Maryland Climate Change Commission
Buildings Ad Hoc Group

July 9, 2020

The meeting began at 3:00pm online.

Attendees: Aaron Greenfield, Amanda Best, Brian Frazee, Brian Smith, Chris Hoagland, Cindy Osorto, David Lis, David Smedick, David St. Jean, Ellen Valentino, Emily Curley, Eric Coffman, Hannah Thonet, James Grevatt, Jennifer Eugene, John Quinn, Julian Varo, Lori Graf, Lorig Charkoudain, Margo Thompson, Mark Stewart, Michael Eseteve, Michael Powell, Nick Umosella, Peter Trufahnestock, Richard Louis, Ruth W, Sara Fidler, Stephen Holcomb, Stephen Soule, Susan Casey, Susan Miller, Tamra Spielvogel, Thomas Walz, Tom Ballentine, Tory Clark, Vladimir Kochkin, William Ellis, Patrick Roddy, Kenneth Schisler, Patrick Roddy, Melissa Adams, Sam DuPont, Jessie Keller, Bryan Howard, John Fiatro, Jessie Keller, Jennifer Gallichio, Julian Varo

Introduction

- Chris Hoagland: Thanked everyone for attending today's meeting.
- Note by Co-Chair Michael Powell: Has received calls over the past few days over the meeting. There are no confines based on the Mitigation Working Group, except for statutory language.
- Group Facilitator Mark Stewart: Today we'll be looking at approaches for decarbonization.

Building Electrification in Maryland presentation by Tory Clark, Director of the Energy + Environmental Economics (E3)

- Today we'll be looking at the role of electrification in reducing greenhouse gas emissions, including lessons learned from other states; and specific insights from Maryland modeling specifically.
- **Role of Electrification**
    - There's a role for every sector of the economy to participate in decarbonization; there are also some key pillars: energy efficiency and conservation, electrification, low-carbon fuels, and the reduction of non-combustion emissions
    - The buildings sector may include higher efficient space heating and water heating technologies; industry electrification may include HVAC considerations; and energy efficiency may include codes and standards, building shell improvements, overall more efficient appliances and devices, as well as behavioral conservation and smart growth strategies.

- **Lessons Learned from Other States**
    - E3 Background includes working in California, New York, Oregon, Maryland, Minnesota, and United States government.
    - Strategies for building decarbonization include: 1) complete electrification of heat pumps; 2) hybrid option of electric heat pumps with gas back-up; and 3) blends of renewable natural gas (RNG) in the gas pipeline.
    - Key takeaway from E3 study on natural gas distribution in California: biofuels are important but limited in terms of availability and cost-effectiveness by 2050; there are also considerations pertaining to where the biofuels would be going to - for example, it might make more sense that biofuels would go towards transportation needs that are not able to use other methods/technologies to decarbonize.
    - Another study in California pertaining to decarbonization cost-effectiveness across all sectors found that building electrification, especially heat pumps, tends to be cheaper than other mitigation measures, like renewable energy, cleaner trucks, biofuels, power-to-gas, and other approaches.
    - Grid impacts from building electrification vary based on climate and technologies; Cold climates may become winter-peaking electric systems, mild climates may continue to be summer-peaking systems and thus heat pump technologies that have the most emissions-savings and cost-savings may vary across states.
    - There would be an analysis needed in Maryland in order to determine the state-specific cost-effectiveness of heat pumps and building electrification measures.
- **Building Electrification in Maryland**
    - E3 has used a PATHWAYS modeling approach to conduct GHG and energy analysis in Maryland in order to test "what if" scenarios.
    - Today will focus on two scenarios: electricity generation and buildings and industry sector.
        - Electricity Generation scenario assumes: 50% RPS by 2050, 75% RPS and 100% zero-emissions electricity by 2040.
        - Electricity Generation scenario would achieve short-term targets by 2030 and would come close to meeting the target by 2050.
        - Building Electrification scenario assumes increased EmPOWER efficiency goals by 2023 and beyond as well as aggressive building electrification for new construction and retrofits.
        - Building Electrification models are assuming that new construction would have new heat pumps; there's an assumption that there would be a lag in terms of heat pump adoption rates but by 2050 the majority of buildings would have heat pumps.

        - Even as population grows in the state, total energy by fuel would be expected to decrease with time due to energy efficiency measures; total direct emissions by technology shows that space heating and water heating technologies have the potential to decrease carbon emissions significantly.
        - This scenario alone was estimated to achieve 41% reductions by 2050 relative to 2006 levels.
        - Emissions reductions could be stronger if EmPOWER expands to include a few different measures, such as requiring efficiency for natural gas appliances and adding new technology incentives.
    - Additional resources are included at the end of the presentation.
- **Questions:**
    - Emily Curley (Montgomery County): What are some of the aspects that would drive higher heat pump adoption in the MWG Scenario?
        - Tory: This could include: Incentives, rate structures, pilot projects for different types of buildings, coordination with utilities/contractors/distribution planning/local capacity needs.
    - Ellen Valentino (Mid-Atlantic Petroleum Distributors Association): Are propane and heating oil options that can kick in when there are energy needs in emergency situations? Such as heating hospitals and chicken houses?
        - Chris Hoagland: This may relate to the polar vortex, and the utilities and PSC may have more information.
        - William Ellis (Pepco): Grid's ability to handle load is different than generation availability; there is a difference between generation and capacity of load and emergency/reliability measures are often dealt by PJM and the utilities.
    - David Smedick (Sierra Club): In Slide 15 there is mention of other devices vs heat pumps - is electric resistance a part of that?
        - Tory Clark: Yes
    - Tom Ballentine (Maryland Builders Association): Are commercial buildings part of the studies discussed and if so, how so? Was there another study done in the Pacific northwest?
        - Tory Clark: Study did not do a detailed study on the different technologies across commercial buildings; this would require an additional study. Some information pertaining to the Pacific northwest study was cited in this presentation, including additional reading resources.

Northeast State's Buildings Decarbonization Policies and Programs presentation by David Lis, Director of Technology Solutions of Northeast Energy Efficiency Partnerships (NEEP)

- NEEP's mission is to promote advanced energy efficiency and related solutions and aims to drive market transformation in the Northeast region through collaboration, innovation, developing tools, and disseminating knowledge.
- NEEP has conducted a **regional study on strategic electrification**, which included an assessment on how to drive decarbonization and later crafted an action plan.
    - Even after factoring in energy efficiency and clean grid strategies such as renewable energy, there was a question on how to address "other emissions" in order to meet a target of 80% CO2 emissions reductions by 2050 based on 2001 levels.
    - Further studies found that the direct use of fossil fuels through building usage had a significant carbon emissions impact, including residential, commercial, and industrial buildings.
        - The vast majority of emissions is made up of heat and water systems.
        - Alternative technologies were explored; concluded that heat pumps had a great potential for carbon emissions reductions in the buildings sector.
    - A tremendous amount of research on decarbonization pathways and NEEP's studies are in line with many other technical studies, including utility or nonprofit studies.
- The **central role of building decarbonization has three elements**: space and water heating through heat pumps, thermal improvements, and flexible use of low-carbon electricity.
    - Heating electrification technologies include air-source heat pumps, ground-source heat pumps, and solar thermal systems; many technologies have been around for a while and there have been real advancements over time pertaining to efficiencies during cold or warm times.
    - Residential technologies are ahead of commercial technologies but there are many success stories of university and college campus projects reaching high efficiency for their heating and cooling needs.
    - Air Source Heat Pumps (ASHPs) market has experienced about a 20% annual growth increase over four years in the New England region.
    - Alternative building decarbonization pathways have issues of readiness, cost, and scalability compared to current electrification technologies.
        - Alternative pathways include: heating oil/renewable oil (biodiesel, ethanol, synthetic fuels), fossil natural gas/renewable gas (landfill gas, anaerobic digesters, gasification, and synthetic gas), and hydrogen (electrolysis).
    - Cost is a barrier for current technologies but customer awareness is currently low.
    - Building decarbonization policy and program survey across states provide a wide range of potential approaches including: specific heat pump targets/goals,

promotional programs for energy efficient appliances, alternative portfolio standards, benchmarking and labeling, lead-by-example approaches, workforce development (ex. NYSERDA), building codes, and supporting communities. More resources are included at the end of this presentation and at NEEP's website: https://neep.org/.

New Jersey's Energy Master Plan and Building Decarbonization, presentation by Hannah Thonet, Senior Policy Advisor to the New Jersey Board of Public Utilities

- **High Level Overview of 2019 Energy Master Plan**
  - The 2020-released Plan aims for: 100% clean energy by 2050, 80% reduction in emissions by 2050 relative to 2006 levels, and a stronger and fairer New Jersey.
  - By order of highest greenhouse emissions (in CO2 emissions): transportation, electric generation, commercial and industrial buildings, and residential buildings; These combined industries create about 90.5 MMT of carbon dioxide emissions and will require an approach that considers the three sectors.
  - NJ created an energy master plan with significant public participation feedback; There are seven main strategies that aims to lower carbon emissions with consideration of the entire New Jersey energy system; there also is an Integrated Energy Plan, a 30-year, full energy system model that identifies the most economically beneficial and least-cost pathways to achieve state goals.
  - Seven Strategies:
    - Reduce Energy Consumption and Emissions from the Transportation Sector
    - Accelerate Deployment of Renewable Energy and Distributed Energy Resources
    - Maximize Energy Efficiency and Conservation and Reduce Peak Demand
    - Reduce Energy Consumption and Emissions from the Building Sector
    - Decarbonize and Modernize New Jersey's Energy Systems
    - Support Community Energy Planning &Action with an Emphasis on Encouraging Participation by Low & Moderate Income and Environmental Justice Communities
    - Expand the Clean Energy Innovation Economy
- **Modeling New Jersey's Energy System and Greenhouse Gas Emissions**
  - The integrated energy plan (IEP) only includes today's cost-effective technologies; not tomorrow's technologies; the model is considered a "living, breathing document" that could change over time if new technologies prove to be cost-effective.
  - The IEP considers a model of NJ's growing economy, NJ's energy needs, and finally estimates least-cost investments to meet the needs of the state.

    - The IEP team worked with stakeholders to define different nine scenarios and explore tradeoffs and implications of external factors and policy decisions.
    - Key takeaway from least-cost scenario: NJ's 80% reduction by 2050 target is needed in order to continue driving greenhouse gas emissions reductions into the future, even after considering existing policies; this would involve a reduction in diesel, fossil gas, and gasoline usage.
    - Meeting emissions targets increases the average costs of New Jersey's total annual energy system from 3.5% to 3.7% of GDP by 2050.
        - Includes supply-side capital costs, incremental demand-side equipment, fuel costs, and operations and maintenance costs.
    - Incremental costs of meeting emissions targets are offset by fossil fuel cost savings and cost savings associated with reduced pollution.
    - The Least Cost Scenario involves building electrification, assuming a 90% electrified building sector by 2050.
        - Industrial processes demand assumes continued gas fuel use and 10% non-electrified space and water heating loads.
        - Includes the consideration that functioning equipment would not be replaced with new technologies, but rather would be replaced once it no longer works.
    - Variation 3 Scenario involves retaining gas in buildings, meaning no electrification of residential and commercial buildings and an increased reliance on higher cost carbon-neutral fuels to achieve emissions reductions.
        - By 2050, total energy demand is 20% higher than Least Cost Scenario
        - Transportation industry is assumed to have to purchase expensive biofuels in order to offset higher GHG emissions.
        - Costs are 50% higher than the Least Cost Scenario relative to the Business as Usual Scenario.
        - Further emissions becomes increasingly expensive due to existing gas infrastructure by 2050 being difficult to replace.
- **The Case for Building Electrification**
    - The case for building electrification is many-fold: reduced stranded assets, increased energy efficiency, increased financial savings, and increased increased flexibility to achieve emissions goals.
        - If you don't decarbonize the buildings that are easiest to decarbonize, then you will be losing out on real long-term emissions reductions.
        - Natural gas infrastructure creates stranded assets that locks in decades of costs and continued emissions due to the difficult in replacing invested infrastructure, including building appliances and gas pipelines.

        - Heat pumps are already more energy efficient than fossil fuel technologies and thus more cost-effective.
        - Building electrification is the most cost-effective path to emissions reductions beyond current goals because it adds fuel flexibility and reduces total energy consumption.
- **EMP Strategy 4: Reduce Energy Consumption Emissions from the Building Sector**
    - Building sector strategies can focus on:
        - Electrify state facilities.
        - Partner with private industry to establish electrified building demonstration projects.
        - Expand and accelerate the current statewide net zero carbon homes. incentive programs for both new construction and existing homes
        - Study and develop mechanisms and regulations to support net zero carbon new construction.
        - Develop electric vehicle-ready and demand response-ready building codes for new multi-unit dwelling and commercial construction.
    - Start the transition to electrify existing oil and propane-fueled buildings.
        - Incentivize transition to electrified heat pumps, hot water heaters, and other appliances.
        - Develop a transition plan to a fully electrified building sector.
- **Questions**
    - Delegate Lorig Charkoudian: Maryland has natural gas infrastructure investments on the Eastern Shore. There is a need for more analysis on biogas availability and strategic thinking. Question: Was there tension on these strategies?
        - Hannah Thonet: Small businesses for propane and oil providers were afraid that this strategy would take away their jobs but the plan is not aiming to do that. The aim is to decarbonize in a cost-effective way. When you lean on biogas, you lose on the possibility of building a long-term efficient and flexible electricity grid. Biogas may not be rare but it is in limited supply. The economics of biogas adoption does not work out on a broader scale.
    - Melissa Adams (Washington Gas): Interested in reliability of energy during cold weather since WGL has found that in Washington D.C. natural gas can deliver more energy than the electricity grid.
    - Ellen Valentino: If there is a mass outage of electricity and there is no secondary energy market, what happens?
        - Hannah Thonet: There are several approaches to decarbonization of the building sector and emergency situations would present unknown challenges.

        - Dave Lis: Temporary blips would need to be managed as they come up
    - David Smedick: There is a strong need to look into low-income affordable housing recommendations and stranded asset risks.
        - Hannah Thonet: Low-income housing tends to be extremely inefficient and can lead to indoor air pollution. There are programs and projects that can address this, such as community solar projects or pilot programs.

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