
Sketchbox for Building Energy Modeling

WTEA 8:45 am Friday, Mar 10

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Accelerating climate solutions. For everyone.

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

www.slipstreaminc.org

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Physics and math teacher, engineering background

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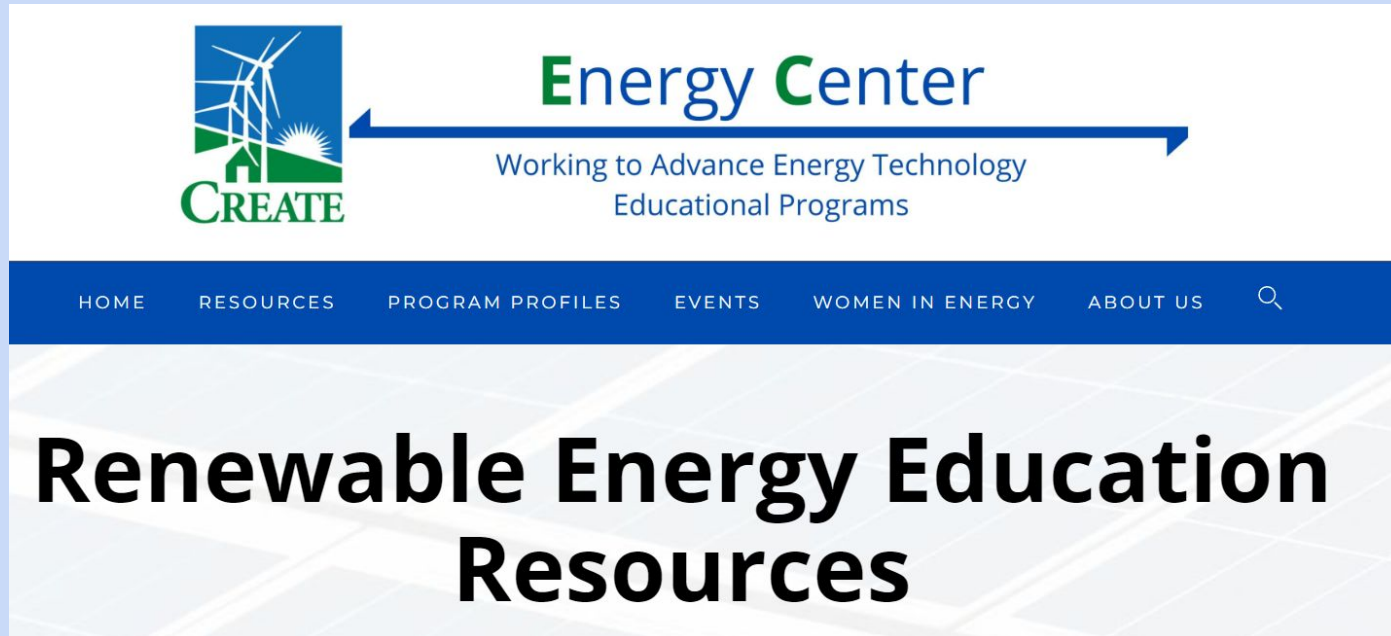
Introduction to Renewable Energy course
(dual credit with Madison College)

Energy Management and Energy Economics

CREATE

Center for Renewable Energy Advanced Technological Education

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



The image shows a screenshot of the Energy Center website. At the top left is the CREATE logo, which features a stylized wind turbine and sun over a green landscape with the word "CREATE" below it. To the right of the logo is the text "Energy Center" in a blue serif font, with "Energy" in blue and "Center" in green. Below this is a blue horizontal line with arrowheads at both ends, and underneath it, the text "Working to Advance Energy Technology Educational Programs" in a smaller blue font. A dark blue navigation bar contains the following links in white uppercase letters: HOME, RESOURCES, PROGRAM PROFILES, EVENTS, WOMEN IN ENERGY, and ABOUT US, followed by a magnifying glass icon for search. The main content area has a light gray background with a faint grid pattern and features the text "Renewable Energy Education Resources" in a large, bold, black sans-serif font.

Presentation Outline

Overview of building energy modeling and sketchbox

Sample lessons, course context and standards

Student reactions from class trials

Access and support

Q&A and feedback survey

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 DOE provides DOE2 Building Energy Use and Cost Analysis Software

DOE provides E-Quest as a user interface

Download and install required, learning curve

Sketchbox by Slipstream as a teaching tool

Online user interface to DOE2

Free to use, no download required

Runs on a student chromebook

Preloaded building types, systems/technologies, weather data, utility rates, and many more data

Why teach this to students?

Awareness of resource utilization

Cost-benefit analysis and business connections

Energy DPI Pathway

Get students motivated/excited about climate solutions

Careers: Building manager, energy engineering,

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

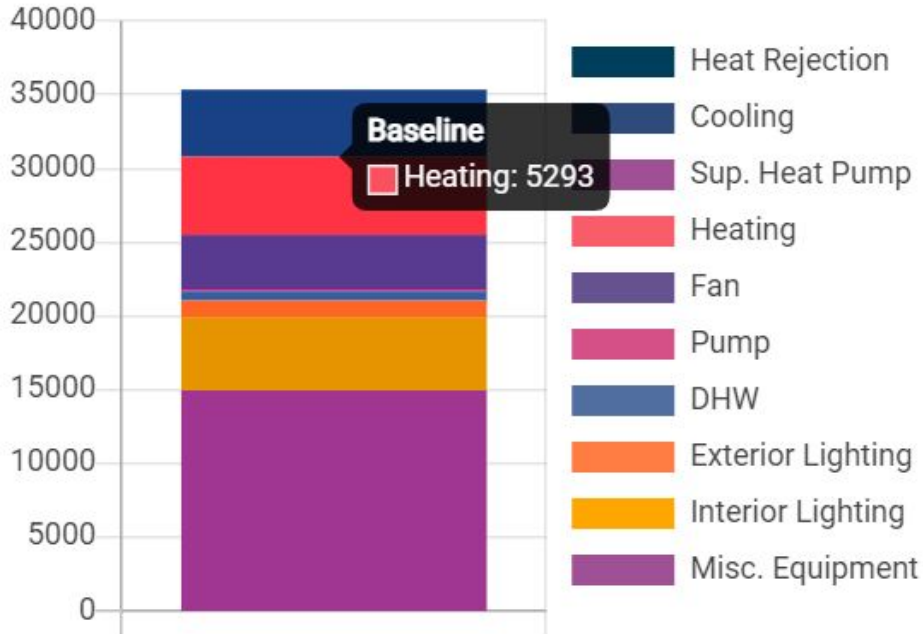
5.3

kg of CO₂e/therm

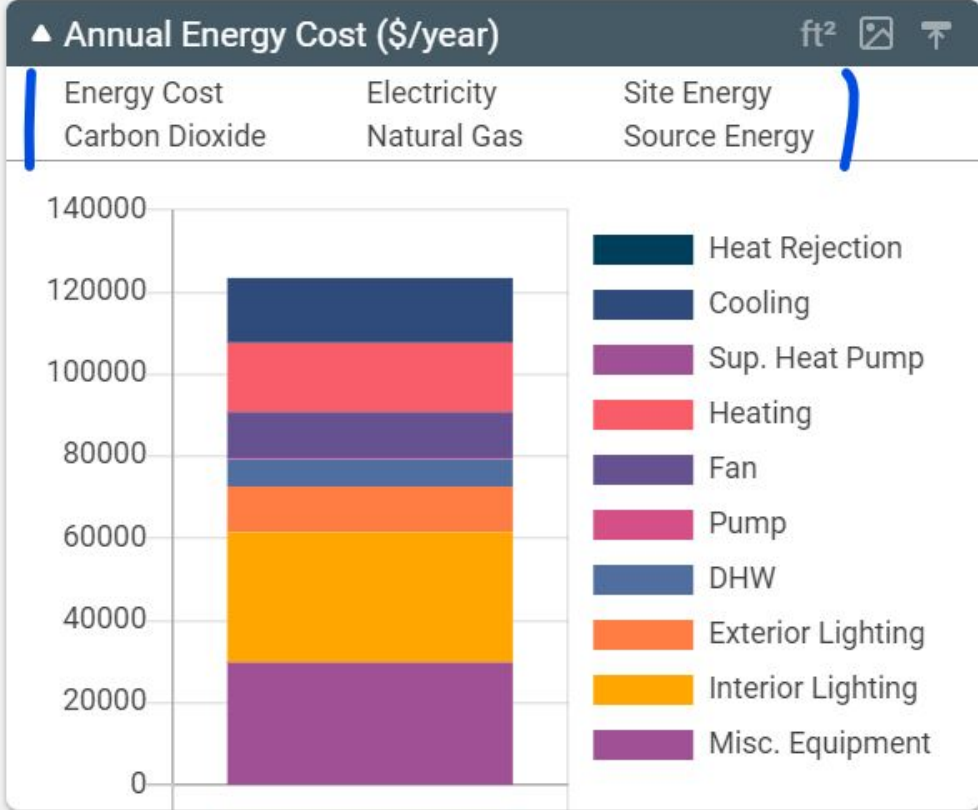


▼ Annual Energy Cost (\$/year)

ft²

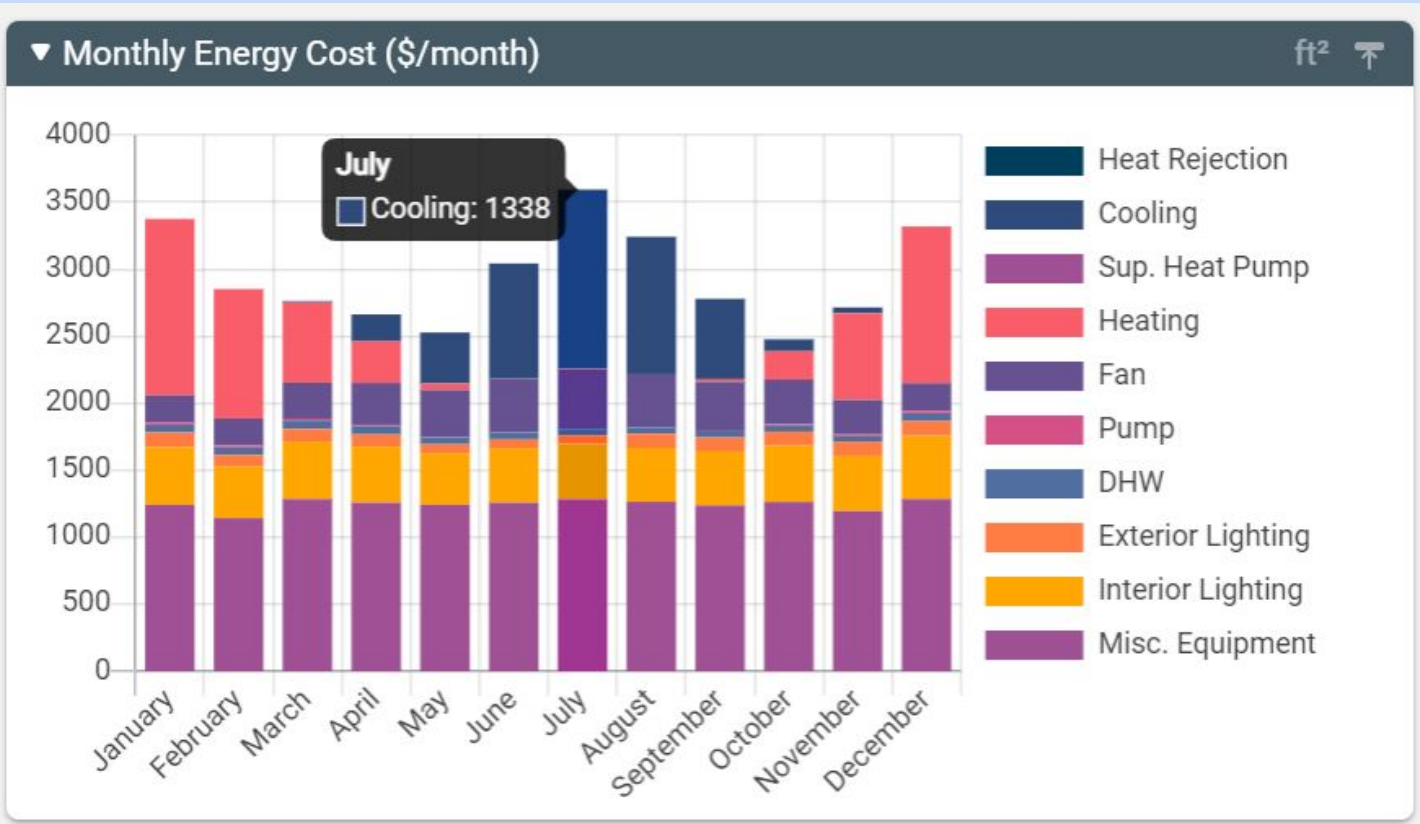


Energy Cost by Utilization



Other display options

Monthly breakdown



Annual Summary

Peak Cooling (kBTU/hr)	Peak Heating (kBTU/hr)	Peak Electric Demand (kW)	Annual Electric Consumption (kWh)	Annual Natural Gas Consumption (therm)	Annual Energy Cost (\$)
878.1	751.8	127.9	326919	8539	35339

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

Building type (e.g. school, commercial)

Location

Window Fraction

Spatial Orientation

Energy Code

Lessons in development

Lesson 1 introduction to get students started quickly

Studies impact of size, location, window percentage

Demonstrates basic functions and model results

Lessons in development

Lesson 2 Energy code options (IECC and ASHRAE)

Measures sets, pre-built building upgrades to compare baseline (code), “better” and “best” (practical) options

16 upgrade categories including roof insulation, interior lighting, wall R-value, window properties, air-sealing, DHW

Lesson One Instructions

Change building type to school or university

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

Design Tab Options

Lesson One Scenarios

Change building size

Change window percentage

Change location (to Los Angeles)

Participant discussion - what change in energy use and cost will each change create? Increase/decrease, by what percent?

Electricity, Natural Gas, Overall Cost

1. Cut building square footage in half
 2. Double window percentage
 3. Change location (Chicago to Los Angeles)
-

Participant discussion - RESULTS

Scenario	Electricity (MWh)	Natural Gas Therms	Total Cost Dollars
Baseline	1031	34,300	116,600
Half area (75,000 ft ²)	513	18,400	58,900
Double window area	1070	35,000	120,000
Move to LA	1060	9750	167,900

Lesson Two Scenarios

Change energy code

Change building components and construction, selected measures

Participant discussion

1. Change from IECC 2018 to IECC 2015

Change in energy cost? Increase/decrease, percent

2. Four measures, rank in by largest energy cost reduction

Upgrade roof insulation

Efficient Interior Lighting

Upgrade window solar heat gain coefficient

Upgrade Cooling Equipment

Participant discussion

1. Change from IECC 2018 to IECC 2015

Change in energy cost? Increase/decrease, percent

2018: \$116,600

2015: \$123,400

2. Four measures, rank in by largest energy cost reduction

Upgrade roof insulation: \$326

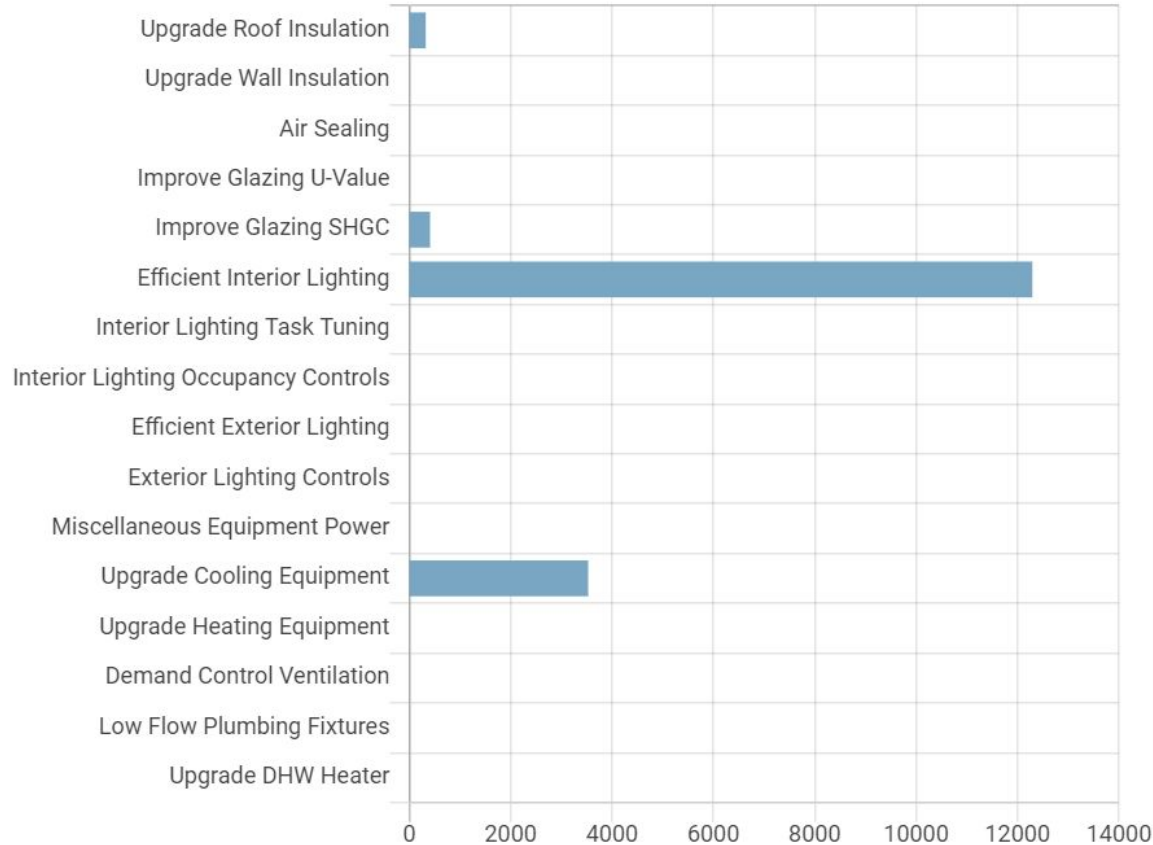
Efficient Interior Lighting: \$12,293

Improved glazing solar heat gain coefficient: \$411

Upgrade Cooling Equipment: \$3531

▼ Energy Cost Savings (\$/year)

ft²  



Future lessons in development

Will be available from CREATE website

Lessons being developed by other educators

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.”

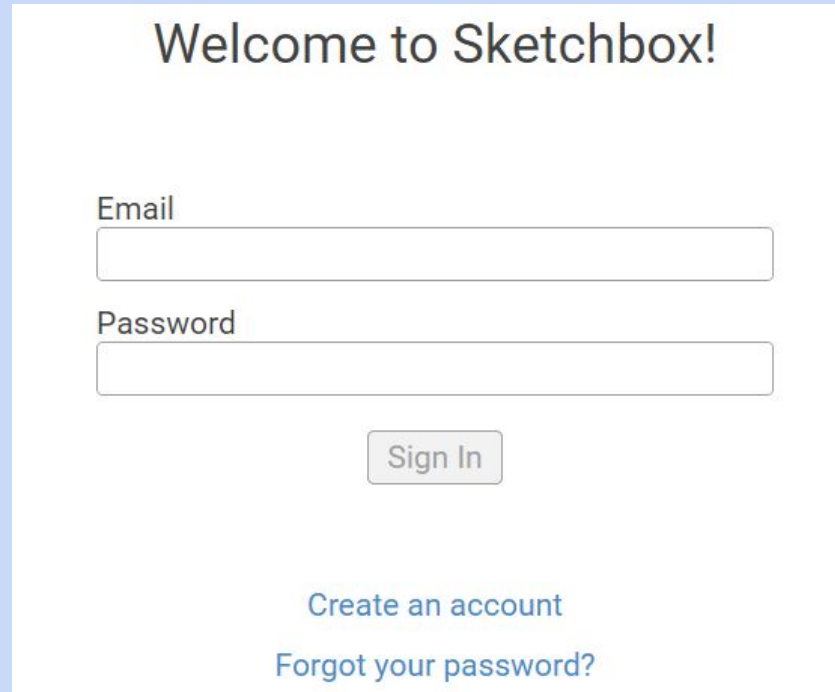
“How this ties into architecture and buildings”

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

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

Access to Sketchbox: <https://slipstreaminc.org/sketchbox>

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



>Welcome to Sketchbox!

Email

Password

Sign In

[Create an account](#)

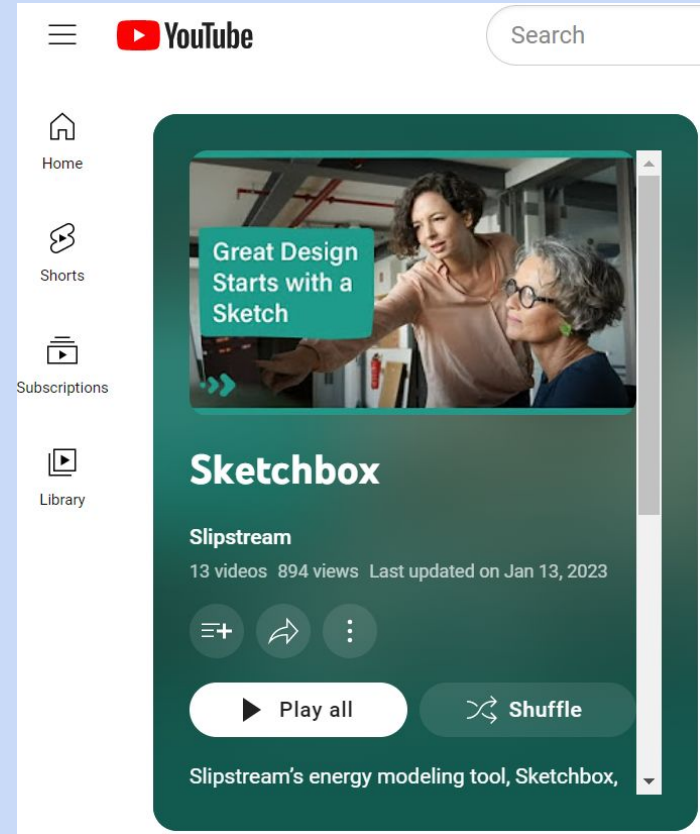
[Forgot your password?](#)

Sketchbox Support

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

Support: tools@slipstreaminc.org

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



The image shows a screenshot of a YouTube channel page for 'Sketchbox' by 'Slipstream'. The page features a dark green header with the YouTube logo and a search bar. The channel name 'Sketchbox' is prominently displayed in white. Below the name, it shows 'Slipstream' with '13 videos' and '894 views', and a note that it was 'Last updated on Jan 13, 2023'. There are three icons for adding to a playlist, sharing, and more options. Below these are two buttons: 'Play all' and 'Shuffle'. At the bottom, there is a description: 'Slipstream's energy modeling tool, Sketchbox,'. The main content area shows a video thumbnail with the text 'Great Design Starts with a Sketch' overlaid on a photo of two women in a workshop setting.

Join us for a virtual workshop to learn how to use Sketchbox in *your* classroom!

Professional development opportunity hosted by KEEP and Slipstream

Date/time: July 20, 2023 (9am - 3pm)

Participants who attend the full workshop are eligible to receive a **\$250** stipend upon completing and submitting an assignment that will be uploaded to DPI WiseLearn.



For more detail and to register scan QR code above, or please visit:

<https://cnroureached.asapconnected.com/#CourseID=283657>

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

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

Energy Career Maps through CREATE

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

SOLAR TOOLKIT



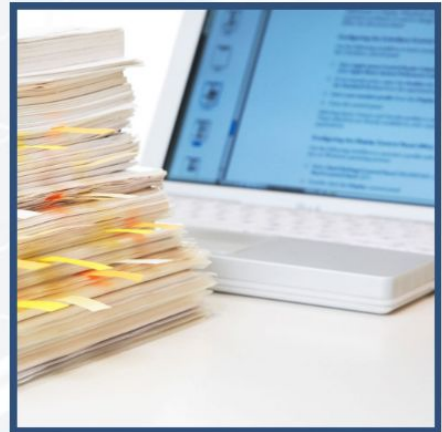
TEACHING MATERIALS



CAREER MAPS



PUBLICATIONS



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

8 video profiles

<https://slipstreaminc.org/cleanenergycareers>

Q&A and feedback forms

End of presentation
