



***Solar for Building
Certifications and Zoning***

August 11, 2022

Summer Series of Webinars

Second Thursday of each month, from 1 - 2pm

June 9

**Solar 101 +
Financing and
Contracting**

Great for Developers

July 14

**Solar Design for
New Construction**

*Great for Architects
and Developers*

August 11

**Zoning &
Certifications**

*Great for Architects
and Developers*

LISC BOSTON

40  **MACDC**
Celebrating 40 years

Agenda

1. **Overview of Common Building Certifications**
2. **Passive House (PHIUS)**
3. **Living Building Challenge (LBC)**
4. **BERDO**
5. **Zoning/Municipal Requirements**
6. ***BONUS* Inflation Reduction Act**
7. **Recap**

Q&A Session (20 Minutes)

Please add all questions to the Q&A box, as we will have time at the end to address them

Who We Are

- **Mission:** To expand access to clean energy in underinvested communities
- **About:** Boston-based development company building projects in MA, NY
- **Focus:** Affordable Housing, Nonprofit, Small Commercial
- **Mechanics:** Aggregating solar projects for low-cost, high quality installations and impact financing





Overview of Common Building Certifications

Common Building Certifications

1. **Passive House US (PHIUS)**
2. **LEED**
3. **Living Building Challenge**
4. **E+**



LIVING
BUILDING
CHALLENGE



Passive House (PHIUS)



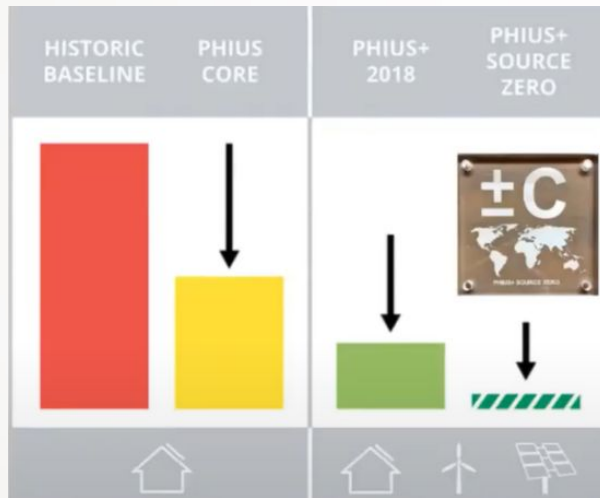
What is Passive House?

- “Passive House” refers to:
 - an **approach** to the design of highly energy- efficient buildings
 - a **building** that is designed using a passive house approach
 - a **standard** for building energy efficient buildings developed by a Passive House organization. In the case of most US buildings, PHIUS Core and PHIUS ZERO standards.

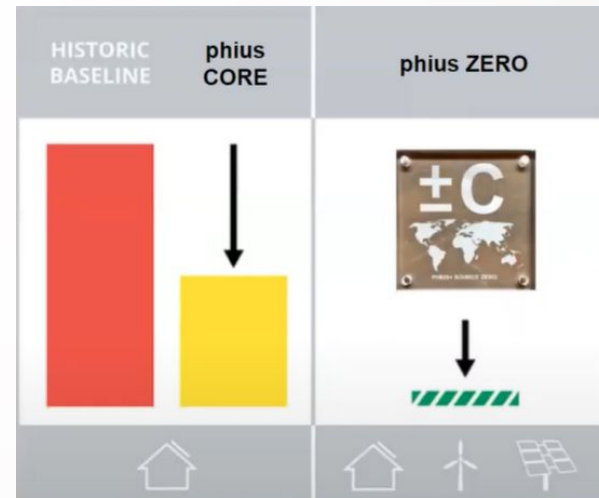


PHIUS 2018 vs. PHIUS 2021 Certifications

2018










2021



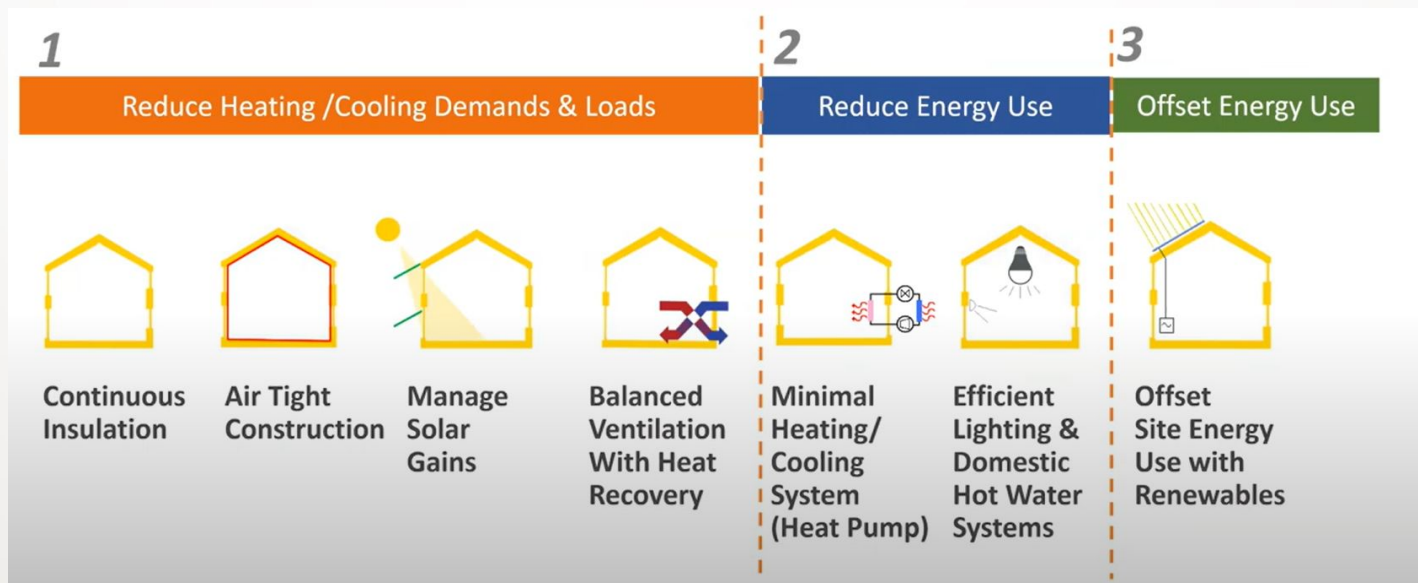
PHIUS Comparison

U.S. DOE High Performance Staircase

								Source Zero Renewable Energy System
							Balanced Ventilation HRV/ERV	Balanced Ventilation HRV/ERV
							SOLAR READY ALWAYS	SOLAR READY ALWAYS
							Eff. Comps. & H ₂ O Distrib	Eff. Comps. & H ₂ O Distrib
							EPA Indoor airPLUS	EPA Indoor airPLUS
							Ducts in Condit. Space	Ducts in Condit. Space
			HVAC QI w/WHV	HVAC QI w/WHV	HVAC QI w/WHV		Micro-load HVAC QI	Micro-load HVAC QI
			Water Management	Water Management	Water Management		Water Management	Water Management
			Independent Verification	Independent Verification	Independent Verification		Independent Verification	Independent Verification
IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2012/15 Encl./ES Win.			Ultra-Efficient Enclosure	Ultra-Efficient Enclosure
HERS 85-90	HERS 70-80	HERS 65-75	HERS 55-65	HERS 48-55			HERS 35-45	HERS < 0
 IECC 2009	 IECC 2012	 ENERGY STAR v3	 ENERGY STAR v3.1	 ZERH		 phiUS CORE	 phiUS ZERO	

Net Source Energy Goals

- PHIUS CORE: Finding the optimum balance of on-site conservation through passive and active strategies
- PHIUS ZERO: Targeting annual net zero operational energy



PHIUS Comparison

GETTING TO ZERO

with a passive building baseline



Solar & PHIUS 2021

- CORE: Renewable energy is not required, but some on-site renewable energy is credited. REAF is determined by a pre-defined utilization curve provided by PHIUS.
- ZERO: The adjusted renewable energy provided to the project must be equal to or greater than the modeled energy use of the building.

Table A-2: Multipliers for Renewable Energy Procurement Methods

Location	Renewable Energy Source	Renewable Energy Adjustment Factor	
		CORE	ZERO
On-Site	On-Site Renewable Energy System	Varies ⁵¹	1.00
Off-Site	Directly Owned Off-Site Renewable Energy System	N/A	0.75
Off-Site	Community Renewable Energy System	N/A	0.75
Off-Site	Virtual PPA	N/A	0.75
Off-Site	Green-e RECs	N/A	0.20

Solar & PHIUS 2021

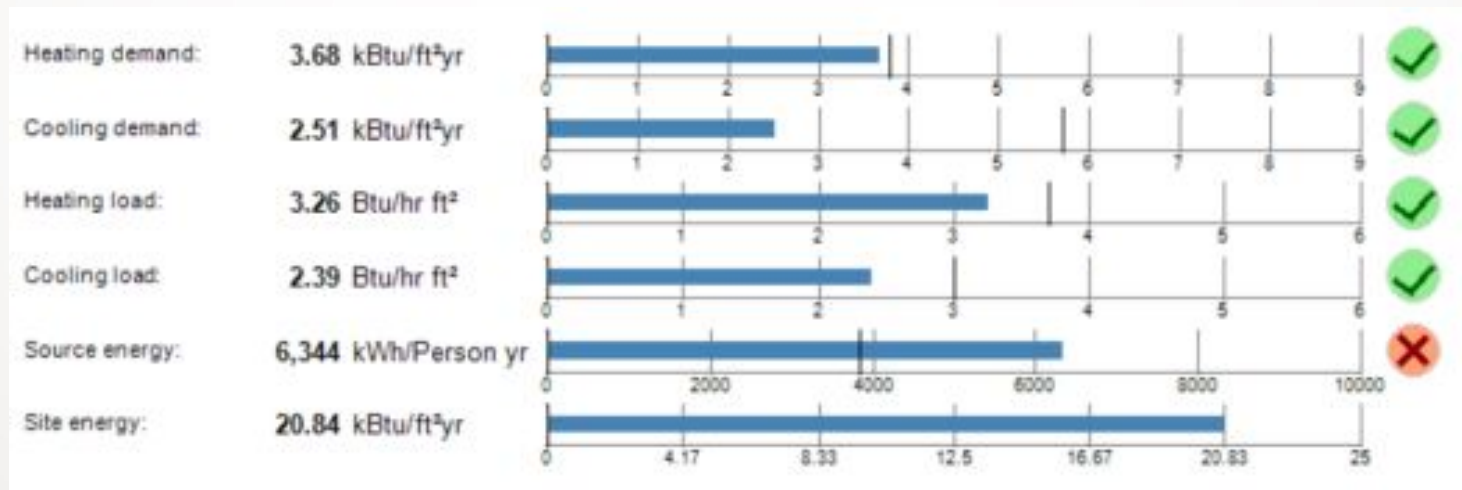
- Grid-Electricity Source Energy Factor for the US is 1.8

Phius CORE	Annual Renewable Energy Production (kWh/yr)	Adjustment Factor	Grid-Electricity Source Energy Factor	Offset to Source Energy
On-Site Renewable Energy System	✗	Varies	✗	≡
TOTAL	-	-	-	

Phius ZERO	Annual Renewable Energy Production (kWh/yr)	Adjustment Factor	Grid-Electricity Source Energy Factor	Offset to Source Energy
On-Site Renewable Energy System	✗	1	✗	≡
Directly Owned Off-Site Renewable Energy System	✗	0.75	✗	≡
Community Renewable Energy System	✗	0.75	✗	≡
Virtual Power Purchase Agreement	✗	0.75	✗	≡
Green-E Certified RECs	✗	0.2	✗	≡
TOTAL	-	-	-	

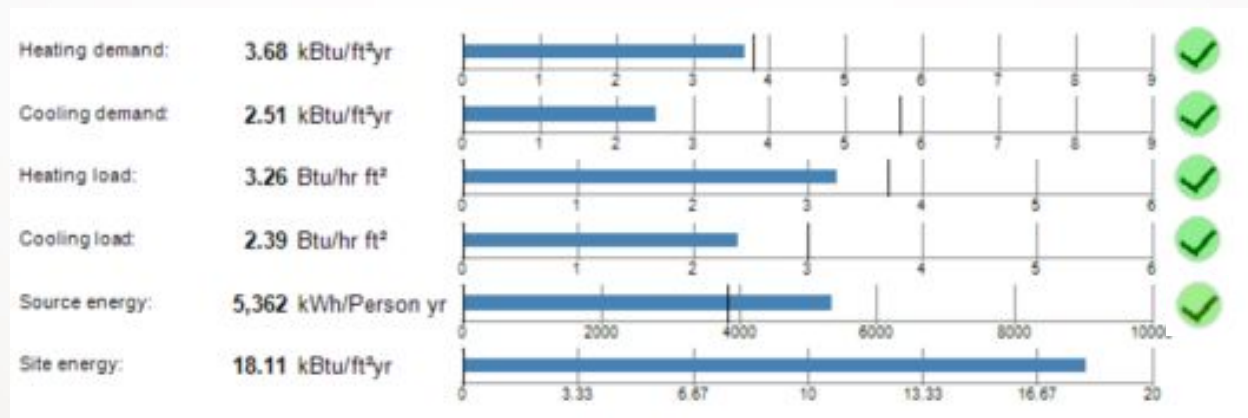
Ex. Project: 2018 PHIUS Core

- PHIUS 2018 Core calls for 5,500 kWh/yr/person for residential multifamily buildings
- Note: PHIUS 2021's kWh/yr/person is determined on a project by project basis



Ex. Project: 2018 PHIUS Core

- With an estimated 35,000 kWh/year of solar electricity generated by the solar PV array being installed on this building, the project is able to get under the 5,500 kWh/person/yr requirement.



An aerial photograph of a historic clock tower with a green dome and a modern solar panel array on the roof. The tower is white with two large circular clock faces. The surrounding area includes a town with various buildings, trees, and a parking lot with several cars. The sky is blue with scattered white clouds.

Living Building Challenge (LBC)

What is the LBC?

- A building standard with compliance based on actual, rather than modeled or anticipated, performance. Projects need to be operational for at least 12 months prior to audit to verify Imperative compliance and any building project can be eligible.
- All Living Building Challenge projects must address aspects of all 7 of their “Petals” (performance categories) through the “Core Imperatives”
- 2 Certification types:
 - Petal Certification: building addresses “Core Imperatives” in addition to selected petals
 - Full Certification: building addresses all 7 petals




















7 LBC Petals (Performance Categories)



Full List of Imperatives

The Living Building Challenge is composed of 20 Imperatives grouped into seven petals. Some Imperatives are not required for all Typologies.

PETAL		IMPERATIVE	TYPOLOGY			
			New Building	Existing Building	Interior	Landscape + Infrastructure
PLACE		01 Ecology of Place	Required	Requirement Dependent	Not Required	Required
		02 Urban Agriculture	Required	Required	Not Required	Not Required
		03 Habitat Exchange	Required	Required	Required	Required
		04 Human Scaled Living	Required	Requirement Dependent	Requirement Dependent	Not Required
WATER		05 Responsible Water Use 	Required	Required	Requirement Dependent	Required
		06 Net Positive Water 	Required	Required	Not Required	Required
ENERGY		07 Energy + Carbon Reduction	Required	Required	Requirement Dependent	Required
		08 Net Positive Carbon	Required	Required	Not Required	Required
HEALTH + HAPPINESS		09 Healthy Interior Environment	Required	Required	Not Required	Not Required
		10 Healthy Interior Performance	Required	Required	Not Required	Not Required
		11 Access to Nature	Required	Required	Not Required	Not Required
MATERIALS		12 Responsible Materials	Required	Required	Not Required	Required
		13 Red List	Required	Required	Not Required	Required
		14 Responsible Sourcing	Required	Required	Not Required	Required
		15 Living Economy Sourcing	Required	Required	Not Required	Required
		16 Net Positive Waste	Required	Required	Not Required	Required
EQUITY		17 Universal Access	Required	Requirement Dependent	Requirement Dependent	Requirement Dependent
		18 Inclusion	Required	Required	Not Required	Required
BEAUTY		19 Beauty + Biophilia	Required	Required	Not Required	Required
		20 Education + Inspiration	Required	Required	Not Required	Required

-  CORE IMPERATIVE
-  SCALE JUMPING ALLOWED
-  HANDPRINTING IMPERATIVE
-  IMPERATIVE REQUIRED FOR TYPOLOGY
-  REQUIREMENT DEPENDENT ON SCOPE
-  NOT REQUIRED FOR TYPOLOGY

Solar & LBC

- Imperative 7: Energy & Carbon Reduction (core imperative)

	NEW BUILDING	EXISTING BUILDING	INTERIOR
ENERGY PERFORMANCE REQUIREMENT	70% reduction from an equivalent building baseline	50% reduction from an equivalent building baseline	35% reduction from an equivalent building baseline
COMBUSTION LIMITS ¹⁷	Not Allowed (except through existing exceptions)	Allowed for HVAC systems that are not in project scope. Phase out plan and advocacy are required.	
RENEWABLES	Must be on-site to count towards the efficiencies above.		

- Imperative 8: Net Positive Carbon
 - Projects need to be designed to be “zero ready” through strategies such as pre-installing wiring and connection for EV charging & future installation of renewable energy systems.
 - All projects must supply **105%** of their project’s energy needs through on-site renewable energy on a net annual basis, without the use of combustion.
 - projects must also sub-meter major energy end uses

Solar & LBC

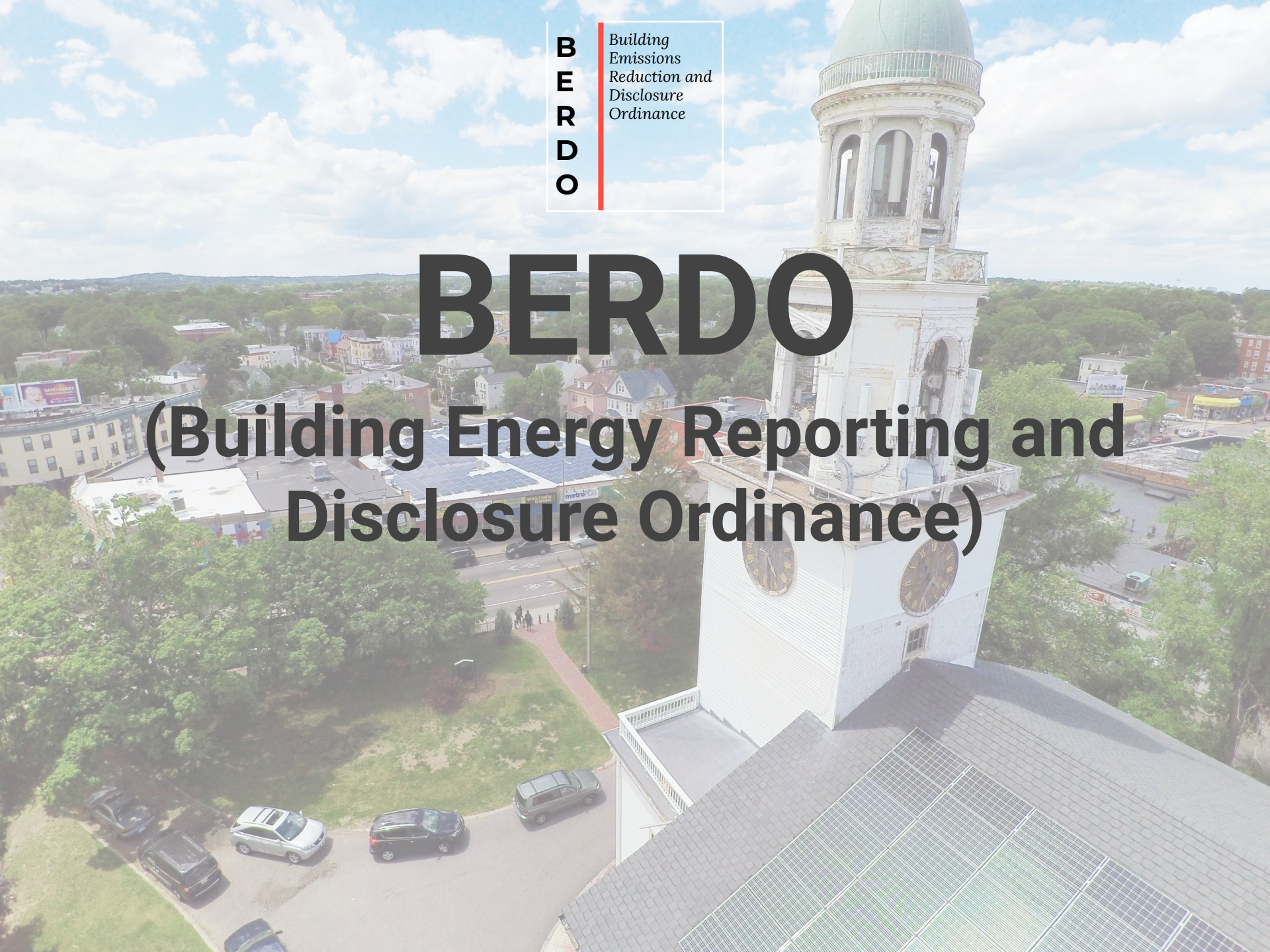
- “The Living Building Challenge (LBC) Red List represents the “worst in class” materials, chemicals, and elements known to pose serious risks to human health and the greater ecosystem that are prevalent in the building products industry”
- Solar requires Red List material exceptions in 99% of cases due to certain banned materials being in many solar components.



**B
E
R
D
O**

*Building
Emissions
Reduction and
Disclosure
Ordinance*

BERDO **(Building Energy Reporting and Disclosure Ordinance)**



What is BERDO?

Goal: Gradually reduce emissions from buildings to net zero by 2050

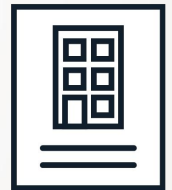
How: Require large buildings first to report emissions, then to fall below a certain level of emissions, or risk significant fines

Where: BERDO is Boston-specific

Similar programs already exist, or are likely to be replicated in cities across the state and country.

BERDO

Building Emissions Reduction and Disclosure Ordinance



When is BERDO?

	15 - 35 Unit Buildings	35+ Unit Buildings
Reporting Begins	2022	2017
Emissions Standard Begins	2030	2025

* Third party verification required

BUILDING USE	2025-2029	2030 - 2034	2035 - 2039	2040-2044	2045-2049	2050 -
Assembly	7.8	4.6	3.3	2.1	1.1	0
College / University	10.2	5.3	3.8	2.5	1.2	0
Education	3.9	2.4	1.8	1.2	0.6	0
Food Sales and Service	17.4	10.9	8.0	5.4	2.7	0
Healthcare	15.4	10.0	7.4	4.9	2.4	0
Lodging	5.8	3.7	2.7	1.8	0.9	0
Manufacturing / Industrial	23.9	15.3	10.9	6.7	3.2	0
Multifamily Housing	4.1	2.4	1.8	1.1	0.6	0
Office	5.3	3.2	2.4	1.6	0.8	0
Retail	7.1	3.4	2.4	1.5	0.7	0
Services	7.5	4.5	3.3	2.2	1.1	0
Storage	5.4	2.8	1.8	1.0	0.4	0
Technology / Science	19.2	11.1	7.8	5.1	2.5	0

Emissions Standards: Multifamily Housing

In kgCO₂e/sf/year

2025 - 2029	2030 - 2034	2035 - 2039	2040 - 2044	2044 - 2049	2050+
4.1	2.4	1.8	1.1	0.6	0

PHIUS & BERDO

PHIUS-certified
multifamily
housing

≈ 1.6 - 2.1
kgCO₂e/sf/year



2025 - 2029	2030 - 2034	2035 - 2039	2040 - 2044	2044 - 2049	2050+
4.1	2.4	1.8	1.1	0.6	0

The more you rely on electricity over gas, the better your emissions factor.

Solar & BERDO

Rooftop solar PV reduces
your BERDO emissions factor.

✓ PPA

✓ Direct
Purchase

Regulation specifics are still being worked out this year.

Emissions reporting will include your utility bills,
as well as any PV production and purchased RECs.



Zoning/Municipal Requirements

Requirements in MA Municipalities

- **Watertown**: requires solar PV on most new commercial buildings (*ordinance passed in November 2018*)
 - 10,000+ sq ft roof and good solar orientation requires at least 50% of the roof to be covered in solar
- **Boston**: requires buildings look into solar, considering requiring solar moving forward if it is technically feasible
- **Salem**: looking into either requiring solar or requiring new buildings to look into it, similar to Boston
- **Cambridge**: looking into requirements for solar for new construction
- *More to come - likely to become a requirement statewide in the coming years (based on CA solar requirement).*

BONUS!

Inflation Reduction Act: Solar for Affordable Housing Implications

(According to bill language passed by the United States Senate on August 7, 2022)

Inflation Reduction Act Sneak Peek

Year	Base ITC	EJ Location “Adder”	EJ Offtaker “Adder”	Largest ITC Possible
2022	30%	-	-	30%
2023	30%	10%	20%	50%*
2024	30%	10%	20%	50%*
2025	30%	-	-	30%
...	(Until 2031)	Qualification: Located in Federal EJ census tract	Qualification: A) Low income community solar w/ 50% to LI offtakers <u>or</u> B) Aff Housing with power “Equally distributed to tenants”; def TBD)	Note: Additional 10% available if all components made in the US. *Projects capped at 50% ITC

Note: There is a total of 1.8 GW of combined first come, first serve capacity for EJ adders in 2023 and 2024. Can build up to 4 years after reserving adder.

Recap



How to Work with Resonant

1. Provide Intake Info + Drawings
2. Review Feasibility Analysis (No Cost). + 2 Wks
3. Sign Letter of Intent (LOI) with design retainer
4. Sign Contract + 3-4 months
5. Resonant delivers solar PV solution at a timeline that works for the client
 - a. time sensitivity on Fed Tax Credit and first-come-first-serve MA SMART program.
6. *Note: Installation is typically at very end of construction after all roof, HVAC, Plumbing work is complete + permanent power brought to site*

New Project Intake Process

New Construction - Key info:

1. Groundbreaking date (estimated)
2. Project tax credits (LIHTC, Historic), and whether financing is closed or still pending.
3. Target building certification(s)
4. Electric service (3 phase vs. single phase)
5. Target solar output (kWh/year)
6. Common-area electricity usage (est.)
7. Drawing sets (roof 1st; then structural & electrical)

[Visit New Construction Webpage](#) - for intake sheet and submission process.

Resonant Blog Posts

Isaac Baker:

[New Construction:
Estimating Electricity
Usage & Why It
Matters](#)

Katherine Wagner:

[Resonant Energy's
"Solar Ready"
Definition for New
Construction](#)

(Designing for Solar)

Questions

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LLSC BOSTON

40  **MACDC**
Celebrating 40 years

A wide-angle photograph of a rooftop solar panel installation. The panels are dark blue and arranged in neat rows, held up by white concrete blocks and black plastic spacers. The roof is dark, and a brick wall is visible in the foreground on the right. In the background, a city skyline is visible under a blue sky with scattered white clouds. The text "Thank You!" is overlaid in large, bold, yellow letters across the center of the image.

Thank You!