DRAWDOWN GA

BUILDINGS & MATERIALS

RECYCLING / WASTE MANAGEMENT

REFRIGERANT

RETROFITTING

RETROFITTING

OVERVIEW OF A HIGH-IMPACT DRAWDOWN SOLUTION

Buildings use electricity and natural gas for heating, ventilation and cooling (HVAC), water heating, lighting, and to power appliances and electronic devices. Retrofitting existing buildings to reduce energy demand can lower the GHG emissions due to these energy uses. This solution considers several key retrofitting options:

- Improving insulation/air sealing of existing buildings
- Replacing conventional lighting with LED lighting in both residential and commercial buildings
- Replacing conventional HVAC systems and gas- and oil-fired furnaces with high-efficiency heat pumps
- Installing water-saving devices such as low-flow fixtures and efficient appliances
- Replacing conventional thermostats with smart thermostats
- Using automated control systems in existing commercial buildings that can regulate heating, cooling, lighting, appliances, and more to maximize energy efficiency
- Using alternative roof designs such as green roofs, which line a roof with soil and vegetation, as well as cool roofs, which reflect solar energy to reduce a building's electricity demand and therefore reduce emissions

In addition, solutions that were not originally considered by Project Drawdown®, including replacing conventional windows and water heaters with high-efficiency units, recommissioning / retro-commissioning of existing commercial buildings, and dead band range expansion / human factors will also be considered under the Retrofitting bundle for the Drawdown Georgia project.

TECHNOLOGY AND MARKET READINESS

The technologies are mature and market ready, innovations continue to improve efficiency of retrofitting technologies. Historically in Georgia, retrofitting rates have been relatively low due to market barriers including high upfront costs, information asymmetry, transaction and administrative costs, and split/misplaced incentives and subsidies. However, policy improvements could make the solution workable by 2030.

LOCAL EXPERIENCE AND DATA AVAILABILITY

There is state-level data available for some solutions, and nationwide data available for many of the solutions that can be projected down to the state level. There is ample local experience available with retrofitting projects (both commercial and residential) in the state. There are also several state-level studies (including one performed by Nexant for Georgia Power) highlighting the cost-effective energy savings potential of retrofitting in Georgia.

TECHNICALLY ACHIEVABLE GHG REDUCTION POTENTIAL

Preliminary analysis based on NEMS data as obtained from EIA's Annual Energy Outlook 2018 (reference case vs. new-efficiency case, with U.S. level results proportioned for Georgia), suggests that many of the individual solutions do not necessarily meet the threshold of 1 Mt CO2 annual reduction. However, strategic combination of technologies (for both residential and commercial sectors) as part of a retrofit bundle can provide CO2 reduction potential well beyond the 1 Mt threshold. The CO2 reduction potential can be further increased by promoting replacement strategies that favor more efficient solutions relative to the baseline alternatives for technologies that have reached end-of-life and are in need to replacement.

COST COMPETITIVENESS

Review of literature and expert survey feedback indicate that the individual solutions that make up a retrofit are typically cost-effective, with heat pumps being potentially not cost effective depending on the type of retrofit (Nadel & Ungar, 2019). However, the bundles can be selected with emphasis on cost-effective solutions, and highly cost-effective solutions like smart thermostats and LED lighting can be used to offset less cost-effective solutions like heat pumps. We will explore Georgia-specific cost effectiveness during the next phase of research

BEYOND CARBON ATTRIBUTES

According to the 2017 American Housing Survey, Georgia has an estimated 4.2 million homes, with 2.8 million of these being single-family detached residential units [4].

The greatest social benefits from the implementation of retrofitting can be seen through air quality improvements [5]. These improvements are a result of an increase in energy efficiency and reduction in energy demand from residential and commercial buildings [6,7,8]. Improved building health can lead to increased productivity and lower absenteeism particularly in commercial buildings and office environments. However, Atlanta ranks fourth highest in median energy burden levels and third highest among low income household populations compared to other major cities in the United States [3]. This indicates that there is a "beyond energy" benefit to retrofitting residential homes to decrease economic hardship of families [4]. However, access to retrofits is often cost-prohibitive for low income communities without external financing and support. Without inclusion of lower income residents, retrofitted home value increases can contribute to neighborhood gentrification and a reduction in affordable housing [9].

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RECYCLING & WASTE MANAGEMENT

OVERVIEW OF A HIGH-IMPACT DRAWDOWN SOLUTION

Recycling can reduce GHG emissions because recycling is often less energy intensive than producing new items. This solution considers increases in recycling at the household level; increases in industrial and commercial recycling; and a focus on increasing paper recycling.

TECHNOLOGY AND MARKET READINESS

The technologies used in Recycling / Waste Management are mature and market ready. According to Project Drawdown®, Europe achieves paper recycling rates as high as 75% and the United States currently achieves paper recycling rates of 66%. Other recyclable materials have commercial and market presence in the United States including plastics (8%), glass (27%), and aluminum (50%) [1].

LOCAL EXPERIENCE AND DATA AVAILABILITY

There are state-level data available (Beck, 2005) on the amount of recyclable waste (paper, plastics and metals), though the data are somewhat dated. There are also more recent U.S.-level data available through the EPA [2]. The City of Atlanta and many other cities in Georgia have active recycling programs. Other organizations, such as the Center for Hard to Recycle Materials (CHARM) highlight innovative partnerships to improve recycling rates by using information provision programs and facilitating the procurement of high-quality recyclable materials. Plastic recycling start-ups such as Nexus LLC demonstrate opportunities for commercialization of plastic recycling in Georgia.

TECHNICALLY ACHIEVABLE GHG REDUCTION POTENTIAL

The GHG reduction potential is high. According to a 2005 municipal solid waste (MSW) composition study by the Georgia Department of Community Affairs (Beck, 2005), Georgians annually throw away approximately 1.9 million tons of paper, 1 million tons of plastics, 0.36 million tons of metal and 0.24 million tons of glass. This study also indicated that Georgia generally lags behind the United States in terms of recycling rates, especially in paper recycling.

Significant energy savings can be achieved by more widespread recycling. For example, one ton of recycled plastic saves approximately 5,800 kWh or energy [2]. Preliminary analysis using assumed current recycling rates equal to the U.S. averages for different recyclable materials and increasing to 65% for plastics, glass and metals and 90% for paperboard by 2030, indicates carbon reduction potential greater than the 1 Mt CO2 threshold.

COST COMPETITIVENESS

This bundle may not be a highly cost-competitive solution, based on global Project Drawdown® estimates. In addition, current market conditions are not necessarily favorable for increased recycling (e.g., abundance of cheap natural gas in the United States has formed an economic barrier against increased plastics recycling). We will explore Georgia-specific cost effectiveness during the next phase of research.

BEYOND CARBON ATTRIBUTES

Co-benefits: Benefits from this solution relate to environmental and public health from the improvement in air quality and water quality associated with waste diversion from landfills. Additional benefits would likely emerge from the creation of jobs associated with expanded/upgraded recycling services [4,5]. Moreover, establishing alternative waste management and recycling programs could create a steady supply of recycled materials that could be used in promoting new business and construction startups, products, and services (for example, the use of recyclable plastics in house insulation or reclaimed fibers in new textiles and clothes). This could foster the creation of new local economies for recycled/reclaimed products, that would promote jobs and local economic development [6].

Co-costs: There are concerns relating to the siting of additional recycling facilities which may be disproportionately located in low-income communities, negatively impacting air quality and in turn would negatively impact property values in those areas [7].

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REFRIGERANT MANAGEMENT

OVERVIEW OF A HIGH-IMPACT DRAWDOWN SOLUTION

Hydrofluorocarbons (HFCs) are chemicals used to cool refrigerators and air conditioners. They are also an extremely potent GHG. Efforts to control leakages and replace HFCs with alternative refrigerants and to properly dispose of and recycle existing HFCs would lower GHG emissions.

TECHNOLOGY AND MARKET READINESS

The technology is mature and market ready. The high global warming potential of refrigerants (as much as 22,800 CO2-e) means that there are large opportunities available for reducing the emissions of refrigerants. Evidence from the EPA's Green Chill program and evidence from other corporate programs that improve refrigerant management or implement alternative refrigerants suggests that substantial reductions of refrigerant emissions are possible at relatively low cost [1]. Project Drawdown® calculates that globally, only 2.7% of refrigerants are destroyed or recycled at end of life [2]. Their technical potential assumptions suggest that nearly all refrigerants can be eliminated from developed countries. Further, the Kigali Accord of 2016 aims to phase out many synthetic refrigerants and move towards less harmful alternatives, suggesting significant political momentum aimed at reducing refrigerants.

LOCAL EXPERIENCE AND DATA AVAILABILITY

There is state level data available from EPA on emissions resulting from ozone depleting substance (ODS) substitutes, and leak rates for refrigerants can be approximated based on EPA guidelines. Local experience is also available; for example, Atlanta-based Coca-Cola Company has been switching to HFC-free natural refrigerants in their new cold-drink equipment, with stated plans to be 100% HFC-free by 2020. That said, there is little information about specific initiatives and strategies in Georgia to address refrigerants. It is assumed that technological and managerial strategies that exist globally are also available in Georgia.

TECHNICALLY ACHIEVABLE GHG REDUCTION POTENTIAL

The GHG reduction potential is high. According to EPA's 2016 Revised Section 608 - Refrigerant Management Regulations, the allowable leak rates of refrigeration and air-conditioning equipment containing 50 or more pounds of refrigerant was lowered from 35% to 30% for industrial process refrigeration, 35% to 20% for commercial refrigeration and 15% to 10% for comfort cooling equipment, effective January 2019 [3]. Preliminary analysis using these leak rates as a current baseline and EPA's ODS substitutes emissions data for Georgia [4] indicates that reducing the leak rates slightly below the new EPA guidelines by 2030, and to 5% or less by 2050 (similar to the targets specified by EPA's GreenChill program), can result in a reduction significantly greater than the 1 Mt CO2-e annual reduction threshold.

COST COMPETITIVENESS

While there are ambitious national and international goals for improving refrigerant management, there are unclear economic incentives in place to accomplish these reductions. Refrigerants are highly distributed through a wide range of industrial, commercial and residential applications. Further, the strategies for reducing refrigerant leakage are highly distributed as well, with strategies relating to the reduction of usage of appliances that use refrigerants; the improved efficiency of these appliances; replacement of refrigerants; the improved management and operation of refrigerants; and improved collection and destruction of refrigerants at end of life. One challenge of estimating costs is that Project Drawdown® notes a lack of information on the costs of improving refrigerant management – and in particular any increases in operational costs in order to reduce leakage, switch to natural refrigerants, or improved efficiency of appliances [2]. Project Drawdown® relies solely on estimated costs of the safe disposal of existing refrigerants. Without clear economic incentives to improve refrigerant management, the cost-effectiveness of solutions is uncertain, and there are mixed results on cost-effectiveness of this solution based on global Project Drawdown® estimates and abatement curve data (e.g., McKinsey abatement curve). We will explore Georgia-specific cost effectiveness during the next phase of research.

BEYOND CARBON ATTRIBUTES

Reducing refrigerant leakage and replacing HFCs with HFC-free alternatives have beyond carbon benefits mainly in the form of improved air quality, which consequently leads to improved public health in the surrounding areas [5]. Improved cooling systems for residential communities would also help to reduce energy bills as HVAC costs account for a large portion of utility bills. A cost of the solution is retraining programs for HVAC professionals to promote HCF free refrigerants [6], and the development of proper installation and disposal procedure as these alternative refrigerants are still chemical agents [7].

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