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Workshop title: Overview of EPA tools for supporting local-, state- and regional-level decision makers addressing energy and environmental issues

EPA's Office of Research and Development (ORD) has been developing tools and illustrative case studies for decision makers in local and regional authorities who are facing challenges of establishing resilience to extreme weather events, aging built environment and infrastructure, urbanization, managing limited natural resources, meeting environmental goals, and sustaining economic growth. Understanding the environmental and health implications of energy supply and use, as well as the extent to which energy resources and technologies may contribute to achieving current and future environmental goals is essential, but potentially could be a daunting task for local, state and regional authorities.

This workshop will focus on two decision support tools developed at EPA/ORD:

1. Community-scale MARKAL model: an energy-water technology evaluation tool
2. Municipal Solid Waste Decision Support Tool (MSW DST)

Community scale MARKAL model: an energy-water technology evaluation tool

City planners often consider providing electricity and water services (drinking water and wastewater treatment) to residential, commercial and industrial customers as separate activities. Examining water and energy consumption and management together, however, can provide insights into ways to become more sustainable and even more resilient to challenges such as heat waves, heavy rainfall, and other extreme weather events that might lead to disruptions in energy and water services. To address this challenge, a community-scale energy-water technology evaluation tool was built using the MARKet Allocation (MARKAL) energy modeling platform. Researchers have been using the MARKAL framework to model the nation's energy system and evaluate different energy technology options for reducing air pollutant emissions for more than three decades. However, combining energy and water technology evaluation has been initiated recently with the launch of this project.

The community-scale MARKAL model taps into an energy and water technology database where the full range of technology profiles and associated data (i.e., cost, efficiency, emission factors) for energy extraction and conversion, power plants, buildings, transportation, and industrial sectors as well as water and wastewater infrastructure, building energy retrofits, green infrastructure (GI) alternatives (e.g., green roofs), and distributed energy options (e.g. roof-top solar PV and combined heat and power plants) are populated. Using this database, city planners can design and simulate future scenarios with a range of policy options to evaluate the most cost-effective and environmentally sustainable solutions for providing energy- and water-related services such as heating, cooling, and water and wastewater treatment. These scenarios may demonstrate pathways to create resilient communities and minimize disruptions in electric and water supply. Further modeling results may include quantified impacts of

environmental and energy policy instruments, including air emission regulations and alternative energy portfolio standards (e.g., Renewable Energy and Energy Efficiency), variation in summer peak electricity loads, changes in waterbody withdrawal rates, discharges for thermoelectric cooling, changes in wastewater treatment plant loads and impacts of distributed energy systems.

A prototype database has been in development for the past two years and includes economic and environmental data for New York City and the surrounding region. EPA/ORD is currently collaborating with city universities and city officials on building case studies with the New York City tool, however, EPA/ORD's long term goal is to make the tool available for use by other cities and communities that could input their unique data and use the scenario building features to evaluate the energy-water connection in their city. One way to achieve this goal is to work with universities to create academic hubs where the tool can be tailored for specific case studies while providing educational development opportunities for students.

Municipal Solid Waste Decision Support Tool (MSW DST)

EPA/ORD has been involved in development of the Municipal Solid Waste Decision Support Tool (MSW-DST) for over 20 yrs. This work has been a collaboration with EPA/ORD, Research Triangle Institute and North Carolina State University. The MSW-DST evaluates the net life-cycle tradeoffs (special focus on air emissions and energy consumption) and cost for materials and discards management from municipal and commercial solid waste. It identifies strategies that reduce air pollution and conserve energy and other natural resources while reporting on full cost accounting. The MSW-DST helps identify solutions to reduce waste going to landfills and move towards more sustainable materials management. Across the US, strategies are being implemented to reduce waste and encourage recycling and composting without the benefit of understanding the environmental tradeoffs. Optimal strategies can differ depending on population density, infrastructure, energy grid mix, waste composition, and transportation distances for hauling waste to and from facilities for processing, recovery, or disposal.

The MSW-DST takes into account all waste management activities and the inherent differences among materials (e.g., food waste, glass, metals, paper, plastics, and yard debris) that can affect energy recovery and life-cycle environmental tradeoffs. Options can be interrelated, and it can be unclear how best to manage MSW considering total emissions over time. For example, what may be more environmentally advantageous in a rural region may be different from urban or suburban communities. Another factor to consider is that most carbon inventories consider annual emissions and not total emissions over the life-cycle. For most unit processes, emissions are instantaneous. However, if waste is buried in a landfill, then total emissions can occur over many decades and depending upon the time horizon, carbon storage may occur. The MSW-DST provides a systematic approach to evaluating total life-cycle emissions for collecting, hauling, processing, and disposal of MSW while factoring in offsets for materials and energy recovery.

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