

## MEMORANDUM

**To:** Hannah Payne, Carbon Neutrality Program Manager, City of Boston  
Kat Eshel, Deputy Director of Climate and Environmental Planning, City of Boston  
Alison Brizius, Commissioner of Environment Department, City of Boston  
**From:** Claudia V. Diezmartinez Peregrina, Rappaport Public Policy Summer Fellow  
**Re:** Options for the development of environmental justice metrics for BERDO 2.0

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This memorandum presents a series of options for the development of environmental justice metrics for the City of Boston's Building Emissions Reduction and Disclosure Ordinance (BERDO 2.0). The memo includes three main sections. The first section provides background information on BERDO 2.0 and its requirements on environmental justice metrics and public disclosure. The second section introduces a general approach to develop metrics that (a) are able track the impacts and performance of BERDO 2.0 either directly or by proxy, and (b) correspond to data that is currently available or could be easily collected by the Environment Department. The third section presents a list of options for environmental justice metrics that the City could use for annual disclosure purposes.

### **I. Background**

The City of Boston's [Building Emissions Reduction and Disclosure Ordinance \(BERDO 2.0\)](#) sets emissions standards for large buildings to gradually reduce their energy use and greenhouse gas emissions, with the goal that all covered buildings achieve net zero emissions by 2050.

During the development of BERDO 2.0, the City of Boston conducted a resident-focused engagement process that identified a series of community priorities related to the program. Specifically, the City found that residents prioritize issues of indoor and outdoor air quality, reduction of energy bills, displacement, heating and cooling improvements, local job creation, and environmental benefits. These community priorities are directly reflected in the Ordinance text, which establishes that “the [Air Pollution Control] Commission shall disclose information relevant to air quality, Energy cost burdens, fair housing and housing displacement, jobs, and other qualitative and quantitative metrics related to Environmental Justice Populations and equitable implementation of this Subsection”, and that “within one year, the Environment Department shall identify appropriate metrics and research

*mechanisms for (i) measuring and collecting this type of information and (ii) analyzing the impact, if any, of this Subsection on such metrics.”*

This memo presents a general approach and a list of options for environmental justice metrics that the City could use to (a) monitor the impacts and performance of BERDO 2.0 and (b) directly respond to the Ordinance’s disclosure requirements and community priorities. All options are based on a literature review and benchmarking of existing urban environmental justice metrics and a series of interviews with staff from the Environment Department and other Departments across the City of Boston.

## **II. General Approach to Develop Environmental Justice Metrics**

This section presents the main challenges to monitor the environmental justice impacts of BERDO 2.0 and introduces a general approach to develop metrics that provide relevant information on key topics of interest and that are adapted to the type of data available to the City.

### **Challenges to develop environmental justice metrics**

Interviews with staff at the City of Boston showed that there are three main barriers to the development and monitoring of environmental justice metrics for BERDO 2.0:

- **Data availability and collection:** The City does not currently implement systematic data collection practices on several of the key topics required for BERDO disclosure, and when data exists, it is dispersed across City Departments. Disclosure for BERDO will require collaboration with multiple teams within the Environment Department, as well as constant communication with the Boston Public Health Commission, the Mayor’s Office of Housing, and the Mayor’s Office of Workforce Development, among others. Several metrics also rely on increasing reporting burdens on building owners to collect additional information through the BERDO Reporting Form.
- **Data granularity:** Data related to environmental justice and other key topics is usually not available at an address or building-specific level. This means that several metrics can only be collected and reported at the level of census tracts, zip codes, or neighborhoods, confounding the impacts of BERDO with other socioeconomic and policy dynamics present in the city.
- **Privacy concerns:** Even when data can be collected at the level of individual buildings, building-specific reporting is often not recommended due to privacy concerns. This is particularly important for sensitive data related to health impacts or displacement.

### Approaches to develop environmental justice metrics

Given the obstacles the City faces to collect, monitor, and disclose environmental justice related data, there are two types of metrics that the City could use for annual disclosure purposes (see **Table 1**). The options for environmental justice metrics presented in this memorandum follow this typology.

**Table 1. Types of environmental justice metrics**

Type of metric	Description	Example
<b>Impact and performance metrics</b>	Indicators that can be directly traced at the building level and aggregated for disclosure. These also include general performance metrics for the Equitable Emissions Investment Fund.	“Eviction filings in BERDO buildings”  Since eviction filings data is collected at the level of individual addresses, we can (technically) know the aggregate number of evictions filed in BERDO buildings.
<b>Contextual metrics</b>	Indicators that can be traced at the level of a census tract, zip code, or neighborhood, and compared against the number (or density) of BERDO buildings in each area.	“Asthma emergency department visits by zip code”  We cannot track asthma emergency department visits coming from each BERDO building, but we have this data by zip code and can analyze whether zip codes with more or less BERDO buildings have greater rates of asthma.

**Impact and performance metrics** provide direct measurements of dynamics unfolding specifically in buildings covered by the Ordinance. This would enable the City to directly monitor key changes over time (e.g. *Are eviction filings increasing in BERDO buildings?*). However, this does not mean that BERDO 2.0 is the only factor influencing these metrics or even the cause of a certain shift (i.e., *eviction filings may occur in BERDO buildings as a result of a multitude of factors*).

**Contextual metrics** provide information about the context within which buildings covered by the Ordinance exist and operate. Since these metrics do not provide building-specific data, the relationship between BERDO 2.0 and the indicators is more muddled than for metrics focused in BERDO buildings. However, these metrics may enable the City to identify potential correlations between BERDO 2.0 and key indicators (e.g., *Are energy burden rates higher in zip codes with a greater number of BERDO buildings?*). These metrics could also serve as a foundation for more sophisticated statistical analyses that could help untangle the impacts of BERDO 2.0 from other policies and confounding factors.

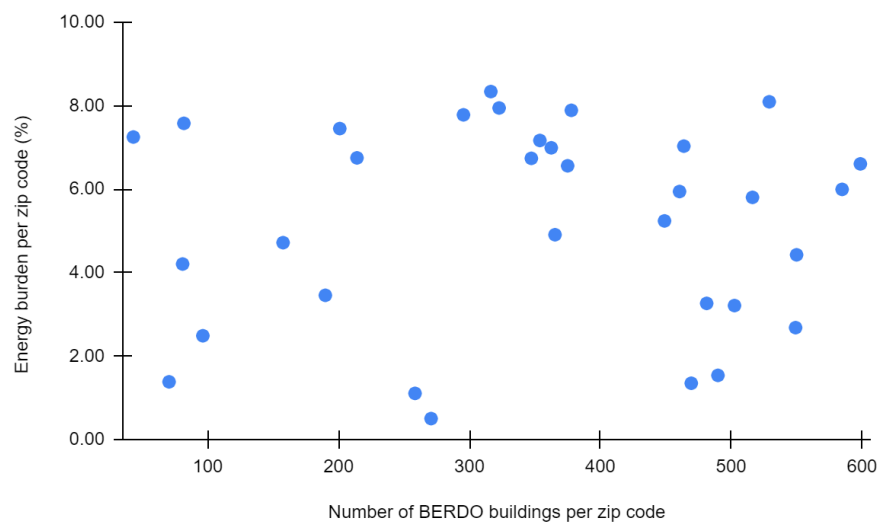
While most data that can be tracked for contextual metrics are available at the level of census tracts, zip codes, or city neighborhoods, it is recommended to select and maintain a uniform scale for all metrics. These different scales have advantages and disadvantages that must be considered for public disclosure:

- **Census-tract-level data** provide the greatest granularity, but may also raise privacy concerns for certain sensitive data, particularly with metrics related to health issues and displacement.
- **Neighborhood-level data** is easily distinguishable for Boston residents, but does not provide enough nuance to distinguish smaller-scale trends within the city.
- **Zip-code-level data** is compatible with both Census data and other indicators collected by city departments. It provides greater granularity than the neighborhood level, but also more anonymity or protection for residents than census tracts.

For purposes of public disclosure, **the zip-code level** may be the most appropriate scale for contextual environmental justice metrics.

### **Visualizing contextual environmental justice metrics**

Since contextual metrics provide information about the environment and conditions within which BERDO buildings operate - rather than direct outcomes from BERDO -, it is important to report and visualize these metrics in a way that reflects their nature and purpose. Scatter plots and maps may be two useful tools for this objective (see Fig. 1 - 2).



**Fig. 1. Example of scatter plot of a contextual metric (note: not real data).**

Fig. 1. shows how a contextual metric varies across zip codes with different numbers of BERDO buildings. This visualization emphasizes the relationship or correlation between the indicator and the number of BERDO buildings existing within each zip code. However, this type of visualization may obscure relevant geographic patterns across the city.

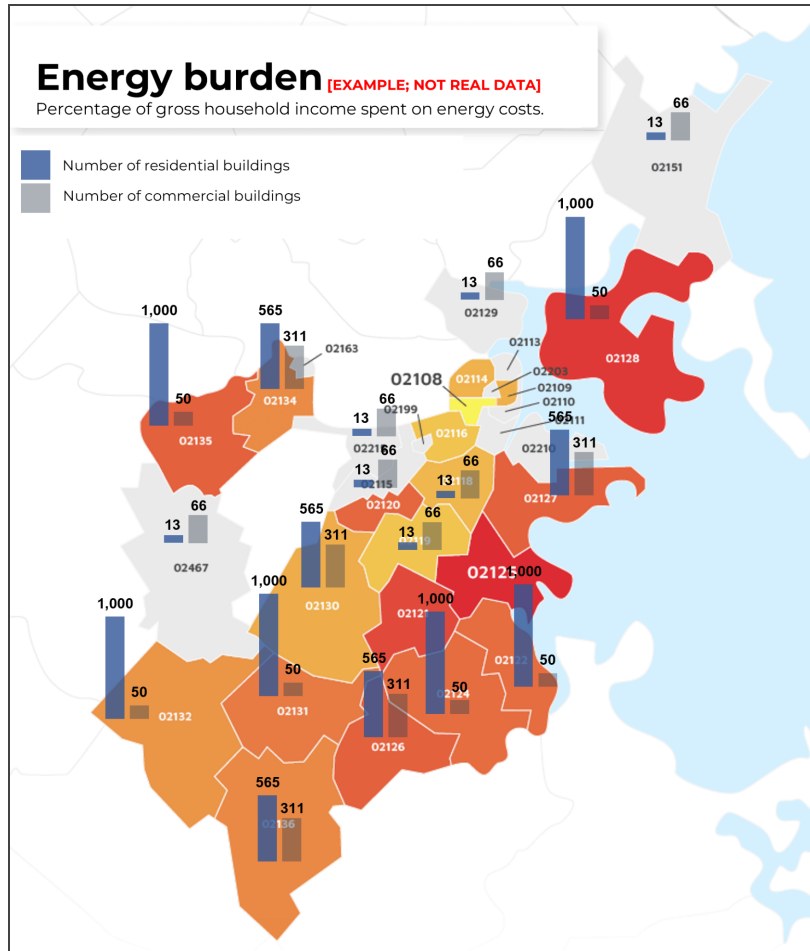


Fig. 2. Example of mapping a contextual metric (note: not real data)

Original map by [Point2](#)

Fig. 2. shows how a contextual metric varies across zip codes while also presenting the number of BERDO buildings that exist within each zip code. This visualization emphasizes the geographic patterns of the metric, but the relationship between the number of BERDO buildings and the indicator may not be immediately obvious.

### III. Options for Environmental Justice Metrics

Table 2 below presents 42 options for environmental justice metrics, organized by key topics: (a) indoor and outdoor air quality; (b) thermal comfort; (c) energy cost burdens; (d) local jobs and workforce development; (e) displacement and fair housing; and (f) environmental impacts and program performance. This is followed by detailed descriptions of each environmental justice metric, including information on data sources, data collection, and possible scales of measurement.

Table 2 uses the following codes to indicate the data source and internal validity (i.e., the extent to which metrics are actually measuring the real-world states or events that they are intended to measure) for each metric.

- **Metric types**
  - **IMPACT** = Impact and performance metric
  - **CONTEXT** = Contextual metric
- **Data source**
  - **A** = Data collected by the Environment Department
  - **B** = Data collected by other City of Boston Departments and Agencies
  - **C** = Self-reporting data from building owners
  - **D** = Data collected from U.S. Census or other third-parties
  - **E** = Data collected after Equitable Emissions Investment Fund is established
- **Internal validity**
  - **1** = Metric is unlikely to reflect the actual status of the key topic that is intended to measure.
  - **2** = Metric may reflect the actual status of the key topic that is intended to measure.
  - **3** = Metric is highly likely to reflect the actual status of the key topic that is intended to measure.

**Table 2. Master list of environmental justice metrics options**

Metric	Metric type	Data source	Internal validity
<b><u>A. Indoor and outdoor air quality</u></b>			
A.1. Indoor air quality complaints in BERDO buildings	IMPACT	B	1
A.2. Adult asthma rates by zip code	CONTEXT	D	3
A.3. Asthma emergency department visits by zip code	CONTEXT	B	2
A.4. Asthma hospitalizations by zip code	CONTEXT	B	2
A.5. Efforts for indoor air quality monitoring in BERDO buildings	IMPACT	C	1
A.6. Stove electrification in BERDO buildings	IMPACT	C	3
A.7. Investments in populations impacted by air pollution	IMPACT	E	2
A.8. Investments in populations with high asthma rates	IMPACT	E	2
<b><u>B. Thermal comfort</u></b>			
B.1. Thermal comfort complaints in BERDO buildings	IMPACT	B	1
B.2. Electrification of heating by zip code	CONTEXT	D	1
B.3. Tenant control on heating and cooling in BERDO buildings	IMPACT	C	2
B.4. Access to cooling in BERDO residential buildings	IMPACT	C	2
B.5. Passive Housing in BERDO buildings	IMPACT	C	2
B.6. Heat mitigation efforts in BERDO buildings	IMPACT	C	2
B.7. Investments in thermal comfort	IMPACT	E	2
B.8. Investments in populations impacted by the Urban Heat Island	IMPACT	E	2
<b><u>C. Energy cost burdens</u></b>			
C.1. Average energy burden by zip code	CONTEXT	D	2
C.2. Estimated energy savings in BERDO buildings	IMPACT	C	2
C.3. Estimated energy cost savings in BERDO buildings	IMPACT	C	1
C.4. Enrollment in BCCE in BERDO buildings	IMPACT	A	2
C.5. Enrollment in BCCE's Optional Green 100 Service in BERDO buildings	IMPACT	A	2
C.6. Investments in populations impacted by high energy burdens	IMPACT	E	2

C.7. Investments in affordable housing BERDO buildings	IMPACT	E	2
<b><u>D. Local jobs and workforce development</u></b>			
D.1. Contracts with Minority and Women Owned Business Enterprises for third-party verification	IMPACT	C	2
D.2. Contracts with Minority and Women Owned Business Enterprises for building upgrades	IMPACT	C	2
D.3. Contracts with graduates from green workforce development programs	IMPACT	C	2
D.4. Investments in buildings owned by Minority and Women Owned Business Enterprises	IMPACT	E	2
<b><u>E. Displacement and fair housing</u></b>			
E.1. Eviction filings in BERDO buildings (undergoing energy efficiency renovations or upgrades)	IMPACT	B	3
E.2. Displacement risk in BERDO buildings	CONTEXT	B	2
E.3. Demographic change by zip code	CONTEXT	D	2
E.4. Gross rent as a percentage of household income by zip code	CONTEXT	D	2
E.5. Housing burden by zip code	CONTEXT	D	2
<b><u>F. Environmental impacts and program performance</u></b>			
F.1. Greenhouse gas emissions reductions in BERDO buildings	IMPACT	C	3
F.2. Greenhouse gas emissions reductions financed by the Equitable Emissions Investment Fund	IMPACT	E	3
F.3. BERDO 2.0 compliance rates	IMPACT	C	3
F.4. Rates of compliance through Renewable Energy Credits	IMPACT	C	3
F.5. Rates of compliance through Power Purchase Agreements	IMPACT	C	3
F.6. Total Expenditures from the Equitable Emissions Investment Fund	IMPACT	E	3
F.7. Net-Zero BERDO buildings	IMPACT	C	3
F.8. Energy storage systems in BERDO buildings	IMPACT	C	3
F.9. Electric vehicle infrastructure in BERDO buildings	IMPACT	C	3
F.10. On-site energy generation in BERDO buildings	IMPACT	C	3



**A. Indoor and outdoor air quality**

<b>A.1. Indoor air quality complaints in BERDO buildings</b>			
<b>Description</b>	Number of indoor air quality complaints in BERDO buildings reported to the Boston Public Health Commission.		
<b>Units</b>	Number	<b>Data sources</b>	- The Boston Public Health Commission (BPHC) collects information on all indoor air quality complaints they receive. The data is available by address so this could be matched to BERDO buildings.
<b>Scale</b>	Zip code Census tract Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>Numbers on complaints are biased since residents need to know there is a mechanism to complain to the BPHC in the first place.</p> <p>If the Environment Department does not have capacity to match each complaint to a BERDO building, the metric could be reported by zip code.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>A.2. Adult asthma rates by zip code</b>			
<b>Description</b>	Median percentage of adults (populations age 18 or older) with asthma by zip code.		
<b>Units</b>	Percentage	<b>Data sources</b>	- Asthma rates, as defined in this metric, are reported in the <a href="#">Greenlink Equity Map</a> . Data on asthma rates is obtained through CDC 500.
<b>Scale</b>	Census tract	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>Asthma-related data is readily available data that could be considered a proxy for both indoor and outdoor air quality conditions.</p> <p>While Greenlink maps this metric by census tract, this data could (technically) be matched to zip codes.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>A.3. Asthma emergency department visits by zip code</b>			
<b>Description</b>	Number of asthma emergency department visits by zip code.		
<b>Units</b>	Number	<b>Data sources</b>	- The Office of Research Evaluation of the Boston Public Health Commission monitors and reports out on asthma metrics through the Boston Behavioral Risk Factor Surveillance System (BRFSS) which is collected every two years and results are published in the <a href="#">Health of Boston Report</a> .
<b>Scale</b>	Zip code Census tract Neighborhood	<b>Frequency</b>	Every 2 years
<b>Additional notes</b>	<p>This metric could be reported for all ages or for specific sub-groups such as children between 5 and 17 years old.</p> <p>The Health of Boston Report has not been published in a while because of COVID, but the Office of Research Evaluation can pull out the data broken down by race, ethnicity, gender, zip code, age, housing type etc. Main contact on asthma data is Eugene Barros (<a href="mailto:ebarros@bphc.org">ebarros@bphc.org</a>).</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>A.4. Asthma hospitalizations by zip code</b>			
<b>Description</b>	Number of asthma hospitalizations by zip code.		
<b>Units</b>	Number	<b>Data sources</b>	- The Office of Research Evaluation of the Boston Public Health Commission monitors and reports out on asthma metrics through Boston Behavioral Risk Factor Surveillance System (BRFSS) which is collected every two years and results are published in the <a href="#">Health of Boston Report</a> .
<b>Scale</b>	Zip code Census tract Neighborhood	<b>Frequency</b>	Every 2 years
<b>Additional notes</b>	<p>This metric could be reported for all ages or for specific sub-groups such as children between 5 and 17 years old. See note on Health of Boston Report in metric A.3.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>A.5. Efforts for indoor air quality monitoring in BERDO buildings</b>			
<b>Description</b>	Number of BERDO buildings that monitor indoor air quality.		
<b>Units</b>	Number Census tract	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric could also be presented as a percentage.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>A.6. Stove electrification in BERDO buildings</b>			
<b>Description</b>	Number of BERDO buildings that have electrified all stoves in their units.		
<b>Units</b>	Number Census tract	<b>Data sources</b>	- BERDO Reporting Form could ask building owners from residential buildings to report whether all (or some) of their units have switched to electric stoves.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric could also be presented as a percentage.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>A.7. Investments in populations impacted by air pollution</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards census tracts (or zip codes) with low air quality.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF. - Areas with low air quality could be determined through the City's current air monitoring programs.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also be presented as a percentage of the total investment from the EEIF.		

<b>A.8. Investments in populations with high asthma rates</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards census tracts (or zip codes) with high asthma rates.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF. - Census tracts with high asthma rates can be obtained from the <a href="#">Greenlink Equity Map</a> or through the Boston Public Health Commission (see metric A.2 - A.4.)
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also be presented as a percentage of the total investment from the EEIF.		

**B. Thermal comfort**

<b>B.1. Thermal comfort complaints in BERDO buildings</b>			
<b>Description</b>	Number of thermal comfort complaints in BERDO buildings reported to the Boston Public Health Commission.		
<b>Units</b>	Number	<b>Data sources</b>	- The Boston Public Health Commission (BPHC) collects information on all thermal comfort complaints they receive. The data is available by address so this could be matched to BERDO buildings.
<b>Scale</b>	Zip code Census tract Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	BPHC mentions that most complaints are usually related to workspaces; less so from residential buildings. Most residential complaints relate to buildings not turning on heating or cooling (building code rules).  If the Environment Department does not have capacity to match each complaint to a BERDO building, the metric could be reported per zip code.		

<b>B.2. Electrification of heating by zip code</b>			
<b>Description</b>	Percentage of occupied housing units using electricity for heating by zip code.		
<b>Units</b>	Percentage	<b>Data sources</b>	- Five-year estimates on use of heating fuels are reported every year by the ACS.
<b>Scale</b>	Zip code Census tract	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric is also available for other fuels, including utility gas, bottled, tank, or LP gas, fuel oil or kerosene, coal or coke, wood, and solar energy.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>B.3. Tenant control on heating and cooling in BERDO buildings</b>			
<b>Description</b>	Percentage of BERDO buildings that allow tenants to control heating and cooling within their units.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO Reporting Form could ask building owners to report whether their buildings allow their tenants to control the switching and temperature of their heating and cooling systems.
<b>Scale</b>	Total Census tract Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could be compared between EJ and non-EJ areas.		

<b>B.4. Access to cooling in BERDO residential buildings</b>			
<b>Description</b>	Percentage of residential BERDO buildings with access to cooling.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO Reporting Form could ask building owners to report whether their buildings include cooling systems and whether cooling is available in all units or not.
<b>Scale</b>	Total Census tract Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric could be refined to refer to only BERDO residential buildings that have access to cooling in ALL of their units.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>B.5. Passive Housing in BERDO buildings</b>			
<b>Description</b>	Percentage of BERDO buildings that are certified as a Passive House.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO Reporting Form could ask building owners to report on passive house certifications.
<b>Scale</b>	Total Census tract Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could be compared between EJ and non-EJ areas.		

<b>B.6. Heat mitigation efforts in BERDO buildings</b>			
<b>Description</b>	Percentage of BERDO buildings that have implemented a heat mitigation measure or feature.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO Reporting Form could ask building owners to report heat mitigation measures implemented in their buildings from a select number of options (see additional notes).
<b>Scale</b>	Total Census tract Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	Heat mitigation measures can be taken from the City's <a href="#">Heat Plan</a> , and may include cool roofs (green roofs, white roofs), green walls, etc.  This metric could be compared between EJ and non-EJ areas.		

<b>B.7. Investments in thermal comfort</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards weatherization and retrofitting projects that improve heat comfort in buildings.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also be presented as a percentage of the total investment from the EEIF.		

<b>B.8. Investments in populations impacted by the Urban Heat Island</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards improving thermal comfort in areas with a high Urban Heat Island Index.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF. - Information on census tracts and UHI index can be obtained from current <a href="#">data</a> in the Environment Department.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric could also be presented as a percentage of the total investment from the EEIF.</p> <p>If data on UHI is not available at a granular level, this metric could refer to the “Heat Vulnerable Focus Areas” identified in the City’s Heat Plan: Chinatown, Dorchester, East Boston, Mattapan, and Roxbury.</p>		



**C. Energy cost burdens**

<b>C.1. Average energy burden by zip code</b>			
<b>Description</b>	Average percentage of gross household income spent on energy costs by zip code.		
<b>Units</b>	Percentage	<b>Data sources</b>	<ul style="list-style-type: none"> <li>- Energy burden (or utility burden) is reported in the <a href="#">Greenlink Equity Map</a> and updated annually.</li> <li>- U.S. DOE maps energy burden at the level of census tracts in their <a href="#">LEAD Tool</a>. This tool is based on five-year data estimates and is not updated annually.</li> </ul>
<b>Scale</b>	Census tract	<b>Frequency</b>	Annual or every five years
<b>Additional notes</b>	<p>While this metric is available by census tract, this data could {technically} be matched to zip codes.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>C.2. Estimated energy savings in BERDO buildings</b>			
<b>Description</b>	Estimated amount of MWh saved due to compliance with BERDO.		
<b>Units</b>	KWh / MWh	<b>Data sources</b>	- Could be estimated through BERDO reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric requires the definition of a baseline against which energy consumption will be compared. The City could report energy savings with respect to the beginning of the Ordinance in 2022 or other specific baseline year or annual savings.		

<b>C.3. Estimated energy cost savings in BERDO buildings</b>			
<b>Description</b>	Estimated energy cost savings due to compliance with BERDO.		
<b>Units</b>	KWh / MWh	<b>Data sources</b>	- Could be estimated by multiplying the estimated energy savings (see metric C.2.) by an average cost of electricity.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric would require data from metric C.2.		

<b>C.4. Enrollment in BCCE in BERDO buildings</b>			
<b>Description</b>	Number of accounts in BERDO buildings enrolled in any service of Boston's Community Choice Electricity Program.		
<b>Units</b>	Number	<b>Data sources</b>	- COB has quarterly - and eventually annual - reports including the number of accounts and total KWh consumed in BERDO buildings.
<b>Scale</b>	Total Census tract	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric serves as a proxy of energy cost savings and customer protection from competitive suppliers.</p> <p>This metric could also be reported as the percentage of BERDO buildings enrolled in BCCE.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>C.5. Enrollment in BCCE's Optional Green 100 Service in BERDO buildings</b>			
<b>Description</b>	Number of accounts in BERDO buildings enrolled in the Optional Green 100 service of Boston's Community Choice Electricity Program.		
<b>Units</b>	Number	<b>Data sources</b>	- COB has quarterly - and eventually annual - reports including the number of accounts and total KWh consumed in BERDO buildings.
<b>Scale</b>	Total Census tract	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric serves as a proxy of energy cost savings, customer protection from competitive suppliers, and access to renewable energy.</p> <p>This metric could also be reported as the percentage of BERDO buildings enrolled in BCCE;s Optional Green 100 Service.</p> <p>This metric could be compared between EJ and non-EJ areas.</p>		

<b>C.6. Investments in populations impacted by high energy burdens</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards energy efficiency and weatherization improvements in areas with high energy burdens (more than 6%).		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also be presented as a percentage of the total investment from the EEIF.		

<b>C.7. Investments in affordable housing BERDO buildings</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards energy efficiency and weatherization improvements in affordable housing BERDO units.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also be presented as a percentage of the total investment from the EEIF.		

**D. Local jobs and workforce development**

<b>D.1. Contracts with Minority and Women Owned Business Enterprises for third-party verification</b>			
<b>Description</b>	Number of contracts with MWBEs created for third-party verification of BERDO reporting.		
<b>Units</b>	Number	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	The City would need to identify eligible MWBE third-party verifiers and identify the number of buildings / building portfolios that contracted with them.		

<b>D.2. Contracts with Minority and Women Owned Business Enterprises for building upgrades</b>			
<b>Description</b>	Number of contracts with MWBEs created for building upgrades in BERDO buildings.		
<b>Units</b>	Number	<b>Data sources</b>	- BERDO Reporting Form could ask building owners to report whether they implemented any energy efficiency or weatherization upgrades and whom they contracted. - An alternative is to survey a variety of companies and report an estimate of BERDO-related contracts.
<b>Scale</b>	Total	<b>Frequency</b>	- Annual
<b>Additional notes</b>	The City would need to identify eligible MWBEs and identify the number of buildings / building portfolios that contracted with them.		

<b>D.3. Contracts with graduates from green workforce development programs</b>			
<b>Description</b>	Number of contracts with graduates from green workforce development programs for building upgrades in BERDO buildings.		
<b>Units</b>	Number	<b>Data sources</b>	<ul style="list-style-type: none"> <li>- BERDO Reporting Form could ask building owners to report whether they implemented any energy efficiency or weatherization upgrades and whom they contracted.</li> <li>- An alternative is to survey a variety of companies that hire graduates and report an estimate of BERDO-related contracts.</li> </ul>
<b>Scale</b>	Total	<b>Frequency</b>	- Annual
<b>Additional notes</b>	The City would need to identify eligible workforce development programs in existence, such as Boston’s PowerCorps Program, MassCEC Clean Energy Internship Program, Roxbury’s Center for Smart Building Technology, etc., and have an understanding of the companies that have hired their graduates. For example, MassCEC maps the employers that have participated in their <a href="#">Clean Energy Internship Program</a> .		

<b>D.4. Investments in buildings owned by Minority and Women Owned Business Enterprises</b>			
<b>Description</b>	Dollar amount from the Equitable Emissions Investment Fund directed towards energy efficiency and weatherization improvements in buildings owned by MWBEs.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>This metric could also be presented as a percentage of the total investment from the EEIF.</p> <p>This metric could be expanded to include buildings rented by MWBEs.</p>		

**E. Displacement and fair housing**

<b>E.1. Eviction filings in BERDO buildings undergoing energy efficiency renovations or upgrades</b>			
<b>Description</b>	Number of eviction filings in BERDO buildings (undergoing energy efficiency renovations or upgrades).		
<b>Units</b>	Number	<b>Data sources</b>	<ul style="list-style-type: none"> <li>- The Office of Housing can provide data on eviction filings on a monthly basis.</li> <li>- BERDO buildings undergoing renovations or upgrades can be identified either through BERDO reporting or by identifying buildings that applied for a permit to do upgrades.</li> </ul>
<b>Scale</b>	Zip code Neighborhood	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>Numbers could be compared to a sample of non-BERDO buildings to determine whether there is a disproportionate number of eviction filings in BERDO buildings.</p> <p>Numbers could also be compared between EJ and non-EJ areas to determine if evictions in BERDO buildings disproportionately occur in EJ populations.</p>		

<b>E.2. Displacement risk in BERDO buildings</b>			
<b>Description</b>	Number of BERDO buildings located in a census tract or zip code with a high displacement risk index.		
<b>Units</b>	Number	<b>Data sources</b>	<ul style="list-style-type: none"> <li>- The Office of Housing publishes data on Boston's displacement risk index. Example from 2020 <a href="#">here</a>.</li> <li>- The Environment Department could determine the number of BERDO buildings located within each census tract.</li> </ul>
<b>Scale</b>	Census tract Zip code	<b>Frequency</b>	Annual
<b>Additional notes</b>	Tracking this metric over time could help understand nuanced and low onset changes in the areas where BERDO buildings are located.		

<b>E.3. Demographic change by zip code</b>			
<b>Description</b>	Percentage change in the number of White people (White alone, not Hispanic or Latino) over a five year period.		
<b>Units</b>	Percentage	<b>Data sources</b>	- One-year and five-year population percentage estimates are published by the ACS. Five-year estimates are generally considered more reliable. A longer time frame is also recommended to capture slow processes such as gentrification.
<b>Scale</b>	Census tract Zip code	<b>Frequency</b>	Every 5 years
<b>Additional notes</b>	This metric is used by the City of Providence’s “Just Providence Framework” as a proxy of gentrification (see report <a href="#">here</a> , page 6).		

<b>E.4. Gross rent as a percentage of household income by zip code</b>			
<b>Description</b>	Gross rent as a percentage of household income.		
<b>Units</b>	Percentage	<b>Data sources</b>	- One-year and five-year population percentage estimates are published by the ACS. Five-year estimates are generally considered more reliable.
<b>Scale</b>	Census tract Zip code	<b>Frequency</b>	Annual or every 5 years
<b>Additional notes</b>	This metric could be compared between EJ and non-EJ area.		

<b>E.5. Housing burden by zip code</b>			
<b>Description</b>	Percentage of households that pay more than 30% of their income on mortgage or rent.		
<b>Units</b>	Percentage	<b>Data sources</b>	- Housing burden, as defined in this metric, is reported in the <a href="#">Greenlink Equity Map</a> . This mapping tool uses data from the ACS, so the raw data could also be retrieved directly from there.
<b>Scale</b>	Census tract Zip code	<b>Frequency</b>	Annual or every 5 years
<b>Additional notes</b>	This metric could be compared between EJ and non-EJ areas.		



**F. Environmental impacts and program performance**

<b>F.1. Greenhouse gas emissions reductions in BERDO buildings</b>			
<b>Description</b>	Total reduction of greenhouse gas emissions in BERDO buildings.		
<b>Units</b>	tons of CO <sub>2e</sub>	<b>Data sources</b>	- BERDO reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric requires the definition of a baseline against which GHG emissions will be compared. The City could report emissions reductions with respect to the beginning of the Ordinance in 2022, annual changes, or a specific baseline year.		

<b>F.2. Greenhouse gas emissions reductions financed by the Equitable Emissions Investment Fund</b>			
<b>Description</b>	Total reduction of greenhouse gas emissions resulting from projects financed through the Equitable Emissions Investment Fund.		
<b>Units</b>	tons of CO <sub>2e</sub>	<b>Data sources</b>	- Collected information from the EEIF.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric requires the definition of a baseline against which GHG emissions will be compared. The City could report emissions reductions with respect to the beginning of the Ordinance in 2022, annual changes, or a specific baseline year.		

<b>F.3. BERDO 2.0 compliance rates</b>			
<b>Description</b>	Percentage of BERDO buildings in compliance with the current Emissions Standard without making Alternative Compliance Payments.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO reporting
<b>Scale</b>	Total Census tract	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could be compared between EJ and non-EJ areas.		

<b>F.4. Rates of compliance through Renewable Energy Credits</b>			
<b>Description</b>	Percentage of BERDO buildings that retired RECs as a method of compliance with BERDO 2.0.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	The current version of the BERDO Reporting Form only asks owners to answer if they have purchased RECs. The form could have an additional question inquiring the number of RECs (or MWh) retired from the market, and these numbers could be reported as well.		

<b>F.5. Rates of compliance through Power Purchase Agreements</b>			
<b>Description</b>	Percentage of BERDO buildings that retired RECs as a method of compliance with BERDO 2.0.		
<b>Units</b>	Percentage	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	The current version of the BERDO Reporting Form only asks owners to answer if they have a PPA. The form could have an additional question inquiring the amount of energy procured through the PPA, and these numbers could be reported as well.		

<b>F.6. Total Expenditures from the Equitable Emissions Investment Fund</b>			
<b>Description</b>	Total expenditures from the Equitable Emissions Investment Fund.		
<b>Units</b>	USD	<b>Data sources</b>	- Collected information from the EEIF.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also include the total number of projects that received funding from the EEIF.		

<b>F.7. Net-Zero BERDO buildings</b>			
<b>Description</b>	Number of BERDO buildings that are certified as Net-Zero.		
<b>Units</b>	Number	<b>Data sources</b>	- BERDO Reporting Form could ask building owners to report about the net-zero status of their buildings.
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	This metric could also be presented as a percentage of BERDO buildings that are certified as Net-Zero,		

<b>F.8. Battery energy storage systems in BERDO buildings</b>			
<b>Description</b>	Number of BERDO buildings that have installed battery energy storage technologies.		
<b>Units</b>	Number	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>The BERDO Reporting Form could also inquire about the storage capacity and report the total KW of energy storage installed in BERDO buildings.</p> <p>This metric could also be presented as a percentage of BERDO buildings that have energy storage.</p>		

<b>F.9. Electric vehicle infrastructure in BERDO buildings</b>			
<b>Description</b>	Number of BERDO buildings that have installed electric vehicle charging stations.		
<b>Units</b>	Number	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>The BERDO Reporting Form could also inquire about the number of stations and the charging capacity of the charging stations.</p> <p>This metric could also be presented as a percentage of BERDO buildings that have EV infrastructure.</p>		

<b>F.10. On-site renewable energy generation in BERDO buildings</b>			
<b>Description</b>	Total KWh generated by renewable energy systems in BERDO buildings.		
<b>Units</b>	KWh / MWh	<b>Data sources</b>	- BERDO Reporting
<b>Scale</b>	Total	<b>Frequency</b>	Annual
<b>Additional notes</b>	<p>The BERDO Reporting Form could also inquire about the charging capacity and report the total KW of energy storage installed in BERDO buildings.</p> <p>This metric could also be presented as a percentage of BERDO buildings that have EV infrastructure.</p>		