Heliocentris

Renewable Energy Technology for Education and Research

For Schools, Vocational Schools, Universities and Research Institutes

ACADEMIA OFFERING

Fuel Cells Energy Management Renewable Energy Efficiency Power to Ga

Heliocentris Academia – Your Partner for Instruction in Renewable Energies, Energy Storage and Energy Management.

Knowledge about renewable energies and their storage have become a permanent fixture in our lives and will play an even greater role in the future. The education of students in this technology is a central element of our mission.

Heliocentris training products help students at schools, universities and research institutions to understand key concepts regarding renewable energy, energy management and energy storage. You will bring students closer to these complex technologies, while achieving the desired learning outcomes in a fun and interesting way. Heliocentris products will pique the interest of students and assist instructors in the key areas of Science, Technology, Engineering and Mathematics. Each product includes well written manuals, instructional material and software that is tailored to the key topics covered by the system. While the curriculum topics vary, they help give students the required knowledge to understand renewable energy systems.

Our products stand for:

» Curricular relevance and didactic quality
» Measurement precision and excellent workmanship
» High quality products and robust construction
» Simple and fast commissioning and operation
» Versatile areas of application in chemistry, physics and electrical engineering
» Target-group-specific documentation and experiments for students

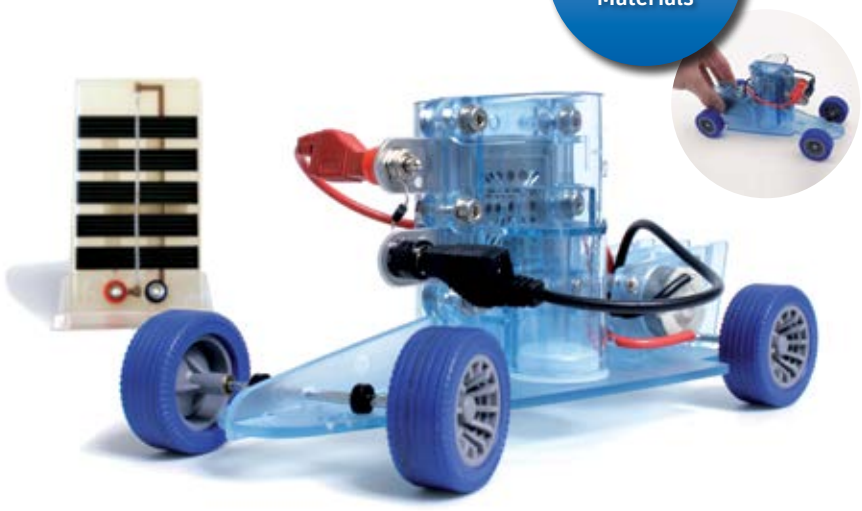
Heliocentris Academia

Training Products for Schools, Universities and Research Institutes

Model Car

Model Car with Reversible Fuel Cell

Includes Instructional Materials



Powered by water and sunlight, the Model Car is a vivid introduction to the topic of renewable energies. With pre-configured experiments and a curriculum-oriented instruction manual, the contents of solar, hydrogen and fuel cell technology can be easily communicated.

The Model Car is distinguished by its flexible and durable construction and can be used for individual or group work. The numerous experiments can be practically implemented for current topics such as energy storage and alternative drives.

Key Features

- Design of fuel cells and solar cells
- How to measure the current and the voltage of the fuel cell
- Up to 5 students can work with the Model Car at the same time
- Suitable for communicating subject matter from physics, chemistry and technology curricula
- CO_2-free mobility
- Energy Storage and use of renewable energies
- Chemical reactions of the entire energy conversion chain (e.g. water to hydrogen and oxygen)
- Hydrogen generation by means of electrolysis via solar module or hand generator

COMPONENTS

STORAGE BOX

REVERSIBLE FUEL CELL

SOLAR PANEL

CHASSIS

HAND GENERATOR*

LOAD MEASUREMENT BOX*

RING BINDER AND CD

Sample Experiments

- Energy conversion
- How to measure the current and the voltage of the fuel cell and electrolysis
- Hydrogen generation by means of electrolysis via solar module or hand generator
- Load measurement box for measuring current and voltage
- Characteristic curves of current and voltage
- Measurement of electrical charge
- Various load settings possible for measuring the effect on current and voltage
- Use of renewable energies
- Design of fuel cells
- Design of solar cells
- Solar cell: measurement of electrical power depending on the alignment of the solar module and the intensity of the light source (measurement curves)
- Generation of electrical energy

Model Car available as a class set. *Page 7*

Product Options

Model Car Complete	Model Car Demo
The measurement box enables quantitative investigations. Power can be generated with the hand generator as an alternative to the solar module	Numerous simple demonstration experiments for physics, chemistry and technology lessons
» Reversible fuel cell » Solar panel » Chassis » Instruction material with Experiment Guide in ring binder + CD » Bottle with distilled water » Cable set » *Load measurement box** » *Hand generator**	» Reversible fuel cell » Solar panel » Chassis » Instruction material with Experiment Guide in ring binder + CD » Bottle with distilled water » Cable set
Art. no. 354	**Art. no. 352**

Accessories

Lamp	Lamp for operating the solar cell	**Art. no. 314**

Dimensions (W x H x D): 345 x 160 x 280 mm, weight: approx. 2.9 kg.
*Only included with Model Car Complete.

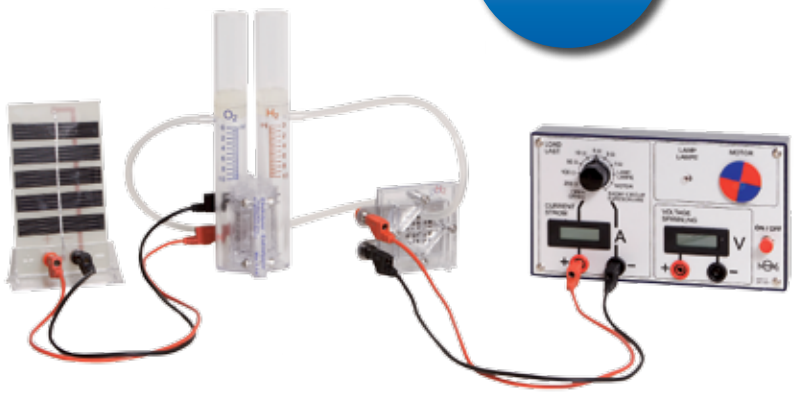
Science Kit

Practice and Demonstration Set for Solar, Hydrogen Technology

Includes Instructional Materials

The Science Kit is an extensive experiment set for the subject of renewable energies. 20 pre-configured experiments and extensive accompanying materials make it a complete solution for physics and chemistry lessons.

The components form a complete solar-hydrogen energy conversion chain and can be flexibly combines with one another. The topic of renewable energies can be approached in consideration of the entire conversion chain or on the level of the individual technologies, such as photovoltaics or fuel cells. All components can be used and investigated separately.



Key Features

- Basic design of fuel cells and solar cells
- Up to 5 students can work with the Science Kit at the same time
- Suitable for communicating subject matter from physics, chemistry and technology curricula
- Energy Storage and use of renewable energies
- Chemical reactions of the entire energy conversion chain, e.g. water to hydrogen and oxygen or methanol to carbon dioxide and current
- Hydrogen generation by means of electrolysis via solar module or hand generator
- Conversion of solar energy to electronic energy and hydrogen
- Increase of efficiency of fuel cells
- Use of stored energy
- Separation of water into hydrogen and oxygen

COMPONENTS

STORAGE BOX

FUEL CELL

LOAD MEASUREMENT BOX

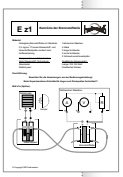
METHANOL FUEL CELL*

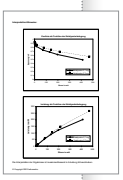
FUEL CELL COMPONENTS*

INSTRUCTION MATERIAL WITH EXPERIMENT GUIDE AND CD

Sample Experiments

- Examination of solar cells and their efficiency
- How to determine the tilt angle of solar cells
- How many solar cells supply a house?
- Investigation of water electrolysis – how is water separated?
- Investigation of the electrolyzer: Does current increase when the voltage is increased?
- Examination of a hydrogen and methanol fuel cell
- How does the green house effect work?
- Examination of efficiency in the system
- Investigating electrolyzers and fuel cells
- Hydrogen as an energy carrier and storage
- How to create a characteristic curve of an electrolyzer and of a hydrogen and methanol fuel cell
- Calculating the Faraday efficiency of an electrolyzer





Science Kit is available as a class set. *Page 7*

Product Options

Science Kit Complete	Science Kit Demo
Basic experiments and in-depth experiments for various fuel cell types	A variety of basic experiments for physics, chemistry or technology lessons
» Electrolyzer » Fuel cell » Solar panel » Load measurement box » Instruction material with Experiment Guide + CD » Take-apart fuel cell* » *Methanol fuel cell**	» Electrolyzer » Fuel cell » Solar panel » Load measurement box » Instruction material with Experiment Guide + CD
Art. no. 355	**Art. no. 350**

Accessories

Lamp	Lamp for operating the solar cell	**Art. no. 314**
Hand generator	Hand generator for manual production of hydrogen	**Art. no. 354**

Dimensions (W x H x D): 430 x 150 x 310 mm, weight: approx. 5.6 kg.
*Only included with Science Kit Complete.

Professional

Practice and Demonstation Unit for Solar, Hydrogen Technology

The Professional Training System forms a complete solar-hydrogen energy circuit. Electric current is generated by a solar cell, stored by means of electrolysis and converted back in a fuel cell which supplies a consumer.

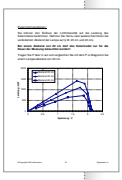
The Professional Training System supports you in presentations to the class. Solar technology and fuel cells can be investigated in detail. Large components and easy-to-read displays are ideal for group presentations.
Pre-configured experiments and comprehensive documentation simplify lesson preparation.

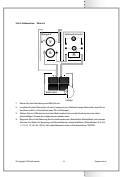
Key Features

- Demonstration unit for classroom-style teaching
- Suitable for communicating subject matter from physics, chemistry and technology curricula
- Basic design of fuel cells and solar cells
- How to measure the current and the voltage of the fuel cell and electrolyzer
- Energy storage and use of renewable energies
- Chemical reactions of the entire energy conversion chain
- Water to hydrogen and oxygen
- Hydrogen generation by means of electrolysis via solar module or hand generator
- Quick guide for fast commissioning
- Complete energy conversion chain from solar energy to hydrogen and into electrical energy again
- Observing increased efficiency of fuel cells

Sample Experiments

- Examination of solar cells and their efficiency
- How to determine the tilt angle of solar cells
- How many solar cells supply a house?
- Investigation of water electrolysis: How is water separated?
- Investigation of the electrolyzer – does current increase when the voltage is increased?
- Examination of a hydrogen and a methanol fuel cell
- How does the green house effect work?
- Examination of efficiency in the system
- Investigating electrolyzers and fuel cells
- Hydrogen as an energy carrier and storage
- Characteristic curve of an electrolyzer and a hydrogen fuel cell
- Calculating the Faraday efficiency of an electrolyzer





Includes Instructional Materials

INSTRUCTION MATERIAL WITH EXPERIMENT GUIDE + CD

SOLAR PANEL

DOUBLE FUEL CELL

ELECTROLYZER

MEASURING UNIT[1]

LOAD

Product Options

Professional Complete	Professional Demo
Visualization of measurement data by the measuring unit	Numerous descriptive demonstration experiments for physics, chemistry and technology lessons
» Solar panel » Electrolyzer » Double fuel cell » Load » Instruction material with Experiment Guide + CD » *Measuring unit*[1]	» Solar panel » Electrolyzer » Double fuel cell » Load » Instruction material with Experiment Guide + CD
Art. no. 392	**Art. no. 391**

Accessories

Lamp	Lamp for operating the solar cell	**Art. no. 314**

Dimensions (W x H x D): 600 x 840 x 460 mm, weight: approx. 10.1 kg.
[1] Measuring unit only included with Professional Complete.

Class Sets and Instruction Material

The affordable offer for the entire class.
The class sets are designed for use by six groups of four students each.
One set of Instructional Material is included in each set.

Professional Complete – class set

1 x Professional Complete
6 x Science Kit Basic*
1 x Science Kit instructional materials
1 x CD

Includes the Professional Complete for presentations to the class. It is based on the same didactic concept as the included Science Kits.

Art. no. 927

Professional Demo – class set

1 x Professional Demo
6 x Science Kit Basic*
1 x Science Kit instructional materials
1 x CD-ROM

Includes the Professional Demo (without measuring module) for presentations to the class. It is based on the same didactic concept as the included Science Kits.

Art. no. 915

Science Kit Basic – class set

6 x Science Kit Basic*
1 x Science Kit instructional materials
1 x CD

Includes the Science Kit Basic for experiments together with the class.

Art. no. 916

Model Car Complete – class set

Model Car Class Set

6 x Model Car Complete*
1 x Model Car instructional materials
1 x CD

Includes the Model Car Complete for experiments together with the class.

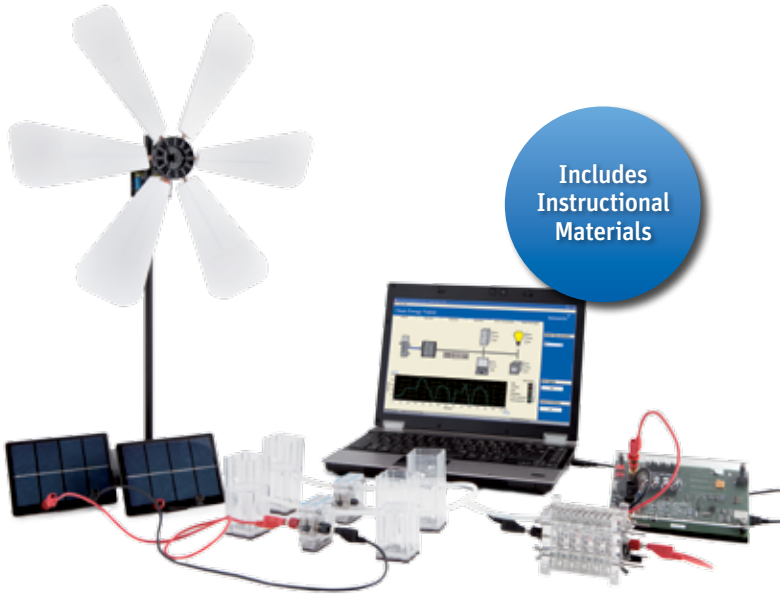
Art. no. 926

*Without instruction material.

Clean Energy Trainer

Experimentation Set for Energy Production, Energy Storage and Energy Supply

The Clean Energy Trainer demonstrably shows your students the complete chain of renewable energy production (from wind and solar) and hydrogen-based energy storage. Various climate and consumption profiles corresponding to the components in use can be selected in the learning and experimentation software. The supplied documentation is designed for chemistry, physics and electrical engineering lessons.



Key Features

- Experimentation set for energy production, storage and supply with solar and wind energy, as well as a fuel cell for up to 4 students at the same time
- Control and generation of electrical energy and the management of these processes
- Comprehensive documentation and experimentation in the fields of chemistry, physics and electrical engineering with 6 experiments and their explanation, as well as the instructor solution set

Software

- Learning about energy management and energy storage
- Simulations of loads and source profiles
- Visualization of operating parameters in tables and graphs
- Manual and fully automatic generation of characteristic curves
- Control of solar modules, wind generators, electrolyzers, the fuel cell and load profiles via software

*Lamp and fan are available as accessories.

Sample Experiments

- Explore properties, efficiency and characteristic curves of the Solar Module, Wind Generator and Fuel Cell
- How to optimally align renewable energy sources: Which energy source generates the most hydrogen?
- Chemical reaction of water during electrolysis: How to generate hydrogen with renewable energy sources
- Which constellation is required at the different locations in order to operate an autarkic single-family home?
- How does a solar / wind / hydrogen system have to be designed in order to supply a residence?
- Applying Faraday's first law to fuel cells

Product Overview

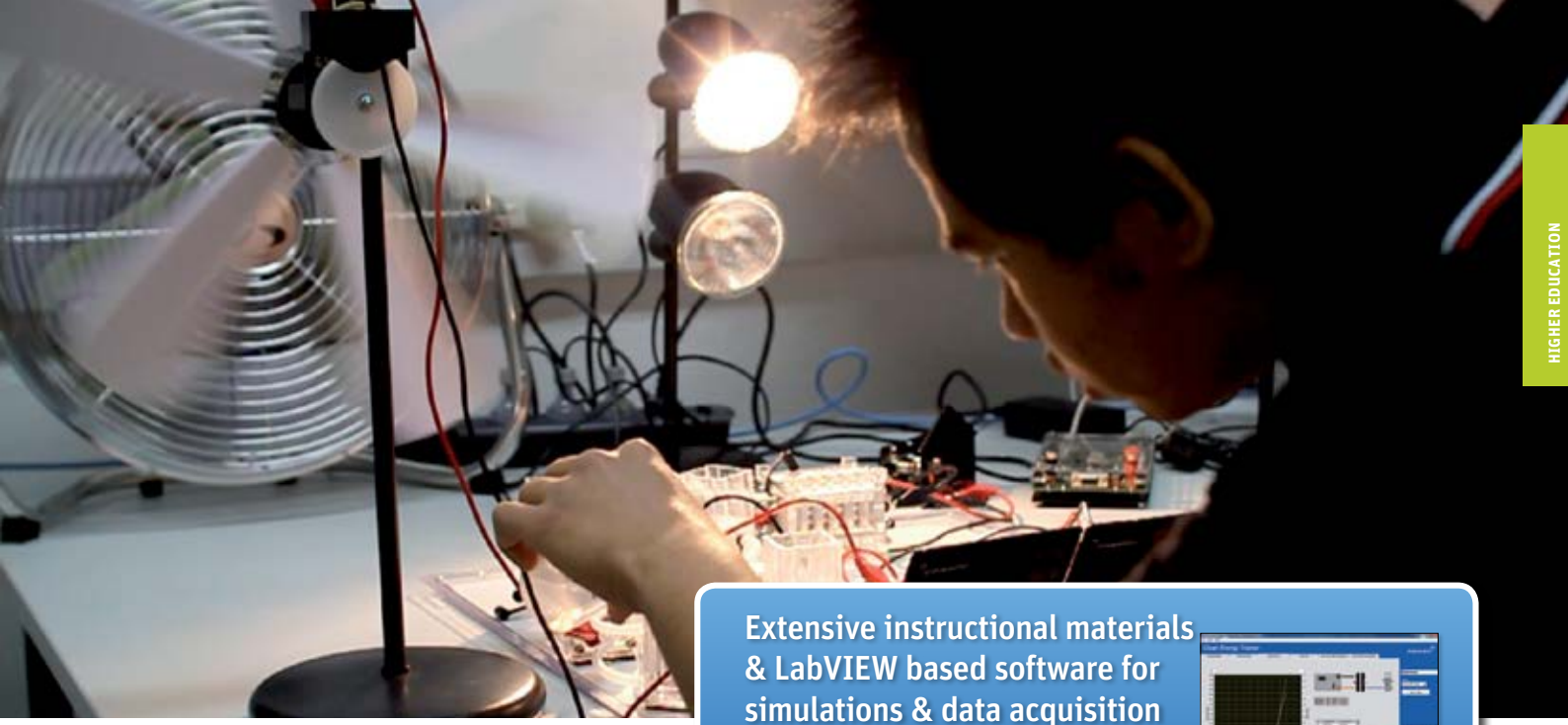
Clean Energy Trainer

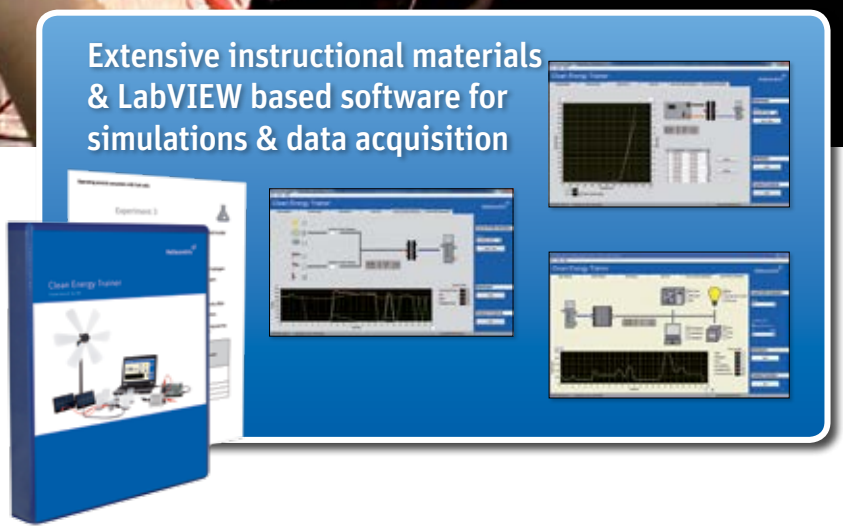
- Wind generator
- 2 x solar module
- 2 x 30 ml hydrogen storage canister and 2 x oxygen storage canister
- 2 x electrolyzer
- Take-apart fuel cell stack
- Consumer (house)
- USB data monitor
- PC software
- Anemometer
- Radiation meter
- Instruction Manual and Experiment Guide + CD

Art. no. 410

Accessories

Double spot lamp	Lamp with two spots for operation of the solar cells	**Art. no. 421**
Fan	Fan for operation of the wind generator	**Art. no. 422**





Clean Energy Trainer Laboratory Set

Makes it Easier to Start Courses on Renewable Energies and Energy Management

Clean Energy Trainer Laboratory Set

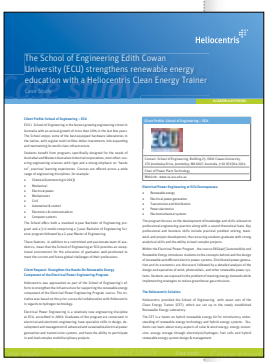
6 x Clean Energy Trainer

1 x Clean Energy Trainer instruction material with Experiment Guide in ring binder
1 x CD with instructional materials and Experiment Guide

With the Heliocentris Clean Energy Trainer Laboratory Set, more than 24 students can perform experiments in six groups.

Art. no. 960

Client Testimonial of the School of Engineering at Edith Cowan University in Australia



Heliocentris has equipped Edith Cowan University with a Clean Energy Trainer Laboratory Set to set up a complete laboratory for renewable energies. With its well-planned design, the Clean Energy Trainer is a valuable tool for renewable energy instruction and to pique your students' interest in renewable energies.

http:www.heliocentris.com/academia/case-studys

"The Clean Energy Trainer is very good for instruction in renewable energies. ... We plan to expand its use beyond the regular instruction units in the laboratory."

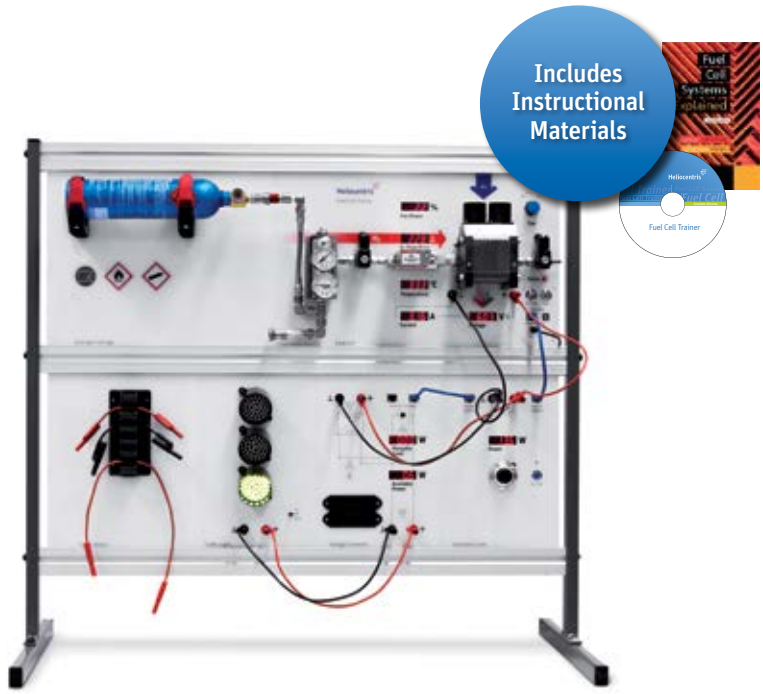
Dr. Octavian Bass, *2013*
School of Engineering, Edith Cowan Universität, Australien 2013

Fuel Cell Trainer

50 W Fuel Cell Training System for Teaching Basic Engineering Principles

The Fuel Cell trainer is ideally suited for teaching the basic engineering principles of PEM fuel cell systems. Extensive experimenting capabilities and comprehensive instruction material with predefined experiments make it a complete instruction package.

All components of the fuel cell system are represented individually and can be examined easily. The supplied software enables your students to conduct experiments and measurements.



SOFTWARE

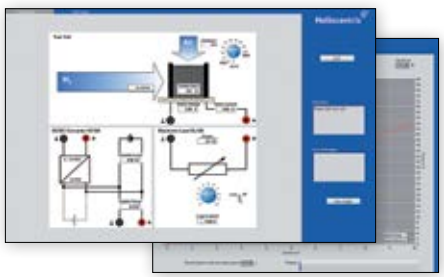
COMPONENTS

Key Features

- Optimized instruction material for teachers and students
- 50 W PEM fuel cell with modular system design and upgrade options
- Extensive measuring technology and data acquisition via PC interface
- Convenient experimentation software and measurement data acquisition
- Integrated safety monitoring also for inexperienced users

Software

- Recording and visualization of measurements
- Computer-supported experimentation



System overview

Fuel cell module

Experiments:

Basic experiments:

- Characteristic curves and efficiency curves
- Dependence of output on temperature and air supply
- Hydrogen / current characteristic curve
- Calculating the efficiency of the fuel cell stack

Application-related experiments:

- System efficiency of a fuel cell system
- Independent power supply and working range of a fuel cell
- Sample application for fuel cell car: fuel consumption and load profile

Product Overview

Fuel Cell Trainer

- Fuel cell module
- Electronic load
- DC voltage converter module
- Traffic light module
- H_2 storage module
- Instruction material with Experiment Guide in ring binder
- Software + CD
- Textbook “Fuel Cell Systems Explained”

Art. no. 693

Accessories: Hydrogen supply – 200 bar H_2 connection kit

Pressure reducer for filling the hydrogen storage canister in the H_2 storage module **Art. no. 631**

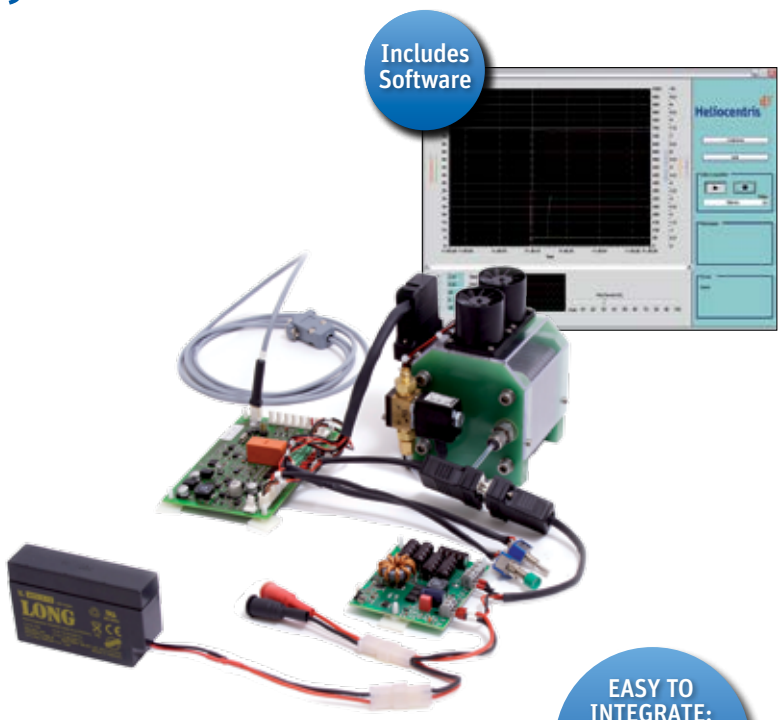
Dimensions (W x H x D): 910 x 840 x 460 mm, weight: 20 kg.

Fuel Cell Integration System

From Theory to Practical Application

The Fuel Cell Integration System is an assembly kit with components that are perfectly optimized to one another, assuring stable operation of the system.

The Fuel Cell Integration System can be hybridized with a battery in order to expand the power range for certain applications. The durable and reliable components are well-suited for the construction of mobile applications. Easy to install and operate, the system serves as the perfect basis for gaining practical experience with fuel cell technology.

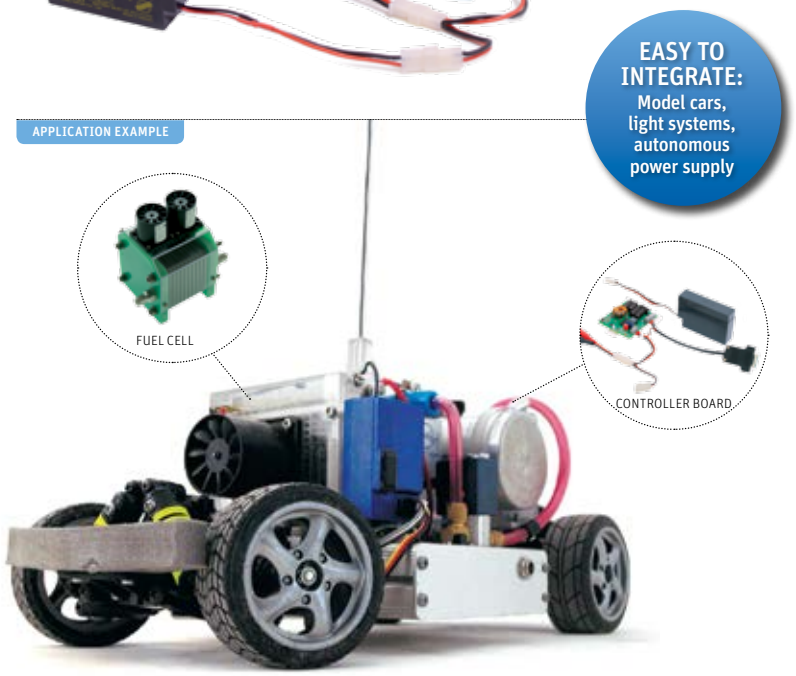


Key Features

- Optimized interfaces
- Modular design
- Flexible system
- Extensive documentation
- Monitoring software

Software

- Recording and visualization of measurements



"Our students were thrilled. We highly recommend Heliocentris for universities with fuel cell courses."

Boris Gauss, *Research Scientist, Technical University of Berlin, 2006*

Product Overview	
Fuel Cell Integration System	
» 50 W fuel cell stack » Controller board	» Monitoring software
	Art. no. 611*
Hybrid Extension	
» DC converter » Load regulator	» 12 V battery
	Art. no. 623

* Only available in combination with a hydrogen connection kit from Heliocentris.

Nexa® Training System

1.2 kW Fuel Cell Training System for Hybrid Applications

The Nexa® Training System allows practical preparatory experiments in the design and hybridization of an energy system using fuel cell technology in your laboratory. With the modular design, students can investigate and influence the fuel cell module, the hydrogen storage canister, the battery and the power electronics on an individual basis and combine the modules with one another.

Extensive instructional material supports instructors for class preparation and instruction. Pre-configured experiments and software-supported experimentation make it easier for your students to work with the complex system.

Key Features

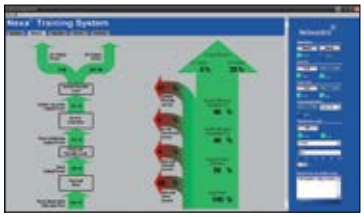
- Realistic training system with a 1.2 kW fuel cell with battery hybridization
- Learning and experimenting software with automatic generation of characteristic curves
- Central visualization and control of all system processes via computer
- Two battery capacities for experiment setups
- Output for DC and AC power
- Integrated hydrogen storage canister
- Flexible use of the system, standing and sitting
- Extensive learning and experimenting materials

Software

- System Overview
- Efficiency Analysis
- Time Curve
- Freely configurable measurements
- Visualization of characteristic curves
- Selection of manual and automated experiments

SOFTWARE

System Overview



Measurements

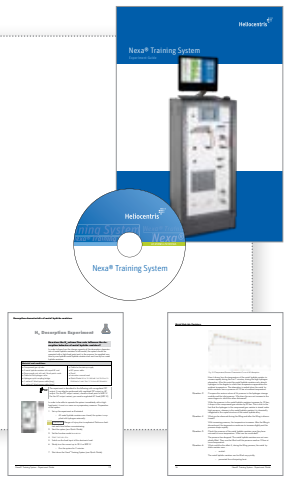
Sample Experiments

System design for special applications:

- Backup
- Emergency power supply (UPS)
- Autonomous power supply

Examination of the operating behavior of:

- Fuel cell module
- DC converter
- Battery module



Product Overview

Nexa® Training System

- Nexa® DC1200 power electronics module
- Electronic load
- Battery module
- H_2 storage module
- System control via touchscreen
- Software + CD
- All-in-one PC

Art. no. 793*

Accessories*: Hydrogen supply – 200 bar H_2 connection kit

Direct supply from H_2 compressed gas cylinders and filling of the H_2 storage module **Art. no. 736**

Dimensions (W x H x D): 600 x 1,350 x 600 mm, weight: approx. 150 kg.
* Only available in combination with a hydrogen connection kit from Heliocentris.

Nexa® Integration System

From Theory to Practical Application

The Nexa® Integration System is ideal for demanding application projects. The Nexa® 1.2kW fuel cell power module has been designed as a very durable and reliable system to ensure success with training and research projects. The system uses a DC/DC converter optimized for the module and a software package for easy control of all components.

The system prepares regulated DC voltage and enables simple hybridization with batteries. Open interface and comprehensive configurability of the individual components simplify the integration and guarantee optimal performance.

Key Features

- Easy to integrate and operate
- Easy to hybridize with batteries and other energy sources
- High efficiency and high reliability due to safe setup of the system
- Easily accessible interfaces make the system easy to interact with

Software

- System Overview
- Efficiency Analysis
- Time Curve
- Freely configurable measurements
- Visualization of characteristic curves

"The Nexa® 1200 is a very maintenance-friendly fuel cell and is outstandingly well-suited for mobile applications, thanks to its reliability."

Thomas Pohle, *Head of Service Operations, Heliocentris*

Nexa® 1200

The Nexa® is a versatile 1.2 kW fuel cell module tailored to the requirements of system integration.

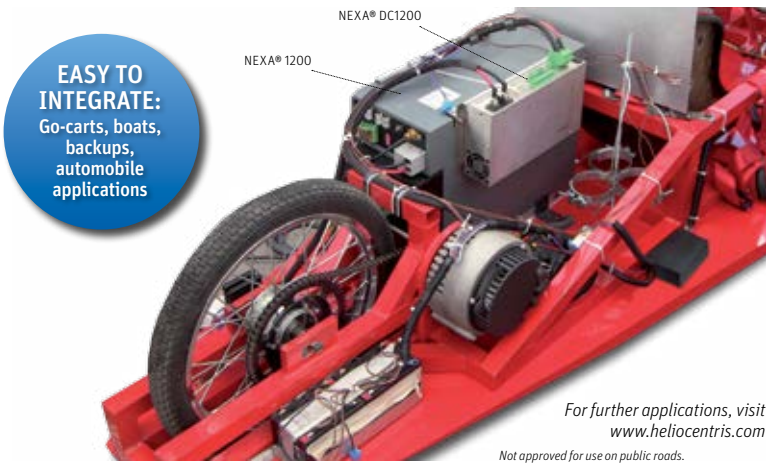
Nexa® DC1200

The Nexa® DC 1200 transforms the non-regulated output voltage of the fuel system to 24/48 V DC voltage and enables simple realization of battery hybridization.

Nexa® OSC Software – For the perfect setup of components

The Nexa® OSC software can be used for efficient overall system control of the Nexa® 1200 and Nexa® DC1200. Data from all components can be centrally parameterized and visualized.

APPLICATION EXAMPLE



For further applications, visit www.heliocentris.com

Not approved for use on public roads.

Product Overview		
Nexa® 1200		
» 1.2 kW fuel cell module » Monitoring and control software	» Startup kit	
		Art. no. 1911*
Nexa® DC1200		
» DC converter	» 24 V	**Art. no. 1610**
	» 48 V	**Art. no. 1611**
Nexa® OSC Software		
» Software package for the overall system control		**Art. no. 1870**

* Only available in combination with a hydrogen connection kit from Heliocentris.

Accessories and hydrogen supply available on request.

Solar Hydrogen Trainer

Mobile Laboratory for Hydrogen Generation with Solar Energy

Includes Instructional Materials

The Solar Hydrogen Trainer is a training system for generating hydrogen by means of an electrolyzer, which is powered by two photovoltaic modules. Performance and generation data of the PV modules, power electronics, battery and electrolyzer are captured and displayed in the included LabVIEW based software.

The system is designed to be combined with additional Heliocentris products, such as the Fuel Cell Trainer, Nexa® or Nexa® Training System. The components of the system are mobile and can be connected or disconnected quickly. The supplied documentation supports instructors in lesson planning.

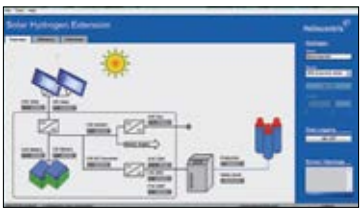
Key Features

- Mobile Laboratory For Solar Hydrogen Generation
- Electrolyzer and PV system can be used separately
- LabVIEW based Software for system control, system monitoring and data acquisition
- Extensive instruction material and Experiment Guide
- User-friendly, easy-to-operate
- Remote monitoring via LAN network is possible
- Can be combined with other systems like Nexa Integration System, Fuel Cell Trainer and Nexa Training System (see page 17).

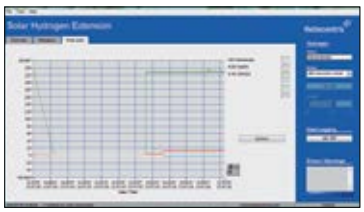
Software

- System overview and control of components
- Overall system efficiency analysis
- Freely configurable measurements
- Overall system output balancing
- System efficiency chain (Sankey diagram) and flow chart
- Voltage and current display for individual components

SOFTWARE



System Overview



Measurements

Learning Objectives

- Basic principles of photovoltaic power production and storage
- Functional principle of an autonomous solar system
- Determining the efficiency of solar hydrogen generation
- Design of a solar hydrogen system
- Mobile system technology unit
- Hydrogen generator

Solar Hydrogen Add-on on page 17

Product Overview

Solar Hydrogen Trainer

- Mobile unit with solar system components
- 2x mobile photovoltaics module
- Hydrogen generator with interface
- Monitoring and control software
- Cable set

PV version (without hydrogen generator)	**Art. no. 810**
Solar Hydrogen Trainer with 30Nl/h	**Art. no. 811**
Solar Hydrogen Trainer with 60Nl/h	**Art. no. 812**

Accessories

PV sensors: radiation, module and ambient temperature	**Art. no. 821**
H_2 storage canister – metal hydride storage canister 760 Nl	**Art. no. 647**

New Energy Lab

Renewable Energy Smart Grid for Training & Applied Research

The New Energy Lab is a full-fledged energy system for conveying practical knowledge in the field of energy management. The system combines renewable energy generation from solar, wind and fuel cell power with modern energy storage technology.

The New Energy Lab enables the exploration of various energy sources in combination with the battery system or electronic load. The Monitoring and Control Software enable your students to optimally evaluate system data.

Key Features

- Laboratory for solar, wind, hydrogen and fuel cell technology
- Set-up of hybrid system with solar, wind, hydrogen and fuel cell technology, as well as batteries
- High reliability and safety
- Comprehensive system software

Software

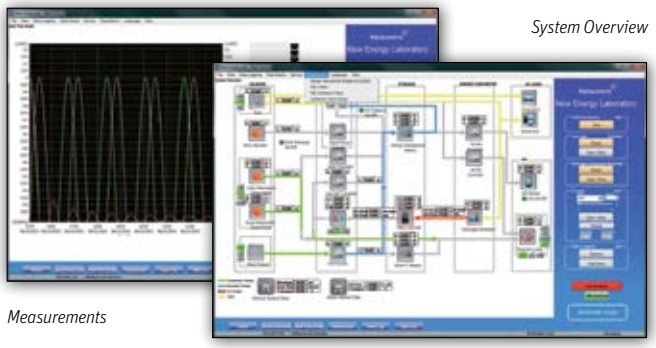
- System overview, control and explanation of components
- Efficiency analysis of the overall system and the individual components
- Freely configurable measurements
- Output balancing of the overall system and the individual components
- System efficiency chain and flow chart
- Voltage and current display for individual components
- Monitoring of the hydrogen circuit
- Creating and saving load profiles

System includes

- Solar system: 1,200 Wp
- Small wind power module: 400 W
- Fuel cell module: 1,200 W
- Battery bank: 110 Ah
- Electrolyzer: 60 Nl/h
- Low-pressure metal hydride canisters: 1,500 Nl
- Electronic load: 2,400 W
- Central energy management unit
- System controller with monitoring and control software
- Measuring technology, such as anemometer, H_2 flow meter

Accessories available on request.

SOFTWARE

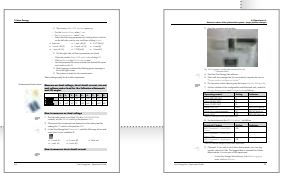


System Overview

Measurements

Learning Objectives

- Introduction to solar, wind, hydrogen and fuel cell technology
- Design of hybrid systems
- Energy management and operation of hybrid systems
- Autonomous operation of real loads
- Scenario analysis: night-time operation, periods of no wind, peak loads



Water-Cooled Fuel Cell Systems

FC-42 Evaluation Kit

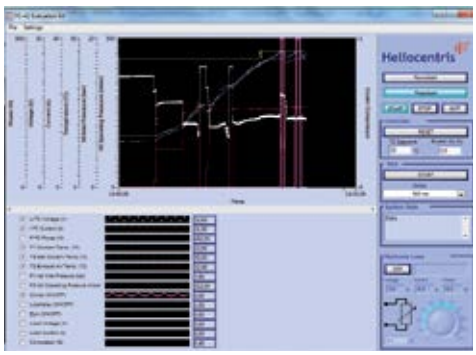
A Fuel Cell System for Power and Heat Research

For use in laboratory or research environments, Heliocentris offers a turnkey solution for water-cooled fuel cell systems. The FC-42 Evaluation Kit enables the operation and investigation of a water-cooled FC-42 fuel cell stack from the company Schunk, which could be used in power and heat co-generation research.

Key Features

- Simple introduction to fuel cell systems as the topic of power and heat co-generation up to 720 watts
- Convenient integration of additional measuring technology
- Extensive possibilities for use / application examples
  - Stationary power supply
  - Emergency power and UPS systems
  - Research modules in the laboratory
  - On-board power supply for vehicles, boats, etc.
- Comprehensive system software for the
  - Central visualization of system data
  - Central operation and parameterization of all components

SOFTWARE



System Overview

Product Overview

FC-42 Evaluation Kit

- Operator
- Controller
- FC-42 stack
- AC adapter
- Monitoring software

360 W version **Art. no. 1902**[1]

720 W version **Art. no. 1903**[1]

Hydrogen supply

200 bar H_2 connection kit for supply from compressed gas cylinders **Art. no. 631**

[1] Only available in combination with a hydrogen connection kit from Heliocentris.

HyPM High Power Fuel Cell Lab

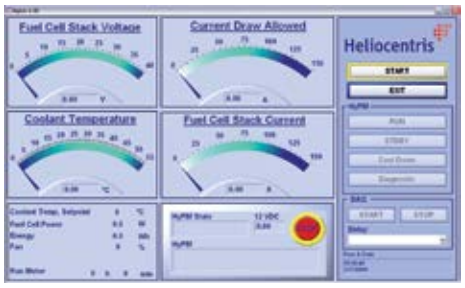
High Power Fuel Cell System for Laboratory Applications

The HyPM Lab Solution is a fully integrated, industrial water-cooled fuel cell system with output power range of 4.5-16.5 kW, which is designed for applications and investigations in a research environment.
The integration comprises:

- Start-up Power Supply
- Cooling circuit
- Power electronics
- Hydrogen safety components
- Overall system control
- Monitoring and control software

The water-cooled HyPM fuel cell systems are used in applications such as emergency power supply or small buses. They feature a completely integrated, compact design, high efficiency and good dynamics. The systems are available from 4.5 kW to 16.5 kW for stationary or mobile applications.

SOFTWARE



System Overview

Product Options
Available from 4.5 kW to 16.5 kW,
more on page 21.

Solar Hydrogen Add-On

With the following products, students have the possibility of investigating the entire energy conversion chain – from hydrogen production to the storage and consumption of hydrogen. We provide extensive competent consultation for equipping your laboratory.

Solar Hydrogen Trainer (p. 14)

+

Metal hydride storage canister

+  **Fuel Cell Trainer** p. 10

+  **Nexa Training System** p. 12

+  **FC-42 Evaluation Kit** p. 16

Hydrogen Supply

For Fuel Cell Modules and Training Systems

HG Series Hydrogen Generators

The HG series hydrogen generators enable the production of the purest hydrogen (99.9999 %) and are suitable for direct operation of fuel cell systems and for filling metal hydride storage canisters.
The maintenance-free generators are available with a production capacity of 30 or 60 Nl/h and are designed for continuous operation. The Input/Output board enables control via PC and an expansion of the product capacity by means of cascading up to 10 generators.

Product Options	
HG30	**Art. no. 651**
HG60	**Art. no. 1302**
Accessories	
HG series Input/Output board	**Art. no. 1801**

Metal Hydride Storage Canisters

Metal hydride storage canisters operate at low pressures from 10 to 17 bar and enable the safe storage of larger quantities of hydrogen.

With various canister capacities (60, 250 and 760 Nl) and the possibility of connecting multiple canisters, the capacity can be increased. The quick coupling connector of the canister assures simple and safe coupling and uncoupling.

Product Options	
HS60	**Art. no. 645**
HS250	**Art. no. 646**
HS760	**Art. no. 647**

H_2 Connection Kit

Pressure reducer for direct operation of fuel cell modules or re-filling metal hydride storage canisters from 200 bar compressed gas cylinders.

Item No. 631

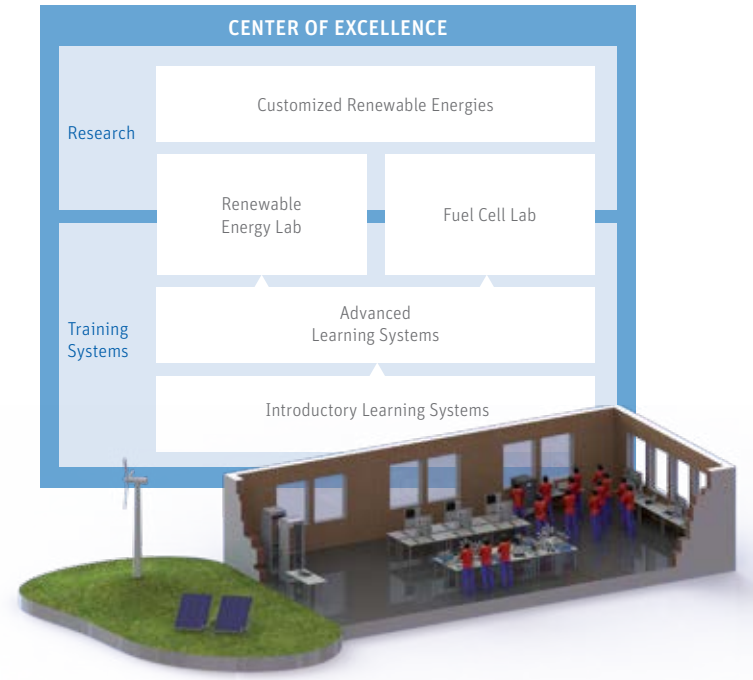
Hydrogen Detector

The portable hydrogen warning device (0 – 100 ppm) for monitoring of the workplace in combination with a leak detection liquid assure safety when working with hydrogen.

Item No. 731

Laboratory Solutions

Optimized for the special requirements of universities and research institutes, Heliocentris offers renewable energy solutions customized with expanded functions for energy management and energy storage.



Center of Excellence

Complete Laboratory Equipment for Training & Research. The modular design of our product range for training and research offers the possibility of combining Heliocentris products optimally for your interest areas to create a competence center.

Renewable Energy Lab

The Renewable Energy Lab provides a comprehensive look at renewable energy technology. From basic knowledge about solar energy, wind power and fuel cell technology to energy storage and energy management.

Fuel Cell Lab

The Fuel Cell lab offers a comprehensive look into fuel cell technology – from the basics, such as the design and function of fuel cell systems, to expert knowledge, such as the combination of fuel cell systems with battery technology.

Satisfied Customers Worldwide

Heliocentris supports educators and researchers around the globe in expanding their knowledge in the area of renewable energies. For this purpose, we offer solutions that are optimally tailored to your requirements and based on the best technologies currently available. With customers in more than 75 countries, Heliocentris is a leader in education and research of renewable energies, energy management and energy storage.

Fuel Cell Trainer & FC-42 Evaluation Kit, Georg Simon Ohm Nuremberg Institute of Technology, Nuremberg, Germany, page 10/16

HyPM 2x 16kW – fuel cell bus, Barth, Germany, page 16

Nexa 1200, Nexa DC1200, fuel cell boat, Buskerud University College, Kongsberg, Norway, page 13

HyPM 12 KW fuel cell car, Ponaganset High School, Rhode Island, USA, page 16

Clean Energy Trainer, Edith Cowan University (ECU), Australia, page 8

Nexa® 1200, Nexa® DC 1200, Hidromobil Hydrogen Race, Turkey, page 13

New Energy Lab, Public Authority for Applied Education & Training (PAAET), Kuwait, page 15

Tailored solution, Bahrain Petroleum Company (BAPCO), Bahrain, page 18

PRODUCT	ART. NO.	ARTICLE	PAGE
SCHOOL LEVEL			
Model Car			**Page 04**
	352	Model Car Demo*	
	354	Model Car Complete*	
	926	Model Car Complete class set of 6 units	
	Accessories		
	314	Lamp for operating the solar cell	
	345	Hand generator for manual production of hydrogen	
	358	Load measurement box	
	917	Lamps – class set of 6 units	
Science Kit			**Page 05**
	350	Science Kit Basic*	
	355	Science Kit Complete *	
	916	Science Kit Basic Bundle - class set of 6 units	
	924	Science Kit Complete Bundle - class set of 6 units	
	Accessories		
	345	Hand generator for manual production of hydrogen	
	314	Lamp for operating the solar cell	
	353	Take-apart fuel cell	
	357	Methanol fuel cell	
	917	Lamps – class set of 6 units	
Professional			**Page 06**
	391	Professional Demo	
	392	Professional Complete	
	915	Professional Demo class set	
	927	Professional Complete class set	
	Accessories		
	314	Lamp for operating the solar cell	
	917	Lamps – class set of 6 units	
HIGHER EDUCATION			
Clean Energy Trainer			**Page 08**
	410	Clean Energy Trainer*	
	960	Clean Energy Trainer Laboratory Set of 6 units	
	Accessories		
	421	Double spot lamp for operating the solar cell	
	422	Fan for operation of the wind generator	
	962	Double spot lamps	
	963	Fans – laboratory set of 6 units	
Fuel Cell Trainer			**Page 10**
	693	Fuel Cell Training System	
	Hydrogen supply		
	631	200 bar H_2 connection kit	
Fuel Cell Integration System			**Page 11**
	611	Fuel Cell Integration System	
	Accessories		
	623	Hybrid Extension – DC voltage converter + load regulator and 12 V battery	
	635	H_2 flow meter	
	Hydrogen supply		
	633	200 bar H_2 connection kit for supply from compressed gas cylinders	
	632	15 bar H_2 connection kit for supply from metal hydride storage canisters	
	645	Metal hydride storage canisters with 60 Nl	
Nexa® Training System			**Page 12**
	793	Nexa® Training System	
	Hydrogen supply		
	736	200 bar H_2 connection kit	

PRODUCT	ART. NO.	ARTICLE	PAGE
Nexa® Integration System			**Page 13**
	1911	Nexa® 1200 1.2 kW fuel cell module	
	1610	Nexa® DC1200-24 DC voltage converter	
	1611	Nexa® DC1200-48 DC voltage converter	
	1870	Nexa® OSC-Software	
	Accessories		
	1660	Power supply unit for the supply of the Nexa® 1200 during the startup phase	
	1650	24 V battery set – for the battery hybridization of Nexa® DC1200	
	1651	48 V battery set – for the battery hybridization of Nexa® DC1200	
	1620	DC/AC inverter for supply of AC voltage consumers	
	1730	Flow meter for measurement of the hydrogen consumption of the Nexa® 1200	
	Hydrogen supply		
	631	200 bar H_2 connection kit	
	1502	15 bar H_2 connection kit for the supply of the system from three metal hydride storage canisters	
Solar Hydrogen Trainer			**Page 14**
	810	PV version (without hydrogen generator)	
	811	Solar Hydrogen Trainer with 30 Nl/h	
	812	Solar Hydrogen Trainer with 60 Nl/h	
	Accessories		
	821	PV Sensor Kit: Sensors for radiation, module and ambient temperature	
RENEWABLE ENERGY LABORATORY SOLUTIONS			
New Energy Lab			**Page 15**
	880	New Energy Lab	
WATER-COOLED FUEL CELL SOLUTIONS			
FC-42 Evaluation Kit			**Page 16**
	1902	FC-42 Evaluation Kit 360 W	
	1903	FC-42 Evaluation Kit 720 W	
	Accessories		
	1201	FC-42 Replacement Stack 360 W	
	1202	FC-42 Replacement Stack 720 W	
	1601	Electronic load	
	Hydrogen supply		
	631	200 bar H_2 connection kit	
HyPM Lab Solution			**Page 16**
	240	HyPM XR from 4.5 kW for stationary applications. Also available up to 12.5 kW	
	250	HyPM XR from 4.5 kW for mobile applications. Also available up to 16.5 kW	
	Hydrogen supply		
	631	200 bar H_2 connection kit	
ACCESSORIES			
HG Hydrogen Generator			**Page 17**
	651	HG30 Hydrogen Generator – 30 Nl/h	
	1302	HG60 Hydrogen Generator – 60 Nl/h	
	Accessories		
	1801	Input/Output board for the HG series	
Metal Hydride Storage Canisters			**Page 17**
	645	Metal hydride storage canisters with 60 Nl	
	646	Metal hydride storage canisters with 250 Nl	
	647	Metal hydride storage canisters with 760 Nl	
Pressure Reducer			**Page 17**
	631	200 bar H_2 connection kit	
Hydrogen Detector			**Page 17**
	731	H_2 detector	
Electronic Load			**Page 17**
	1600	EL 2400 electronic load	

Solar Hydrogen Add-on on page 17

**also available with safety plugs*

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