

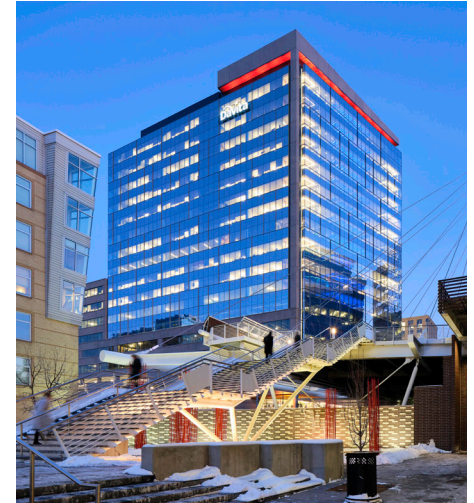
PORTFOLIO-WIDE DECARBONIZATION:

SCALING
SUSTAINABILITY FOR IMPACT

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WHY DECARBONIZING EXISTING BUILDINGS MATTERS

Despite decades of advancements in energy efficiency, buildings remain a major contributor to global carbon emissions, accounting for approximately 40% of total energy use worldwide. With continued development of the built environment, the industry must shift its focus toward decarbonizing the built environment to mitigate climate impact and align with evolving sustainability goals.

Eliminating greenhouse gas (GHG) emissions from the built environment is not only crucial in the fight against climate change, but also improves occupant comfort and indoor air quality. Beyond reducing emissions, decarbonization offers a wide range of benefits, including:

- Energy savings and operational cost reductions
- Greater social responsibility and sustainability leadership
- Lower indoor and outdoor air pollution
- Enhanced community health and well-being
- Increased property value and tenant appeal

Decarbonizing buildings is also essential for organizations seeking to achieve their publicly stated sustainability and ESG commitments. Additionally, as energy codes become more stringent and GHG reduction policies expand across the U.S., building owners must proactively monitor and decrease emissions to ensure compliance.



Legislation Driving Decarbonization

Governments worldwide are tightening regulations on building emissions, placing increasing pressure on owners to monitor, report, and reduce GHG emissions. In the U.S., policies such as Local Law 97 (NYC) and Washington State's Clean Building Performance Standard require significant improvements in energy performance. Many organizations have also set public net-zero carbon goals,

making building decarbonization a critical part of long-term sustainability strategies.

What does decarbonization of existing buildings mean?

Decarbonization, in the context of existing buildings, is the reduction of carbon emissions. This is achieved by implementing energy efficiency upgrades and by converting equipment and systems that run on fossil fuels to highly efficient alternatives using low-carbon or carbon-free energy sources.

This process addresses both operational carbon (from energy and water use during the building's operations) and embodied carbon (from material extraction, manufacturing, transport, and refrigerant leakage that occurred as a result of

constructing the physical building). Strategies to decarbonize buildings regularly include upgrading the building envelope, lighting, and systems, as well as electrifying HVAC, water heating, and appliances. Electrification is a key strategy, contributing to decarbonization when the electricity is from low-carbon sources or when new electric equipment is significantly more efficient.

The overall goal is to reduce a building's carbon emissions throughout its life cycle. This approach considers not only energy efficiency but also factors like healthy environments, sustainability, and economics. Benefits include lower operating costs, mitigated climate change impacts, improved occupant health, and economic advantages for communities.



DEVELOPING A PORTFOLIO-WIDE FRAMEWORK

Taking a portfolio-wide approach to decarbonizing buildings is crucial for owners managing multiple properties, as it allows for more strategic, efficient, and impactful emissions reduction efforts.

One key advantage is the ability to conduct assessments more manageably and cost-effectively. Instead of undertaking exhaustive and expensive detailed analyses for every individual building, a portfolio strategy allows for the selection of

representative buildings. The insights gained from these representative properties can then be extrapolated to project potential impacts and identify opportunities across the entire portfolio or within groups of similar buildings. This method ensures that sufficient information is gathered to guide decarbonization efforts without the need for a costly in-depth study of each asset.

Furthermore, a portfolio-wide perspective enables optimized sequencing and phasing of decarbonization measures. This involves considering not only the order of upgrades within a single building but also the timing of renovations across different buildings. Owners can strategically decide whether to implement specific measures, like lighting upgrades, across several buildings simultaneously or to concentrate on deep energy retrofits one building at a time. Such strategic planning considers factors like building locations, the costs associated with mobilizing contractors, timing of government ordinance requirements and overarching owner objectives and timelines.

This approach also facilitates more effective resource allocation and prioritization. When dealing with numerous buildings, developing various scenarios helps evaluate different phasing options against criteria such as decarbonization goals, available funding, and existing renovation plans. This leads to a more strategic deployment of resources and aids in making informed decisions about which buildings or projects to prioritize to achieve the most significant emissions reductions or meet specific targets.



Ultimately, a portfolio-wide strategy provides a holistic view of impact and goal achievement. By extrapolating building-level assessment results, owners can estimate the collective impact on energy savings, GHG emissions reductions, and operating costs across all their properties. This comprehensive understanding is vital for tracking progress towards broader decarbonization and sustainability objectives.

Finally, managing the implementation of decarbonization measures across a portfolio is inherently more complex than for a single building. A portfolio approach necessitates careful consideration of implementation sequences and schedules, which can influence both project costs and the success of energy and carbon reduction efforts. It allows for strategic decisions regarding the use of subcontractors and the timing of different types of retrofits, ensuring a more coordinated and effective rollout of decarbonization initiatives that align with capital improvement budgets.

Key elements to developing a strategic framework:

1. Engage Stakeholders
2. Determine Goals and Assets
3. Benchmarking and Inventory
4. Define Building Portfolio Categories
5. Determine Measures and Technology Packages
6. Prioritizing Measures
7. Timeline and Funding



ENGAGE STAKEHOLDERS



Engaging stakeholders is fundamental to the success of a building decarbonization project because various groups have a direct interest in the building's performance and the project's outcomes.

- **Buy-in and Financial Commitment:** Investors and owners are typically the first to be informed and approve projects due to the financial commitment involved. Their buy-in is essential.
- **Long-Term Success and Operational Efficiency:** Facilities support staff are critical for the project's long-term success. Gathering their input early and ensuring they understand the project's goals and any new operational requirements is key to achieving and maintaining efficient building operation and intended savings.
- **Economic Impact and Tenant Experience:** Investors, owners, and potentially customers (tenants or users) will experience the economic impact. While owners pay for the project, costs may be passed to customers.
- **Morale and Support:** Communicating the environmental benefits to employees and customers can boost morale and demonstrate a commitment to reducing GHG emissions.
- **Equity and Community Alignment:** Decarbonization can have social and economic impacts (e.g., changes in property values, rental rates, job creation). Engaging community stakeholders helps ensure projects align with community goals and needs. For buildings in disadvantaged communities or with unique equity circumstances, stakeholder engagement is vital to address



these factors and ensure targeted support or resources are utilized.

How to Engage Stakeholders:

The process of engaging stakeholders involves several key actions:

- **Initial Identification and Approval:** The process starts by identifying all relevant stakeholders. Investors and facilities support staff are typically informed first to secure project approval and gather critical operational input.
- **Targeted Communication and Education:** After initial approvals, broader communication is important. This can include:
 - Communicating environmental benefits to all stakeholders.
 - Assembling and disseminating information on the project.
 - Displaying posters in public corridors showcasing the

project scope and GHG emissions savings.

- **Understanding Priorities through Outreach:** Conducting stakeholder outreach is important to understand the circumstances and priorities of each group. This is especially crucial when upgrades are required to meet publicly stated performance targets, as additional support might be needed to address equity.
- **Addressing Equity Considerations:** Employing inclusive and community-centered approaches to gather feedback from diverse groups is recommended.
- **Defining Roles and Responsibilities:** Different stakeholder categories have distinct responsibilities. For example, Executive Leadership provides resources, Finance identifies financial metrics, Property Management provides building-level information, and ESG/Sustainability provides input on broader sustainability goals and risks. External occupants and community members can help address occupant concerns and collaborate on larger-scale efforts.

DETERMINE GOALS AND ASSETS



02

To determine and set decarbonization goals, the critical first step is to establish them with buy-in from building ownership and stakeholders. These goals should be based on clear driving factors, such as regulatory requirements, corporate sustainability objectives, tenant expectations or other market drivers.

As part of the goal setting process, owners must determine which buildings will be included or excluded in the decarbonization strategy. This process involves evaluating each building's energy consumption, operational characteristics, and potential for emissions reductions.

Buildings may be excluded due to specific constraints, such as feasibility limitations, historical preservation restrictions, or financial considerations.

The chosen goals should be tailored to the specific building or portfolio, reflecting ownership or stakeholder interests and strategic priorities. These may include long-term targets, such as achieving net zero emissions by a specific year, or interim milestones, like achieving a percentage reduction in emissions by a set date compared to a baseline performance year.

Additionally, setting these goals may require conducting a greenhouse gas (GHG) inventory or establishing a performance baseline to measure progress. This may be done as part of a broader effort to prioritize decarbonization actions across a portfolio, ensuring that efforts align with organizational objectives and available resources.

Establishing the justification for these goals is key. The goals should be grounded in data-driven analysis, stakeholder priorities, and compliance considerations. A well-defined and transparent approach to goal-setting and scope determination helps ensure long-term success and accountability in the decarbonization process.



BENCHMARKING AND INVENTORY

03



To establish a decarbonization baseline, a pre-retrofit analysis is required to evaluate energy use, water consumption, and GHG emissions. This includes calculating annual GHG emissions by multiplying energy use by grid emission factors. Emissions intensity is then determined by dividing total emissions by floor area. A GHG end-use balance further refines the analysis by estimating emissions by end use, helping identify reduction opportunities.

Developing energy-use profiles is essential. Tools such as annual heat maps reveal performance trends, peak demand periods, and seasonal patterns. Specific load profiles, which detail energy use for cooling, heating, hot water, and IT, support accurate equipment sizing and identification of heat recovery opportunities.

Finally, integrating water utility data is crucial, as water use directly affects GHG calculations. A clear, data-driven baseline enables decision-makers to set effective decarbonization goals and drive impactful sustainability strategies.

DEFINE BUILDING PORTFOLIO



For owners with large building portfolios, a strategic approach to decarbonization assessment involves categorizing buildings based on various characteristics. This method allows for the selection of representative buildings to analyze, making the process more efficient and targeted.

Grouping Buildings: Buildings can be grouped based on:

- Programmatic needs
- Geographic location
- System types (such as HVAC)
- Financial considerations
- Performance metrics

These factors help in identifying buildings that share similar attributes and operational requirements. For example, buildings in the same geographic location may face similar climate conditions, while those with similar HVAC systems may have comparable energy consumption patterns.

Specific Characteristics for Grouping: Characteristics used for grouping can include:

- GHG emissions intensity
- Total GHG emissions
- Site energy use intensity
- HVAC system type
- Climate zone
- Ownership structure
- Regulatory drivers

By considering these characteristics, owners can identify buildings that are likely to benefit the most from decarbonization efforts.

Once buildings are categorized, representative buildings from each group can be selected for more detailed study or energy audit. This approach allows for a thorough analysis of potential carbon reduction impacts, which can then be projected across the entire portfolio. By focusing on representative buildings, owners can develop targeted strategies that are likely to yield significant

carbon reductions and improve overall sustainability.

In summary, categorizing buildings based on various characteristics and selecting representative buildings for detailed analysis is an effective way to assess and implement decarbonization strategies across large building portfolios. This method ensures that efforts are focused on areas with the highest potential for impact, leading to more efficient and effective decarbonization outcomes.



ANALYZE MEASURES PACKAGES



05

In the pursuit of decarbonization, it is essential to conduct a thorough assessment to identify and implement effective measures. This process involves several key steps to ensure that the most feasible and impactful Energy Efficiency Measures (EEMs) and Decarbonization Reduction Measures (DRMs) are selected and optimized. Below is a detailed outline of the steps involved in this assessment.

Identify Measures: The decarbonization assessment will identify EEMs and DRMs that are feasible within the existing building's constraints. High-priority measures, such as replacing equipment near its end of useful life (EUL), should be identified to ensure maximum impact and efficiency.

Evaluate and Group Measures: Once feasible measures are identified, they should be evaluated and grouped for optimization. The best combination of measures should be based on an established framework for building decarbonization assessment. This step ensures that the selected measures work synergistically to achieve the desired outcomes.

Evaluate Multiple Scenarios: After gathering data on possible decarbonization measures and their considerations during the assessment, the project team should evaluate multiple scenarios. These scenarios will consist of different combinations of measures to help select the best overall combination. Evaluating multiple scenarios allows for a comprehensive analysis of potential outcomes and helps in making informed decisions.

Apply Evaluation Criteria: The criteria for determining the best combination of measures will vary. During scenario evaluation, the project team should assess several factors, including expected emissions reduction, system life evaluations (repair/

replace/refurbish), cost of carbon, future changes in energy markets, occupant considerations, implementation time and cost (including available funding and payback period), and how each scenario fits into the facility's short- and long-term goals.

Compare Packages: The various measures considered should be grouped and compared based on the highest priority criteria. For example, comparing two packages of DRMs for their GHG emissions reductions and considering other factors like occupant disruption. This comparison helps in selecting the most effective and least disruptive measures.

By following these steps, the decarbonization assessment will ensure that the most feasible and impactful measures are identified, evaluated, and implemented in an optimal order. This systematic approach will help achieve significant emissions reductions and energy efficiency improvements, contributing to the overall sustainability goals of the organization.

PRIORITIZING MEASURES



The decarbonization assessment identifies EEMs and DRMs that are feasible and high-priority, such as replacing equipment near its EUL. The best combination of measures should be based on a comprehensive framework that evaluates multiple scenarios with different combinations to select the optimal one. Criteria for determining the best combination vary but should include:

- Expected emissions reduction
- System life evaluations
- Cost of carbon
- Future energy market changes
- Occupant considerations
- Implementation time and cost (including funding and payback)
- Alignment with facility goals

Measures should be grouped and compared based on the highest priority criteria. For building portfolios, prioritization may be driven by goals, targets, available funding, planned renovations, or a combination of these factors. Developing several scenarios to evaluate phasing options against these prioritization criteria ensures a strategic and effective approach to decarbonization.

By following these steps, organizations can create a robust decarbonization plan that not only meets regulatory requirements but also maximizes financial incentives and minimizes disruptions. This comprehensive approach ensures that decarbonization efforts are both effective and sustainable, contributing to a greener future.

TIMELINE AND FUNDING



07

Embarking on a decarbonization journey requires meticulous planning and strategic implementation. Central to this process is establishing a well-defined timeline for implementing measures to meet decarbonization targets. The building owner can set this timeline, or it can be dictated by

incentive programs or local ordinances, ensuring that all actions align with regulatory requirements and financial incentives.

A crucial aspect of defining this timeline is establishing a capital improvements budget. While operations and maintenance budgets might fund minor upgrades, significant improvements often necessitate multiyear planning and budgeting. For facilities with aging systems approaching their end of useful life (EUL) or requiring persistent maintenance, planning for replacement options becomes invaluable. Additionally, taking advantage of available financial incentives, which may have sunset dates, and minimizing the impact on building occupants are key considerations in the timeline planning process.

The decarbonization plan provides a longer-term view, identifying measures or packages of measures to be implemented along a timeline to achieve both current and future goals. Some measures may have discrete implementation times, while others depend on precursory events or triggers. These triggers can include:

- Failure or required replacement of existing systems
- Tenant turnover
- Enactment of government policies
- Available rebates or funding
- Changes in utility policies

- Organizational goals
- Availability of specific equipment or technological advances

Securing Funding for Decarbonization Initiatives

Funding is a critical component of any decarbonization strategy, enabling organizations to implement energy-efficient solutions while minimizing financial strain. While self-funding may be an option, leveraging external funding sources can expand project scope, accelerate impact, and improve long-term financial returns. Organizations can explore various financial mechanisms, including:

- **Owner Investment:** Direct capital allocation from company reserves.
- **Bank Loans:** Traditional financing for sustainability upgrades.
- **Utility and Municipal Incentives:** Financial support from local programs, often with customer or program caps.
- **Government Grants and Tax Credits:** State and federal funding based on eligible technologies.
- **Energy Service Performance Contracts (ESPCs):** Structured agreements leveraging energy and carbon savings to finance improvements.

Beyond conventional funding avenues, organizations can explore specialized financial instruments:

- **Low-Interest Loans:** Cost-effective financing for clean energy projects.
- **Energy Efficiency Rebates:** Direct reimbursements for qualifying upgrades.
- **Power Purchase Agreements (PPAs):** Third-party financing for renewable energy installations.
- **Green Bonds:** Dedicated funds for sustainability-driven capital projects.
- **Corporate Sustainability Initiatives:** Private-sector investments in decarbonization.
- **Public-Private Partnerships (P3s):** Collaborative funding models between businesses and governments.
- **PACE Funding:** Property Assessed Clean Energy financing allows property owners to finance renewable energy and decarbonization improvements through a voluntary property tax assessment
- **Community-Based Funding:** Localized financing for shared energy goals.
- **Better Buildings Financial Allies:** Networks offering financial solutions for energy projects.

Given the competitive nature of incentives, grants, and tax credits, early research into eligibility criteria and application processes is essential. Many programs require projects to be registered during the planning phase, reinforcing the importance of proactive engagement.

About NORESO

NORESICO, an OPTERRA company, helps clients adapt to and mitigate the impacts of climate change by decarbonizing, modernizing and electrifying aging infrastructure to be more sustainable and resilient. Through strategic consulting services and deployment of innovative distributed energy, storage and renewable energy solutions, NORESICO improves the health and efficiency of existing campuses, buildings and communities. To date, NORESICO has guaranteed more than \$5 billion in energy and operating cost savings at more than 10,000 facilities while reducing customer CO2 emissions by more than 25 million metric tons.

NORESICO influences many levels of the built environment – from optimizing new and existing buildings, to improving regional utility programs, to developing national energy codes and standards. We bring thought leadership and hands-on engineering expertise to every project. We offer services for new and existing buildings including:

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Sustainability

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