

# **SUSTAINABILITY CHALLENGE WORKSHOP**

**PICATINNY ARSENAL CASE STUDY | TEACHER GUIDE**

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## LEARNING OUTCOMES

At the end of the workshop, students are expected to:

- 1) Describe the rationale, current threats, and strategies for improving the military's energy resilience
- 2) Demonstrate knowledge of the variations, strengths, and limitations of different renewable energy sources *(aligns with 21 st Century Theme on Environmental Literacy)*
- 3) Analyze simulation data to determine the relative costs and benefits of competing options for a renewable energy portfolio  
*(aligns with NGSS standards HS-ESS3-2 and HS-ESS3-4 and 21 st Century Critical Thinking and Problem Solving Skills)*
- 4) Work effectively in teams to analyze a problem, determine an optimal solution, and communicate findings *(aligns with 21 st Century Critical Thinking and Problem Solving, and Communication and Collaboration Skills)*

## CASE CHALLENGE OVERVIEW

Students assume the role as summer interns for Ultimate Clean Energy Solutions (UCES), a consulting company that advises federal, commercial, and industrial entities that want to shift toward renewable energy. UCES was awarded a contract with Picatinny Arsenal. Students will work within 3-5 person research teams to determine how to best increase Picatinny Arsenal's clean energy usage. Each team will develop a portfolio consisting of solar photovoltaic panels and wind turbines that would allow Picatinny Arsenal to obtain 50% or more of their current energy needs from on-site renewable energy within the next 5 years. Then students will present their recommendations and supporting rationale to their peers.

Over the past ten weeks, students have been learning about climate change solutions and renewable energy. They will rely on their curriculum knowledge to revise Picatinny Arsenal's infrastructure and present their suggestions to the UCES senior management team.

## PICATINNY RENEWABLE ENERGY CALCULATOR

The [Picatinny Renewable Energy Calculator](#) is a spreadsheet-based analytic tool that will support the students' decision-making throughout the event. The spreadsheet provides details about assets at Picatinny Arsenal that could support different renewable energy installations. The tool also allows students to simulate different renewable energy combinations and gauge effects on key outcomes.

## WORKSHOP ACTIVITIES AND PRESENTATIONS

1) When students arrive at **Catholic University's Pangborn School of Engineering**, they will check in, receive their name tags, pick up breakfast, then prepare for the day-long simulation in the Scullen Room. Facilitators will introduce themselves to student groups (brief ice breaker, if time permits).

9:30 - 10:00 AM

2) The program will open with a 30 minute introduction and overview of the day led by SGAP Leaders, and a University faculty member - Dr. Otto Wilson. It will include a 15 minute review of the Picatinny Arsenal tool and calculator. Once the students are briefed regarding their responsibilities, they will move to the adjacent classroom.

*Estimated time: 30 minutes*

Break

10:20 - 11:18

3) In the classroom, students will meet with their facilitator to discuss the case study and the calculator. The case study includes appendices with vocabulary, links and role description. . **Facilitators will briefly review the Challenge, then make sure that each student understands the expectations of the Challenge and the ways to use the Renewable Energy Calculator.** SGAP Leaders will create a web page with all links and information to assist the students to craft their presentation and support their rationale.

We will have 5 groups of 3-4 students. One facilitator will have 1-2 groups. Student teams will choose a name. FYI: Students have kept the same group since the beginning of the school year.

*Estimated time: 60 minutes*

11:20 - 11:50

4) Working Lunch in the Scullen Room. Students may be creative regarding how they wish to present (drawings, Google Presentation, Google maps of the location etc.). Each student on each team must all be working on an aspect of the presentation. They must collectively decide how best to present. Boxed lunches will be available for facilitators. Please provide your dietary preference and/or allergies to SGAP Leaders during our online training.

*Estimated time: 15 minutes for lunch and 30 minutes for discussion and presentation preparation*

5) Each team will determine their own definition of an “optimal” renewable energy portfolio. Students will work with the [Renewable Energy Calculator Tool](#) to determine the combination of solar and wind energy that best achieves their target outcomes. They will draft a rationale and brief description for their chosen portfolio, noting cost-benefit trade-offs that were observed among the various combinations that were considered.

Each team will then place multi-color stickies on a satellite map of Picatinny Arsenal (that they studied in Modules 9-10) to illustrate where they would place the solar panels and wind turbines. Each team is given

Maps of Picatinny Arsenal (terrain). **Facilitators, please ensure that all high school students are engaged in the activities around the case study (e.g.: no surfing the net on their phone or distracting other teams).**

*Estimated time: 30 minutes*

6) Each team will deliver a brief 3-5 minute presentation for the senior management team of Ultimate Clean Energy Solutions (UCES) describing their renewable energy portfolio, rationale and observations, and map. The presentation should include a description of the underlying rationale and assumptions leading to their portfolio recommendations, as well as key outcomes, strengths and limitations, and any additional findings. Students will employ the presentation strategies they developed from the module they participated in during Module 9.

*Estimated 30 minutes (includes time for questions)*

\*7) Teams that complete the Challenge activity within the allotted time frame will be encouraged to pursue an additional Challenge activity after they complete the Final Survey:

Using the [Picatinny Renewable Energy Calculator](#), teams should evaluate how their portfolio recommendations would change in two or more of the following scenarios:

- A. Primary objective is to maximize energy production
- B. Primary objective is to maximize cost savings
- C. Primary objective is to maximize greenhouse gas reduction
- D. Installation costs cannot exceed \$40 million

If time permits after each team presents, the Senior Management team (judges) will invite class discussion about the observations that teams drew when they explored the Alternative Scenarios Challenges.

Judges will score each team based on a rubric (see Presentation Rubric), then announce the 2 teams with the highest scores. All students will return to the Scullen Room, where the awards will be announced.

## RUBRIC

**TeamWork Timing  
Renewable Energy**

**Knowledge  
Presentation Delivery**

**Strategic  
Approach to Analysis**

**Additional Findings  
(Bonus)\***

**1. Team Work:** Evidence that each team member meaningfully contributed to the primary Challenge, mapping, presentation preparation, and/or presentation delivery. **10 points**

**2. \*Stakeholder Awareness:** In choosing their renewable energy portfolio, the team demonstrates awareness of the needs of Picatinny Arsenal, the surrounding community, the state of New Jersey, and the compelling societal needs for clean, renewable energy and a reduction in GHG emissions. **5 points**

**3. Strategic Approach to Analysis:** The team demonstrates a thoughtful and systematic approach to evaluating different renewable energy combinations within the Picatinny Renewable Energy Calculator and for choosing their selected renewable energy portfolio. **20 points**

**4. Renewable Energy Knowledge:** The team demonstrates fundamental knowledge of energy derived from solar photovoltaic panels, wind turbines, and geothermal systems, including relative strengths and limitations, and considerations about where these energy sources can be placed. **10 points**

**5. Presentation Delivery:** Presenters employ the delivery strategies suggested in their previous seminar, including clear pronunciation, interactive audience engagement, and clean transition between speakers. Students will make an effort to connect to the material, “speak from the heart” (opposed to relying on their visual material), and coordinate transitions with their peers. They will project, speak clearly, and dress the part!

**50 points**

**6. Presentation Timing:** The team’s presentation covers all important material within the allotted time period of 3-5 minutes. [30 second grace period] **5 points**

## **SUGGESTED POST-WORKSHOP EXERCISE**

Amina is a former employee of UCES who recently relocated to Cheyenne, Wyoming. She contacts the project team about a renewable energy project she is working on. Although Cheyenne and the Picatinny Arsenal have similar latitudes, Cheyenne's location and geography have significant implications for renewable energy.

Look at NREL's U.S. maps showing how [Solar Irradiance](#) and [Wind Speeds](#) vary across the country.

***What conclusions can you draw about renewable energy using solar and wind in Cheyenne?***

Although they will not be represented at your presentation, members of the surrounding community as well as the state of New Jersey are important stakeholders in the plan.

***What issues are likely to be important to these audiences that will need to be addressed to elicit their support?***

