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AUTUMN 2022

The Future of Decarbonization in Chicago

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The Future of Decarbonization in Chicago

With buildings responsible for approximately 40% of CO₂ emissions globally¹, reducing the greenhouse gas (GHG) emissions of buildings has become a focus for government efforts (State, Local, & Municipal) to address the impacts of climate change. Over the next several decades, as policy makers and regulators continue to increase efforts to require decarbonization and electrification through increasingly stringent code and building performance standards, a proactive approach to address decarbonization will be necessary for building owners and managers to be ready for these changes.

A plan to address building decarbonization can reduce building emissions while providing comfort to building occupants, decreasing operational costs and creating more resiliency in building systems. Additionally, according to a study by the U.S. Department of Energy², high performing buildings demand higher rental rates and have higher occupancy rates; and resulting in increased sale prices.

In 2021, The City of Chicago convened the Building Decarbonization Working Group, a consortium of industry professionals tasked with providing the City of Chicago recommendations regarding building decarbonization. Recommendations are expected in 2022, signaling the next step in local decarbonization efforts. With this in mind, building owners and managers should evaluate their buildings now to add value to their properties and to avoid potential future fees or special assessments related to likely decarbonization laws.

Decarbonization and Electrification:

Decarbonization refers to the reduction of greenhouse gas (GHG) emissions in the manufacturing/transportation of building materials, building construction, building operation, and building end-of-life cycle. The GHG emissions associated with the manufacturing/transportation of building materials, building construction, and end-of life are commonly referred to as Embodied Carbon. The GHG emissions associated with operating and maintaining a building are commonly referred to as Operational Carbon. Operational Carbon will be the focus of the decarbonization laws discussed in this article. GHG emissions are measured in CO₂ equivalent (CO₂e). CO₂e is a common unit that describes the equivalent amount of CO₂ that a metric ton of a given GHG would emit.

Electrification is commonly discussed when talking about decarbonization. Electrification refers to the conversion of onsite natural gas or fuel fired equipment to electric equipment. Although electrification is a key component of decarbonization, they are not the same. Successfully reducing emissions through electrification will depend on how much the grid relies

on carbon to generate electricity. Grids that rely more on natural gas or coal will have a high CO₂e value whereas a grid that contains only renewable energy will have a CO₂e value of zero. Thus, a building can fully electrify its heating, cooling, and ventilation systems but still have carbon emissions associated with operating on a particular electricity grid. For this reason, Decarbonization and Electrification efforts across state, local, and municipal levels are commonly paired with reducing and removing natural gas, coal, and/or other fuels from the electricity grid.

Decarbonization in Other US Cities

The Intergovernmental Panel for Climate Change (IPCC) has issued several reports on the state of climate change and the actions needed to limit global warming to 1.5 degrees Celsius. In 2015, The Paris Agreement, a legally binding international treaty on climate change, committed 196 Parties – including the United States -- to limit global warming to 1.5 degrees Celsius by mid-century or 2050. With climate action stalled at the Federal level, many municipalities have nonetheless committed to the Paris Climate Agreement and have begun creating Climate Action Plans to address global warming through various measures including decarbonization and electrification³. For example, Boston, Denver, New York City, and Washington D.C., have all enacted new laws requiring energy reduction, decarbonization, and in some cases electrification, while many other cities are in the process of passing similar laws. Below are a few highlights of the decarbonization laws of the cities just mentioned.

Boston » BERDO 2.0 (Building Emissions Reduction and Disclosure)⁴ – Boston's BERDO law requires all buildings with 20,000 square feet or more to adhere to a series of emissions targets beginning in 2025 and leading to zero carbon emissions in 2050. Penalties range from \$150-300/day for reporting failures and \$300-\$1,000/day for emissions failures.

Denver » Energize Denver⁵ – This bill establishes energy use intensity (EUI) limits, typically measured as (kbtu/sq.ft/year), that seek 30% total energy savings across all building types

greater than 25,000 square feet in Denver by 2030. Included in this bill are timelines to electrify building components. Energy performance targets are set for 2024, 2027, and 2030. Electrification requirements begin as early as 2025.

New York » Local Law 97 (LL97)⁶ – LL97 sets emissions limits that become more stringent in 5-year periods starting in 2024 for buildings greater than 25,000 square feet. Financial penalties for buildings that do not meet the emissions limits are \$268 per metric ton (1000kg of CO₂e) out of compliance.

Local Law 154 (LL154) – LL154 bans natural gas in new buildings (<7 stories) beginning in December 2023 and new buildings (>7 stories) beginning in 2027.

Washington D.C. » The Clean and Affordable Energy Act⁷ – New building energy performance standards (BEPS) will have buildings meet one of several compliance pathways to reduce source EUI and/or reduce energy use of its buildings. Three reporting periods, that update every 6 years beginning in 2021, will be utilized and will expand from buildings over 50,000 square feet in BEPS Period 1 down to buildings over 10,000 square feet in BEPS Period 3.

Decarbonization in Chicago

In 2022, Chicago released their Climate Action Plan (CAP)⁸. Chicago's plan is to reduce GHG emissions by 62% when compared to 2017 levels. Currently, buildings account for approximately 70% of total citywide emissions. The Chicago CAP states "building decarbonization provides the greatest opportunity to reduce the city's emissions." Two strategies relevant to this article are to retrofit and improve existing buildings and enable electrification.

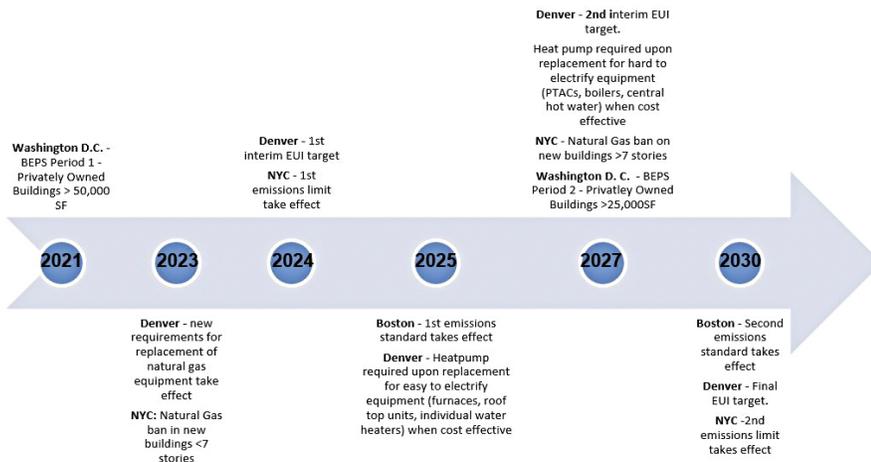
For retrofitting existing buildings, the Chicago CAP includes:

- Retrofit residential buildings with 4 or fewer units: 20% by 2030 and 50% by 2040 prioritizing low-or moderate-income households
- Retrofit 20% of all 5+ story buildings by 2030
- Retrofit 20% of total industrial buildings by 2030
- Retrofit 90% of total City-owned and sister agency-owned buildings by 2035
- Retrofit 20% of total commercial buildings by 2035

For electrification, the Chicago CAP includes:

- Enacting policies that support electrified renovations and new construction by 2023

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High Rise Residential	
Built	1961
Floors	20
Gross SF	225,000
annual kWh (2020)	410,661
Annual therms (2020)	221,754
Annual kBtu (2020)	22,170,078

NYC LL97 Calculation	
ton CO2e (kWh)	118.67
ton CO2e (kBtu nat gas)	1,177.45
Total ton CO2e	1,296.12

Building Type (NYC)	
	R-2
2024 Emissions limit (ton CO2e)	1,518.75
Current Building Emissions (ton CO2e)	1,296.12
2024 Result	Compliant
2030 Limit (ton CO2e)	915.75
2030 Result	Not Compliant
2030 Penalty	\$101,938.69

Impact of NYC LL 97 on an Example Chicago Building¹

¹For these calculations, the 2030 GHG coefficients are not yet published in LL97 so the 2024 GHG coefficients were applied. It is expected that the 2030 GHG coefficients for electricity will be lower as decarbonization of the electricity grid in New York advances, potentially lowering financial penalties presented.

building, supporting their function for a defined set of years, and reducing operational and energy costs for all stakeholders. Improving building operation, comfort, and energy efficiency should be the long-term goal of the Strategic Master Plan. Additionally, decarbonization and electrification should be addressed with both short-term and long-term goals to ensure that a building can practically prepare for building decarbonization requirements that are likely to be enacted.

The Strategic Master Plan should include recommendations and budgetary estimates for critical needs, energy conservation measures, and future considerations. With decarbonization and electrification requirements increasing around the United States, the recommendations below should be prioritized by critical needs as well as local requirements. Replacements and retrofits should consider emissions impacts to account for future building performance.

Recommended Actions for Critical Needs

Recommended Actions for Critical Needs typically address essential needs of the building and are driven primarily by occupant comfort and equipment reliability. Measures identified under this category often are vital to sustain the systems and infrastructure serving the building and therefore, take the highest priority. For example, replacement of a central heating or cooling plant operating beyond its expected service life is a common measure included under this category as the risk of failure is high and could result in a substantial service interruption to building occupants.

Decarbonization and Electrification Timelines for Boston, Denver, New York City, and Washington D.C.

- Electrify 30% of total existing residential buildings by 2035
- Electrify 20% of total existing industrial buildings by 2035
- Electrify 10% of total existing commercial buildings by 2035
- Electrify 90% of total existing City-owned buildings by 2035
- Enable net-zero-carbon construction by 2040

As mentioned previously, Decarbonization laws are commonly paired with laws that require the removal of natural gas, coal, and other fuels from the electricity grid. It is important to note that in 2021, Illinois passed the Climate and Equitable Jobs Act (CEJA)⁹. This act will require the electricity grid in Illinois to contain 50% renewables by 2040 and to be 100% carbon free by 2045. These requirements will be critical for buildings to achieve decarbonization through electrification efforts.

As previously mentioned, the City of Chicago convened the Building Decarbonization Working Group in 2021¹⁰ to develop strategic building decarbonization recommendations with a report expected in 2022. Historically, because Chicago has followed closely in New York City’s footsteps when it comes to building performance standards, it is reasonable to expect that over the next several years, Chicago will adopt decarbonization guidelines similar to those of New York City’s.

Therefore, due to nearly certain future decarbonization and electrification requirements for buildings within the City of Chicago, additional planning and considerations should be taken by building owners and managers to meet new emissions limits and to avoid any associated financial penalties. To provide some context for possible monetary impacts of non-compliance, the table below shows the impacts of NYC’s LL 97 emissions limits on a typical 1960’s era Chicago condominium if specified reduction targets are not achieved by 2030.

By comparing LL97 emissions limits to a typical Chicago high rise condominium, it is clear that the financial penalty for failing to meet the emissions limits as defined in LL97 by 2030 can

be significant. Due to the relatively large volatility in material, equipment and labor pricing amid the current global supply chain crisis, early planning is critical to design, bid, and implement projects ahead of expected compliance deadlines. Fortunately, there are clear steps building owners and managers can take to prepare for and mitigate any potential penalties while improving the value of the building and spreading out the costs of compliance.

How can building owners and managers prepare now?

Preparing for building decarbonization now can help building owners and managers mitigate costs and risks associated with decarbonization requirements adopted by government agencies. Benchmarking, energy audits, and proper budgeting will all play important roles to ensure buildings are prepared.

Benchmarking is required in Chicago and Evanston in Illinois. Benchmarking requires yearly submission of a building’s energy and/or water use to the municipality (commonly through EPA’s Portfolio Manager tool) to compare a building’s performance with similar buildings. A critical first step for decarbonization is to understand a building’s current performance as measured by EUI or other performance metrics obtained through benchmarking.

The next step building owners and managers should do to prepare for decarbonization is to create or update building master plan documents. An existing energy audit or master plan can be quickly updated to account for decarbonization and to prioritize measures to meet emissions targets. Additionally, upcoming reserve expenditures and scheduled equipment replacements should be re-evaluated to determine the impact of potential decarbonization and electrification ordinances.

If a building does not have an energy audit or master plan, they should have an Energy Audit performed by a Qualified Individual or firm. A building Energy Audit will inform an effective Strategic Master Plan that centers on specific objectives identified by Ownership in collaboration with their engineering team that focuses on sustaining the systems serving the

Energy and Water Conservation Measures

Energy and Water Conservation Measures are primarily based on reducing energy and water usage, enhancing equipment performance, and minimizing carbon footprint. Examples for this category include implementing demand-controlled ventilation, variable speed operation, and smart controls and economizers for “free” winter cooling.

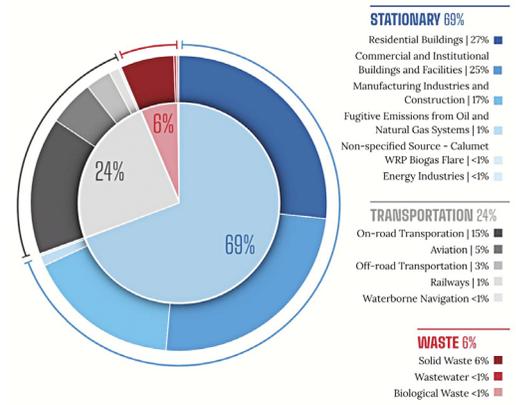
Future Considerations

Future Considerations typically include measures that are not vital to sustain the building systems and infrastructure but, can be implemented to further improve operational performance of the building. For example, improving changeover time of a dual temperature system is a measure that can be included under this category to increase operational flexibility

during shoulder months.

Conclusion

Although decarbonization and electrification codes and standards are becoming common and increasingly stringent, building owners and managers can prepare today with early strategic planning through benchmarking, energy audits, and proper budgeting. Strategic Master Plans should be updated or created with the added goal of evaluating decarbonization and building emissions in the short-term and long-term and to serve as a focused road map for building operations despite inevitable changes in building performance standards over time. The Strategic Master Plan’s initial cost is often realized in savings in a short period of time once projects identified within the master plan are implemented. 🍃



Chicago's Green House Gas Emissions Profile

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