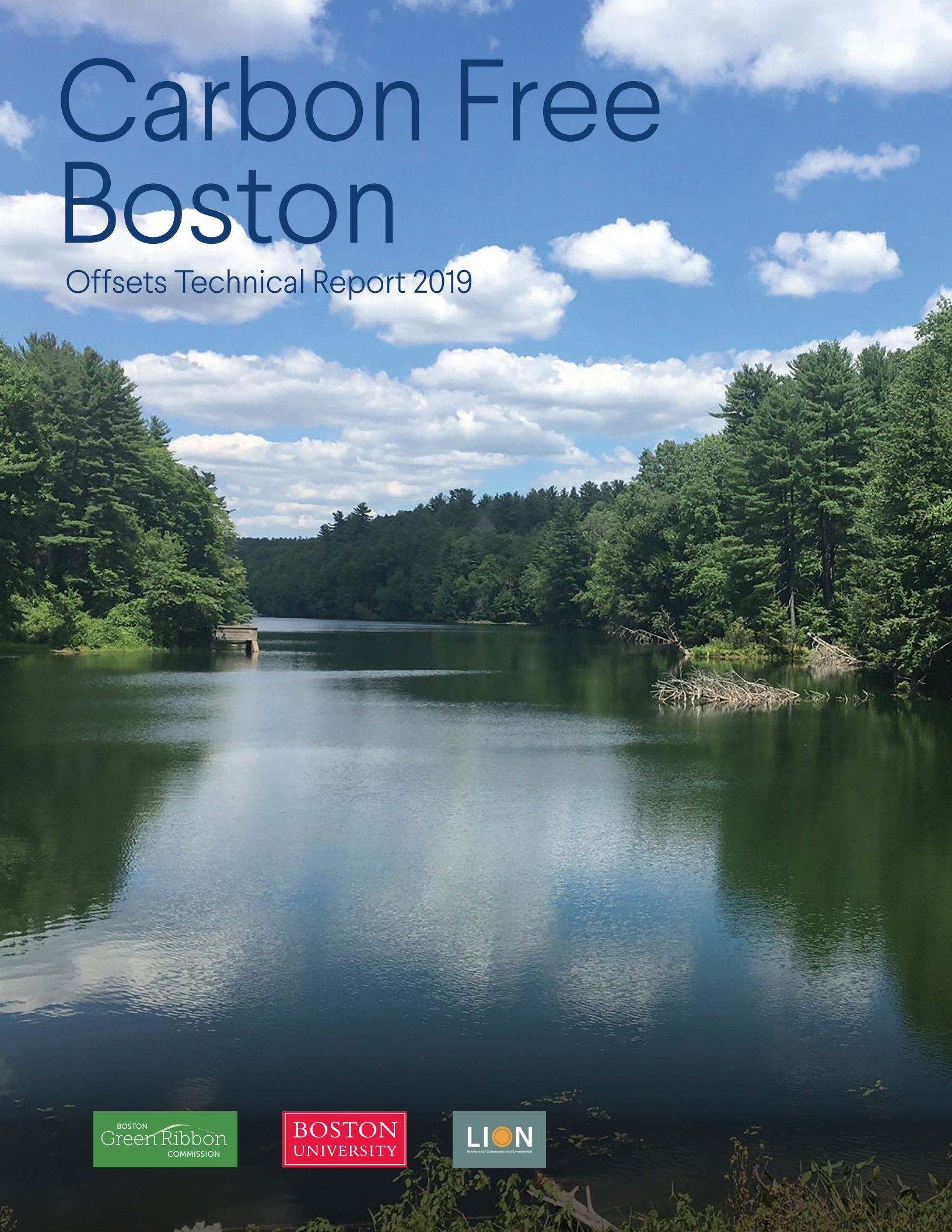
Carbon Free Boston

Offsets Technical Report 2019



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Carbon Free Boston: Offsets Technical Report

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Carbon Free Boston: Summary Report
Carbon Free Boston: Social Equity Report
Carbon Free Boston: Technical Summary
Carbon Free Boston: Buildings Technical Report
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1 OVERVIEW

The U.S. Environmental Protection Agency defines offsets as a specific activity or set of activities intended to reduce GHG emissions, increase the storage of carbon, or enhance GHG removals from the atmosphere [1]. From a city perspective, they provide a mechanism to negate residual GHG emissions—those the city is unable to reduce directly—by supporting projects that avoid or sequester them outside of the city's reporting boundary.

Offsetting GHG emissions is a controversial topic for cities, as the co-benefits of the investment are typically not realized locally. For this reason, offsetting emissions is considered a last resort, a strategy option available when the city has exhausted all others. However, offsets are likely to be a necessity to achieve carbon neutrality by 2050 and promote emissions reductions in the near term. While public and private sector partners pursue the more complex systems transformation, cities can utilize offsets to support short-term and relatively cost-effective reductions in emissions. Offsets can be a relatively simple, certain, and high-impact way to support the transition to a low-carbon world.

This report focuses on carbon offset certificates, more often referred to as offsets. Each offset represents a metric ton of verified carbon dioxide (CO_2) or equivalent emissions that is reduced, avoided, or permanently removed from the atmosphere ("sequestered") through an action taken by the creator of the offset. The certificates can be traded and retiring (that is, not re-selling) offsets can be a useful component of an overall voluntary emissions reduction strategy, alongside activities to lower an organization's direct and indirect emissions. In the *Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories* (GPC), the GHG accounting system used by the City of Boston, any carbon offset certificates that the City has can be deducted from the City's total GHG emissions.

2 OFFSET MARKETS – TYPES AND PARTICIPANTS

Any purchase of offsets related to Boston's carbon neutrality goal is considered voluntary; it is currently not required by regulation. However, its procurement of offsets could occur either through a voluntary or a compliance market. Compliance markets exist to regulate mandatory regional, national, or international programs. Internationally, this has mostly focused on the Kyoto Protocol,[1] however, related international standards and guidance are evolving due to the 2016 Paris Agreement.

Outside of these compliance programs, individuals, institutions, corporations, and governments can voluntarily purchase offsets either through the Kyoto Protocol's Clean Development Mechanism (CDM), which would involve retiring compliance related offsets, or with Voluntary Emissions Reductions (VER) through a purely voluntary market.[2] There are currently four major rating standards involved with

[1] The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) spurred creation of different programs, based on assigned carbon caps that were ratified by each participating country, thus making its achievement mandatory. The Kyoto Protocol established a cap-and-trade system, and to increase the cost-effectiveness of emissions reductions, established the Clean Development Mechanism (CDM) and Joint Implementation carbon markets. Fifteen EU countries formed the EU Emissions Trading Scheme (EU-ETS) [2].

[2] "Compared to the compliance market, trading volumes in the voluntary market are much smaller because demand is created only by voluntary buyers. Because there is lower demand and because VERs cannot be used in compliance markets, VERs tend to be cheaper than those credits sold in the compliance market" [2]. While compliance offsets typically sell at a relatively consistent price, offset prices on voluntary carbon markets can range dramatically due to project locations, type of activities, buyer's preferences, and size of the purchase [3].

voluntary carbon markets: Verified Carbon Standard, Climate Action Reserve, Gold Standard, and American Carbon Registry. The vast majority of projects on the voluntary market follow rules and procedures set out by these voluntary carbon standards.

For both compliance and voluntary markets, offset projects start with developers who work onsite to bring the project to fruition and realize GHG emissions reductions. Third party reviewers and rating agencies evaluate these projects to certify the credibility of the crediting mechanism, according to their standards. Brokers and retailers or registries commonly serve as the intermediary platform, aggregating offsets for sale and tracking the unique identification number associated with each to ensure that ownership remains clear and transparent. However, end buyers can work directly with developers on projects. The purchaser of the offsets, either directly from the developer or through an intermediary retailer, holds or uses and retires the credit.

3 OFFSET CRITERIA

Historically, not all offset projects have realized their promised greenhouse gas emissions reductions, defeating the purpose of the investment and leading to mistrust of offsets as a mechanism to drive down global GHG emissions. To address these concerns, a number of best practice requirements have been established and upheld by third-party standards. These standards seek to enforce the quality of offsets and increase transparency in the market. To be considered a verified emissions reduction, the offset must result from a project that meets a number of criteria:

- **Permanent**: non-reversible, lasts in perpetuity
- **Additional**: beyond business as usual (uneconomical, not policy driven)
- **Verifiable:** measurable, must be confirmed and monitored
- **Enforceable:** clearly defined, exclusive ownership (avoids double-counting)
- **Real:** not subject to leakage, generates a true net reduction in GHG emissions

3.1 STANDARD CRITERIA

Third party rating agencies evaluate projects to ensure they result in GHG emissions reductions beyond what would have occurred under the status quo. This is called, *additionality*, and it is the fundamental requirement that underpins an offset's ability to drive change in net emissions. Additionality tests evaluate legal and regulatory requirements, financial and market projections, common practice expectations, and designed performance, among other attributes. These tests ensure emissions are only "offset" from projects that would not have occurred under business as usual conditions without the offset-related investment. In other words, these projects do not contribute to compliance of existing regulations and are not considered by the market to be financially attractive on their own.

Offsets are also evaluated on whether there will be *permanent* reductions or sequestration of GHG emissions from the project. The reductions must last in perpetuity without risk that they could become reversed, which means that once the GHG emissions have been removed—or avoided—there is no to low risk that those removals could be reversed in the future. Renewable energy projects for offsets address the concern of permanence easily, while forestry projects face greater difficulty satisfying this criterion [4].

To be *enforceable*, a crediting agency must ensure that emissions reductions have truly occurred as the result of a discrete project, and that the volume of that net reduction is matched appropriately to the issued offsets. From an accounting perspective, this means the accounting of the emissions reduction is complete and accounts for any resulting increases of emissions anywhere, commonly referred to as leakage. This establishes the offset as *real.*

Once the GHG emissions reductions is proven to be additional, permanent, and real, carbon credits reflecting the emissions reductions are structured as legal instruments with clear ownership and usage restrictions. This legal instrument creates the offset, which allows for *verification* and *enforcement* and ensures that the credits are not double counted. Once an offset is issued, it is assigned a unique serial number and listed on a registry that traces the offset from issuance through transaction(s) to retirement. This is a critical step in providing transparency around offset ownership and to prevent double-claiming.

3.2 ADDITIONAL CRITERIA

As the offset market matures, some procurers (end users) are looking for projects that meet additional criteria. Some of these requirements are nuanced details related to the additionality, real, permanence, and enforcement criteria. For example, they want to ensure the offsets are synchronous, only considering them valid if the GHG emission reductions, avoidance and removals occur during a distinct period of time that is reasonably close to the time it is used to balance, compensate, or offset their GHG emissions. Additionally, others feel their offsets have greater creditability if they have been independently validated and verified by a third-party and are publicly registered, ensuring that no other entity has rights to claim future credit for the same reduction, making this an emerging criterion for voluntary programs.

More and more, buyers of offsets seek projects that result in benefits beyond GHG emissions reduction and provide environmental, health, economic, and social benefits for local communities, either at home or abroad. They want project selection to consider all direct and indirect social and environmental impacts of an offset project, along with potential educational, economic development, and resiliency benefits. Similarly, they avoid projects with any harmful impacts.

4 OFFSET PROJECT TYPOLOGIES

There are several types of offset projects. The most common ones include energy efficiency and fuel switching, renewable energy, waste management, and carbon sequestration related to land use. However, additional project typologies are emerging, including those involving carbon capture and storage, while others exist but are not common due to historic performance, riskiness, cost or misalignment with global best practices.

Table 1. Transacted Volume and Average Price by Project Category

	Volume (Mt CO_2e)	Average Price (per t CO_2e)
Renewables	18.3	$1.4
Forestry and Land Use	13.1	$5.1
Methane	5.6	$1.8
Efficiency and Fuel Switching	4.5	$2.9
Household Device	3.4	$5.2
Transportation	1.9	$0.3
Gases	1.4	$5.7
Other	0.5	$4.0

Based on 717 transactions representing 48.8 Mt CO_2e in 2016. *Source*: [5]

4.1 Energy Efficiency and Fuel Switching

Energy efficiency and/or fuel switching projects include improvements that reduce energy consumption and replace dirtier fuels with cleaner ones, thereby reducing associated GHG emissions. These are among the most common types of projects that the purchase of offsets enables. They often involve improvements to building energy performance such as the replacement of conventional light bulbs with LEDs; the provision of efficient and clean energy cookstoves to replace open fire combustion of wood, crop residues, and dung; and changes to water filtration and agricultural processes to reduce energy intensity. In order for these projects to result in qualified carbon offsets, the GHG emissions reductions associated with a project must pass the additionality test, which likely would require the project to take place outside the city's geographic boundary.

4.2 Waste and Wastewater Management

Related to renewable energy projects, there are offset projects that achieve emissions reductions by capturing and collecting methane emissions from landfills or wastewater and then converting it to usable, renewable fuel for heating or transport. These projects have multiple benefits: they reduce emissions of methane, a greenhouse gas that is over 20 times as potent a greenhouse gas as CO_2; they have the potential to reduce landfill impacts on air and water quality; and they reduce the need to burn fossil fuels.

4.3 Sequestration

Carbon sequestration is the act of removing carbon from the atmosphere and storing it securely. Carbon sequestration is also a way of generating negative emissions. The Intergovernmental Panel on Climate Change has identified the need for significant negative emissions to achieve ambitious climate goals that limit temperature rises to 2°C [6, p. 5]. Generating negative emissions through sequestration readily achieves the PAVER criteria outlined above. Sequestration typically involves enhancing biological uptake of carbon or long term geological storage of carbon.

Biological sequestration typically involves planting new trees where there were none originally, enhancing trees' carbon density through improved forest management, and avoiding deforestation. Forestation offset projects tend to have lower implementation and regulatory risks compared to energy

projects [7]. Forestry also has numerous ecological co-benefits, such as soil, water, and biodiversity enhancements, as well as human use benefits. However, as it is more challenging to ensure permanence of forestry projects, given the potential for natural (e.g., fire) or human (e.g., unsustainable timber services) caused forest destruction [7]. Other approaches to biological sequestration include agricultural and soil management. However these projects pose challenges for carbon markets as the result in diffuse emissions reductions that are hard to quantify [8].

Geological sequestration, also known as carbon capture and storage, is a process that captures carbon dioxide from stationary sources, such as power plants and other large industrial facilities, and injects it deep underground where it is to remain isolated for long periods of time. The technology to support this project is still being developed; only a few industrial-sized projects are operating worldwide.

4.4 LESS COMMON PROJECTS

There are additional project typologies that exist beyond energy and land use ones. These tend to be less common either because they are hard to quantify, hard to enforce, or hard to guarantee permanence, or they provide the risk of greater emissions. For example, in the past there were offset projects that aimed to reduce industrial emissions of hydrofluorocarbons (HFC), a greenhouse gas that is thousands of times more potent than carbon dioxide. The idea was to provide a financial incentive to reduce these emissions. Instead, however, it provided an incentive for these industries to first emit more HFCs to then obtain the funding to decrease emissions. As a result, the offset market has concluded that it should not support this type of project.[3]

There are also a relatively low number of new offset projects that focus on reducing emissions from the agricultural sector. Some of these projects fall under waste management (e.g., methanization of livestock waste) and renewable energy (e.g., biofuels from crop residues) typologies.

Another offsetting strategy is the retirement of compliance credits. As mentioned above, voluntary buyers of carbon offsets can purchase the carbon credits from compliance markets and retire them, thus reducing the supply of compliance credits, increasing their price, and fostering the development of additional GHG emissions reduction projects.

5 WHAT DOES THIS MEAN FOR CITIES?

Since Boston may not achieve net-zero CO_2 emissions with its footprint via its own actions by 2050, it may need to purchase offsets to achieve its goal. Under accepted protocols, this is a perfectly acceptable way to reach carbon neutrality, as long as proper offsets are purchased. However, most offset programs were not developed with cities looking to offset community-wide emissions in mind. But with more and more cities committing to carbon neutrality or equivalent goals, there will likely be greater attention given to the role of offsets in achieving these goals.

[3] According to David Suzuki, offset projects involving the destruction of halocarbon gases (e.g., HFCs) have actually resulted in a perverse incentive (because of the sheer volume of offsets—and profits—that they generate) for more of the ozone-depleting gas to be created. And due to the very high global warming potential, the price of offsets from these projects is so low that they tend to flood the market and squeeze out more sustainable offset projects, like solar and wind" [9].

To help guide cities, the C40 Cities Leadership Group and the Carbon Neutral Cities Alliance have begun to develop a carbon neutrality protocol for cities; the City of Boston has been part of the group of leading cities working on this guidance. The objective of the protocol is to ensure cities have the tools they need to develop and implement 1.5°C compliant plans, including ways to ensure credibility of progress and offset accounting.

Boston, like many of its peer cities, accounts for its greenhouse gas emissions following a standardized protocol and unit of measurement, CO_2e. At the most basic level, the cities should be able to offset, either directly or indirectly (i.e., through other stakeholders in the city) a metric ton of CO_2e of its emissions with a metric ton of CO_2e from eligible GHG projects. The process to purchase carbon offsets does not necessarily have to differ from existing ones. However, the opportunity becomes more complex as it wrestles with a number of values-based, political, administrative, and financial questions.

5.1 The Role of a City

Before questions around project typology and location can be addressed, a city must consider who is responsible for purchasing the offsets and the role it feels it should play in the procurement. This decision will likely be driven by its specific context, such as its GHG accounting boundaries, economic feasibility, procurement restrictions, city powers and authorities, regulatory structures, and preferences.

Identifying which sectors or scopes of emissions the city would like to offset will be a first step to determining the appropriate role(s) it should play. Does it play one role to offset its residual municipal GHG emissions and another to address community-wide emissions? In parallel, the city may want to consider the role and involvement of different partners and stakeholder groups: large institutions, building owners and developers, transportation service providers, agencies and authorities, environmental groups, community organizations, etc.

For example, a city could be a procurer of offsets, using tax dollars or a separate revenue stream to procure and retire offsets directly through an offset market, either for its own municipal emissions or for citywide emissions, as well. Conversely, a city's role could be to create requirements for others to procure offsets and act as a facilitator of the process, such as requiring building developers and owners to achieve certain building standards related to decarbonization, and then allowing them to purchase offsets to fill the gap for what they could not achieve directly. Or, the city could choose to be an offset project developer, either directly or indirectly with partners, among other options.

5.2 City Approach Options

As leading cities on climate action consider the potential role offset purchases may play, there is general consensus that at a minimum, cities should focus on direct emissions as much as possible and consider offsets as secondary [10]. Beyond that, a city has options on how it positions offsets within its climate action planning and implementation, including how it budgets for and chooses offset projects as well as how it communicates its climate action narrative and obtains buy-in for its strategies. As carbon offsetting is a relatively new consideration for cities, there will likely be a number of approaches and new best practices that will emerge over time. In the meantime, here are a few potential approaches for cities to consider.

A city may approach an offset as an opportunity to internalize the cost of carbon. In this approach, the city acts as if there is a cost to each ton of CO_2e it emits, as if it were assuming that a future carbon price—whether through a carbon tax or a future cap and trade system—was inevitable. The cost could be based on an agreed upon social cost of carbon, the cost to address the long-term damage from climate change, or based on the average market price for the offsets. The city can use this cost to drive direct investments into emissions reduction projects and/or create a budget to purchase offsets from projects outside of its reporting boundary. Besides creating a funding structure for climate action, internalizing the cost of carbon helps to address concerns that the ability to offset would reduce incentives for direct actions to reduce GHG emissions. This approach is especially effective if the city's offset program is designed such that the offset expense is paid by the agency, sector, or institution responsible for the emissions.

A city may see offsets as an opportunity to leverage local resources, and therefore seek to become a project developer or partner with a developer. For example, a city may have land appropriate for planting a new forest or pursue a forestry project in the region, outside its direct borders but close enough to provide an indirect benefit to city residents. As noted above, most offset projects take place outside of the investing entities geographic boundaries, in this case the city, and the transaction does not lead to direct emissions reductions in the city. This approach is consistent with the desire to make investments that have a direct impact on their residents, economy, and natural environment. This is sometimes referred to as "carbon insetting," a mechanism that can produce localized benefits for the offsetting city. Insetting projects are typically related to the consumption of goods and services and/or supply chain activities, yet are not accounted for by the offsetting institution's greenhouse gas inventory methodology.

Alternatively, a city may approach offsets as an opportunity to optimize for institutional objectives, such as equity, economic development, or resilience. For example, for cities—and their stakeholders—committed to the goal of equity and global social justice, it may be preferable to choose offset projects that support new skills, livelihoods, and/or infrastructure for impoverished individuals, families and communities. Often, these are the types of projects that may not occur without the financial investments available from the sale of offsets. These projects, if verified by a credible third party, also can address equity between regions that continue to emit and those that host the offsets.

Finally, a city may approach offsets as an opportunity to maximize the reduction of global GHG emissions. It may choose to prioritize projects, both within and outside of its boundaries that allow for each dollar of investment to result in the largest quantity of GHG emissions.

6 WHAT BOSTON CAN DO AS A NEXT STEP

The development of a carbon offset program is critical for two key reasons. The first is that it enables Boston to achieve and accelerate the pathway to net zero emissions without having to undergo infeasible or exorbitantly costly mitigation actions. Second, it helps to develop markets that will spur demand for sequestration or negative emissions. This latter item is a required element of deep decarbonization pathways that aim to limit temperature rises to 2°C [6]. Offsets should not be an afterthought or treated as a last resort, but as strategic component of decarbonization pathway that can

deliver lower cost emissions reductions and global benefits. The challenge currently lies with the nascent state of the offset market and negative emissions technologies.

6.1 Expand the Conversation

Boston is already ahead of most U.S. cities when it comes to thinking about offsets. The City through its climate-focused networks such as C40 and the Carbon Neutral Cities Alliance, has the opportunity to lead other cities around the world in the development of pilot offset projects. The City should also foster discussions locally through various stakeholder engagement mechanisms to build the buy-in and support future initiatives around offsetting. Whether it is through the *Imagine Boston 2030* platform or in partnership with neighboring institutions, the City can build upon its on-going engagement strategies to begin the dialogue on this currently esoteric and sometimes controversial topic.

6.2 Clarify its Objectives and Preferred Approaches

Through stakeholder engagement, Boston will have to figure out how to situate offsets within its greater climate action efforts and municipal responsibilities, in regards to regulation, administration and financial responsibility. The City will need to be clear on why it is utilizing offsets, what it hopes to achieve with them, and how it would generally like to pursue them. It will need to identify who would be responsible for the procurement of offsets and when an entity would be liable for procuring an offset.

6.3 Determine the Role it Can and Prefers to Play and the Role of Stakeholders

Consistent with its identified objectives and preferred approaches, the City will need to define the role(s) it plans to play in carbon offsetting as well as the role(s) of others. This can include the roles of the procurer, regulator, facilitator, and educator, among others. In each of these roles, Boston can support investment into offset projects that directly impact its own GHG emissions and those of other governmental agencies and private stakeholders. The City can also foster support for carbon neutrality and verified and beneficial offset projects by continuing to partner with neighboring local governments (i.e., Metro Mayors) on attainment of their joint goal and by advocating for policies that support internalizing the cost of carbon.

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Peter Fox-Penner holds equity in Energy Impact Partners, a utility-backed energy investment and innovation firm, and consults for Energy Impact Partners and The Brattle Group on energy technologies. Dr. Fox-Penner also conducts research in areas of interest similar to the business interests of Energy impact Partners and The Brattle Group. The terms of this arrangement have been reviewed by Boston University in accordance with its financial conflicts of interest in research policies.

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ABBREVIATIONS

CDM	Kyoto Protocol's Clean Development Mechanism
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
EU	European Union
EU-ETS	EU Emissions Trading Scheme
GHG	Greenhouse Gas
GPC	Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories
HFC	hydrofluorocarbons
PAVER	Permanent, Additional, Verifiable, Enforceable, Real
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emissions Reductions

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