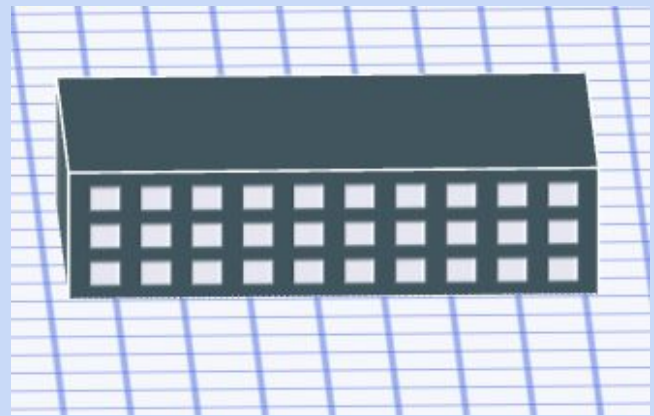


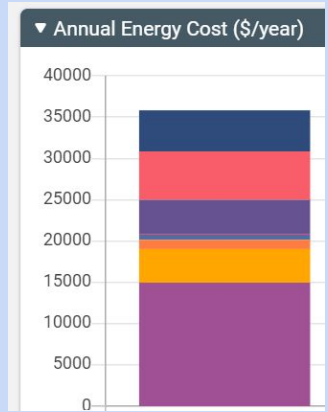
Sketchbox™ by Slipstream

Thursday, August 15, 2024



My Project

PROJECT DESIGN SCHEDULES BASELINE



Teaching Presenters

Joe Phillips - phillipsj@esschools.k12.wi.us

HS and MS Science Teacher, Eleva-Strum

James Reichling - jpreichling@madison.k12.wi.us

Physics & math teacher, Madison Metro School District
Instructor, CREATE center

Samara Hamzé - samara.hamze@uwsp.edu

Program Manager at KEEP (Wisconsin's K-12 Energy
Education Program)

Slipstream Staff

Dave Vigliotta

Senior Director of Partnership Development

Drew Morrison

Senior Energy Engineer

Emily Golen

Energy Engineer II

Peggy Heisch

Project Manager

Participant Introductions

Your name

What level and classes you teach or other industry connection

How do you expect you will use sketchbox?

Recording in Progress!

For later training purposes today's sessions are being recorded

Thank you

SPONSOR



PARTNERS



Wisconsin K-12 Energy Education Program (KEEP)
College of Natural Resources
University of Wisconsin - Stevens Point



Energy Center

Working to Advance Energy Technology
Educational Programs



Accelerating climate solutions. For everyone.

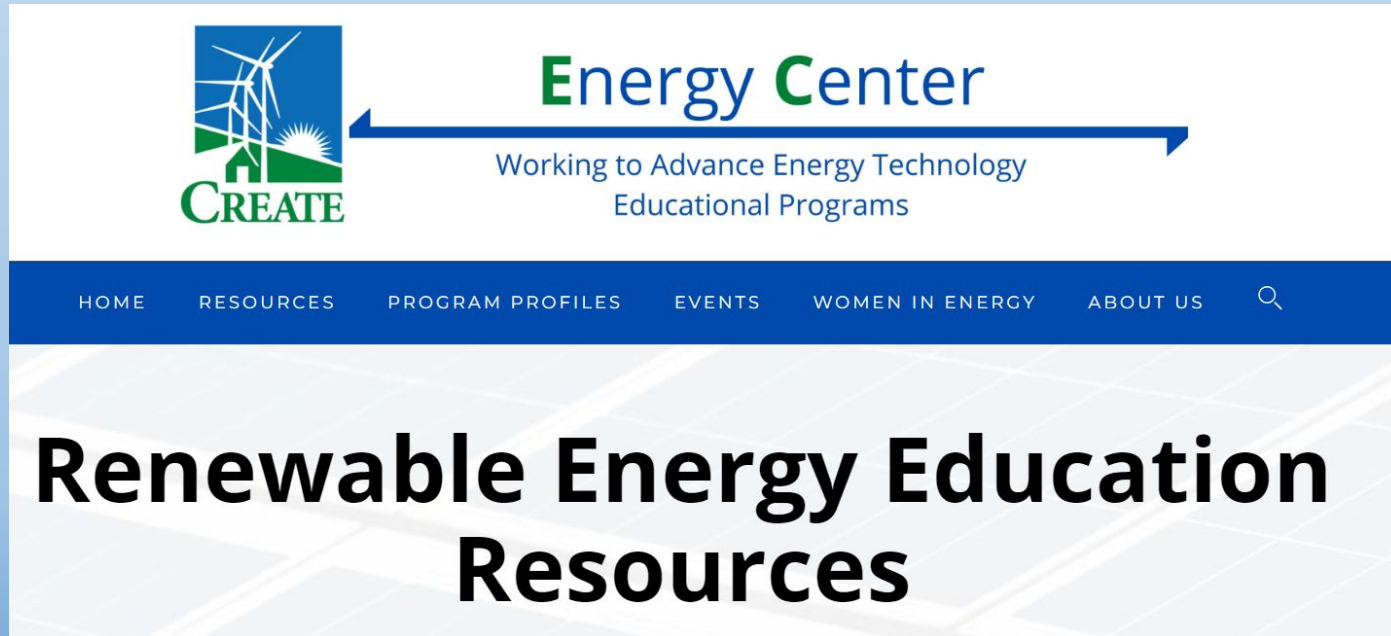
We deliver research, technical assistance, financing, education and training, and programs for stakeholders.

www.slipstreaminc.org

CREATE

Center for Renewable Energy Advanced Technological Education

<https://createenergy.org/resources/>



The image shows a screenshot of the CREATE Energy Center website. At the top left is the logo, which features a stylized green house with a white roof, a white sun, and two white wind turbines on a green hill, with the word "CREATE" in green below it. To the right of the logo is the text "Energy Center" in blue, with a blue double-headed arrow pointing left and right. Below this is the tagline "Working to Advance Energy Technology Educational Programs" in blue. A dark blue navigation bar contains the following links in white: "HOME", "RESOURCES", "PROGRAM PROFILES", "EVENTS", "WOMEN IN ENERGY", and "ABOUT US", followed by a magnifying glass icon. The main content area has a light blue background with a white grid pattern and features the text "Renewable Energy Education Resources" in large, bold, black font.

Agenda (part 1)

9:00 - 9:15 Introductions and objectives

9:15 – 9:30 Overview of Sketchbox

9:30 – 9:40 Curriculum Connections

9:40 – 10:00 Sample Building Model

10:00 - 10:10 Overview of Lessons and Resources

BREAK - Resume at 10:25 CDT

Agenda (part 2)

- 10:25 – 10:35 Integration of External Resources
(e.g. PV Watts, Future Urban Climates, Career Roadmaps)
- 10:35 - 10:50 Breakout Groups with Sketchbox
- 10:50 - 11:05 Technical Q & A with Slipstream
- 11:05 – 11:15 Review of Resources, Brief Evaluation
Conclusion of Workshop
-

Objectives

Introduce Sketchbox Building Energy Modeling Interface

Motivate the use of energy modeling in the classroom,
including career connections

Describe available lesson materials and resources

Demonstrate creation of several building models

Overview: Energy use in buildings

US EIA reports buildings account for 39% in 2021

Example strategies to save energy, reduce cost

- upgrade lighting
 - scheduling and set points
 - update mechanical systems
 - building envelope improvements
-

Energy modeling helps make decisions about which strategies provide the greatest return on investment

US Dept of Energy (DOE) provides DOE2 Building Energy Use and Cost Analysis Software

DOE provides E-Quest as a user interface

Download and install required, can be hard to learn

Sketchbox by Slipstream as a teaching tool

Online user interface to DOE2

Free to use, no download required

Runs on a student chromebook

Students can change parameters to explore impact on energy utilization and cost. Examples:

Building type (school, commercial, library, fitness center)

Location (City and State)

Window Fraction and Spatial Orientation

Energy Code

Sketchbox navigation through tool tabs

PROJECT DESIGN SCHEDULES

BASELINE MEASURES RESULTS

Pre-loaded sample data for quick-start including:
Building types, building size, mechanical systems,
weather data and utility rates by location

Sketchbox Example

150,000 square foot school building in Chicago

Demonstrate in sketchbox

Sketchbox demo school

PROJECT DESIGN SCHEDULES BASELINE MEASURES RESULTS

<https://slipstreaminc.org/sketchbox>

START USING SKETCHBOX TODAY

Welcome to Sketchbox!

Email

Password

Sign In

[Create an account](#)

[Forgot your password?](#)

Questions?

Please contact us at tools@slipstreaminc.org

Default Project Settings

PROJECT DESIGN SCHEDULES BASELINE MEASURES RESULTS

General

Project Name

My Project

Project Environment

Basic

State

Illinois

Nearest City

Chicago

Energy Code

IECC 2018

Financial

Rate Category

Commercial

Cost of Electricity

0.09

\$/kWh

Cost of Natural Gas

0.693

\$/therm

Emissions

Energy Source to Site Ratio

Electricity

Natural Gas

2.8

1.05

CO₂ Equivalence for Electricity

0.371

kg of CO₂e/kWh

CO₂ Equivalence for Natural Gas

5.3

kg of CO₂e/therm

Design Tab Options

Building Type
School/University

Parent Shell: None
Adjacency: Not Used

Area: 150000 ft²
Aspect Ratio: 1

Floors
Number: 2
Height: 13 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: 22
South: 22
East: 22
West: 22

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

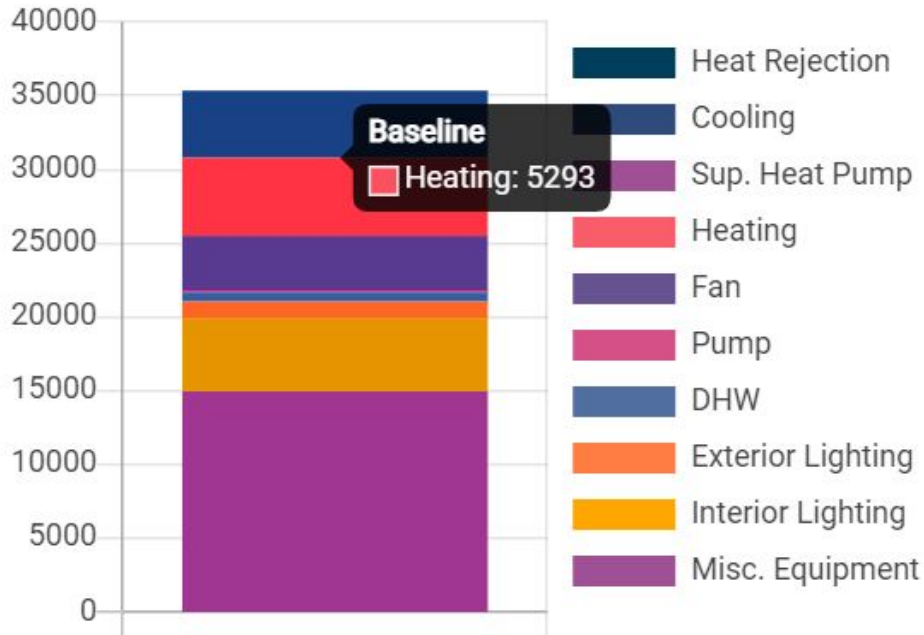
Heating System: Boiler

Dedicated Outdoor Air System: None

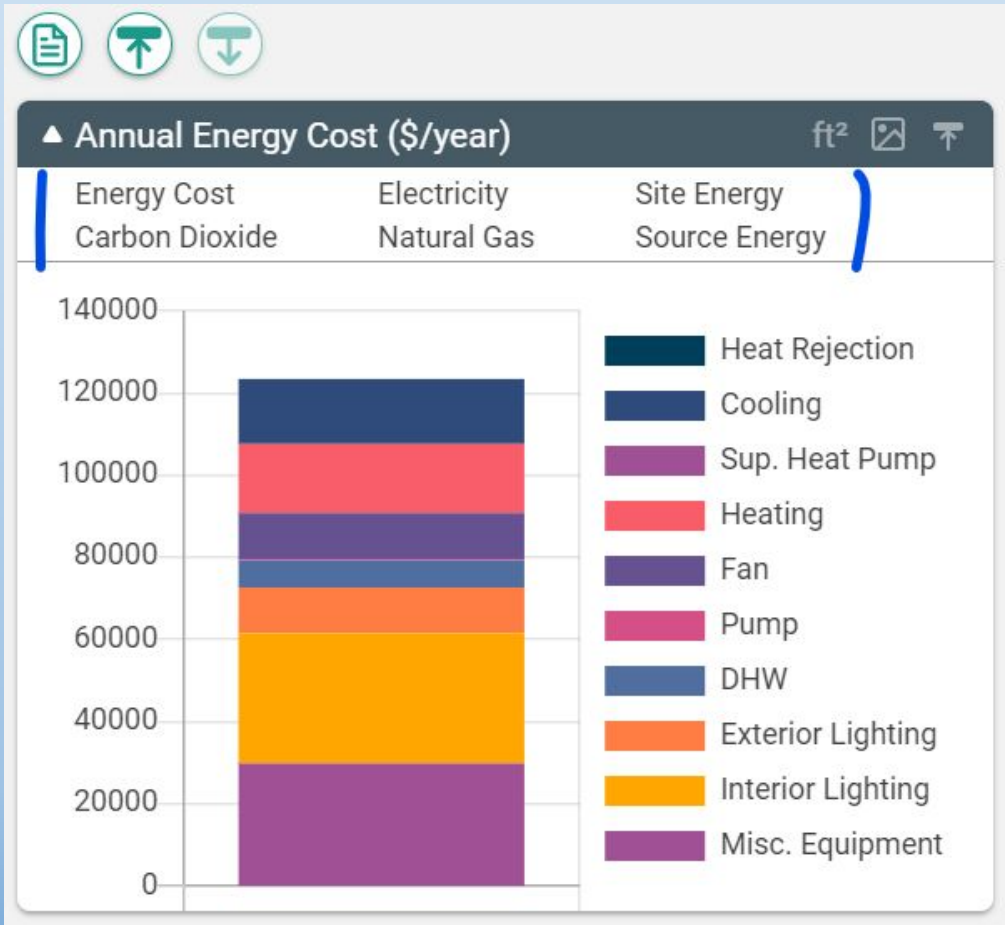


▼ Annual Energy Cost (\$/year)

ft² [Image] [Arrow]

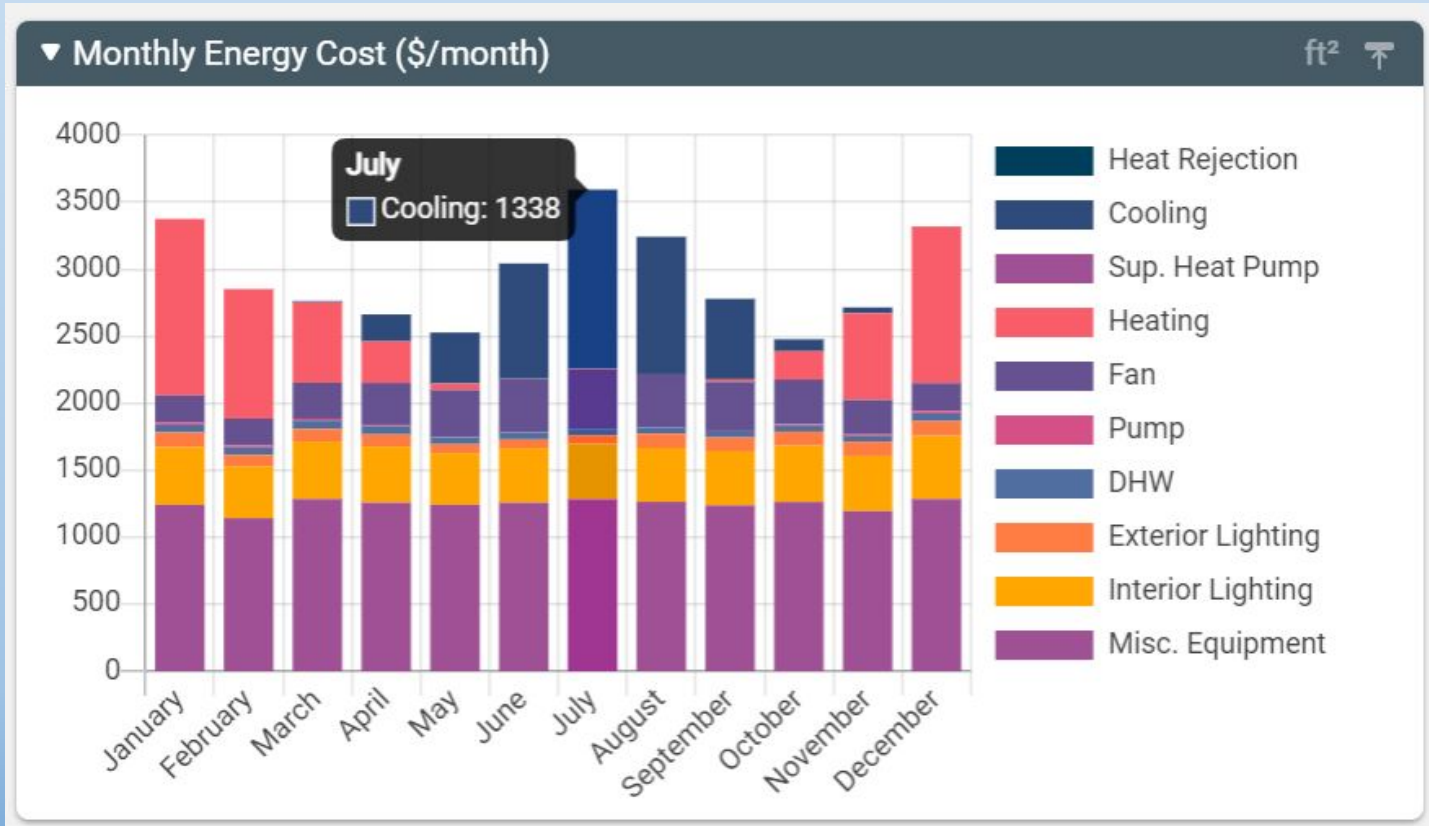


Energy Cost by Utilization



Other display options

Monthly breakdown



Annual Summary

Results Table

	Peak Cooling (kBTU/hr)	Peak Heating (kBTU/hr)	Peak Electric Demand (kW)	Annual Electric Consumption (kWh)
Baseline	3244.8	2404.7	413.1	1027457

Annual Natural Gas Consumption (therm)	Annual Energy Cost (\$)	Annual Water Consumption (gal/yr)
34975	116709	1950000

Sketchbox Example - What if... ?

Building size reduced by half

Original building had more windows

Original building moved to LA

<https://forms.office.com/r/XWvFWevVF0>

Lesson 1 - Introduction to Sketchbox - RESULTS

Scenario	Electricity (MWh)	Natural Gas Therms	Total Cost Dollars (\$)
Baseline	1027	34,975	116,709
Half area (75,000 ft ²)	513	18,672	59,074
Double window area	1064	35,163	120,122
Move to LA	1051	10,064	166,944

Lesson 1 - Introduction to Sketchbox - RESULTS

Scenario	Electricity (MWh)	Natural Gas Therms	Total Cost Dollars (\$)
Baseline in Chicago	1027	34,975	116,709
Move to Los Angeles	1051	10,064	166,944

In Chicago electricity has a carbon impact of 0.371 kgCO₂/kWh

In California this value is 0.191 kgCO₂/kWh

Natural gas is 5.3 kgCO₂/therm

Lesson 1 - Introduction to Sketchbox - RESULTS

Scenario	Electricity (MWh)	Natural Gas Therms	Total Cost Dollars (\$)
Baseline in Chicago	1027	34,975	116,709
Move to Los Angeles	1051	10,064	166,944

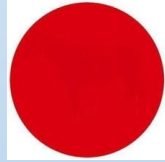
Chicago:

566,400 kg-CO₂e

Los Angeles:

443,30 kg-CO₂e

Curriculum Connections

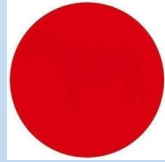


Why teach this to students?

Classroom, Curriculum, and Common Sense Enhancement

- Understanding Resources
 - Analyzing Costs and Benefits in Life and Business
 - Provide Real Examples of Climate Change and Solutions
 - Demonstrate Career Opportunities, Specialization, and Advancement Possibilities
 - Building Manager, Energy Engineering, Architecture, HVAC, Energy Analysts, Construction/Contractor, Sustainability Coordinator
-

Curriculum Connections



Why teach this to students?

Meeting Standards in Relatable and Useful Ways

- Mathematics: Area, Volume, Percent and Percent Change
- CTE: Insulation Values, Material Costs, Marketing and Managing
- Science:

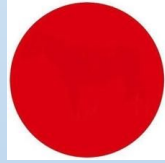
MS-PS1-4 Matter and its Interactions

Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS-ETS1-2 Engineering Design

Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

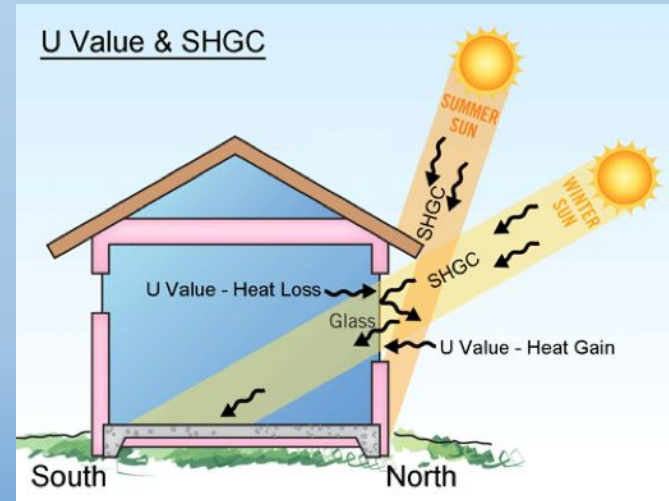
Curriculum Connections



Why teach this to students?

Expand Knowledge and Possibilities

- SHGC: What is it?
 - Solar Heat Gain Coefficient
 - Solar? Coefficient? Values?
 - Cost of materials?
 - Payback and time?
- The best “bang for the buck”?
 - As compared to LED lighting?



Why teach this to students?

Energy DPI Pathway

Job growth in renewable energy

Green buildings career map:

<https://greenbuildingscareermap.org/>

Exploring A Job In The Energy Industry



Exploring A Job In The Energy Industry

encourages students to explore a potential, future energy job. Using [Career Maps](#), students research compensation, qualifications, job demands, and advancement opportunities for the job they selected.

Renewable Energy Career Maps

- Solar
- Climate Control
- Bioenergy
- Wind
- Green Buildings

DPI Regional Career maps

https://dpi.wi.gov/sites/default/files/imce/pathways-wisconsin/2022_11_14_Final_Energy_Career_Pathway_11.14.22.pdf

- Energy Generation & Conservation
- Energy Transmission, Distribution, & Storage

Training levels: H.S. Diploma, Certification or Technical Diploma, Registered Apprenticeship, Associates Degree, Bachelor's Degree and beyond

DPI Regional Career maps



Energy Career Pathway <Name of Region> 2022-2024

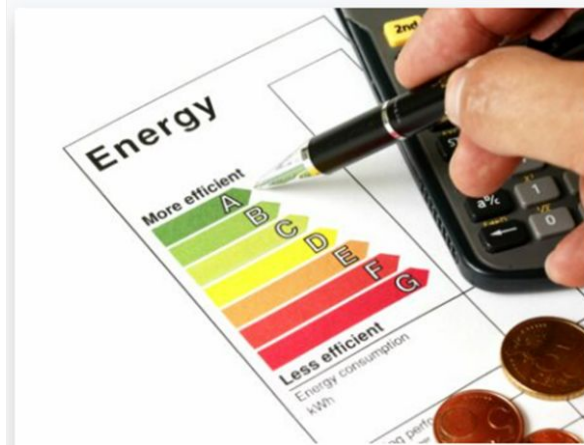
EXPLORE: Click on the links to find the job titles that seem most interesting to you to learn more! Save any jobs account so that you can create an Academic and Career Plan (ACP) later on.

Educational Level May also require work experience	Energy Generation & Conservation
High School Diploma, Certification	Solar PV Installer * <input type="radio"/> Electrical & Gas Power Line Helper * <input type="radio"/> Utility Lineman * <input type="radio"/> Range \$xxx,xxx-x
Certification or Technical Diploma	Distribution Generation Operator <input type="radio"/> Solar/Wind Energy Technician * <input type="radio"/> Building Automation Technician * <input type="radio"/> Energy Auditor <input type="radio"/> Residential HVAC Technician * <input type="radio"/> Range \$xxx,xxx-xxx,xxx
Registered Apprenticeship	Substation Electrician * <input type="radio"/> Apprentice Plant Attendant * <input type="radio"/> Range \$xxx,xxx-xxx,xxx

KEEP's Energy Lessons



ENERGY CONCEPTS



ENERGY EFFICIENCY



RENEWABLE ENERGY

[Download FREE Resources](#)



KEEP Kits

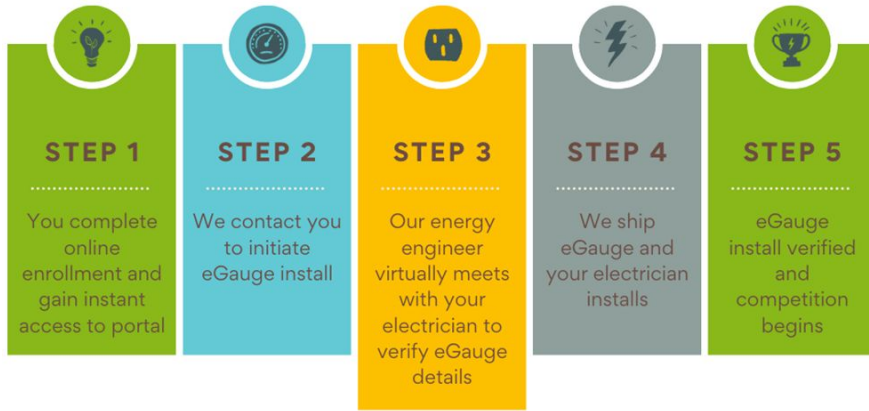


- 9 KEEP Energy Kits
- > 35 total KEEP/LEAF/WCEE Kits
- Free to use throughout WI
- Most kits can be shipped

[Reserve
a Kit!](#)



Renew Our Schools



More information and Enrollment Form



[RenewOurSchools Wisconsin - Resource Central](#)

Renew Our Schools

**Energy Conservation Competition
Place-Based Energy Education**

Fall 2024

October 7- November 15

- Reduce your school's energy consumption
- Reduce your school's electricity bill
- Reduce your school's carbon footprint

Learn about Participating WI Schools



[Renew Our Schools Competition \(arcgis.com\)](#)



Wisconsin K-12 Energy Education Program (KEEP)
College of Natural Resources
University of Wisconsin - Stevens Point



Clean Energy Careers Video Series

The clean energy sector is blossoming with career opportunities.

9 Clean Energy Career Video Profiles

Each video includes lesson slides and student assessment in Google format

<https://slipstreaminc.org/cleanenergycareers>

General building science resources and connection to Smart Start materials through CREATE

Teaching Materials, Energy Fundamentals

Select a category to view lesson plans in a specific Renewable Energy topic.

Energy
Fundamentals

Energy
Management &
Efficiency

Solar PV

Bioenergy

SCADA

9:40 – 10:00 Sketchbox model of specific buildings

Start in Google Earth, make measurements from satellite image

Collect building data, select building type

Match closest geographic location, check operating schedule

9:40 – 10:00 Sketchbox model of a specific building

Design and operating characteristics:

Building area

Window percent

Number of floors

Adjacency

Aspect ratio

Occupancy schedules

Construction

9:40 – 10:00 Sketchbox model of a specific building



Goodman South Campus

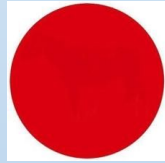
School building

76,000 square feet, three floors

15 ft floor height, 55% glass

Mass walls

Sketchbox Example: Retail Mall



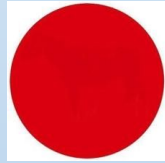
Have you ever wondered WHY the retail mall model is failing across the United States? Why are there so many online options instead?

- More options?
- Easier to ship?
- Less Employees?
- Or.....



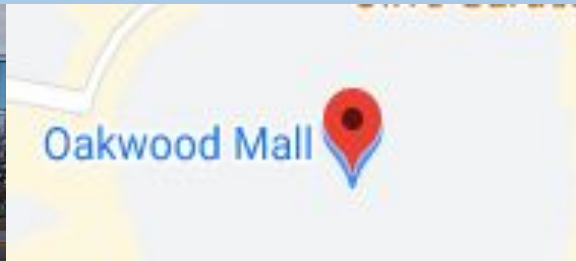
Sketchbox Example: Retail Mall

Let's discover what it costs to operate a "brick & mortar" retail space using Sketchbox!



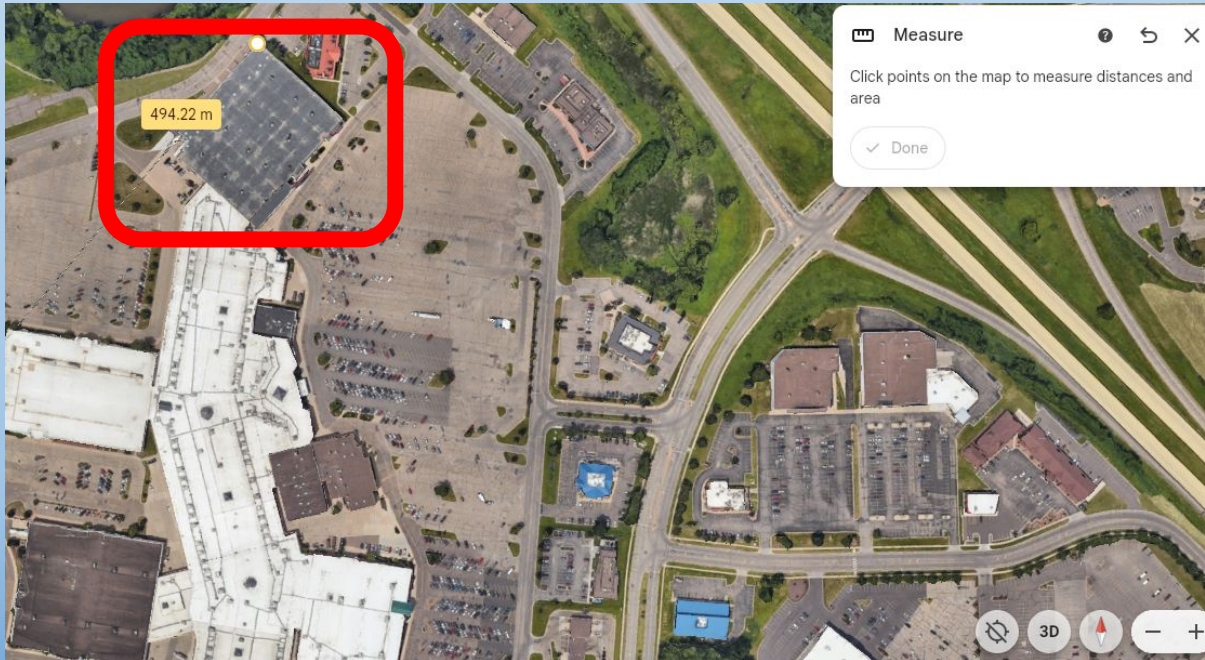
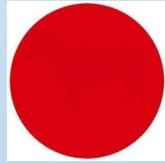
Eau Claire, WI

Oakwood Mall, 4800 Golf Rd, Eau Claire, WI 54701



Sketchbox Example: Retail Mall

Using Google Earth, I've taken dimension of one segment of the mall.



Area: $300\text{ft} \times 300\text{ft} = 90,000\text{ft}^2$

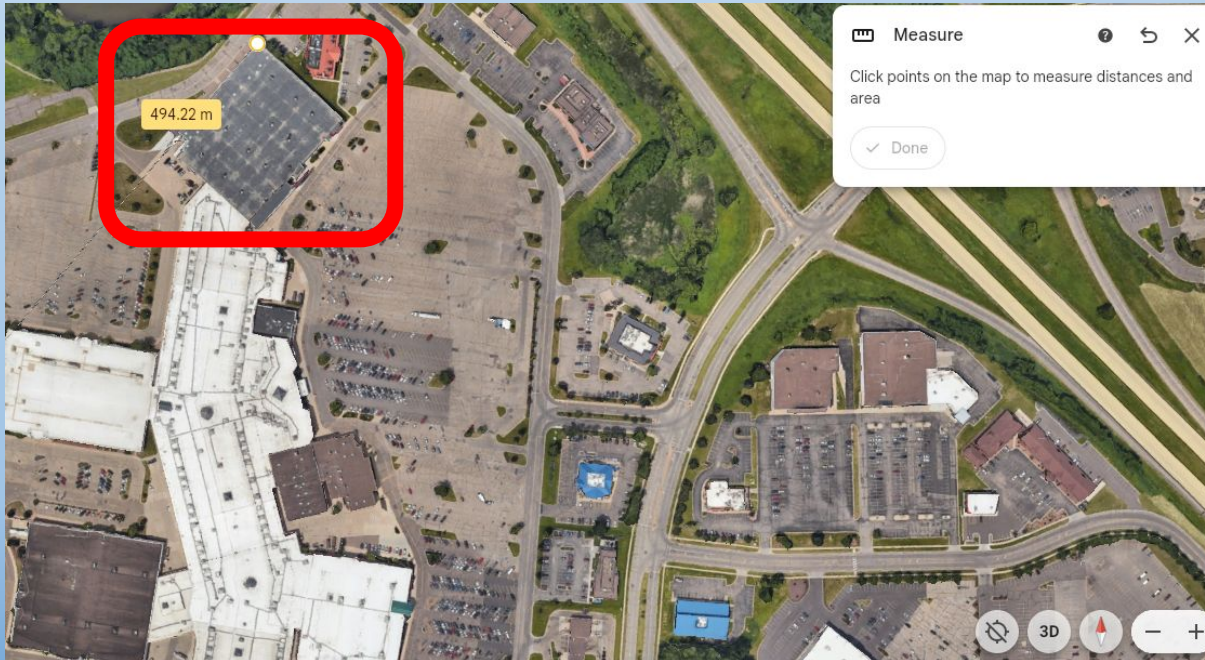
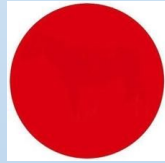
Height: 30ft

Volume: $2,700,000\text{ft}^3$

Area, Volume, Unit Conversion, Dimensional Analysis

Sketchbox Example: Retail Mall

Heating & Electrical Costs?



Electrical Pre-Set: 10.8 cents/kWh

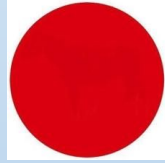
Actual: 12.9 cents/kWh
Height: 30ft

Location: Eau Claire, WI

Window Ratio

Sketchbox Example: Retail Mall

Making Sense of Schedules



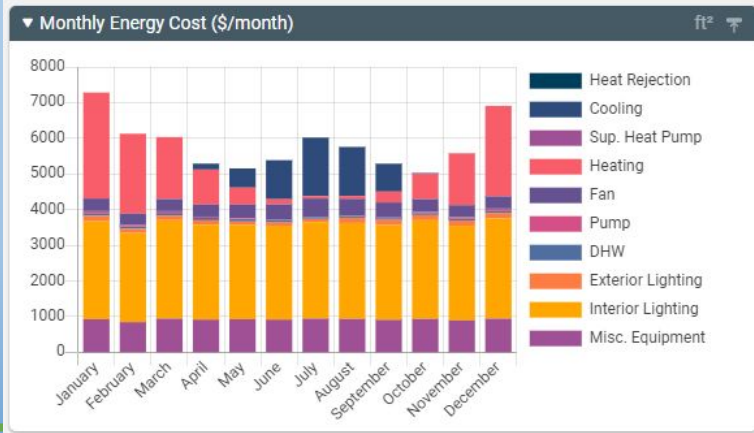
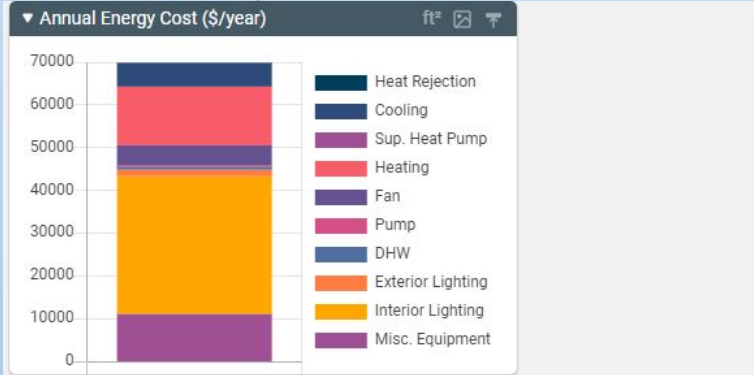
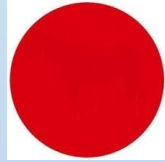
What do these schedules mean?

Do they relate to one another?

Inverse vs direct relationships

Sketchbox Example: Retail Mall

Costs and Analyzation



What is the single biggest cost?

What's the most expensive month to operate?

What ONE architectural adjustment could you make to save the most money?

What changes would be seen if this mall was located in Dallas, TX?

Percentages of a Whole

10:00 - 10:10 Existing lessons and Resources

Available from from Slipstream



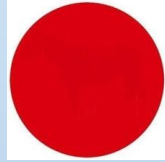
Lesson 1 Intro to building models

Lesson 2 Energy codes and measures

Lesson 3 Building Schedules

Lesson 4 Carbon Emissions

Available from from Wiselearn



Sketchbox Lesson Building Expansion: Energy Cost of Expansion (Dave Luety)

This lesson examines increased energy cost for a proposed building expansion at a high school

Energy Modeling and Climate Change (Joe Phillips)

When added, this lesson examines changing energy use and cost due to climate change

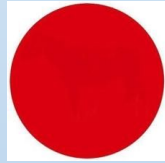
Nervous? Don't Be!

Sketchbox offers a robust YouTube channel to help get you started!

<https://www.youtube.com/@SlipstreamInc/featured>

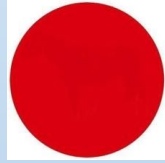
NOTE DUPLICATE ~ slide 31

[Slipstream Sketchbox Playlist](#)



The screenshot shows a YouTube video player. The video content is a login screen for the "Slipstream Energy Modeling Tool". The login form includes fields for "Username" (with "slipstream" entered) and "Password" (with "*****" entered). There is a checkbox for "Keep me signed in" which is checked, and a "Sign in" button. Below the button are links for "Create an account" and "Forgot your password?". The video player interface includes a search bar at the top, a progress bar at the bottom showing 1:32 / 5:31, and a channel name "Sketchbox Tutorial: Overview" with a "Subscribe" button and "Like", "Share", and "Download" icons.

Slipstream Sketchbox Youtube Playlist Includes:



Short tutorials on each Sketchbox function tab

3 part case study of a community library

53 minute Sketchbox Webinar from 2022

Time to take a break!

Create Account and Login to Sketchbox

<https://www.sketchbox.io/login>

Compile technical questions for Q & A

Return in 10 min

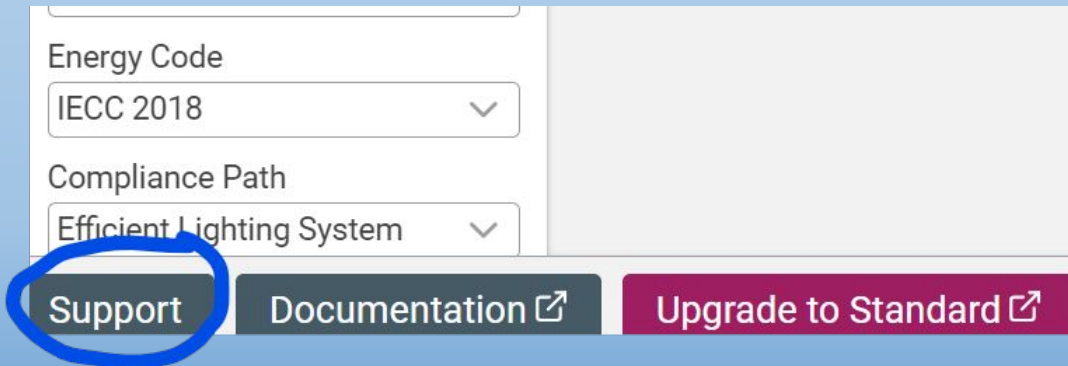
Recording in Progress!

For later training purposes today's large group sessions are being recorded

Support Features in Sketchbox

Unmet Hours for technical questions

“Contact Support → “ for account issues or software errors



In Development

Lesson 5 Energy Use Intensity

Lesson 6 Integrating Sketchbox with solar PV

Lesson two sample results



Table 1

Building model	Annual electric use (kWh)	Annual natural gas use (therm)	Annual energy cost (USD, \$)
Baseline (IECC 2018)	1,030,906	34,336	116,577
IECC 2015	1,111,081	33,763	123,395
ASHRAE 2016	1,066,255	33,384	119,099

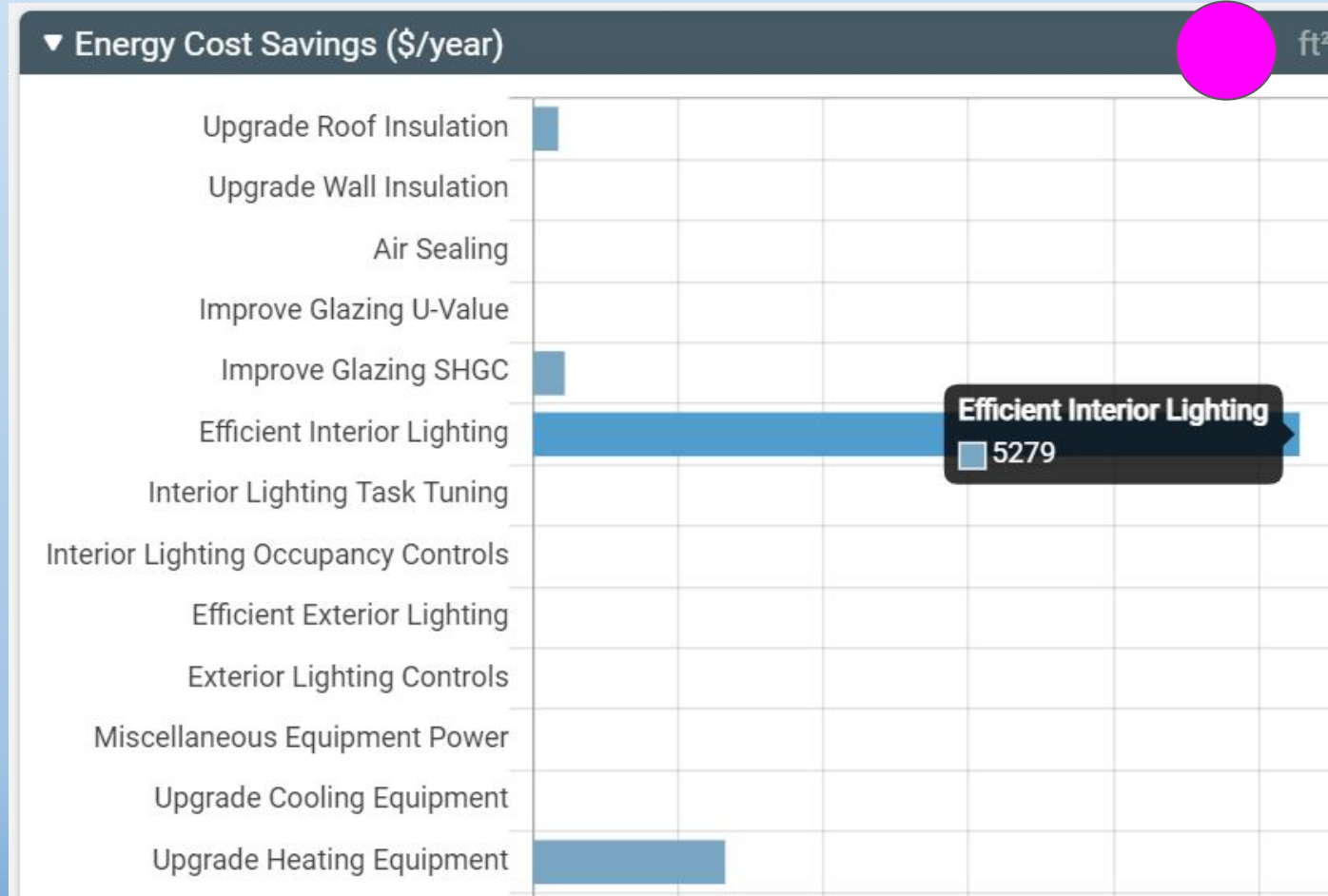
Lesson two sample results



Table 2

Building model	Annual electric use (kWh)	Annual natural gas use (therm)	Annual energy cost (USD, \$)
IECC 2018 “no change” (baseline- from table 1)	1,030,906	34,336	116,577
IECC 2018 Four selected improvements	947,063	33,981	108,784
IECC 2018 “best” measures set	686,592	14,533	44,498

Sample results



Sketchbox™ by Slipstream

Thursday, August 15, 2024: Part 2

Joe Phillips, science educator

James Reichling, MMSD and CREATE

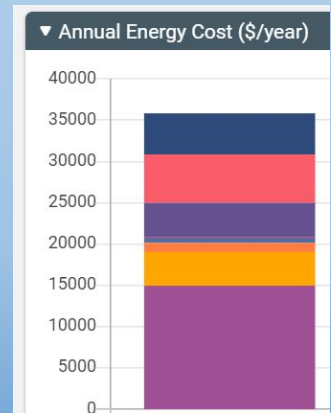
Samara Hamze, KEEP

Dave Vigliotta, Slipstream



My Project

PROJECT DESIGN SCHEDULES BASELINE



Agenda (part 2)

- 10:25 - 10:35 Integration of external resources
(e.g. PV Watts, Future Urban Climates Interactive)
 - 10:35 – 10:50 Sketchbox in breakout groups
 - 10:50 – 11:05 Q & A with Slipstream Staff
 - 11:05 – 11:15 Participant reactions, Conclusion
-

Integrating Solar Energy with Sketchbox

<https://pvwatts.nrel.gov/>

Electrification using heat pumps for HVAC and hot water

<https://slipstreaminc.org/education/air-source-heat-pumps-and-electrification>

Air Source Heat Pumps and Electrification

Wednesday, August 21, 2024 | 8:00 AM - 9:00 AM CST

Sketchbox and Climate Change

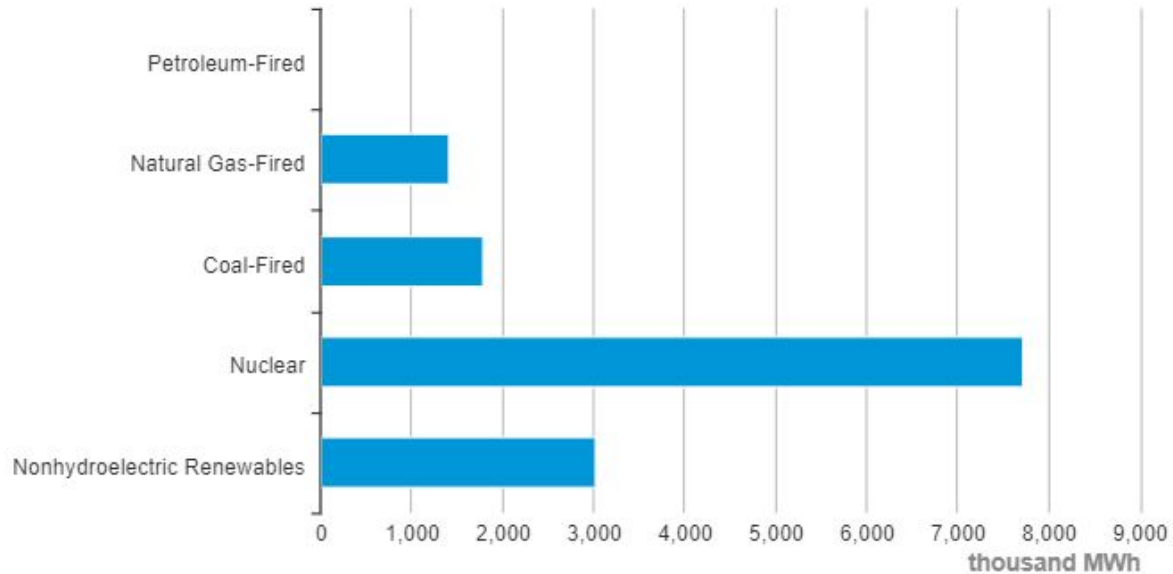
Future Urban Climates (University of Maryland)

<https://www.umces.edu/futureurbanclimates>

EIA state energy profiles: <https://www.eia.gov/state/>

Illinois Net Electricity Generation by Source, Apr. 2024

DOWNLOAD



Illinois

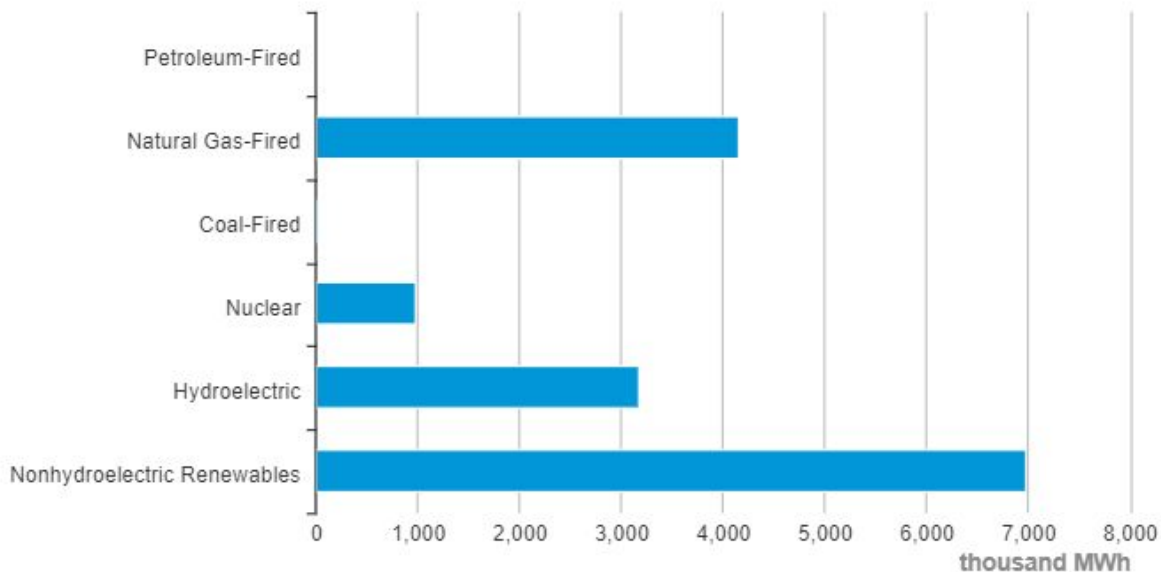


Source: Energy Information Administration, Electric Power Monthly

EIA state energy profiles: <https://www.eia.gov/state/>

California Net Electricity Generation by Source, Apr. 2024

DOWNLOAD



Source: Energy Information Administration, Electric Power Monthly

California

LEED: <https://www.usgbc.org/leed>

Leadership in Energy and Environmental Design

U.S. Green Building Council

Working Groups

Model a 30,000 sq ft health care clinic

Report annual electricity consumption, peak electric demand, and annual energy cost for different locations in microsoft form:

<https://forms.office.com/r/ykkm1k8fKN>

Explore additional features as a team by interest

<https://forms.office.com/r/ykkm1k8fKN>

10:50 - 11:05 Technical Questions with Slipstream Staff

What are the major variables to consider when students are just starting out?

- Learn by doing, try out some of the lessons
- Window/Wall ratio (glazing)
- Lighting
- Types of HVAC systems; heating & cooling efficiencies

How to decide which building type to use when using Sketchbox when that building category is not in Sketchbox:

- Choose one that you think is similar (consider general building usage, the building's operation & occupant usage)
- Alternatively possible to create 2 shells in Sketchbox and use those

What differentiates an Office from a School? Helpful to have reference material.

- Drew conducted an on-screen demonstration

Where does Slipstream see the Sketchbox tool going? It seems like it's pretty new.

- Genesis out of Slipstream staff need to streamline some of their workflow

Any plans for a specific residential version of Sketchbox? Getting further into the details of wall or roof assemblies?

- Currently good for modeling multi-family buildings (have in templates now)
 - Modeling a house or duplex; no because this is so different from a commercial building
-

11:05 - 11:15

Closing remarks, workshop evaluation, participant lessons

Workshop evaluation: <https://bit.ly/3YLgb9r>



Lesson development / Model Exploration

WI educators may contribute a lesson and receive a stipend

Submit lessons in Word or Google Doc format to Jim:

jpreichling@madisoncollege.edu and CC Samara:

samara.hamze@uwsp.edu

Deadline: Monday, Sept. 16

Lesson development template: Objectives

- 1) Demonstrate energy, financial, or CO₂ savings from updating a building schedule
 - 2) Show how the CO₂ impacts of a building are different in different areas of the United States
 - 3) Compare estimated building energy savings from improved building schedules to the savings from adding energy efficient lights
 - 4) Estimate the added annual energy costs for a building expansion
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Lesson development template: NGSS standards

HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

HS-ETS1-4 Engineering Design

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

NGSS Science and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
 2. Developing and using models
 3. Planning and carrying out investigations
 4. Analyzing and interpreting data
 5. Using mathematics and computational thinking
 6. Constructing explanations (for science) and designing solutions (for engineering)
 7. Engaging in argument from evidence
 8. Obtaining, evaluating, and communicating information
-

Lesson development template: Metatags

Budget, building code, building design, building envelope, building science, carbon emissions, carbon footprint, computer model, data analysis, efficiency, electricity, energy, energy career, energy conservation, energy economics, energy efficiency, energy management, green building, heating and cooling, HVAC, kwh, natural gas, NG, simulation, sustainability, utilities, utility rates

End of presentation

Career Connections to Sketchbox

Example careers: building manager, energy engineer, architect, HVAC, energy analyst, construction/contractor, sustainability

<https://greenbuildingscareemap.org/>

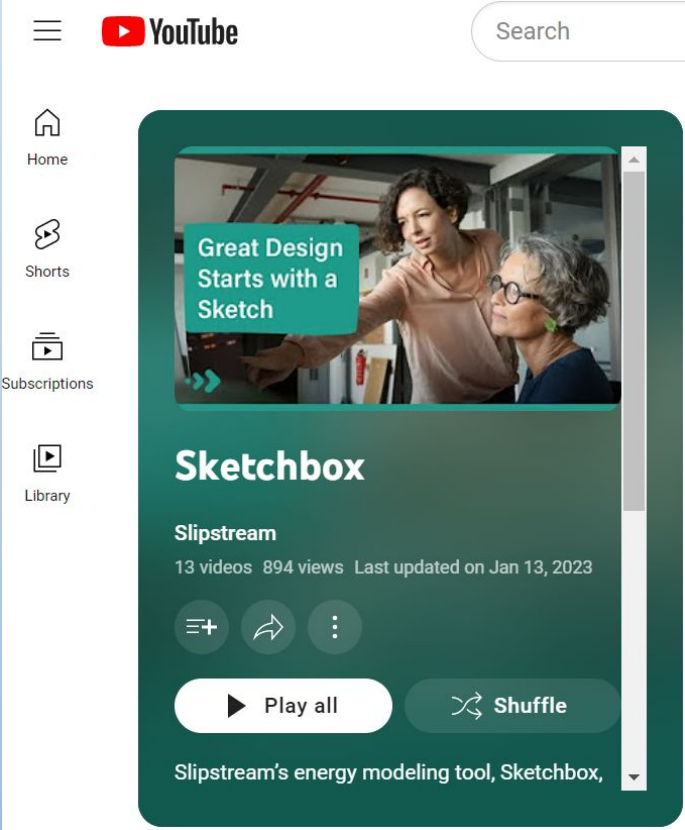
createenergy.org

Resources → teaching materials → energy fundamentals → exploring a job in the energy industry

Sketchbox Support

Youtube tutorials at the sketchbox
[youtube](#) channel

Support: tools@slipstreaminc.org



The image shows a screenshot of a YouTube channel page for 'Sketchbox' by 'Slipstream'. The page features a navigation menu on the left with icons for Home, Shorts, Subscriptions, and Library. The main content area displays a video thumbnail with the text 'Great Design Starts with a Sketch' overlaid. Below the thumbnail, the channel name 'Sketchbox' is prominently displayed, followed by 'Slipstream' and statistics: '13 videos 894 views Last updated on Jan 13, 2023'. There are three icons for video management: a list icon with a plus sign, a share icon, and a vertical ellipsis. Below these are two buttons: 'Play all' and 'Shuffle'. At the bottom, a partial description of the channel is visible, mentioning 'Slipstream's energy modeling tool, Sketchbox,'.

Createenergy.org

**It Pays To Save
In Your Home**



**Exploring A Job
In The
Energy Industry**




**Smart PV:
Battery &
Charge Controller**



**Building A Passive
Solar Home**




**What's In An
Energy Bill?
Part 2**



**What's In An
Energy Bill?
Part 1**




**Solar PV:
Balance Of System
& System Design**




**Solar Site Analysis:
The Solar
Pathfinder**



**Dairy Waste
To Power**



**Measuring
Sunlight:
The Pyranometer**




By The Numbers



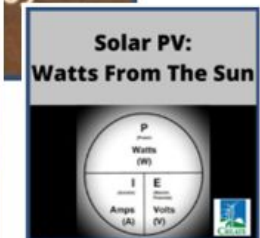
**What's The
Cheapest Watt?**



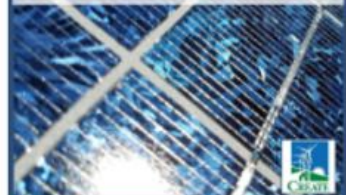
**Solar PV: Module
Performance
(Instructional Size Module)**



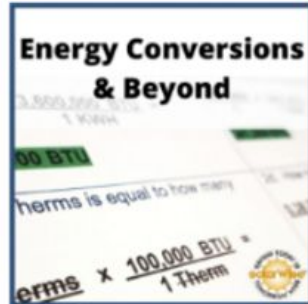
**Solar PV:
Watts From The Sun**




Solar PV Silicon



**Energy Conversions
& Beyond**



**Solar Location
Analysis:
The PVWatts
Calculator**



UPDATE: General building science resources and connection to Smart Start materials through CREATE

Energy Career Maps through CREATE

<https://createenergy.org/resources/>

SOLAR TOOLKIT



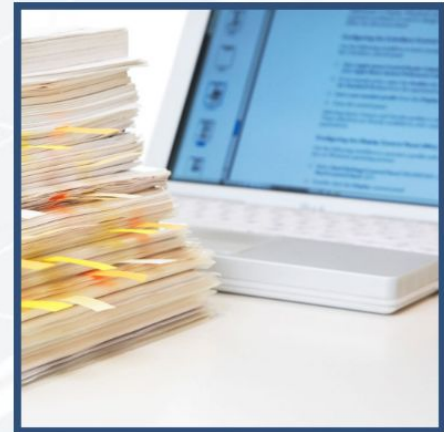
TEACHING MATERIALS



CAREER MAPS



PUBLICATIONS



Student reactions from class trials

High level of engagement

Easy access to results

Desire to independently explore

Students in pilot asking to participate in another round

What did students find most interesting about sketchbox?

“... how small factors can change so many things. I also found predicting them fun.”

“How this ties into architecture and buildings”

“How [the building in] California uses less energy but costs more”

“How small changes in building design can greatly influence energy cost”

Additional presentation notes follow on the next slides

Links to Sketchbox lessons 1 - 4 in google doc form

<https://docs.google.com/document/d/1fj2sXF77KSPGMQqkucsKC4C8kxyMpLXMhAJ0U3wJfrA/edit?usp=sharing>

<https://docs.google.com/document/d/12ksKAdrqxvzbYqLVu1RnP-KTPbrxNwLtUIO3EI8p2Rk/edit?usp=sharing>

<https://docs.google.com/document/d/16c0ITKcOpXZkV5R925S7FArZy7w752yUsV4o0qTTCZk/edit?usp=sharing>

<https://docs.google.com/document/d/1qGTBNiFDhQyqxo5LgDvcXzc2FNZ0zOGmrjzdYribnnE/edit?usp=sharing>

Links to Sketchbox lessons 1 - 4 in google doc form

[Lesson 1 introduction](#)

[Lesson 2 energy code](#)

[Lesson 3 schedules and measures](#)


[Lesson 4 carbon emissions](#)

Annual Summary

Results Table

	Peak Cooling (kBTU/hr)	Peak Heating (kBTU/hr)	Peak Electric Demand (kW)	Annual Electric Consumption (kWh)
Baseline	972.1	785.3	134	325849

Annual Natural Gas Consumption (therm)	Annual Energy Cost (\$)	Annual Water Consumption (gal/yr)
9365	35816	700000



Agenda (part 2)

- 10:00 – 10:15 Technical Q & A with Slipstream
 - 10:15 - 10:25 Integration of external resources
(e.g. PV Watts, Future Urban Climates Interactive)
 - 10:25 – 10:35 Intro to Participant Lesson Development
 - 10:35 – 10:45 Resources: KEEP, DPI, CREATE, Slipstream
 - 10:45 – 11:00 Participant reactions, Conclusion
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Sample Lesson three results

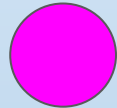


Table 1

Building model	Annual electric consumption (kWh)	Annual natural gas consumption (therm)	Annual energy cost (\$)
Baseline (<u>simple</u> thermostats)	1,027,748	33,651	115,817
Simple thermostats Weekday 8am – 8 pm	1,030,906	34,336	116,577
Simple thermostats Weekday 8am – 4 pm	1,026,151	33,382	115,488
<u>68 degree</u> heating setpoint <u>77 degree</u> cooling setpoint	998,770	32,249	112,238

Exceeding code - Lesson 2 overview



Roughly 40 building parameters on the “baseline” tab

Pre-set upgrades on the “measures” tab

Three values for each (no change, better, best)

Lesson 3 and 4 objectives



Investigate scheduling and its impact on building energy

Calculate carbon equivalent emissions avoided due to energy savings

Explore electrification of heating and its impact on emissions

Sample Lesson four results

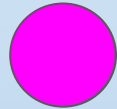


Table 1

Building model	Annual electric consumption (kWh)	Annual natural gas consumption (therm)	Annual Kg-CO ₂ e
Baseline	326,919	8539	166,544
Energy efficient lights	301,874	8829	158,789
Demand control ventilation	325,514	7568	160,876
Move to Madison, WI	322834	10109	257,932