Horizon Educational

SCIENCE TECHNOLOGY ENGINEERING ART MATHEMATICS

CATALOG 2024

STEAM

THROUGH THE MEDIUM OF **RENEWABLE ENERGY**

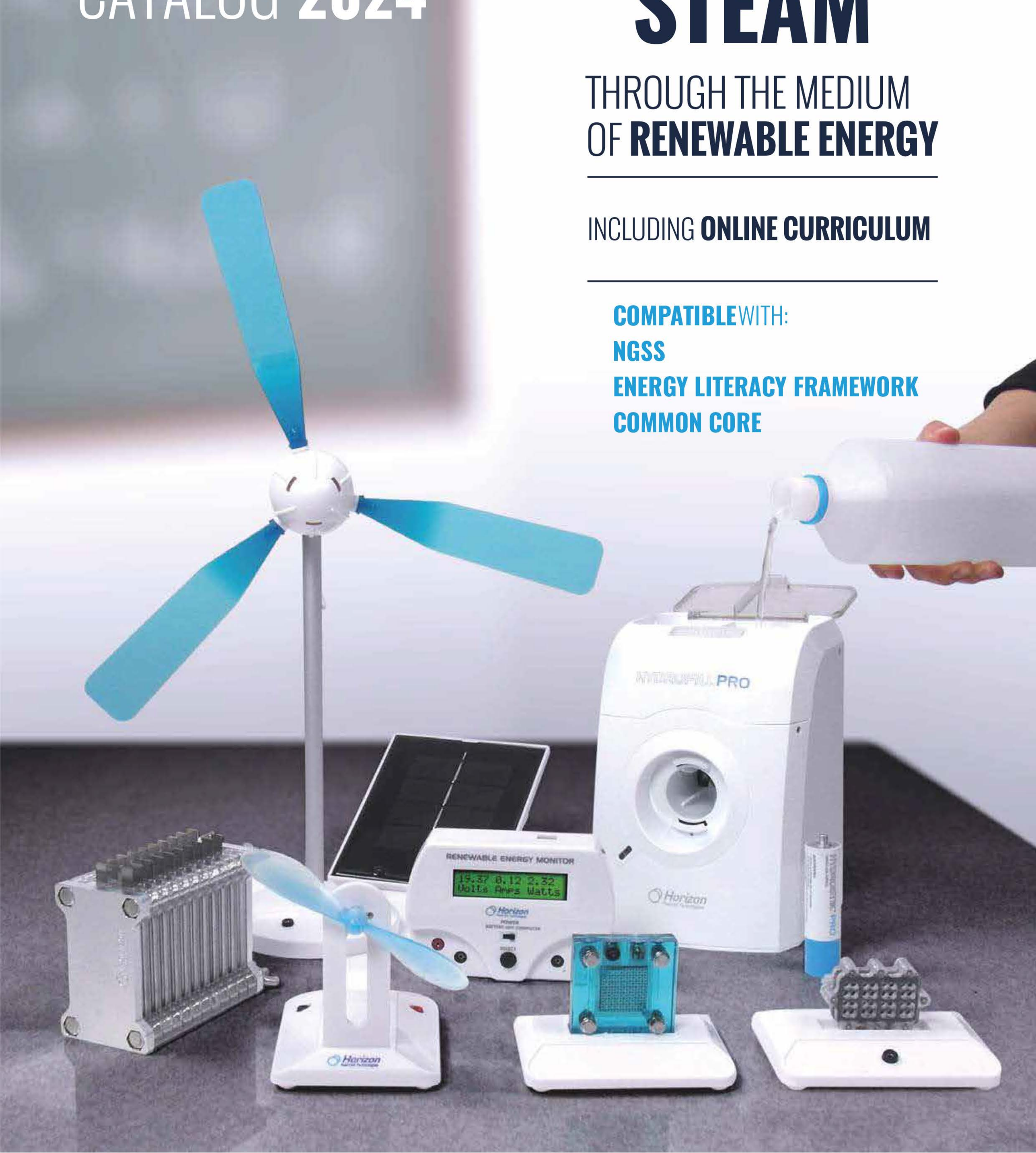
INCLUDING **ONLINE CURRICULUM**

COMPATIBLE WITH:

NGSS

ENERGY LITERACY FRAMEWORK

COMMON CORE



WHAT IS INCLUDED

	Fuel Cell Car Science Kit	Solar Hydrogen Education Kit	Wind Energy Education Kit	Vertical Axis Wind Turbine	Salt Water Fuel Cell Science Kit	Super Capacitor Science Kit	Thermal Power Science Kit	Wind to Hydrogen Education Kit	Ethanol Fuel Cell Science Kit	Electric Mobility Experiment Set	Multi Energy Car Science Kit	Renewable Energy Education Set	Horizon Energy Box
TECHNOLOGY													
Ethanol Fuel Cells									✓				✓
Hydrogen Fuel Cells	✓	✓						✓		✓	✓	✓	✓
Salt Water Batteries					✓					✓	✓		✓
Solar Panels	✓	✓								✓	✓	✓	✓
Supercapacitors						✓				✓	✓		✓
Thermoelectrics							✓						✓
Wind Turbines			✓	✓				✓				✓	✓
MATERIALS PROVIDED													
Hands-on Lab Activities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teacher's Guides	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PBL Units										✓	✓	✓	✓
E-Book	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Teacher Forum	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

HORIZON ENERGY CURRICULUM

WHAT IS INCLUDED IN THE HORIZON ENERGY CURRICULUM?

The lab equipment is just the beginning. We've built the Horizon Energy Curriculum to provide teachers with multiple resources for engaging their students.

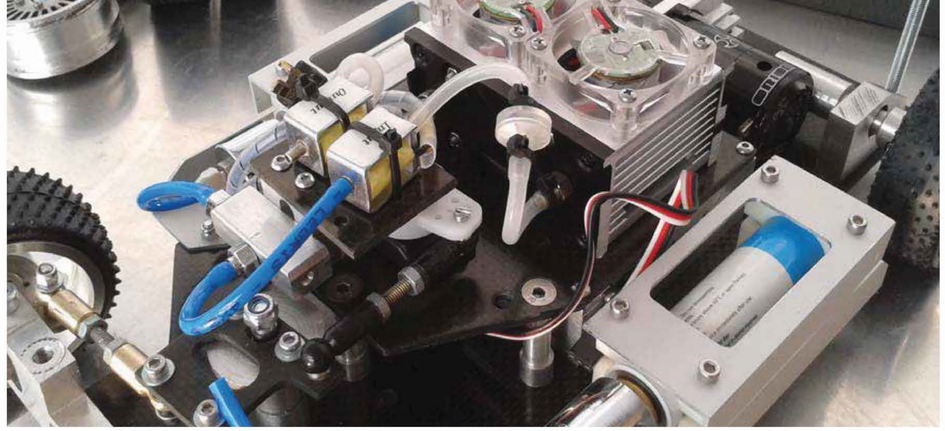
CHECK IT NOW!

EASY TO DOWNLOAD!

www.horizoneducational.com

CONCEPTS COVERED

	Fuel Cell Car Science Kit	Solar Hydrogen Education Kit	Wind Energy Education Kit	Vertical Axis Wind Turbine	Salt Water Fuel Cell Science Kit	Super Capacitor Science Kit	Thermal Power Science Kit	Wind to Hydrogen Education Kit	Ethanol Fuel Cell Science Kit	Electric Mobility Experiment Set	Multi Energy Car Science Kit	Renewable Energy Education Set	Horizon Energy Box
CHEMISTRY CONCEPTS													
Biofuels									✓				✓
Electrochemistry					✓					✓	✓		✓
Electrolysis	✓	✓						✓		✓	✓	✓	✓
Energy	✓	✓			✓			✓	✓	✓	✓	✓	✓
Ethanol Reactions									✓				✓
Hydrogen Generation	✓	✓			✓			✓		✓	✓	✓	✓
Organic Chemistry									✓				✓
pH									✓				✓
Reaction Rates	✓	✓			✓			✓	✓	✓	✓	✓	✓
Reaction Yield		✓			✓							✓	✓
Reactions	✓				✓			✓	✓	✓	✓	✓	✓
Redox Reactions	✓									✓	✓	✓	✓
Semiconductors		✓										✓	✓
Solution Concentrations					✓					✓	✓		✓
Stoichiometry		✓							✓			✓	✓
PHYSICS CONCEPTS													
Angular velocity			✓	✓				✓				✓	✓
Capacitors						✓				✓	✓		✓
Classical Mechanics	✓		✓	✓				✓		✓	✓	✓	✓
Current/Voltage						✓	✓			✓	✓		✓
Efficiency	✓		✓	✓				✓				✓	✓
Electric Charge						✓				✓	✓		✓
Electric Circuits		✓				✓				✓	✓	✓	✓
Energy	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Generators						✓				✓	✓		✓
Heat							✓						✓
Light		✓											✓
Ohm's Law	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Parallel Circuits		✓								✓	✓	✓	✓
Power (Electric)	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
Rotational Mechanics			✓	✓				✓				✓	✓
Series Circuits		✓								✓	✓	✓	✓
Thermal Energy							✓						✓
EARTH SCIENCE CONCEPTS													
Climate Change										✓	✓	✓	✓
Renewable Energy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Human Impacts										✓	✓	✓	✓



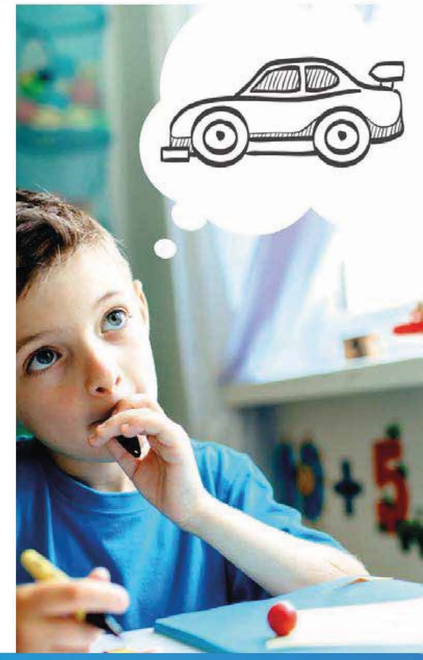
THE WORLD OF **HORIZON EDUCATIONAL**

STUDENT **COMPETITIONS**

Horizon organizes and supports a range of international competitions dedicated to discovering the best in global engineering talent. From middle school to university, our schools challenges get students talking about the future of energy and putting their practical skills to the test. Learning to use advanced design software, discovering the principles of hybrid engines, building the most efficient racecars in the world — with Horizon's Engineering Challenges, tomorrow's innovators will experience science in a whole new way. For more information visit: www.horizoneducational.com

ONLINE **PROFESSIONAL TRAINING**

Supporting teachers is the number one priority of Horizon Educational. Our online training content includes tutorials covering how Horizon science kits work and best practices for how to use them in the classroom.



STEAM EDUCATION
H2 GRAND PRIX XPR

SEL LEARNING

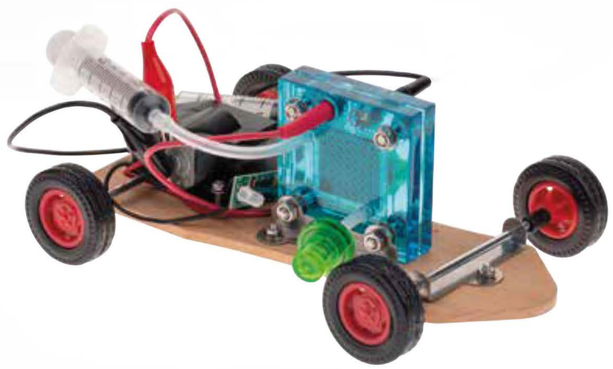
DO IT YOURSELF

AGES 6-10

The Horizon Hydrogen Explorer (XPR) program introduces elementary and middle school students to basic science and engineering principles together with sustainability and renewable energy awareness. This program allows students to design & build their own fuel cell-powered vehicles using recycled materials. Through its broad spectrum and developed curriculum, the H2GP XPR will easily fit in your Chemistry, Physic, as well as Art or Ecology classes.

FALL IN LOVE WITH SCIENCE

Besides the knowledge, students' competencies are developed through SEL principles. The H2GP XPR program raises self-awareness, develops self-management, and emphasizes social awareness. It was developed to help young students fall in love with science.



HOW WILL YOU SHAPE THE FUTURE?

What can you do with the DIY Fuel Cell Science Kit from Horizon? Whatever you can dream up! Everything you need to produce hydrogen from water and convert it to electricity is included in your kit. What that electricity powers is up to you. Use our included activity guide or come up with your own ideas. How will you shape the future of energy?

WATER POWERED VEHICLE • CURRICULUM AND VIDEO SUPPORT
RENEWABLE ENERGY • STUDENT COMPETITION • SEL LEARNING

DESIGN BUILD RACE

Using our Race Manual, you can easily organize a race for your students so they can test their designs and see which vehicle is able to travel the furthest.

STEAM & SEL - BASED PROGRAM FOR ELEMENTARY AND MIDDLE SCHOOL STUDENTS

DIY FUEL CELL SCIENCE KIT CLASSROOM PACK

PRODUCT CODE: **RESK-02B**

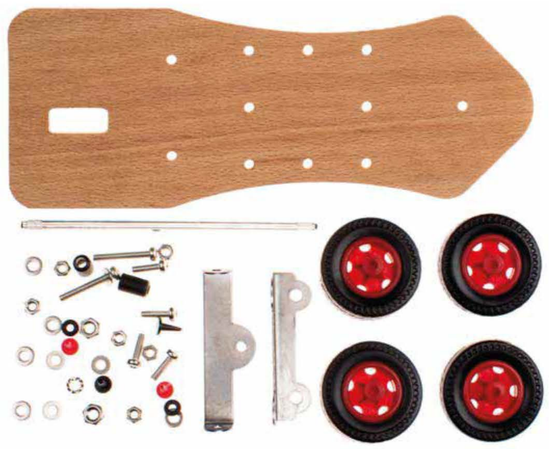
12 Reversible fuel cells
12 Sets of silicone tubing
24 Syringes (5ml)
24 Syringes (20ml)
12 LED diodes
12 Sets of alligator wire
12 Sets of red and black pins
12 Motors (required input 0.6V)
12 Transaxles
24 Pressure relief valve
24 Plastic clamps
12 Bags to protect fuel cells
Horizon Blue Box

DIY FUEL CELL CHASSIS KIT CLASSROOM PACK

PRODUCT CODE: **RESK-02C**

ADD-ON

Wooden Chassis	12X		
Small Nut	72X	Long Screw	24X
Wheels	48X	Fuel Cell Holder	12X
Big Nut	24X	Front Wheel Bumping Post	24X
Axle	12X	Flat Metal Washer	84X
Short Screw	48X	Rubber Washer	24X
Front Wheel Supporter	12X	Metal Profilled Washer	12X



EDUCATIONAL PROGRAMS

STEAM EDUCATION
H2 GRAND PRIX SPRINT

UNLEASH INNOVATION

AGES 10-16

The H2GP SPRINT program boosts education to the next level – allowing students to extend their renewable energy engineering skills with a lightning-fast 1:20 scale SPRINT car.

CURRICULUM

Our one-of-a-kind SPRINT Car Kits are complemented by an innovative curriculum delivering an understanding of not only hydrogen fundamentals and fuel cell electrical systems, but also the basic laws of physics, collecting experimental data, and discovering core scientific principles.

NEXT GENERATION SCIENCE STANDARDS · ISTE Standards · ITEEA · COMMON CORE STATE STANDARDS INITIATIVE

EQUIPMENT

PC: **RESK-03-1**

H2GP SPRINT Car Kit

The H2GP Sprint Car includes everything students need to create their own hydrogen before using it to power their lightning-fast, 1:20 scale SPRINT car.

Once your students familiarize themselves with the technology, encourage them to build their own car from scratch and then use the Fuel Cell and motor to power it.

ADD-ON: H2GP SPRINT REFUELLING BUNDLE

PC: **RESK-03-RB** With Hydrofill and Hydrostik, you get liters of hydrogen available on demand, accelerating the pace of H2GP Sprint races and offering students a completely seamless learning experience

HYDROGEN ENERGY • COMPETITION • STEAM PROGRAM
HARDWARE FROM HORIZON • CURRICULUM AND VIDEO SUPPORT

DESIGN BUILD RACE

STEAM & SEL - BASED PROGRAM FOR MIDDLE AND HIGH SCHOOL STUDENTS

PC: **RESK-03**

H2GP SPRINT Classroom Pack

The H2GP SPRINT classroom pack is your complete classroom solution, allowing 12-24 students to dive into the thrilling world of hydrogen racing with the six included fuel-cell electric SPRINT cars. The classroom pack also includes unique code to access our full SPRINT curriculum.

1x Unique Code to Access the Sprint Curriculum

6x H2GP Sprint Car Kits

Each Sprint Car Includes:

1 x 1.5W Hydrogen Fuel Cell
1 x PEM Electrolyzer
1 x Chassis Kit (including Chassis, Axle holder, x 2 Tubing Holder, 2 x Motor and Tank Holder, Central Holder)
2 X AA Battery Holder + Banana Plugs
1x 1.2 V Electric Motor
1 x Purge Valve
1x Gas Tank
2 x 7cm Axle
4 x Rubber Tyre
4 x Wheels (Including Wheel 50-8, Wheel 42-16, Wheel 44-14, Wheel 48-10)
2 x Spur Gear (Spur Gear 8, Spur Gear 10)
1 x 45cm silicon tubing
1 x White Valve Clip
1 x Green Male Valve
1 x Green Female Valve
1 x 5ml Syringe
1 x Electrolyzer plate

PC: **RESK-03-PT**

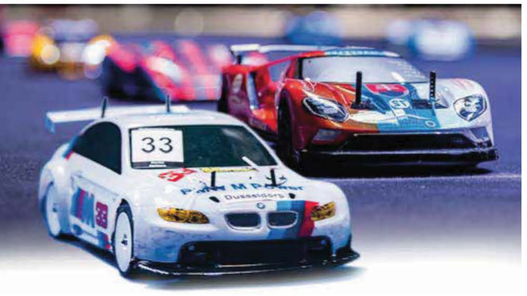
H2GP SPRINT Practice Track

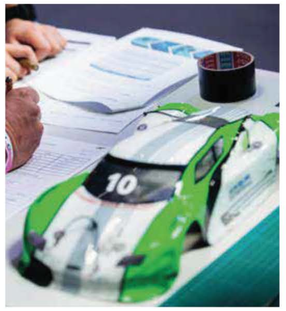
Our lightweight, on-demand 10m (33ft) practice track allows you to race Sprint cars literally anywhere – a school gym, a classroom tabletop, or even down the hallway.

STEAM EDUCATION
H2 GRAND PRIX PRO

AGES 14-19

The people of the 21st century are facing few challenges as difficult as the growing demand for energy in an era of manmade climate change. Today's students come of age at a time when we need their creativity, ingenuity and critical thinking skills more than ever.





The Horizon Hydrogen Grand Prix is a comprehensive science and engineering program that gives students from all over the world the opportunity to acquire knowledge of environmental sustainability, renewable energy and alternative fuels, especially hydrogen, through a variety of science experiments and curricular materials.

6-MONTH PROGRAM, LIFELONG BENEFITS

Students must be able to use a wide range of knowledge acquired in the first part of the program.
Their task is to design, engineer and build their own 1:10 scale fuel cell-powered RC car and test it in 4–6-hour endurance races. From the earliest conceptual stages to maintaining and repairing their car during the race, students are in control of every step of the process, enabling truly immersive experience that captures the rigor and excitement of real-world science and engineering endeavors.

The entire program is accompanied by a professionally developed 4-month long curriculum, from package delivery to the final Horizon Hydrogen Grand Prix Race on a national level. Winners of the national competitions then compete in an international championship with teams around the world. Thanks to the program, students gain real-world engineering experience, hands-on automotive mechanical experience, and an exposure to careers in STEAM.

HYDROGEN ENERGY • GLOBAL COMPETITION • STEAM PROGRAM
HARDWARE FROM HORIZON • CURRICULUM AND VIDEO SUPPORT

CREATING TOMORROW'S INNOVATORS

The H2GP Pro program provides the next generation of designers and engineers with the skills they need to lead us into a sustainable future. Our one-of-a-kind, hands-on program allows students to gain real-world experience working with hydrogen fuel cells and 1:10-scale electric vehicles.

PC: **H2GP-SO**

H2GP BASIC CHASSIS 1:10

✓ electro RTR 2,4 GHz with extra batteries

H-CELL 2.0

PC: **H2GP-21**

Horizon's next generation H-Cell replicates the technology of real-scale hybrid vehicles, improving electrical batteries with the addition of hydrogen fuel that has extremely high energy density.

H2GP - Hydrofill Black

PC: **FCH-010**

Hydrofill Black is a "hydrogen on demand" desktop refueling station designed for easy and automatic refilling of hydrostik Black metal hydride cartridges

H2GP - Hydrostik Black

PC: **LWH22-10L-5(Black)**

HYDROSTIK Black is a convenient hydrogen storage solution to fuel your hydrogen powered devices.

www.h2grandprix.com

SCIENCE **KITS**

IDEAL FOR:

HS CHEMISTRY — NUMBER OF EXPERIMENTS 3

HS PHYSICS — NUMBER OF EXPERIMENTS 3

PRODUCT CODE: **FCJJ-11**

FUEL CELL CAR SCIENCE KIT

- ✓ Investigate reaction yields, reduction and oxidation, and other chemistry concepts by performing electrolysis reactions.
- ✓ Learn about conservation of energy, electric power, and other physics concepts by modifying your fuel cell car.

**Dimensions (LxWxH): 30x21x9.7cm. Weight (kg/lbs) 1.75/3.87*

IDEAL FOR:

HS CHEMISTRY — NUMBER OF EXPERIMENTS 9

HS PHYSICS — NUMBER OF EXPERIMENTS 5

PROBLEM BASED LEARNING — UNIT

PC: **FCJJ-30**

ELECTRIC MOBILITY EXPERIMENT SET

- ✓ Full PBL unit on sustainable transportation technologies includes an investigation of the causes of global climate change.
- ✓ Hands-on activities center on designing and building a car that can accelerate quickly and run for a long time.
- ✓ Complete student and teacher materials for up to 10 class periods of activities.

**Dimensions (LxWxH): 43x33.5x23.5cm. Weight (kg/lbs) 2.05/4.52*

PC: **FCJJ-31**

MULTI ENERGY CAR SCIENCE KIT

The Multi Energy Car Science Kit lets students experiment with tomorrow's sustainable transport solutions.

IDEAL FOR:

HS CHEMISTRY — NUMBER OF EXPERIMENTS 3

HS PHYSICS — NUMBER OF EXPERIMENTS 3

PRODUCT CODE: **FCJJ-20**

HYDROCAR

Thanks to reversible fuel cell the car can both produce hydrogen from destilled water and revert it back to electricity to power its motor. Excellent example how the electrolysis works. Very simple kit to build and run.

**Dimensions (LxWxH): 30x21x10cm. Weight (kg/lbs) 0.66kg, 1.5lbs*

PRODUCT CODE: **FCJJ-23**

H-RACER 2.0

The kit consists of a remote control, car and hydrogen station in which an electrolyzer can separate hydrogen from destilled water. Hydrogen flowing from the station to the car via transparent house reminds filling the car tank at real petrol station.

**Dimensions (LxWxH): 30x21x10cm. Weight (kg/lbs) 0.76kg, 1.7lbs*

IDEAL FOR:

HS CHEMISTRY — NUMBER OF EXPERIMENTS 10
HS PHYSICS — NUMBER OF EXPERIMENTS 6
PROBLEM BASED LEARNING — UNIT

PC: **FCJJ-37**

RENEWABLE ENERGY EDUCATION SET

- ✓ Full PBL unit on clean power generation includes an exploration of the environmental effects of atmospheric carbon dioxide.
- ✓ Hands-on activities center on complementary attributes of different renewable energy sources.
- ✓ Complete student and teacher materials for up to 10 class periods of activities.

Dimensions (LxWxH): 44x33x11cm. Weight (kg/lbs) 2.05/4.52

IDEAL FOR:

HS CHEMISTRY — NUMBER OF EXPERIMENTS 15
HS PHYSICS — NUMBER OF EXPERIMENTS 21
PROBLEM BASED LEARNING — UNIT

PC: **FCJJ-40**

HORIZON ENERGY BOX

- ✓ Full PBL units on sustainable transportation, clean power generation, and more include multiple ways to learn about climate change.
- ✓ Hands-on activities including renewable energy sources, alternative fuels for transportation, and more.
- ✓ Complete student and teacher materials for up to 20 class periods of activities.

Dimensions (LxWxH): 40x28x9cm. Weight (kg/lbs) 6.6/14.6

PC: **LWH22-10L-5(PRO)**

HYDROSTIK PRO

- ✓ Safe, solid metal hydride storage
- ✓ Store 10 L of unpressurized H_2
- ✓ Power fuel cells, run experiments, and more
- ✓ Refill using HYDROFILL PRO for more H_2 power
- ✓ Operates at room temperature

Dimensions (LxWxH): 9x4.8x4.7cm. Weight (kg/lbs) 0.1/0.22

Name	HYDROSTIK PRO
Model number	LWH22-10L-5
Capacity	10 L hydrogen
Hydrogen purity	≥99.995%
Cartridge size	ø22x88mm
Weight	Approx. 105g
Storage material	AB5 metal hydride
Rated charging pressure	3.0MPa
Working temperature	0-55°C (0-131°F)
Service life	10 years

PC: **FCH-20**

HYDROFILL PRO

- ✓ Refill HYDROSTIK PRO with a tabletop electrolyzer
- ✓ Generate 10 L of H_2 in as little as 4 hrs
- ✓ Create 99.99% pure H_2 from distilled water
- ✓ Link to solar or wind for totally clean power
- ✓ Recharge HYDROSTIK PRO for diverse lab uses

Dimensions (LxWxH): 20.9x15x10.3cm. Weight (kg/lbs) 0.36/0.79
Note: Hydrostik Pro is not included.

Stack type	PEM electrolysis cell
Dimensions (WxDxH)	145x153x208 mm (5.7x 6x8.2 in)
Weight	1.8Kg ±5% (3.97Lbs ±5%)
Rated power	≤23W
Input voltage	DC: 10V-19V
Water input	De-ionized or distilled water
Water temperature	10-40°C (50-104°F)
Water consumption	Approx. 20ml/hr (1.2in3 /hr)
H_2 output pressure	0-3.0 MPaG (0-435.11 PSI)
H_2 generation capacity	Up to 3L/hr (0-183 in /hr)
Purity	99.995%
Compatible cartridge	HYDROSTIK & HYDROSTIK PRO
Refilling time for one Cartridge	Around 4 hours
Stack weight (with fan & casing)	(at 25°C room temperature)
Controller weight	90g(±10g)

IDEAL FOR:

HS PHYSICS

NUMBER OF EXPERIMENTS 2

PC: **RESK-01**

VERTICAL AXIS WIND TURBINE STEM KIT

- ✓ 3 different blade configurations
- ✓ More than 25 hours of activities covering physics and earth/environmental science
- ✓ Discover cutting-edge wind turbine technology

**Dimensions (LxWxH): 20.9x15x10.3cm. Weight (kg/lbs) Product assembled: 600g*

IDEAL FOR:

HS CHEMISTRY

NUMBER OF EXPERIMENTS 4

HS PHYSICS

NUMBER OF EXPERIMENTS 6

PC: **FCJJ-39**

WIND ENERGY SCIENCE KIT

- ✓ Uniquely designed blade profile based on NASA aeronautics
- ✓ Most realistic wind turbine experimentation available on the market

**Dimensions (LxWxH): 31x15.3x5.5cm. Weight (kg/lbs) 0.7/1.54*

IDEAL FOR:

HS CHEMISTRY

NUMBER OF EXPERIMENTS 4

HS PHYSICS

NUMBER OF EXPERIMENTS 6

PC: **FCJJ-56**

WIND TO HYDROGEN EDUCATION KIT

- ✓ Explore stoichiometry, reaction rates, and other chemistry concepts by generating hydrogen from wind power.
- ✓ Use angular velocity, drag force, and other physics concepts to design and build an efficient wind turbine.

**Dimensions (LxWxH): 32x23.5x14cm. Weight (kg/lbs) 1.28/2.82*

ADD-ON

PC: **FCJJ-24**

HORIZON ENERGY MONITOR

- ✓ Gather data from different energy sources
- ✓ Analyze results of multiple experiments
- ✓ Record real-time information
- ✓ Learn about Ohm's Law and electric circuits
- ✓ Measure amps, volts, watts, ohms, and more

**Dimensions (LxWxH): 14.7x21x10cm. Weight (kg/lbs) 0.43/0.95. Note: computer is not included.*

ADD-ON

PC: **DA-100**

DIGITAL ANEMOMETER

- ✓ Air Velocity Measurement Range: 0.3 to 30m/s (±5%)
- ✓ Temperature Measurement Range: -10 to 50°C (±1°C)
- ✓ Humidity Measurement Range: 0%-99% (±5% at 20%-90%)
- ✓ Air Velocity Unit Selection: m/s, ft/min, knots, km/h, mph
- ✓ Beaufort scale
- ✓ °C / °F selection
- ✓ Max/Min/Avg Reading Selection
- ✓ Hold Function
- ✓ Wind-chill Indication
- ✓ Low Battery Warning
- ✓ Auto Power Off (with override function)
- ✓ Calibration Function
- ✓ Resolution: 0.1m/s, 1%, 0.1°C

**Dimensions (LxWxH): 11.5x4x2cm. Weight (kg/lbs) 0,06kg, 0.027lbs*

IDEAL FOR:

HS CHEMISTRY | NUMBER OF EXPERIMENTS 4

HS PHYSICS | NUMBER OF EXPERIMENTS 6

PC: **FCJJ-16**

SOLAR HYDROGEN EDUCATION KIT

- ✓ Explore series and parallel circuits and other physics concepts with renewable energy power from a fuel cell and solar panel.
- ✓ Use the power of the Sun to split water and generate hydrogen gas while learning about chemistry concepts.

**Dimensions (LxWxH): 63x44x35cm. Weight (kg/lbs) 0.56/1.23*

PC: **FCJJ-44**

MICRO FUEL CELL SCIENCE KIT

- ✓ Power a mini turbine by converting solid state hydrogen into electrical energy
- ✓ Explore the effect as the hydride slowly cools and releases hydrogen into the fuel cell

**Dimensions (LxWxH): 21x15x10cm. Weight (kg/lbs) 0.4/ 0.88*

IDEAL FOR:

HS CHEMISTRY | NUMBER OF EXPERIMENTS 4

PC: **FCJJ-34**

SALT WATER FUEL CELL SCIENCE KIT

- ✓ Find out how solution concentration can affect reaction rates using electricity and a salt water electrochemical cell.
- ✓ Experiment with electrochemistry processes and measure the output of your generator.

**Dimensions (LxWxH): 20.9x15x10.3cm. Weight (kg/lbs) 0.36/0.79*

HS PHYSICS | NUMBER OF EXPERIMENTS 6

PC: **FCJJ-38**

THERMAL POWER SCIENCE KIT

- ✓ Discover the thermoelectric effect and the materials that cause it while performing experiments with a unique generator.
- ✓ Create an electric current using nothing more than temperature differences while investigating physics concepts.

**Dimensions (LxWxH): 29.7x20.6x9.7cm. Weight (kg/lbs) 0.64/1.40*

PC: **FCJJ-22**

BIO-ENERGY EDUCATION SCIENCE KIT

- ✓ Understand the principles behind ethanol fuel cell technology
- ✓ Includes pH paper to shows the change in the physical properties of the consumed ethanol fuel

**Dimensions (LxWxH): 15x21x10 cm. Weight (kg/lbs) 0.38/0.84*

IDEAL FOR:

HS CHEMISTRY | NUMBER OF EXPERIMENTS 3

HS PHYSICS | NUMBER OF EXPERIMENTS 3

PC: **FCJJ-42**

ETHANOL FUEL CELL SCIENCE EDUCATION KIT

- ✓ Investigate chemistry concepts such as pH and oxidation while running an ethanol fuel cell.
- ✓ Determine how to change the products of a combustion reaction involving ethanol.

**Dimensions (LxWxH): 30x21x9.7cm. Weight (kg/lbs) 0.50/1.10*

IDEAL FOR:

HS CHEMISTRY | NUMBER OF EXPERIMENTS 4

PC: **FCJJ-35**

SUPERCAPACITOR SCIENCE KIT

- ✓ Discover the science behind capacitors and generators by using them to power simple electric circuits.
- ✓ Understand electric charge, electric current, and other physics concepts while using a generator to charge a capacitor.

**Dimensions (LxWxH): 30x21x9.7cm. Weight (kg/lbs) 0.59/1.30*

PEM **FUEL CELLS***

PC: **FCSU-023, FCSU-023B**

PEM TRANSPARENT/ BLUE REVERSIBLE FUEL CELL

High performance reversible PEM fuel cell

Electrolyzer function:

- ✓ Input Voltage: 1.8V ~ 3V (DC)
- ✓ Input Current: ¬0.7A
- ✓ Hydrogen production rate: 7ml per minute at 1A
- ✓ Oxygen production rate: 3.5ml per minute at 1A

Fuel cell function:

- ✓ Output Power: 210mW
- ✓ Output Voltage: 0.6V (DC)
- ✓ Output Current: 360mA
- ✓ Oxygen production rate: 3.5ml per minute at 1A

Dimensions (LxWxH): 21x15x10cm. Weight (kg/lbs) 0.61kg, 1.3lbs

PC: **FCSU-012B**

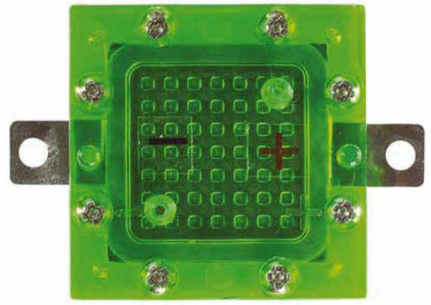
PEM BLUE ELECTROLYZER

When applying an electrical current (solar or DC power) the electrolyzer produces hydrogen and oxygen from water.

- ✓ Input Voltage: 1.8V ~ 3V (DC)
- ✓ Hydrogen production rate: 7ml per minute at 1A
- ✓ Oxygen production rate: 3.5ml per minute at 1A

Dimensions (LxWxH): 21x15x10cm. Weight (kg/lbs) 0.61kg, 1.3lbs

*AVAILABLE IN 5-PACKS OR INDIVIDUALLY



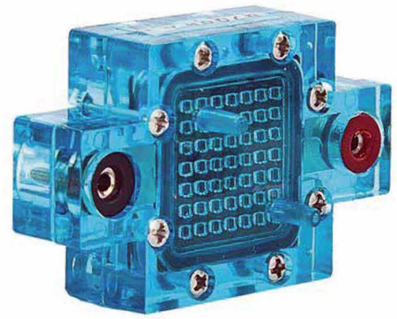
PC: **FCSU – 012G**

PEM GREEN MINI FUEL CELL

PEM fuel cell, part of H-racer 2.0

- ✓ Output Power: 270mW
- ✓ Output Voltage: 0.6V (DC)
- ✓ Output Current: 0.45A

Dimensions (LxWxH): 21x15x10cm. Weight (kg/lbs) 0.37kg, 0.8lbs



PC: **FCSU-010B**

PEM BLUE MINI FUEL CELL

High performance PEM fuel cell

- ✓ Output Power: 270mW
- ✓ Output Voltage: 0.6V (DC)
- ✓ Output Current: 0.45A

Dimensions (LxWxH): 21x15x10cm. Weight (kg/lbs) 0.41kg, 0.9lbs

PC: **SL-314**

SOLAR LAMP

LED Solar Lamp

- ✓ 40W LED lamp with E27 socket
- ✓ Lamp holder with cable and switch

Dimensions (LxWxH): 30cmx22cmx16cm
Weight (kg/lbs) 0.99kg, 2.18lbs

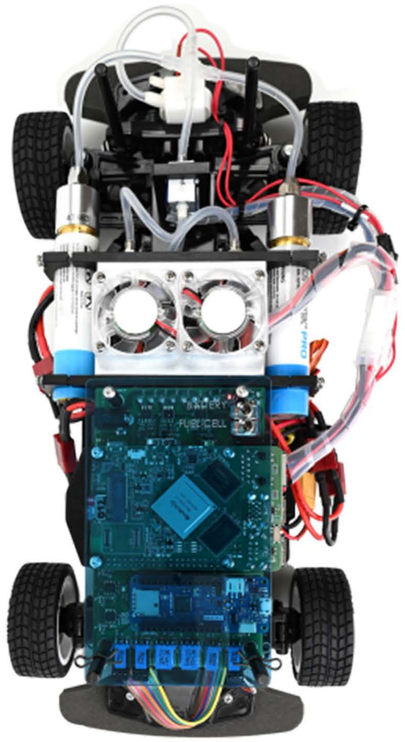
TECHNICAL **EDUCATION**

PRODUCT CODE: **FCAT-30**

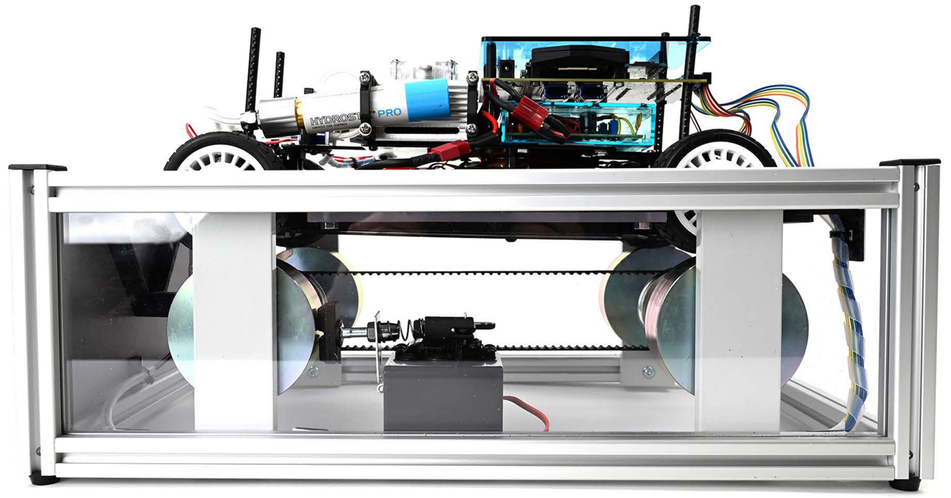
H2HYBRID

– FUEL CELL AUTOMOTIVE TRAINER

- ✓ Explore the difference between expected performance and experimental results
- ✓ Engineer new solutions for optimization of car's performance
- ✓ Examine the three fields of energy management
- ✓ Comprehend hybrid propulsion technology and work to minimize environmental impacts
- ✓ Measure the breaking force under different conditions with the roller test bench
- ✓ Learn about data acquisition and discover how to manipulate, analyze and interpret graphs



COMPLETE RESOURCES FOR ADVANCED EXPERIMENTS



LESSON PLANS

- ✓ 6 months of curriculum in physics, chemistry and engineering
- ✓ Students and teachers' material
- ✓ Hands-on experiments and problem based learning

CAR SYSTEMS

1.1. Steering and Propulsion
1.2. Using Electrical Energy to Power the Vehicle
1.3. Transmitting Mechanical Energy
1.4. Speed and Consumption of Energy
1.5. Measuring Changes in Electrical Energy

THE ROLE OF HYDROGEN

2.1. Understanding the hydrogen fuel cell
2.2. Understanding modern batteries
2.3. Comparing sources of electricity

ENERGY NEEDS

3.1. Using models to describe the car's motion
3.2. MATLAB: Simulating the car's motion
3.2. OpenModelica: Simulating the car's motion
3.3. Making measurements on the track
3.4. Making measurements on the charging bench

SYSTEM ADAPTABILITY

4.1. Providing power
4.2. H-Cell power
4.3. Influence of the arrangement of the components of the fuel cell
4.4. Effects of the arrangement of the Hydrostiks

MANUFACTURER'S DECISIONS

5.1. Making measurements on the track
5.2. Making measurements on the charging bench
5.3. Energy consumption
5.4. Sustainable development

CUSTOMIZING YOUR CAR

6.1. Changing how you drive
6.2. Changing the components of the energy system of the car
6.3. Reducing various forms of resistance to motion
6.4. Changing the mode of hydrogen production

25 + LESSONS

PRODUCT CODE: **HSETS-11**
**Dimensions (LxWxH): 100cm x 60cm x 60cm*

HORIZON SOLAR ENERGY TRAINER SET

The Horizon Solar Energy Training Set is prepared for the purpose of experimenting with solar power and its impact on electricity production. The experiment set is designed in accordance with the curricula of all institutions requiring technical education in which can be listed as technical university, technical high school and any institution in need of technical

In the experiment set, user safety is prioritized in accordance with legal regulations. Laser technology is used in drawing the symbols and writing a technical brief above the test box modules. The content of the training set is applicable for advanced technical training, including basic training. The entire set of the experiment unit consists of modules that can be easily attached and removed from the main unit depending on the experimental work to be carried out. All of the components used in the modules are products or their counterparts in which are produced for industrial purposes.

Test Box

- ✓ AC/DC Voltage-Current Measurement Module
- ✓ Light Source Control Module
- ✓ 220 V AC Lamp Module
- ✓ 12 V DC Lamp Module
- ✓ PC Interface Module
- ✓ Off Grid Inverter Module
- ✓ Solar Charge Regulator Module
- ✓ Adjustable Ohmic load
- ✓ Diode Module

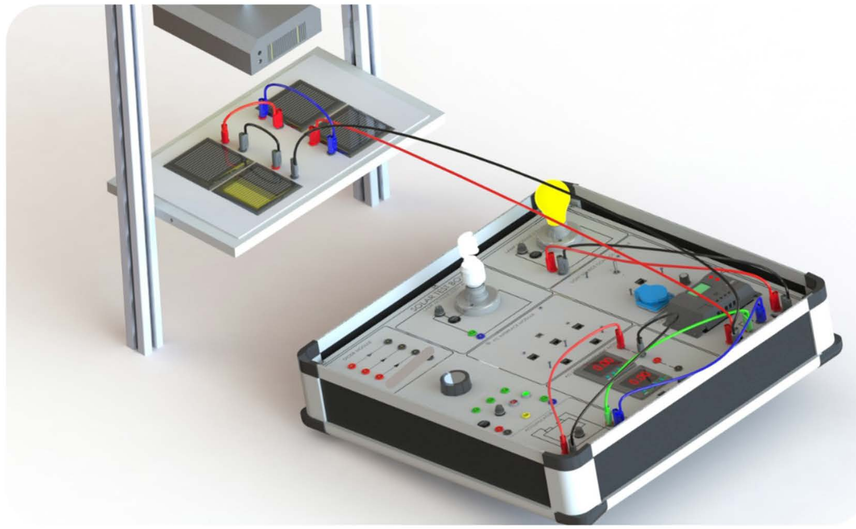
Experimental Application Module

- ✓ PV Panel that can move in 2 axes
- ✓ Monocrystalline pv panel 4 pcs
- ✓ Movable Halogen Lamp Module

Accessory

- ✓ Isolated Cable Set 40 pcs
- ✓ Data Link Cable
- ✓ Software
- ✓ Experiment Book

SAMPLE EXPERIMENT SCHEME



SOLAR ENERGY EXPERIMENTS

- ✓ Examination of Parallel Connection of Photovoltaic Panels
- ✓ Examination of Shadow Effect on Photovoltaic Panels
- ✓ Examination of Bypass Diode Effect on Photovoltaic Panels
- ✓ Examination of Mismatching Effect on Photovoltaic Panels
- ✓ Examination of the Effect of Blocking Diodes on Photovoltaic Panels
- ✓ Photovoltaic System Experiments
- ✓ Directly Connecting Photovoltaic Panel to Load
- ✓ OFF GRID Inverter Startup (No-Load)
- ✓ Installation of the Basic Photovoltaic System (DC Load)
- ✓ Installation of Basic Photovoltaic System (AC Load)
- ✓ Measurement of Energy Taken from OFF GRID Inverter
- ✓ Measurement of OFF GRID Inverter Output Power and its Efficiency
- ✓ Photovoltaic Panel Experiments
- ✓ Measurement of Photovoltaic Panel Open Circuit Voltage
- ✓ Measurement of Photovoltaic Panel Short Circuit Current
- ✓ Photovoltaic Panel Current Voltage Characterization
- ✓ Examination of Photovoltaic Panels No-load Output Voltage Relative to the Whole-Day Movement
- ✓ Examination of Photovoltaic Panels Loaded Output Voltage Relative to the Whole-Day Movement
- ✓ Examination of Photovoltaic Panels Seasonal No-load Output Voltage
- ✓ Examination of Photovoltaic Panels Seasonal Loaded Output Voltage
- ✓ Series Connection of Photovoltaic Panels

FUEL CELL **STACKS**

We offer the widest range of standard “off-the-shelf” PEM fuel cell systems today from 12W to 5kW (deliverable within 1 to 4 weeks), as well as customized fuel cell system configurations up to 30kW. Our standard systems are modular, simple, efficient, and feature one of the highest power densities available in the world opening new possibilities for integration and commercialization.

FUEL CELL STACKS FROM 12W TO 30W

PC: **FCS-B12 12W**

FCS-B12 12W

- ✓ Integrated fan and casing 12W stack with blower
- ✓ 12W stack with blower

**Dimensions (LxWxH): 7.5x4.7x7cm. Weight (kg/lbs) 0.27/0.60*

PC: **FCS-B20 20W**

FCS-B20 20W

- ✓ Miniature electronic valve
- ✓ Control electronics
- ✓ Integrated fan and casing
- ✓ Low voltage protection
- ✓ 20W stack with blower

**Dimensions (LxWxH): 7.5x4.7x7cm. Weight (kg/lbs) 0.27/0.60*

PC: **FCS-B30 30W**

FCS-B30 30W

- ✓ Miniature electronic valve
- ✓ Control electronics
- ✓ Integrated fan and casing
- ✓ Low voltage protection
- ✓ 30W stack with blower

**Dimensions (LxWxH): 8x4.7x7.5cm. Weight (kg/lbs) 0.27/0.60*

	12 W	20 W	30 W
Type of fuel cell	PEM	PEM	PEM
Number of cells	13	13	14
Rated power	12W	20W	30W
Rated performance	7.8V@1.5A	7.8V@2.6A	8.4V@3.6A
Purging valve voltage	6V	6V	6V
Blower voltage	5V	5V	5V
Reactants	Hydrogen and Air	Hydrogen and Air	Hydrogen and Air
Ambient temperature	5-30°C (41-86°F)	5-30°C (41-86°F)	5-30°C (41-86°F)
Max stack temperature	55°C(131°F)	55°C(131°F)	55°C(131°F)
Hydrogen pressure	0.45-0.55Bar	0.45-0.55Bar	0.45-0.55Bar
Humidification	Self-humidified	Self-humidified	Self-humidified
Cooling	Air (integrated cooling fan)	Air (integrated cooling fan)	Air (integrated cooling fan)
Stack weight (with fan & casing)	275g(±30g)	275g(±30g)	280g(±30g)
Controller weight	90g(±10g)	90g(±10g)	90g(±10g)
Stack size	75x47x70mm	75x47x70mm	80x47x75mm
Flow rate at max output	0.18L/min	0.28L/min	0.42L/min
Hydrogen purity	≥99.995% dry H_2	≥99.995% dry H_2	≥99.995% dry H_2
Start up time	≤30s (ambient temp.)	≤30s (ambient temp.)	≤30s (ambient temp.)
Efficiency of system	40% at full power	40% at full power	40% at full power

FUEL CELL STACKS FROM 60W TO 500W

PC: **FCS - C100 100W**

FCS -C100 100W

FCS - C60 60W ON DEMAND

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 100W stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

**Dimensions (LxWxH): 118x104x94mm. Weight : 1460g (±50g))*

PC: **FCS - C200 200W**

FCS -C200 200W

**Dimensions (LxWxH): 118x183x94mm. Weight: 2230g (±50g)*

PC: **FCS - C500 500W**

FCS -C500 500W

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 500W stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

**Dimensions (LxWxH): 130x268x123mm Weight: 3370g (±50g)*

PC: **FCS - C300 300W**

FCS -C300 300W

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 300W stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

**Dimensions (LxWxH): 118x262x94mm Weight: 3000g(±30g)*

	100 W	200 W	300W	500W
Type of fuel cell	PEM	PEM	PEM	PEM
Number of cells	20	40	60	24
Rated power	100 W	200 W	300 W	500 W
Rated performance	12V@8,3A	24V@8.3A	36V@8.3A	14.4V at 35A
Purging valve voltage	12V	12V	12V	12V
Blower voltage	12V	12V	12V	12V
Reactants	Hydrogen and Air	Hydrogen and Air	Hydrogen and Air	Hydrogen and Air
Ambient temperature	5-30°C (41-86°F)	5-30°C (41-86°F)	5-30°C (41-86°F)	5-30°C (41-86°F)
Max stack temperature	65°C (149°F)	65°C (149°F)	65°C (149°F)	65°C (149°F)
Hydrogen pressure	0.45-0.55Bar	0.45-0.55Bar	0.45-0.55Bar	0.45-0.55Bar
Humidification	Self-humidified	Self-humidified	Self-humidified	Self-humidified
Cooling	Air (integrated cooling fan)	Air (integrated cooling fan)	Air (integrated cooling fan)	Air (integrated cooling fan)
Stack weight (with fan & casing)	1460g (±50g)	2230g (±50g)	3000g(±30g)	3370g (±50g)
Controller weight	400g (±30g)	400g (±30g)	400g (±30g)	627g (±30g)
Stack size	118x104x94mm	118x183x94mm	118x262x94mm	130x268x123mm
Flow rate at max output	1.3L/min	2.6L/min	0.42L/min	6.5L/min
Hydrogen purity	≥99.995% dry H_2	≥99.995% dry H_2	≥99.995% dry H_2	≥99.995% dry H_2
Start up time	≤30s (ambient temp.)	≤30s (ambient temp.)	≤30s (ambient temp.)	≤30s (ambient temp.)
Efficiency of system	40% @12V	40% @24V	40% at 36V	40% at 14.4V

FUEL CELL STACKS FROM 1KW TO 5KW

PC: **FCS-C1000 1KW**

FCS-C1000 1KW

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 1000W stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

**Dimensions (LxWxH): 264x203x104mm. Weight: Approx. 5kg*

PC: **FCS-C2000 2KW**

FCS-C2000 2KW

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 2 KW stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

**Dimensions (LxWxH): 303x350x183mm. Weight: 2500g (±100g)*

PC: **FCS-C3000 3KW**

FCS-C3000 3KW

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 3 KW stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

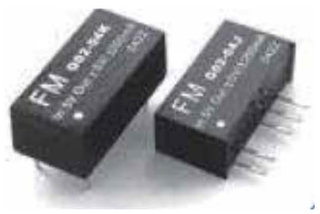
**Dimensions (LxWxH): 418x350x183mm. Weight: 2500g (±100g)*

PC: **FCS-C5000 5KW**

FCS-C5000 5KW

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box
- ✓ 5 KW stack with blower
- ✓ Fuel cell ON/OFF switch
- ✓ SCU ON/OFF switch

**Dimensions (LxWxH): 650x350x212mm. Weight : 2500g (±100g)*



	1 KW	2 KW	3 KW	5 KW
Type of fuel cell	PEM	PEM	PEM	
Number of cells	50	48	72	120
Rated power	1 KW	2 KW	3 KW	5 KW
Rated performance	30V at 33.5A	28.8V at 70A	43.2V at 70A	72V at 70A
Purging valve voltage	12V	12V	12V	12V
Blower voltage	12V	12V	12V	12V
Reactants	Hydrogen and Air	Hydrogen and Air	Hydrogen and Air	Hydrogen and Air
Ambient temperature	5 - 35°C (41-95°F)	5 - 35°C (41-95°F)	5 - 35°C (41-95°F)	5 - 35°C (41-95°F)
Max stack temperature	65°C (149°F)	65°C (149°F)	65°C (149°F)	65°C (149°F)
Hydrogen pressure	0.45-0.55Bar	0.45-0.55Bar	0.45-0.55Bar	0.45-0.55Bar
Humidification	Self-humidified	Self-humidified	Self-humidified	Self-humidified
Cooling	Air (integrated cooling fan)	Air (integrated cooling fan)	Air (integrated cooling fan)	Air (integrated cooling fan)
Stack weight (with fan & casing)	Approx. 5kg	14.1kg (±200g)	15kg (±200g)	30kg (±200g)
Controller weight	Approx.1.9kg	2500g (±100g)	2500g (±100g)	2500g (±100g)
Stack size	264x203x104mm	303x350x183mm	418x350x183mm	650x350x212mm
Flow rate at max output	12.5L/min	26L/min	39L/min	65L/min
Hydrogen purity	≥99.995% dry H_2	≥99.995% dry H_2	≥99.995% dry H_2	≥99.995% dry H_2
Start up time	≤30s (ambient temp.)	≤30s (ambient temp.)	≤30s (ambient temp.)	≤30s (ambient temp.)
Efficiency of system	48% at 30V LHV (net)	40% at 28.8V	40% at 43.2V	40% at 72V

NOTE!

Make contact with our team to explore accessories, new D/DC power conversion devices, H2 Sensor, Ultracapacitor and other system components you may need.

XP SERIES FUEL CELL **STACKS**

PC: **H-1000-XP**

H-1000 XP FUEL CELL STACK

**Dimensions (LxWxH): 203x104x264mm. Weight : 5kg*

H-500/1000 XP FUEL CELL STACKS

Horizon's XP-series systems are the most fuel efficient available on the market - ideal for use in efficiency competitions such as Shell Ecomarathon.

- ✓ Connections/Tubing
- ✓ Electronic valves
- ✓ Electronic control box H-500/H-1000 stack with blower
- ✓ Stack holder
- ✓ LCD Display
- ✓ SCU ON/OFF switch
- ✓ Start up battery connector
- ✓ Ambient temperature sensor
- ✓ Blower controller

Optional components:

- ✓ Monitoring software
- ✓ Hydrogen sensor
- ✓ DC/DC converter
- ✓ Ultracapacitor bank

H-500 XP FUEL CELL STACK

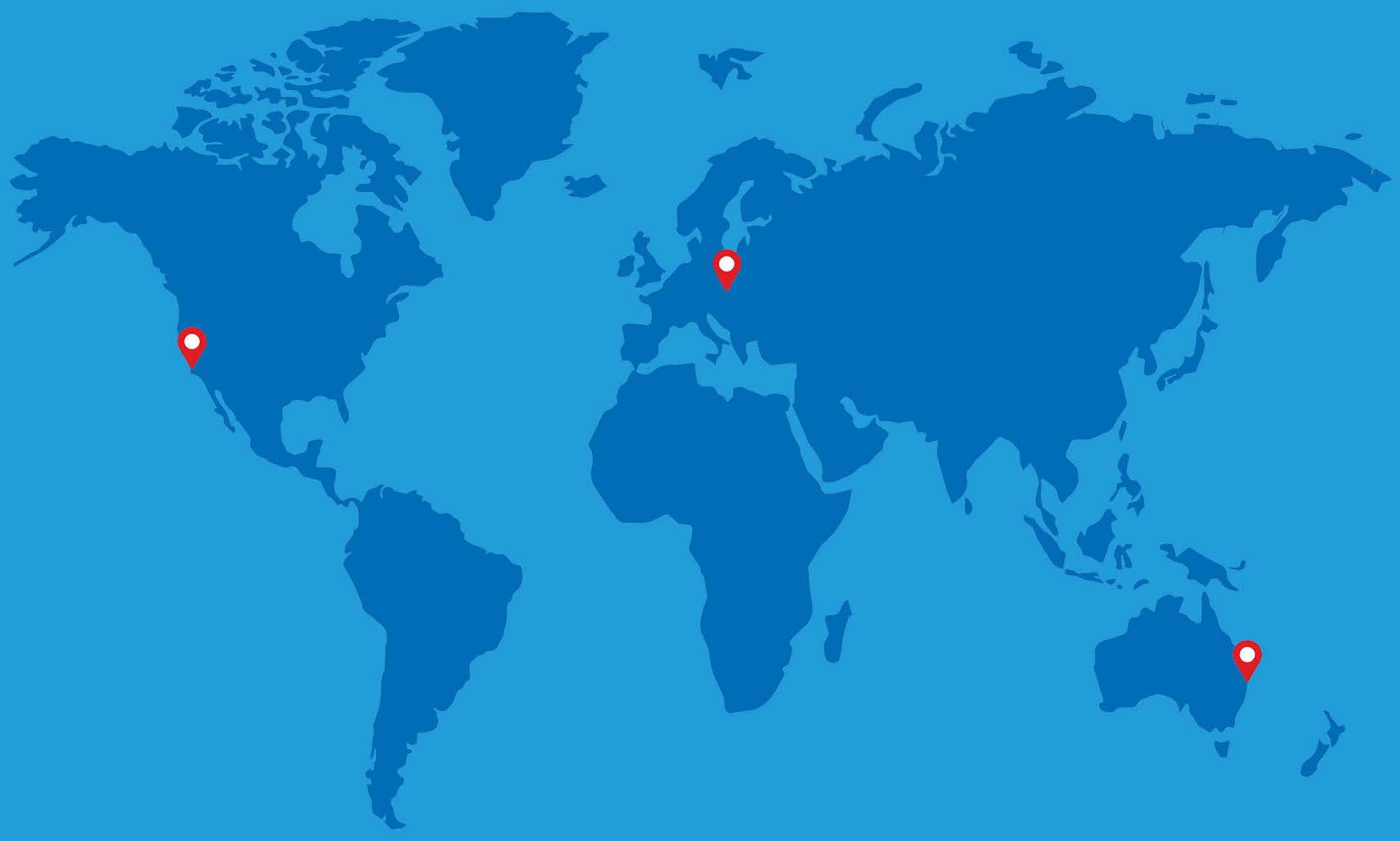
PC: **H-500XP**

**Dimensions (LxWxH): 130x203x52mm Weight : 3.9kg*

	H-500	H-1000
Type of fuel cell	PEM	PEM
Number of cells	30	50
Rated power	500W	1000W
Rated performance	18V@27.8A	30V@33.5A
Reactants	Hydrogen and Air	Hydrogen and Air
External temperature	> 0 up to +35°C	5-35°C
Max stack temperature	63°C	65°C
Composition	99.99% dry H_2	99.99% dry H_2
H2 pressure	7.2-9.4 PSI	7.2-9.4 PSI
Humidification	Self-humidified	Self-humidified
Cooling	Air	Air
Weight	3.9kg	5kg
Dimensions	130x203x52mm	203x104x264mm
Flow rate at rated output	5.86L/min	15.5L/min
Peak efficiency of stack	56%	59%

Horizon Educational

The Horizon Educational Group was formed in 2011 with the goal of bringing renewable energy technology to classrooms and teachers across the globe. We design, produce, and distribute STEM education kits and teaching materials to over 150 countries, with a focus on hydrogen and hydrogen fuel cell education. This empowers students from the ages of 6-21 to develop renewable energy technology skills through hands-on learning.



AMERICAS
us@horizoneducational.com
+1 (424) 305-4671
Horizon Fuel Cell Americas, Inc.
1001 Wilshire Boulevard #1099
Los Angeles, CA 90017
United States

EUROPE
eu@horizoneducational.com
+420 222 530 490
Horizon Fuel Cell Europe, s.r.o.
Na Prikope 583/15
110 00 Prague 1
Czech Republic

ASIA PACIFIC
apac@horizoneducational.com
+61 405 913 115
Horizon Fuel Cell APAC Pty Ltd
Suite 40, 207 Currumburra Road 4214
Ashmore, QLD
Australia

www.horizoneducational.com