Blueprint for Accelerating On-Site Emissions Reductions Fact Sheet

North Central Texas Council of Governments

Introduction

In 2024, the Department of Energy released Decarbonizing the U.S. Economy by 2050.[1] This plan aims to reduce building carbon dioxide equivalent emissions by 65% by 2035 and 90% by 2050. The blueprint outlines four strategic objectives:

1. Increase Building Energy Efficiency
2. Accelerate On-Site Emissions Reductions
3. Transform the Grid Edge
4. Minimize Embodied Life Cycle Emissions

This fact sheet will summarize **Strategic Objective #2: Accelerate On-Site Emissions Reductions.**

NCTCOG produced another factsheet on Strategic Objective 1: Increase Building Energy Efficiency, this can be found on the Conserve North Texas website.[2]

Why Reduce On-Site Emissions?

On-site emissions come from inside the building, such as propane appliances. Appliances that produce on-site emissions emit significantly more ozone precursors, such as nitrous oxides (NO_x), compared to electric alternatives. As the power grid becomes less emissions intensive, it becomes increasingly important to reduce on-site emissions from traditional fuel combustion, refrigerants, and other fluorinated gases, as they will be responsible for an increasing amount of total building emissions.[3] Reducing on-site emissions will improve indoor air quality, reduce construction costs, and insulate the consumer from fuel price fluctuations.

The North Central Texas Council of Governments' 2050 Forecast for the DFW Area expects the population to increase from 7,528,004 in 2019 to 12,297,156 by 2050.[4] The population growth will result increased use of gas appliances, which contributes to the large portion of precursors for ground-level ozone produced by area sources.[5]

Performance Target: *Reduce on-site emissions in buildings by 25% by 2035 and 75% by 2050 vs. 2005*

To achieve the 2035 and 2050 goals, the Blueprint recommends key strategic measures, including the electrification of space and water heating, and reduction of fugitive emissions.

On-Site Emissions Fast Facts

- Gas appliances in U.S. buildings emit twice as much NOX as gas power plants.
- 17% of on-site emissions come from fluorinated gases.
- Space and water heating make up half of building site energy use and 90% of on-site emissions.
- Approximately 60% of homes in Texas use electricity as their primary heating source.

Key Strategic Measures:

The Blueprint presents the following key measures to decrease on-site emissions.

Measure I: *Electrification of Space/Water Heating*

- Transition to electric heat pumps, including air-source and ground-source heat pumps.
- Promote the adoption of heat pump water heaters to replace conventional gas or electric resistance water heaters.
- In Texas, using a heat pump can save an average of 2,535 kWh of energy annually per home.[6]

Measure II: *Reduction of Refrigerant Emissions*

- Implement best practices for refrigerant management, including regular maintenance and leak detection.
- Transition to low global warming potential (GWP) refrigerants in heating, ventilation, and air conditioning (HVAC) systems.

1. https://www.energy.gov/eere/articles/decarbonizing-us-economy-2050
2. https://www.conservenorthtexas.org/
3. https://www.energy.gov/eere/articles/decarbonizing-us-economy-2050
4. https://www.nctcog.org/getattachment/c2beea0e-a7a1-4111-a889-d53ece0feee3/2024-11-COMPLETE-Agenda.pdf?lang=en-US&ext=.pdf
5. https://www.tceq.texas.gov/airquality/areasource/emissions-sources-charts
6. https://www.aceee.org/sites/default/files/pdfs/transforming_texas_-_how_heat_pumps_can_replace_electric_resistance_heat_reducing_costs_and_winter_power_peaks.pdf

Barriers to Reducing On-site Emissions:

Barrier I: *Insufficient Local Electrical Capacity*

For potential adopters of the above measures, electrical infrastructure upgrades can be costly in time and money, disincentivizing the adoption of upgrades unless absolutely necessary. While newer, lower- power appliances are being brought to market, they are not well known. These appliances could support the electrification of appliances, heat pumps, and water heaters without needing electrical improvements. Another way to avoid needing to upgrade electrical infrastructure is to adopt energy efficiency measures, as outlined in Objective 1 of the Blueprint.

Barrier II: *Cold Climate Performance*

Large buildings with high heating demands (ex: high-rise office buildings) may require backup electric or fossil fuel heaters to assist heat pumps in the case of extreme cold snaps, like the 2021 Winter Storm Uri.

Electrical and fossil fuel backups can have negative impacts which should be considered. For example, the need for electrical assistance can potentially lead to increased energy inefficiency and peak demand, while fossil fuel backups increase on-site emissions from fugitive gases (i.e. unintended gas releases from equipment or industrial processes).

Barrier III: *Upfront Costs for Equipment*

The upfront costs of purchasing and installing highly efficient equipment is often higher than conventional equipment. This can be a barrier for some, despite the lifetime savings from the more efficient equipment offsetting the upfront costs.[7]

Barrier IV: *Fragmented Market and Risk-Averse Practitioners*

There are 124,000 active independent HVAC contractors in the United States. Without any standards for training, installation, or pricing on heat pump projects, the market has become fragmented. Lack of familiarity and experience with heat pump sizing and installation adds to installer uncertainty and fear, such as more frequent issues that eat into thin profit margins.

Barrier V: *Lack of Product Awareness*

Potential adopters can lack familiarity with modern heat pump technology, which undermines adoption.

Barrier VI: *Concerns About Ultra-Low GWP Refrigerants*

Conversion of existing systems to use new refrigerants may require costly system redesign and the use of new tools and techniques. Further disincentivizing the conversion, some lower GWP refrigerants have higher flammability or toxicity ratings, and may not have been tested in real world applications.

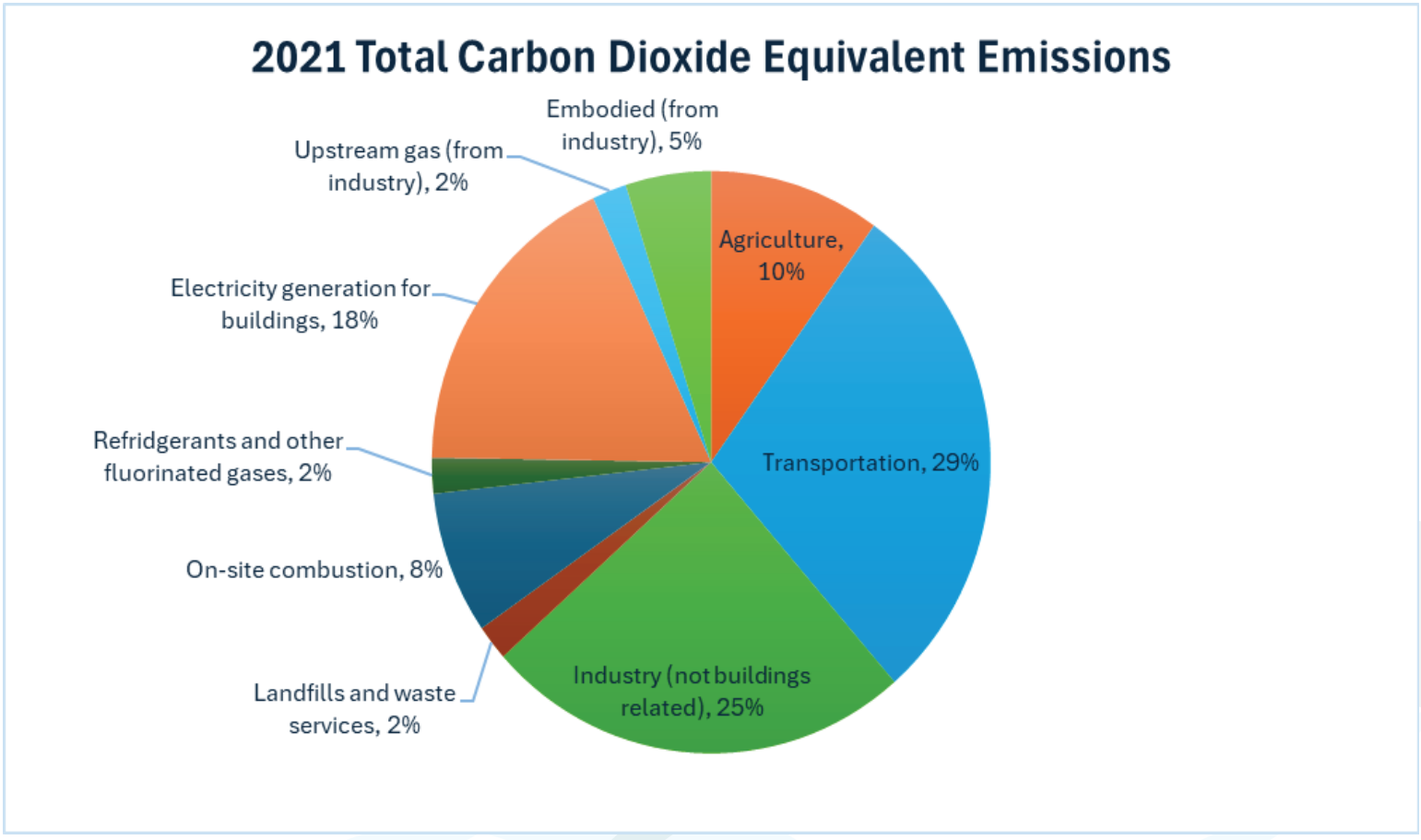

Figure A National Carbon Dioxide Equivalent Emissions from 2021[8]

7. https://www.aceee.org/sites/default/files/pdfs/transforming_texas_-_how_heat_pumps_can_replace_electric_resistance_heat_reducing_costs_and_winter_power_peaks.pdf
8. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021

Technical Solutions for Building Emissions Reductions

Solution I: *Energy Efficiency and Efficient Electrification*

As outlined in the fact sheet on Objective 1 of the Blueprint, energy efficiency upgrades can massively reduce building emissions.

In addition to traditional energy efficiency upgrades, the conversion to electric alternatives can greatly reduce building emissions. Using highly efficient electric upgrades can prevent the electrification from overwhelming the grid.

Solution II: *Low Global Warming Potential (GWP) Refrigerants and Other Fluorinated Gases*

By adopting low-GWP (<150 GWP) refrigerants, improving methods of detecting refrigerant leakage and, enhancing maintenance practices, entities can ensure emission reductions from electrification are not offset by the fugitive emissions. For more information on the transition to low GWP refrigerants see the Environmental Protection Agency's information about substitutes.

Actions State and Local Governments Can Take to Increase Building Energy Efficiency

The blueprint outlines various options that state and local governments can take in aiding in the reduction of building emissions.

Action I: *Set Building Codes and Performance Standards*

- Adopt and enforce building codes and/or performance standards to ensure new buildings are designed to be energy efficient.
- Set appliance efficiency standards.

Action II: *Champion Policy to Increase Investments*

- Champion utility rate reform and infrastructure subsidies to support adoption of emissions reducing technologies.
- Reform zoning regulations to reduce barriers to implementation.

Action III: *Adopt Clean Heat Standards for Utilities*

- Champion utilities adopting low-carbon hydrogen, addressing methane leaks, and weatherization, to reduce emissions and establishing long-term energy savings targets.

Milestones to Accelerate On-Site Building Emission Reductions

The milestones below, in Figure B., relate to technology, the market, and policies that support the goals of accelerating on-site building emission reductions across the U.S.

To further assist in this endeavor, the cross-cutting goals are designed to work alongside the strategic objectives and guide them along the 2050 vision.

Conclusion

Achieving the on-site emissions reduction targets laid out by the blueprint will require a coordinated effort from both the public and private sector to convert to non-fossil fueled systems and to systematically address fugitive emissions.

Cross Cutting Goals

These goals are designed to work with the Strategic Objectives and help achieve the 2050 vision.

Affordability

- Providing customer savings by reducing building energy demand.
- Tapping into energy efficiency measures early rather than waiting for equipment to fail.
- Utilizing state and federal funding to help with the high up-front costs.

Resiliency

- Increasing energy efficiency and resiliency of buildings to withstand or recover from disasters, outages, and extreme weather.
- Improving the structural durability and thermal resiliency by upgrading building envelopes.

Objective 2: Accelerate on-site emissions reductions	
By 2035	**By 2050**
· Model codes for electric-ready and all-electric buildings are widely available, with technical support for adoption.	· Heat pumps supply over 90% of residential and small commercial heating and water heating sales, and over 75% for large commercial installations.
· Over 90% of air conditioners sold provide heating (e.g., heat pumps).	· No new fossil-fueled district steam systems are built; all existing systems are converted to renewable sources.
· Heat pumps reach 75% of space heating and 25% of water heating sales.	· 75% of installed building equipment uses refrigerants with GWP<150.
· 120-volt appliances become common.	· All federal buildings achieve zero on-site fossil fuel emissions.
· Low-GWP (<10) refrigerant equipment for buildings is widely available.	· Low-GWP blowing agents are standard for foam insulation and air-sealing products.
· HFC use drops 85% relative to 2011–2013 levels.	

Figure B *Milestones to accelerate on-site emissions reductions*