



## High Schools - 2020-2021

### Energy Efficiency and Conservation

#### STEM Activities: 9<sup>th</sup> – 12<sup>th</sup> grade



**Title:** Net Zero Schools

**Objective:** Students research and analyze the benefits and challenges of Net Zero Schools, then form a claim for or against solar installation as a goal for their school.

**Materials:** Internet Access

**Estimated Time Needed:** 90 min

**Background Information:** A zero energy building produces enough renewable energy to meet its own annual energy consumption requirements, thereby reducing the use of nonrenewable energy in the building sector. According to the U.S. Department of Energy, schools spend more on electricity and natural gas than on textbooks and computers. Net zero energy schools virtually eliminate that operating expense.

**Procedures:** (for students)

1. Conduct a literature search to define and explain the concept of Net Zero Schools (See Additional Resources for sample websites).
  - a. Topics to consider:
    - i. Energy-efficiency, environmental, and sustainability goals
    - ii. Natural ventilation
    - iii. Lighting—daylight and electric lights
    - iv. Metering requirements
    - v. Indoor environmental quality
    - vi. Plug load management
2. Choose and read 1 case study article at: <https://newbuildings.org/case-studies/>
3. Form a claim for or against solar installation in school. Justify your claim, consider risks and identify unintended consequences.
  - a. Type the location address into [Google Project Sunroof](#). Project Sunroof will analyze the hours of usable sunlight per year and the square footage available for solar panels at your location! - OR- if Project Sunroof is not available for your location type the street address into Google Maps. Open Satellite View.
    - i. [Calculate](#) how many solar panels would need to be installed for average use (if electric bill available, calculate based on average use)
    - ii. [Calculate](#) how many hours of daily (peak) sunlight school receives
  - b. Does the roof face south? South-facing roofs are best for solar. (East and west-facing roofs can also work for solar, but north-facing roofs do not get enough sunshine.).
  - c. Use the compass tool to determine which side of the roof faces south. Are there large trees or buildings shading the roof? A shade-free roof is best for solar! Use the 3D mapping feature on the bottom right corner of the screen of Google Maps to see whether the south-facing roof is shaded. If school has an unshaded, south-facing roof area, it may be a good spot for solar panels!
4. Write either a Descriptive, Explanatory or Persuasive paper to report claim. Identify audience for paper.



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#### **Guiding Questions:** (for teachers)

- What does it mean for a school to be Net Zero?
- What would be the benefits of different types of energy efficiency methods?
- What would be the cost benefit of a Net Zero school?
- What would be the benefits of solar as compared to other sources of renewable energy?

**Evaluation:** Turn in example of student paper.

#### **Benchmarks:**

##### *Science*

- SC.912.P.10.2 Explore the Law of Conservation of Energy
- SC.912.E.6.6 Analyze past, present, and potential future consequences to the environment
- SC.912.E.7.1 Analyze the movement of matter and energy
- SC.912.L.17.11 Evaluate the costs and benefits of renewable and nonrenewable resources
- SC.912.CS-CS.4.9 Analyze Historical Trends

##### *Language Arts*

- LAFS.910.WHST.1.1 Write arguments focused on discipline-specific content
- LAFS.1112.WHST.1.1 Write arguments focused on discipline-specific content
- LAFS.1112.W.1.1 Write arguments to support claims
- ELA.11.C.1.3 Write literary analyses to support claims
- ELA.12.C.1.3 Write literary analyses to support claims
- ELA.12.R.2.4 Compare the development of multiple arguments in related text

##### *Mathematics*

- MA.K12.MTR.3.1 Complete tasks with mathematical fluency
- MA.912.DP.4.10 Given a mathematical or real-world situation, calculate the appropriate permutation or combination.
- MA.K12.MTR.6.1 Assess the reasonableness of solutions
- MAFS.912.F-BF.1.1 Write a function that describes a relationship between two quantities.



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#### Additional Resources:

- Worksheet [CALCULATING THE SIZE OF YOUR PV ARRAY](#) – created by Mark Mastaller at University of Alaska Fairbanks-Bristol Bay
- Article: [Net-zero movement gaining traction in U.S. schools market](#)
- Article: [Net zero energy schools pass the test](#)
- U.S. Department of Energy website [Zero Energy Schools](#)
- The Center for Green Schools website [Guide to Achieving Zero Energy in Schools](#)
- [Net Zero Schools Roadmap](#) – Kendeda Fund

**Extension:** *EcoRise Sustainable Intelligence* [Energy: Lesson 6.1: 101 Fundamentals: Energy](#) In this lesson, students explore the topic of energy via two presentations. The first presentation provides an overview of the primary types of traditional and alternative energy resources we currently use. In the second presentation, students consider some of the pressing energy challenges we face today and think critically about what is being done—and what each of us can do personally—to address those challenges.

Access the *Energy* lesson and resources, along with 159 more lessons  
by enrolling today at [www.ecorise.org/si](http://www.ecorise.org/si)  
Questions? Email us at [support@ecorise.org](mailto:support@ecorise.org)



EcoRise inspires a new generation of leaders to design a sustainable future for all. Our school-based program empowers more than 100,000 youth each year to tackle real-world challenges in their schools and communities by teaching eco-literacy, design, and social innovation.

#### SUSTAINABLE INTELLIGENCE CURRICULUM

Through a partnership with Dream in Green, Miami K-12 teachers now have access to EcoRise's Sustainable Intelligence (SI) curriculum at no cost! SI is an engaging, ready-to-use, K–12 curricula that guides students in building a foundation of environmental literacy and sustainability knowledge across seven eco-themes.

SI introduces students to the challenges and opportunities surrounding sustainability and invites them to develop real-world solutions. Through hands-on activities, design challenges, and eco-audits, students cultivate 21st-century skills such as creative problem solving, collaboration, and systems thinking while fostering leadership, empathy, and mindfulness.

The SI curriculum includes:

- ✓ **160 lessons in both English and Spanish**, including lesson plans, slideshows, videos, activity sheets, assessments, technology tools, and extension opportunities.
- ✓ **Real-world application** and hands-on design projects, including school and home Eco-Audits and Green Design Labs.
- ✓ **Alignment** to the Next Generation Science Standards.

