modifications, as well as by providing outreach on the benefits of vehicle improvements to truck operators.
TLU-5b	Improve Traffic Flow through Bottleneck Improvements such as Additional Lanes, Shoulder Conversions and Widening of Lanes	Improving vehicle flow on the roadway system can reduce fuel use and GHG emissions for all vehicles, including trucks. Coordinated operation of the regional transportation network, such as through the use of freeway ramp metering, can improve system efficiency, reliability, and safety.
TLU-5c	Truck Stop Electrification to Reduce Idling	Truck emissions can be reduced by providing electrification at truck stops to reduce idling and associated fuel consumption during extended stays at truck stops. These electrical hookups can provide power for heating, cooling, and other needs while trucks are stopped, which could be particularly beneficial at overnight rest stops. While electricity produces some GHG emissions, they are typically much less than the emissions that occur from trucks leaving their engines running.
TLU-5d	Increase the Number of Flex-Fuel Fueling Stations	The use of flex-fuels in heavy duty vehicles is not only constrained by the types of vehicles on the road, but also by the availability of fueling stations offering these types of fuels. Increased availability of flex fuels would encourage investment in flex fuel vehicles.
<b>TLU-6</b>	<b>RAIL, AIR AND PORT STRATEGIES</b>	
TLU-6a	Intermodal Freight Technologies such as Intermodal Freight Connectors	This Action focuses on the improvements to railroad and inland marine infrastructure and other strategies to encourage more use of rail and marine freight transport. For example, transport of freight can be shifted from the roadway system to rail. In many cases, carrying freight by river barge or railroads rather than truck can reduce emissions and fuel consumption while reducing congestion on major roadways.
TLU-6b	Increase Rail Capacity and address Rail Freight System Bottlenecks	Increasing rail capacity may allow some freight to shift from trucks to rail. In addition, rail infrastructure improvements could enable more use of the more fuel-efficient double-stack rail cars.
TLU-6c	Shift Freight Movements from Truck to Rail	Economic assistance and regulatory streamlining could improve intermodal rail yards and relieve rail freight bottlenecks. Moving freight by rail is much more fuel efficient than by truck. Moving freight from highways to rail would also relieve congestion on highways, improving the fuel economy of the remaining vehicles on the road.

Option No.	LEDS Policy/Action Option	Description
TLU-6d	Improve and Invest in High-Speed Rail	This Action would provide financing, regulatory relief, and the use of eminent domain to develop, publicly or privately, a high-speed intercity passenger rail system serving major urban areas. It would also provide additional financial assistance to improve services already provided by Amtrak on other routes. This would allow for the more energy-efficient movement of people, reducing GHG emissions associated with aircraft activity and highway travel, while eliminating highway congestion.
TLU-6e	Tighten Standards for Aircraft Emissions	This Action would support increased operational efficiency of aircraft to reduce GHG emissions. Incentives or subsidies can be provided to accelerate implementation of a number of air traffic control innovations that are well under development (reduced vertical separation minimums, continuous-descent landings) at state airports. Other improvements can include reduced aircraft engine idle time at the gate and on the runway, R&D of emission-reducing technologies for aircraft, and the use of ground tractors to pull aircraft the full distance from the gate to the taxiway (rather than inefficiently using the aircraft's engines for this purpose—already implemented by Virgin Atlantic).
TLU-6f	Adopt Green Port Strategy that Supports the Clean-up of Port Dwelling and Cargo Handling Equipment Operations	This Action would adopt port measures to encourage more energy-efficient technologies for vessel dwelling (plug-in technology, vehicle retrofits, etc.) and for land-side cargo-handling equipment ("Clean Truck Fees," low-sulfur vehicles, etc.). It would also encourage clean diesel cranes, consider electrifying or other methods to reduce GHG emissions, and consider shore power where applicable and feasible for shipping vessels in port.
TLU-6g	Two-Stroke Engine Efficiency Standards and Review these Engines to suggest Methods to Increase Efficiency	Two-stroke engines (also known as "Two-Cycle Engines"), typically used in small motorized devices such as chainsaws, outboard motors, small capacity motorcycles, lawnmowers, etc. have significantly higher levels of emissions due to the engine design. As a result, many states have sought to ban the use of or at least partially ban the use of two-stroke engines.
<b>TLU-7 ALTERNATIVE FUELS AND VEHICLES</b>		
TLU-7a	Expand Ethanol Use in Light Duty Vehicles by Increasing Gas/Ethanol Blend for General Use using Corn Ethanol	The state can adopt standards that require a certain amount or percentage of fuel sold within the state to be a renewable corn ethanol. This percentage can gradually increase over time. The State can help facilitate transition to renewable fuels by regulating quality standards for fuel blends.
TLU-7b	Expand Ethanol Use in Light Duty Vehicles by Increasing Gas/Ethanol Blend for General Use using Cellulosic Ethanol	The state can adopt standards that require a certain amount or percentage of fuel sold within the state to be a renewable fuel (e.g., ethanol or biodiesel). This percentage can gradually increase over time. The State can help facilitate transition to renewable fuels by regulating quality standards for fuel blends. This Action could also promote R&D related to biofuels production, such as the use of enzymes for breaking down cellulose to produce ethanol (as opposed to corn-based ethanol, which has a lower life cycle benefit).
TLU-7c	Expanding Ethanol Use in Light Duty Vehicles by Shifting Fleet to Greater Proportion of Flex Fuel Vehicles that are Running on Gas or E85)	This plan will detail how an E85 use goal can be met and how the state and retailers can work together to ensure that all E85 purchases are electronically coded and reported accurately.
TLU-7d	Increase Use of Compressed Natural Gas in Heavy Duty Vehicle	Create incentives for the purchase of Heavy Duty Vehicles that run on natural gas. Incentives could include tax rebates, reduction in vehicle registration, or other incentives.

Option No.	LEDS Policy/Action Option	Description
TLU-7e	Increase Use of Biodiesel in Heavy Duty Vehicles	The state can adopt standards that require a certain amount or percentage of diesel fuel sold within the state to be a biodiesel. This percentage can gradually increase over time. The State can help facilitate transition to renewable fuels by regulating quality standards for fuel blends.
TLU-7f	Increase Use of Cellulosic Ethanol in Heavy Duty Vehicles	Create incentives for the purchase of Heavy Duty Vehicles that run on cellulosic ethanol. Incentives could include tax rebates, reduction in vehicle registration, or other incentives.
TLU-7g	Expand the Use of Electric Vehicles	Adopt a variety of programs to increase purchase of electric vehicles. State incentives could include registration fees, feebates, and/or tax credits.
TLU-7h	Expand the Use of Plug-in Hybrid Electric Vehicles	This Action would provide incentives for or discounts for fleet operators for the purchase of hybrid and/or other cleaner-technology vehicles. It would also provide education and encouragement for "right-sizing" fleet vehicles, purchasing the smallest, most fuel-efficient vehicle compatible with its needs and vehicles (e.g., replacing large sedans and SUVs with smaller vehicles where feasible).
TLU-7j	Expand the Use of Battery Electric Vehicles	Adopt a variety of programs to increase purchase of battery electric vehicles. State incentives could include registration fees, feebates, and/or tax credits. Interventions may also include increased R&D on battery technologies to reduce cost and increase capacity.
TLU-7k	Expand Use of a Combination Electric Vehicles, Plug-in Hybrid Electric Vehicles and Battery Electric Vehicles	Adopt a variety of programs to increase purchase of fuel-efficient or low-GHG vehicles and equipment (including pure electric, hybrid, plug-in hybrid, and other alternative-fuel vehicles). State incentives could include registration fees, feebates, and/or tax credits.

**Table-4. Agriculture, Forestry, & Other Land Use (AFOLU)**

*This catalog will be reviewed, revised and expanded during the AFOLU TWG process. TWG members are encouraged to provide input on policies and programs in place in [Jurisdiction] to assist in defining baselines.*

Option No.	LEDS Policy/Action Option	Description
<b>AFOLU-1</b>	<b>AGRICULTURE &amp; FORESTRY—PRODUCTION OF FUELS AND ELECTRICITY</b>	
AFOLU-1a	Expanded Use of Biomass Feedstocks for Electricity, Heat, and Steam Production	This Action would increase the amount of biomass available from forests for generating electricity and displacing the use of fossil energy sources. Considerations should include the sustainability of biomass, the environmental impacts from biomass harvesting, and the transportation costs of moving biomass from the source location to the processing location. This Action is related to WM-21 (Expanded Use of MSW and Yard Waste Biomass Feedstocks for Electricity, Heat, and Steam Production), which uses municipal solid waste as an energy feedstock.
AFOLU-1b	Provincial Liquid/Gaseous Biofuels Production for Stationary and Mobile Applications	This Action would increase production of ethanol, biodiesel, or other liquid/gaseous biofuels from agriculture and forestry feedstocks (raw materials) to displace the use of fossil fuel in both stationary applications (such as biodiesel for electricity plants) and mobile applications (such as transportation fuels). For example, cellulosic ethanol feedstocks and production systems that use renewable fuels lower the embedded carbon content of ethanol. Increased production and consumption of in-state biofuels will likely provide the highest benefits. Considerations should include the sustainability of biomass, the environmental impacts from biomass harvesting, and the transportation costs of moving biomass from the source location to the processing location. Note that this Action is related to WM-22 (Waste Management Feedstocks for Liquid/Gaseous Fuels Production for Stationary and Mobile Applications).
AFOLU-1c	Improved Commercialization of Biomass Conversion Technologies	This Action would improve the rate of technology development and market deployment of biomass conversion technologies including biomass gasification combined-cycle, pyrolysis, and plasma arc technologies. These technologies expand the application of renewable fuels derived from biomass. A range of renewable products can be developed from these processes, including gaseous and liquid fuels, biochar, chemical products, and methane to methanol. Existing processes include waste combustion and energy recovery (as electricity, steam, or both) or ethanol plants using co-products for heating and drying, rather than relying on outside energy sources.
AFOLU-1d	Integrated Bioenergy Research and Commercialization	This Action would integrate electricity from anaerobic methane digestion of manure, with production of by-products (e.g. biodiesel and ethanol), and would pyrolyze biomass to create energy and by-products (e.g., syngas, bio-oil and biochar).
AFOLU-1e	Manure Digesters/Other Waste Energy Utilization	This Action would reduce the amount of methane emissions from livestock manure by installing manure digesters on livestock operations. Energy from the manure digesters is used to create heat or power, which offsets fossil fuel-based energy production and the associated GHG emissions. This Action may consider new technologies as well, such as plasma arc technology. Integrating methane digesters into agricultural operations could generate energy from waste on an individual or community basis.
<b>AFOLU-2</b>	<b>AGRICULTURE—LIVESTOCK AND RANGE MANAGEMENT</b>	

Option No.	LEDS Policy/Action Option	Description
AFOLU-2a	Manure Management—Manure Utilization	This action may include manure capture, management, and utilization. Manure management practices that reduce GHG emissions associated with manure handling and storage can include (but are not limited to) manure composting (to reduce methane emissions), manure crusting, addition of additives to decrease the amount of nutrients lost, and improved methods for application to fields (for reduced nitrous oxide [N <sub>2</sub> O] emissions). Application improvements include incorporation into soil instead of surface spraying or spreading. Implementation of digester and energy recovery projects at concentrated animal feeding operations (CAFOs) can reduce methane emissions to utilize the energy to displace fossil fuels. The utilization of collection and control equipment, such as biofilters at CAFOs, can reduce methane emissions. Increasing the area over which manure is deposited can reduce methane emissions, since the manure is more likely to be decomposed aerobically than anaerobically.
AFOLU-2b	Encourage Mitigation of Carbon Sequestration Loss and GHG Emissions from Prescribed Burning of Crop/ Grassland Residues	Naturally occurring wildfires at historic frequencies and intensities are important for maintaining grassland health. However catastrophic fires can cause significant emissions and lower the soil carbon sequestration potential for some time. Programs to reduce the potential for catastrophic wildfire will help vegetation and soil to sequester carbon and resist invasion by less desirable, and more fire-prone vegetation. Note that this Action may have overlap with AFW-2.5, below, but will focus on separate practices.
<b>AFOLU-3 AGRICULTURE—CROP PRODUCTION</b>		
AFOLU-3a	Soil Carbon Management	The amount of carbon stored in the soil can be increased by the addition of such practices as conservation, no-till cultivation, and crop rotation. Reducing summer fallow and increasing winter cover crops are complementary practices that reduce the need for conventional tillage. In addition, the application of biochar (i.e., charcoal) may also increase soil carbon content and stabilize soil carbon. By reducing mechanical soil disturbance, these practices reduce the oxidation of soil carbon compounds and allow more stable aggregates to form. Other benefits include reduced wind and water erosion, reduced fuel consumption, improved wildlife habitat. This policy Action would encourage soil productivity and carbon sequestration through the use of biochar, winter overcrops, and practices, such as crimping/rolling.
AFOLU-3b	Nutrient, Pesticide/Herbicide, and Water Management	This Action would improve the efficiency of fertilizer use and other nitrogen-based soil amendments through implementation of management practices and Generally Accepted Agriculture Management Practices (GAAMP). Excess nitrogen not metabolized by plants can leach into groundwater and/or be emitted to the atmosphere as N <sub>2</sub> O. Better nutrient utilization can lead to lower N <sub>2</sub> O emissions from runoff. Upstream emissions for nutrient production and transport are also reduced. This Action also addresses other chemical use for crop production including pesticides and herbicides. Use of integrated pest management practices can reduce the use of these chemicals, which reduce the energy and GHG emissions associated with chemical production and application. This Action would also improve the efficiency of water use through implementation of best management practices and GAAMP. Excess water can lead to nitrogen runoff, with subsequent emission to the atmosphere as N <sub>2</sub> O. Managing and improving water consumption and nutrients spread on crops will minimize loss of carbon from the soil. Reduced water consumption can result in lower energy use for water pumping. Also, improved drainage on agricultural lands prevents ponding, which could lead to anaerobic soils and GHG emissions (methane).

Option No.	LEDS Policy/Action Option	Description
AFOLU-3c	Technology Improvements to Increase Efficiency and Yields	New technologies and cultivation methods have the potential to reduce GHG emissions when fossil fuel or electricity consumption can be reduced. Auto-steer guidance systems are an example, as is auto-swath technology, which uses global positioning system (GPS) technology to automatically turn the spray boom sections on or off when coming to an area of the field that has been sprayed or needs to be sprayed. Auto-swath technology can be used for planting, fertilizing, and other operations. On odd-shaped fields, it can result in a 3%–5% savings. See <a href="http://www.agleader.com/products.php?Product=directcommand_l">http://www.agleader.com/products.php?Product=directcommand_l</a> . Variable-rate fertilizing and liming are also becoming more popular among farmers. The farmer has a local co-op grid sample the field, and then variable rate technology applies the fertilizer or lime only in the areas of the field that need it. This approach can result in a 50%–60% reduction in the amount of lime or fertilizer needed. See <a href="http://www.agleader.com/products.php?Product=directcommand_g">http://www.agleader.com/products.php?Product=directcommand_g</a> . As another example, GreenSeeker normalized difference vegetation index (NDVI) is a promising new technology that is still in its early testing stages. A farmer applies 50%–70% of his nitrogen at planting and then, in season, uses GreenSeeker to apply what the plant needs when it is growing. This efficient technology reduces the over-application of nitrogen. See <a href="http://www.ntechindustries.com/greenseeker-RT200.html">http://www.ntechindustries.com/greenseeker-RT200.html</a> . Improvements may also encompass newer machines with better fuel efficiency, larger planters and combines, and genetically modified seed.
AFOLU-3d	Recycling of Mulching Film	Recycling plastic mulching film could be considered as part of a Waste Management sector option that more broadly addresses re-use and recycling.
<b>AFOLU-4 AGRICULTURE – LAND USE CHANGE</b>		
AFOLU-4a	Land-Use Management that Promotes Grassland Cover	This Action would convert marginal agricultural land used for annual crops to permanent cover—such as grassland/rangeland, orchard, or forest—where the soil carbon and/or carbon in biomass is higher under the new land use. It includes opportunities to keep Conservation Reserve Program lands covered in perpetuity. Increased demand for corn-based ethanol and biodiesel feedstocks can act as an incentive for converting grassland to cropland. This Action would adopt mechanisms to prevent these acres from returning either to conventionally tilled production or to suburban/urban development.
AFOLU-4b	Preserve Open Space/Agricultural Land	This Action would reduce the rate at which agricultural lands are converted to developed uses, while protecting private property rights and responsibilities. This retains the above- and belowground carbon on these lands, as well as their carbon sequestration potential. Transportation emissions will be reduced indirectly through more efficient development and lower vehicle use. Agricultural land conversion may be prevented through conservation land grants and conservation easements facilitated through nonprofit land-preservation organizations.
<b>AFOLU -5 AGRICULTURE—OTHER FARMING PRACTICES</b>		
AFOLU-5a	Increase On-Farm Energy Production and Efficiency	This Action would encourage adoption of practices and equipment that reduce on-farm emissions through efficiency and energy production. Renewable energy can be produced and used on site at agriculture operations. Examples of practices and technology include using tractors with variable-speed transmissions to reduce fuel consumption; installing solar or wind power; using hydro-powered generators for irrigation; converting diesel farm equipment to liquefied natural gas, compressed natural gas, or hybrid technology; increasing on-farm use

Option No.	LEDS Policy/Action Option	Description
		of biofuels and other renewables; expanding farm energy audit programs; and updating machinery, equipment, and engines to reduce carbon dioxide (CO <sub>2</sub> ) emissions by displacing the use of fossil-based fuels.
AFOLU-5b	Promotion of Urban Agriculture	This Action would promote participation in urban agriculture programs that reduce GHGs by sequestering carbon and reduce cooling costs by mitigating urban heat islands. It would also promote all forms of urban agriculture and intensification of plant density in urban settings through community gardens, backyard gardens, and green roofs. This policy would also promote vegetation on vacant or abandoned lands. Urban agriculture programs also reduce transportation related emissions by reducing food miles for urban consumers.
<b>AFOLU-6 FORESTRY— BIOMASS PROTECTION AND MANAGEMENT</b>		
AFOLU-6a	Forest Protection—Reduced Clearing and Conversion to Non-forest Cover	Much of the carbon stored in forest biomass and soils can be lost as a result of land-use conversion. This Action would reduce the rate at which existing forests are cleared. Easements, conservation programs, improved markets for timber and non-timber forest products, and payment for ecosystem services are some mechanisms that may be used. Implementation practices may also include education programs and technical and financial assistance for private forest landowners, if applicable, so they will be more willing to manage their forests.
AFOLU-6b	Urban Forestry	This Action would maintain and improve the health and longevity of trees in urban and residential areas to protect and enhance the carbon stored in tree biomass. Indirect emission reductions may also occur by reducing heating and cooling needs as a result of planting shade trees.
AFOLU-6c	Afforestation and/or Reforestation of Non-forested Land	This Action would establish forests on land that has not historically been forested (e.g., agricultural land—“afforestation”), and promote forest cover and associated carbon stocks by regenerating or establishing forests in areas with little or no present forest cover (“reforestation”). In addition, it would implement such practices as soil preparation, erosion control, and stand stocking to ensure conditions that support forest growth. This policy can include forestation of previously mined surface mines as well as unforested riparian areas.
	Forestry Management for Carbon Sequestration	This policy focuses on forest management activities that promote forest productivity and increase the rate of CO <sub>2</sub> sequestration in forest biomass and soils and in harvested wood products. Practices may include increased stocking of poorly stocked lands, age extension of managed stands, thinning and density management, fertilization and waste recycling, expansion of short-rotation woody crops (for fiber and energy), expanded use of genetically preferred species, modified biomass removal practices, fire management and risk reduction, and pest and disease management. This policy would also encourage the use of native species and noninvasive species, and promote biomass removal practices to ensure forests and woodland regeneration and minimize soil loss.

**Table-5. Waste Management (WM)**

*This catalog will be reviewed, revised and expanded during the WM TWG process. TWG members are encouraged to provide input on policies and programs in place in [Jurisdiction] to assist in defining baselines.*

Option No.	LEDS Policy/Action Option	Description
<b>WM-1</b>	<b>WASTE MANAGEMENT—SOLID WASTE MANAGEMENT STRATEGIES</b>	
WM-1a	Source (Waste Generation) Reduction Strategies	This action would reduce the volume of waste from residential, commercial, and government sectors through programs that reduce the generation of waste. Reducing waste generation at the source reduces both landfill emissions and upstream production and transport emissions.
WM-1b	MSW Reuse, Recycling, and Organic Waste Management Programs	This action would increase reuse, recycling, and composting programs in order to limit GHG emissions associated with landfill methane generation and with the production of raw materials. It would increase reuse and recycling programs for municipal solid waste (MSW), create new recycling programs, provide incentives for the reuse and recycling of construction materials, develop markets for reused and recycled materials, and increase average participation and recovery rates for all existing recycling programs. This action would also reduce the biodegradable fraction of waste emplaced through recycling of organic wastes (e.g., lawn and garden waste, food waste, wood, paper, and bio-based plastics); would encourage conversion technologies, including composting, anaerobic digestion, or hybrids of these technologies; and would include recycling of agriculture plastic waste (greenhouse plastic). Waste oils can serve as an energy feedstock. Reuse of waste materials leads to the highest GHG benefit by reducing the energy inputs associated with conversion of waste.
WM-1c	Expanded Use of MSW and Yard Waste Biomass Feedstocks for Electricity, Heat, and Steam Production	This Action would increase the amount of biomass available for generating electricity and displacing the use of fossil energy sources. Local electricity or steam production yields the greatest net energy payoff. Note that this Action is related to AFF-1, which uses biomass feedstocks for energy.
WM-1d	Waste Management Feedstocks for Liquid/Gaseous Fuels Production for Stationary and Mobile Applications	This Action would use MSW biomass (waste wood, landscape debris, other fiber) to produce liquid or gaseous biofuels for use in transportation or stationary energy needs. For example, this biomass could include cellulosic ethanol feedstocks, biomass gasification feedstocks, etc.
WM-1e	Expand/Enhance MSW Collection & Management Infrastructure and Services	This Action would expand centralized MSW collection and management services to areas that are not currently served. This will reduce the amount of MSW disposed in unmanaged sites, including open dumps, or other disposal methods such as open burning. Centralized treatment of MSW could take the form of: modern landfilling, constructed to enhance methane collection and use and to limit other environmental problems (e.g. soil and groundwater contamination); waste combustion for energy recovery; anaerobic digestion; composting; or other methods with environmentally superior results to BAU practices with a focus on "resource reutilization" (recovery of energy or other valued resource).  This action also addresses achieving higher efficiencies in the collection and transport of solid waste in areas that are already served by collection and management infrastructure/services. This could include collection route optimization, use of more efficient collection/transport equipment, and curbside waste segregation.

Option No.	LEDS Policy/Action Option	Description
		The latter item promotes segregating wastes by the waste generator into different "streams", such as organics (e.g. food waste for composting/other organics management), recyclables (for direct transport to a recycling or materials recovery facility), and other wastes (e.g. for waste combustion, landfilling or other management).
<b>WM-2</b>	<b>WASTE MANAGEMENT—LANDFILL GAS/BIO-METHANE STRATEGIES</b>	
WM-2a	Landfill Methane Energy Programs	This Action would use the renewable energy created at landfills by anaerobic digestion (methane) to make electric power, space heat, or compressed biogas. This action could also address methods to reduce methane emissions at sites where methane collection and use is not economically feasible. This could include landfill gas collection and flaring, flaring at the well head, or other methods to reduce methane emissions (e.g. biofilters).
WM-2b	Methane and Biogas Energy Programs	This Action would encourage and promote the use of anaerobic digesters and energy recapture for organic components of the MSW waste stream (e.g., food and yard waste). Projects would be located at the landfill site or, preferably, at the site of the waste generator (e.g. food processing facility). These projects will help prevent the emission of methane while producing clean energy. Anaerobic digesters make a two-fold contribution to climate protection: the usual unchecked discharge of methane into the atmosphere is prevented, and the burning of fossil fuels is replaced with renewable energy (biogas).
<b>WM-3</b>	<b>WASTE MANAGEMENT—WASTEWATER ACTIVITIES</b>	
WM-3a	Energy Efficiency/ Technology Improvements	<p>This Action would provide incentives for efficiency improvements or technology upgrades; encourage the setup of energy policies, energy audits, and energy cost tracking; and identify and implement energy improvements, such as using energy-efficient equipment and generating onsite power (e.g., solar power, digester gas). Common energy efficiency improvements cover lighting, pumps, and fans. Other improvements can include:</p> <ul style="list-style-type: none"> <li>- Conversion of secondary aeration processes to fine-bubble diffusion and optimization of oxygen transfer efficiencies.</li> <li>- Research and development (R&amp;D) of diffuser cleaning protocols.</li> <li>- R&amp;D to increase removal of chemical oxygen demand in primary treatment tanks and clarifiers.</li> <li>- Evaluation of steam usage in plant processes and biofilters, optimization of use, and promotion of alternatives.</li> <li>- R&amp;D of Actions to optimize denitrification in secondary treatment.</li> <li>- R&amp;D of ways to use wastewater biomass as an energy source, rather than a soil carbon source.</li> </ul> <p>Financial and performance analyses that may be conducted to assist the implementation of this Action include:</p> <ul style="list-style-type: none"> <li>- Creation of a leveraged state revolving loan fund program to capitalize energy efficiency in municipal wastewater treatment plants (WWTPs).</li> <li>- Conducting benchmarking of energy use per million gallons treated in state to showcase good and deficient energy performance in this specific climate.</li> </ul>
WM-3b	Reduce Wastewater Generation (for lower wastewater processing needs)	This Action would develop and implement best practices for lowering water consumption and waste production in the industrial, commercial, and residential sectors. It would encourage and create incentives for R&D on methods or technologies to reduce water consumption and waste production, provide education to

Option No.	LEDS Policy/Action Option	Description
		reduce water consumption and waste production, and promote the use of "reclaimed" water from WWTPs for the purpose of irrigating urban green space. Lower water consumption and production lead to lower GHG emissions.
WM-3c	Install Digesters and Turbines/Engines at Existing and New Treatment Plants	This Action would provide incentives to install anaerobic digesters to treat municipal waste and create methane, and would install turbines or reciprocating engines to generate electricity from the methane. Reductions occur via methane control and offsetting fossil energy use. This Action would also provide incentives to recover heat from wastewater influent or effluent through the use of heat pumps, and would investigate opportunities for waste heat recovery from biogas combustion units (turbines, engines, flares).
WM-3d	Expand Capacity of Centralized WW Treatment to Unserved Areas	This Action would expand centralized wastewater treatment infrastructure (piping systems, pump stations, treatment facilities) to areas that are not currently served by these systems. Centralized plants can reduce methane and nitrous oxide emissions associated with simpler forms of wastewater treatment (e.g. anaerobic lagoons). Modern plants designed to treat waste anaerobically can also utilize the methane generated as an energy source for local heat/steam needs, on-site electricity needs, or export of electricity to the local grid.
WM-3e	Develop or Expand the Use of Reclaimed Water	This Action would develop or expand the treatment and delivery infrastructure (piping systems, pump stations, treatment facilities) to treat and utilize "reclaimed water". In this action, reclaimed water has been treated at centralized facilities to levels safe for use as irrigation water (e.g. lawns, golf courses, agriculture) or other non-drinking water uses. The lower level of treatment requires lower levels of energy and chemical inputs as compared to treatment levels needed for drinking water. Reclaimed water essentially provides for two uses of the same water source: first as domestic water; and then second as an irrigation purpose. This reduces the amount of energy required to initially pump water from its original source (e.g. groundwater, through pipelines over long distances). Reductions in energy use result in lower GHG emissions (either within or outside of the jurisdiction).
WM-3f	Optimize Sewage Sludge Treatment	This Action addresses the application of new technologies and management methods to optimize sewage sludge treatment and disposal to achieve environmentally-superior results, including reduced GHG emissions, water pollution, and land use. Depending on how sewage sludge is currently managed in an area, this could include: sewage treatment plant retrofits from aerobic to anaerobic biosolids digestion to reduce sludge volumes and subsequent use of methane as an energy source; better land application methods (to reduce run-off and leaching of nitrogen); bans for disposal in landfills that are not equipped with landfill gas collection and use; and other methods.