

NYS 4-H Youth Development

POWER PROTECTORS

4-H STEM CHALLENGE



Welcome!

About the 4-H STEM Challenge

Power Up!

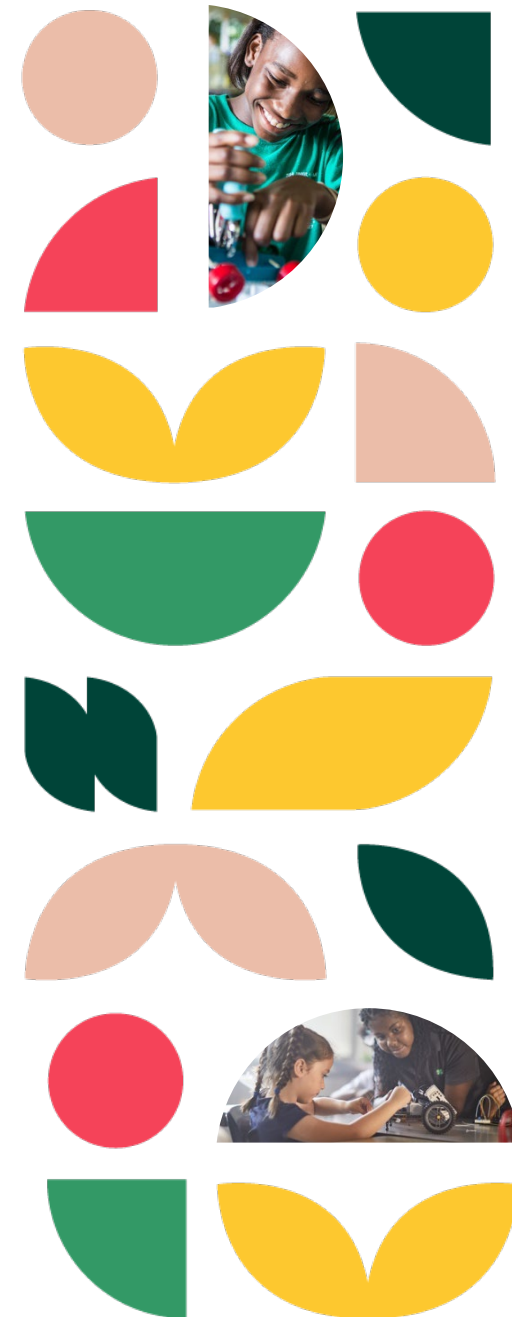
- Reflect on your experience and expectations
- Cultivate developmental relationships
- Grow curiosity through STEM

Adventure through the Kit!

- Kit contents
- Activity tips and tricks

All Systems Go!

- Next Steps
- Wrap Up





POWER PROTECTORS

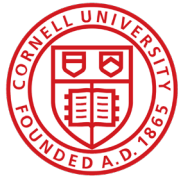
4-H STEM CHALLENGE 

About the 4-H STEM Challenge





Background



Cornell University



UNIVERSITY OF
ILLINOIS
URBANA - CHAMPAIGN



Utah State
University



West Virginia
University

The 2023 4-H STEM Challenge, *Power Protectors* teaches kids how to use science, technology, engineering and math (STEM) to explore the world of **renewable energy**.

Developed by Council and 4-H educators from Cornell University, The University of Illinois, West Virginia State and Utah State University, *Power Protectors* is a collection of three activities that provide kids with STEM-based content knowledge and the opportunity to develop learning skills, address real word issues, and connect to careers in energy.



The Story



Power Level: CRITICAL. Through decades of neglect and waste, Energy Island is in danger of becoming unplugged forever. Now it's in the hands of the next generation—The Power Protectors—to bring back a sustainable balance.

Working together as a SUPER team toward a common goal, young people will help endangered Energy Island move from its unsustainable carbon-based energy use to renewable solar, wind and hydro power.

By completing three engaging activities and using cooperation, determination and the POWER of reusable energy, youth will PLAY and WIN together as The Power Protectors!



POWER PROTECTORS

4-H STEM CHALLENGE 

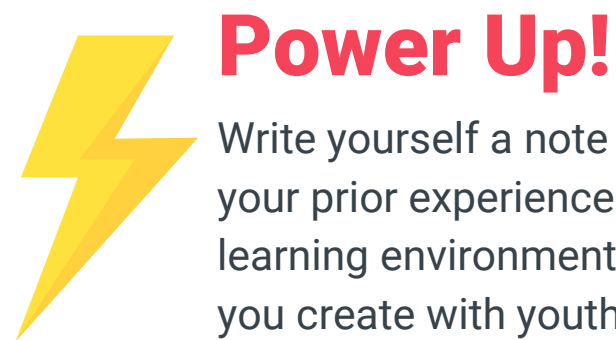
Power Up!
Preparing to Lead Activities



Pause to Reflect

K-W-L

- What I already KNOW
- What I WONDER
- What I have LEARNED
- + How do I FEEL



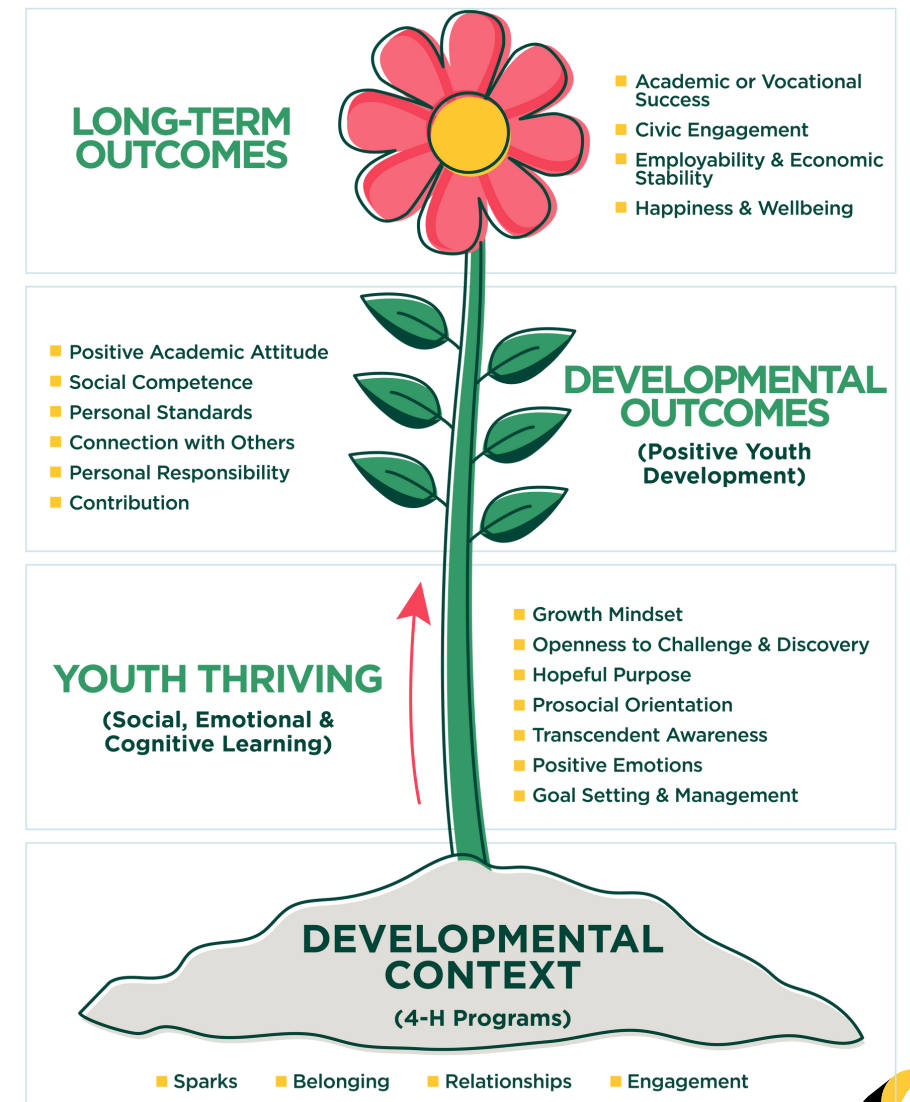
Power Up!

Write yourself a note - How might your prior experience impact the learning environment and experience you create with youth?



Environments for Transformational Learning

- Sparks - interest, skill, or capacity that provides energy, joy, purpose, and direction
- Belonging - youth feel safe, connected, supported, and that they matter
- Relationships - active ingredient of positive youth development
- Engagement - duration and intensity, youth voice

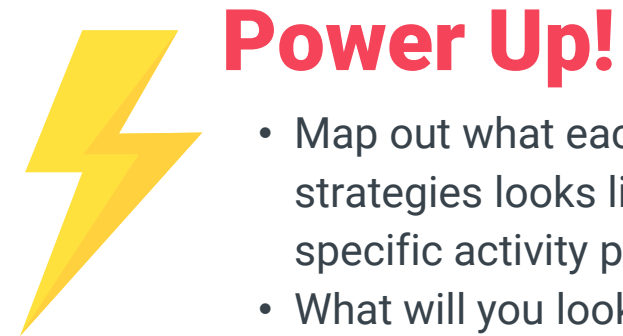


Cultivate Developmental Relationships

close connections between youth and adults that help “young people discover who they are, cultivate abilities to shape their own lives, and learn how to engage with and contribute to the world around them”

(Roehlkepartain, Syversten, & Wu, 2017, p. 3)

- Express Care
- Challenge Growth
- Provide Support
- Share Power
- Expand Possibilities

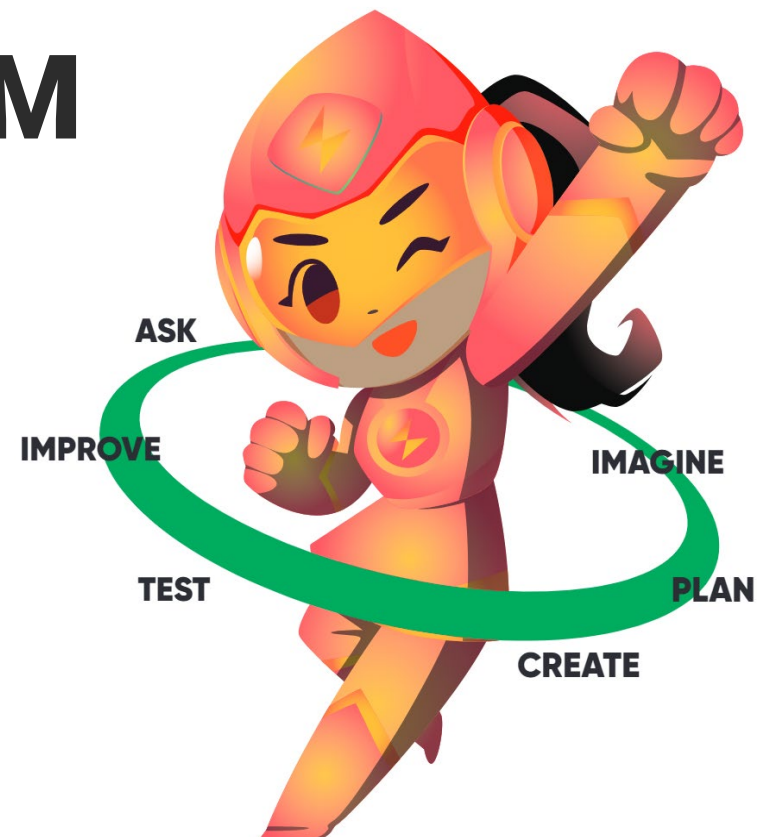


- Map out what each of the 5 strategies looks like in your specific activity plans
- What will you look for to notice youth sparks, sense of belonging, and engagement?



Grow Curiosity through STEM

- Review the Facilitator Guide background information and practice the activities
- Connect with local experts. Who are your supports and champions?
- Prepare to dive into the unknown. How can you partner with youth when you both discover a question you can't answer yet?



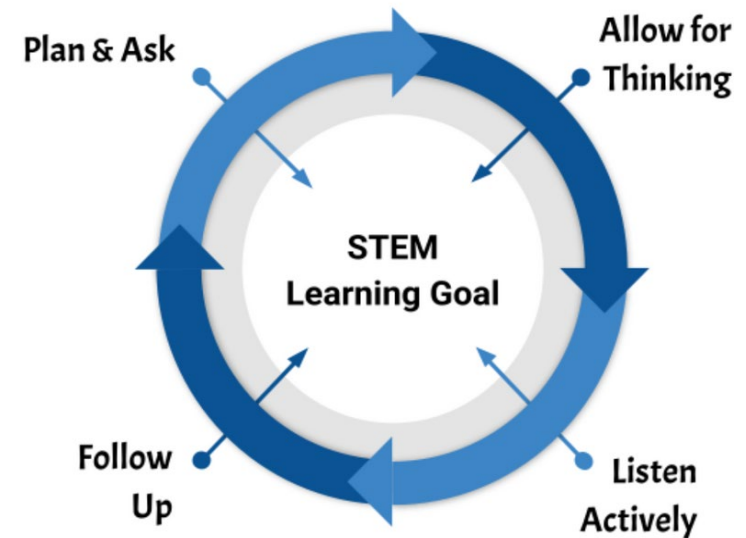
Power Up!

Get local. Research related local resources. Connect with your local 4-H professional if you haven't yet. Check out local and university media sources for current related projects.



First Connection, then Purposeful Questions

- Well-placed questions that drive learning experiences while helping learners understand what they should focus on, and where they should go next
- The Process
 - Start with a purpose
 - Plan some Purposeful Questions
 - Allow for Think Time
 - Follow up to Understand their Thinking



Power Up!

Prepare and practice your purposeful questions, including follow up questions and wait time strategies.



Keep Exploring

- Understand energy as it relates to community
 - [U.S. Energy System Factsheets](#) data. See graphs & fact sheets as resources
 - [United Nations Sustainable Development goals](#)
 - [Project Drawdown](#) and [Regeneration](#)
 - Smithsonian Science Education Center [Sustainable Communities! curriculum](#)
 - National Informal STEM Education Network [Citizen Science, Civics, and Resilient Communities](#) (CSCRC) and [climate change resources](#)
- Know what energy sources are nearby
 - New York locations/maps of [Solar Farms](#), [Hydro power plants](#), and [Wind farms](#)
- Explore potential careers
 - Posters in the kit



Cornell Connections



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“...growing commercial crops on solar farms is a potentially efficient use of agricultural land that can both increase commercial food production and improve solar panel performance and longevity, according to new Cornell research.”

[Made in the shade: Growing crops at solar farms yields efficiency](#)

And related:
[Agrivoltaics Citizen Science](#) from the University of Arizona



“We have all been consuming electricity since we were born, but we don’t know how we consume electricity,” said [Madhur Srivastava](#), assistant research professor in chemistry and chemical biology in the College of Arts and Sciences. “We have no understanding of how much electricity each appliance uses, for example, or each light bulb, or how the costs change for a particular time of use. How can we change our behavior if we have no analysis of it?”

[Cornell, NYSEG pilot app to help consumers moderate electricity use](#)

And related:
[NOVA Labs Energy Lab](#) citizen science project

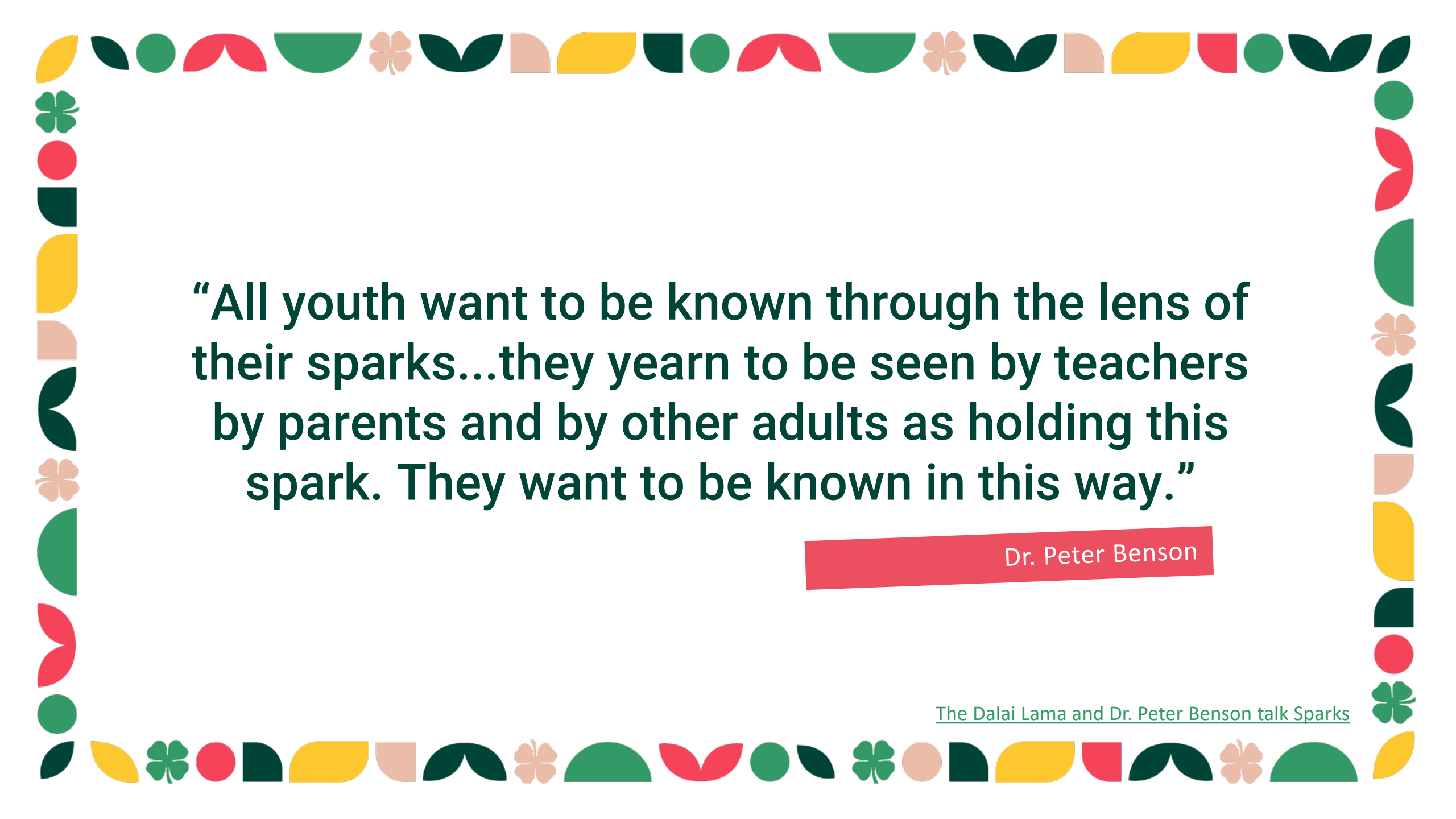


“As New York continues moving toward a green economy, community outreach and education is essential to ensuring all New Yorkers can participate in and benefit from this transition,” Governor Hochul [said](#). “In true New York fashion, these organizations are coming together to help their fellow New Yorkers and ensure every community has the opportunity to thrive.”

[Regional Clean Energy Hubs Program](#)

[Cornell Cooperative Extension Hub leaders](#)





“All youth want to be known through the lens of their sparks...they yearn to be seen by teachers by parents and by other adults as holding this spark. They want to be known in this way.”

Dr. Peter Benson

The Dalai Lama and Dr. Peter Benson talk Sparks



POWER PROTECTORS

4-H STEM CHALLENGE 

Adventure through the Kit



Power Protectors Kit

Includes

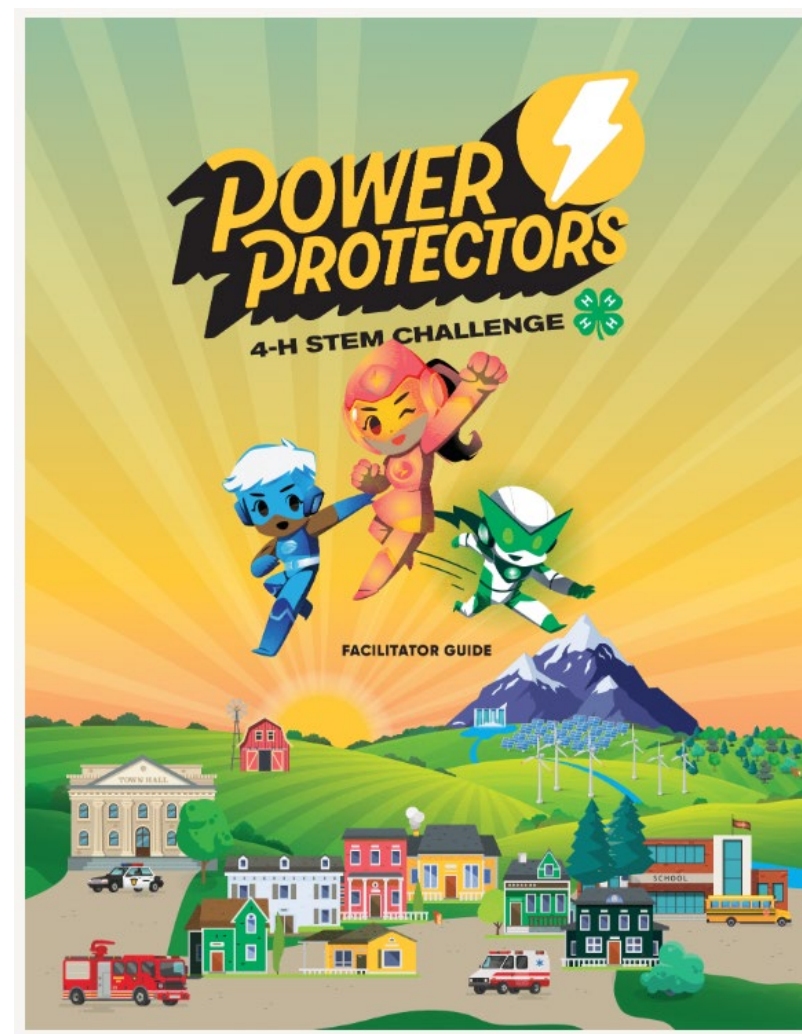
- Three engaging activities highly adaptable for
 - Afterschool programs
 - 4-H clubs
 - Classrooms
 - Home use

Activities designed to match

- A range of learning objectives
- Time constraints
- Levels of access to technology

Created for

- Youth ranging in age from 8 to 14
- Groups or individuals



Kit Activities

WATTS UP GADGETS

FURNACE 10	HOT WATER HEATER 6	ELEVATOR 6	AIR CONDITIONER 4	ESCALATOR 3
LIGHTS 3	ELECTRIC OVEN 3	REFRIGERATOR 2	MICROWAVE 2	WATER PUMP 2
DISHWASHER 2	TELEVISION 2	HYDROPONIC GARDEN 2	BOX FAN 1	COMPUTER 1
VIDEO GAME CONSOLE 1	INTERNET 1	STANDING MIXER 1	CELL PHONE 1	LAND LINE 0
COOKING UTENSILS 0	STAIRS 0	BOOKS 0	BOARD GAMES 0	THINK ON IT! WHAT ARE 5 OTHER HOUSEHOLD ITEMS THAT REQUIRE 50, 10, 5 WATT?

You have 30 points to power your hideout for the year. What gadgets would you put in your hideout?

DESIGN YOUR SUPERHERO HIDEOUT!

Your challenge: Use your superpowers to design a Super Hideout for your Power Protector. You have 30 points of power to spend. What gadgets would you put in your hideout?

Hideout total energy score: _____

Superhero Hideout

Kids will learn about renewable energy and apply this knowledge to analyze and assess their own energy use. They'll design an electrifying Power Protector hideout using their imagination and critical thinking skills to create a space to collaborate and protect Energy Island.

AMPED UP ENGINEERING

Amped Up Engineering

Using the Engineering Design Process, kids will design and build a model of a sustainable energy source to help Energy Island survive and thrive. They will use their Super Skills of creativity, problem solving and innovative thinking to save the day!

ENERGY ISLAND ADVENTURE GAME PLAY

EACH TURN:

- Draw a resource card to the hand limit.
- Reveal a challenge card.
- OPTIONAL: Trade cards with one player.
- Purchase or renewable energy source OR discard one card.

EACH PURCHASE:

☑️ + ☑️ + ☑️ OR ☑️ OR ☑️

LEVELS OF SUCCESS

Smuggling—Farm, homes, emergency services
Smuggling—Farm, homes, emergency services, school
Thriving—Farm, homes, emergency services, school, transportation, town hall

Energy Island Adventure

Playing this collaborative board game, kids work as a SUPER team to achieve a common goal: Help the endangered Energy Island move from its unsustainable carbon-based energy use to renewable solar, wind and hydro power. They use decision making, communication and collaborative skills to play—and WIN—together as The Power Protectors of Energy Island.

Superhero Hideout

Youth will:

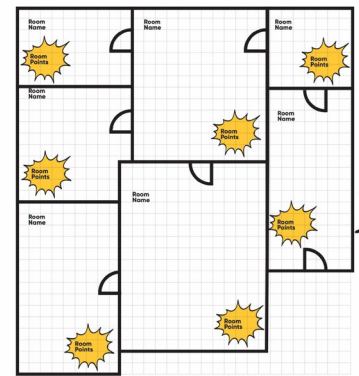
- Be introduced to renewable energy concepts
- Analyze and assess their own energy use
- Design an electrifying Power Protector hideout
- Use imagination, critical thinking and collaboration skills

FURNACE 10	HOT WATER HEATER 6	ELEVATOR 6	AIR CONDITIONER 4	ESCALATOR 3
LIGHTS (for entire hideout) 3	ELECTRIC OVEN 3	REFRIGERATOR 2	MICROWAVE 2	WATER PUMP 2
DISHWASHER 2	TELEVISION 2	HYDROPONIC GARDEN 2	BOX FAN 1	COMPUTER 1
VIDEO GAME CONSOLE 1	INTERNET 1	STANDING MIXER 1	CELL PHONE 1	LAND LINE 0
COOKING UTENSILS 0	STAIRS 0	BOOKS 0	BOARD GAMES 0	THINK ON IT! WHAT ARE 5 OTHER HOUSEHOLD ITEMS THAT REQUIRE 50 / 0 KWH?

WATTS UP GADGETS

WATTS UP
FURNACE
Estimated Yearly Energy Cost: \$1,728
Estimated Yearly Electricity Use: 14,040 kWh
Watts Up Score: 10

You have 30 points to power your hideout for the year. What gadgets would you put in your hideout?



DESIGN YOUR SUPERHERO HIDEOUT!

Your challenge: Use your superpowers to design a Super Hideout for an evil Super Villain and to be a champion of being energy responsible. You have 30 points to power your hideout for the year. What gadgets would you put in your hideout?

Hideout total energy score:

AIR CONDITIONER
Used to cool a building
Watts Up Score: 4

WATTS UP
AIR CONDITIONER
Estimated Yearly Energy Cost: \$259.20
Estimated Yearly Electricity Use: 2,160 kWh
Watts Up Score: 4





A

B

*This
or That?*



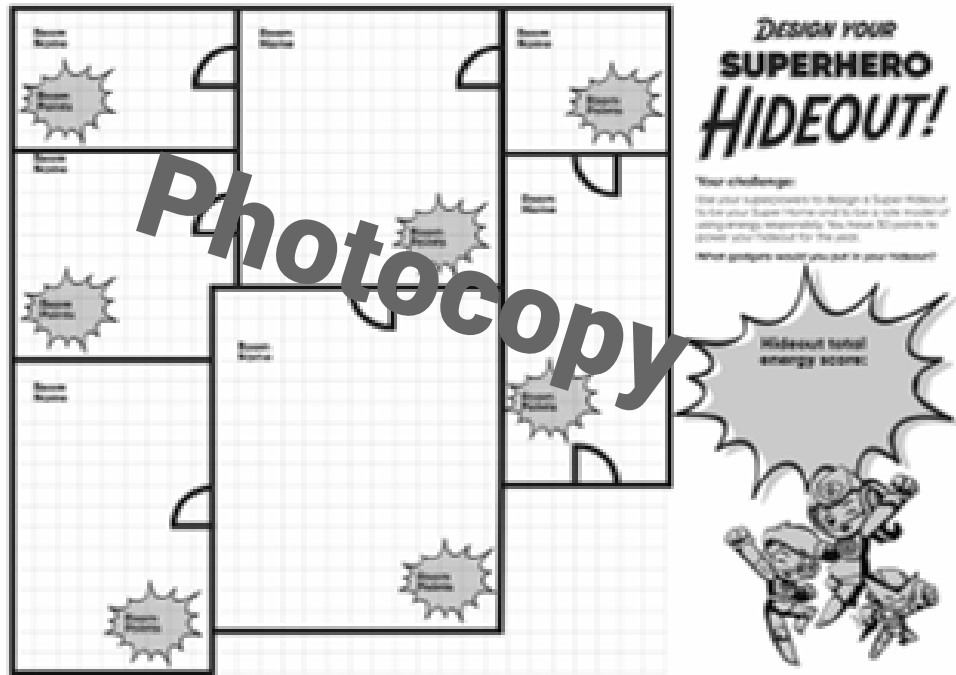
AIR CONDITIONER
Used to cool a building



FURNACE
Used to heat a building



Superhero Hideout Tips & Tricks



Review the Facilitator Guide

- Remember you don't have to be an Expert, ask youth what they think or research if there is a question you don't know the answer to!

Ask yourself

- Time?
- Individual, Partners or Teams?
- Whole Group or Station?
- Photocopy?

Gather needed materials

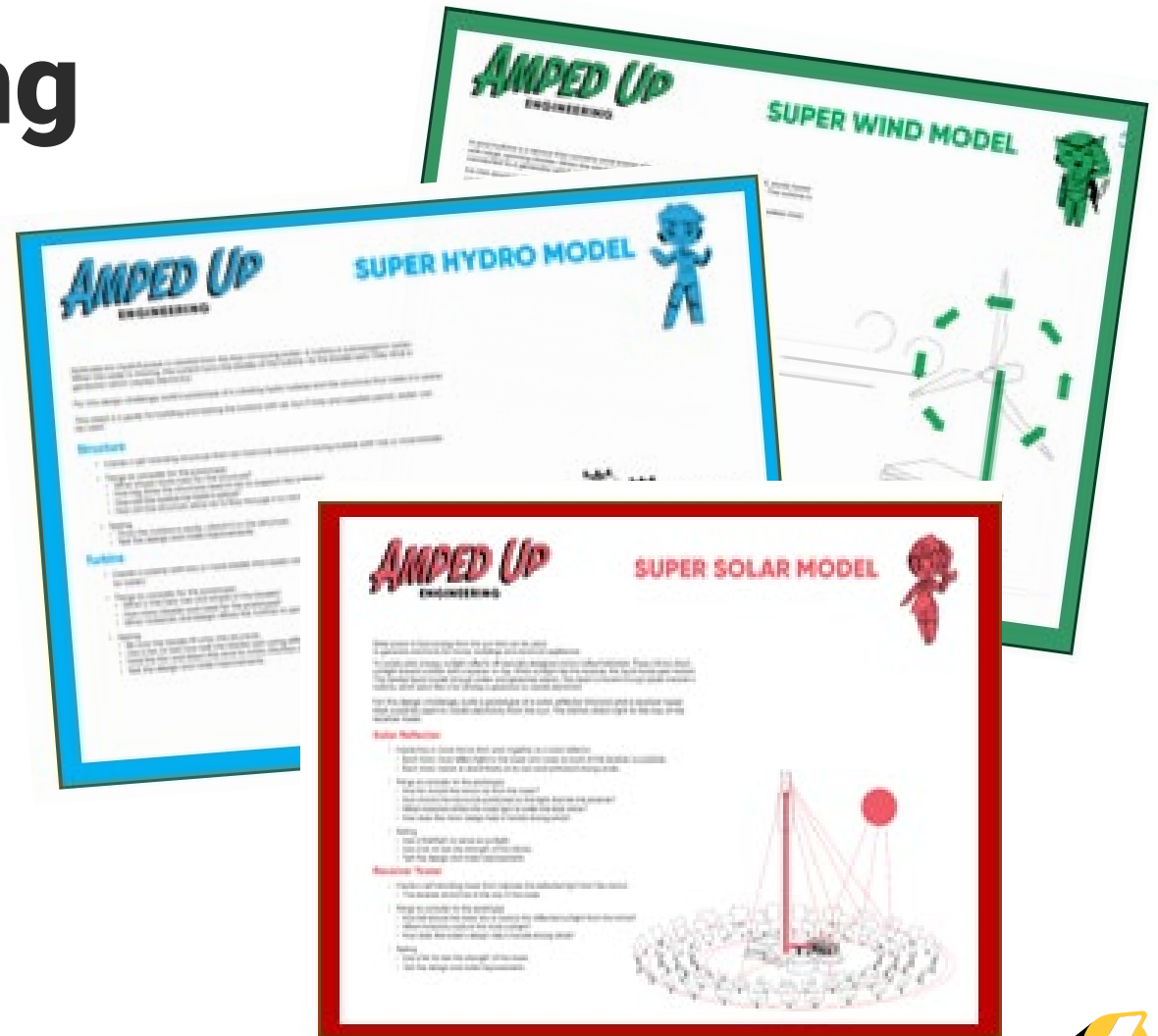
- Watts Up Cards
- Superhero Hideout Blueprint (original 6 or copies if needed)
- Dry Erase Markers
- Paper
- Pencils/Pens



Amped Up Engineering

Youth will:

- Explain the differences between renewable and non-renewable energy sources
- Use the Engineering Design Process to create, build, test and improve a model of solar, wind or hydro power source
- Apply creativity, problem solving and creative thinking skills



Model Redesign

Iterative Process

- Youth choose type of renewable energy
- Build a basic model using common recyclables like cardboard, plastic bottles, and aluminum foil
- Model the process of using renewable energy to turn a generator to create electricity
- Test prototype and revise design

Skill Development

- Resilience - Failure is the first step to success
- Critical Thinking - Learn to identify strengths and weaknesses
- Teamwork - Learn valuable communications and problem-solving skills

In STEM, a project is rarely complete on the first try.

Amped Up Engineering Tips & Tricks



- Request donations of recyclable materials and/or found objects
- Review the Facilitator Guide, Superhero Support Sheets, and Engineering Design Process

Ask yourself

- Time?
- Individual, Partners or Teams?
- Whole Group or Station?
- Prototype?
- Photocopy?

Gather needed materials

- Super Support Sheets (original 6 or copies if needed)
- Dry Erase Markers
- Engineering Design Supply Pack
- Tape and/or low-temperature glue gun
- Scissors or tin snips
- Fan
- Flashlight
- Pencils/Pens
- Recyclable Materials or Found Objects



Request Recyclable & Found Object Donations

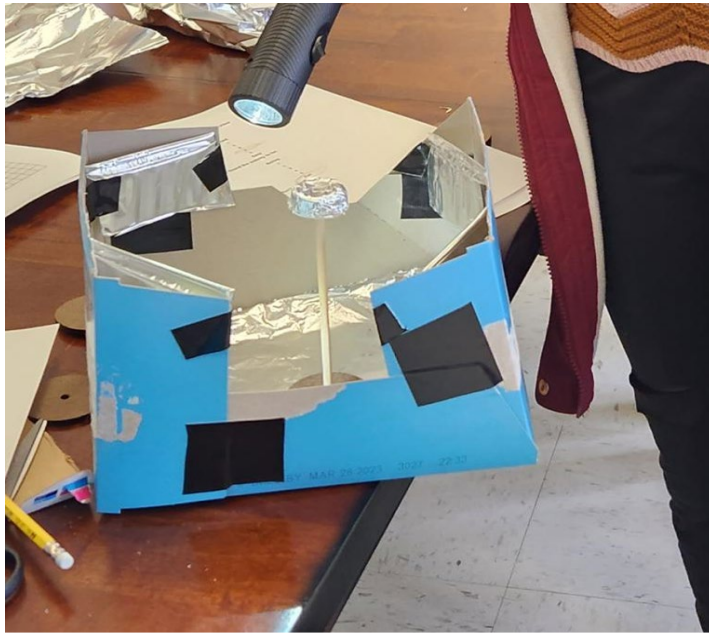
- Cardboard
- Toilet paper or paper towel rolls
- Plastic bottles- water, soft drink, milk
- Plastic lids
- Plastic Silverware
- Aluminum foil
- Disposable aluminum pans
- Newspapers or magazines
- Disposable plastic food containers
- Old folders or binders
- Popsicle sticks
- Pipe cleaners
- Paper clips
- Straws
- Q-tips
- Toothpicks
- Old or broken toys, especially those with wheels



Example Youth Designs



Hydro



Solar



Wind

Energy Island Adventure

Youth will:

- Describe three types of sustainable energy
- Address problems and create solutions
- Collaborate and strategize to help Energy Island use renewable energy sources such as sun, wind and water
- Apply collaboration, critical thinking and decision-making skills



Cooperation is the greatest superpower of all!

ENERGY ISLAND ADVENTURE GAME PLAY

EACH TURN:

- Draw to replenish up to the hand limit.
- Resolve Caution Cards.
- OPTIONAL: trade cards with one player.
- Purchase a renewable energy source OR discard one card.

EACH PURCHASE:



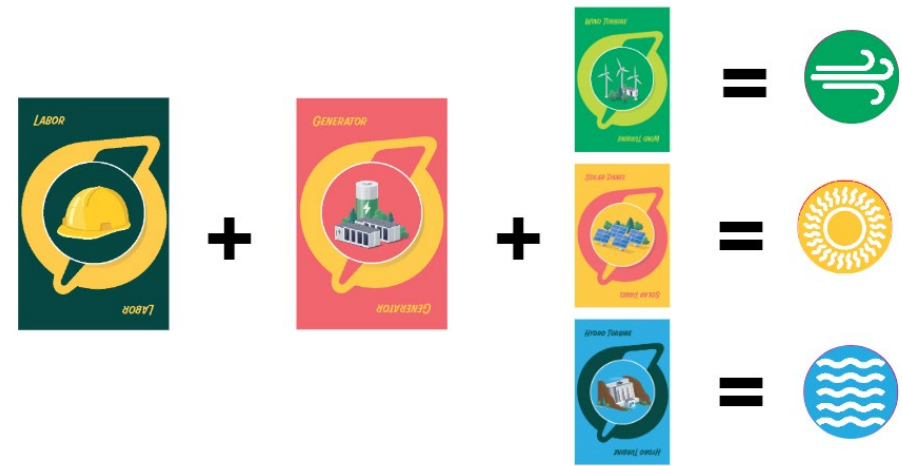
LEVELS OF SUCCESS

Struggling—Farm, homes

Surviving—Farm, homes, emergency services

Sustaining—Farm, homes, emergency services, school

Thriving—Farm, homes, emergency services, school, transportation, town hall

LABOR + GENERATOR = GENERATOR

WIND + SOLAR = SUN

HYDRO = WATER



GIFT

SITUATION: Your work as a Superhero is being celebrated!
Choose one PART card from another player as a reward.

REPLACE

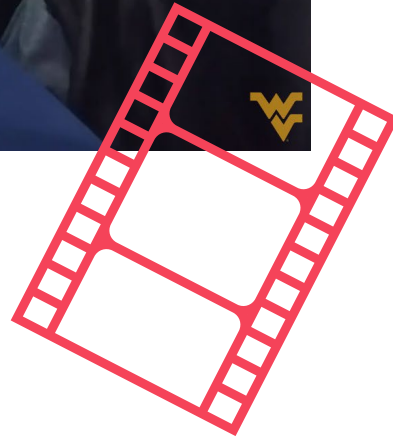
CAUTION: A solar panel developed a hot spot.
Replace it by discarding one solar panel card.



Energy Island Adventure Tips & Tricks



[Power Protectors Gameplay Tutorial](#)



Review the Game Instructions

- If you can, play the game yourself before hand.
- Watch the how-to video

Ask yourself

- Time?
- Whole Group or Station?

Gather needed materials

- Game Board
- Instructions
- Deck of Cards
- Renewable Energy Tokens
- Optional- scrap of paper and pencil to mark each round



Supplies for Larger Groups

More Tips & Tricks

More Materials

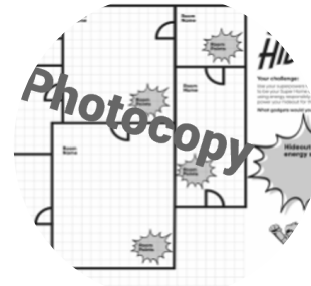
More Sharing



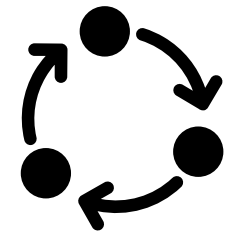
Engineering Design
Parts Pack



Energy Island
Adventure Board Game



Make copies



Learning Stations

Teamwork

More Tips & Tricks

- Youth Teams
- Facilitator Teams





POWER PROTECTORS

4-H STEM CHALLENGE 

All Systems Go!



Your Mission

Work as a team to lead a Power Protectors program for a minimum of one group in your community.

Reach out with questions and for support.

Tell us about your experience.

Upcoming Activities

Your Power Grid

January 12 from 5:30 – 6:30 PM

Practice team-building and connection strategies to keep supporting your local Power Protectors superheroes and power up your power grid. Share your progress so far and plan next steps. Share your Power Protectors story!

Star Power hosted by Cornell Spacecraft Planetary Imaging Facility

January 26 from 5:30 – 6:30 PM

Power Protectors explores ways we can generate electricity here on Earth, but what about on other worlds? As spacecraft, and someday humans, venture into space to explore the Solar System, we'll have to find ways to generate power that work in these alien environments. Join us to learn about these strange new worlds and come up with your own solutions to power the future of space exploration!



Resources

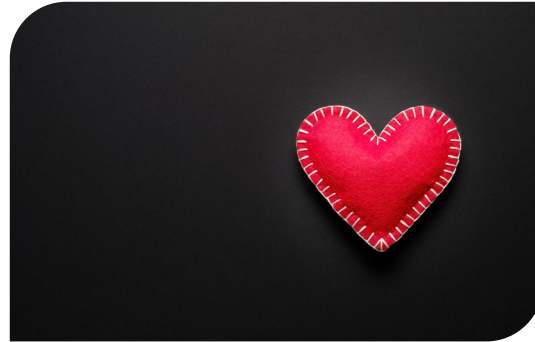
- [NYS 4-H STEM Challenge](#) webpage
- [National 4-H STEM Challenge](#) webpage
 - [Kit Introduction Video](#)
 - Facilitators Guides: English/Spanish
 - Social Media Graphics
 - Career Posters
 - Facilitators Survey
- Email ask37@cornell.edu



Closing Reflections



What is something you learned?



How do you feel?



What is something you will do differently now?



What's something you are grateful for?



Thank you!

POWER PROTECTORS

4-H STEM CHALLENGE

