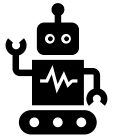
Leading by Example Council Agenda
March 8, 2022

Welcome

LBE Updates and Clean Energy News



Innovative Technology Presentations

Discussion: Barriers and Opportunities

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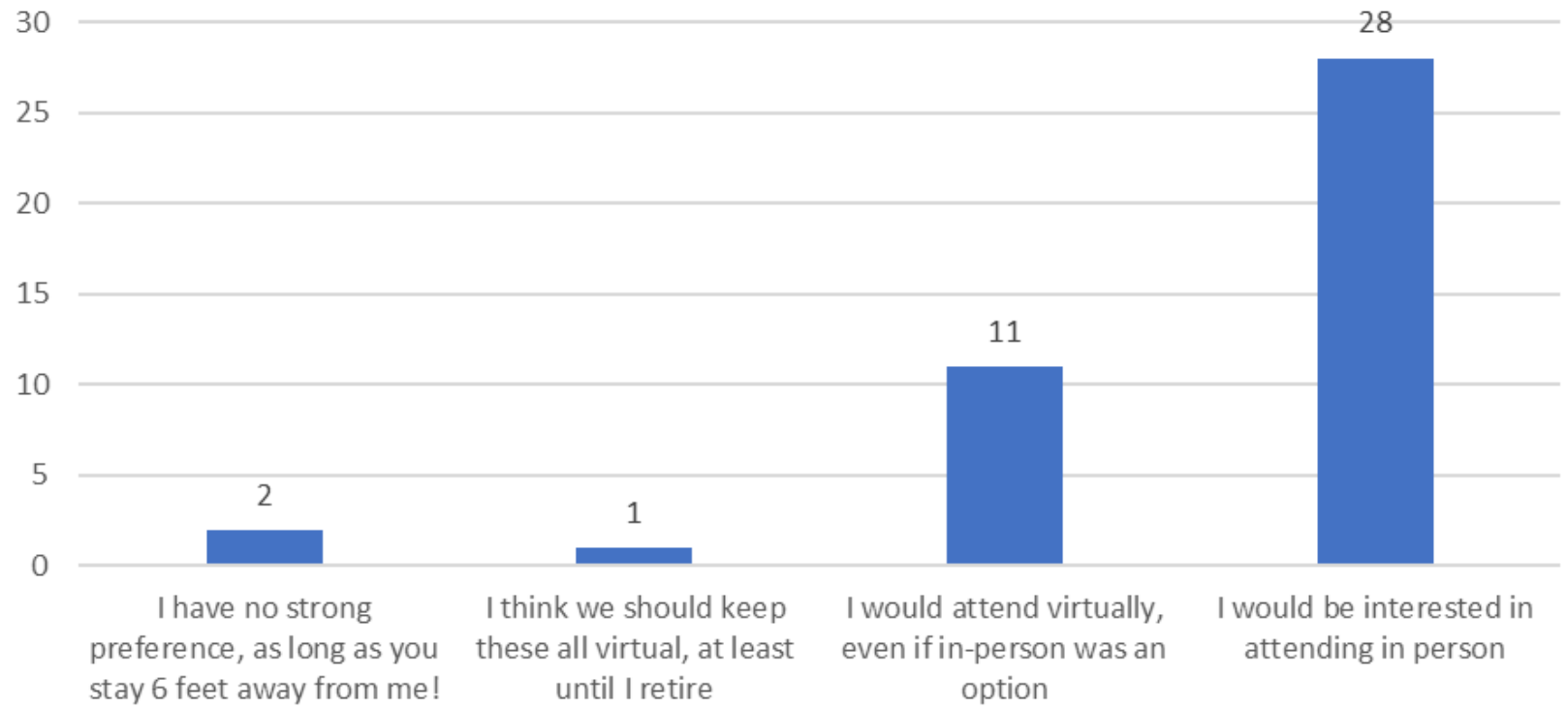
Audience Poll: Come What May?

LBE is considering a hybrid (in-person + remote) LBE Council meeting in May…what do you think?



Massachusetts Department of Energy Resources

LBE and DOER Updates

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MA Building Stretch Code Straw Proposal

Comments due 5 pm March 18, 2022

Proposal includes an update to the stretch code alongside the new specialized stretch option:

Base Code (10th Edition of MA Building Code)

- New Buildings in towns and cities that have not adopted a stretch code
- 52 communities
- BBRS update effective in 2023

Stretch Code (Update)

- New Buildings in towns and cities that adopted, including all green communities
- 299 communities
- DOER update effective in 2023

Specialized Opt-in (New Code Option)

- New Buildings in towns and cities that choose to opt-into this code
- Available for adoption Dec 2022

https://www.mass.gov/info-details/stretch-energy-code-development-2022

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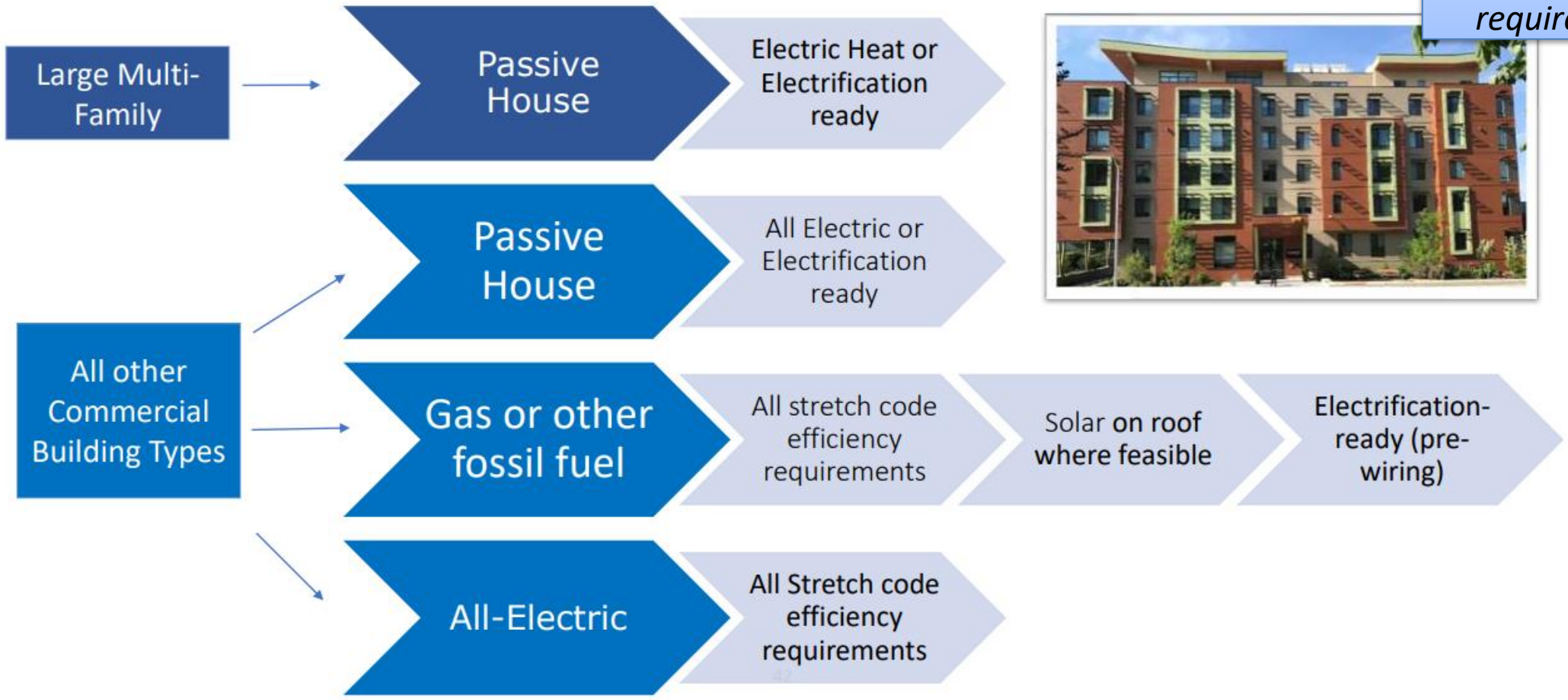
MA Building Stretch Code Straw Proposal

Final opt-in code anticipated to replace EO 594 new construction energy performance requirements

Specialized Opt-in Code (Net Zero) - Commercial



https://www.mass.gov/info-details/stretch-energy-code-development-2022

Recent DPU Rulings – Solar

SMART Program

- Capacity expansion approval
  - 1,600 MW → 3,200 MW
- BTM projects now eligible for Alternative on Bill Credits (AOBC)
- Customers living in low-income EJCs eligible for low-income incentives
- Additional items under review

As of 3/7/2022

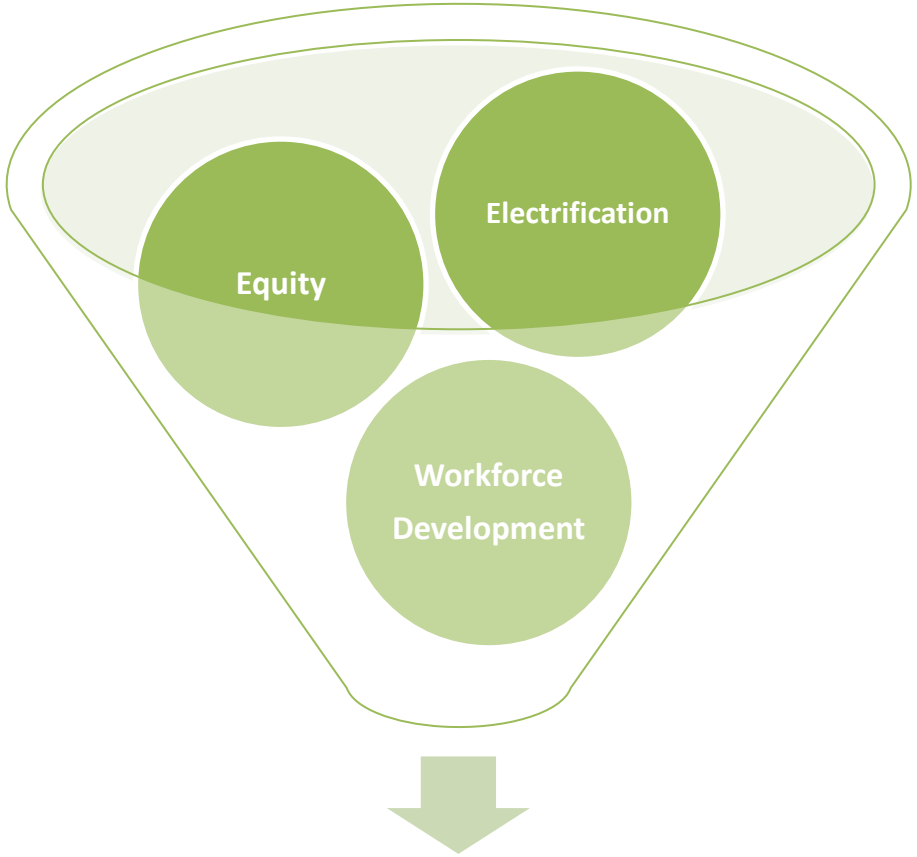
Large Projects >25 kW AC	Accepting Applications for Block…	Total Remaining Capacity, All Blocks (MW)
Eversource East + West	9 of 16	623.65
National Grid	10 of 16	502.16
National Grid Nantucket	3 of 4	5.29
Unitil	5 of 8	3.91

https://www.mass.gov/solar-massachusetts-renewable-target-smart

Recent DPU Rulings – Energy Efficiency

Three-Year Plan

- Approved by EEAC for 2022-2024
- Total budget: $3.94 billion
  - Significant portion for electric heat pump incentives and weatherization
  - Gas to electrification incentives allowed
- Targeted equity initiatives
- Program-level details forthcoming



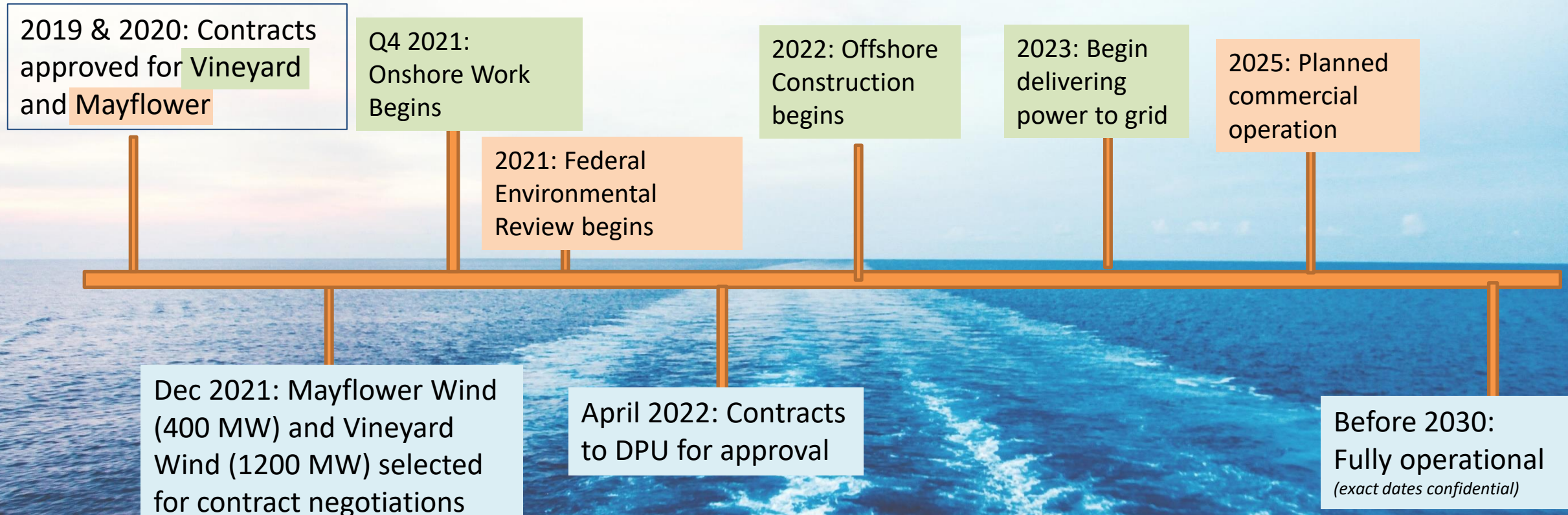
Plan Priorities

https://www.mass.gov/info-details/eeac-energy-efficiency-three-year-planning

Offshore Wind Advances: Planned Timelines

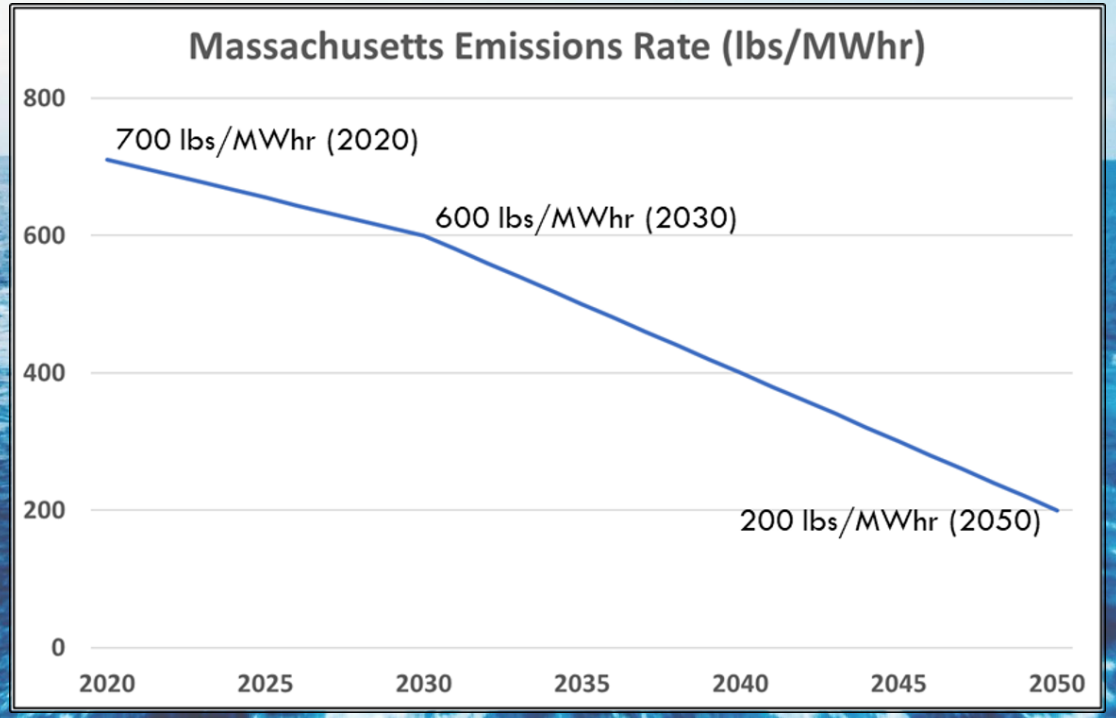
Three solicitation rounds in MA:

- Vineyard 800 MW
- Mayflower 804 MW
- Mayflower 400 MW + Vineyard 1200 MW



Breezing Towards 100% Clean Electricity

- Currently procured OSW will total 3200 MW, delivering 13 million MWh per year – 25% of current electricity consumption
- DOER currently has authorization to procure 5600 MW of OSW
- 2050 Decarbonization Roadmap calls for 80% of electricity consumed in New England to come from renewables, particularly wind and solar (15-20 GW each)



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EPP Program Annual Report

- The ***Annual Environmental Preferable Product Procurement Program Report*** summarizes the achievements and progress towards EO515 ("Establishing an Environmental Purchasing Policy") signed in 2009
- EPPs are included in 57 of OSD's 125 statewide contracts, comprising thousands of products and services
- Key environmental and cost benefits include:

	FY21
Estimated EPP spending from Statewide Contracts	$433M
Estimated annual savings, primarily from energy efficient purchasing choices	$2.2M
Reduction in lifetime metric tons of carbon dioxide equivalent ($MTCO2e)^3$, primarily from purchasing energy efficient products, those containing post-consumer recycled content, or materials diverted from disposal	319,116
Estimated tons of waste diverted from disposal to recycling	13,049

See the report on the EPP website, and contact Julia Wolfe (Julia.Wolfe@mass.gov), Director of Environmental Purchasing, for any questions or guidance

Earth Day 2022: "Invest in Our Planet"

Earth Day 2022's theme highlights how investments in sustainability lead to prosperity, equity, and healthy communities

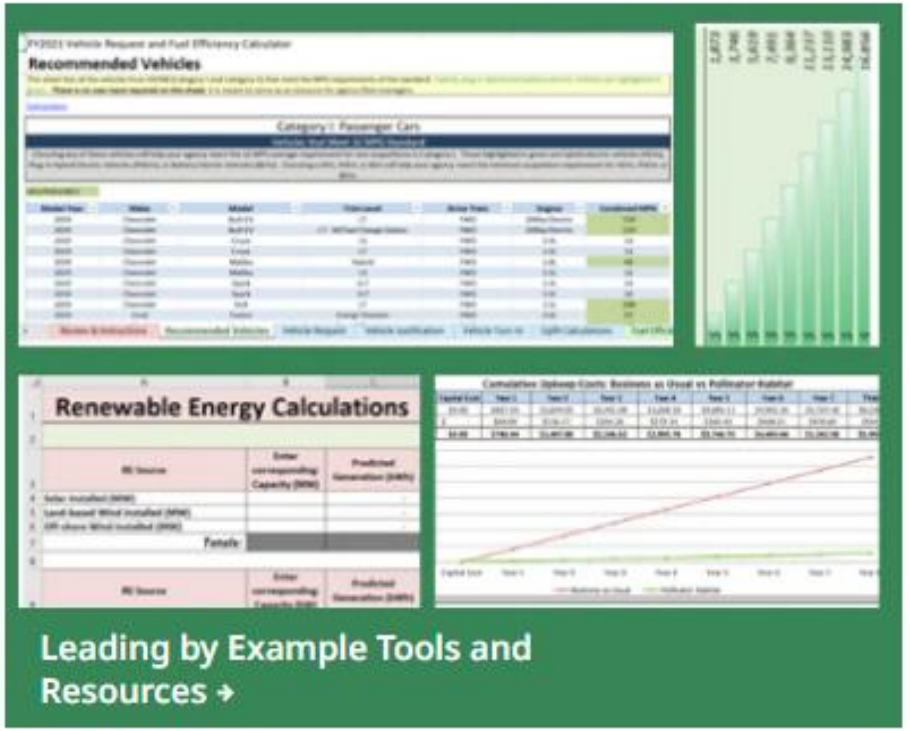
Planning a ribbon cutting, lecture series, email campaign, website launch, or another event for Earth Day? Email details to Ryan.Kingston@mass.gov!

2022 Environmental Holidays	
Solar Appreciation Day	3/11/22
Global Recycling Day	3/18/22
International Day of Forests	3/21/22
World Water Day	3/22/22
Arbor Day	4/10/22
World Bee Day	5/20/22
Bike to Work Day	5/20/22
Endangered Species Day	5/20/22
World Environment Day	6/5/22
World Oceans Day	6/8/22
Global Wind Day	6/15/22
Pollinator Week	June 20-26
National Honey Bee Day	8/15/22
Bay State Bike Month	September
National Clean Energy Week	3rd week of Sept
National Drive Electric Week	9/23/22-10/2/22
World Environmental Health Day	9/26/22
Energy Efficiency Day	10/5/22
America Recycles Day	11/15/22

LBE Tools and Resources Website

Your one-stop shop for calculators, quick-guides, and other helpful documents developed by the LBE team!

- Recently developed documents include:
  - Procuring Biofuels for Building Heat via ENE52
  - EV Total Cost of Ownership Calculator
  - Green Your Fleet – EV Options on Statewide Contracts
  - Considerations to Inform EV Charging Station Decision-Making
- Additional resources can be found by category:

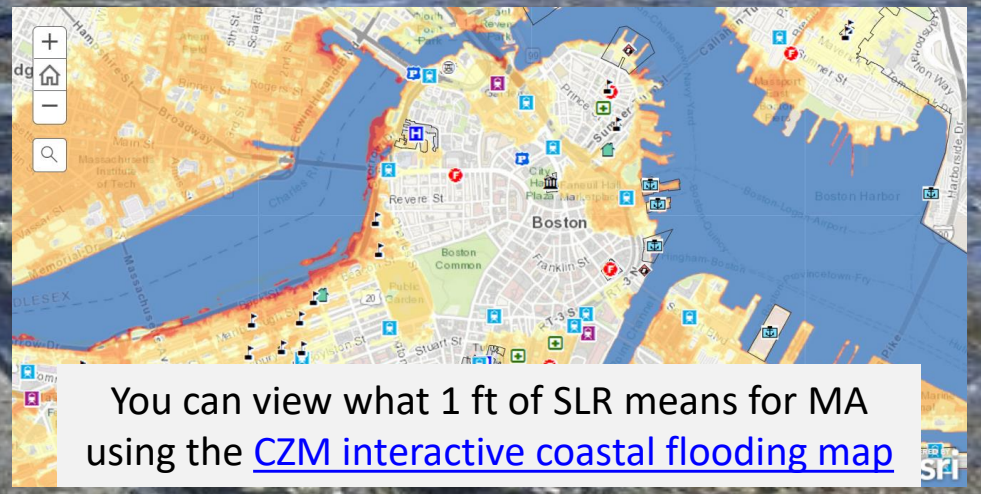


Massachusetts Department of Energy Resources

Clean Energy News

Sea Level to Rise One Foot by 2050

- NOAA report projects seas to rise 10-12 inches by 2050 – as many inches as SLR measured between 1920-2020
- By 2050, “moderate” flooding is expected to occur 10+ times more often
- 2 feet of SLR is increasingly likely by 2100. Failing to curb emissions could cause an additional 1.5-5 ft (for a total of 3.5-7 feet) by 2100.



You can view what 1 ft of SLR means for MA using the CZM interactive coastal flooding map

Source: NOAA

Image: Waves topped 12 feet during a ‘king tide’ in November 2021 (Source: Boston Globe)

New England Warming Faster than Rest of Planet

- New England warmed 3.3F between 1900-2020, while rest of planet rose 2F
  - MA warmed by 3.5F
- New England *winters* have warmed an average 4.86F
  - In MA, winter temperatures increased an average of nearly 7F
- Previous study found New England lost an average of 6.2 days of snow covering the ground between 2001-2017
  - MA lost 12 days of snow cover

"Based on the data presented here, and the continuing increase of greenhouse gases, it is clear that humanity does not have its hand on the rudder of climate control," the authors wrote. "We are in a climate crisis, and we need to take concerted steps to reduce our production of greenhouse gases as soon as possible."

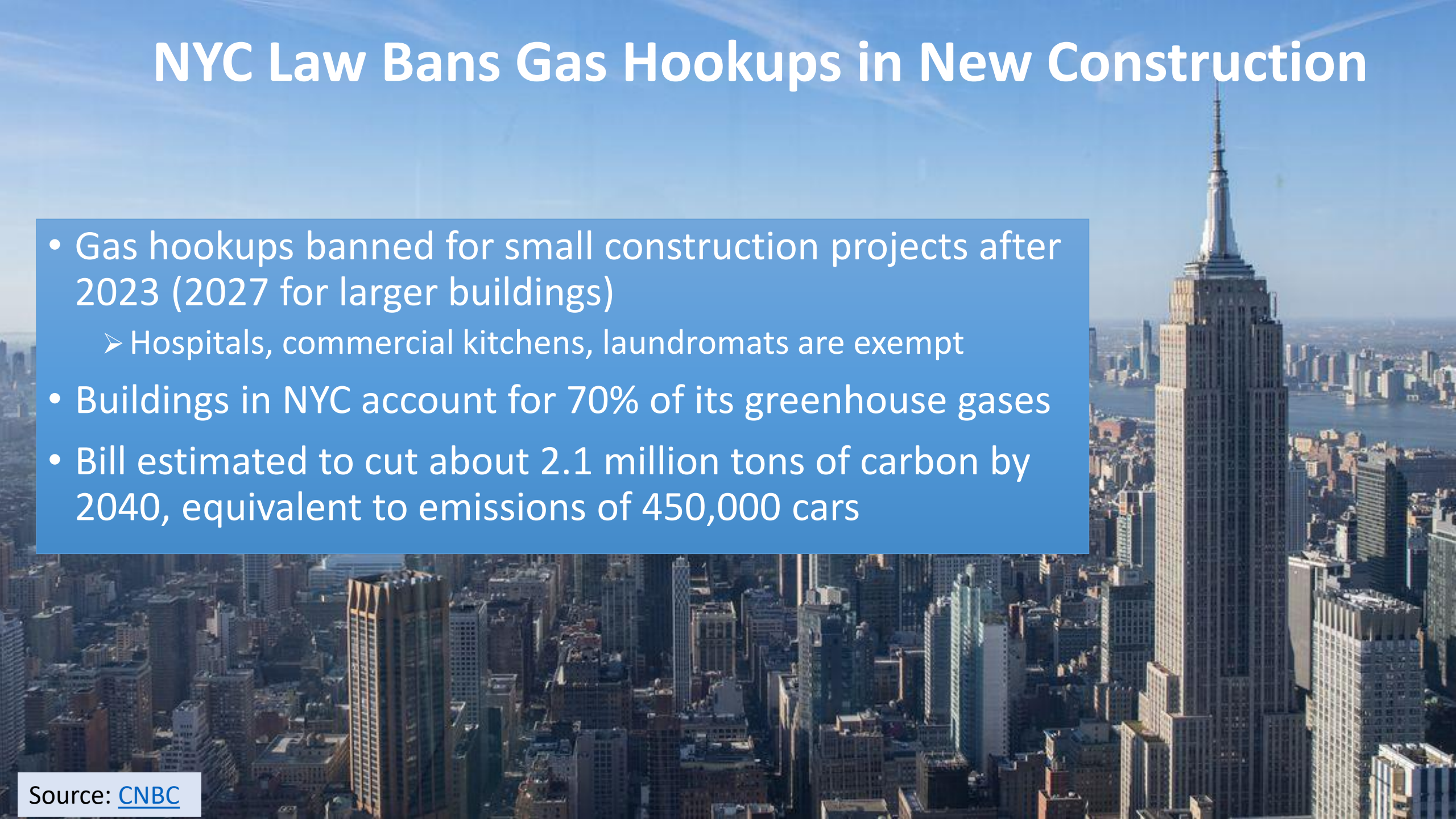
Source: Boston Globe

Gas Stoves Leak Methane, Even When Off

- Study examined how much methane is leaked at three points:
  - When knob is turned, before gas ignites
  - During cooking
  - When stove is off
- 80% of emissions happen when stoves are off – from loose couplings and fittings
- An estimated 1.3% of gas used in stoves leaks into atmosphere

Source: NPR

NYC Law Bans Gas Hookups in New Construction



- Gas hookups banned for small construction projects after 2023 (2027 for larger buildings)
  - Hospitals, commercial kitchens, laundromats are exempt
- Buildings in NYC account for 70% of its greenhouse gases
- Bill estimated to cut about 2.1 million tons of carbon by 2040, equivalent to emissions of 450,000 cars

Source: CNBC

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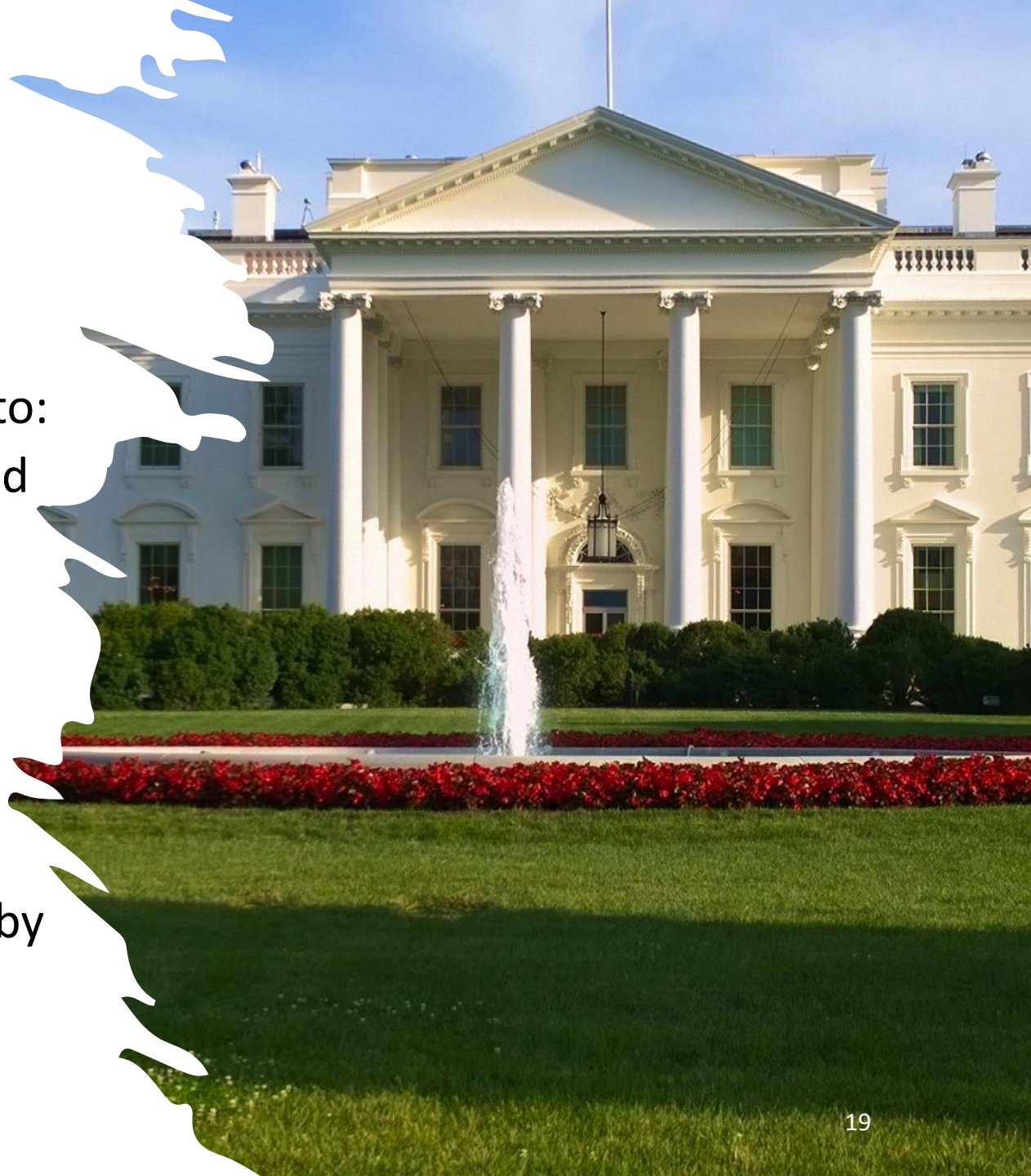
Largest North American Battery Recycling Plant

- With strong demand for EVs and limited amounts of metals on earth, recycled materials will be essential
- Facility will open in Georgia in August 2022 and will process 30,000 metric tons of batteries per year
- Battery Resourcers intends to open additional facilities across the world to process up to 150,000 metric tons of lithium-ion material globally per year

Source: Automotive Logistics

Federal Low-Carbon Construction Initiative

- White House launched “Buy Clean” task force to:
  - Boost federal procurement of low-embodied carbon materials
  - Identify and prioritize low EC materials
  - Increase emissions transparency through supplier reporting
  - Launch pilot programs
- GSA aiming to set standards for concrete and asphalt for Land Port of Entry projects funded by recent infrastructure act



Source: Construction Dive

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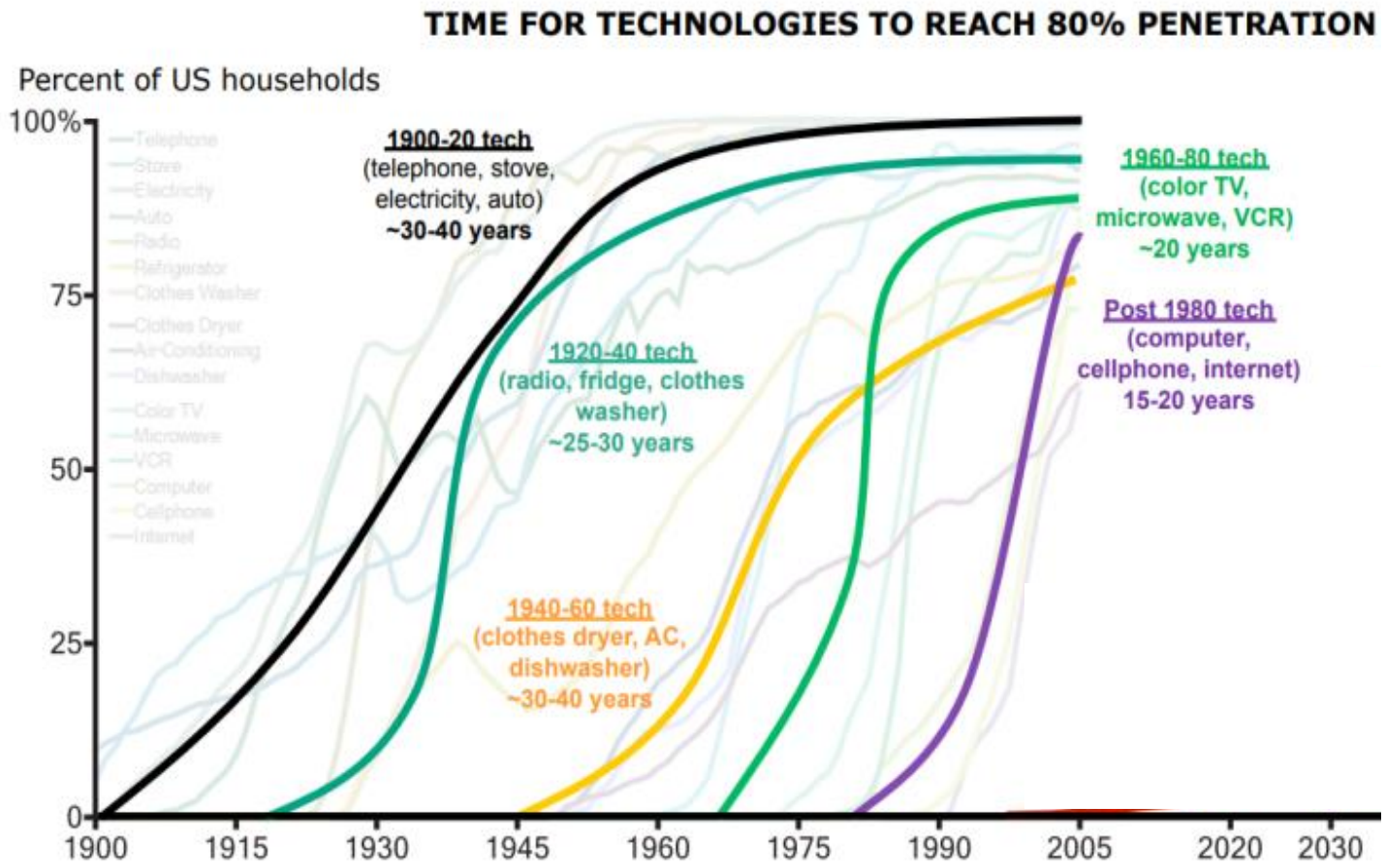
Meeting Spotlight:

Integrating Innovation: Technologies and Opportunities

Innovative Climate Tech Trends

Historical Technology Adoption Trends

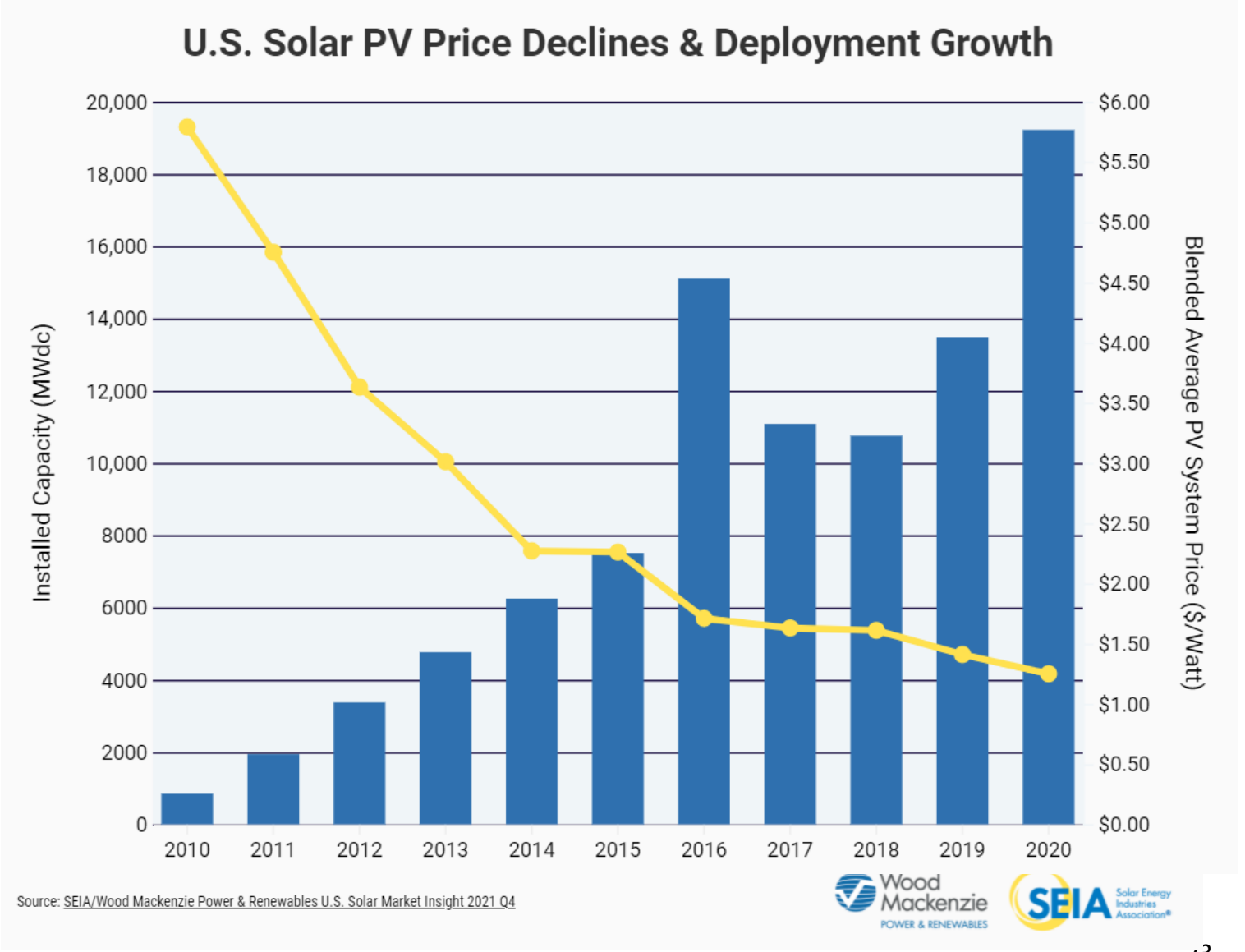
In general, uptake of new technologies has increased in rate in recent decades



Source: World Economic Forum, Our World in Data

Is Clean Energy Tech Following Similar Trends?

- 1954: First solar PV modules first developed
- 2007: ~680 MW of solar capacity installed nationwide
- 2021: ~115,000 MW installed nationwide

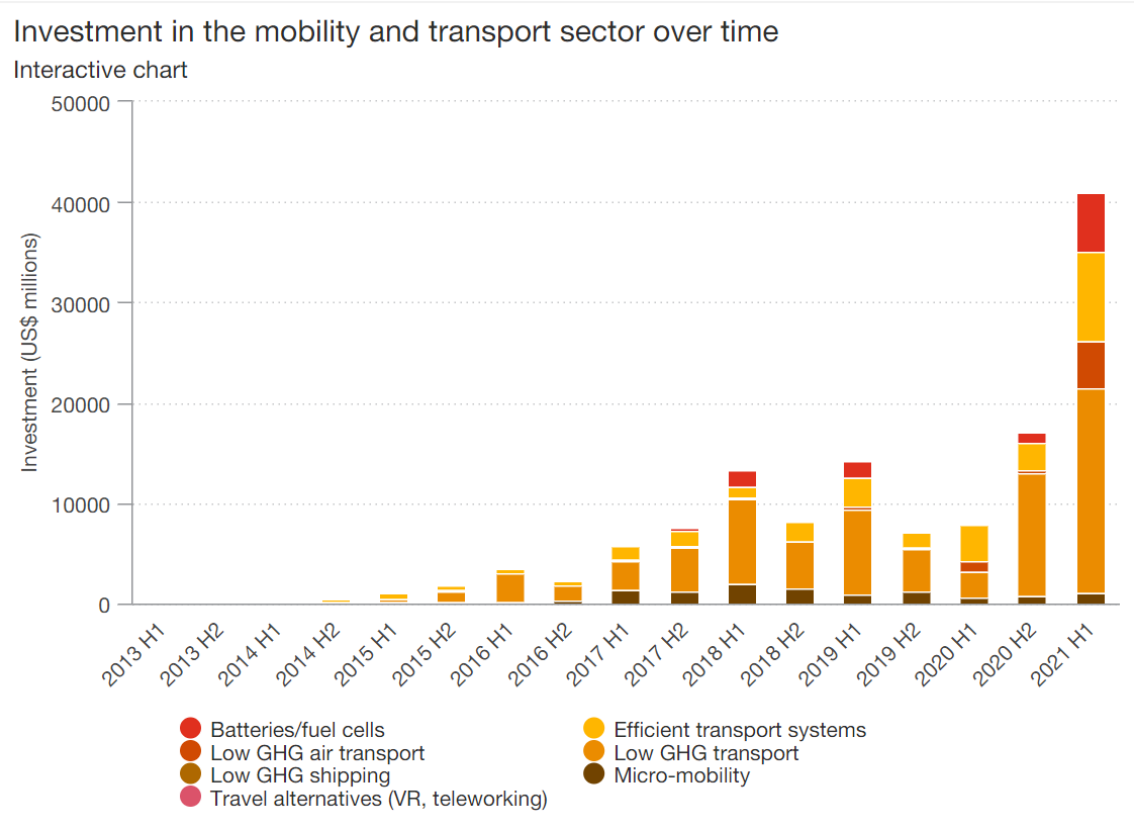


Source: SEIA

Innovative Climate Tech Investment Trends

Investments in climate technologies have increased rapidly in recent years, covering a range of areas, including clean energy, carbon capture and storage, waste management, food technologies, and more

2021 Dealroom Report	5,000 startups raised $32B from Jan-Oct 2021	5x increase over 2016
2021 PWC Report	3,000 startups raised $87.5B from July 2020-June 2021	2x increase over 2019-2020
Greentown Labs	180 startups raised $1B since 2011	Started as 4 startups in 2011



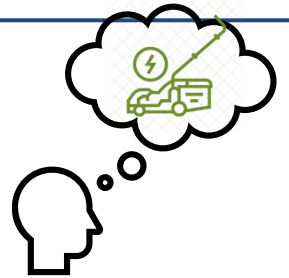
More Money, More Tech, More Problems…?

As more investments are made in innovative tech, more tech will theoretically come to market

How can MA state entities take advantage and adopt these technologies?

Example Pathway to Innovative Tech Adoption: Statewide Contracts

New product demonstrates potential environmental benefits



Before 2018, BPLE not widely used or understood

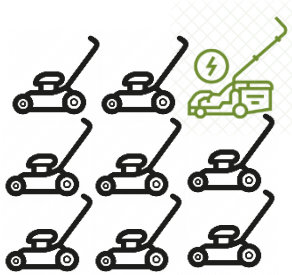
Product is vetted

OSD may require 3rd party testing, certifications, and/or pilot projects

In 2017, OSD hired consultant to develop specs and conduct pilots to test BPLE

Product added to contract on limited basis

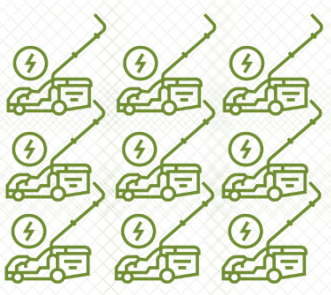
Product offered through existing vendors on contracts, or offered as 'alternative' option



BPLE added to contract through existing and new vendors

Product becomes mainstream

As product becomes more widely used and available, contracts may be updated to reflect technology as "sole choice" or primary product



BPLE is currently offered through FAC116 as its own Category

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Adding Innovative Tech to Statewide Contracts

- Several current contracts are already prioritizing cleaner, innovative, environmentally preferable products

FAC116: Lawns and Grounds Equipment	• Commercial battery-powered options available for several products, including utility vehicles, zero-turn mowers, and more
VEH110: Light and Medium-Duty Vehicles	• Sedans, Minivans, and SUVs on contract must now be hybrid electric, plug-in hybrid, battery electric, or fuel cell electric
VEH102: Advanced Vehicle Technology Equipment	• EV Charging equipment with innovative features
FAC100: Building Maintenance Repair and Operations	• Category 10 open for rolling enrollment to enable adoption of innovative energy efficient, less toxic, or otherwise preferable technologies
ENE52: Heating Fuel	• APS-eligibility is now a requirement of any biofuel on contract
FAC85: Environmentally Preferable Cleaning Products	• All products required to meet environmentally preferable specifications

Technology Presentations

DOER does not endorse any such products or services that participants are made aware of through DOER's Leading by Example Division (LBE), LBE Staff, LBE Council meetings, or any mailing list. Products and services presented and discussed by LBE are provided for *information purposes only*.

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Technology Presentations

- Boost EV Charging (Jordan Baroody, FreeWire)
- 100% Biodiesel for Heavy-Duty Vehicles (Jon Scharingson, REGI)
- Mass Timber for Low Embodied Carbon (Nicole St. Clair Knoblock, Olifant)
- HVAC Load Reduction and Air Purification Systems (Christian Weeks, enVerid)
- Off-grid, Solar-Powered Streetlights (Anicet Mabonzo, Fonroche)
- Flexible Thin-Film Solar (Mike Ma, Miasole)

FREEWIRE

Introduction to Ultrafast Charging & Energy Storage

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FreeWire Technologies – Boost Charger™

Electrification beyond the grid™

FreeWire offers **flexible solutions** leveraging energy storage for rapid and sustainable electrification.

Helping **automotive, workplace, utility, city, retail and fleet operators** deploy clean power for EV charging and broader energy needs.

World class investors include:

STANLEY Ventures · R/GA Ventures · ABB · MOMENTA PARTNERS · SPIKE VENTURES · bp · MACQUARIE · trirec · Energy Innovation Capital · VOLVO · STRAWBERRY CREEK VENTURES

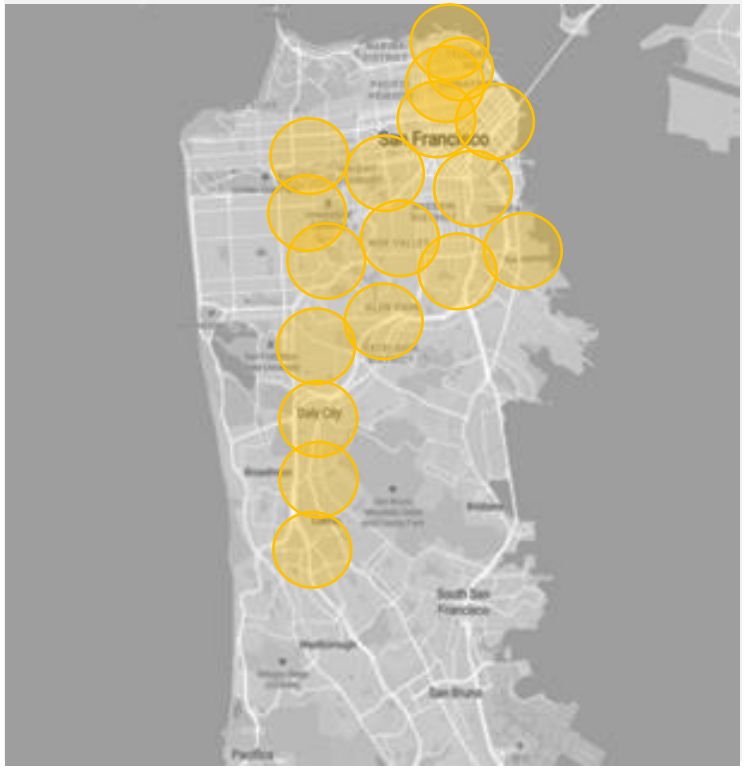
BUY AMERICA COMPLIANT

Founded in 2014 in the **San Francisco Bay Area.**

Conventional Fast Charger Deployment Challenges

Limitations of Grid Infrastructure

Pacific Gas & Electric (PG&E) in California found that only 45% of the transformers across their network had enough available capacity to install one 100kW ultrafast charger



Limited sites available to support fast charging

The electric grid is not prepared to meet the power requirements of traditional fast EV charger installations, resulting in:

Electrical Infrastructure Upgrades

Fast and Ultra-fast EV charging at scale requires extremely high-power outputs, but the grid edge has capacity limitations.

High Cost

Each ultrafast charger requires $100K+ in infrastructure costs alone.

Time Delays

Grid upgrades and construction projects severely impact the deployment time of ultrafast chargers – up to 30 months for permitting & easement, civil works, and construction.

Inflexibility

Current EV charging solutions are inflexible because they require significant capital into infrastructure, which is underground and cannot be relocated.

Boost Charger Is a Next-Generation DC Fast Charger

Lower cost of Installation

- Powered by 208V or 240V (no need for 480V)

2 EVs can charge simultaneously

- Traditional DCFC have two connectors, but only 1 EV can charge at a time
- Smaller parking lot footprint

Faster deployment

- Easy infrastructure, permitting, and install time

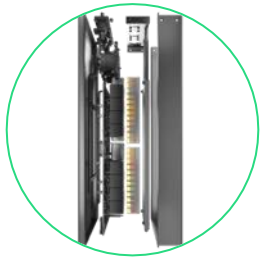
Lower cost of installation

- Built in battery storage mitigates peak loads, eliminating the risk of accruing demand charges

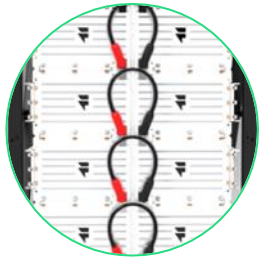
Lower sunken costs

- Possible to relocate (if needed)

FreeWire Technology and Experience



NEXT-GEN POWER CONVERTER
Proprietary power conversion technology with silicon carbide architecture & 99% efficiency



ADAPTIVE BATTERY PACK
Proprietary battery pack with flexible architecture that switches between 400V & 800V

Envision AESC

8 Years Experience
Developing charging technology, energy storage, and software integration, plus extensive testing and industry certification

17 Patents
Filed, pending, and in process covering broad aspects of the technology and product roadmap

50+ Deep Customer Relationships
Unique relationship with leading strategic customers

Regulatory Experience
World-class regulatory team driving business growth and market entry strategies

ADVANCED CONTROL SYSTEM
Optimized to enable distributed energy services

Boost Charger Enables Scalable, Ultrafast Charging

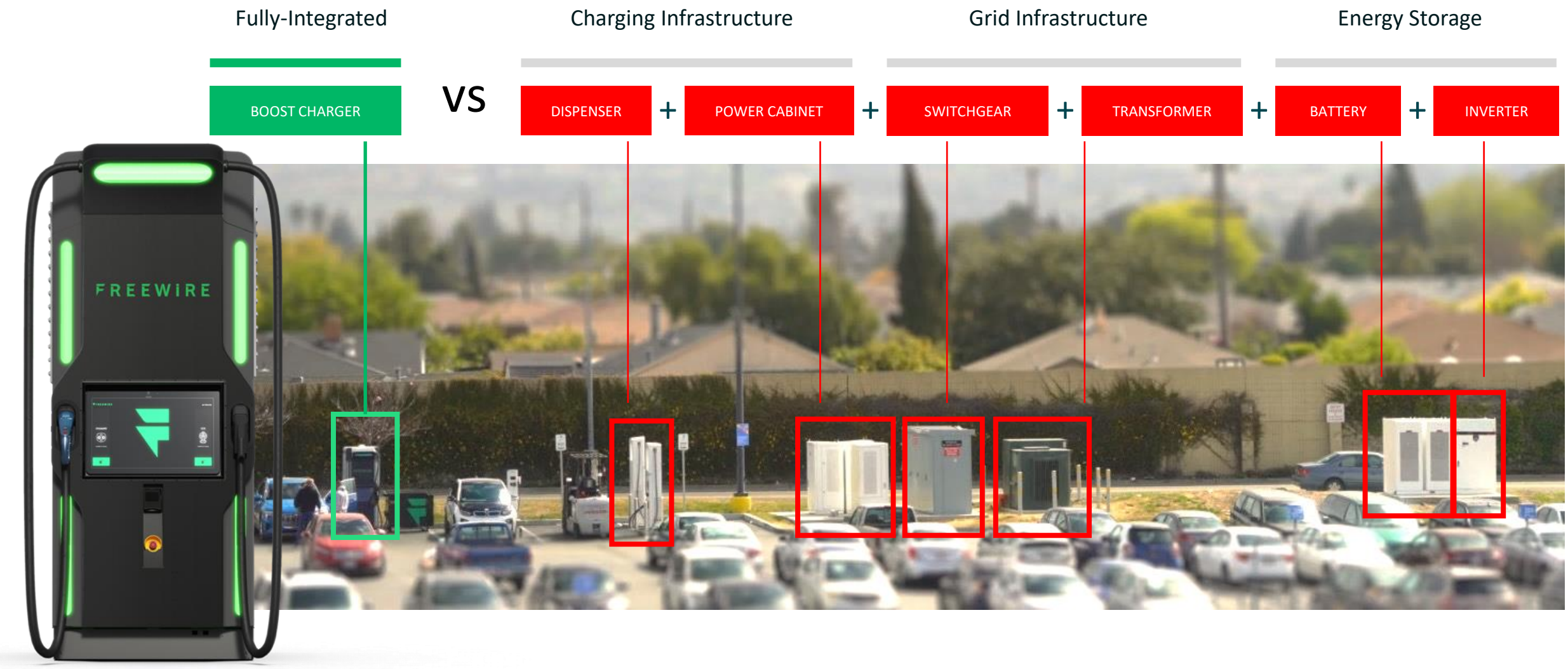
Boost Charger is a battery-integrated fast charger that leverages advanced Power Boost technology to boost power at the grid edge – significantly reducing installation & infrastructure costs by an order of magnitude.

150kW fast charging capability, compatible with all EVs, internal power sharing (2 cars at once)

160 kWh lithium-ion energy storage boosts power from the grid to EVs

Compatible with a Low-voltage grid connection, staying away from cost-intensive grid infrastructure upgrades

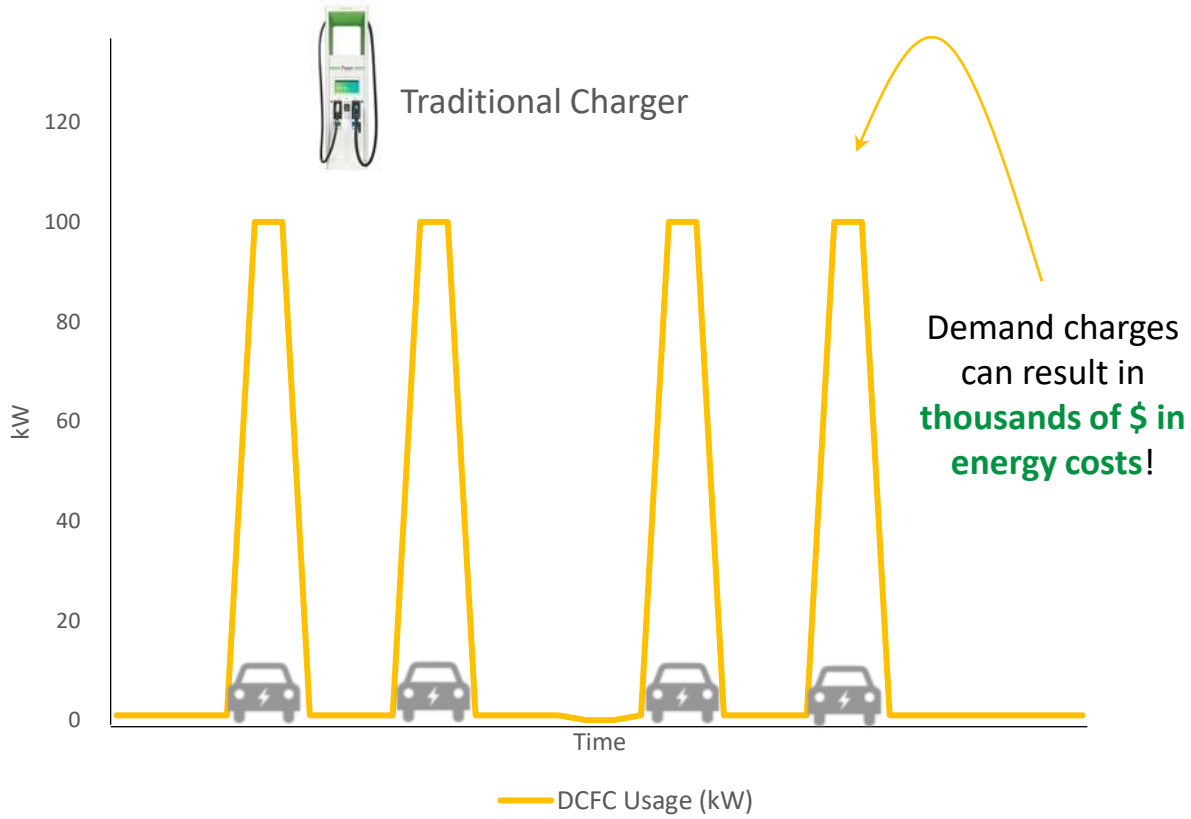
Fully-Integrated Solution Eases Complexity and Cost

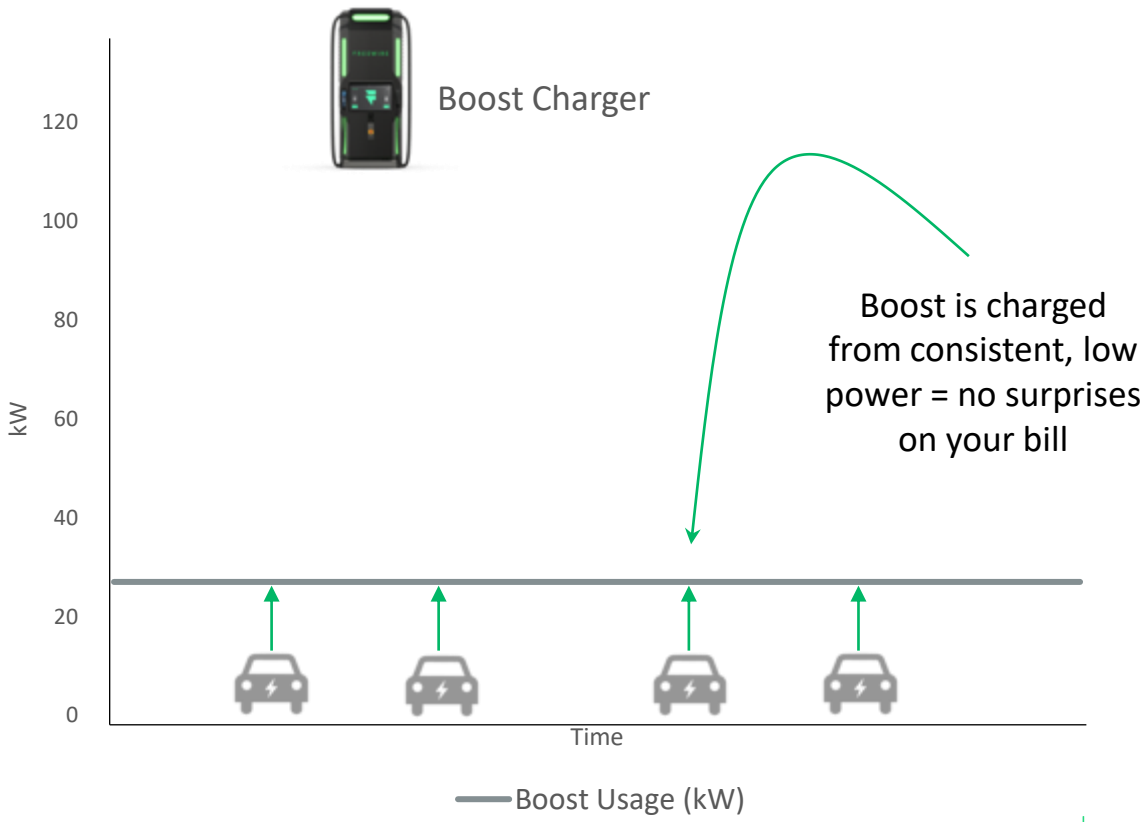


Predictable Power Consumption

Other chargers can significantly impact your energy bill. Boost Charger has predictable power consumption, resulting in lower peak demand and associated energy costs

Charger Electricity Consumption





FreeWire in MA: Greenfield RMV Office

Greenfield, MA RMV Install with MassDOT

FreeWire installation at **Greenfield RMV with MassDOT**

Statewide Contract through **Mass OSD VEH102**: Advanced Vehicle Technology Equipment, Supplies and Services Contract

Project Case Study:

- Remote Location with limited power supply
- Eversource Utility make ready program for (4) Level 2
- Mass DOT identified area as a ”charging desert” needing DCFC
- Eversource would not have funded 480v upgrade

Case Study: Gathering Place

Replaced existing L2 unit with Boost Charger

INDUSTRY	Public park
LOCATION	Tulsa, OK
CHALLENGE	Need to replace old chargers
OBJECTIVE	Increase community EV adoption by offering public charging resources located strategically throughout Tulsa
INPUT POWER	3Ø 208 V | 100 A Service
SITE DESCRIPTION	Replaced L2 charger. Bolted to parking lot, no reinforcement
NETWORK	AMP

"Upgrading from 3 kW charger to 120 kW, it was a no-brainer. We are thrilled to be able to offer the world-class FreeWire EV charging station for our park guests,"

–Tony Moore, Executive Director, Gathering Place

FREEWIRE

ELECTRIFICATION BEYOND THE GRID

Jordan Baroody

jbaroody@freewiretech.com

RENEWABLE ENERGY GROUP

Right Place, Right Time

Accelerating the Transition to Clean Energy

Jon Scharingson
Executive Director,
Strategic Initiatives

Renewable Energy Group

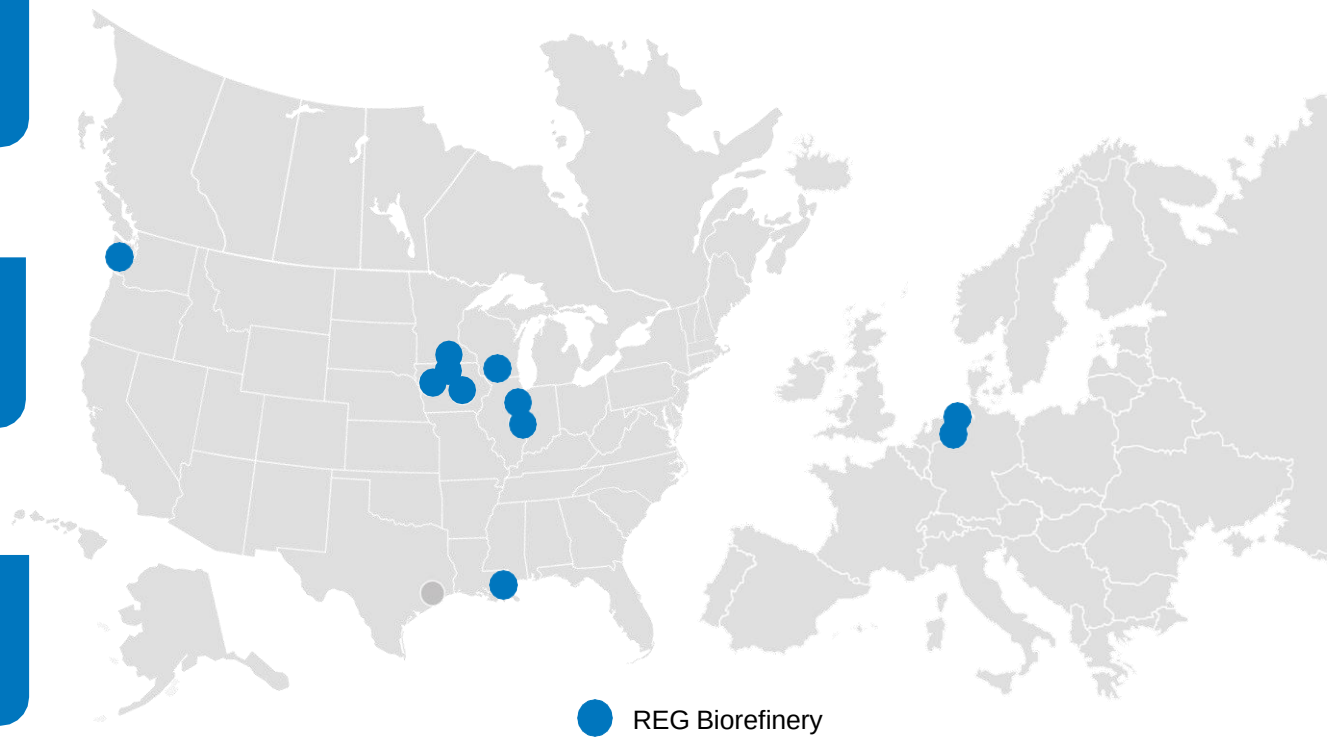
A Leader with International Reach

10 Bio-Based Diesel Plants | **2.1** [(1)] Million Metric Sold in 2020 | REG 2020 Sales were made in: **41** US States, **7** Canadian Provinces, **14** Countries

Global reach with diversified end-market exposure

Flexibility and sales optimization to incentivized markets

Proven access to diversified feedstocks



Source: Company
(1) Includes self-produced and third-party bio-based diesel and petroleum-based diesel.

Energy Transition: An Inflection Point

Low Carbon Solution Available at Scale Now

Providing Cleaner Fuel Solutions for Over Two Decades

WASTE AND BYPRODUCT FATS AND OILS
Renewable Low Carbon Feedstock

5.5X ENERGY RETURN RATIO[1]
Proprietary Refining Technology

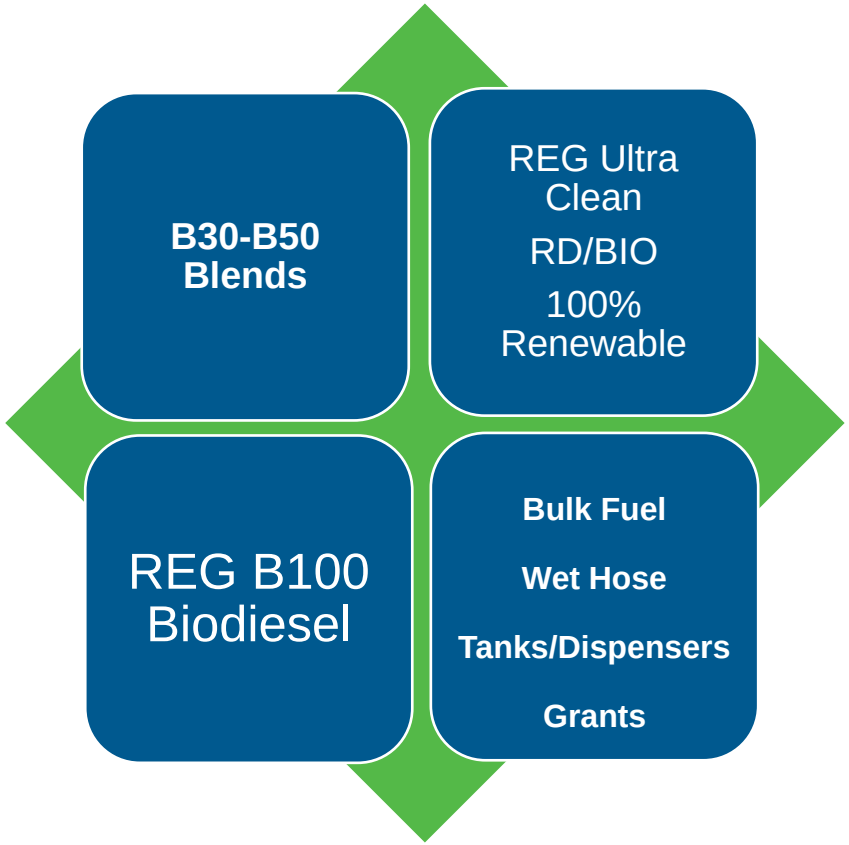
95-100% Scope 1 & 2 GHG Emissions
Biodiesel (BD) & Renewable Diesel (RD)

DOWNSTREAM DISTRIBUTION

Growing Distribution Network

Source:
1. NBB; Defined as units of energy returned per unit of fossil used for production
2. EPA Lifecycle Greenhouse Gas Emissions for Select Pathways

REG provides a portfolio of low carbon solutions



Notes:
1. B20 is readily available today at Travel Centers in IA, IL, OR, CA & MN

Optimus Company Overview

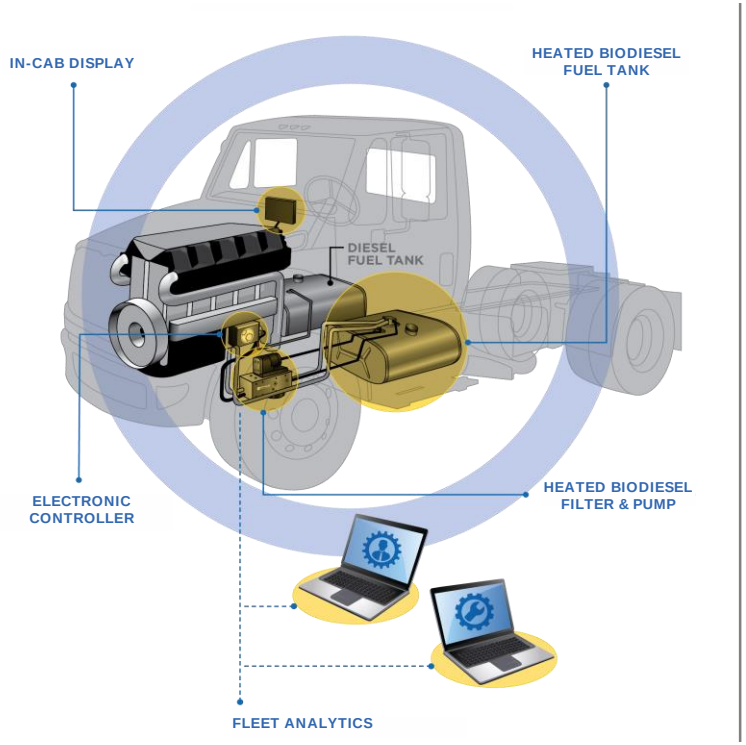
- Technology company based in Pittsburgh, PA – founded in 2010. Manufacturer of biodiesel fuel system technology to enable any existing diesel engine to operate on 100% biodiesel - including DPF and SCR equipped engines - focused on MD/HD applications.
- Fuel system technology cost of $15-17K installed.
- Available as retrofit for existing engines or ship-through select channels.
- Enables use of B100 providing 100% Scope 1 and 2 greenhouse gas emission reduction compared to baseline of diesel fuel.

OPTIMUS® TECHNOLOGIES
REDUCE FUEL COSTS. REDUCE EMISSIONS. EASILY.

REG

B100 Technical Overview

- Dual fuel system comprised of:
  - 2nd heated fuel tank (configurable to application)
    - 2 tanks or 1 dual-chamber tank
  - Heated fuel filter & pump module
    - Filter spec to engine
  - ECU
    - Fully automated controls, no driver interaction
  - In-cab display
    - Primarily functions as biodiesel fuel gauge
    - Alerts of service condition or malfunction
- Startup and shutdown always occurs on diesel
  - Key removal triggers engine flush
  - Temperature compensated (60-300 seconds)



OPTIMUS® TECHNOLOGIES
REDUCE FUEL COSTS. REDUCE EMISSIONS. EASILY.

REG

Who else is utilizing B100 technology?

- **Washington DC Department of Public Works**
  - Refuse Trucks
- **City of Chicago Parks District**
  - Refuse Trucks
- **Renewable Energy Group**
  - Semi / Jobber Delivery Trucks
- **City of Ames**
  - Snowplows
- **IOWA DOT**
  - Snowplows
- **Washington DC Water**
  - Dump/Service Trucks
- **ADM**
  - Semi Trucks
- **Star Oil**
  - Combination Trucks Jobber w/Tankers
- **City of Des Moines**
  - Refuse trucks
- **City of Madison**
  - Snow plows

OPTIMUS® TECHNOLOGIES
REDUCE FUEL COSTS. REDUCE EMISSIONS. EASILY.

REG

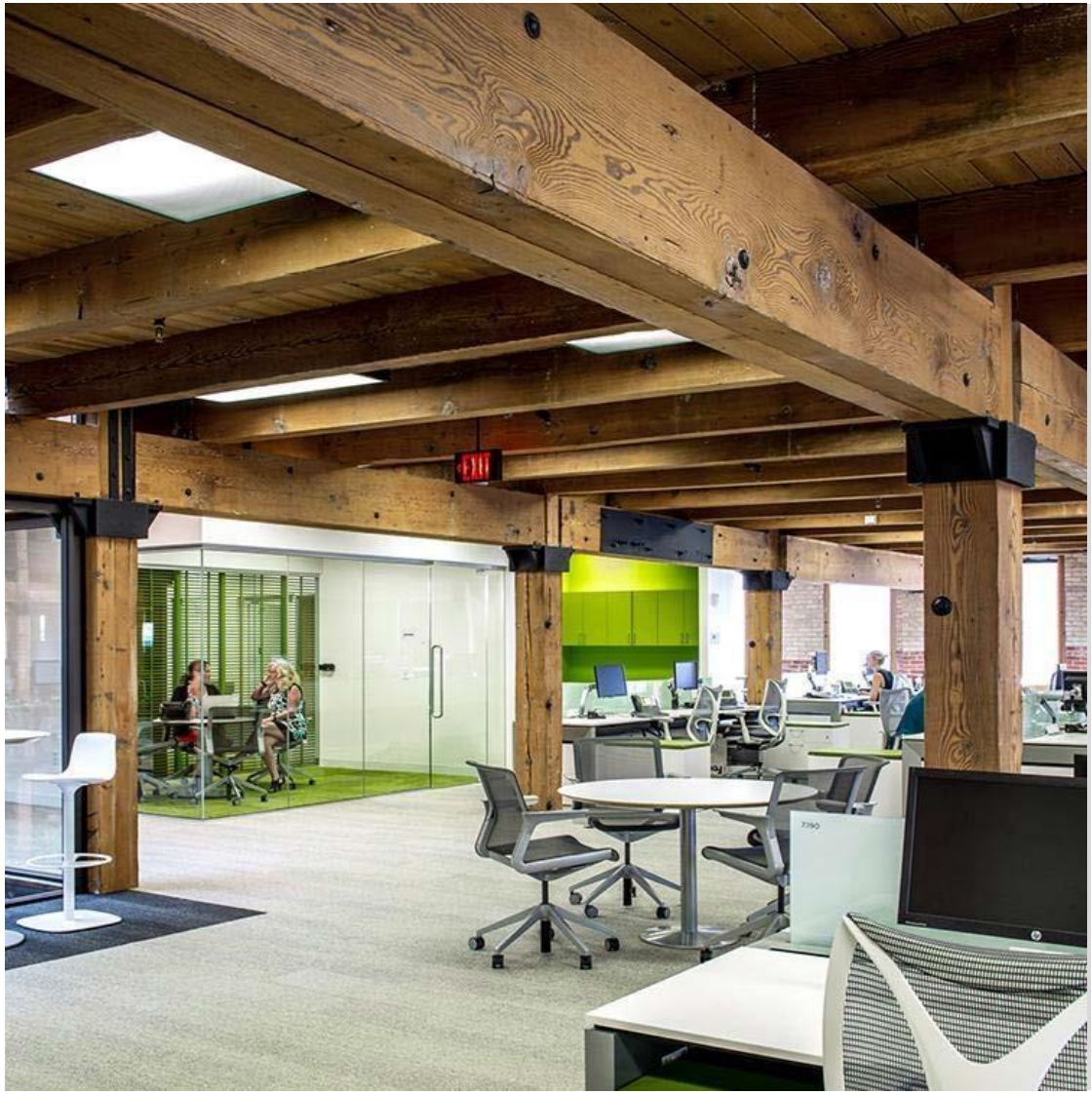
SHIFT TO MASS TIMBER

A CLIMATE SOLUTION TO REDUCE THE CARBON FOOTPRINT OF CONSTRUCTION, SUPPORT REGIONAL FORESTS

Tuesday, March 8, 2022
Leading By Example program
Commonwealth of Massachusetts

Nicole St. Clair Knobloch
Olifant

TIMBER: THE MATERIAL OF THE PAST CAN REDEFINE OUR FUTURE



HEAVY TIMBER

MASS(IVE) TIMBER

Glue Laminated Timber (GLT)

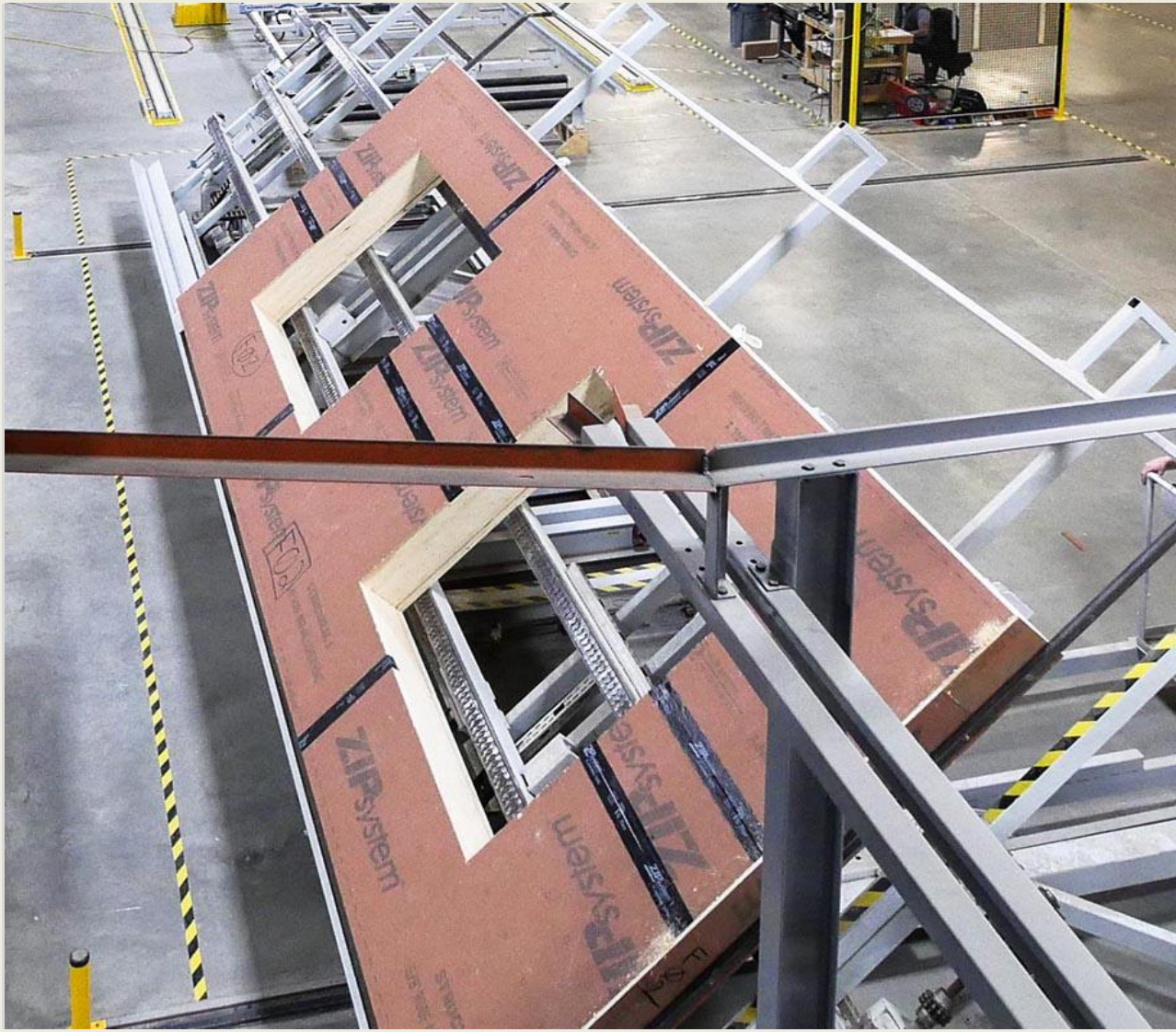
Cross-Laminated Timber (CLT)

Nail-Laminated Timber (NLT)

STRUCTURAL SOLUTIONS | POST, BEAM + PLATE

STRUCTURAL SOLUTIONS | CELLULAR

PRE-FABRICATION POSSIBILITIES



CLT panel construction at Bensonwood's Tektonics
Walpole, NH

OVERSTORY APPLICATIONS

Building gets three new floors
Washington, DC

BEAUTY AND UTILITY

JOHN W. OLVER DESIGN BUILDING
U.MASS-AMHERST

PRECEDENT PROJECTS | UMASS AMHERST DESIGN CENTER

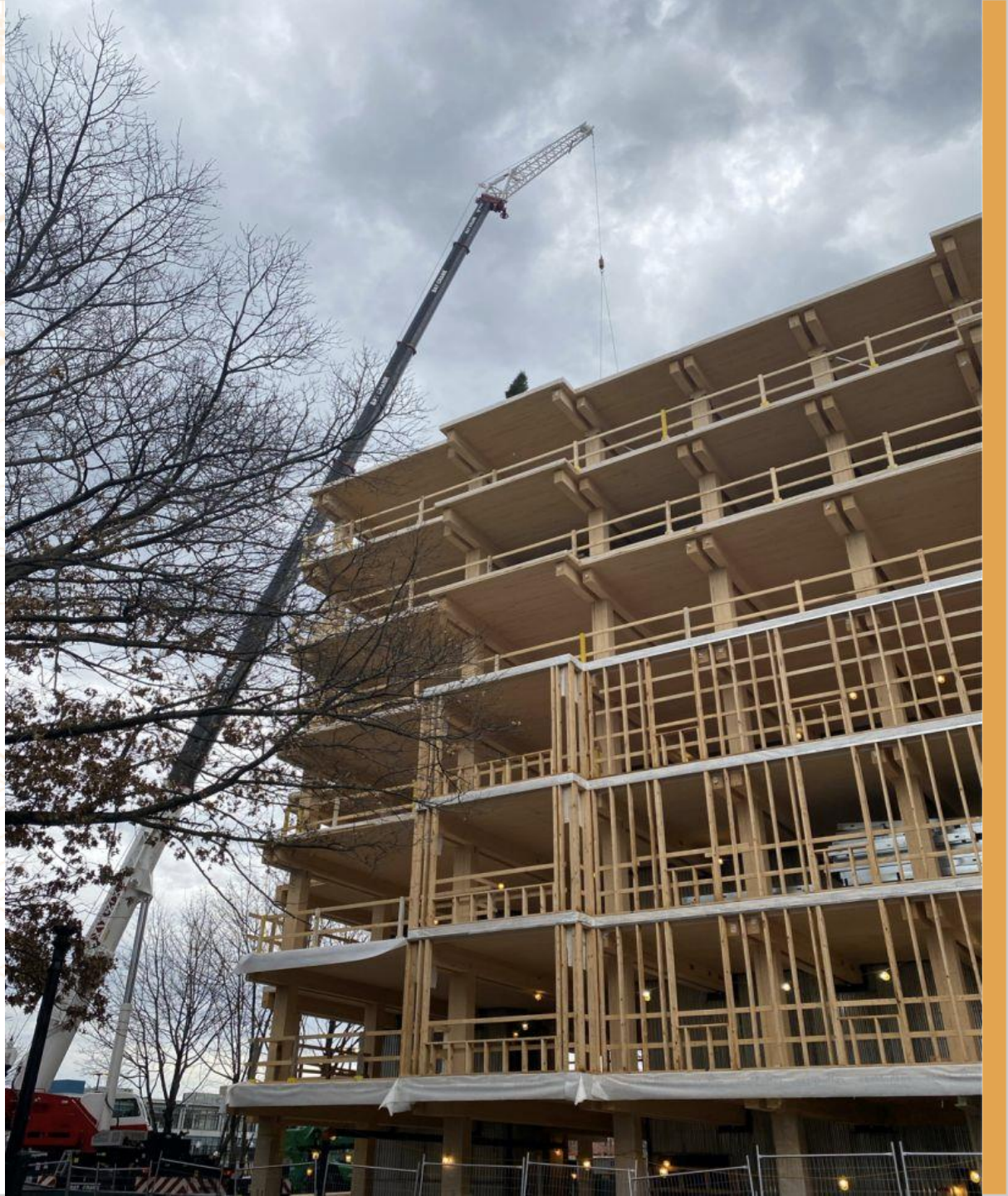
BOSTON. PLANNED FIVE STORY, 2022 USING MASSACHUSETTS HEMLOCK

BOSTON. CONSTRUCTED SEVEN STORY, 2021

HAYCON

11 E. Lenox, Roxbury
Passive House Project,
Mass Timber Project.
Erected Nov.- Dec 2021.
2021.

SAVED TWO MONTHS

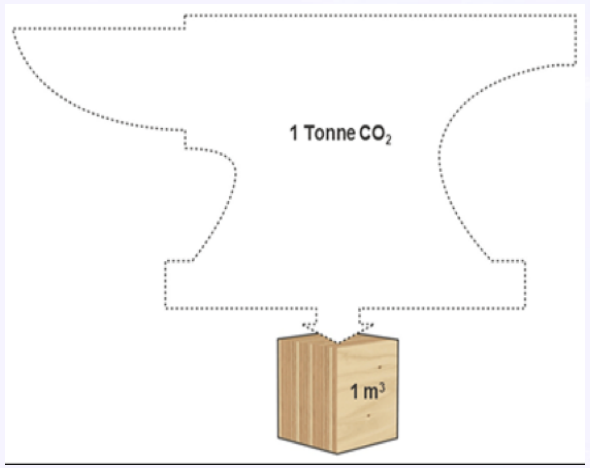


LOWER EMBODIED CARBON IN CONVENTIONAL MATERIALS

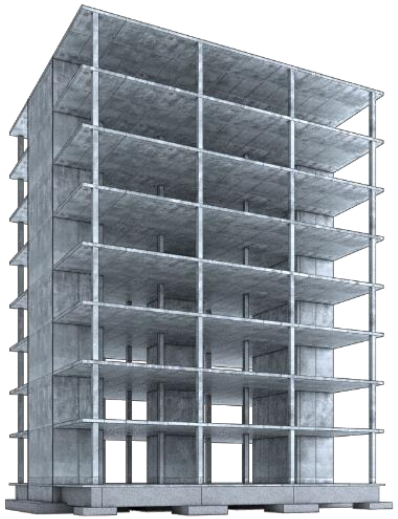
- Can still be extractive, non-renewable, fossil fuel-based.
- No forest benefit.

LOWER EMBODIED CARBON, MASS TIMBER

Biogenic carbon, stored carbon, renewable materials, forest benefit.



Carbon comparison with conventional materials
Baseline designs



Reference 1

Concrete Slab on Steel Frame
>=20’ grid
Full encapsulation

Reference 2

Concrete Flat Slab
>=20’ grid
No encapsulation

concrete cores

Mass Timber Design Options

Timber 1

Timber Post & Plate
<=12’ grid
Full encapsulation

Timber 2

Timber Post, Beam & Plate
12’ to 20’ grid
Full encapsulation

Timber 3

Timber Post, Beam & Plate
12’ to 20’ grid
Partial encapsulation

Timber 4

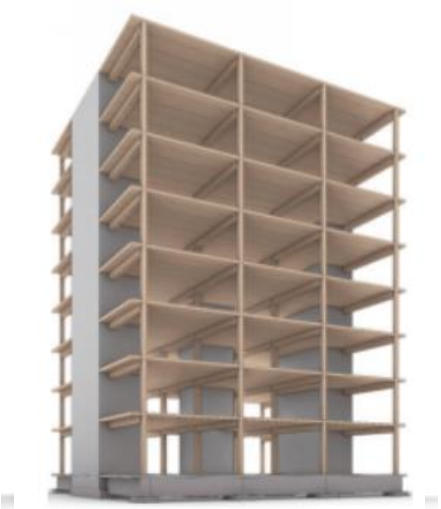
Timber Post, Beam & Plate
12’ to 20’ grid
Partial encapsulation

Timber 5

Timber Post, Beam & Plate
12’ to 20’ grid
Exposed char layer

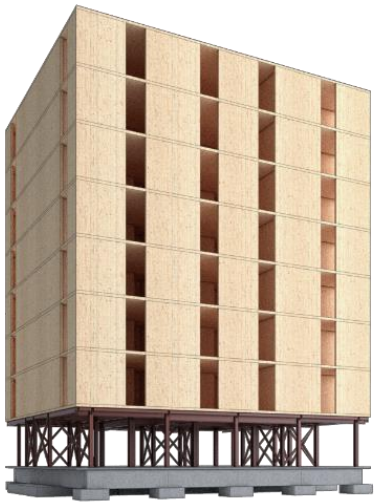
concrete cores

Mass Timber Design Options



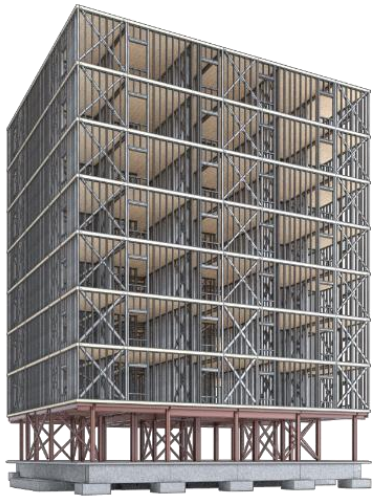
Timber 6

Timber Post, Beam & Plate
>=20’ grid
Partial encapsulation



Timber 7

Timber Floors & Shear Walls
<=12’ grid
Partial encapsulation



Timber 8

Timber Floors & LGM Framing
<=12’ grid
Partial encapsulation

Timber 9

Timber Floors & Steel Frame
12 to 20’ grid
Partial encapsulation

concrete cores

cellular framing on steel frame podium

steel-timber hybrid

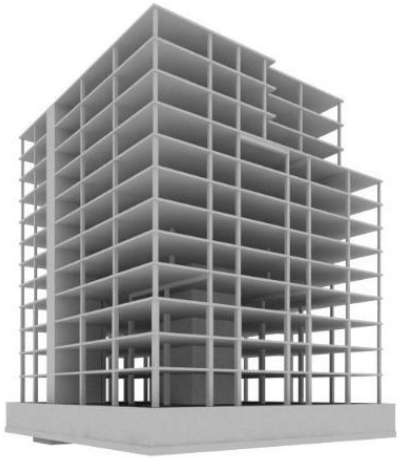
GLOBAL WARMING POTENTIAL (PER BUILDING ASSEMBLY)

The total global warming potential (GWP) of each option is shown with a breakdown by building assembly. The Concrete With Steel Frame and Concrete options have the highest GWP, with the bulk of the impact embedded in the floor slabs. The Hybrid Steel (Timber 1) option offers a slight reduction in GWP,

Likely current construction – mixed use twelve story

Reference 1

Concrete Slab on Steel Frame
14-30’ grid
Full encapsulation
Code compliant



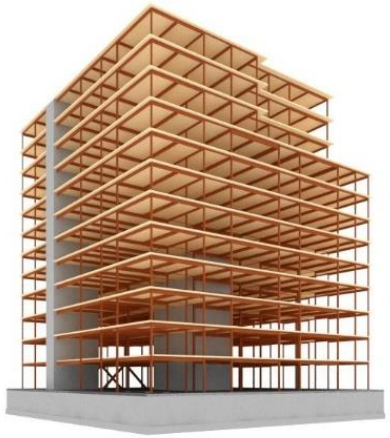
Reference 2

Concrete Flat Slab
14-30’ grid
Encapsulation as finish
Code compliant

concrete cores

BURO HAPPOLD

BUILDING APPLICATIONS AS HYBRID WITH CONVENTIONAL



Timber A

Hybrid Timber/Steel
14-30’ grid
Partial encapsulation
Code compliant

Timber B

Hybrid Timber/Steel
14-30’ grid
Partial encapsulation
Code variant

Timber C

Timber Post, Beam & Plate
14-30’ grid
Char layer for fire
Code variant

Timber D

Timber Post, Beam & Plate
14-30’ grid
Partial encapsulation
Code compliant

Timber E

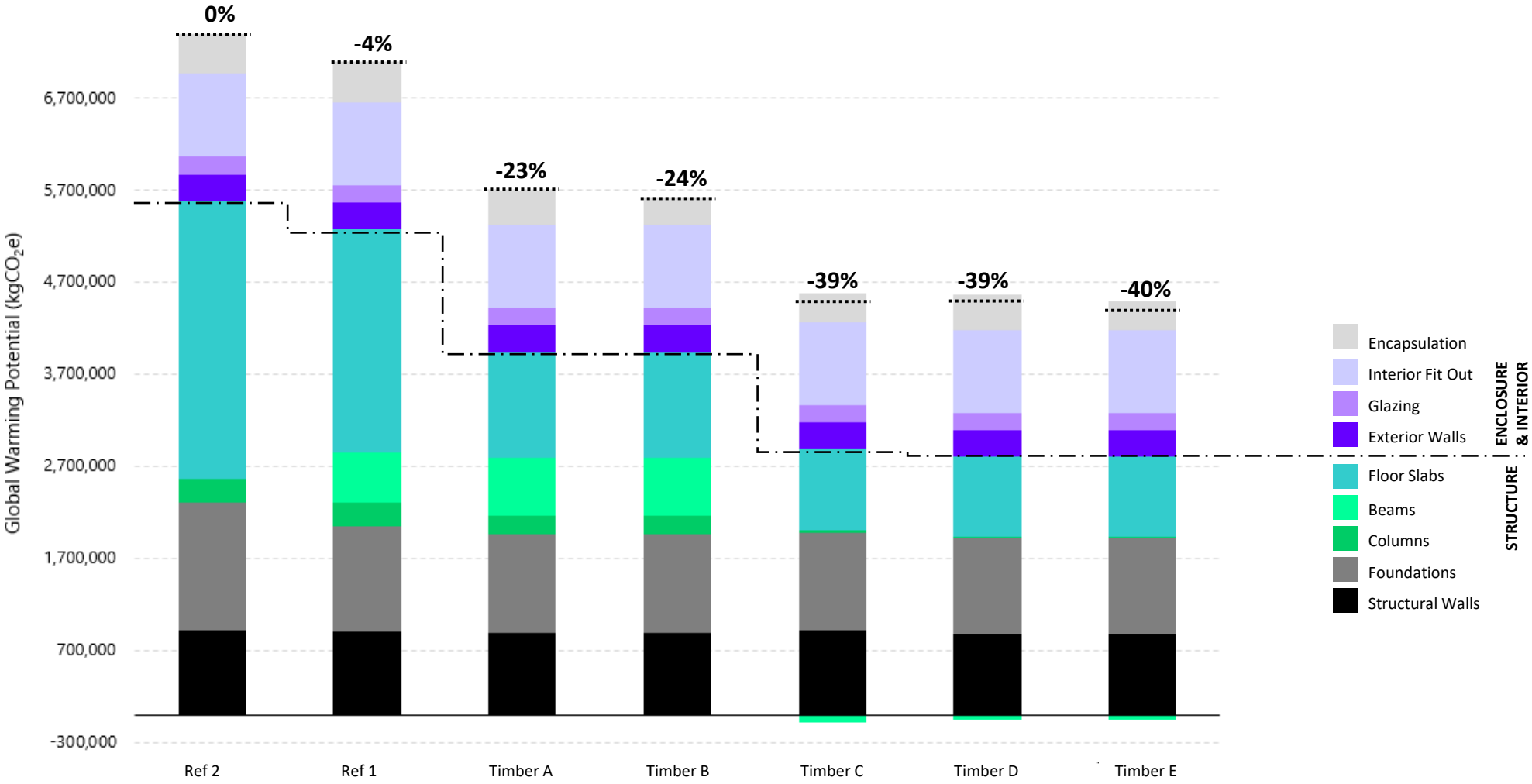
Timber Post, Beam & Plate
14-30’ grid
Partial encapsulation
Code variant

concrete cores

steel-timber hybrid

BURO HAPPOLD

Full Building by Element, Carbon Comparison



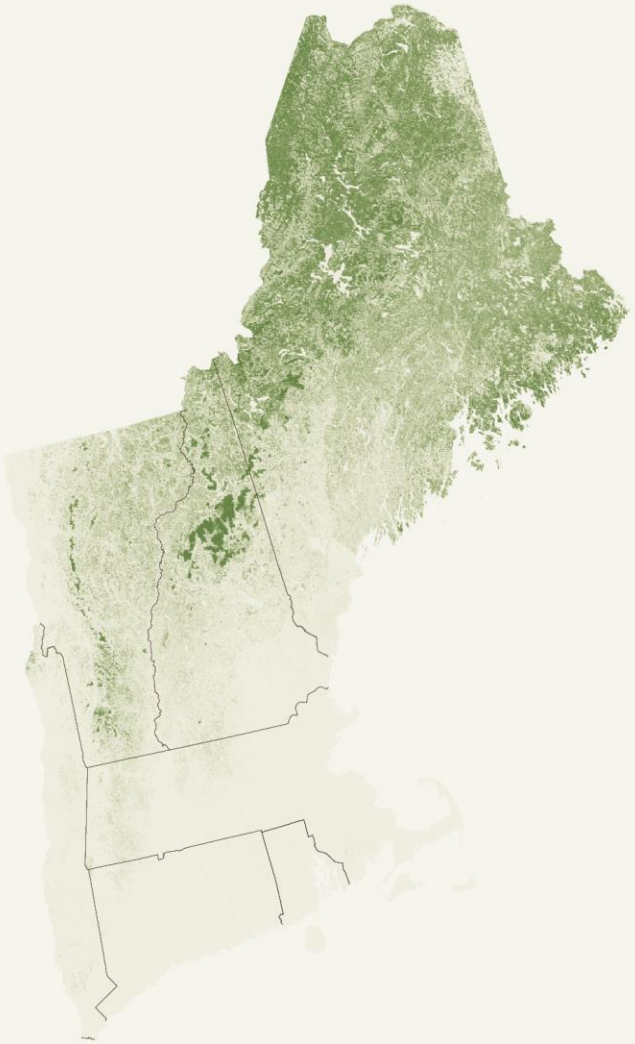
MASS TIMBER SOURCING

Woodsheds

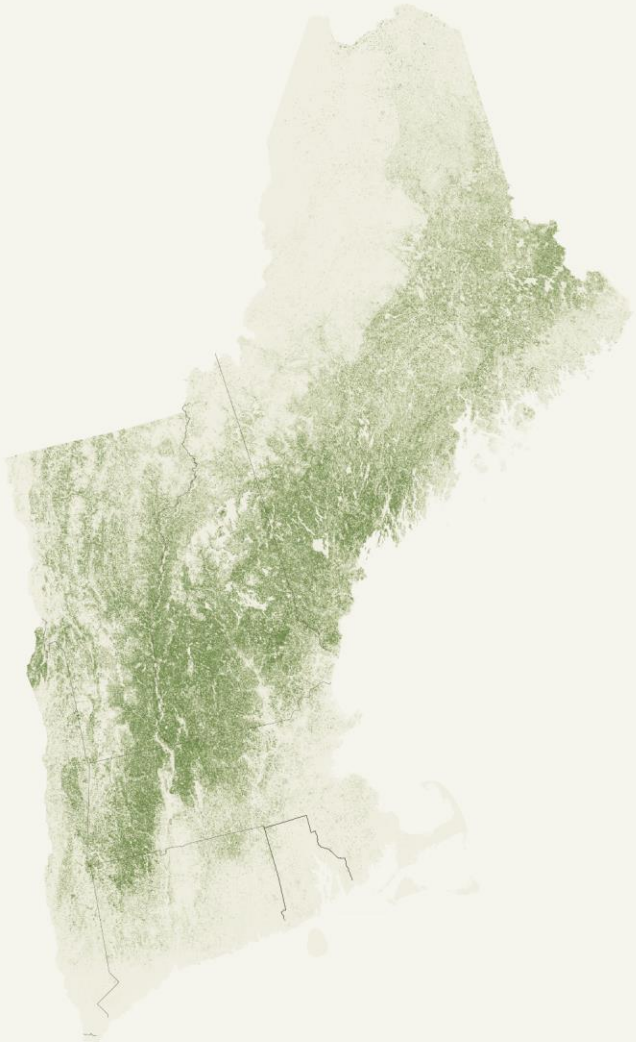
Six major woodsheds currently exist for delivery of wood products to New England, all of which have existing and growing mass timber manufacturing facilities. These regions produce cross laminated timber (CLT), dowel laminated timber (DLT), mass plywood panels (MPP), as well as other innovative wood products. All of these products rely on dimensional lumber combined into a laminate, and primarily source dimensional lumber (lamstock) from existing sawmills.

Mass Timber Facilities (Northern Hemisphere)

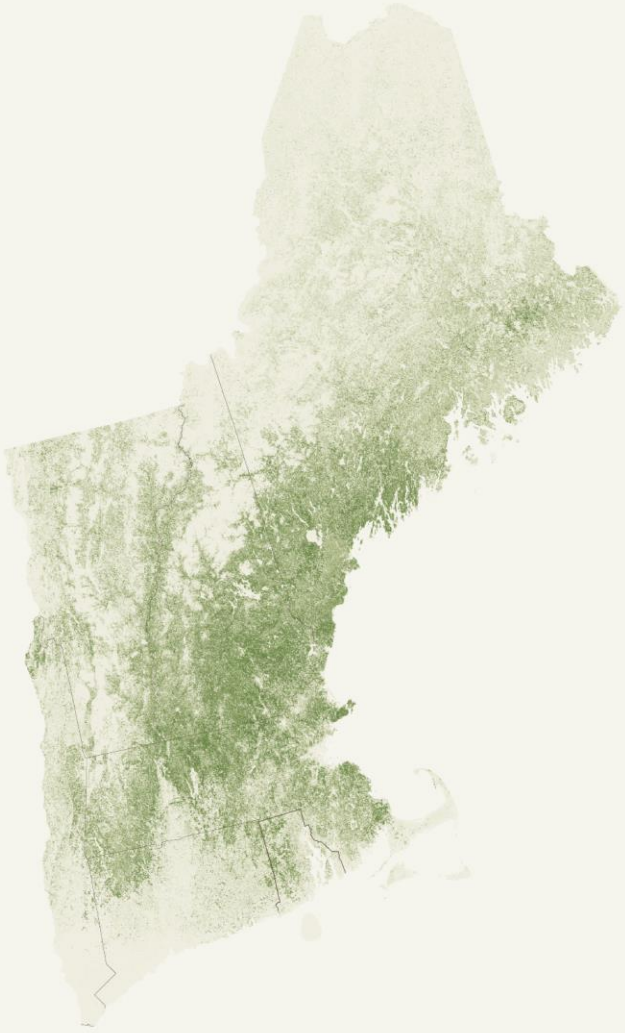
Olifant
INVEST IN WHAT'S BIGGER



Spruce, Pine, Fir



Eastern hemlock



Eastern white pine

Species Distribution (Ft^2 per Acre)

Source: USDA Forest Service, Northern Research Station, 2013

Olifant
INVEST IN WHAT'S BIGGER

ECONOMIC ATTRACTION

Maine Mass Timber Commercialization Center

University of Maine

- State incentives
- Federal government support
- Forestry-based organization partnerships
- Harvest data and modeling
- Workforce training and development
- Economic development
- Investment package for manufacturers
- WOOD INSULATION CO-LOCATION

Photo by Joe Anastasi

The Case for CLT Manufacturing In Maine

RESEARCH INVESTMENT: MASSACHUSETTS PARTNERS

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs

boston planning & development agency

GENERATE

BUROHAPPOLD ENGINEERING

CONSIGLI
Est. 1905

Commonwealth of Massachusetts
Executive Office of Housing and Economic Development

CODE RED CONSULTANTS

Olifant
INVEST IN WHAT'S BIGGER

WoodWorks
WOOD PRODUCTS COUNCIL

Carbon data

Design possibilities

Developer engagement

Adopt new building codes

Incentives for early adopters

COMMONWEALTH OF MASSACHUSETTS INVESTMENT: MASS TIMBER

Analysis: Global Warming Solutions Act, executive orders, stated climate intentions, Massachusetts that will help justify reducing embodied carbon and using mass timber. Olifant.

Research, U.Mass-Amherst Buildings and Technologies program, use of Massachusetts-based species Eastern hemlock and White pine. Ongoing.

Regional dialogue to find incentives for mass timber construction to support the development of a regional supply chain in southern and central New England. 2020-2021.

RESEARCH

UNIVERSITIES CERTIFYING SPECIES

U. Maine- Orono

- Multiple forest products.
- CLT – spruce-pine-fir
- Wood insulation
- New uses for hemlock

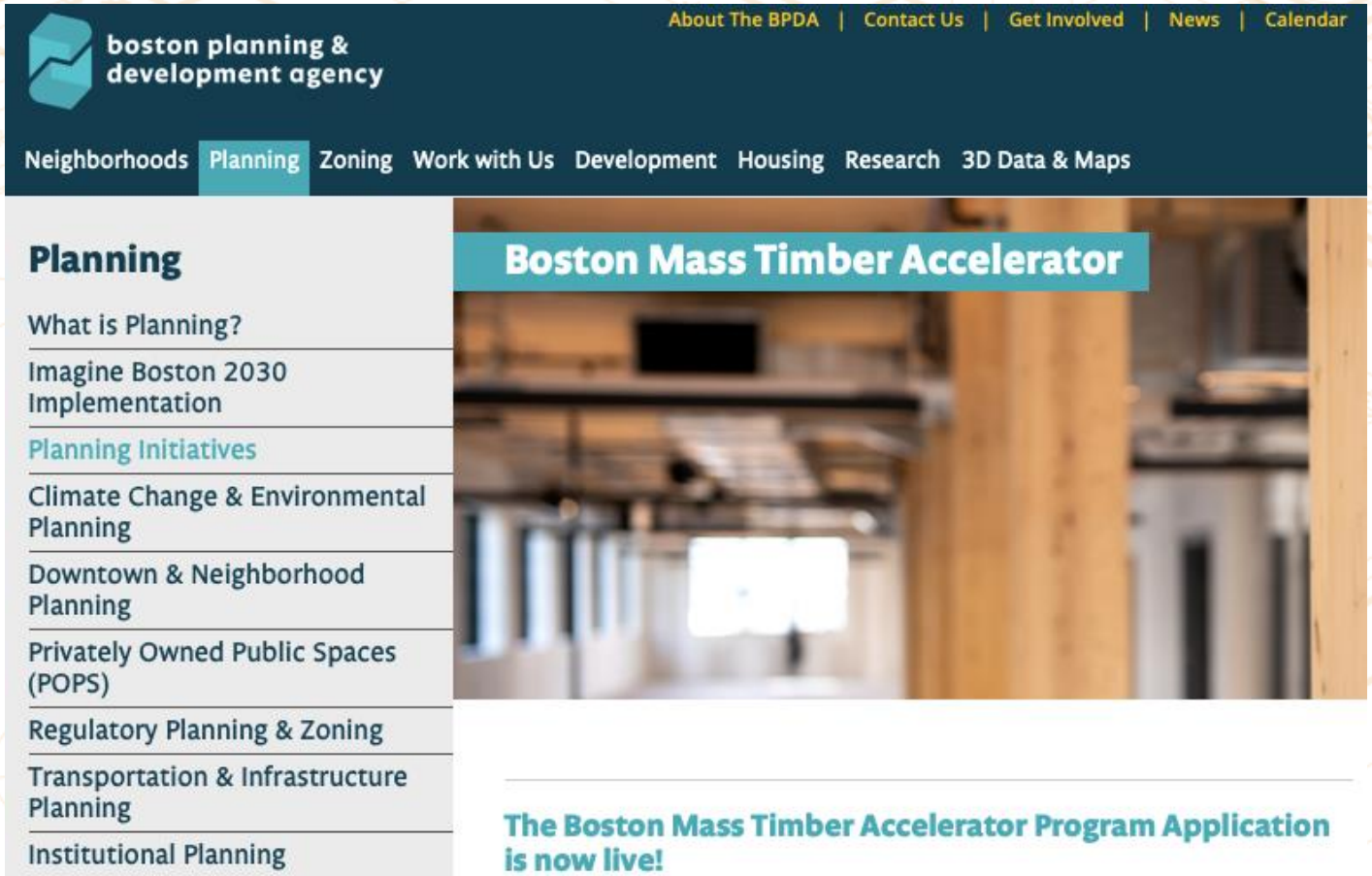
U. Mass-Amherst

- Eastern hemlock, white pine CLT research
- Olver design demonstration building

CITY OF BOSTON MASS TIMBER INCENTIVES

City of Boston
Embodied carbon in Net Zero Stretch code.

- Grants for developers
- Other incentives in permitting process being considered.
- LCA requirement.
- Considering EPDs.



Engagement: The Timber Edge

AECD Mass Timber Consortium in the Northeast

HAYCON

LEERS WEINZAPFEL ASSOCIATES

INTERNATIONAL FRAMERS, LLC

DeStefano & Chamberlain Incorporated

utile

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

LeMessurier.

NORDIC STRUCTURES

ENTUITIVE

LF Driscoll

+schillerprojects

TSKP STUDIO

Olifant

Thank you.

Nicole St. Clair Knobloch
nknobloch@olifant.org

THE TIMBER EDGE

Ventilation Energy Efficiency & IAQ with Sorbent Ventilation Technology

DOER Leading by Example Council | March 8, 2022

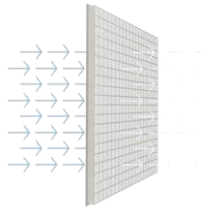
enVerid
Energy savings. Air quality.

CONSULTING - SPECIFYING engineer 2021 PRODUCT OF THE YEAR

AHR EXPO INNOVATION AWARDS 2019 PRODUCT OF THE YEAR

enVerid Solutions: Air Cleaning for Healthy & Efficient Buildings

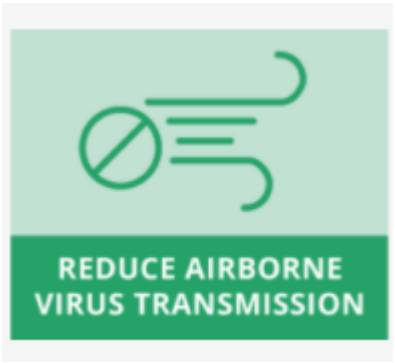
Sorbent Ventilation Technology for Gases

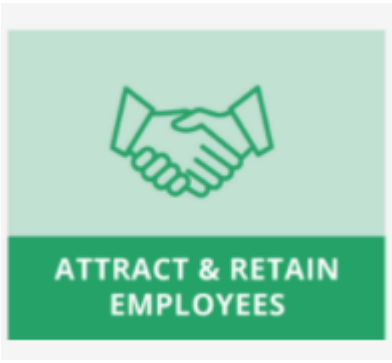


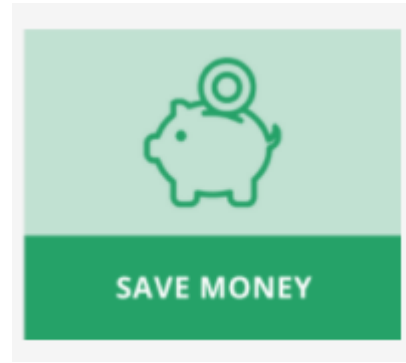
Safely remove CO_2 and VOCs from indoor air so that ventilation rates can be optimized to improve efficiency and indoor air quality and reduce costs.

HEPA Filters for Particles & Viruses

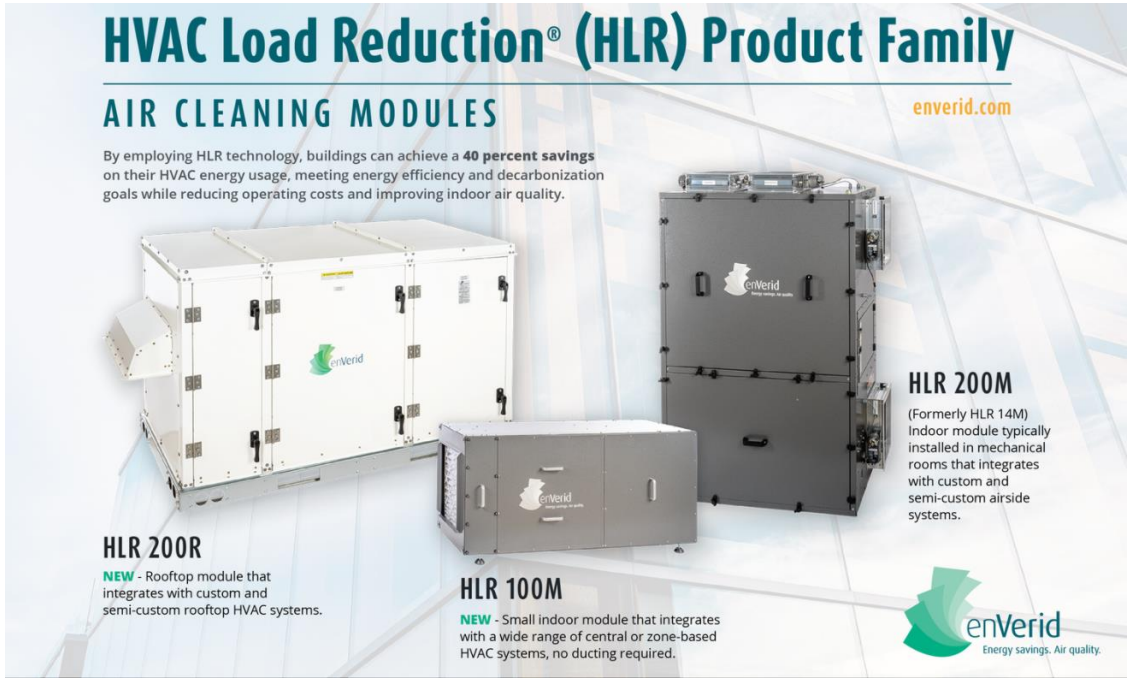
Proven HEPA filtration technology for COVID-19, flu, pollen, and wildfire smoke mitigation in offices, retail outlets, and classrooms.







Our Focus Today: Sorbent Ventilation Technology™ (SVT™)



"Adding SVT to this packaged system delivers superior air quality, and the ability to cut energy use and carbon emissions. It changes how buildings can be designed to further both IAQ and decarbonization efforts." Jim Macosko, VP, Product Management, Daikin Applied

Sorbent Ventilation Technology addresses 3 market trends

COVID-19

The New York Times

Experts Urge Strict Workplace Air Quality Standards, in Wake of Pandemic

NEWS
11/22/2021
CARR PROPERTIES BECOMES FIRST COMMERCIAL REAL ESTATE OWNER TO MAKE PORTFOLIO-WIDE COMMITMENT TO INDOOR AIR QUALITY MONITORING WITH IOT INTEGRATION PARTNER

Demand for better indoor air quality

Climate Crisis

Mandates to reduce building emissions

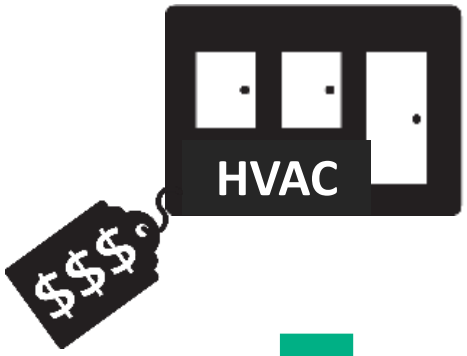
Wildfires & Pollution

Over 54 million Americans live in counties with F grades for spikes in daily particle pollution

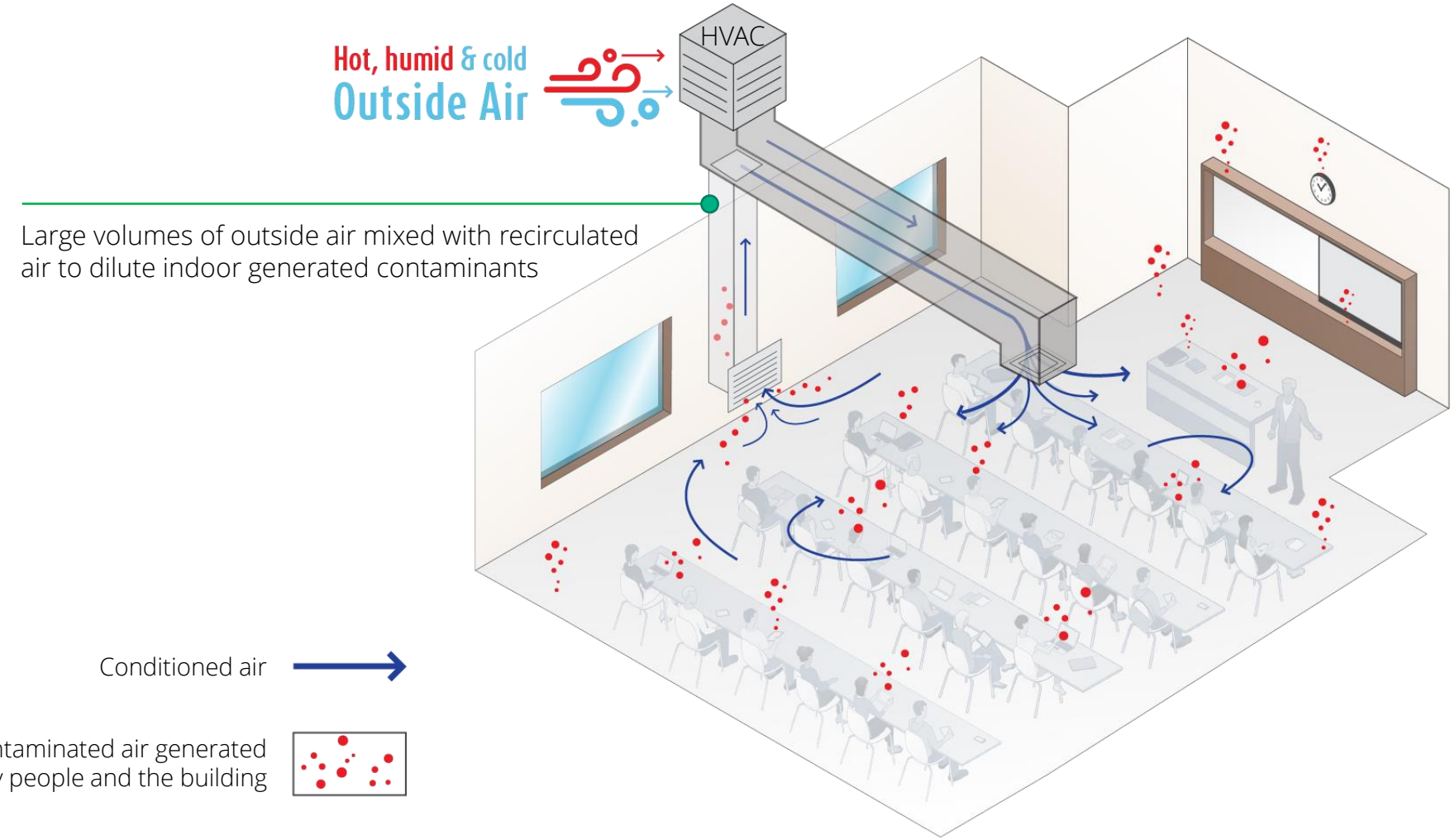
Need to increase building resilience

Sorbent Ventilation Technology: better IAQ more efficiently

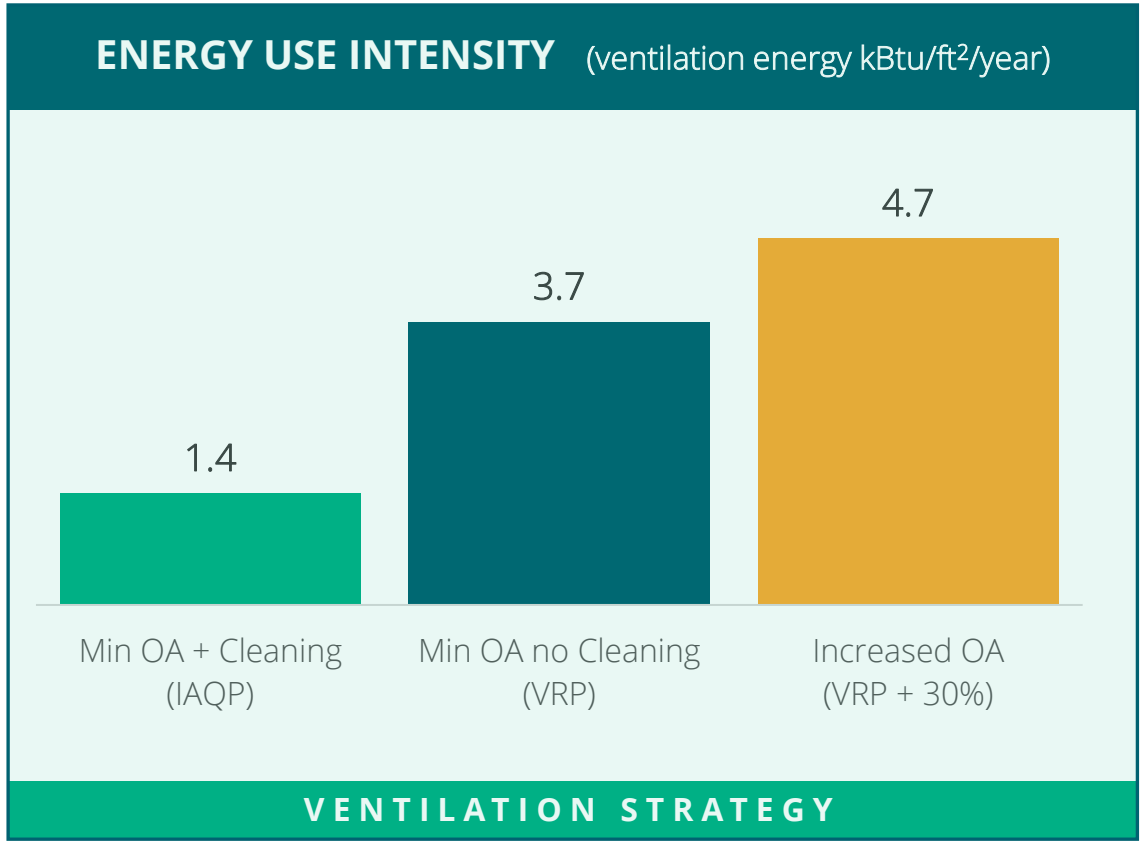
enVerid
Energy savings. Air quality.

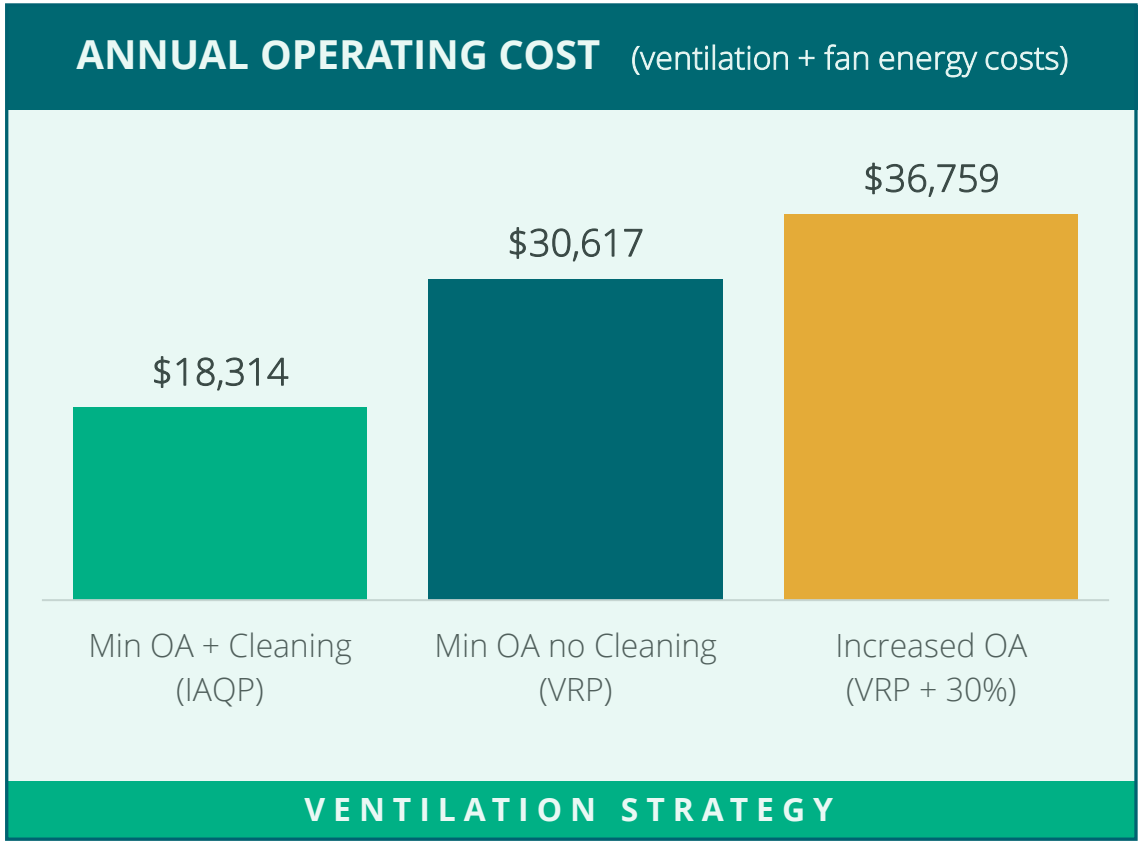
Save money on new HVAC equipment	Reduce HVAC energy costs by up to 40%	Lower Carbon Emissions & Improve IAQ	Earn points for LEED & WELL
			
CapEx	OpEx	Air Quality	Green Buildings

The Old Paradigm: More outside air for better Indoor Air Quality



Challenge #1: More outside air means more energy use and cost



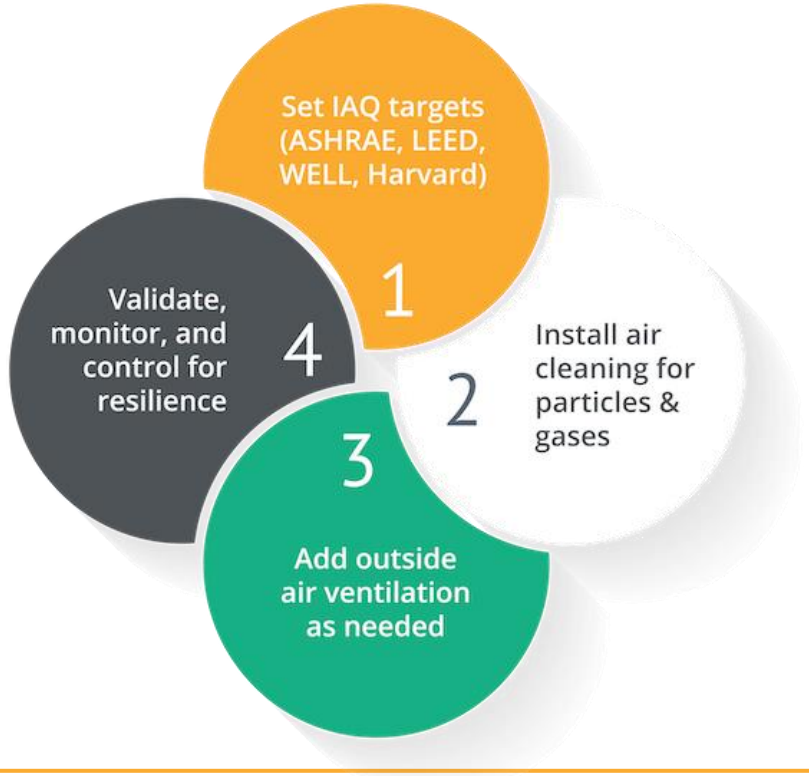


The above scenarios are for a 100,000 ft² all electric office building in Boston.
More air changes means higher HVAC system costs, higher HVAC operating costs, and higher total EUI.

Challenge #2: Outside air is not always “fresh”

Solution: Achieve IAQ and efficiency goals with a layered strategy

Clean First Framework



Sustainable IAQ

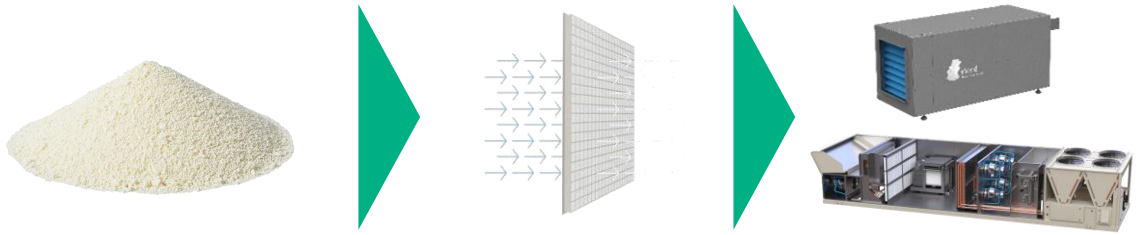
- Better indoor air quality
- More energy efficiently
- With increased resilience

Sustainable IAQ: Combining air cleaning and outside air ventilation to achieve IAQ goals energy efficiently, cost effectively, and resiliently over the long term.

Sorbent Ventilation Technology for gaseous contaminants

enVerid
Energy savings. Air quality.

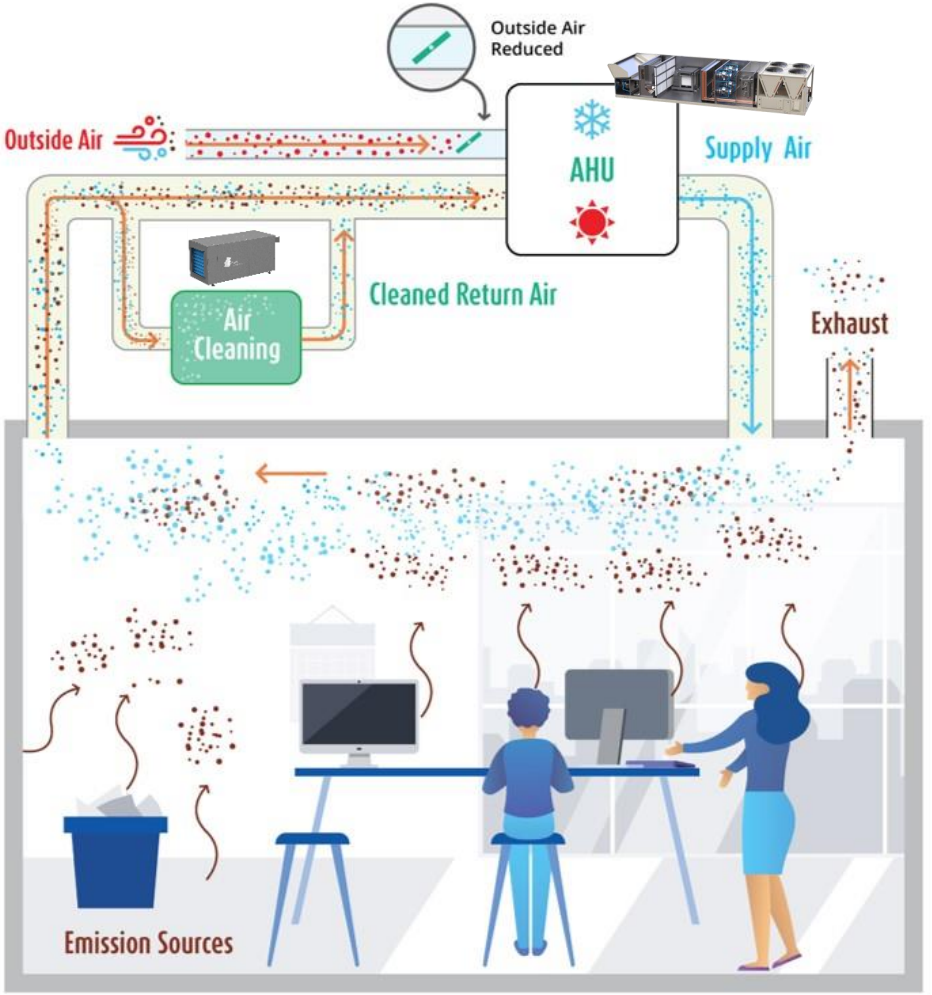
Sorbent Ventilation Technology (SVT) captures CO_2, ozone, and a wide range of volatile organic compounds (VOCs) from indoor air.

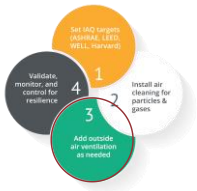


Sorbent Material | Sorbent Filters | SVT Systems

"The use of air cleaning with recirculation could allow for a reduction in the amount of outdoor air required with a concurrent reduction in associated operational energy costs."

ASHRAE 62.1-2019 User's Manual, Pg. 20





Optimize ventilation rates with air cleaning to save energy

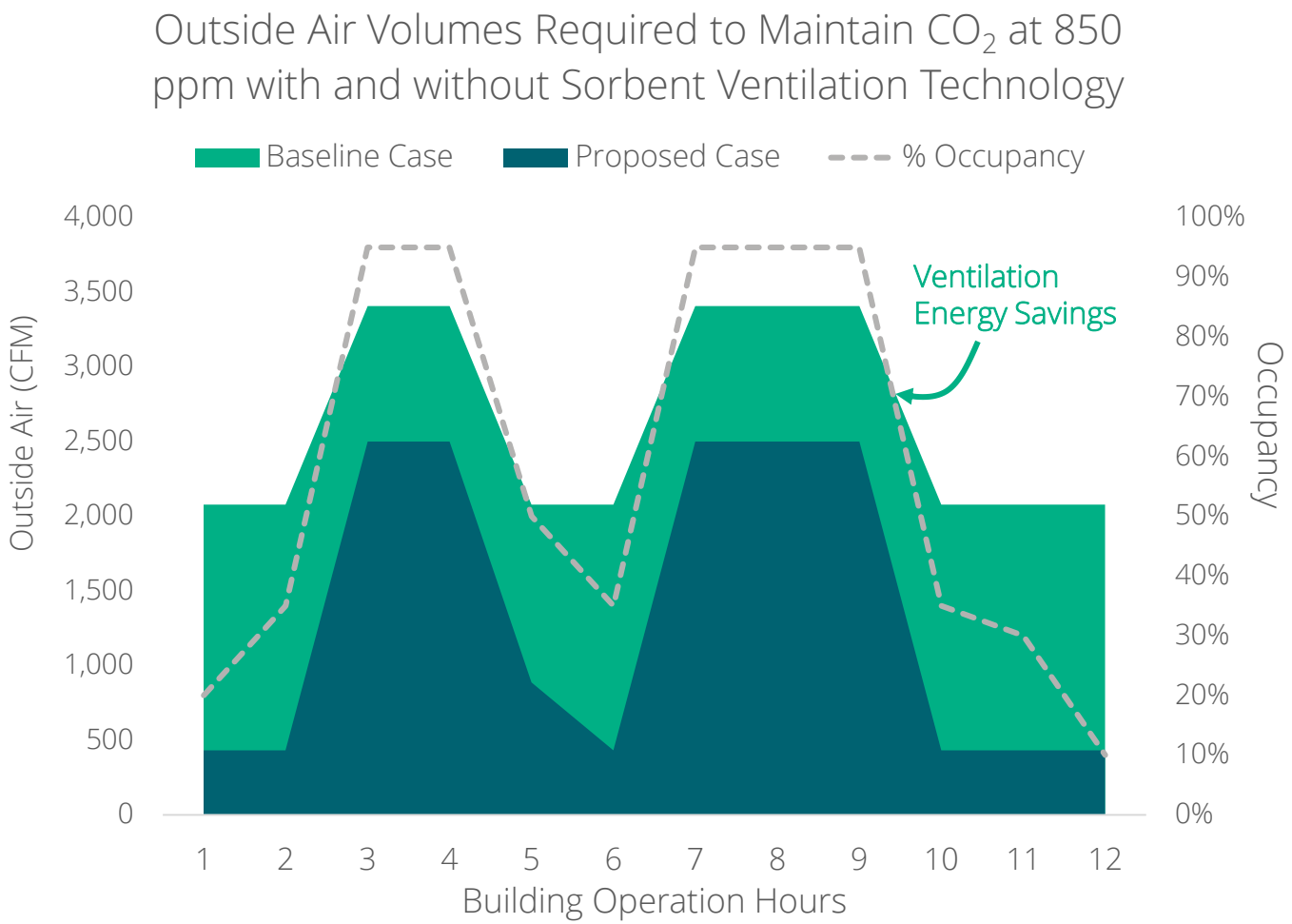
enVerid
Energy savings. Air quality.

ASHRAE Standard 62.1 includes two mechanical ventilation procedures:

	Ventilation Rate Procedure (VRP)	Indoor Air Quality Procedure (IAQP)
Methodology	Prescriptive: Outside air based on area and occupancy only.	Performance-based: Outside air based on contaminants emission rates and source-control and removal measures.
Indoor Air Quality	Depends on quality of outside air and any unusual indoor air contaminates.	Equivalent or better than VRP, especially when outside air is polluted or unusual contaminants.
Energy Intensity	Higher in many climate zones because IAQ is achieved using only outside air.	Lower because a portion of outside air may be replaced with cleaned indoor air.

"The IAQP may allow for a more cost-effective solution to providing good air quality, as all design strategies may be considered and compared..." *Standard 62.1-2019 User's Manual, Pg. 100*

The IAQ Procedure with SVT air cleaning and DCV



Baseline Case – No Sorbent Ventilation Technology

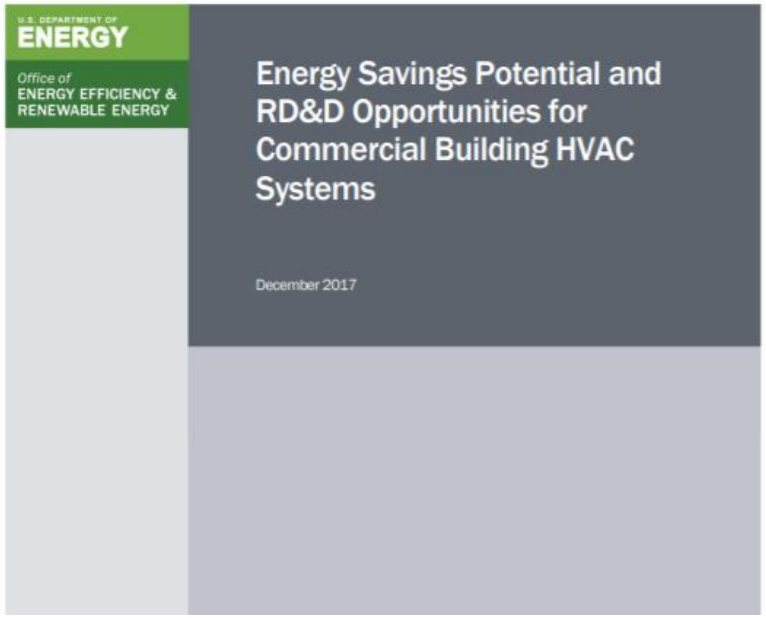
- Minimum outside air based on Ventilation Rate Procedure (VRP) and no sorbent air cleaning
- Using DCV, outside air increases as occupancy increases to maintain 850 ppm CO_2 concentration

Proposed Case – With Sorbent Ventilation Technology

- Minimum outside air based on the IAQ Procedure (IAQP) with sorbent air cleaning
- Using DCV, outside air increases as occupancy increases to maintain 850 ppm CO_2 concentration
- Minimum outside air is lower because sorbent air cleaning reduces the need for dilution ventilation

Light green area represents air cleaned with SVT rather than dilution ventilation and is the source of energy savings and peak demand reductions.

Field Validated: Sorbent air cleaning unlocks energy savings



"The HLR technology was shown to control contaminants of concern below exposure limits with lower ventilation rates…."

Sorbent air cleaning "offers a potential new path to saving energy associated with heating and cooling ventilation air by cleaning air…."

The IAQP with sorbent air cleaning ranked #12 overall in total energy saving and #3 for enhancements for current HVAC systems.

Target Building Types & Applications

Target Building Types

- Office buildings including healthcare MOBs
- Schools / universities / libraries
- Assembly, conference space, indoor arenas
- Malls and big box stores
- Green / LEED / WELL buildings
- NO labs, critical care, multi-family, hotel rooms

Building Qualification Criteria

- 15,000+ ft^2 for new HVAC systems
- 50,000+ ft^2 when retrofitting existing HVAC systems
- 15,000+ CFM supply air for mixed air systems
- 3,000+ CFM supply air for DOAS systems
- Dedicated mechanical space (ducted or plenum ok)
- Direct Digital Control (DDC) over outdoor air flows

Sampling of projects using enVerid's HLR technology

Office Buildings | *Higher Education* | *K-12 Education* | *Indoor Arenas* | *Airports* | *Concert Venues*

Thank you

Christian Weeks
+1 603 547 5527
cweeks@enVerid.com

MiaSolé Introduction

Mike Ma
2022. 03

MiaSolé Company Overview

- Thin film solar technology solution provider
  - Founded in 2004 in the Silicon Valley
  - Full turnkey solar manufacturing equipment, product, solutions
  - Over 120 US patents
- Focus on infrastructure, mobile energy, safety and security solutions
- Highest production efficiency rollable solar modules made in USA (17.5% average module efficiency)
  - World records in:
  - Large Area Production Module Efficiency : 18.64%
  - Mini-Cell Efficiency: 20.56%
  - Tandem CIGS and perovskite solar cell: 27%

97

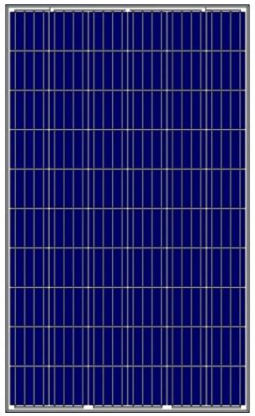
MiaSole World Records

- Large Area Production Module Efficiency : 18.64%
- Mini-Cell Efficiency: 20.56%
- Tandem CIGS and perovskite solar cell: 27%

We Are Making Rollable Solar

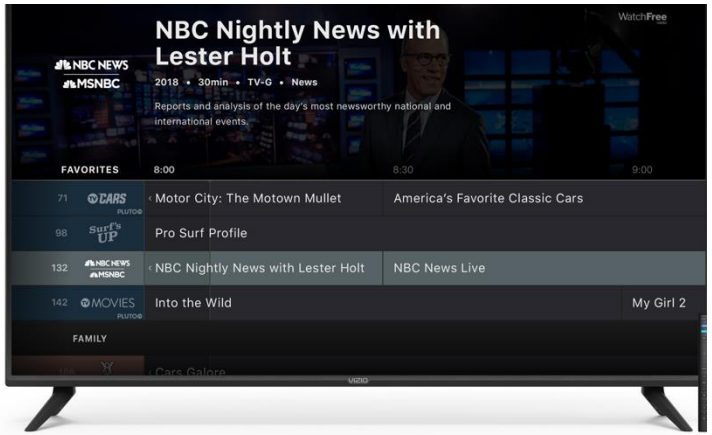
Si cell

Miasolé cell

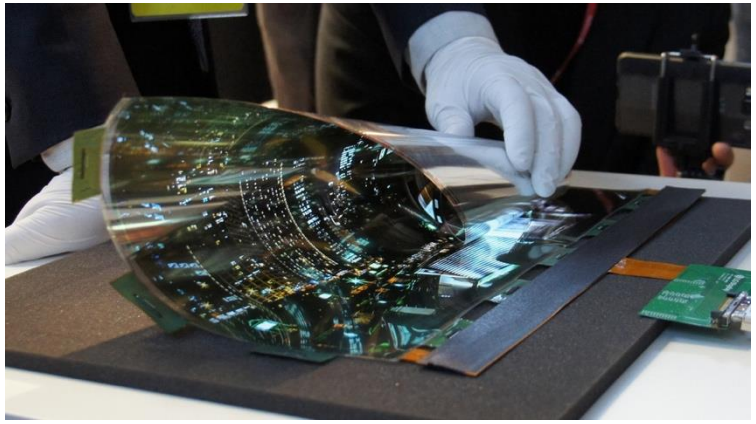


Si Module

Miasolé module



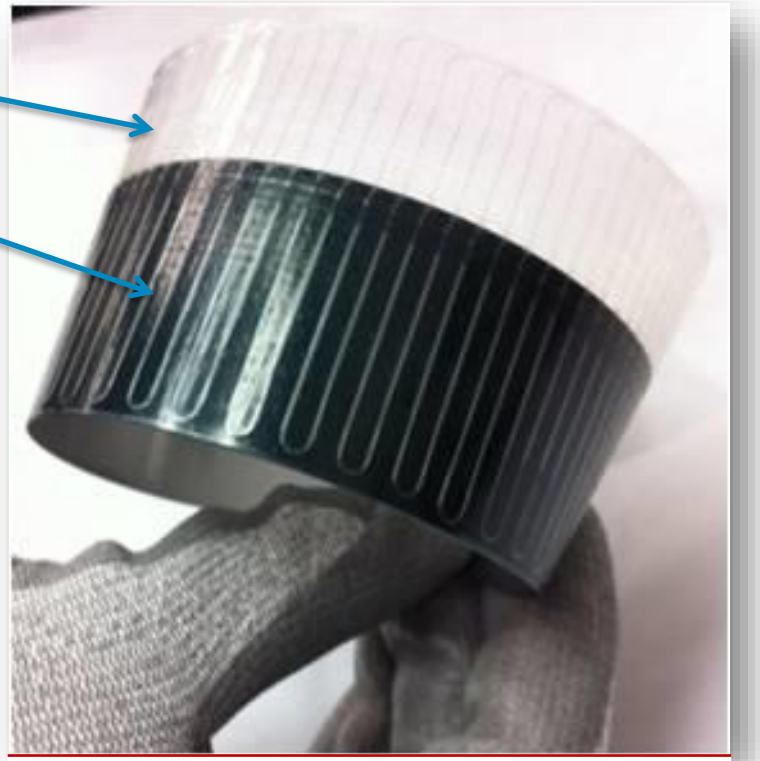
Compare to: Traditional TV



Rollable TV

MiaSolé Flexible Cell Technology

The building block of our solar products



Advantages:

- Flexible
- Lightweight
- Configurable size
- Innovative integration
- High power density

Technology	**CIGS**
Width	**43.75 mm**
Length	**312 mm**
Weight	**3.3 g/watt**
Efficiency	**Up to 19.4%**
Power	**Up to 2.66Wp**

Silicon vs. MiaSolé CIGS Thin Film

Comparison	Silicon Solar	MiaSolé CIGS Thin Film	Which means …
Form factor	Rigid	Flexible, Rollable	$B unserved markets
weight	16kg/m² （with racking）	2kg/m²	$B underserved markets
Typical module Thickness	10-40 mm	1.5 -3 mm	$B underserved markets
After bullet penetration	Shattered, failed	Keep working for years	Military markets
Shadow effect	Hot Spots burn, efficiency loss	Minimal	Better safety, utilization, energy production yield
Roof penetrations	Possible leak	No leak	Better Safety, lower risk
High wind	Risk of Lift off	Stick to roof	Great for high wind regions
Temperature Coefficients	－0.41%/℃ (high loss @ High T)	－0.38%/℃ (Low loss @ High T)	Great for hot regions
PV Panel Efficiency	17-22%	18%	High efficiency
Production electricity consumption(MWH/MW)	560	200 (64.2% less)	Green production
Production water consumption （ton／MW）	2172	173 (92% less)	Green production

3rd Party Validation of Accelerated Reliability Testing

intertek
Total Quality. Assured.

MiaSolé Hi-Tech Corp
LETTER REPORT

SCOPE OF WORK
DAMP HEAT TESTING FOR FLEX GEN 3 ON 8 SAMPLES.
PERFORMANCE TESTING TO IEC 61215-2: 2016ED1

REPORT NUMBER
103813765LAX-001E

ISSUE DATE
3-October-2019

PAGES
3

DOCUMENT CONTROL NUMBER
GFT-OP-10a (21-June-2019)

MIAMI-DADE COUNTY APPROVED

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LETTER REPORT

October 3, 2019

Intertek Report No. 103813765LAX-001E
Intertek Project No. G103813765

Paul Robusto
MiaSolé Hi-Tech Corp.
2590 Walsh Ave
Santa Clara, CA 95051
PRobusto@miasole.com

Ph: (408) 919-5749

Subject: Performance testing to IEC 61215-2.

Dear Paul Robusto,

This letter report represents progress of our testing of the above referenced product(s) to the requirements contained in the following standards:

- *IEC 61215-1 Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 1: Test Requirements [IEC 61215-1:2016 Ed.1]*
- *IEC 61215-2 Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 2: Test Procedures [IEC 61215-2:2016 Ed.1]*

SECTION 1
SUMMARY

This investigation was authorized by the quote # Qu-00921670, issued on 11/11/2018. The scope of work was to perform a total of 2000 hours of damp heat along with light soaking and module stabilization. On 05/31/2019 a project change order Qu-00985487 was issued to perform an additional 1000 hours of damp heat along with module light soaking and module stabilization. Intertek wishes to inform you that the required tests under project # G103813765 has been completed.

SECTION 2
TESTING

Three consecutive Damp Heat 1000 tests at 85°C and 85% relative humidity were performed. Light Stabilization (MQT 19.2) defined in IEC 61215-1-4:2016 was performed before damp heat and after each Damp Heat 1000.

The average power change for all 8 modules after each Damp Heat 1000 is summarized in the table below:

Test	Average Power Change
DH 1000	1.90%
DH 2000	2.20%
DH 3000	-3.00%

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MiaSolé Hi-Tech Corp.
Intertek Report No:
103813765LAX-001e

LETTER REPORT

The table below summarizes the electrical characteristics of the modules after 3000 hours of damp heat and light stabilization:

Sample ID	Model	Voc[V]	Isc[A]	Vpm[V]	Ipm[A]	FF
LAN1901181632-001	Flex-03-70N	22.24	4.42	17.20	3.96	69.3%
LAN1901181632-002	Flex-03-70N	22.18	4.43	17.23	4.01	70.3%
LAN1901181632-003	Flex-03-70N	23.03	4.43	18.20	4.01	71.5%
LAN1901181632-004	Flex-03-70N	22.70	4.44	17.98	4.01	71.6%
LAN1901181632-005	Flex-03-65N	20.99	4.66	15.97	4.14	67.5%
LAN1901181632-006	Flex-03-65N	21.47	4.65	16.70	4.12	69.0%
LAN1901181632-007	Flex-03-65N	21.47	4.63	16.59	4.17	69.5%
LAN1901181632-008	Flex-03-65N	21.37	4.68	16.45	4.18	68.8%

SECTION 3
PROJECT STATUS & ACTION

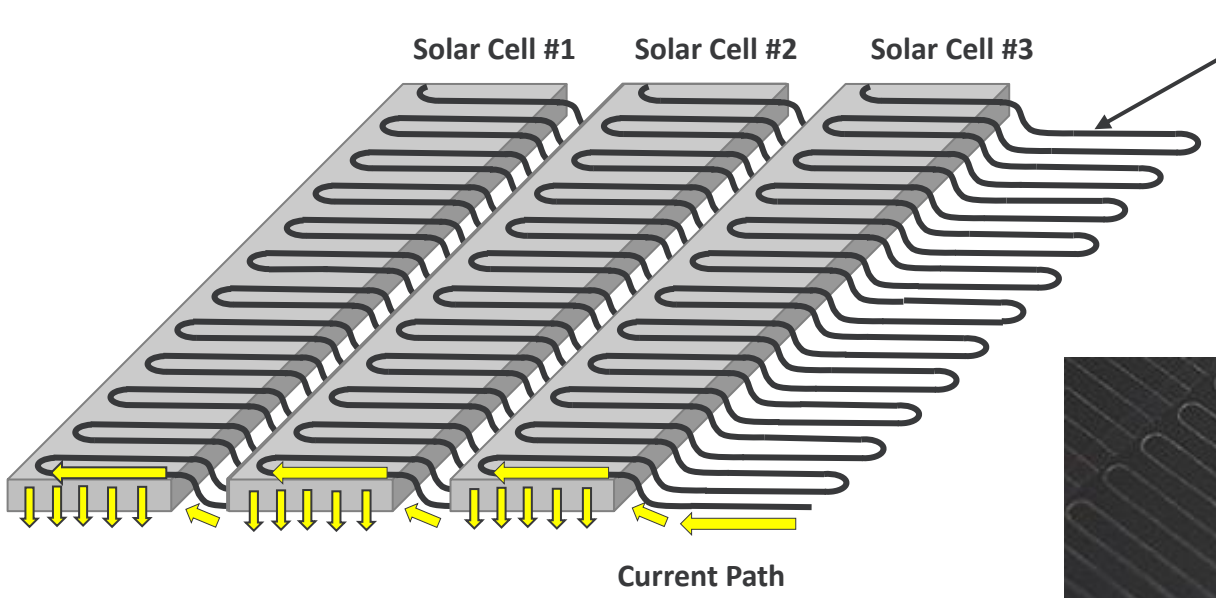
Issuance of this letter report provides the results of the testing covered by Intertek Project No. G103813765.

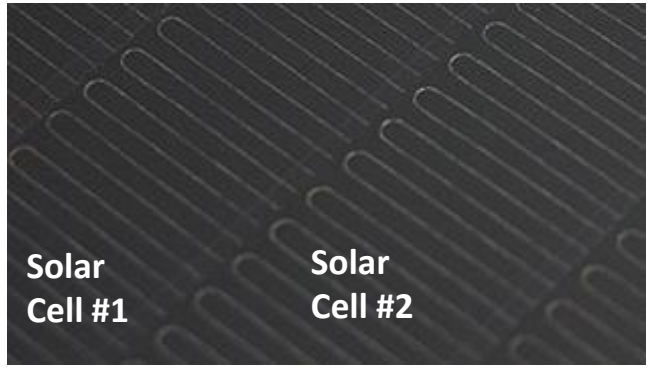
If there are any questions regarding the results contained in this report, or any of the other services offered by Intertek, please do not hesitate to contact your dedicated Intertek Project Manager.

Completed by:	Abhinav Prakash	Reviewed by:	Faraz Ebneali
Title:	Project Engineer	Title:	Reviewer
Signature:		Signature	
Date	10/03/2019	Date:	10/03/2019

Please note: this Letter Report does not represent authorization for the use of any Intertek certification marks.

MiaSolé Cell Interconnect

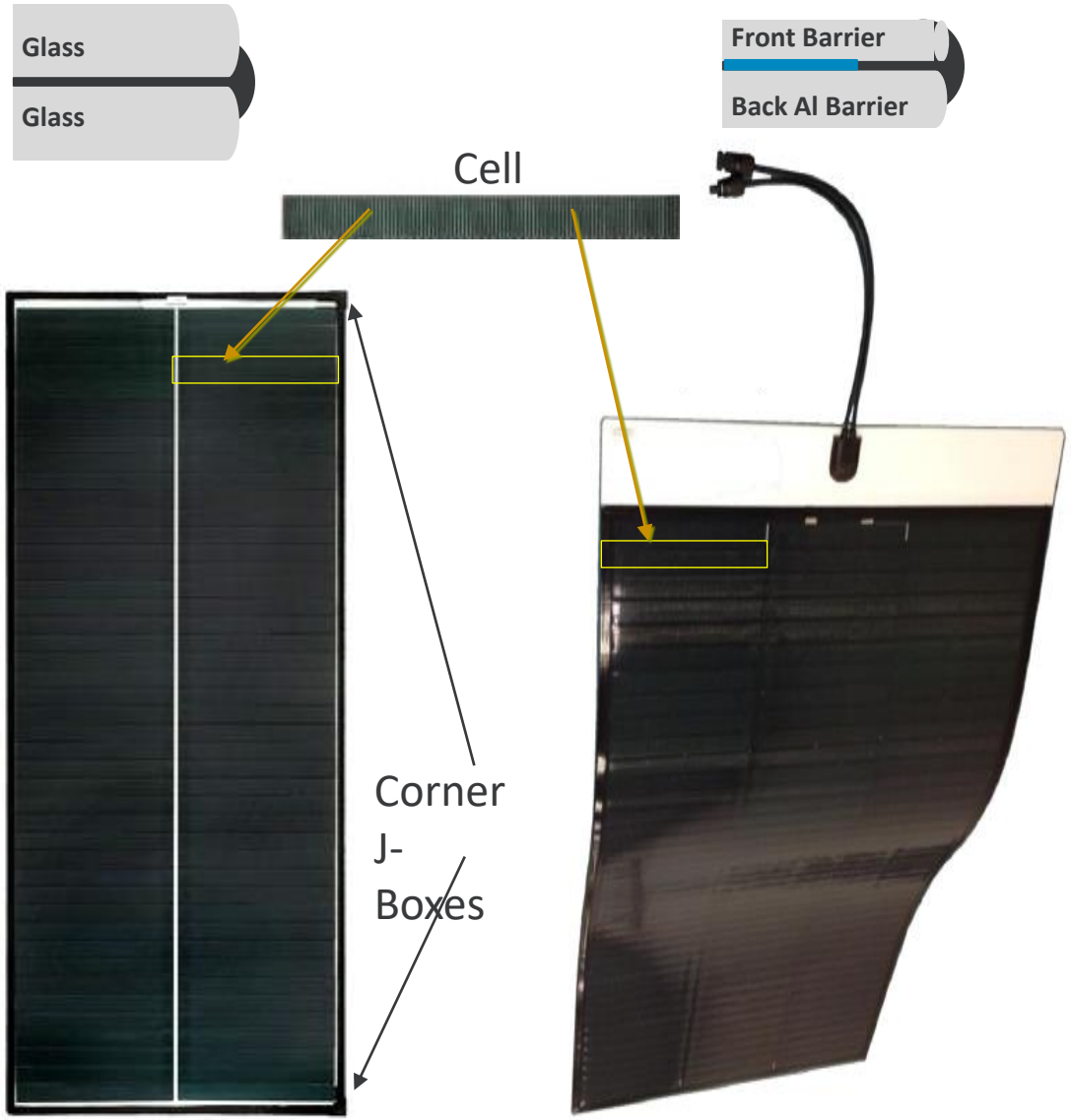




- Low resistance Collection Grid
- Redundant wires provide distributed interconnect between cells
- No solder joints, welding, or screen printing required

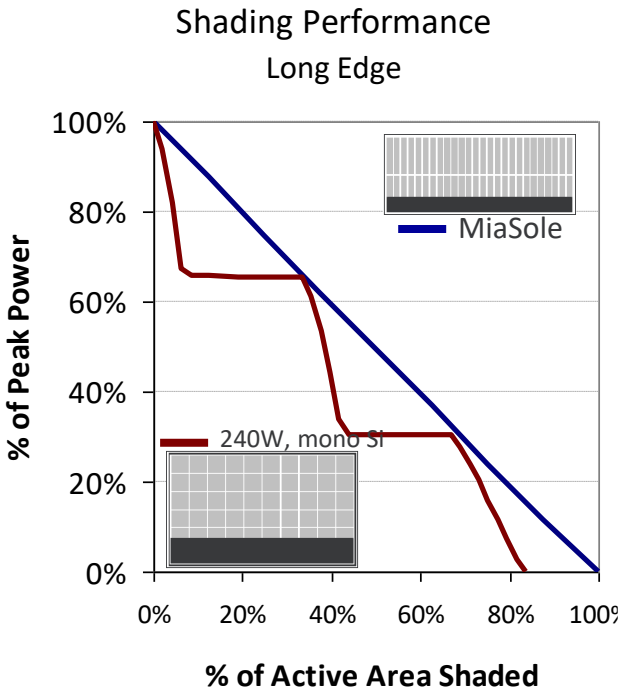
MiaSolé Module Design

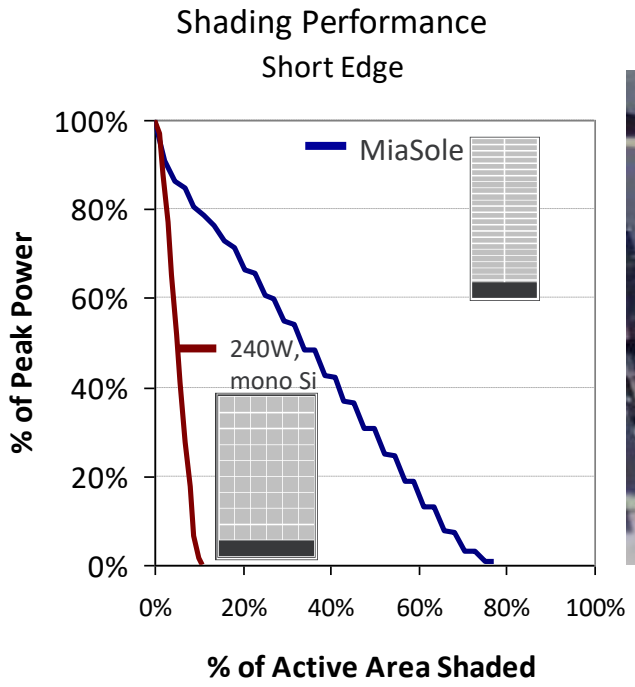
- Moisture Protection
  - Glass or flexible barrier
  - Butyl edge seal
- One Integrated By-Pass Diode for every two cells
  - no solder or welds
- Dual junction boxes on glass product
  - Reduced cable costs



Superior Partial Shading Performance

- One ByPass Diode for every 4Watts vs 80W for Si Modules (means higher production daily output)





Closer spacing of rows

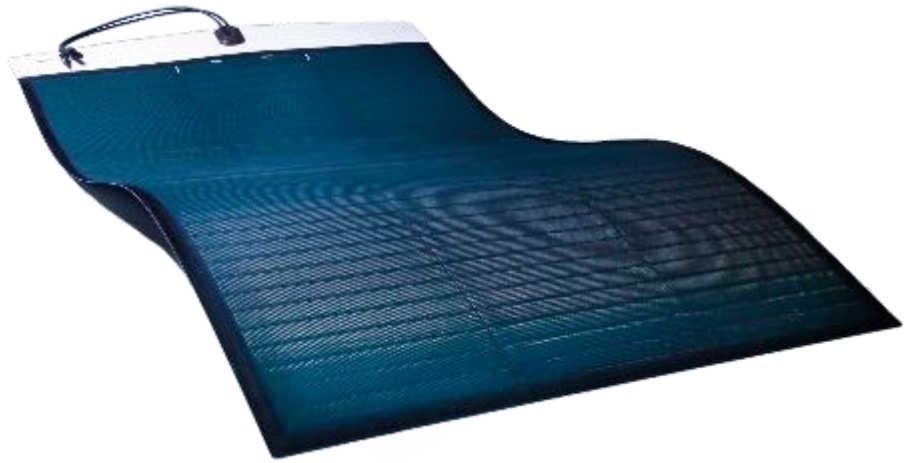
Protection in partial shading enables closer spacing of rows

MiaSolé FLEX Technology

Integration of flexible cells in a world class solution

Shatter-proof

FLEX modules will not break when struck by debris



Lightweight

MiaSolé FLEX modules weigh less than 4 lbs./Sqyard or 2.0 kg/m^2

Powerful- 540W per module

With aperture efficiencies as high as 18.65%, you get the most power possible in a flexible, lightweight module

Resistant to Wind

FLEX modules have been tested on winds up to 200mph

Available in many sizes

FLEX modules are available in:

- 3 widths (narrow, mid, wide)
- numerous length (100 to 590cm)

FLEX modules are made to suit your project.

FLEX modules can also made custom sized.

Easy to Install

MiaSolé FLEX modules are easy to install:

- **Peel-and-stick installation in four easy steps:**

1. Prepare roof

2. Arrange panels

3. Remove backing film

4. Use roller to ensure adhesion

MiaSolé Product Applications

Confidential

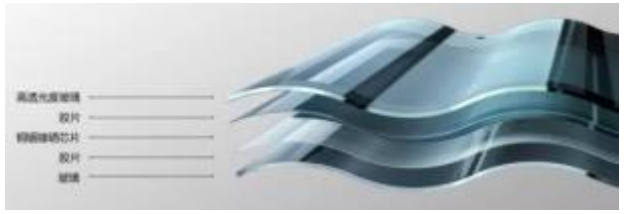
MiaSole Flexible Panels on Membrane Roof on a Fire Station in Florida

MiaSole Flexible Solar on Large Commercial Membrane Roof

Residential Solar Rooftop Applications

Solar Curve Tiles Use MiaSole High Efficiency Light Weight Flexible CIGS Cells for Elegant Solutions

One Tile = One Tree



Solar Wall Application

Green House Application

Solar Panel on Fabric Tent Applications

Solar Car Port Application

25KW Car Park Installation in Qatar

Special Architecture Design Applications

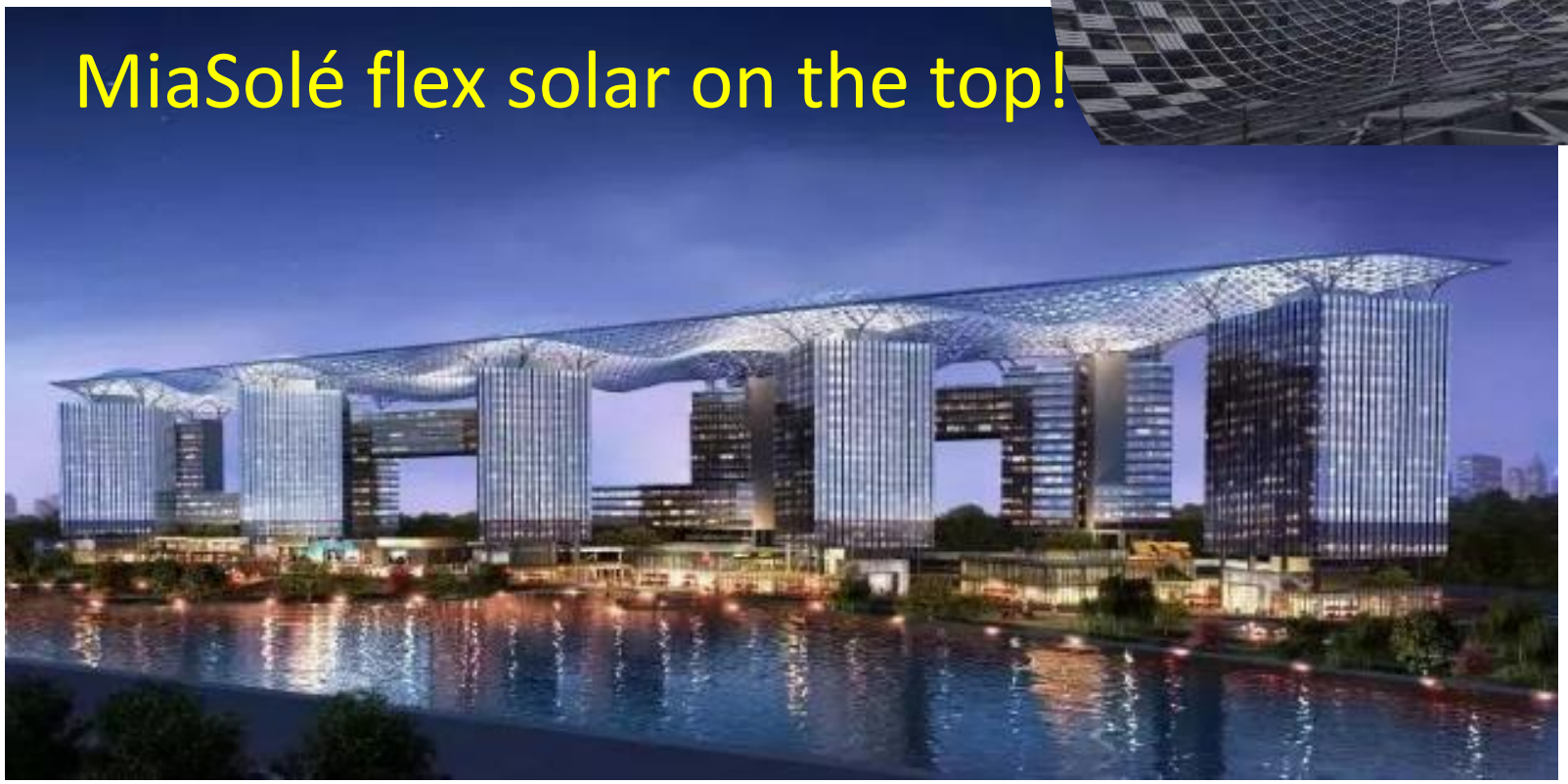
Imagination without limits

Key project and News

Shanghai New Landmark

Rafael Gallery Project

1.5 kilometers long and designed by internationally renowned architect Raphael Vinori, the world's longest urban industrial corridor



Floating Solar Application with MiaSole Flexible Solar in Netherland

Landfill Ground Cover Solar Power Plant Applications

Power Up Off-Grid Smart Streetlight Applications for Safety and Security – Can be Equipped with WiFi, 5G, Surveillant Camera, Gunshot Sensors, Air Quality Sensors, Temperature Sensors etc.

MiaSolé Solar Panels Fit All Transportation Applications – Self powered when sun rises

Military Charger Application

Troops Are Always Powered

- Custom Built with high profit margin.
- Product is in testing stage

Gunshot Through the Module:

Before and After Being Shot – the moment of truth

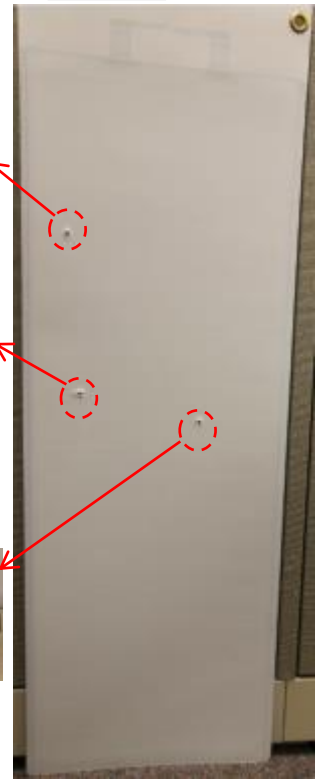
Weapon

Ammunition: .223 caliber, Federal, 55 grain, FMJ (Full Metal Jacket).

Rifle : Ruger M77 Mark II. Bolt action.

FRONT

BACK

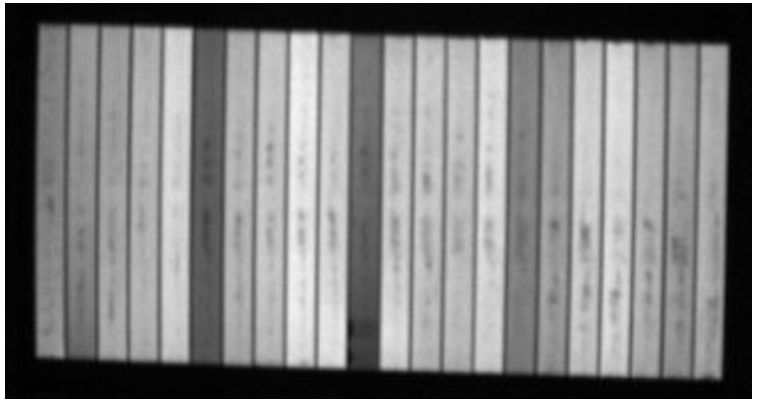


Shot at 50 yards

Before and After PV Performance:

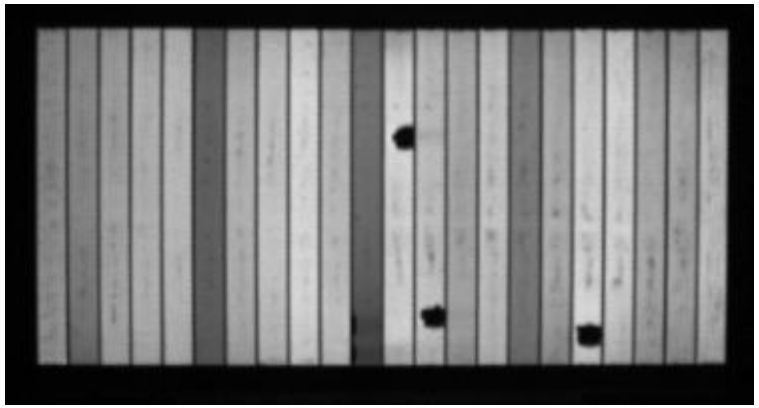
Infrared Images and Electrical Performance

Before



Efficiency : 15.8%
Maximum Power : 47.4 W

After



Efficiency : 15.8%
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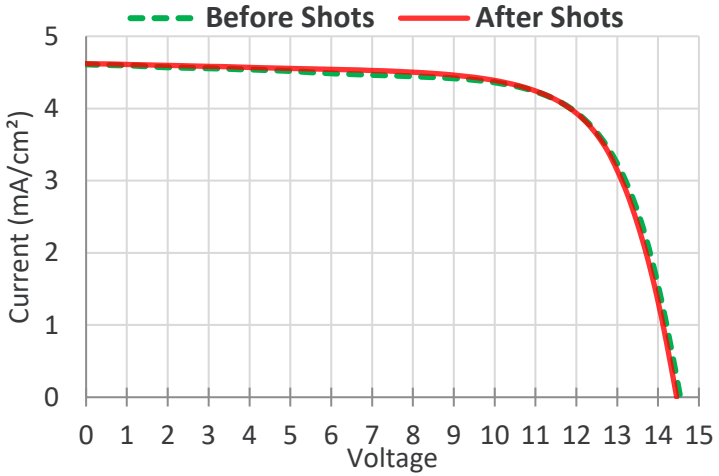


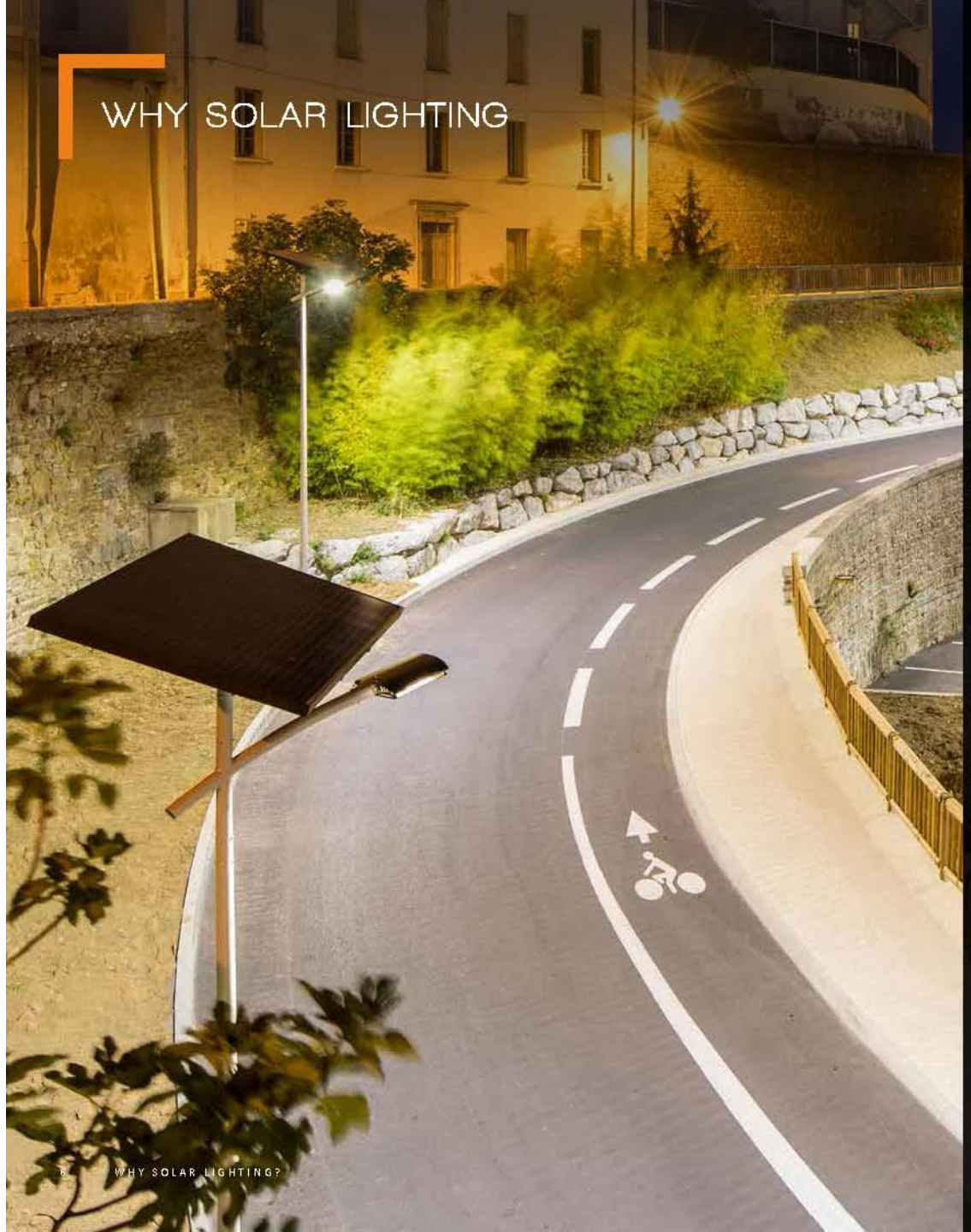
Same Power Output Before and After being Shot

MiaSolé One Flexible Solar Cell fits Many Products and Applications

Mike Ma
Sr. VP S&M Supply Chain
mma@miasole.com
+14084762085
www.miasole.com

FONROCHE lighting AMERICA

Autonomous Solar Lighting



WHY SOLAR LIGHTING

POWERFUL BENEFITS

Adding new grid-connected lighting is like investing in the past. Advanced solar street lighting from Fonroche brings you a wealth of benefits–financial, environmental, and much more. Here are just some of the reasons why Fonroche beats the grid.

SAVES MONEY

We save you money right from the start, eliminating the cost of trenching, wiring, switchgear, and soil remediation. Then we cut electricity costs, year after year—because the sun doesn't send you a bill. And it never experiences outages.

NO MAINTENANCE FOR A DECADE

Thanks to meticulous design and advanced battery technology, our solar lighting systems run year after year, creating light with no scheduled maintenance for 10+ years.

SAVES TIME

Smart design and fast installation save time. Our lights are up and running in just hours. And there is no waiting for a hook-up.

ELIMINATES EMISSIONS

Our solar lighting systems let you add new light to key areas without adding more CO2 emissions. Serve the people while saving the planet.

LIGHT AT NIGHT GUARANTEED

We guarantee that you'll get the appropriate light levels you need—365 nights a year – even during utility power outages.

SUSTAINABILITY

SMART FOR THE ENVIRONMENT

Our Smartlight is the smart choice for solar street lighting—and the green choice for the environment. You'll find smart choices throughout the design of our Smartlight, aimed at minimizing environmental impact and maximizing sustainability—while controlling costs.

Unlike many other battery systems, Fonroche's NiMH battery packs are considered non-toxic and rated non-hazardous.

- SmartLights are emission-free, helping you meet your climate action goals
- No trenching means hardscape, wetlands, mature native landscape, and tree roots are untouched
- Greater than 95% of each SmartLight component is recyclable

récylum
engagés pour un recyclage responsable

PV CYCLE

ida
DARK SKY APPROVED

SMARTLIGHT TECHNOLOGY

SMART AT THE HEART

At the heart of every Smartlight, you'll find the Power 365 Power Center, our innovative solution for smart energy storage and management. Our Power 365 Center brings you:

- Protection from water and dust ingress
- Water-tight, plug-and-play connectors
- Superior battery technology for longer life and an attractive profile
- On-board BMS (battery management system) & anti-blackout protection
- LoRa wireless radio module

SMART CONTROLS

In addition to managing energy and balancing the batteries, the SmartLight System can be programmed with over 300 unique lighting profiles.

The lighting system can be set to provide the same light level all night long or lighting can be dimmed for designated periods. Dimming the lights during low conflict times saves money by using less energy and a smaller power package.

Adding a wireless gateway makes your lighting project even smarter. You'll be able to request profile changes, track energy production, measure carbon off-set, detect faults, and more.

SO SMART, IT'S SIMPLE

Your power center arrives pre-wired, programmed, and sealed in a compact enclosure. You don't need to load or wire batteries, which saves time and prevents errors. Just plug in the panel and light fixture to activate the system. When you use one of our direct burial poles, installation is as simple as planting a tree.

The biggest maintenance expense associated with solar street lights is battery replacement. Fonroche's own Nickel Alloy (NiMH) batteries outperform AGM, lithium and gel batteries in the field. We formulated our batteries to excel in tough temperature ranges, so they have extremely wide temperature tolerances—for both charging and operating.

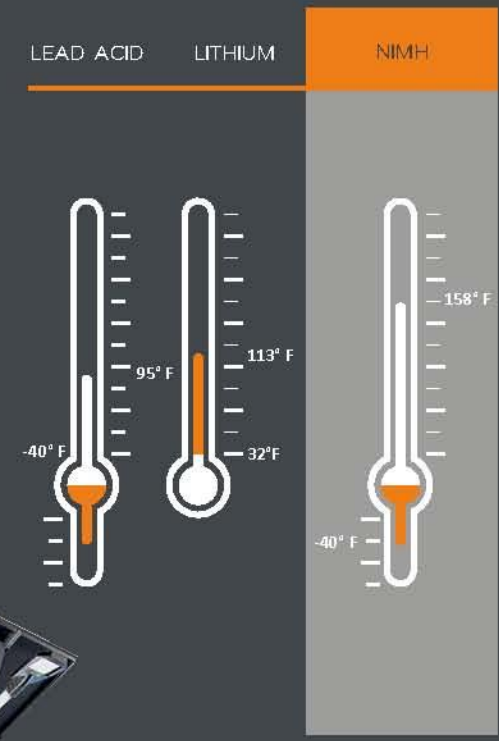
CHARGING TEMPERATURE:

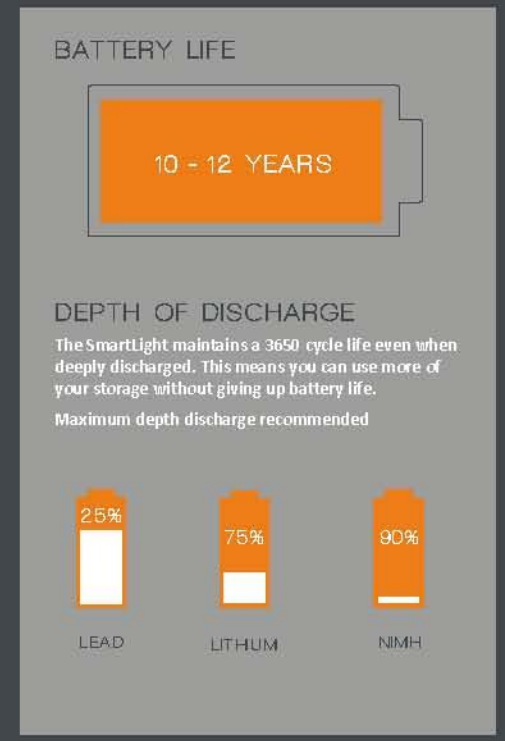
Most lithium ion batteries discharge in cold climates but don't accept a charge below freezing.

Fonroche's industrial NiMH battery formulation charges and discharges in temperatures from -40°F to +158°F.

OPERATING TEMPERATURE:

Heat shortens the life of lead acid batteries very quickly. That's why we developed the Power 365 NiMH battery/charging system, which is optimized to meet the rugged challenges of solar lighting. It's built for operating in temperatures up 158° F.

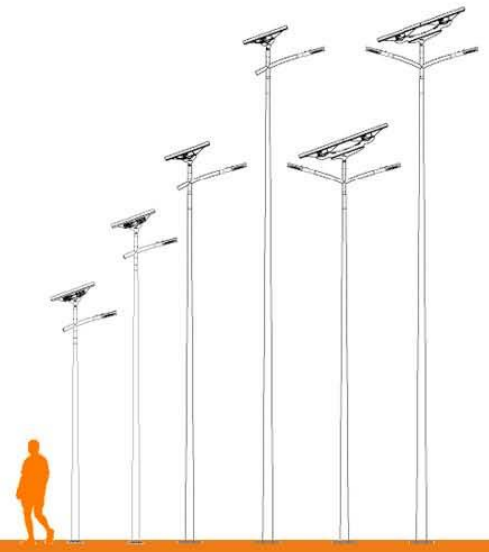




SMART CHOICES

PRODUCT RANGE

We keep our solutions simple with Smartlight—one proven, powerful solar light that meets a wide range of needs. Its unique black solar panel looks elegant, day or night. No hanging wires or bulky battery box. No solar panel that looks like a high school science project. We use powerful components and smart controls to provide all the energy you need in a sleek package, so you can count on all-night lighting all year round.



Standard SmartLight systems are configured a Power 365 assembly, one (single) lighting fixture or two (twin) lighting fixtures.

Standard systems address most park, pedestrian, basic parking, and street lighting applications. Double systems provide extra power for parking lot and roadway applications. Each double system is configured with two Power 365 assemblies and one (single) or two (twin) fixtures.

- SmartLight Single
- SmartLight Twin
- SmartLight Double Single
- SmartLight Double Twin

Standard pole heights of 14'-25'

STANDARD ROADFOCUS LUMINAIRE

The versatile RoadFocus has a sleek, unobtrusive design that is at home in all types of environments. With three color temperature choices, six light distribution patterns, zero uplight and optional shielding, it is a great solution for pathways, bike paths, streets, general area lighting, and parking lots. The luminaire's superior optics allow you to get the most out of your solar lighting systems by using your lumens exactly where you need them. Dark Sky Certified fixtures and optional house side shields protect neighboring properties.

LUMINAIRE ALTERNATIVES

When simplicity and performance aren't enough, we partner with Tier 1 luminaire manufacturers to provide decorative alternatives. Each luminaire is tested to ensure the same rock-solid reliability as our standard product offering.

FONROCHE CONNECT

An optional Fonroche Connect Gateway creates a solar lighting wireless network that provides you with greater control and responsiveness.

CARREFOUR - PORTET/GARONNE

FONROCHE lighting

LOGOUT

DASHBOARD | SHOW THE MAP | CONTACT | REQUEST FOR INTERVENTION

143

Number of street lamp in your park

State of connected street lamp

Operating	With default
143	0

Energy available

Light on time	Light off time
19:15	08:45

Energy Produced

26940.20 kWh

Economy of CO_2

2.29 t

FONROCHE lighting

SHOW THE MAP | CONTACT | REQUEST FOR INT

Layout map of street lamps:

Center the map

LEGEND

- single - nominal
- double - nominal
- single - no signal
- double - no signal
- single - in default
- double - in default

Rightsized to your specific needs

1 Project = 1 Study

10-Year Analysis of local weather data

We use the **PVsyst** software suite and **Meteonorm** historical time series irradiation data to calculate the real-world operating conditions — orientation and tilt angle of the panel, shadow, etc. — and external parameters, such as direct and diffuse irradiation, temperature and the solar calendar.

Simulation of product(s) over a typical year

Our teams have developed a solar sizing software application, which we use to determine which products will best meet your needs. We then simulate how these products operate over a typical year, based on the average conditions for **the last decade**.

Sizing the project to your needs

We use a set of key criteria to optimally specify your project:

- Average battery charge level over the year
- Minimum charge level
- Comparative analysis of energy generated by the panel vs. energy used by the system
- Worst-case scenario (lowest irradiation, longest night)

Results

Based on our experience, we propose the **optimal solution** in terms of lighting **performance** and **cost effectiveness**.

Autonomy of
365
nights of lighting /year

SMARTLIGHT WITH SIGNIFY ROADFOCUS

WARRANTY 5 years
Non pro-rated

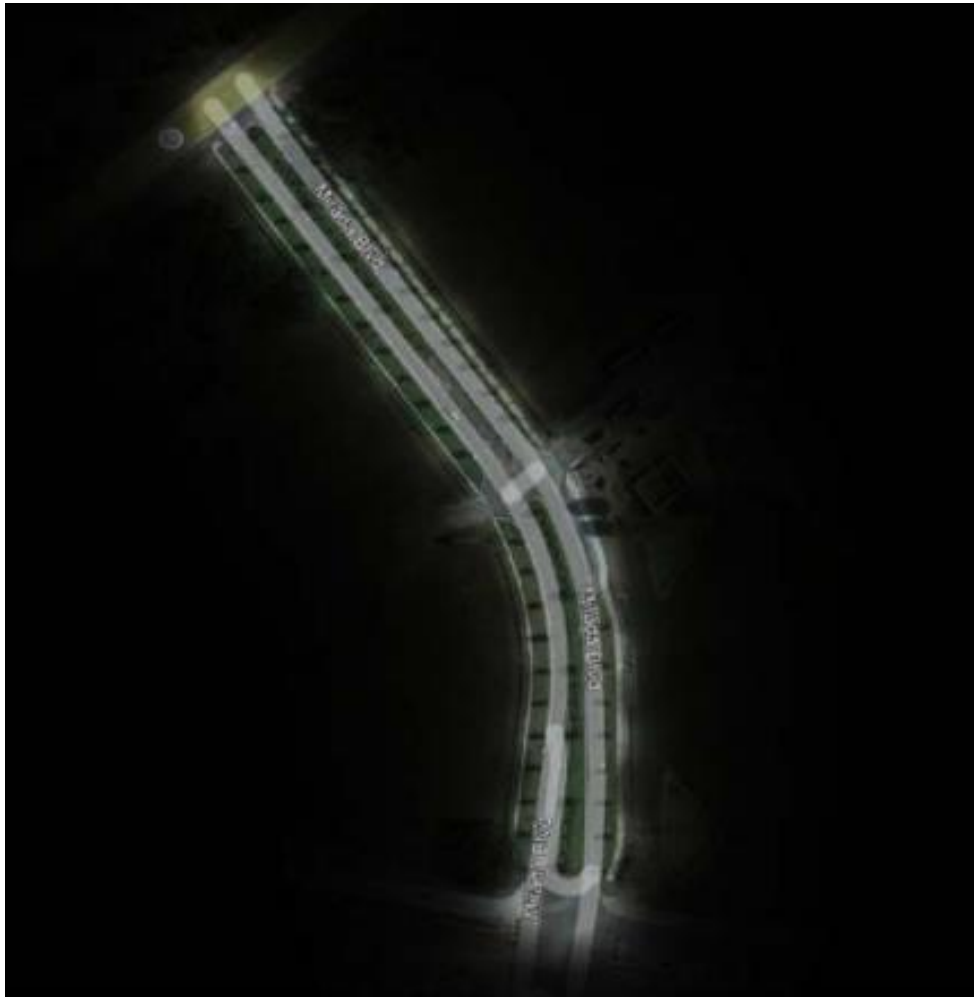
signify
Lumec RoadFocus LED

Project-Specific System Specifications

PHOTOVOLTAIC MODULE (30 years)	
PV panel power rating	260 Wp
PV panel tilt angle	10°
POWER 365: SMART STORAGE AND MANAGEMENT (10 years)	
Battery capacity (Must be NiMH)	936 Wh
LED LIGHT UNIT (20 years)	
Lighting power	40 W nominal
LED light unit specification	4000K - 126 Lm/w
POLE & CROSSPIECE	
Pole height	25’
Protective treatment	Powder Coated

Chosen lighting profile for your project

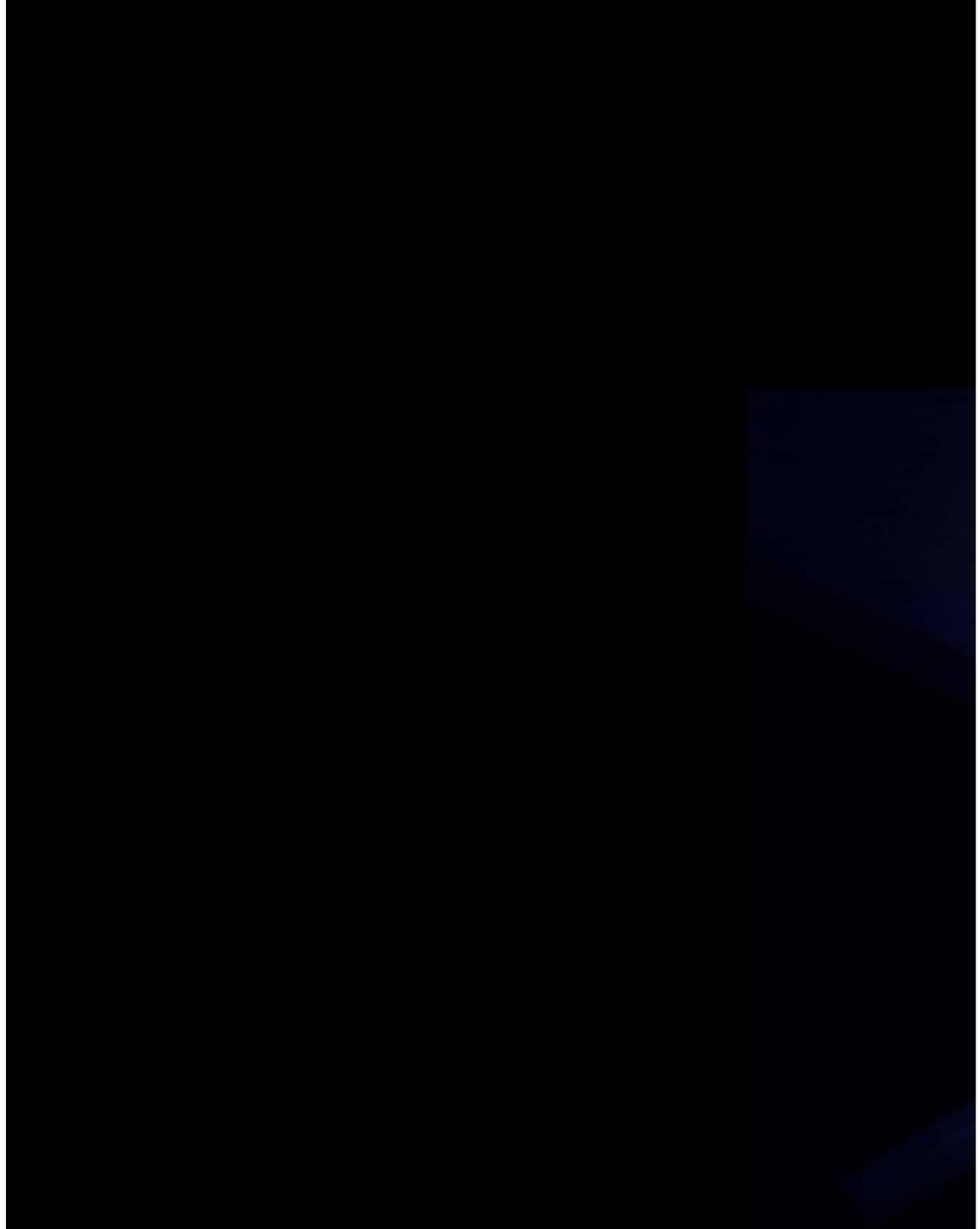

Publix Super Market a
539 ft




Burrus Old Mill Park


SOLAR-ADVANCE®
Swiss solar lighting
ÉVOLÈNE
RÉGION


flunch
P2



CONTACT US FOR MORE INFORMATION

https://www.fonrochesolarlighting.com/

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FONROCHESOLARLIGHTING.COM

339-225-4530 EXT. 1

Contact information: Anicet Mabonzo
Email: a.mabonzo@fonroche.us
Phone: +1 316-833-0976

FONROCHE LIGHTING NORTH AMERICA
FONROCHESOLARLIGHTING.COM

Presenter Q&A

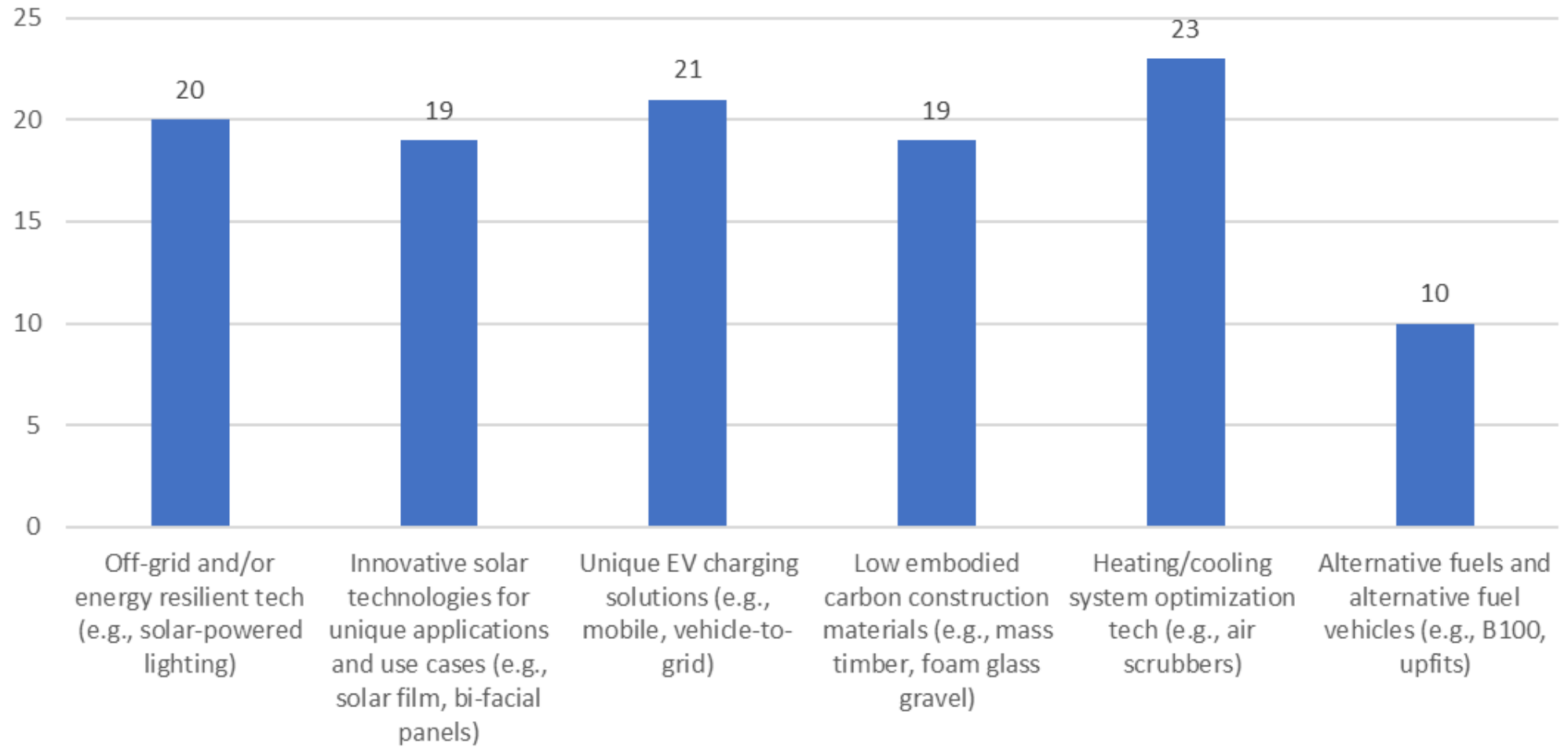
DOER
Massachusetts Department of Energy Resources

Thank you to today's presenters!

Smaller Group Discussions

Innovative Technologies at State Facilities: Challenges and Opportunities

Which of these categories of tech do you want to know more about, whether because of interest or potential applicability at your facilities?



Before We Break… Context for Discussion

"Innovative technology" typically categorized by Technology + Commercial Readiness Level (TRL)

Research and prototyping	TRL 1-4
Demonstration and acceleration	TRL 5-7
Commercialization and growth	TRL 7-9

- What innovative tech categories or types would you have liked to see that weren't part of today's presentations?
- Where have you had success or identified opportunities?
- What procurement, financing, or other challenges have you faced when trying to incorporate innovative tech into projects?

Next LBE Council Meeting
Spotlight: Mass Save 2022-2024 Energy Efficiency Plan

Save the Date!

Tentative:

Tuesday, May 10th

10:00 am–12:00 pm

Upcoming Tentative Meeting Dates:
July 12th
Sept 13th
Nov 8th

Creating a Clean, Affordable and Resilient Energy Future for the Commonwealth

DOER
Massachusetts Department of Energy Resources