

Dr. John Johnson



Deputy State Superintendent



WISCONSIN DEPARTMENT OF
Public Instruction

Ben Austin



Sustainability Lead

Findorff
BUILDING & BEYOND

ABOUT US

Findorff is one of the Midwest's leading builders, and is proud of the successful long-standing relationships with our clients in Wisconsin.

PROUD OF OUR CLIENT RETENTION

83% REPEAT CLIENTS

SELF-PERFORM WORK

- » Concrete
- » Steel Erection
- » Masonry
- » Metal Stud and Drywall
- » Carpentry

ANNUAL REVENUE

\$930M+



OVER

1000

CONSTRUCTION PROFESSIONALS
- in Wisconsin -

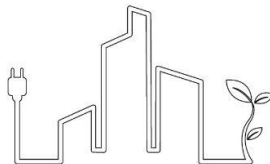
130+
YEARS



of **BUILDING EXPERIENCE**

WISCONSIN'S TOP
GREEN CONTRACTOR

THE PAST TWO YEARS



(Engineering News-Record Magazine)

\$1 BILLION

IN LEED CERTIFIED BUILDINGS

\$2.5 MILLION

IN FOCUS ON ENERGY INCENTIVES

VOTED **"MOST TRUSTED BUILDER"** BY PEERS
(In Business)

**LARGEST
VERIFIED**

NET ZERO K-12 SCHOOL
IN THE MIDWEST

1,704

SOLAR-PANELS



**FIRST NET
ZERO SCHOOL**

IN WISCONSIN

99

GEOHERMAL WELLS
THAT ARE
406 FEET DEEP

Project Team



Findorff
BUILDING & BEYOND

HGA

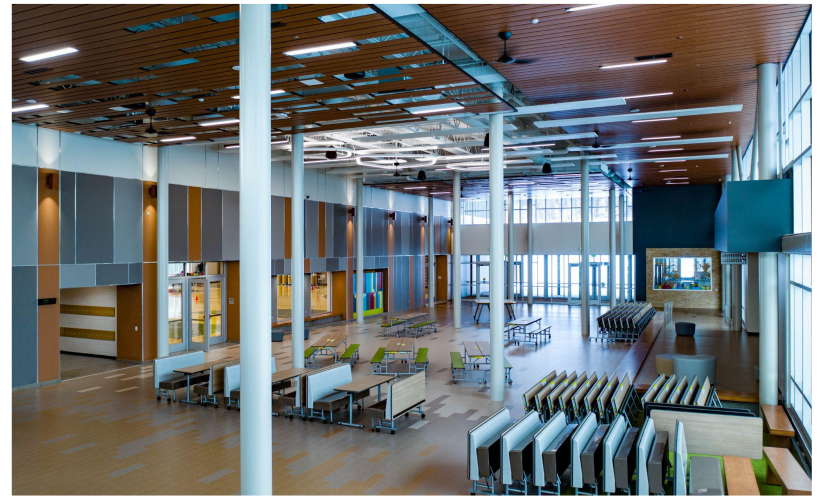
About Forest Edge

Net Zero

Net zero or zero-energy buildings **produce at least as much energy as they consume on an annual basis.**

They do this by incorporating state-of-the-art energy efficiency and renewable energy technologies.

- *The National Renewable Energy Laboratory*



Syed Abbas



Director of Education & Training

 **slipstream**



Accelerating climate solutions. For everyone.

We deliver research, technical assistance, financing, education and training, and programs for stakeholders.



Agenda



Group Session

- Welcome
- The Oregon Story
- Next Steps for Net Zero

Breakout Sessions

- Energy Efficiency
- Renewable Energy
- Energy Storage
- Buildings as Teaching Tools

Lunch and Networking

Matthew Matenaer



Business Customer Relations



your community energy company

The Oregon Net Zero Story



Board Policy

- Community and staff committee drafted a paper on sustainability in the OSD
- Paper became policy and provided direction
- The policy provides a platform for staff-led environmental initiatives





"The Oregon School District believes it is critical for the future of our planet to **develop learners who are ecologically literate and environmentally responsible citizens and stewards**. We believe it is important to model the District's commitment by establishing these values and developing practices consistent with them:

The District will **continue to develop building and operational practices and procedures** that reflect a commitment to environmental sustainability; and

The District will have an **aligned K-12 curriculum that integrates ecological and environmental sciences and issues into the curriculum**, including socio-economic aspects. This may include, but is not limited to, experiences outside the classroom, project-based learning, and environmental services projects."

OREGON'S VALUE STATEMENT

The Beginning: Energy Management

eGauge Pro

- Cost effective (\$800)
- Easy to use and implement
- Helps to make data driven decisions





Oregon Middle School 2014



Original Solar Panel →

Oregon Middle School Solar | 62 kW



Brooklyn Elementary School Solar | 36 KW



Oregon High School Solar | 136 KW

Oregon's Journey

SOLAR PANEL 2014



Oregon Middle
School

SOLAR ARRAYS *and* GEOTHERMAL 2014 Referendum

Oregon
High
School



Oregon
Middle
School



Brooklyn
Elementary



NET ZERO 2018 Referendum



Forest Edge Elementary



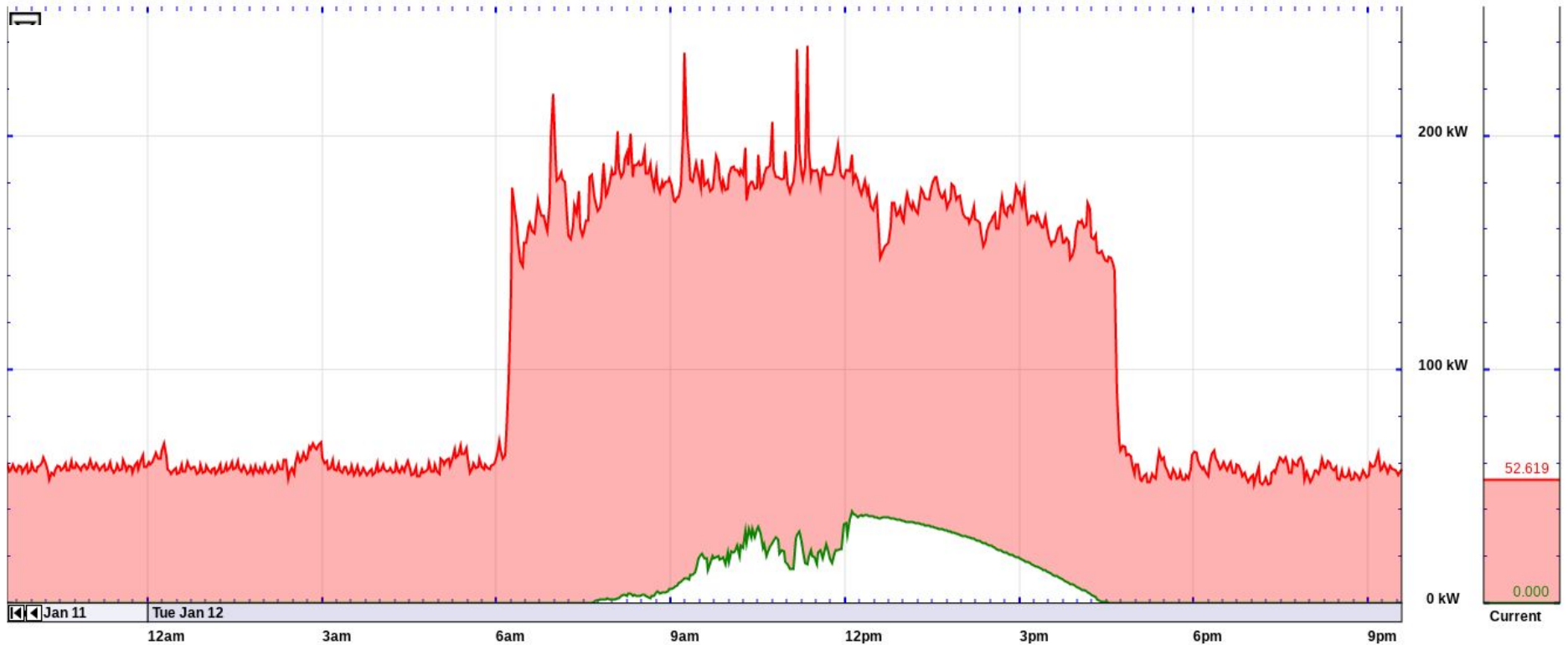
Summary for time-period shown in graph

Energy Used	2.61 MWh	(approx. \$312.73 used)
Energy Generated	174 kWh	(approx. \$20.83 saved)
Net	2.43 MWh bought	(approx. \$291.91 spent)

Summary over last 30 days

Energy Used	59.6 MWh	(approx. \$7,155.46 used)
Energy Generated	1.42 MWh	(approx. \$170.49 saved)
Net	58.2 MWh bought	(approx. \$6,984.97 spent)

- All
- 1y
- 6M
- 3M
- 1M
- 3w
- 1w
- 3d
- 1d
- 12h
- 6h
- 3h
- 1h
- 10m
- Auto
- 500kW
- 100kW
- 50kW
- 10kW
- 5kW
- 1kW
- 500W
- 100W
- 50W





Net Zero Tracking Month-by-Month

Electric

Show Hover Chart

High / Low

Consumption (kWh) ▾

Bar ▾

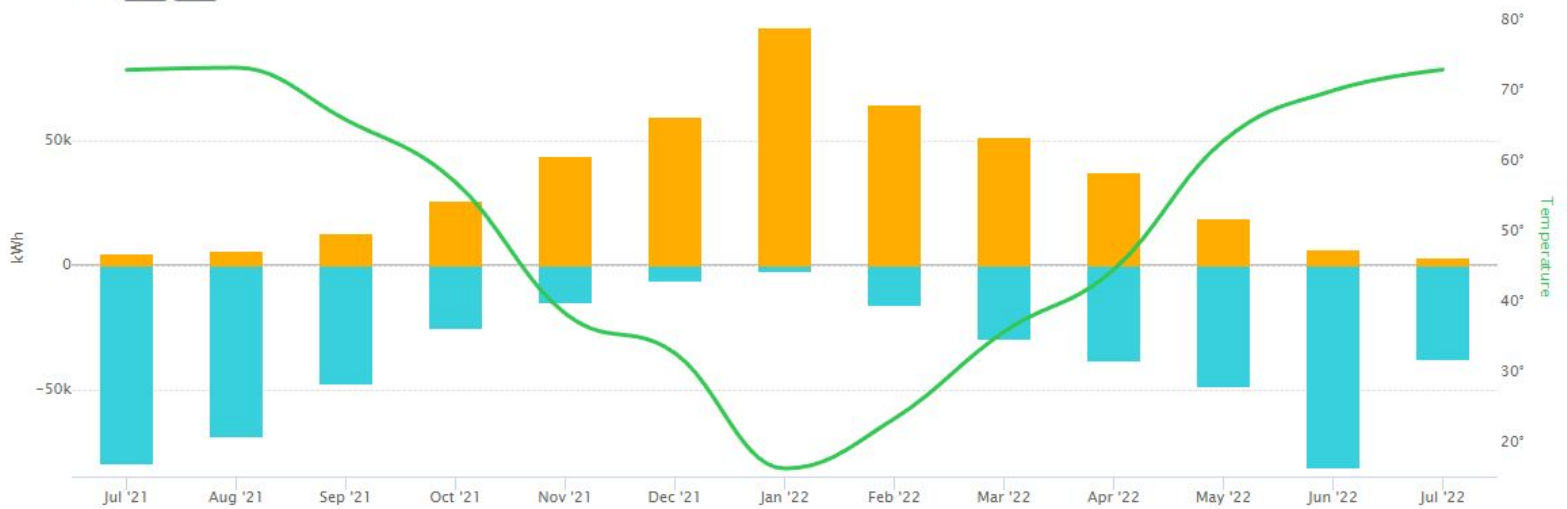
Monthly ▾

range

legend

marker

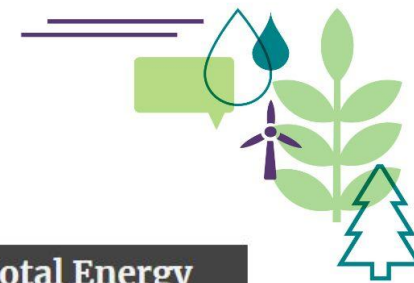
Zoom 1y 2y



Comparison ■ Average Temperature ▾ Comparison ■ None ▾ Comparison ■ None ▾ Comparison ■ None ▾

Weather information provided from [Aeris Weather](#)

Energy Usage Comparison



Building	Square Footage	Utility	Total by Utility	Total Energy Costs by Building
Rome Corners Intermediate School	110,000	Gas	\$ 24,930	\$114,547
		Electric	\$ 89,617	
Oregon Middle School	132,000	Gas	\$ 32,063	\$122,131
		Electric	\$ 90,060	
Forest Edge Elementary School	126,000	Gas	<i>does not apply</i>	\$56,873
		Electric	\$ 56,873	

Energy costs reflect data from September 2020 - August 2021.

Forest Edge energy costs per square foot is nearly 50% less than Rome Corners and the Middle School.

\$57,674

difference in energy costs between Forest Edge & Rome Corners

\$65,258

difference in energy costs between Forest Edge & the Middle School

Maintaining a Net Zero Building

- Needs a willing advocate with some passion for sustainability
- Requires time to learn and trust the technology
- Needs minimal systems maintenance
 - Have not needed to add FTE



What's Next for Oregon?

- Continue to learn and share our journey with other school districts
- Develop long-term approach to energy consumption
- Leverage building as an educational tool
- Empower future sustainability champions



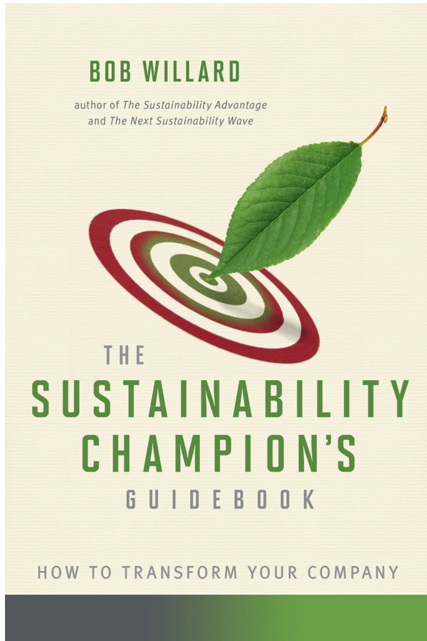
...sources of light is
...and even better
...the sun and wind
...energy. Annual
...projects.



Getting to Zero: 
Top 5 Steps for New
and Existing Buildings



Net Zero Top 5: Identify Champions



“Sustainability champions promote the dialogue that creates the culture change and governance necessary for a company to be truly sustainable. They are change makers.”



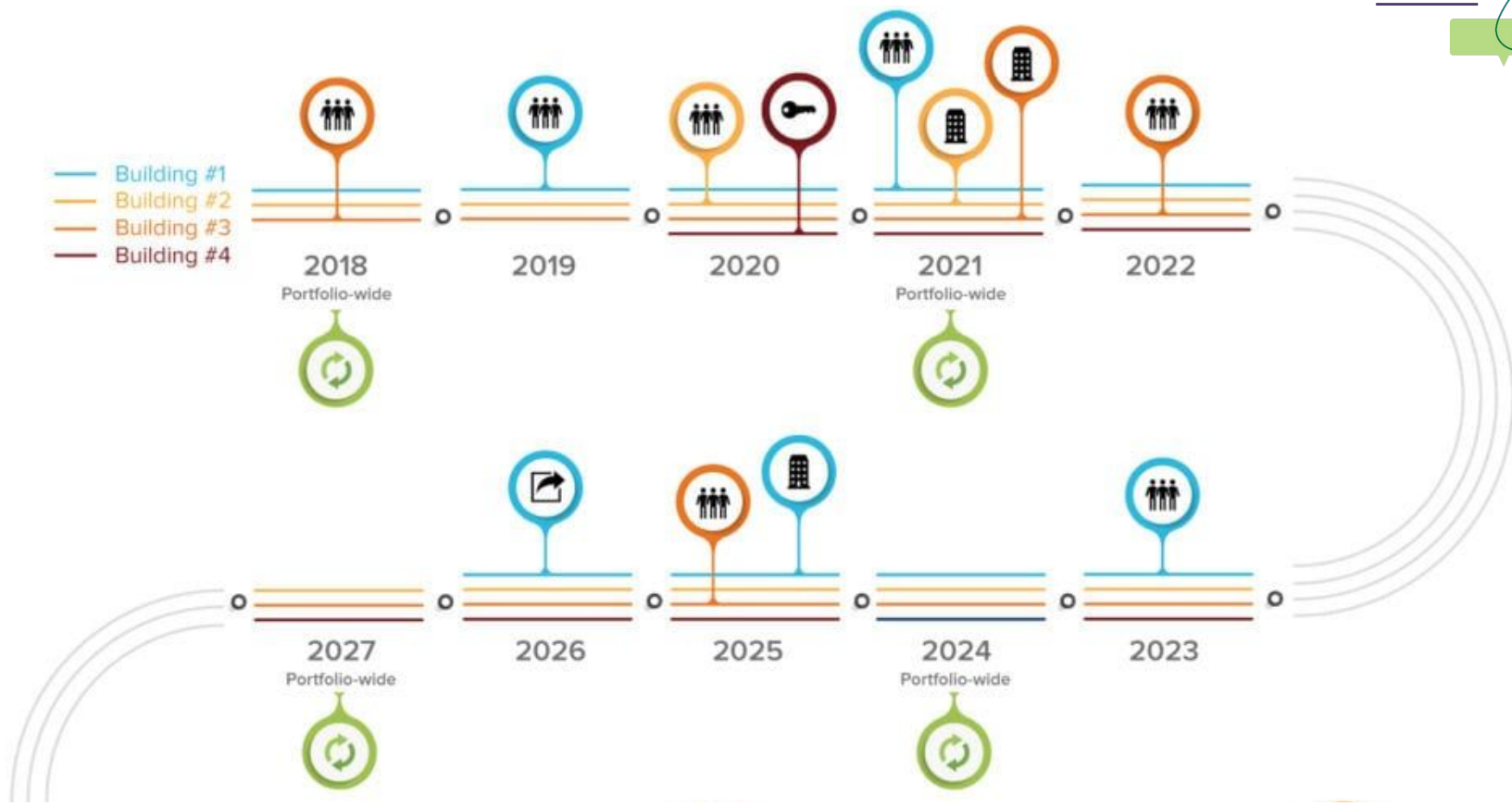
Net Zero Top 5: Benchmark & Set Goals



- Benchmark Your Current State -
- Set Goals
 - Energy Goals
 - Carbon Emissions Goals
 - Non-Energy/Carbon Goals

$$\text{Energy Use Intensity (EUI)} = \frac{\text{Building Energy Use (kBTU)}}{\text{Building Square Feet (ft}^2\text{)}}$$





Net Zero Top 5: Establish a Roadmap

GRANT & INCENTIVE – Examples

Goal: Offset First Cost Impact



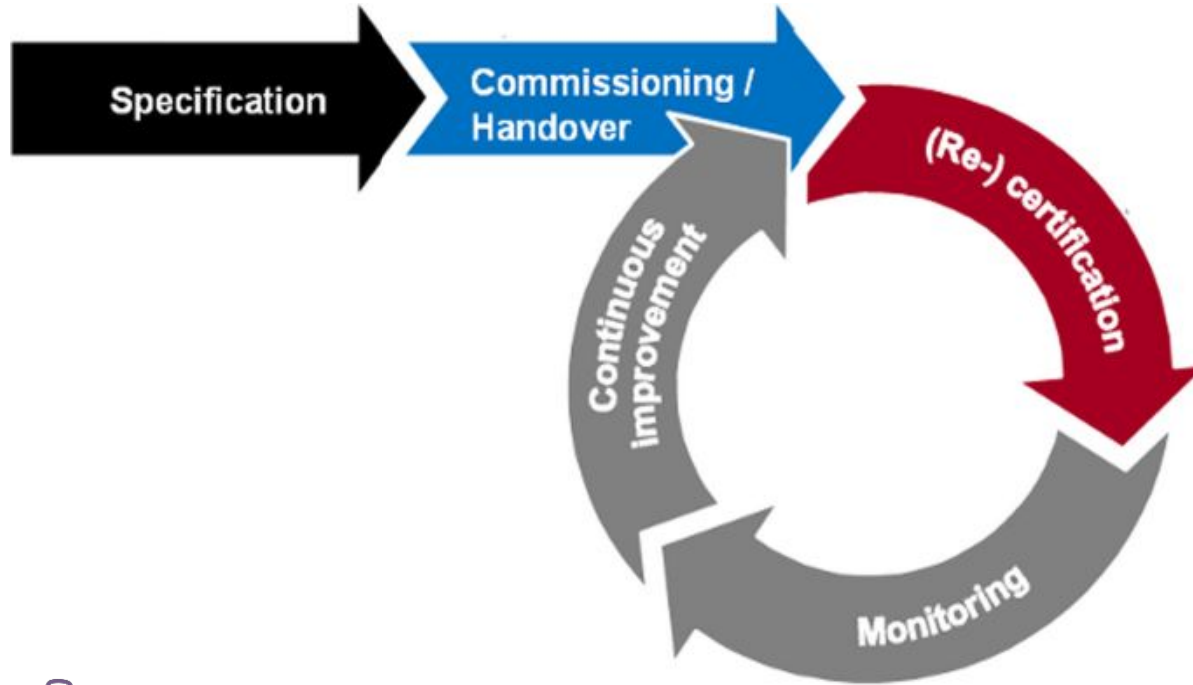
FINANCING - Examples

Goal: Reduce Upfront Cost, Cash-Flow Positive Early



Net Zero Top 5: Leverage Financial Tools

Net Zero Top 5: Measure & Verify, Commission



Net Zero Top 5: New & Existing Buildings



- Identify Champions
- Benchmark & Set Goals
- Establish a Roadmap to Achieve Your Net Zero Goals
 - Align with Building Lifecycle Events
- Leverage Financial Tools
- Measure & Verify, Commission



...sources of light is
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...the sun and wind
...energy. Annual
...projects.



Getting to Zero: Tools for Net Zero Buildings



Posted originally, 1/11/2018
Reposted with errata dated 1/31/18 incorporated, 2/1/2018



ACHIEVING ZERO ENERGY

Advanced Energy Design Guide for K-12 School Buildings

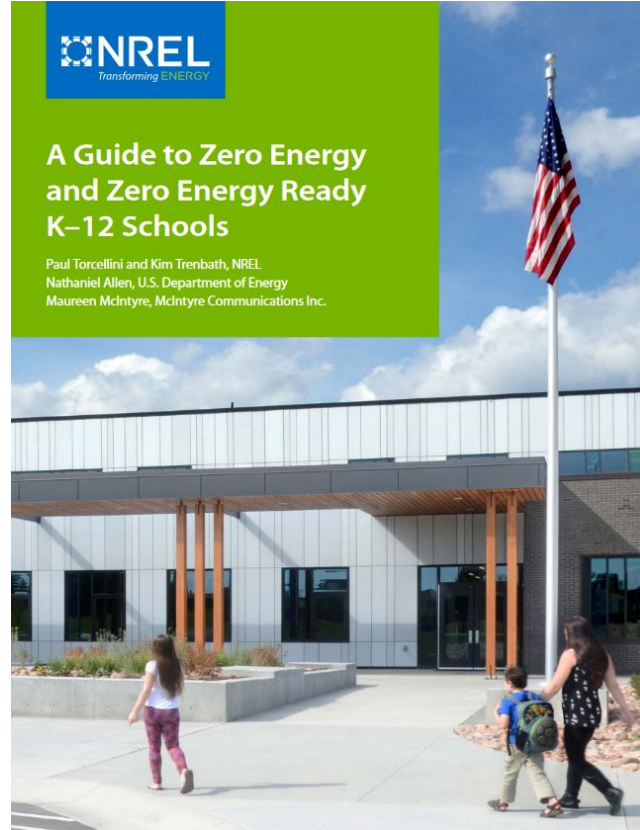


Developed by:
ASHRAE
The American Institute of Architects
Illuminating Engineering Society
U.S. Green Building Council
U.S. Department of Energy

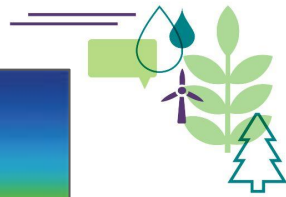
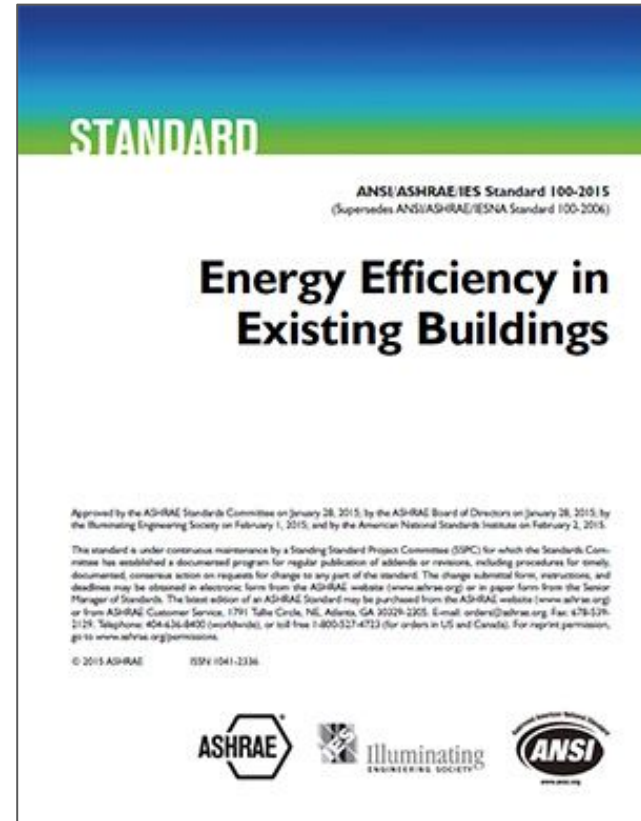
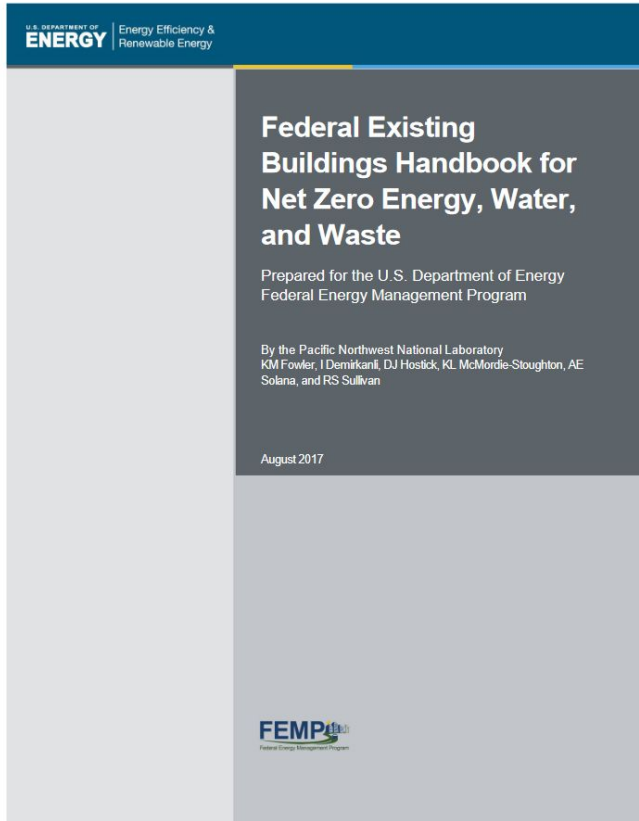


A Guide to Zero Energy and Zero Energy Ready K-12 Schools

Paul Torcellini and Kim Trenbath, NREL
Nathaniel Allen, U.S. Department of Energy
Maureen McIntyre, McIntyre Communications Inc.



Tools for Net Zero: Design Guides



Tools for Net Zero: Design Guides



Tools for Net Zero: Building Certifications

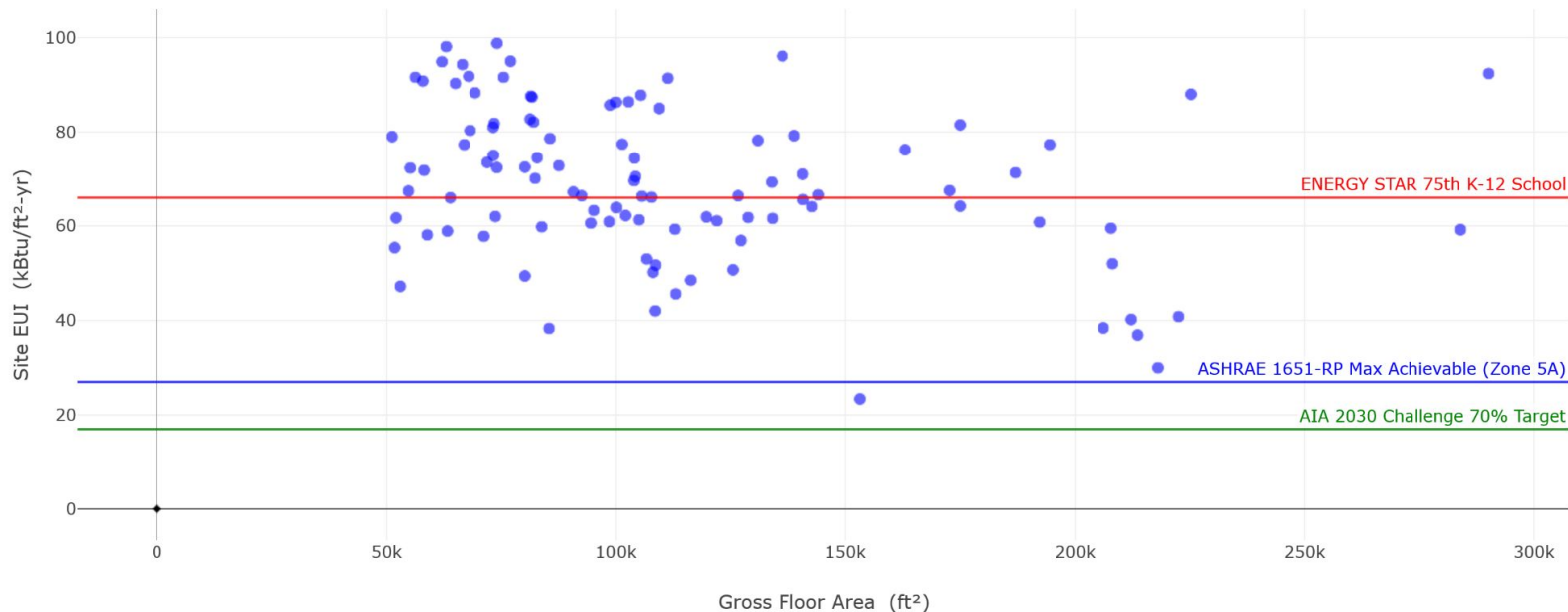
Tools for Net Zero: Benchmarking

Property Use Detail	Value
★ Gross Floor Area	* 128,500 <input type="text"/> Sq. Ft. <input type="button" value="v"/>
★ High School	No <input type="button" value="v"/> <input type="checkbox"/> Use a default
★ Number of Workers on Main Shift	70 <input type="text"/> <input type="checkbox"/> Use a default
Student Seating Capacity	430 <input type="text"/> <input type="checkbox"/> Use a default
Months in Use	<input type="button" value="v"/>
★ Weekend Operation	No <input type="button" value="v"/> <input type="checkbox"/> Use a default
Number of Computers	224.88 <input type="text"/> <input checked="" type="checkbox"/> Use a default
★ Cooking Facilities	Yes <input type="button" value="v"/> <input type="checkbox"/> Use a default
Gross Floor Area Used for Food Preparation	10000 <input type="text"/> Sq. Ft. <input type="button" value="v"/> <input type="checkbox"/> Use a default
Number of Walk-in Refrigeration/Freezer Units	1.29 <input type="text"/> <input checked="" type="checkbox"/> Use a default
★ Percent That Can Be Heated	All of it - 100% <input type="button" value="v"/> <input type="checkbox"/> Use a default
★ Percent That Can Be Cooled	90 <input type="button" value="v"/> <input type="checkbox"/> Use a default



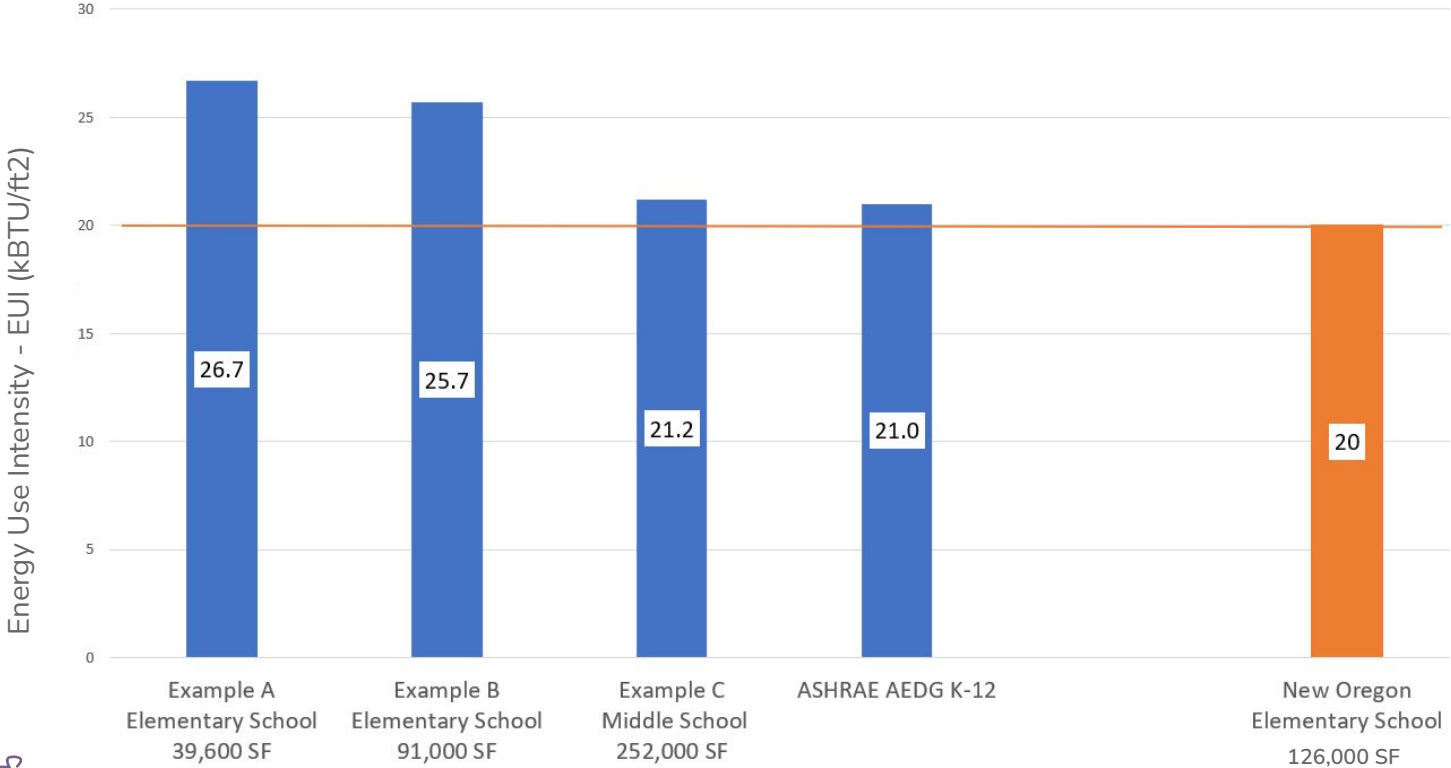


Tools for Net Zero: Benchmarking



EUI Analyzer

Tools for Net Zero: Benchmarking



Tools for Net Zero: Early Energy Modeling



eQuest
Quick Energy Simulation Tool



Tools for Net Zero: Early Energy Modeling



School Example

PROJECT DESIGN SCHEDULES BASELINE MEASURES RESULTS

School Office Gymnasium Site +

Name: School Color:

Building Type: School/University

Parent Shell: None Adjacency: Not Used

Area: 50000 ft² Aspect Ratio: 0.33

Floors: Number: 2 Height: 15 ft

Perimeter Zone Depth: 15 ft

Roof Type: Insulation entirely above deck

Wall Type: Metal framed

Glazing Type: Fixed fenestration

Window-to-Wall Ratio (%): North: 50 South: 50 East: 50 West: 50

Skylight Type: Plastic Curb

Skylight-to-Roof Ratio: 0 %

Heating Fuel Type: Natural Gas

Air-Side System: Packaged VAV with HW Reheat

Cooling System: Direct Expansion

Heating System: Boiler

Dedicated Outdoor Air System: None

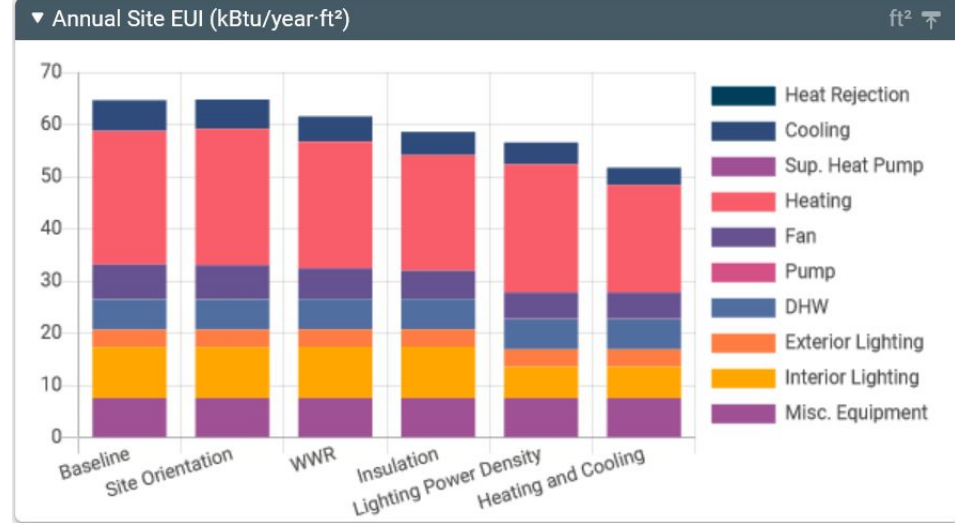
Right click on any building surface to assign adjacency

Tools for Net Zero: Early Energy Modeling



Annual Summary

	Baseline	Proposed	Absolute Savings	Relative Savings
Energy Cost (\$)	111,711	86,433	25,278	23%
Electric Consumption (kWh)	875,907	667,006	208,901	24%
Natural Gas Consumption (therm)	28,288	23,795	4,493	16%
Site EUI (kBtu/ft ²)	64.6	51.7	12.9	20%
Source EUI (kBtu/ft ²)	126	98.6	27.4	22%
CO ₂ Equivalent (kg of CO ₂ e)	704,379	548,330	156,049	22%



Tools for Net Zero: Renewable Energy

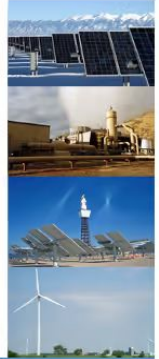


NREL's PVWatts[®] Calculator

Estimates the energy production and cost of energy of grid-connected photovoltaic (PV) energy systems throughout the world. It allows homeowners, small building owners, installers and manufacturers to easily develop estimates of the performance of potential PV installations.



SYSTEM ADVISOR MODEL



Version 2012.5.11: Loading libraries...

Tools for Net Zero: Renewable Energy



Customize Your System To Your Roof

On the map below, click the corners of the desired system. Note that the roof tilt and azimuth cannot be automatically determined from the aerial imagery, and consequently the estimated system capacity may not reflect what is actually possible.

System Capacity: 1406.9 kWdc (9380 m²)



RESULTS

 Print Results

806,780 kWh/Year*

System output may range from 755,388 to 855,510 kWh per year near this location.

Click [HERE](#) for more information.

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)
January	2.30	39,965
February	3.19	48,679
March	4.32	70,041
April	5.05	77,615
May	5.76	88,972
June	6.58	95,473
July	6.51	95,758
August	6.01	88,374
September	4.99	73,755
October	3.46	54,685
November	2.50	39,288
December	2.00	34,175
Annual	4.39	806,780

...sources of light is
...and even...
...the sun and wind
...energy. Annual
...projects.



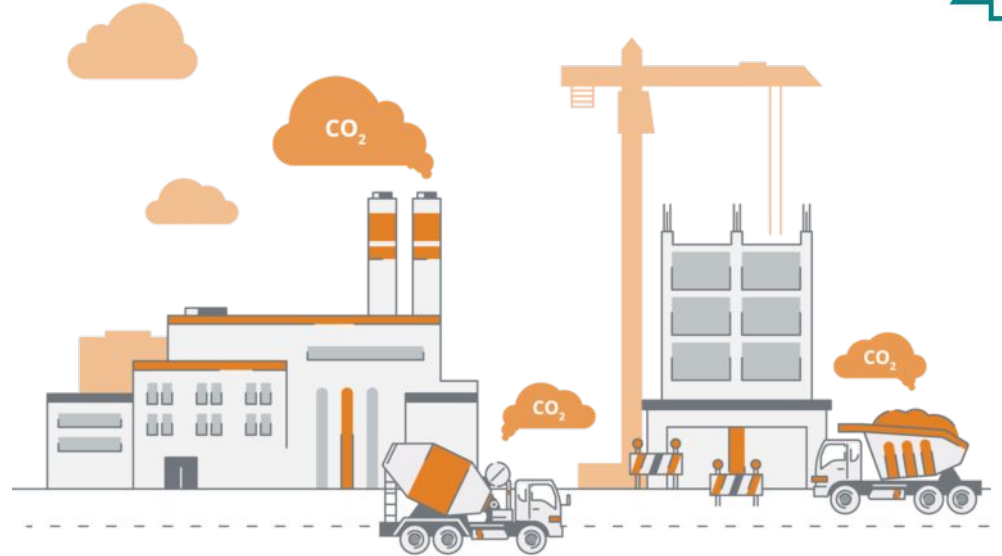
Getting to Zero: Considering Embodied Carbon



LIGHT



Other Focus Areas: Embodied Carbon

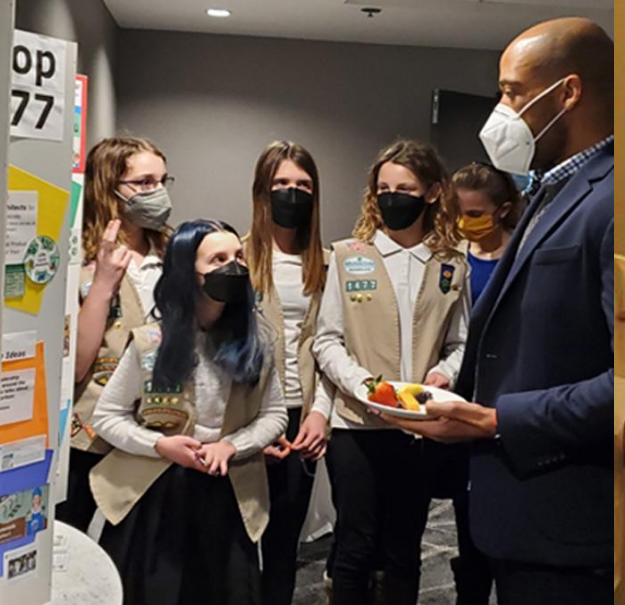
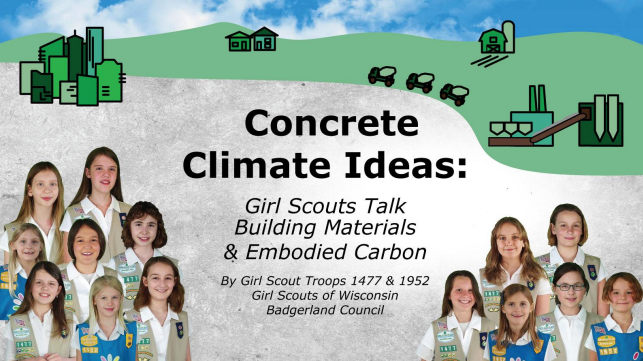


Operational Carbon

The emissions from a building's energy consumption.

Embodied Carbon

The emissions from manufacturing, transportation, and installation of building materials.



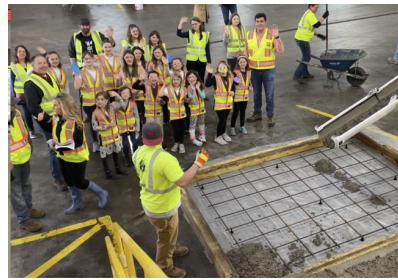


Concrete Climate Ideas:
 Girl Scouts Talk Building Materials & Embodied Carbon
 By Girl Scout Troops 1477 & 1952
 Girl Scouts of Wisconsin Badgerland Council



LOW-CARBON CONCRETE HELPS SOLVE THE CLIMATE CHANGE PUZZLE!





Musical
A Take Action Video
 by Girl Scout Troops #1477 & #1952
 Girl Scouts of Wisconsin Badgerland

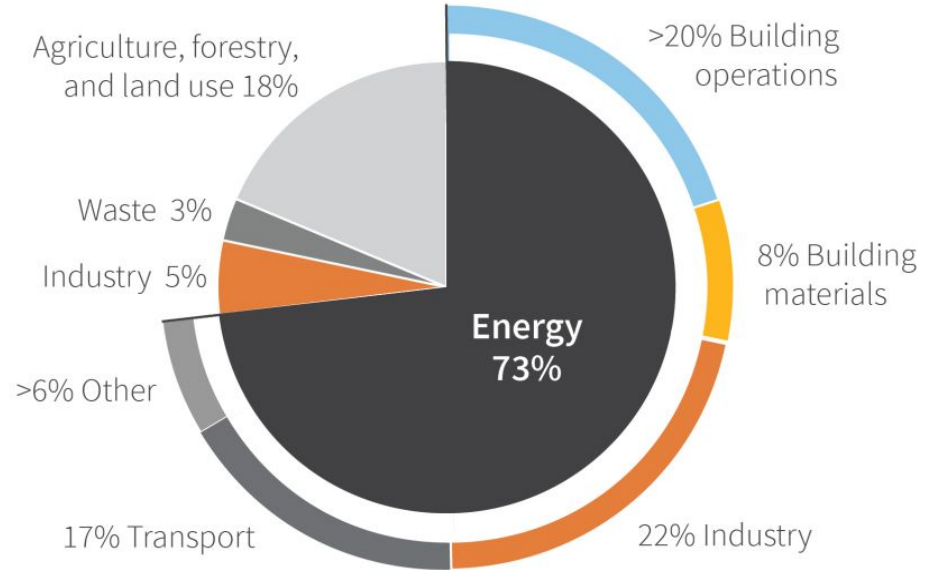


Troops #1477 & #1952 Girl Scouts of Wisconsin Badgerland

Other Focus Areas: Embodied Carbon



- 1 BUILD LESS, REUSE MORE** 
- 2 DESIGN LIGHTER AND SMARTER** 
- 3 USE LOW-CARBON ALTERNATIVES** 
- 4 PROCURE LOW(ER)-CARBON PRODUCTS** 



Global CO₂ emissions by sector. Adapted from the UNEP 2019 Global Status Report and OurWorldInData.org, based on data from Climate Watch and the World Resources Institute.

Embodied Carbon in Wisconsin



Are **YOU** interested in lowering the **embodied carbon** of Wisconsin's buildings?

We are looking to formally **organize a network of WI leaders** to tackle this subject. Reach out if you're interested!

- Julia Pooler - julia.pooler@gmail.com
- Ben Austin - baustin@findorff.com

*Excuse me, do any of your products have EPDs?
We're really watching our carbon!*



Breakout Sessions



Breakout Overview

1. Energy Storage

- Oregon, HGA and MGE

2. Energy Efficiency

- HGA and Findorff

3. Renewable Energy

- Findorff and RENEW WI

4. The Building as a Teaching Tool

- Oregon and Bray



