**Energy Engineers Invention Challenge**

Students designed and built prototypes in the *Amped Up Engineering* activity in the Power Protectors STEM Challenge. In the *Amped Up Engineering* activity, the problem has been already identified and characterized for students, and a solution has already been selected for them. Students only get to decide the design specifics of the predetermined set of solutions.

We want students to be engaged in the entire innovation process. The *Energy Engineers Invention Challenge* will encourage individual students or teams to apply knowledge and skills that they learned through the Power Protectors STEM Challenge kit to identify a problem related to energy efficiency or sustainable power and to invent a solution using the Invention Convention Worldwide 7 Steps of Invention.

**Module 1: IDENTIFYING and UNDERSTANDING an energy problem (1 hour)**

***Preparation:***

* Print out the SCAMPER worksheets for each inventor/inventor team
* Collect energy-related objects to display for the SCAMPER worksheets. Examples include a phone charger, flashlight, or smart watch. The prototypes of wind turbine, solar panels, or hydropower systems from the *Amped Up Engineering* activity could also serve as these items.
* Print out Inventor Logbook Blueprints for inventor/inventor team

***Activities***:

* Facilitate the ***SCAMPER Part 1 Core Activity*** with energy-related objects [see SCAMPER Part 1 core activity lesson plan] (30 minutes)
* Watch [*Soccer Ball That Generates Energy*](https://www.youtube.com/watch?v=0gifXci-FUk)video from The Henry Ford’s Innovation Nation (5 minutes)
* Have students brainstorm problems or needs related to energy consumption and electricity generation that they can try to solve in their inventor logbook under *Invention Step: Identifying and Understanding* section [see the Scamper Part 1 post activity lesson plan for further guidance and encourage students to think about challenges that they learned about through the Power Protectors activities] (25 minutes)

**Module 2: IDEATING and DESIGNING an energy solution (1 hour)**

***Preparation:***

* Return the inventor logbooks and SCAMPER Part 1 worksheet to inventors/inventor teams
* If possible, laptops/tablets/Chromebooks for inventors to research the problem and existing solutions
* Create an [inHub account](https://inhub.thehenryford.org/)

***Activities:***

* Watch [Solar Grill](https://youtu.be/L8D45UJrv2g?si=5MtY6xDBDFarAusP) video from the Henry Ford’s Innovation Nation series (5 minutes).
* Have students brainstorm and select a solution to their chosen energy problem in their inventor logbook under *Invention Step: Ideating* section. Their problem should be documented in previous sections of their inventor logbooks (15 minutes).
* Play the *Designing your Model* Kahoot! on inHub to introduce key aspects of designing a solution (10 minutes).
  + Sign into [inHub.](https://inhub.thehenryford.org/)
  + Select *Kahoot!* on the inHub dashboard.
  + Open the *Designing your Model* Kahoot! in the *Becoming an Inventor* series.
* Have students begin designing this solution in their inventor logbook under *Invention Step: Designing* section (20 minutes).

**Module 3: BUILDING an energy solution (1 hour)**

Below, there is a lesson plan for building a prototype during a 1-hour visit to a classroom or during a club meeting. Facilitators could extend the building process across multiple hours or weeks to yield better developed prototypes. Alternatively, inventors could work on building their projects independently outside of club meetings or school hours.

***Preparation:***

* Return the inventor logbooks to inventors/inventor teams
* Building materials and tools for constructing initial prototypes [Examples: tape, scissors, construction paper, Arduino or micro:bit kits, wood, 3-D printer]

***Activities:***

* Play the *Building and Testing your Prototype* Kahoot! on inHub to introduce key aspects of building and testing a solution (10 minutes).
  + Sign into [inHub.](https://inhub.thehenryford.org/)
  + Select *Kahoot!* on the inHub dashboard.
  + Open the *Building and Testing your Prototype* Kahoot! in the *Becoming an Inventor* series.
* Have students construct a prototype of their solution and record the process in their inventor logbook in the *Invention Step: Building* section (40 minutes).
* Have students develop a testing plan for their prototype in their inventor logbook in the *Invention Step: Testing* section (10 minutes)

**Module 4: TESTING an energy solution (1 hour)**

As mentioned in the previous section, this 1-hour module could be extended across multiple meetings, or students could work independently on this iteration process.

***Preparation:***

* Return the inventor logbooks to inventors/inventor teams
* Building materials and tools for iterating prototypes after testing [Examples: tape, scissors, construction paper, Arduino or micro:bit kits, wood, 3-D printer]

***Activities:***

* Watch [*Famous Failures*](https://youtu.be/YwMsSG4QhLU?si=iL677FVYca-bBlBa)video from the Henry Ford’s Innovation Nation series (5 minutes).
* Reminds inventors of their testing plans that are recorded in their inventor logbooks.
* Have students test their prototype and record the process in their inventor logbook in the *Invention Step: Testing* section (30 minutes).
* Encourage students to iterate their design to address any issues that were identified during test and document this process in their inventor logbook (25 minutes)

**Module 5: COMMUNICATING an energy solution – Part 1 (1 hour)**

Students could work independently on developing their display board outside of class or meetings, but the following lesson plan provides an outline for leading them through designing their display board. For a longer session, give the inventors time to begin designing their boards.

***Preparation:***

* Return the inventor logbooks to inventors/inventor teams
* Poster boards for inventors
* Craft supplies for designing a display board
* Printing the designing my display board worksheets

***Activities:***

* Have students document their communication strategies in their inventor logbook in the *Invention Step: Communicating* section (20 minutes)
* Facilitate the *Designing My Display Board* prep, core, and post activities [see the *Designing My Display Board* lesson plan] (40 minutes)

**Module 6: COMMUNICATING an energy solution – Part 2 (1 hour)**

***Preparation:***

* Return the inventor logbooks to inventors/inventor teams
* Print *Pitch Practice – Guidelines* and Constructive Feedback worksheets
* Display boards from previous module or independent work

***Activities:***

* Screen [this example](https://youtu.be/kwmcuW6otSE?si=BuLc1tWYq-UJiTgD) of a student inventor pitch (5 minutes)
* Facilitate the *Pitch Practice* Core Activity, which involves inventors developing their pitch[see the Pitch Practice core activity lesson plan] (30 minutes).
* Facilitate the *Pitch Practice* Post Activity, which involves inventors pitching to peers and receiving feedback[see the Pitch Practice post activity lesson plan] (25 minutes).

Additional videos on energy-related inventions from The Henry Ford:

* [How Flower Wind Turbines Work](https://youtu.be/3AOeegdAHDA?si=HzQ5SAQVap7ZfqR4)
* [Tree Wind Turbines](https://www.youtube.com/watch?v=Jp0VrAg5eSw&t=7s)
* [How Solar Energy is Used in Water Filtration](https://youtu.be/lA_t8ycO3wU?si=tHINq3aLGnvAFLNh)
* [How One Community Converts Water to Electricity for Homes](https://youtu.be/AGMYVExty0g?si=tF7jrRHKSfpddmfb)