



COMMONWEALTH OF MASSACHUSETTS

*Charles Baker, Governor
Matthew Beaton, Secretary
Judith Judson, Commissioner*

Municipal Primer on Zero-Energy New Construction

*Green Communities Division
Webinar*

April 26, 2018

Today's Presenters

- **Paul Ormond**, DOER Energy Engineer
 - *Nelson Place School Case Study*
- **Sean Tully**, Eversource Energy Efficiency Consultant
 - *Working with Utility New Construction Programs*

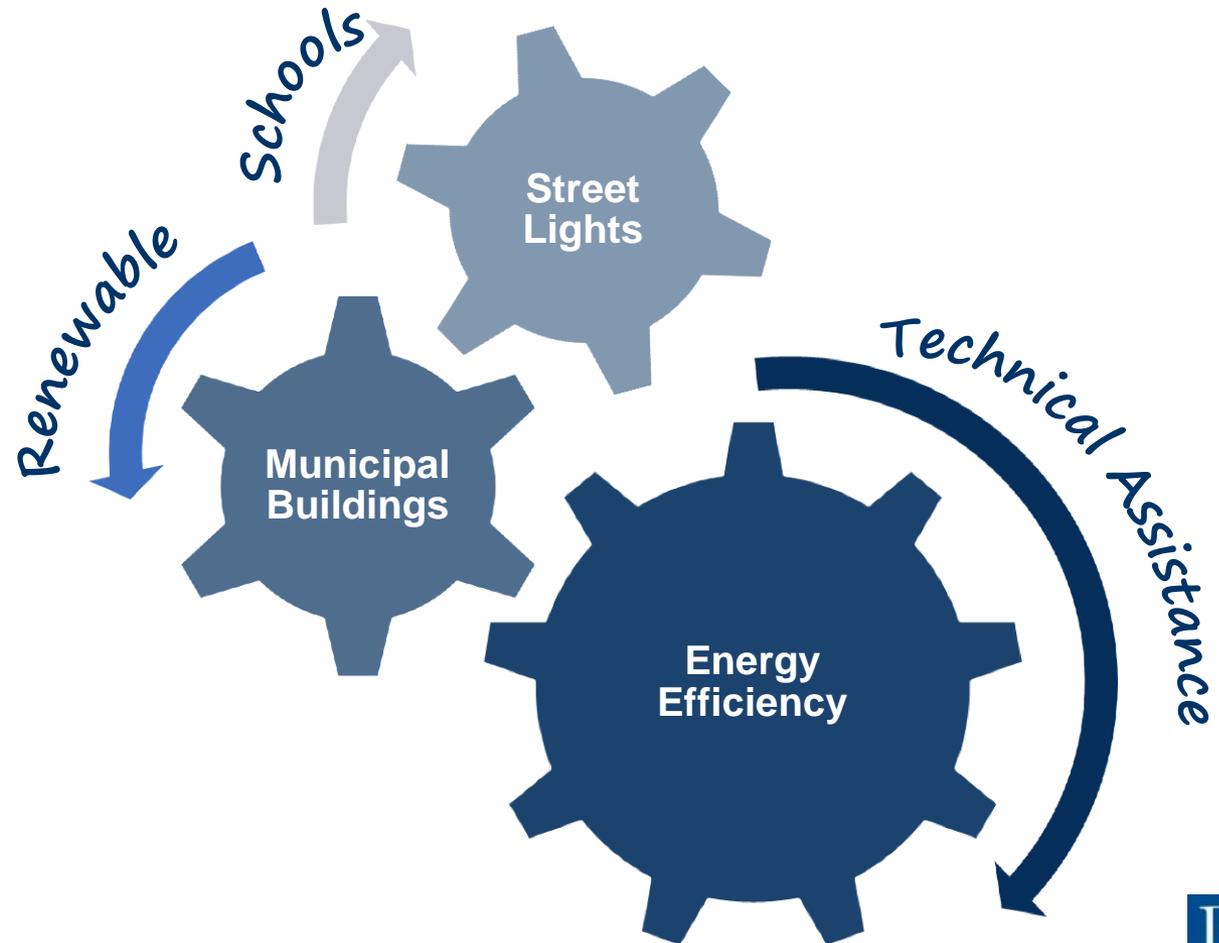


*Helping Massachusetts Municipalities Create a Clean,
Affordable and Resilient Energy Future for the Commonwealth*



Green Communities Division

The energy hub for **all** Massachusetts cities and towns, not just designated “Green Communities.”



*Helping Massachusetts Municipalities Create a Clean,
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Green Communities Division - Programs & Resources for Municipalities

- Green Communities Designation and Grant Program
- MassEnergyInsight energy tracking and analysis tool
- Municipal Energy Technical Assistance
- Energy Management Services Procurement Oversight
- Website filled with tools & resources:
- www.mass.gov/orgs/green-communities-division-masdoer

Email updates via e-blasts – Sign up by sending an email to:
join-ene-greencommunities@listserv.state.ma.us



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Outreach - Regional Coordinators

- Regional Coordinators act as direct liaisons with cities and towns on energy efficiency and renewable energy activities
- Located at each of the DEP Regional Offices:



WERO – SPRINGFIELD: Jim Barry
Jim.Barry@state.ma.us



NERO – WILMINGTON: Neal Duffy
Neal.Duffy@state.ma.us



CERO – WORCESTER: Kelly Brown
Kelly.Brown@state.ma.us



SERO – LAKEVILLE: Seth Pickering
Seth.Pickering@state.ma.us



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Recording & Presentation

- The webinar is being recorded and will be available on our website in approximately 48 hours at: www.mass.gov/orgs/green-communities-division-massdoer
- Click on the camera icon top right of your screen to save any slides for future reference
- Use the Q & A icon on your screen to type in questions



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DOER Technical Assistance

Municipal Energy Technical Assistance (META) grants for communities, water/waste water districts, regional school districts



Up to \$5,000:

- ZE feasibility study or assessment for new construction

Up to \$12,500:

- Integrated design services

Will be posted soon – mid-July deadline



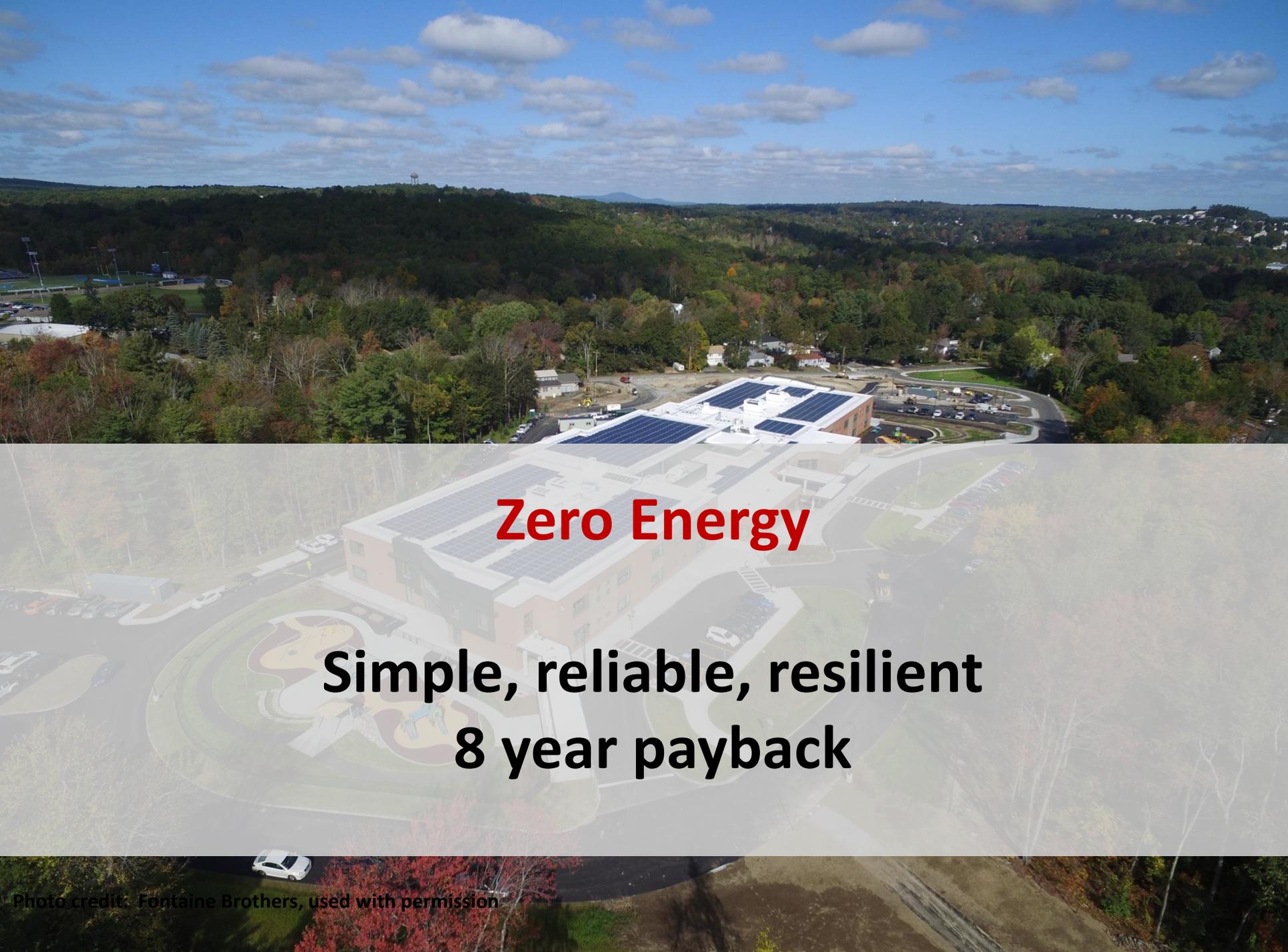
*Helping Massachusetts Municipalities Create a Clean,
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Poll Question #1

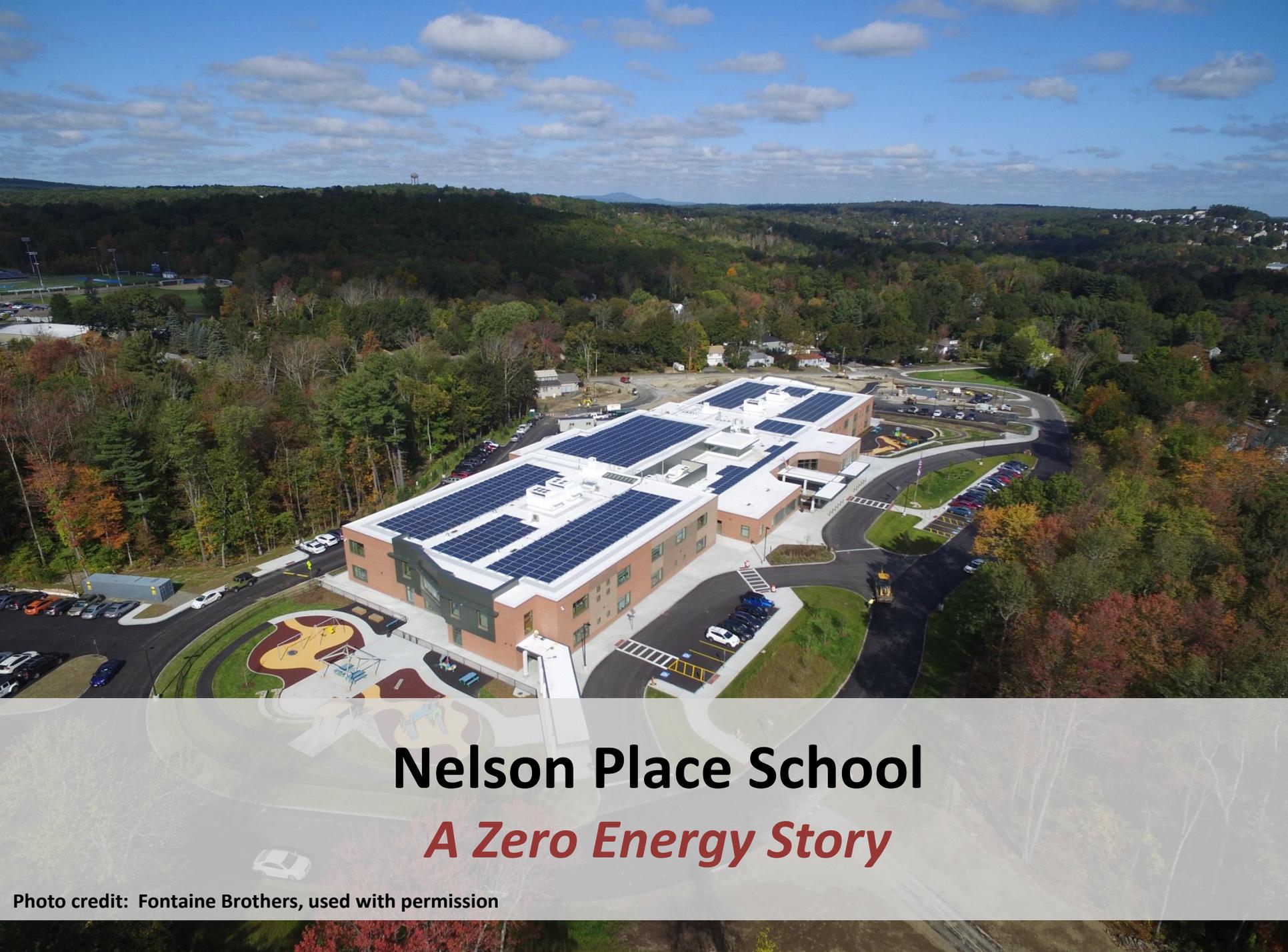
- Is your community planning on constructing a new building in the near future?
 - Yes
 - No



An aerial photograph of a large, modern building with a flat roof covered in solar panels. The building is surrounded by a parking lot and landscaped areas. In the background, there are dense green trees and a clear blue sky with scattered white clouds. The text is overlaid on a semi-transparent white banner across the middle of the image.

Zero Energy

**Simple, reliable, resilient
8 year payback**



Nelson Place School

A Zero Energy Story

Photo credit: Fontaine Brothers, used with permission



Nelson Place School

“Zero Energy within Reach”

Photo credit: Fontaine Brothers, used with permission

Poll Question #2

- Zero Energy is usually:
 - Expensive
 - High maintenance
 - Complicated

Zero Energy

- These days, Zero Energy buildings:
 - ✓ Maintenance friendly
 - ✓ Cost parity; cost savings
 - ✓ Less complicated



Nelson Place School

“Zero Energy within Reach”

Photo credit: Fontaine Brothers, used with permission



City of Worcester

Lamoureux Pagano

Fontaine Brothers

Tishman Construction

Seaman Engineering

The Green Engineer

TNZ Energy Consulting

Eversource

National Grid

- *efficiency first*
- *maintenance friendly*
- *cost effective*



wall
roof
wwr
window $U=0.21$

R19+21ci
R45ci
20%

External shading
Condensing heating
Displacement ventilation
Energy recovery

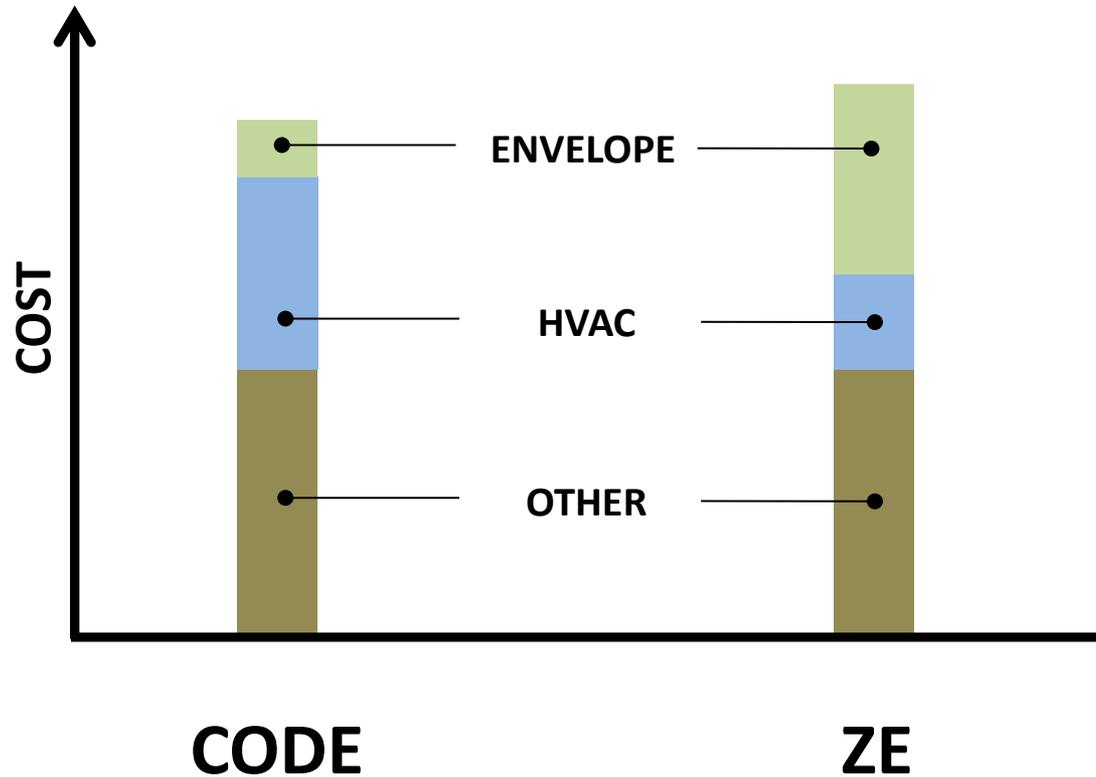
- *efficiency first*
- *maintenance friendly*
- *readily available*

X2

wall R19+21ci
roof R45ci
wwr 20%
window U=0.21

External shading
Condensing heating
Displacement ventilation
Energy recovery

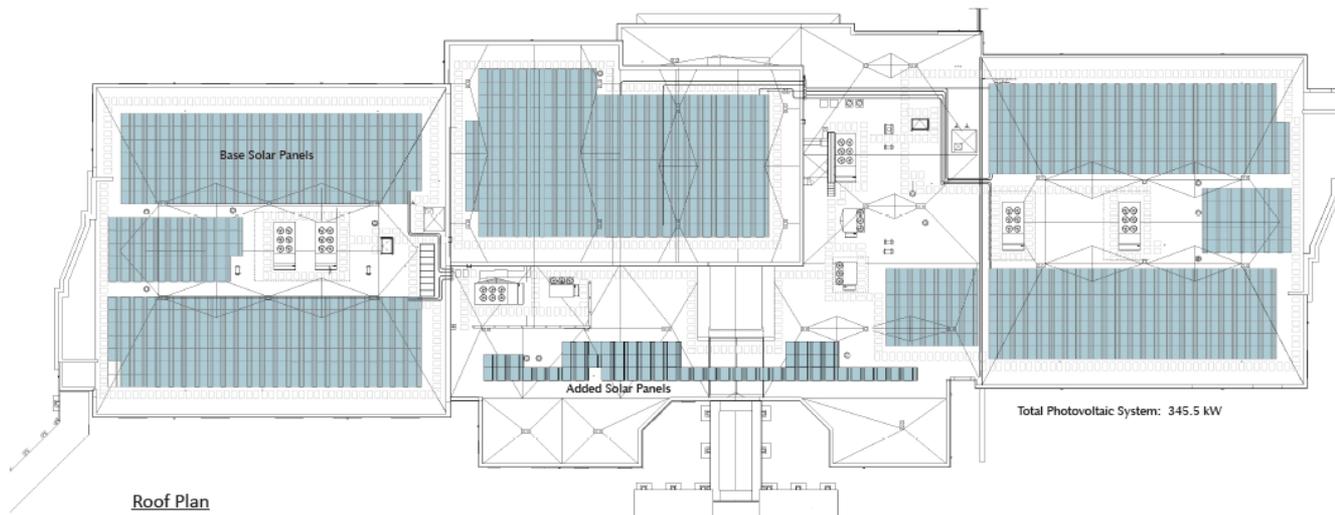
COST SWAP



345 kW



Fontaine Brothers, used with permission



Roof Plan

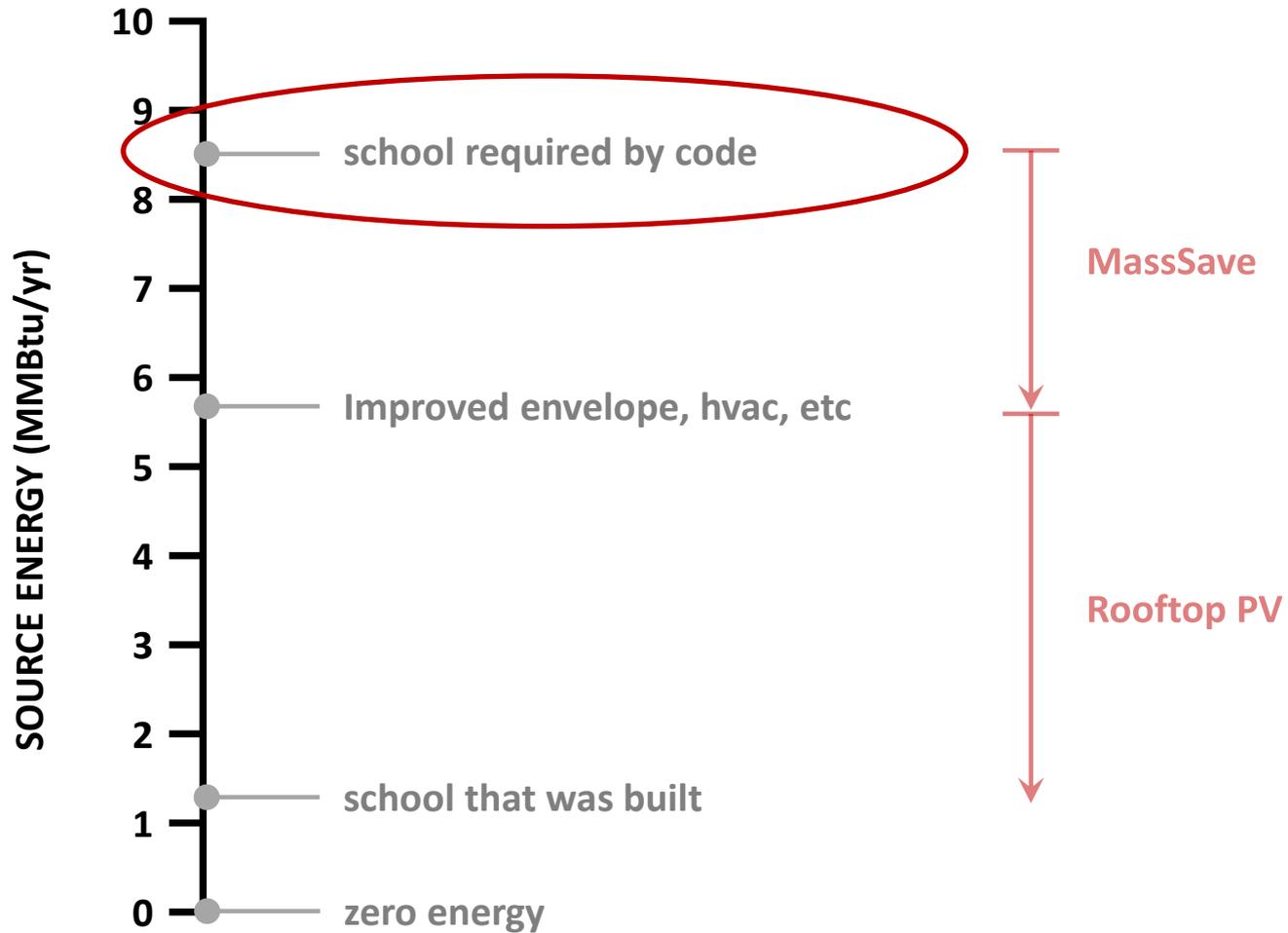
	Site Energy (MBtu/yr)		Site to Source Factor		Source Energy (Mbtu/yr)
Gas	1,318,800	→	1.09	→	1,437,492
Electric	1,360,695	→	3.15	→	4,286,190
Total					5,723,682

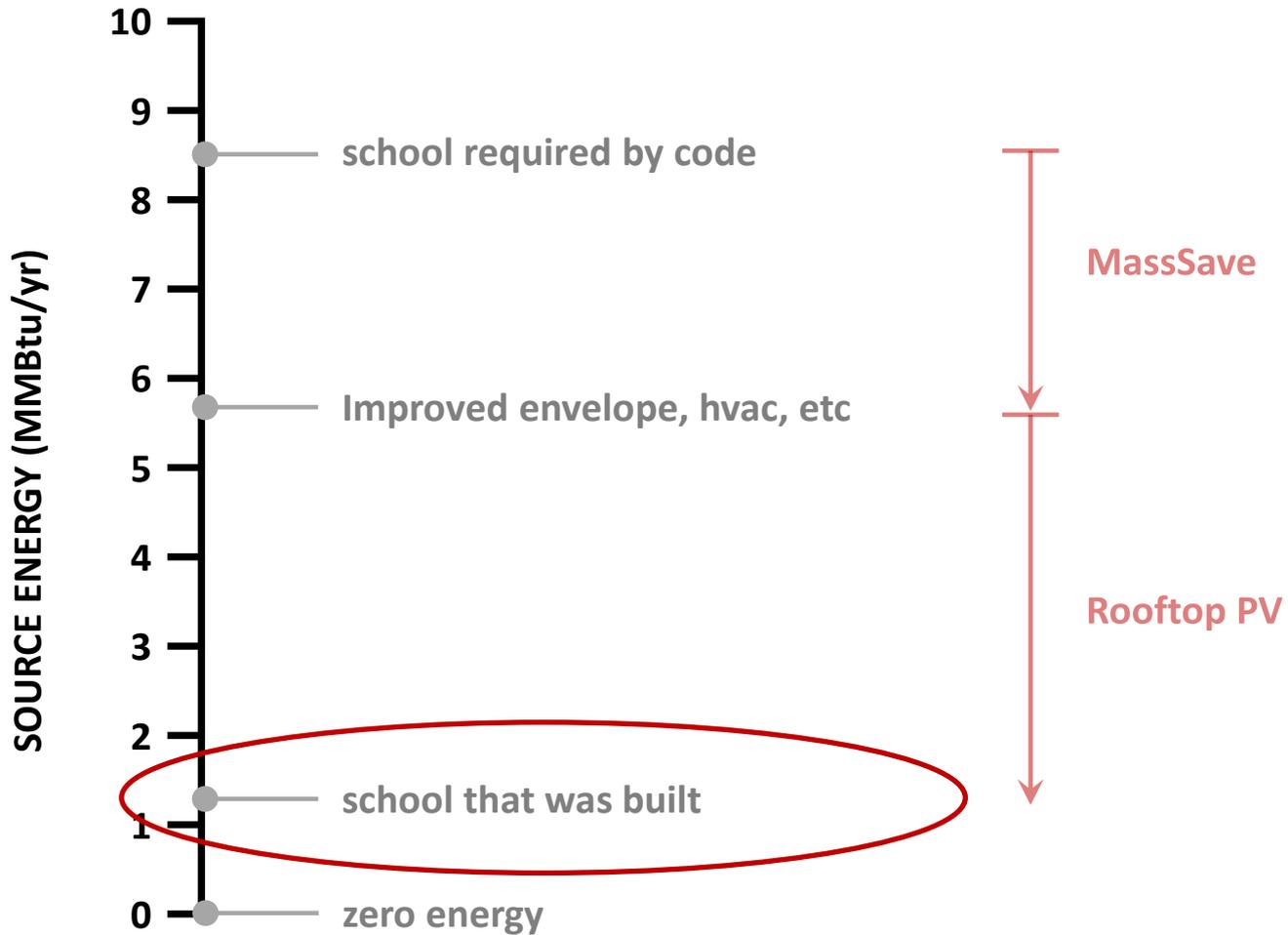
PV	1,817,042	←	3.15	←	5,723,682
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434 kW → **80% ZERO ENERGY**



Massachusetts Department
of Energy Resources





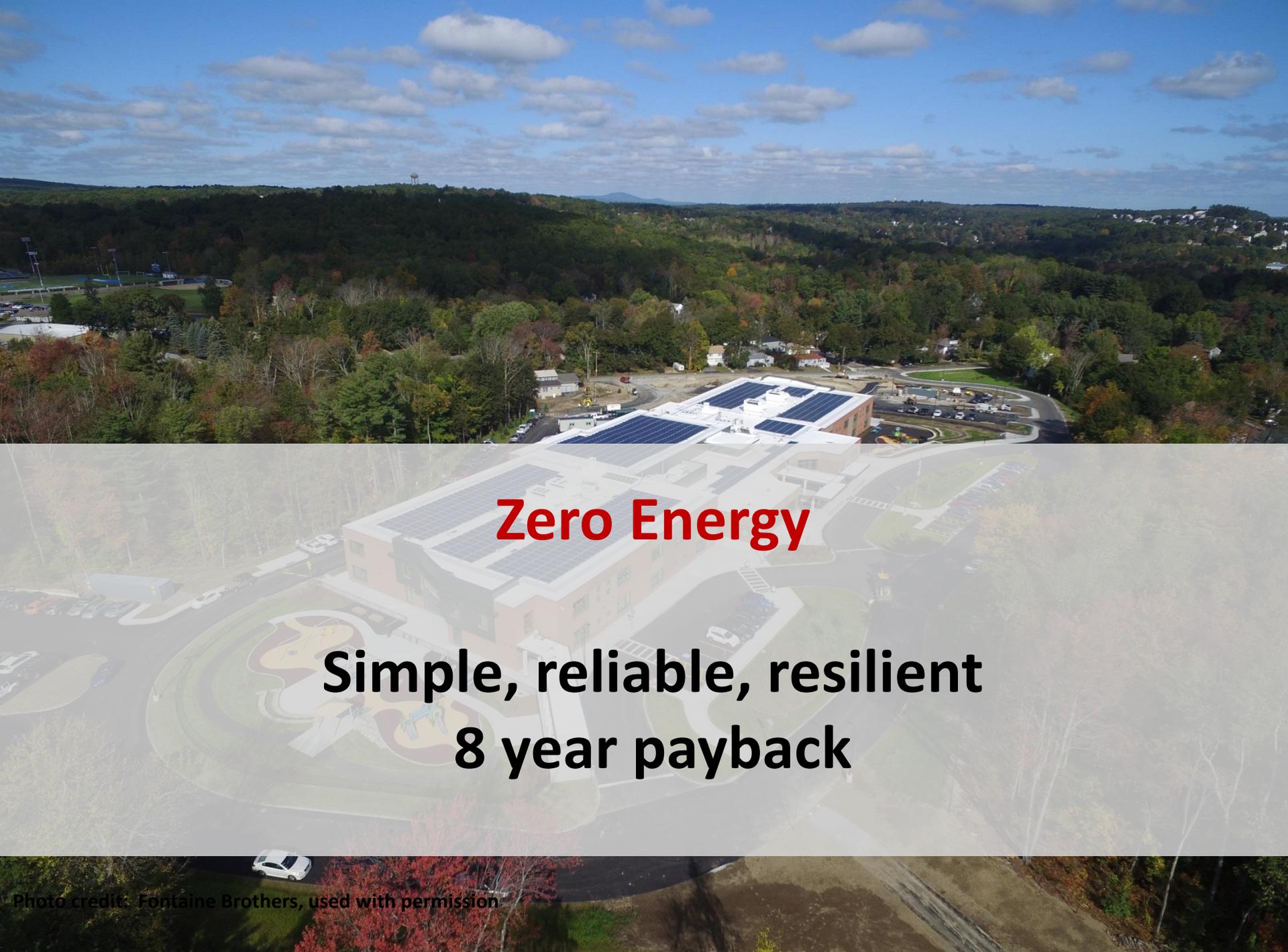


Lamoureux Pagano, used with permission

zero energy – within reach



Photo credit: Fontaine Brothers, used with permission

An aerial photograph of a large, modern building with a flat roof covered in solar panels. The building is surrounded by a parking lot and landscaped areas. In the background, there are dense green trees and a clear blue sky with scattered white clouds. The text is overlaid on a semi-transparent white banner across the middle of the image.

Zero Energy

**Simple, reliable, resilient
8 year payback**

DOER ZE Planning Tool

INPUTS

Building Name and City/Town: Proposed School, Anytown, Massachusetts

Conditioned Building Area: 85,000 sf

Roof footprint: 55,000 sf

Percent of Roof avail for solar: 85%

Ground mounted solar: - sf

Percent Better than Reference: 25% on site EUI basis

Make all electric? Yes, all electric Adds to 100%

Building Type	Percent
Use 1: secondary school	90.12013
Use 2:	0%
Use 3:	0%
Use 4:	0%

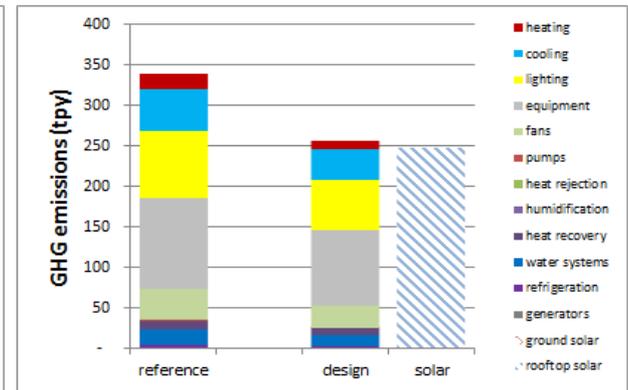
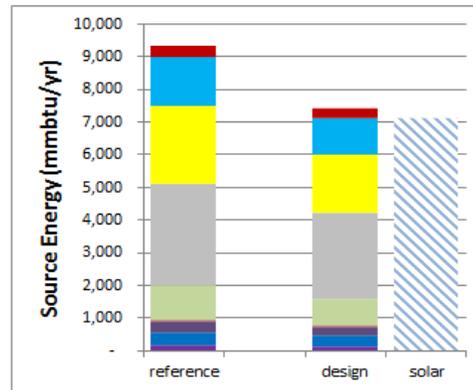
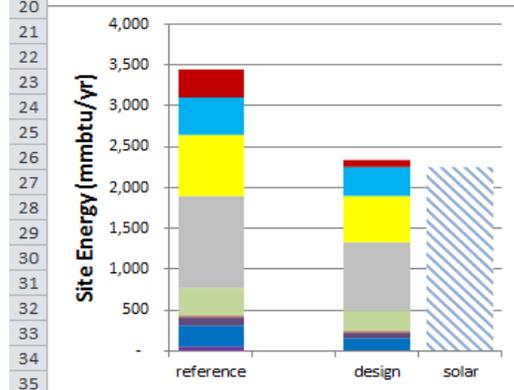
RESULTS FOR DESIGN BUILDING

Consumption		Site Energy (Mmbtu/yr)	Source Energy (Mmbtu/yr)	Emissions (tons CO2/yr)
Electric	687,807 kWhrs/yr	2,347	7,416	257
Gas	- therms/yr	-	-	-
Total		2,347	7,416	257

Production		Site Energy (Mmbtu/yr)	Source Energy (Mmbtu/yr)	Emissions (tons CO2/yr)
Roof	663,439 kWhrs/yr	2,264	7,153	248
Ground	- kWhrs/yr	-	-	-
Total	663,439 kWhrs/yr	2,264	7,153	248

Progress toward Zero Energy

Site Energy Basis	96%	Source Energy Basis	96%	Emissions Basis	96%
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Disclaimer - this is a planning tool and should not be a substitute for evaluations and designs produced by qualified professionals for your unique project.

Contact: Paul.ormond@state.ma.us

AIA ZE Planning Tool

ABOUT YOUR BUILDING

Code Pathway: Prescriptive Performance

Country: USA

State: Massachusetts

City: Boston

Number of Stories: 1

Add Another Use:

Selected Use Type(s): School

SCHOOL delete

Gross Floor Area: 80000 sq.ft

ON-SITE PV SYSTEMS

Default Values estimate on-site building PV system potential. Uncheck Use Default Values to enter custom inputs. If your building has multiple PV systems, add them below.

Use Default Values? delete

PV SYSTEM

Estimated Area for Collectors: 72748.5 sq.ft

Module Type: Standard

Losses (%): 10

Array Type: Fixed - Open Rack

Tilt (Degrees): 10

Azimuth (Degrees): 180

Inverter Efficiency (%): 96

GENERATE RESULTS →

RESULTS

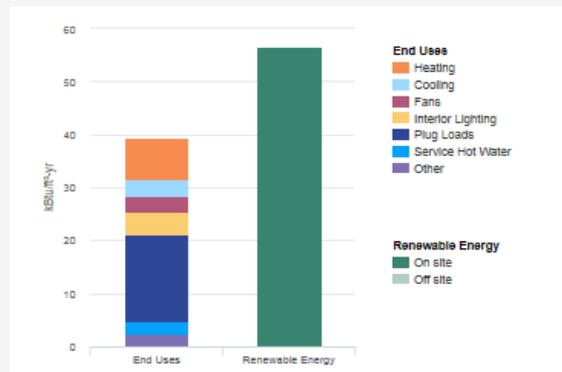
metric Imperial

RENEWABLE ENERGY REQUIREMENTS

Energy Consumption & Generation		
	kBtu/ft ² -yr	MBtu/yr
Estimated Building Energy Consumption	39.2	3,139.7
Total Renewable Energy Required	39.2	3,139.7
On-Site PV Generation Potential	56.6	4,525.2
Remaining Off-Site Procured Renewable Energy	0.0	0.0

On-Site PV System	
Rated Capacity (kW)	1,014
Estimated Area for Collectors (ft ²)	72,749

ESTIMATED BUILDING ENERGY CONSUMPTION



Building Energy Consumption and End Uses are based on a code compliant prototype building modeled by Pacific Northwest National Laboratory. Actual building energy consumption will vary from modeled results.

Estimated Site EUI: 39.25 kBtu/ft ² -yr		
Estimated Energy Consumption: 3,139.65 MBtu/yr		
End Use	Subtotal (kBtu/ft ² -yr)	Percent
Heating	7.72	19.00%
Cooling	3.12	7.95%
Interior Lighting	4.42	11.27%
Plug Loads	16.24	41.38%
Service Hot Water	2.55	6.49%
Fans	2.96	7.53%
Other	0.18	0.45%
Exterior Equipment	0.22	0.51%
Exterior Light	0.22	0.51%
Heat Recovery	0.89	2.51%
Pumps	0.07	0.18%
Refrigeration	0.88	1.76%
Total	39.25	100.00%

PVWATTS RESULTS



<https://zero-code.org/energy-calculator/>

Eversource C&I New Construction Services

Energy Design Areas



- Passive Elements
- Systems
- Renewables
- Operations

Key 2018 Changes



- **Online Applications:**
 - Massachusetts Application Portal (MAP)
 - Available Now on the Mass Save website
 - www.masssaveapplicationportal.com
 - No 2018 PDF, Paper, or Mail-in Forms
 - 2017 forms will be accepted during the MAP transition
- No significant changes to the incentive levels or eligibility criteria from the 2017 application forms

Poll Question #3



■ **Have you heard about New Construction services provided by your utility?**

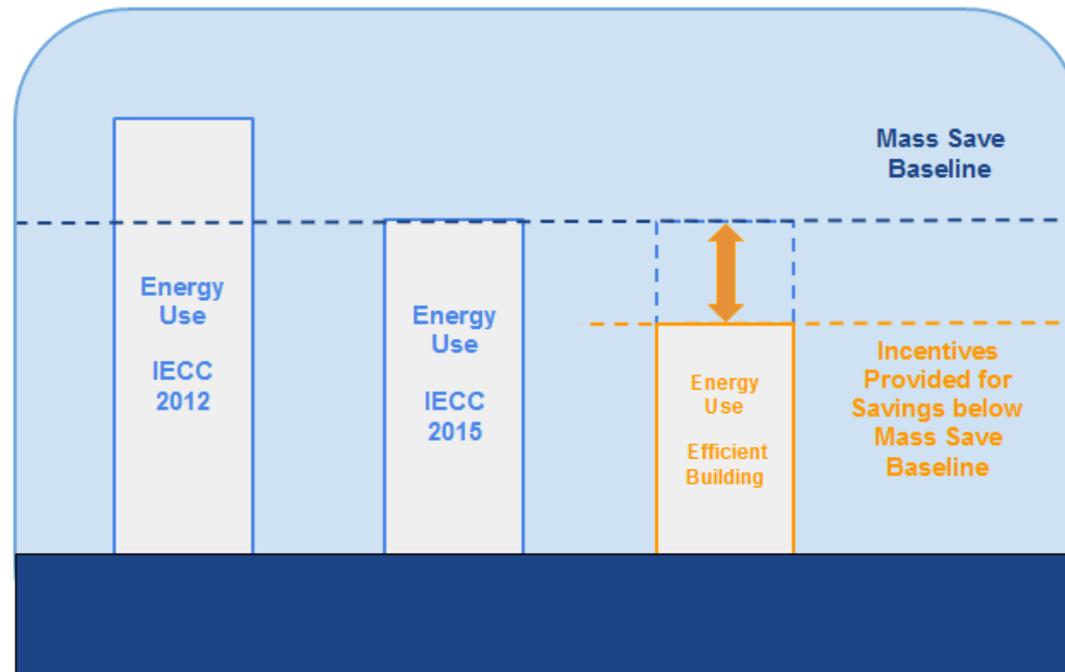
Yes

No

Construction Services Project Types

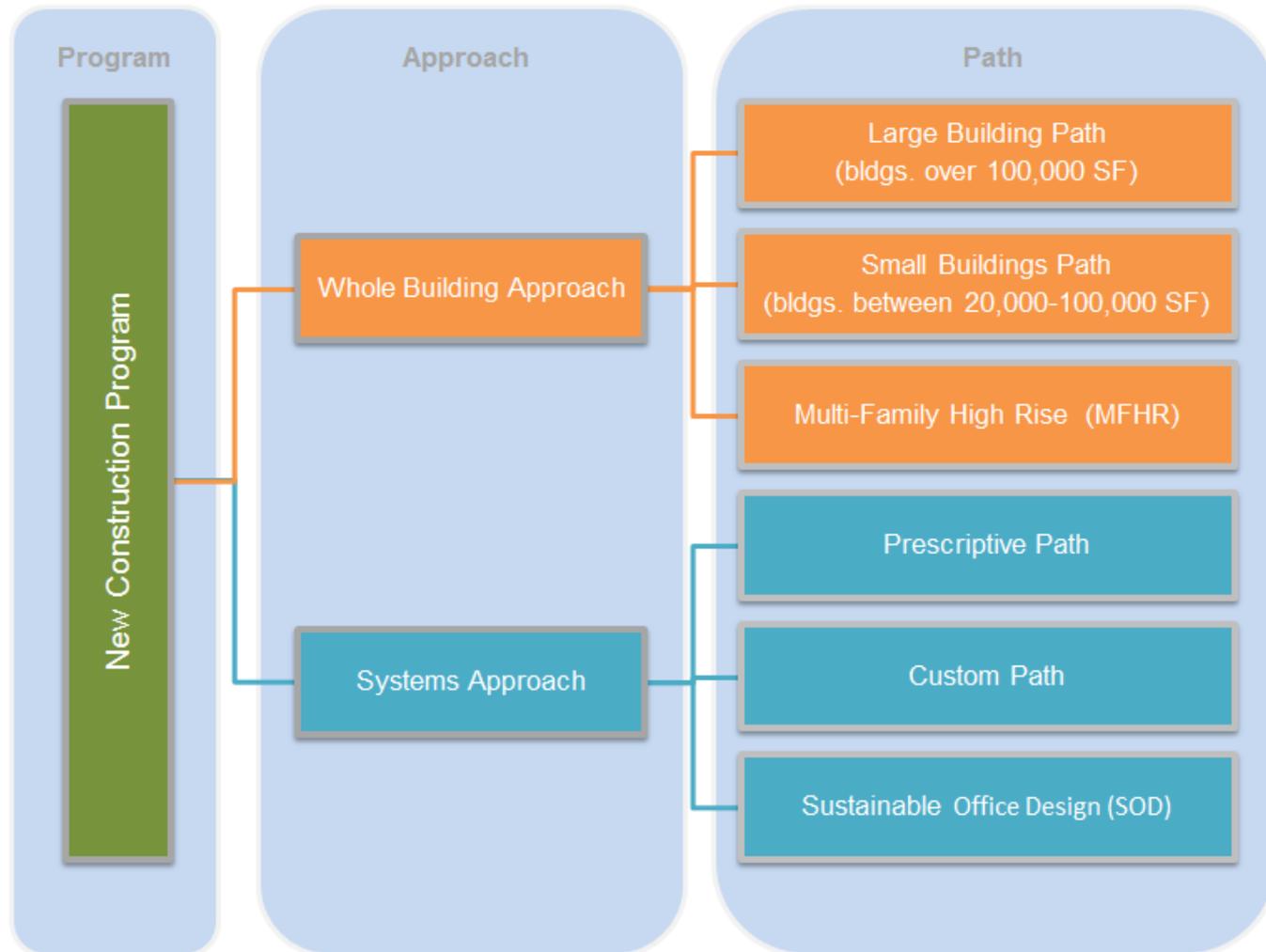


1. **Ground-up new construction*** (commercial, industrial and institutional)
2. **Major renovations, additions, and tenant fit-outs*** (code triggering)
3. **New equipment***



**Project must be located in Program Administrator's service area*

Multiple Pathways Fit Various Project Types

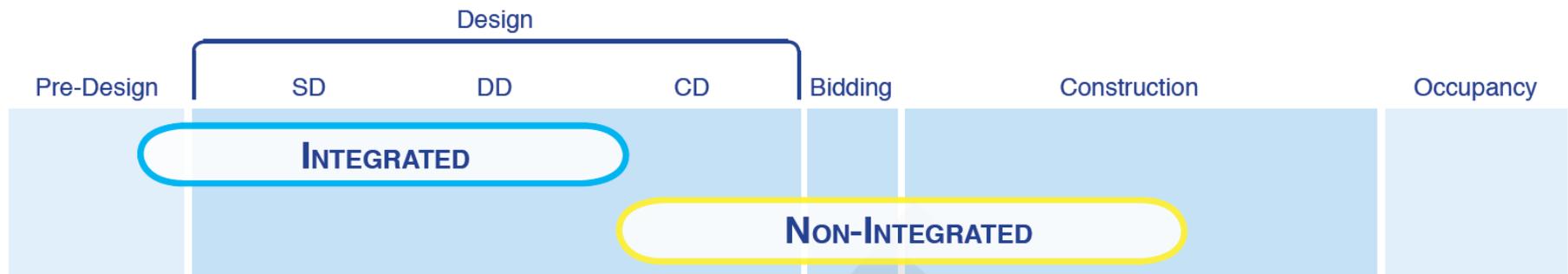


Whole Building Approach



Emphasis on Integrated vs. Non-integrated

- More time to investigate options and costs
- More opportunity to increase energy savings
- Whole Building Approach vs. Prescriptive



Large Buildings



Large Building Customer Incentives*

Savings Beyond Code	\$/kwh	\$/therm
Berkshire Gas ³ , Cape Light Compact, Columbia Gas ³ , Eversource, Unitil Service Territories		
≥30%	\$0.50	\$2.10
20-30%	\$0.40	\$2.00
10-20%	\$0.30	\$1.90
<10%	\$0.20	\$1.80
Berkshire Gas ⁴ , Columbia Gas ⁴ , Liberty Utilities, and National Grid Territories		
All Projects	\$0.35	\$1.70

*Projects must be cost effective to receive full incentive and are subject to applicable PA budget

³ When Eversource is the lead electric utility.

⁴ When National Grid is the lead electric utility.

Design Support Incentives (Integrated Only)

- Energy Charrette
 - ✓ \$3000 stipend – paid to Architect
- Energy Modeling Cost-Sharing
 - ✓ Up to 75% cost share (Preferred vendors)
 - ✓ Up to 25% cost share (Non-Preferred vendors)
 - ✓ Capped at \$20,000
- Design Team Incentive
 - ✓ Projects must achieve $\geq 10\%$ whole buildings savings

Large Buildings



Large Building Design Team Incentives*

Savings Beyond Code	\$/kwh	\$/therm
Berkshire Gas ⁶ , Cape Light Compact, Columbia Gas ⁶ , Eversource, Unitil Service Territories		
≥30%	\$0.07	\$0.34
10-30%	\$0.04	\$0.20
Berkshire Gas ⁷ , Columbia Gas ⁷ , Liberty Utilities, and National Grid Territories		
≥10%	\$0.07	\$0.34

*Each PA capped at \$15,000

- ✓ Paid to design team lead (Architect) to disburse
- ✓ Encourages early engagement, only available when project is integrated

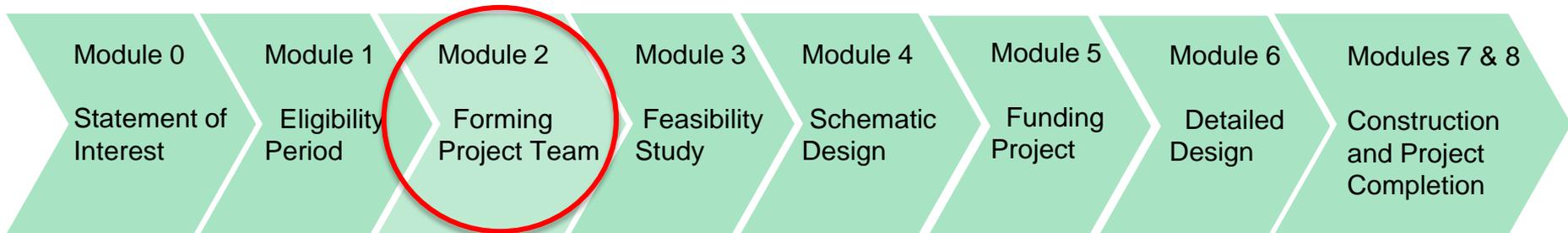
Small Buildings Path

- Early engagement critical
- PAs bring in one of **Four** pre-selected vendors
 - ✓ Vendor runs energy charrette
 - ✓ Vendor available for consultation
 - ✓ Vendor conducts mid-design review to assess progress
 - ✓ Vendor models final design or follows prescriptive path
- Same customer incentive tiers as for Large Buildings path, if project is modeled
- Design team incentives available if $\geq 10\%$ Whole Building savings target is achieved

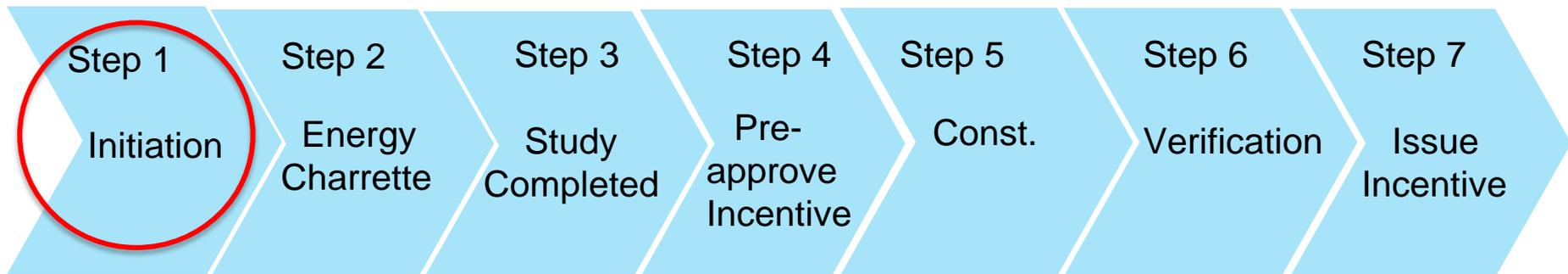
MSBA vs Eversource Process



MSBA Process



Eversource Process



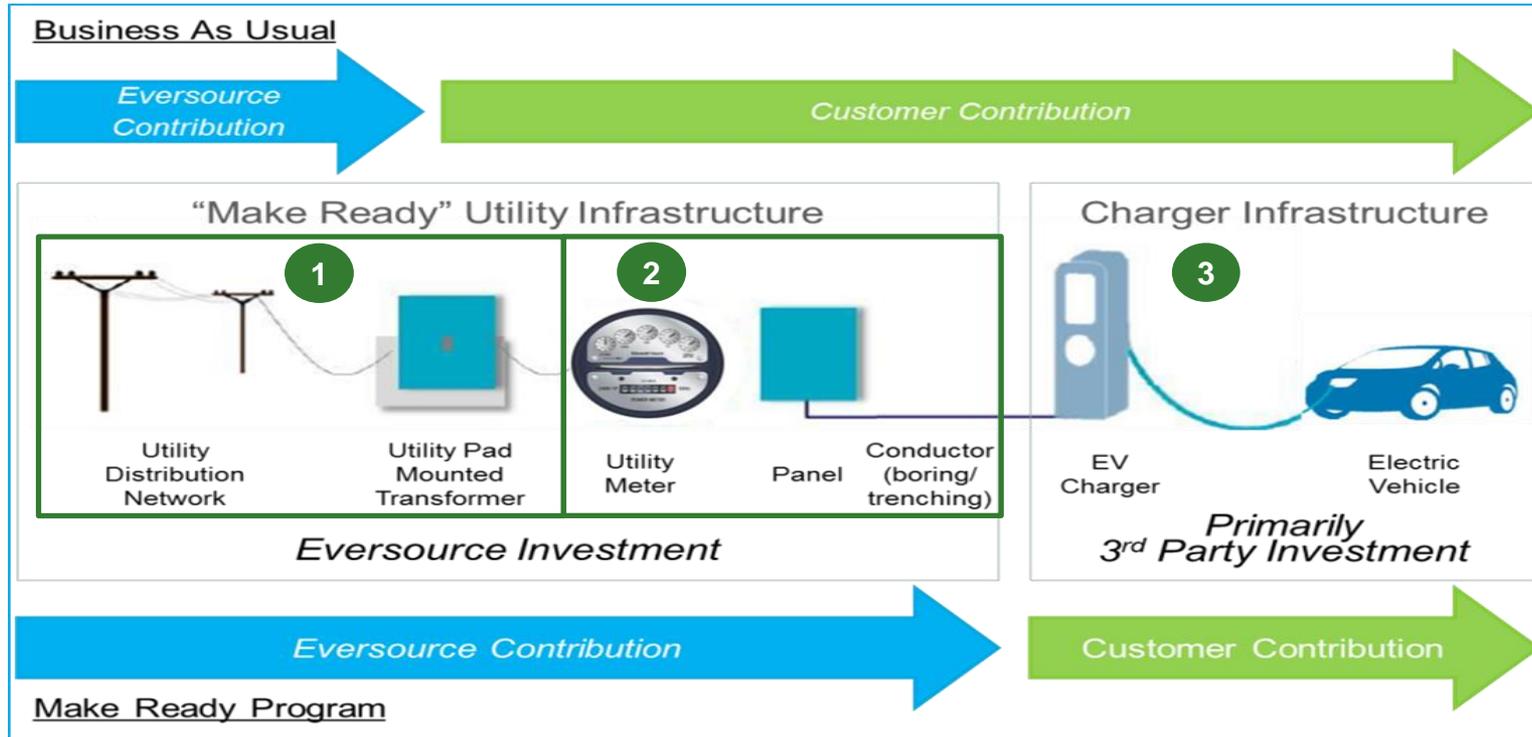
EV Make Ready Program



Program Highlights

- \$45 million program for the deployment of Electric Vehicle Infrastructure in Eversource service territory.
- 5 year program (2018-2022)
- Deployment of approximately 3,500 Level 2 and DC Fast charging stations throughout Eversource electric service territory.
- Proposal will not result in Eversource owning the charging stations
- “Make-Ready” program will shift cost of “behind the meter” charging infrastructure from the site host to Eversource

EV Make Ready Program



1

2

3

Ownership	Eversource	Eversource	Site Host/ 3 rd Party Operator
Construction	Eversource	Electrical Contractor	Site Host/ 3 rd Party Operator
O&M	Eversource	Electrical Contractor	Site Host/ 3 rd Party Operator

Contact info/Resources

- **Paul Ormond** – DOER Energy Engineer, paul.ormond@state.ma.us; 617-626-7349
- **Sean Tully** – Eversource New Construction Energy Efficiency Consultant, sean.tully@eversource.com; 781-441-8569
- **Tracey Beckstrom** – National Grid New Construction Program, tracey.beckstom@nationalgrid.com; 401-474-1640
- <https://www.mass.gov/service-details/what-is-a-zero-net-energy-building>
- <https://zero-code.org/energy-calculator/>