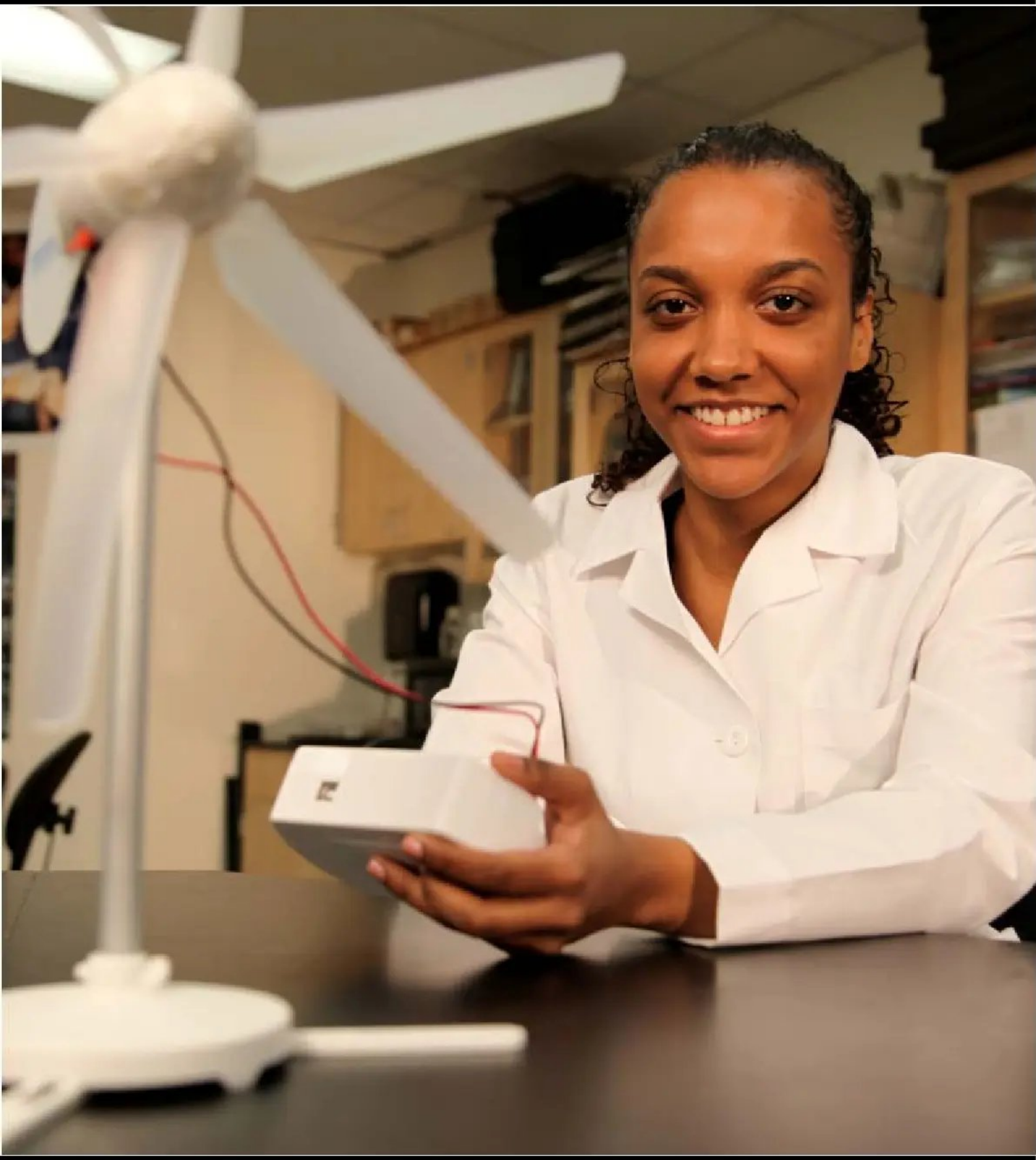
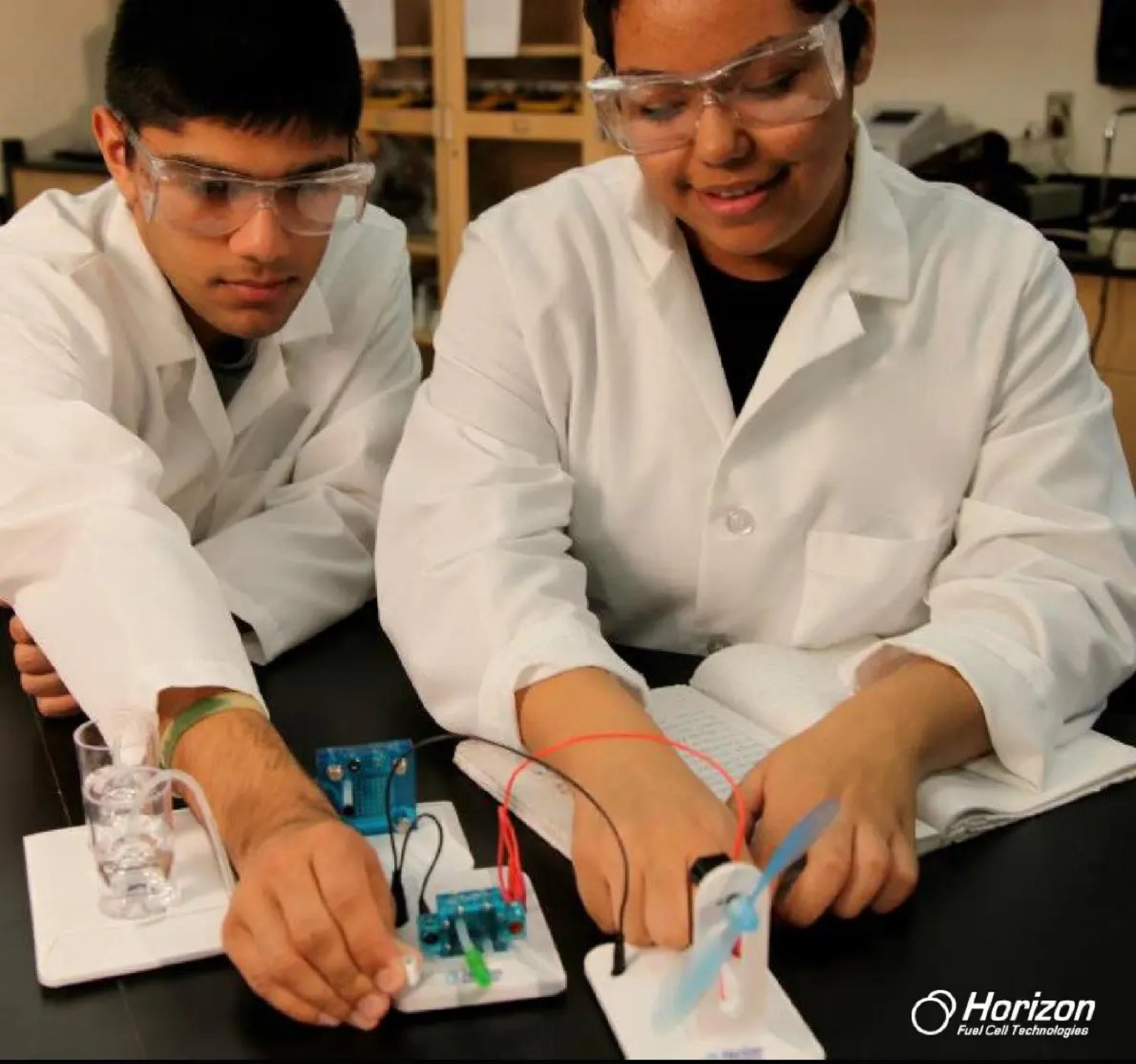
Clean Energy Science Education



Horizon
Fuel Cell Technologies

Clean Energy Science Kits
Product Catalog 2012



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About Horizon Fuel Cell Technologies

Founded in 2003,. Horizon is currently the world's largest volume producer of commercial micro-fuel cell products, serving customers in over 65 countries. The company's technology platforms spans a wide range of PEM fuel cell designs and materials, hydrogen storage and hydrogen generation solutions. The company operates 5 business units, including science education, its earliest and most mature segment. The company is recognized for its superior product designs, and was awarded a Time Magazine Best Invention, as well as an International Design Excellence Award from IDEA Business Week. Today Horizon's products are considered as best in class on hardware, software and content, developed diligently over the years with educators and experts in multiple areas. Other businesses at Horizon develop power supply solutions for consumer electronics, portable and stationary off-grid power, electric mobility and aerospace.



2005 1st product begins shipment

2006 Time Magazine Best Invention

2007 Start of Content Development

2008 Diversification into clean energy

2009 Start of Aerospace business unit

2010 Global market leader in <10W range

2011 Start of global expansion

2012 Launch of Portable Power business

Mission Statement in Education

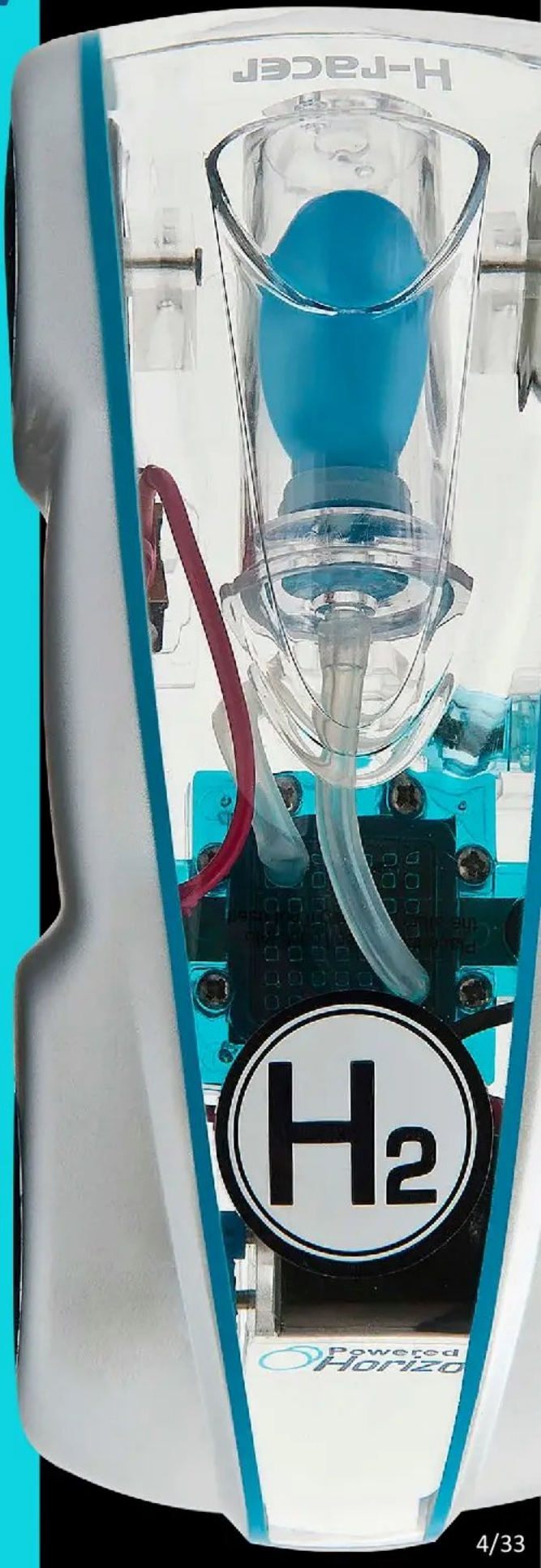
The company's vision is to successfully realize a global move towards a zero carbon economy. A significant part of making this a reality involves inspiring the next generation to become the next scientists, innovators and entrepreneurs in the fast emerging clean energy technology sector. Introducing fuel cell technologies to the general public also means preparing the general public for an understanding of the benefits and potential for this technology, and the science behind it. Horizon is continuously innovating on ways to bring the science across to many young people all over the world, many of which we hope will become the next innovators in this area.

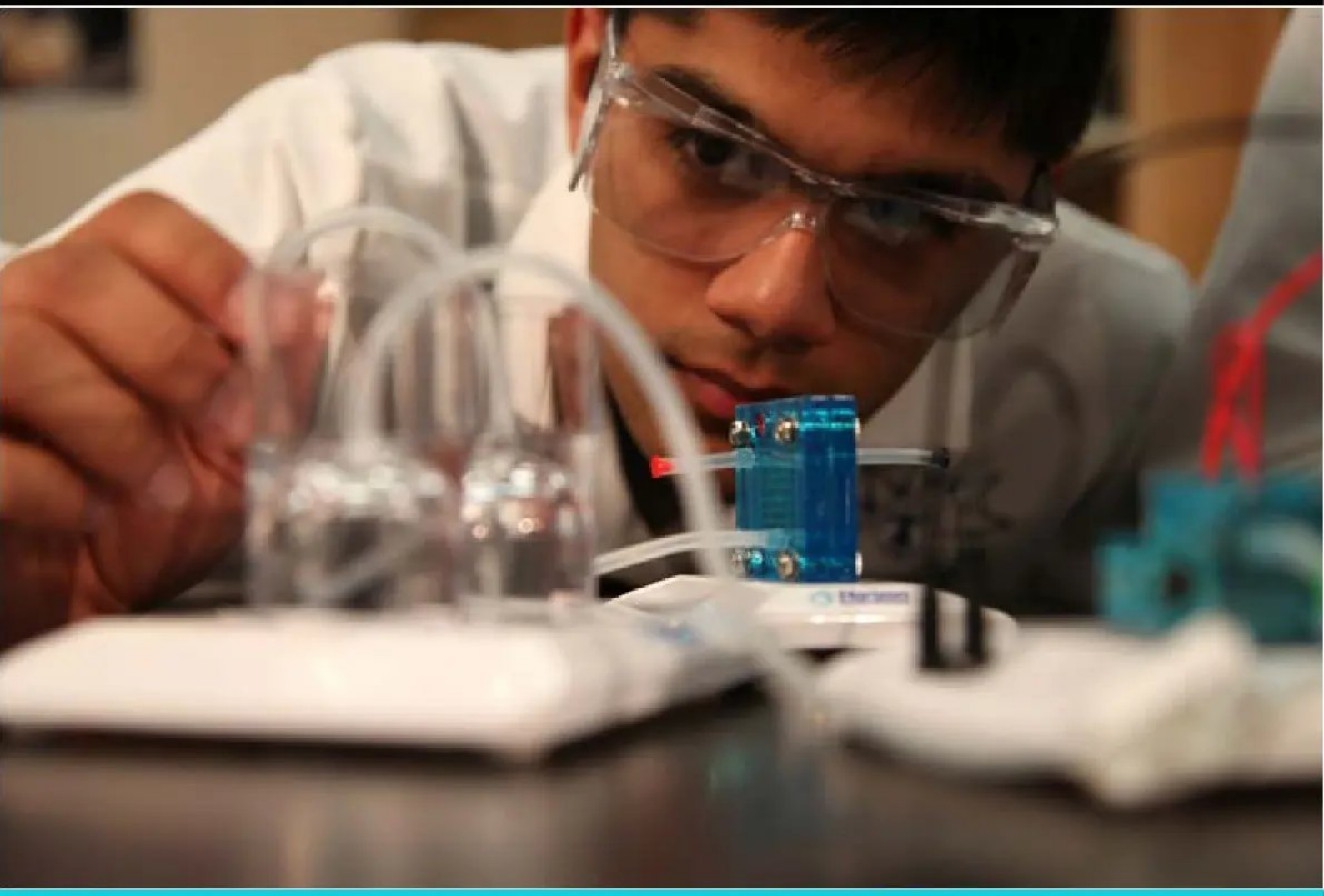
CLEAN ENERGY SCIENCE EDUCATION

HORIZON PRODUCT LINE OVERVIEW

CLEAN ENERGY SCIENCE KITS

1. Renewable Energy Education Lab (REEL)
2. Renewable Energy Education Set (REES)
3. Renewable Energy Monitor (REM)
4. Solar Hydrogen Education Kit
5. Wind-Hydrogen Education Kit
6. Wind-Pitch Education Kit
7. Fuel Cell Car Science Kit
8. Solar Hydrogen Car Science Kit
9. H-racer Car & Solar Hydrogen Station
10. Bio Energy Kit
11. Power Predictor
12. Micro-fuel cells & Electrolyzers





Clean Energy Science Experiment Sets

Designed as the “chemistry sets” of tomorrow, Horizon designed a series of science experiment sets designed to explain renewable energy science in a classroom environment, in school projects or science fairs. Besides classroom activities, their design offers fun and interactive activities for the entire family, and are often used as technology demonstrators by corporations and institutions around the world.

Together with clean energy experts and specialized educators, Horizon developed high value educational content and teacher manuals that bring renewable energy science activities to the classroom. All our products include a comprehensive textbook (CD) covering renewable energy science experiment manuals, teacher notes and classroom guides, animated flash demonstrations, and more. Our quality content complements the award-winning educational kits developed over the course of 8 years.



The widest selection of experiment kits

Designed as the “chemistry sets” of tomorrow, Horizon created a series of science experiment sets to explain renewable energy science in a classroom environment, in school projects or science fairs. Besides classroom activities, their design offers fun and interactive activities for the entire family, and are often used as technology demonstrators by corporations and institutions around the world.

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Item Code: FCJJ-33

1. CLASSROOM Renewable Energy Education Lab



This classroom package can be used as a part of your science, engineering, design or technology courses. It includes hardware, software, and curriculum material take a blended learning approach to teaching green Technologies with applied STEM (Science, Technology, Engineering and Mathematics) activities throughout. Today's students will need a firm grounding in the scientific and engineering principles that underpin these technologies, if they are to contribute to the future of a new sustainable energy economy.

With the contents of the Renewable Energy Education Lab, an entire miniature renewable energy system can be constructed for experimentation and demonstration.

Key Product Features

• Features Revolutionary (NEW) WindPitch Wind Turbine

- Enough hardware, software, and curriculum for 4-5 students to share
- Price per student team (enough hardware, software, and curriculum for 4-5 students to share)
- Recommended age groups - K 6-12
- Contains enough curriculum content to run up to 40 hours of classroom activities.

Item Code: FCJJ-33

1. CLASSROOM Renewable Energy Education Lab



This set includes a real working miniature wind turbine kit, a solar photovoltaic panel, an electrolyzer, a PEM fuel cell, and hydrogen storage system encouraging users to learn the system step by step, configure the system in different ways, and visualize the workings of clean energy principles from start to finish.

This complete classroom package also contains the Renewable Energy Monitor, which is an educational evaluation and monitoring device with measurement software for graphical display of performance characteristics on your PC. Numerous experiments and evaluation activities for hydrogen fuel cells, miniature wind turbine kits, and solar panels will now be quantifiable in real time for voltage, current, power, joules, resistance, and even RPM speed. Contained inside is a complete curriculum on renewable energywith easy to follow experiment manual, assembly guide, flash animations, and background history on the technology.

Item Code: FCJJ-33

1. CLASSROOM Renewable Energy Education Lab

Solar Energy Experiments

1. The Effect of Heat on Solar Panels
2. The Effect of Shade on Solar Panels
3. The Effect of Tilt Angle on Solar Panels
4. Finding the Solar Panel's Maximum Power Point

Energy from Hydrogen Experiments

1. Electrolysis Mode Generating Hydrogen and Oxygen from Water
2. Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen
3. Determining the Minimum Voltage for Water Decomposition
4. Polarization States for Hydrogen Fuel Cells

Wind Energy Experiments

1. How Many Blades Are Best - 1, 2, 3 ... More?
2. Using Three Different Curved Blade Shapes
3. Using Blades You Make Yourself
4. Turbine Efficiencies
5. Measuring RPM
6. Tuning For Maximum Power
7. Determine How Blade Angle or Pitch Affects Output Power
8. To Generate Hydrogen

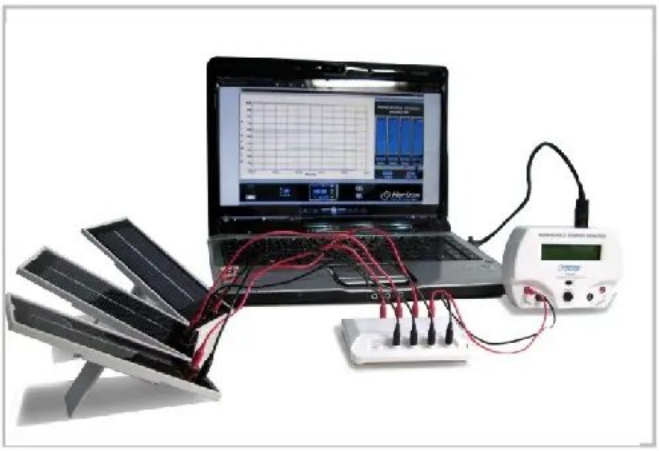
Additional Advanced Experiments

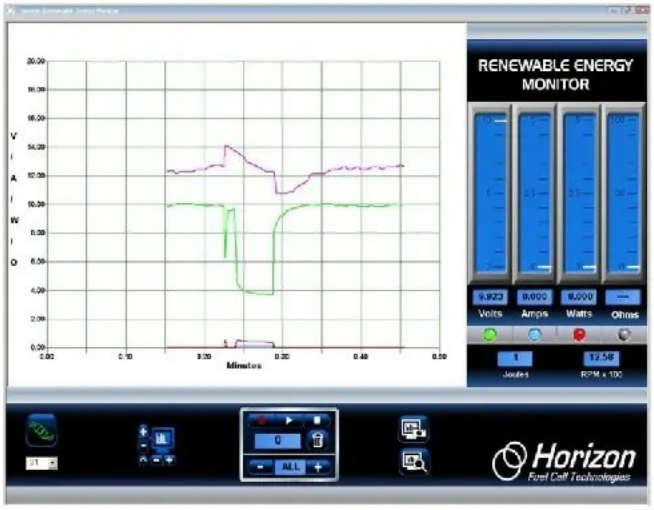
1. Build a Solar Farm
2. Build a Wind Farm
3. Build a Fuel Cells Stack
4. Running Your School With Hydrogen
5. Running Your School With Solar Power
6. Running Your School With Wind Power

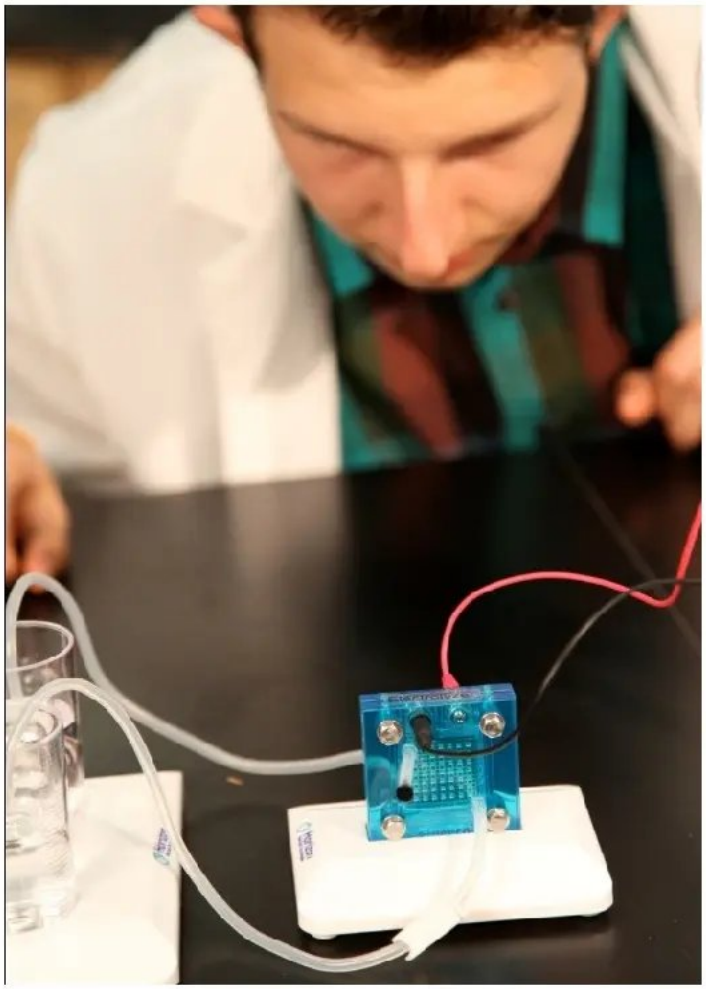


Item Code: FCJJ-33

1. CLASSROOM Renewable Energy Education Lab







Included Contents:

- 1 Watt Solar panel
- WindPitch turbine body
- Rotor head for profiled blades
- 9 profiled blades for turbine (3 sets of 3 types)
- Rotor head adapter for sheet blades
- 3 polypropylene sheet blades for turbine
- Rotor unlocking tool
- Turbine Support base
- Aluminum wind turbine post
- PEM Electrolyzer
- PEM Electrolyzer base
- PEM Fuel cell
- PEM Fuel cell base
- Hydrogen tank
- Oxygen tank
- Inner Gas containers
- Water/gas tank module base
- Flexible 2mm banana connecting leads
- Transparent silicon tubing
- Plastic plug pins for electrolyzer
- Battery pack with connecting leads
- Syringe
- Motor and fan module base
- Propeller blade
- Small car wheel
- LED module base
- Circuit board module base
- 100 ohm Variable Resistor module (potentiometer)
- Adaptors, tubing clincher & purging valve
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals
- Energy Monitor (Data Logging Hardware) with LCD readout screen
- LCD screen provides live measurement of voltage (V, mV), current (A, mA), power (W, mW), RPM speed, Resistance (Ohm), Energy (Joules)
- USB cable- 1 meter length
- CD-ROM with Horizon Data Acquisition software
- CD-ROM with complete renewable energy curriculum
- Flexible 2mm banana connecting leads for connecting to Horizon devices

Extras Needed:

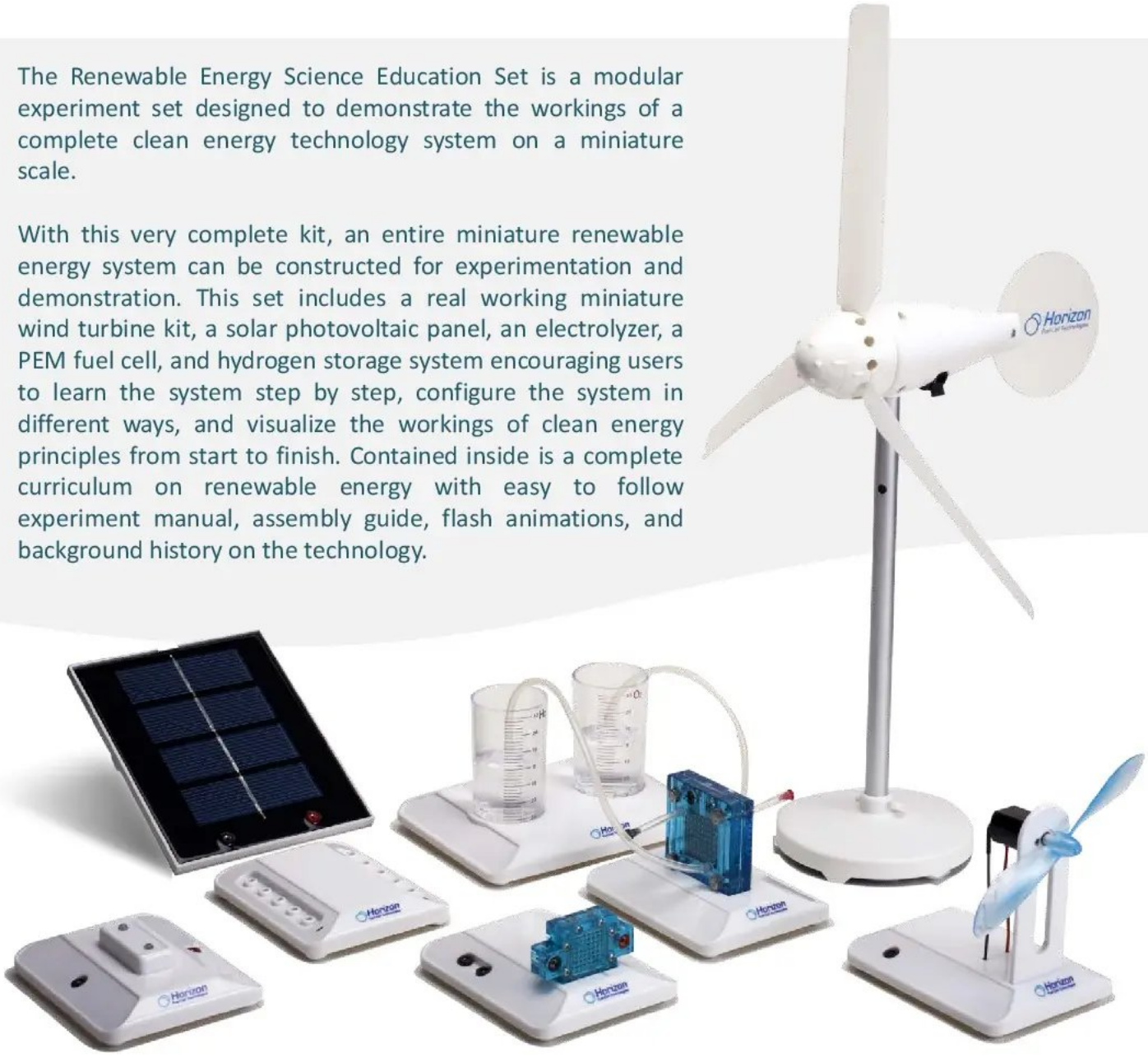
- Lamp for Solar Experiments
- Desktop Fan for Wind Experiments
- PC or Desktop computer

Item Code: FCJJ-27

2. Renewable Energy Education Set

The Renewable Energy Science Education Set is a modular experiment set designed to demonstrate the workings of a complete clean energy technology system on a miniature scale.

With this very complete kit, an entire miniature renewable energy system can be constructed for experimentation and demonstration. This set includes a real working miniature wind turbine kit, a solar photovoltaic panel, an electrolyzer, a PEM fuel cell, and hydrogen storage system encouraging users to learn the system step by step, configure the system in different ways, and visualize the workings of clean energy principles from start to finish. Contained inside is a complete curriculum on renewable energy with easy to follow experiment manual, assembly guide, flash animations, and background history on the technology.



Key Product Features

- Features Revolutionary NEW! WindPitch Wind Turbine
- Enough hardware, software, and curriculum for 4-5 students to share
- Price per 100 students: (20 groups of 5) available
- Recommended age groups- K 6-12
- Contains enough curriculum content to run up to 40 hours of classroom activities.

Item Code: FCJJ-27

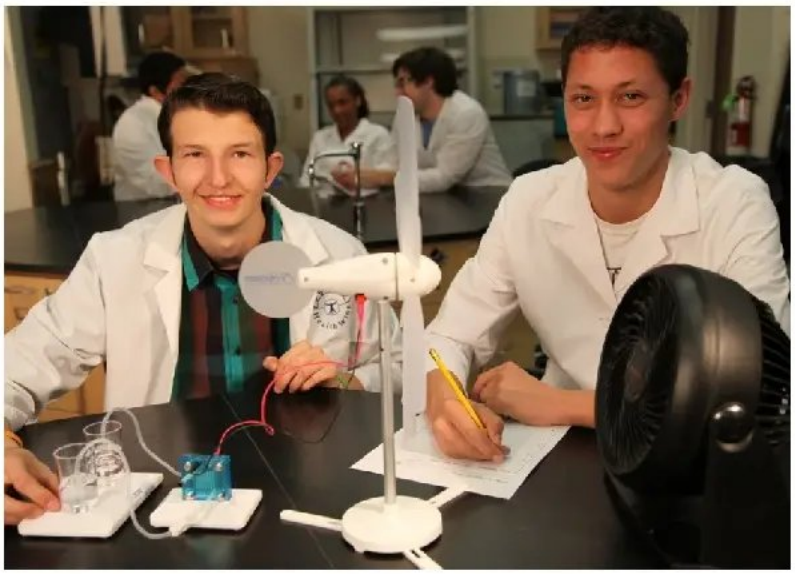
2. Renewable Energy Education Set

Solar Energy Experiments

1. The Effect of Heat on Solar Panels
2. The Effect of Shade on Solar Panels
3. The Effect of Tilt Angle on Solar Panels
4. Finding the Solar Panel's Maximum Power Point

Wind Energy Experiments

1. How Many Blades Are Best - 1, 2, 3 ... More?
2. Using Three Different Curved Blade Shapes
3. Using Blades You Make Yourself
4. Turbine Efficiencies
5. Measuring RPM
6. Tuning For Maximum Power
7. Determine How Blade Angle or Pitch Affects Output Power
8. To Generate Hydrogen





Energy from Hydrogen Experiments

1. Electrolysis Mode Generating Hydrogen and Oxygen from Water
2. Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen
3. Determining the Minimum Voltage for Water Decomposition
4. Polarization States for Hydrogen Fuel Cells

Additional Advanced Experiments

1. Build a Solar Farm
2. Build a Wind Farm
3. Build a Fuel Cells Stack
4. Running Your School With Hydrogen
5. Running Your School With Solar Power
6. Running Your School With Wind Power

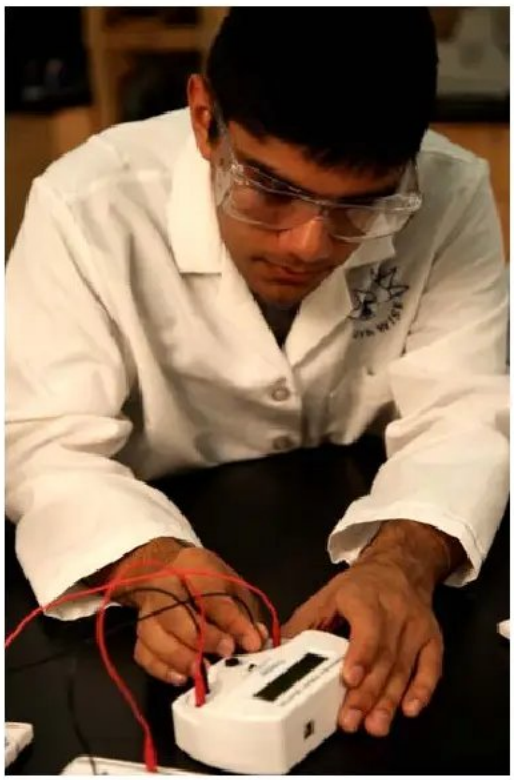
Contents:

- WindPitch turbine body
- Rotor head for profiled blades
- 9 profiled blades for turbine (3 sets of 3 types)
- Rotor head adapter for sheet blades
- 3 polypropylene sheet blades for turbine
- Rotor unlocking tool
- Turbine Support base
- Aluminum wind turbine post
- PEM Electrolyzer
- PEM Electrolyzer base
- PEM Fuel cell
- PEM Fuel cell base
- Hydrogen tank
- Oxygen tank
- Inner Gas containers
- Water/gas tank module base
- Flexible 2mm banana connecting leads
- Transparent silicon tubing
- Plastic plug pins for electrolyzer
- Battery pack with connecting leads
- Syringe
- Motor and fan module base
- Propeller blade
- Small car wheel
- LED module base
- Circuit board module base
- 100 ohm Variable Resistor module (potentiometer)
- 1 Watt Solar panel
- Adaptors, tubing clincher & purging valve
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals



Item Code: FCJJ-24

3. Renewable Energy Monitor





The Renewable Energy Monitor is battery operated so it can also be used with or without a computer – indoors or outdoors – where you can make direct solar and wind measurements.

The Renewable Energy Monitor is an educational evaluation monitoring device with measurement software for graphical display of performance characteristics on your PC. It offers a 2 line LCD screen for viewing measurements that you cycle through at the push of a button – avoiding the multimeter's confusing setup and cumbersome computations.

Horizon developed the Renewable Energy Monitor to provide an immediate, graphical way for recording data directly- with no formulas and nothing to calculate. Numerous experiments and evaluation activities for hydrogen fuel cells, miniature wind turbine kits, and solar panels will now be quantifiable in real time for voltage, current, power, joules, resistance, and even RPM speed.

Key Product Features

- **Compatible with any of Horizons clean energy educational kits!**
- **Compatible on all Windows Operating Systems, and for use on Mac using Windows Parallel or BootCamp**
- **Use indoor or outdoor, with or without a computer!**
- **Ability to export all data to Excel or CSV format**
- **Video Record Function- With the push of a button, record a video live of your experiments for immediate playback and review**

Item Code: FCJJ-24

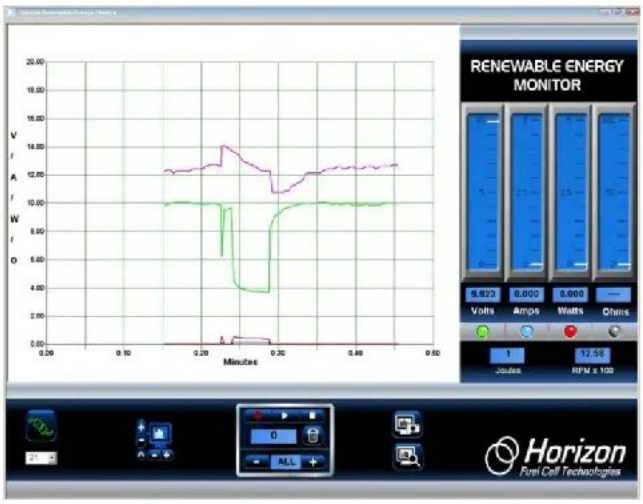
3. Renewable Energy Monitor

Measurement Specifications:

Voltage: 0 - 28 VDC
Current: 0 - 1 Amp DC
Power: 0 - 28 Watts
Resistance: 0 - 999 Ohms
Energy: 0 - 65535 Joules
RPM: 200 - 2500

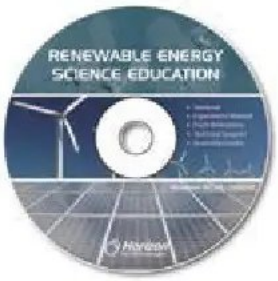
Experiments: (Please refer to page XX for complete list of experiments possible with FCJJ-33, Renewable Energy Education Lab. The possibilities are endless to create your own new experiments!)







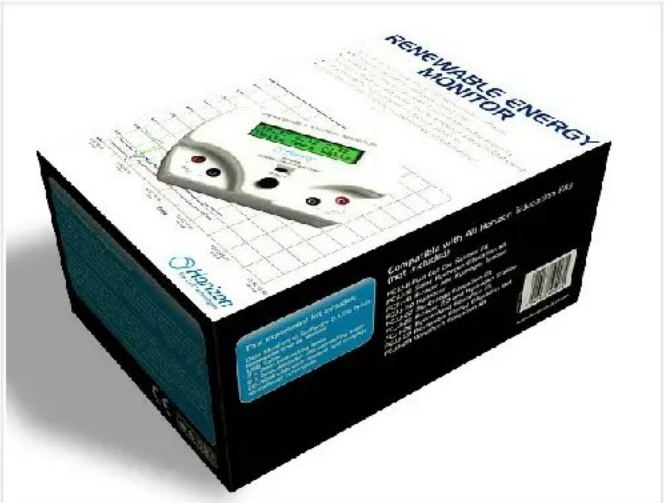












Contents:

- Energy Monitor (Data Logging Hardware) with LCD readout screen
- LCD screen provides live measurement of voltage (V,mV), current (A, mA), power (W, mW), RPM speed, resistance (Ohm), energy(joules)
- USB cable - 1 meter length
- CD-ROM with Horizon Data Acquisition software
- CD-ROM with complete renewable energy curriculum
- Flexible 2mm banana connecting leads for connecting to Horizon devices

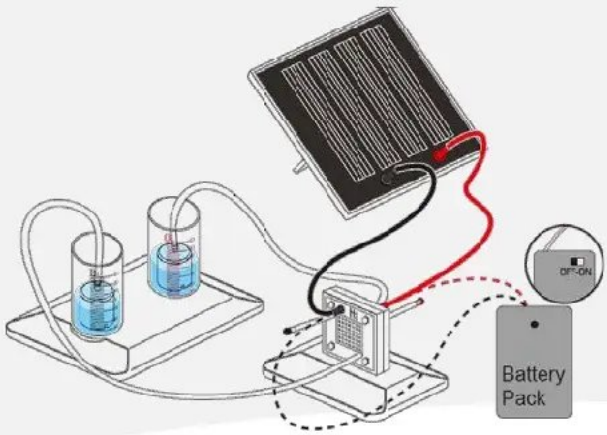
Extras Needed:
1 x 9V Battery (for standalone operation without computer)

Item Code: FCJJ-16

4. Solar Hydrogen Education Set



With this new experiment set you have freedom to invent your own clean energy applications using fuel cells and renewable hydrogen created using solar energy and water. This new set is an optimal tool for inspiration and education in classrooms, as kids get to develop their own applications using a zero-carbon fuel. The kit also comes with a small electric motor and propeller blade as the starting point for motorized applications you can build using your futuristic solar energy storage device.



Key Product Features

- Turn Solar Energy Into Hydrogen Energy!
- Includes Horizon's complete curriculum on renewable energy on CD-ROM
- Focused lessons on solar energy, hydrogen fuel cells, electrolysis, and basic electronics
- Build your own solar powered inventions using a fuel cell!

Item Code: FCJJ-16

4. Solar Hydrogen Education Set

Solar Energy Experiments

1. The Effect of Heat on Solar Panels
2. The Effect of Shade on Solar Panels
3. The Effect of Tilt Angle on Solar Panels
4. Finding the Solar Panel's Maximum Power Point

Energy from Hydrogen Experiments

1. Electrolysis Mode Generating Hydrogen and Oxygen from Water
2. Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen
3. Determining the Minimum Voltage for Water Decomposition
4. Polarization States for Hydrogen Fuel Cells

Additional Advanced Experiments

1.Build a Solar Farm
2.Running Your School With Hydrogen
3.Running Your School With Solar Power



Contents:

- Reversible PEM fuel cell
- Reversible PEM fuel cell base
- Hydrogen and oxygen tanks
- Inner Gas containers
- Water/gas tank module base
- Transparent Silicon tubing
- Flexible 2mm banana connecting leads
- Plastic plug pins for fuel cell
- Battery pack with connecting leads
- Syringe
- Motor and fan with propeller blade
- 1 Watt Solar panel
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals







Item Code: FCJJ-26

5. HydroWind Education Set

With this set you have the freedom to invent your own clean energy applications using fuel cells and renewable hydrogen created using wind and water. This new set includes a real wind turbine, an optimal tool for inspiration and education in classrooms, as kids get to develop their own applications using a zero-carbon fuel. This set now includes the Wind Pitch Educational Kit inside-a miniature real-working wind turbine (wind power generator) designed for students to evaluate the pitch (setting angle) of the profiled blades.

The HydroWind Kit also comes with an LED Voltmeter / Music Maker Module to demon-strate the power created from the wind energy in the form of musical sounds and illuminated LED lights.



Key Product Features

- Turn Wind Power into Hydrogen Energy!
- Build your own Hydrogen-powered inventions using a fuel cell!
- Features Revolutionary NEW! WindPitch Wind Turbine
- Includes Horizon's complete curriculum on renewable energy on CD-ROM
- Focused lessons on wind energy, hydrogen fuel cells, electrolysis, and basic electronics

Item Code: FCJJ-26

5. HydroWind Education Set

Wind Energy Experiments

1. How Many Blades Are Best - 1, 2, 3 ... More?
2. Using Three Different Curved Blade Shapes
3. Using Blades You Make Yourself
4. Turbine Efficiencies
5. Measuring RPM
6. Tuning your turbine For Maximum Power
7. Determine How Blade Angle or Pitch Affects Output Power
8. Using Wind Energy To Generate Hydrogen

Energy from Hydrogen Experiments

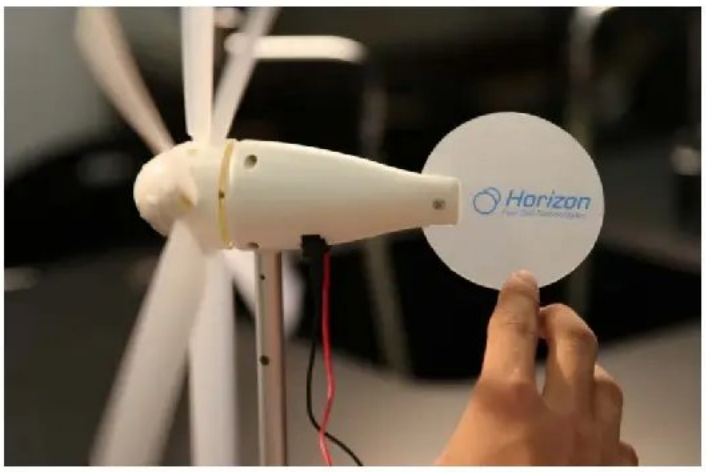
1. Electrolysis Mode Generating Hydrogen and Oxygen from Water
2. Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen
3. Determining the Minimum Voltage for Water Decomposition
4. Polarization States for Hydrogen Fuel Cells

Additional Advanced Experiments

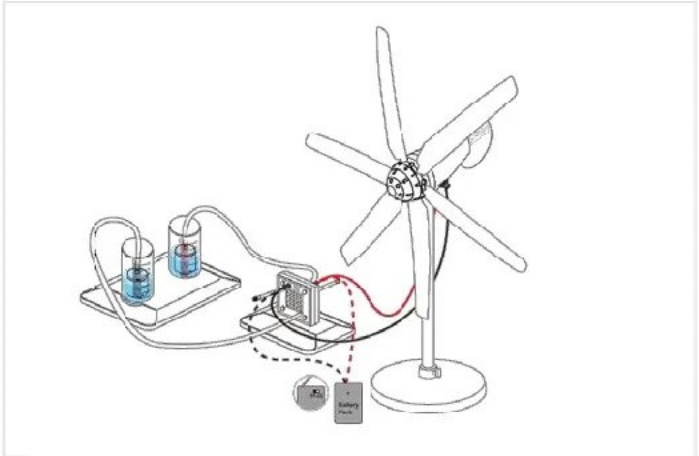
1. Build a Wind Farm
2. Running Your School With Hydrogen
3. Running Your School With Wind Power

Contents:

- WindPitch turbine body
- Rotor head for profiled blades
- 9 profiled blades for turbine (3 sets of 3 types)
- Rotor head adapter for sheet blades
- 3 polypropylene sheet blades for turbine
- Rotor unlocking tool
- Turbine Support base
- Aluminum wind turbine post
- LED Voltmeter/Music Maker Module
- Reversible PEM fuel cell
- Reversible PEM fuel cell base
- Hydrogen and oxygen tanks
- Inner Gas containers
- Water/gas tank module base
- Transparent Silicon tubing
- Flexible 2mm banana connecting leads
- Plastic plug pins for fuel cell
- Battery pack with connecting leads
- Syringe
- Motor with fan propeller blade
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals









Item Code: FCJJ-29

6. WindPitch Education Kit



WindPitch is a miniature real-working wind turbine (wind power generator) designed for students to evaluate the pitch (angle setting) of the profiled blades. Up to 12 profile blades can be installed for evaluation. Learn how the blade pitch and number of blades affect the power output of the wind turbine to maximize the output power. Experimentation also teaches about stalling or reduction of the wind turbine's rotational speed to protect itself under strong wind conditions.

WindPitch includes 3 different types of profiled blades and 1 type of Poly-propylene sheet blades in a complete package that allows many blade parameter's evaluation. The special 3 Phase AC alternator used in the WindPitch is similar to the one used in real commercial wind turbine. WindPitch comes with an LED Voltmeter / Music Maker Module to demonstrate the power created from the wind energy in the form of musical sounds and illuminated LED lights. Contained inside is a complete curriculum on wind energy with easy to follow experiment manual, assembly guide, and background history on the technology and wind power generators.

Key Product Features

- Uniquely designed blade profile based on NASA aeronautics and
- Change the Blade angle from 0-60 degrees
- Most realistic wind turbine experimentation in a product possible on the market
- Complete Wind Energy Curriculum covering vertical and horizontal axis turbines, history on the technology and more...

Item Code: FCJJ-29

6. WindPitch Education Kit

Wind Energy Experiments

1. How Many Blades Are Best - 1, 2, 3 ... More?
2. Using Three Different Curved Blade Shapes
3. Using Blades You Make Yourself
4. Turbine Efficiencies
5. Measuring RPM
6. Tuning For Maximum Power
7. Determine How Blade Angle or Pitch Affects Output Power
8. Build a Wind Farm
9. Running Your School With Wind Power

Contents :

- WindPitch turbine body
- Rotor head for profiled blades
- 9 profiled blades for turbine (3 sets of 3 types)
- Rotor head adapter for sheet blades
- 3 polypropylene sheet blades for turbine
- Rotor unlocking tool
- Turbine Support base
- Aluminum wind turbine post
- LED Voltmeter/Music Maker Module
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals





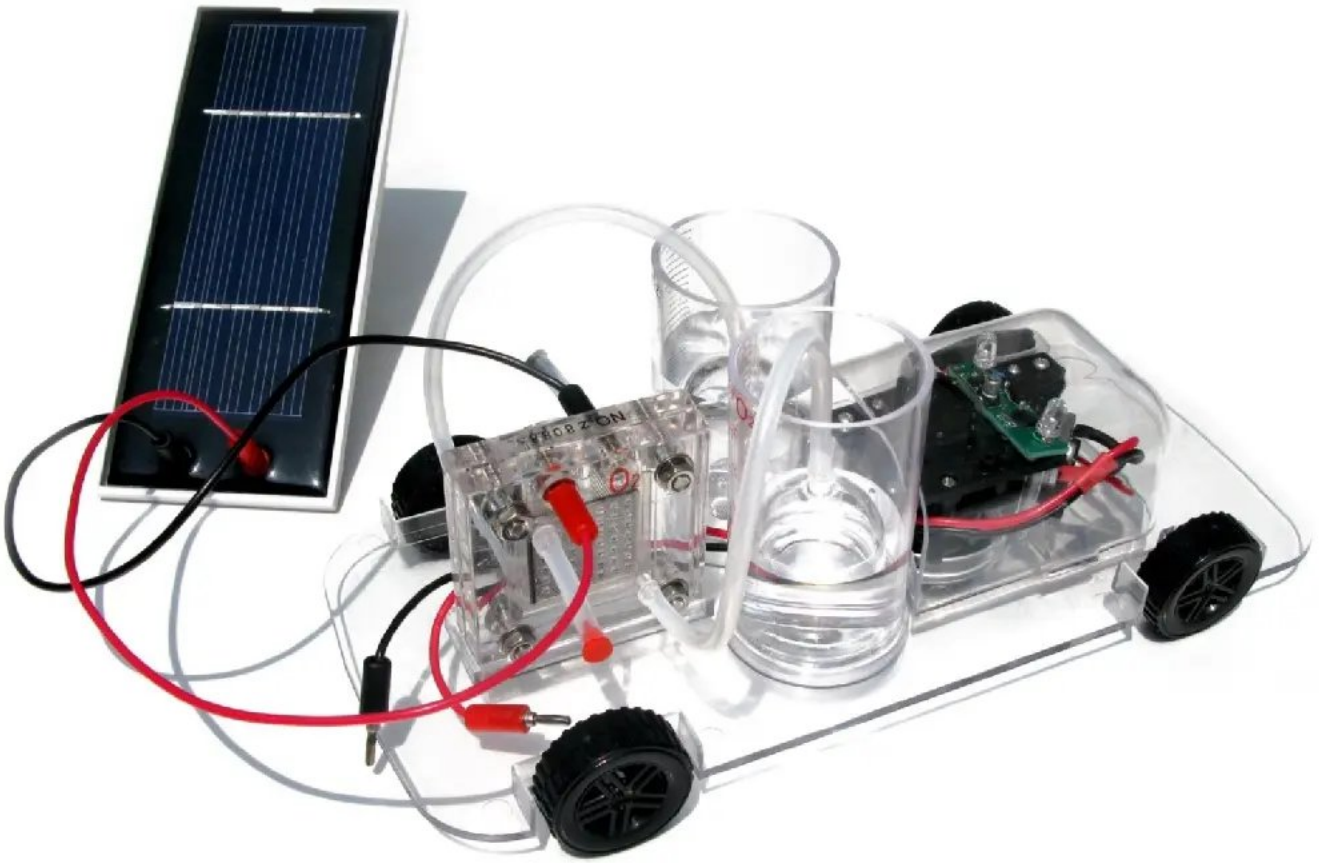




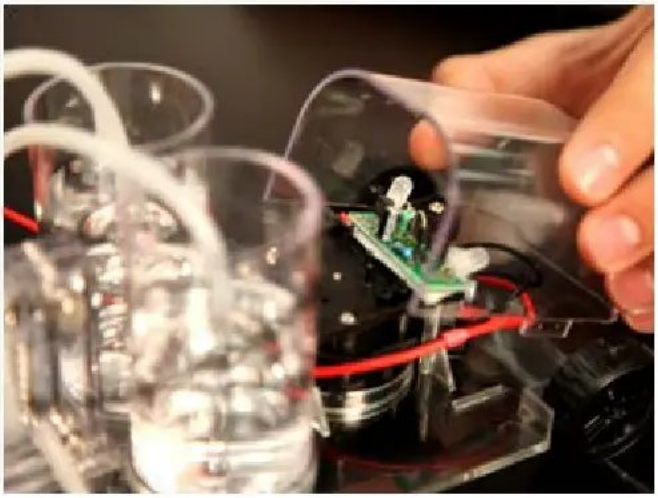


Item Code: FCJJ-11

7. Fuel Cell Car Science Kit



Horizon's Fuel Cell Car Science Kit uses a reversible PEM fuel cell that combines electrolysis and power conversion into one single device. Watch as oxygen and hydrogen gases are formed in two transparent water containers. The car steers independently of the user once in operation: when the car hits a barrier, it will automatically find its way by reversing away 90 degrees. Included in the box is a renewable energy education manual as well as an experiment guide. This fun science kit combines cutting-edge science, education and fun for all!



Key Product Features

- Best entry level fuel cell car kit on the market and one of Horizon's best sellers!
- Clearly demonstrates science behind electrolysis and water decomposition into constituents, oxygen and hydrogen.
- Includes solar panel for powering electrolysis, and complete experiment guide on CD

Item Code: FCJJ-11

7. Fuel Cell Car Science Kit

Experiments and Activities:

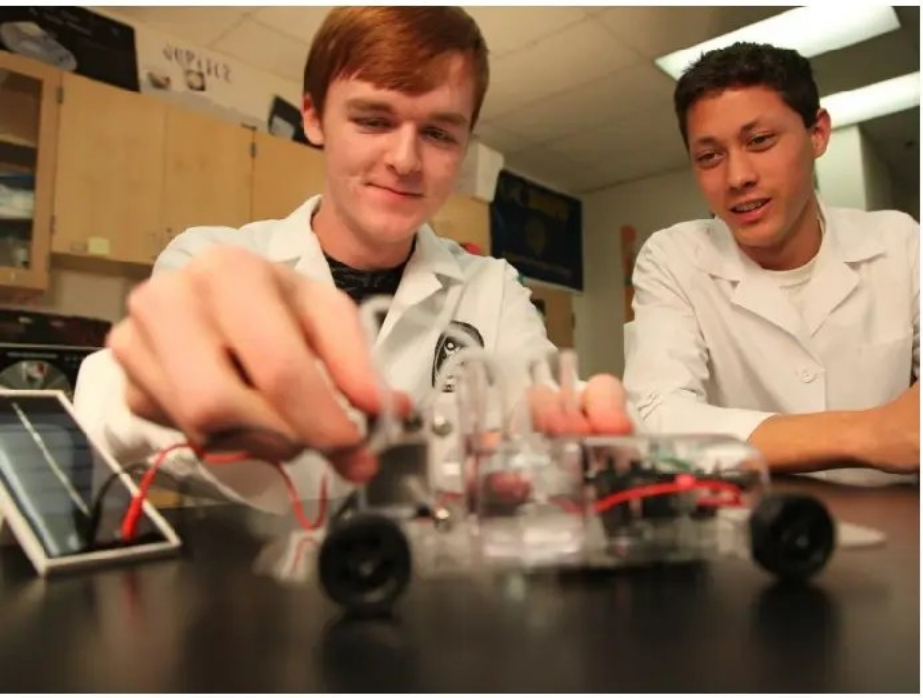
- Assembly and operation of the fuel cell car science kit
- The Effect of Heat on Solar Panels
- The Effect of Shade on Solar Panels
- The Effect of Tilt Angle on Solar Panels
- Finding the Solar Panel's Maximum Power Point

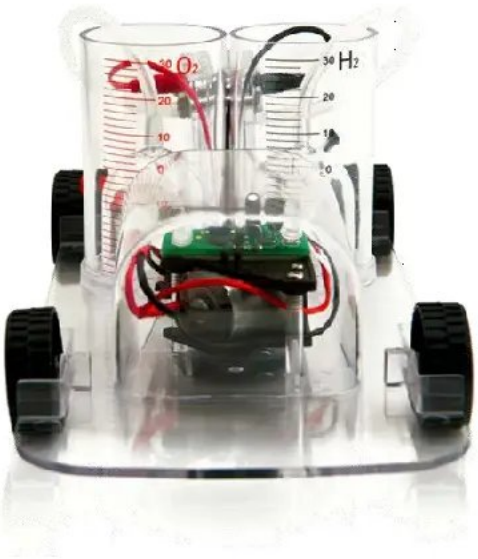
*requires variable resistor module-sold separately

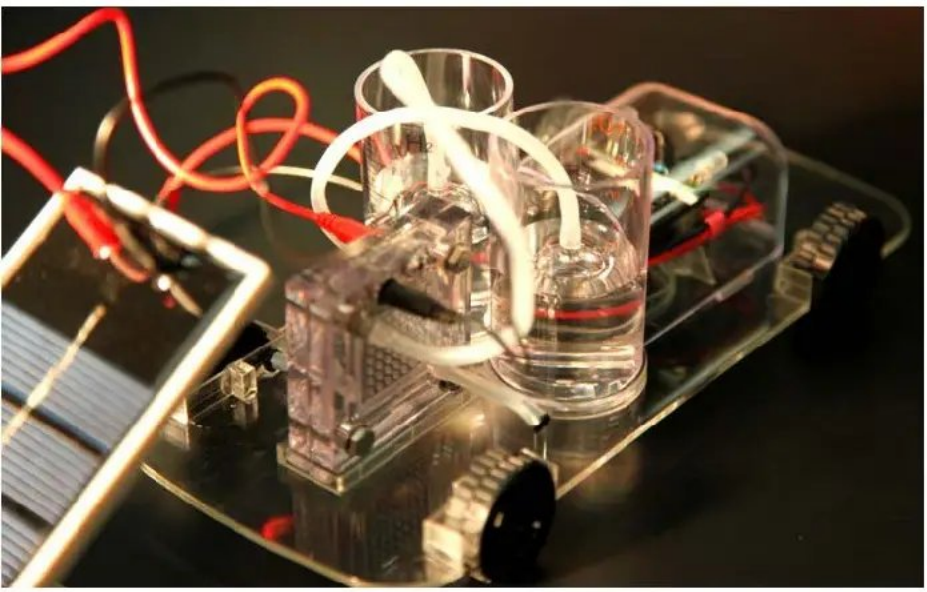
- Electrolysis Mode Generating Hydrogen and Oxygen from Water
- Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen
- Determining the Minimum Voltage for Water Decomposition
- Polarization States for Hydrogen Fuel Cells

Contents:

- Chassis with an LED light and motor
- Reversible (PEM) fuel cell
- 0.75 Watt solar cell
- 2 x 2mm Connecting leads
- Battery pack with connecting leads
- Hydrogen tank
- Oxygen tank
- Inner Gas containers
- Plastic plug pins for fuel cell
- Transparent silicon tubing
- Syringe
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals









Item Code: FCJJ-20

8. Solar Hydrogen Car Science Kit



This vehicle coming straight from the year 2099 is running on clean hydrogen fuel using a next generation reversible Polymer Electrolyte Membrane (PEM) fuel cell. Its new design offers a futuristic feel for what transportation could look like in the next decades. Watch as oxygen and hydro-gen gases are formed in two transparent containers in the back of the vehicle. The kit's fuel cell unit combines water electrolysis and fuel cell functions into one device. The car steers independently of the user once it hits a barrier, and cool blue LED lights flash from inside the cockpit.

Contained inside is a complete curriculum on renewable energy with easy to follow experiment manual, assembly guide, flash animations, and background history on the technology.



Key Product Features

- Great entry level fuel cell kit at an affordable price for everyone
- Clearly demonstrates electrolysis, and water's constituents, oxygen and hydrogen.
- Futuristic design, includes solar panel for powering electrolysis

Item Code: FCJJ-20

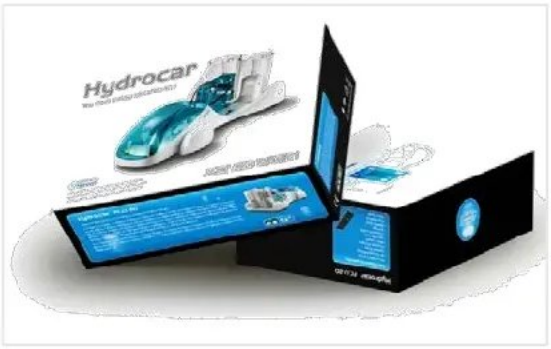
8. Solar Hydrogen Car Science Kit

Experiments and Activities

- *Assembly and operation of the Hydrocar*
- *The Effect of Heat on Solar Panels*
- *The Effect of Shade on Solar Panels*
- *The Effect of Tilt Angle on Solar Panels*
- *Finding the Solar Panel's Maximum Power Point*

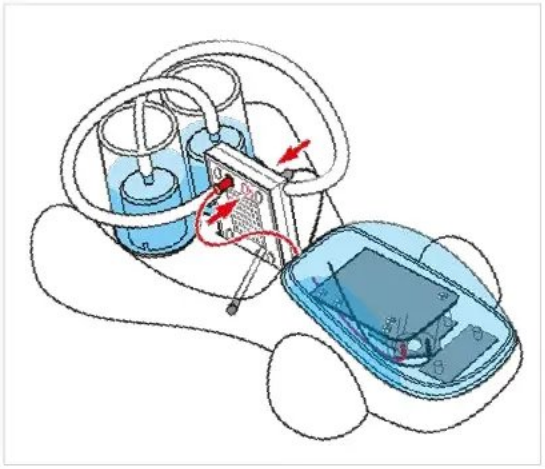
**requires variable resistor module-sold separately*

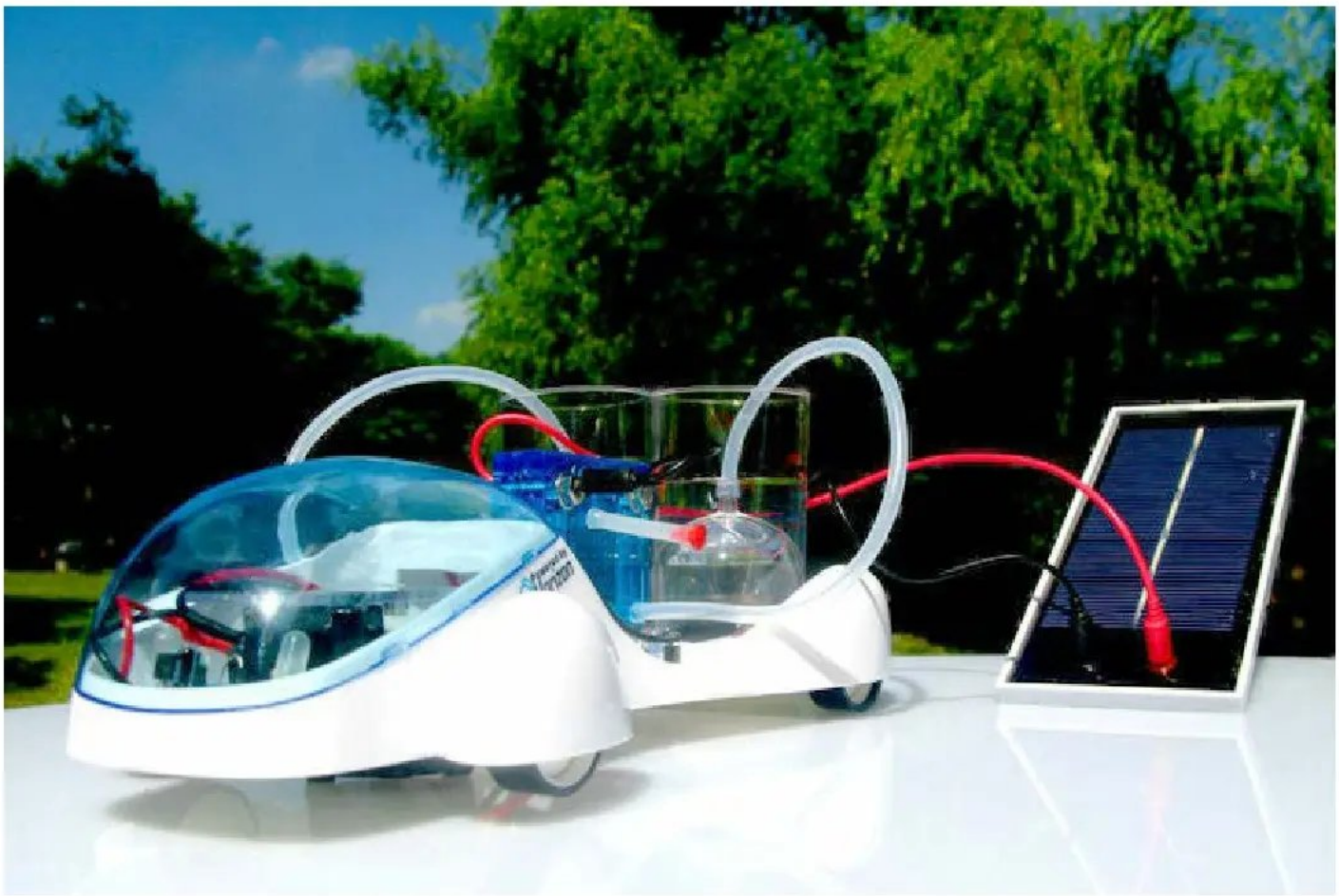
- *Electrolysis Mode Generating Hydrogen and Oxygen from Water*
- *Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen*
- *Determining the Minimum Voltage for Water Decomposition*
- *Polarization States for Hydrogen Fuel Cells*



Contents:

- Chassis with an LED light and motor
- Reversible (PEM) fuel cell
- 0.75 Watt solar cell
- 2 x 2mm Connecting leads
- Battery pack with connecting leads
- Hydrogen tank
- Oxygen tank
- Inner Gas containers
- Plastic plug pins for fuel cell
- Transparent silicon tubing
- Syringe
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals





Item Code: FCJJ-23

9. H-racer Car & Solar Hydrogen Station



Discover the automotive technologies of the future by building and driving your own hydrogen fuel cell car. The H-racer 2.0 is the new generation H-racer, featuring a construction kit of the scale model car, as well as remote controlled steering, and light emitting features within the car. The H-racer received many awards including Time Magazine's "Best Inventions", Business Week IDEA, Metropolitan Home "Design 100", ID magazine annual review, and Business 2.0 Bottom Line Design Awards.

The product includes a solar cell, hydrogen station, remote control, hydrogen fuel cell car assembly parts, as well as a renewable energy education manual and a fun experiment guide.

Key Product Features

- **Accurately reflects how hydrogen cars and refueling stations work in the real world!**
- **Includes solar panel for powering the hydrogen station using renewable energy.**
- **A Time Magazine Best Invention and technology award winner**

Item Code: FCJJ-23

9. H-racer Car & Solar Hydrogen Station

Experiments and Activities

- *Assembly and operation of the H-racer 2.0*
- *The Effect of Heat on Solar Panels*
- *The Effect of Shade on Solar Panels*
- *The Effect of Tilt Angle on Solar Panels*
- *Finding the Solar Panel's Maximum Power Point*

**requires variable resistor module-sold separately*

- *Electrolysis Mode Generating Hydrogen and Oxygen from Water*
- *Fuel Cell Mode Generating Electricity from Hydrogen and Oxygen*
- *Determining the Minimum Voltage for Water Decomposition*
- *Polarization States for Hydrogen Fuel Cells*





Contents:

- Hydrogen station
- Car chassis
- Car body
- PEM fuel cell
- 0.75 Watt Solar panel
- Infrared remote control
- Quick connector
- Purging valve
- Refueling input valve
- Syringe
- Front & rear bumpers
- 3 flexible plastic tubes
- 8 screws
- Connector cable for solar + hydrogen station
- Decorative H2 sticker
- Remote control batteries
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals



Item Code: FCJJ-22

10. Bio-Energy Education Kit



This kit demonstrates the latest in fuel cell technology using ethanol as its fuel source. Currently fuel cells use hydrogen or methanol as fuel. This fuel cell kit directly converts ethanol (alcohol) to electricity silently and without any combustion. The device can run non-stop for hours, providing an amazing demonstration of next-generation bio-fuel cell technology. Included in the box is a renewable energy education manual as well as an experiment guide. Discover the possibilities today!



Key Product Features

- Understanding the properties of an ethanol fuel cell
- Hands on experimentation with a novel new technology

Item Code: FCJJ-22

10. Bio-Energy Education Kit

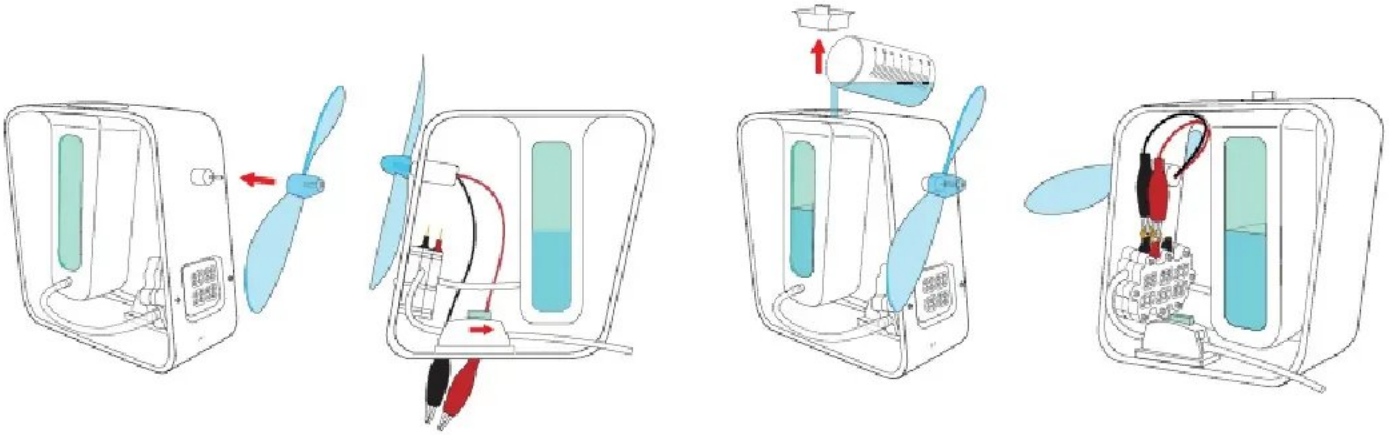
Experiments

1. Create Electricity from ethanol and water
2. Exploring Polarity
3. Investigating the Ethanol Fuel Consumption
4. Exploring the Affect of Varying Fuel Concentrations
5. Create Electricity from Common Wine or Beer
6. Exploring the Affects of Temperature



Contents:

- Sturdy plastic base with ethanol storage
- Rubber tubing
- Purging valve
- Electric motor
- Wire leads with clips
- Fan blade
- Direct Ethanol Fuel Cell
- Container for mixing ethanol solution
- pH paper measuring strips
- Lid for ethanol storage
- Assembly instructions
- CD-ROM with renewable energy curriculum manuals



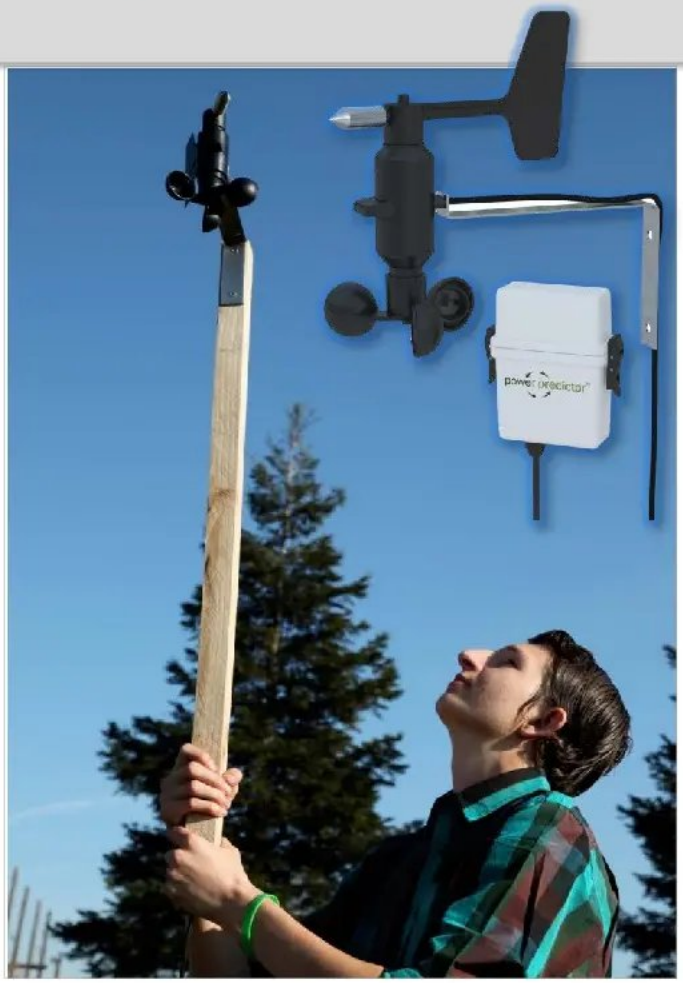




Item Code: FCJJ-32

11. Power Predictor Education Edition

power predictor™



The Power Predictor combines hardware (sensors, measuring tools and data storage) and web-based software to help end-users analyze and decide on the best possible and specific wind turbine or solar panel product available on the market, matching with their exact weather and geographic conditions.

This new breakthrough educational solution combining STEM (science, technology, engineering and math) with real-life green energy solutions, preparing our students for an up and coming green energy industry sector. Enables schools or universities to plan for on-site solar or wind installations and gives the students the opportunity to bring sustainability to their school by making it a student project.

Contained inside is a complete curriculum on renewable energy that offers a diverse set of tasks and large scope of lessons for the students cross-curriculum. This complete solution also offers a web based platform and online forum designed for schools to upload their data, share data with others through inter-departmental access, data comparison and analysis, Google earth software exploration /interaction, and participation and organization of competitions amongst schools.

Become a part of a national or international network of schools using the Power Predictor to teach students the benefits of sustainable energy and enable them to follow through a sustainability project from start to finish.

Key Product Features

- **Software: on-site input of wind speed, wind direction and solar potential measurements**
- **Wind and Solar Data Analysis: wind and solar potential of selected time period**
- **Power and Financial Report: generate reports for renewable technology investments**
- **Share and Compare different location's wind and solar data using Google Earth**
- **Download lesson plans – ready to use lesson plans on a variety renewable energy topic made by teachers, for teachers, for subjects such as Mathematics, Geography, Physics, Design Technology, Business Studies, Environmental Science, etc.**

Item Code: FCJJ-32

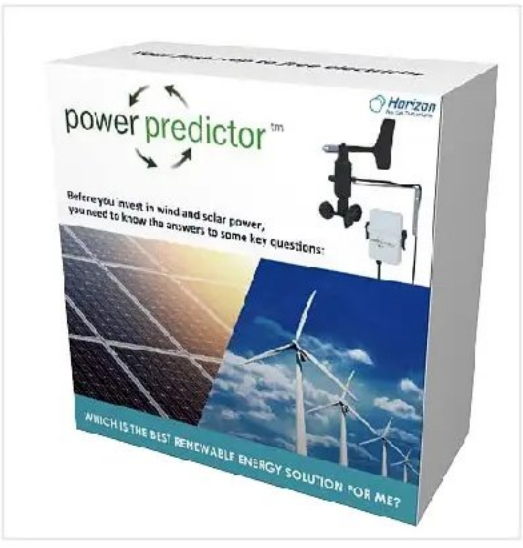
11. Power Predictor Education Edition

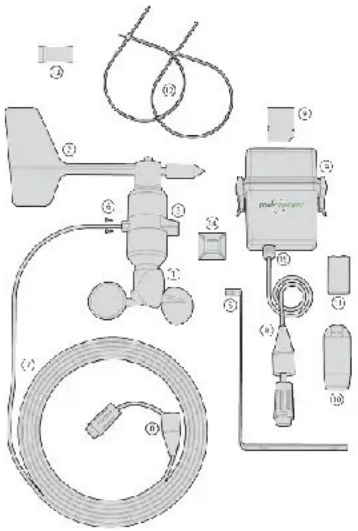
Experiments and Activities

Lesson 1: Choosing the Proper Site
Lesson 2: Designing the Power Predictor Mast Support
Lesson 3: Building and Installing the Power Predictor Mast
Lesson 4: Perform a School Energy Survey
Lesson 5: Perform a Pollution Reduction Prediction Analysis
Lesson 6: Electricity and Magnetism
Lesson 7: Understanding How Wind Turbines Work
Lesson 8: Understanding How Solar Panels Work
Lesson 9: Experiment with Model Wind Turbines and Solar Panels in Class
Lesson 10: Understanding Weather Fundamentals
Lesson 11: Simulating Power Predictor Data
Lesson 12: Retrieving, Uploading and Checking Power Predictor Data
Lesson 13: Comparing Retrieved Power Predictor Data to Weather Conditions
Lesson 14: Analyzing Power Predictor Data with Excel
Lesson 15: Applying Data to Commercial Solar Panels and Wind Turbines
Lesson 16: Model a Commercial Solar / Wind Installation
Lesson 17: Design a Proposal for Your School
Lesson 18: Share Your Results Online with Other Schools
Activity 1: Alternative Energy: Pros and Cons
Activity 2: Conducting a School Energy Survey
Activity 3: Performing a Pollution Reduction Prediction Analysis
Activity 4: Build a Simple Electric Motor
Activity 5: Wind Power and Wind Turbines Lesson
Activity 6: The Science of Solar Panels Lesson
Activity 7: Weather Dynamics









Contents:

- Windspeed cups
- Wind direction vane
- Solar PV cell
- Data logger and waterproof box
- Metal bracket
- 2x Philips screws
- 5m cable
- 2x rubber cable shrouds
- Memory card
- USB memory card reader
- 9V square battery
- Silica gel bag
- Self adhesive cable clip
- Cable gland



Single PEM Hydrogen Fuel Cells – sets of 5 units

Convert H2 and oxygen from the ambient air into electricity and water!

When applying a load and connecting a supply of hydrogen to this device, electricity is generated. This fuel cell's oxygen reactant is supplied directly from the ambient air. This is the perfect item for science labs, classroom use or demonstration purposes!

- Dimensions: 32mm x 32mm x10mm
- Total Weight: 27.3 grams
- Output Voltage: 0.6V (DC)
- Output Current: 0.4A
- Output Power: 240mW



Item Code: FCSU-012

Single PEM Electrolyzers – sets of 5 units

These devices will produce hydrogen and oxygen from pure water and an external power source. To generate hydrogen, they can use a variety of power sources including small solar cells, wind turbines, mechanical hand cranks, or batteries. This is the perfect item for science labs, classroom use or demonstration purposes!

- Dimensions: 54mm x 54mm x 17mm
- Input Voltage: 1.7V ~ 3V (DC)
- Hydrogen production rate: 7ml/min
- Total Weight: 67.7 grams
- Input Current: ≥1A @ 2V
- Oxygen production rate: 3.5ml/min



Item Code: FCSU-010

PEM Reversible Fuel Cells – Sets of 5 units

The reversible PEM fuel cell combines the functions of an electrolyzer and a fuel cell into ONE device. When applying an electrical current the device acts as an electrolyzer that produces hydrogen and oxygen from de-ionized water. When applying a load, the device behaves as a fuel cell and generates electricity from hydrogen.

Its electrolyzer function can use power from solar cells, miniature wind turbines, batteries, or mechanical hand cranks. This is the perfect item for science labs, classroom use or demonstration purposes!

- Dimensions: 54mm x 54mm x 17mm

ELECTROLYZER FUNCTION:

- Input Voltage: 1.7V ~ 3V (DC)
- Input Current: ≥0.7A at 2V
- Hydrogen production rate: 5ml/min
- Oxygen production rate: 2.5ml/min

- Total Weight: 67.7 grams

FUEL CELL FUNCTION:

- Output Voltage: 0.6V. (DC)
- Output Current: 300mA
- Output Power: 180mW



Item Code: FCSU-023

0.6 Watt Solar Panel

Item Code: FCEA-01

Dimensions: 16.5 x 6 cm

Description:
0.6 Watt Solar Panel for use with Horizon's Educational Kits. This Panel is optimal device combined with Horizon reversible fuel cell and elecrolyzers as input power for electrolysis. Connecting Jacks are 2mm banana type, and each panel includes 1 pair of 2mm banana cables. Loading voltage rated at 2V, 300mA.



1 Watt Solar Panel

Item Code: FCEA-02

Dimensions: 12 x 15 cm

Description:
1 Watt Solar Panel for use with Horizon's Educational Kits. This Panel is optimal device combined with Horizon reversible fuel cell and elecrolyzers as input power for electrolysis. Connecting Jacks are 2mm banana type, and each panel includes 1 pair of 2mm banana cables. Loading voltage rated at 2V, 500mA.



Variable Resistor Load Module

Item Code: FCEA-07

Description:
Custom Potentiometer or Variable Resistor allowing you to select resistance levels and apply a variable resistance loads for experimentation with range of 0-100 ohms. This potentiometer connects to other devices with standard 2mm banana plugs.



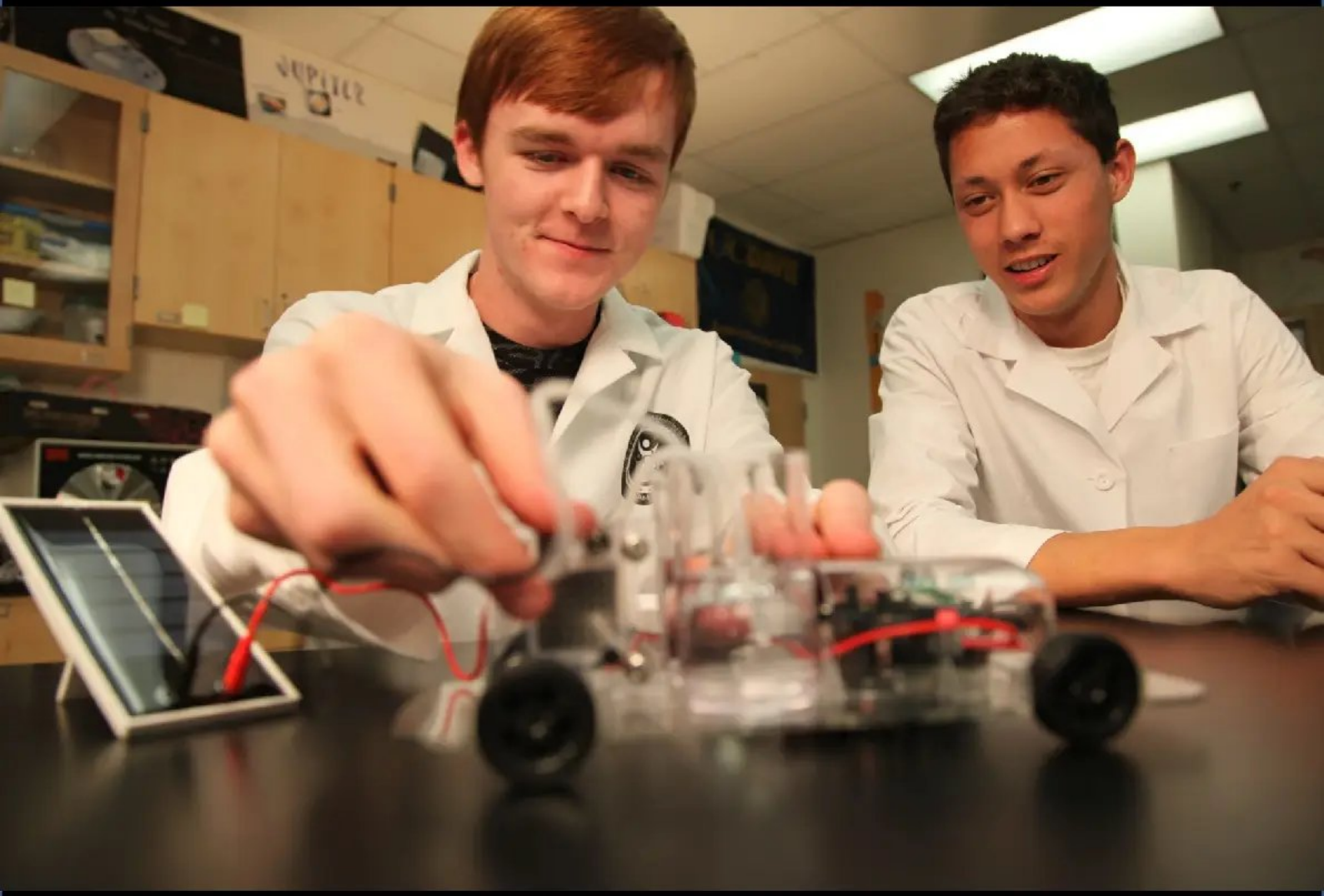
WindPitch Profiled and Sheet Blades - Complete Set

Item Code: FCEA-10

Description:
1 Set of WindPitch blades for the WindPitch Wind turbine that include 9 profiled blades(3 x BP-28, 3 x NACA-44, 3 x NACA 63) and 3 sheet blades.



Horizon
Fuel Cell Technologies



www.horizonfuelcell.com