



# Catalog



understanding new energies  
comprendre les énergies renouvelables  
Исучаем альтернативную энергию

neue energien verstehen  
entendiendo las energías renovables  
领会新能源

capire le nuove energie  
entendiendo las energías renovables  
فهم الطاقات المتجددة

# Greeting Contact

Why does leXsolar-understanding new energies exist?

We are convinced that renewable energies are the only solution to satisfy mankind's massive energy demands. With our products, we lay the foundation of an energy supply, relying 100% on renewable energies.

Everybody is talking about renewable energies. Let yourselves get bitten by the bug and learn to understand renewable energies!



Dr. Ronny Timmreck

Michael Dietrich

leXsolar GmbH  
Strehleener Str. 12- 14  
01069 Dresden  
Germany

Phone: +49 351 - 47 96 56 0  
Fax: +49 351 - 47 96 56 111  
E-Mail: info@lexsolar.com  
Web: www.leXsolar.com

General Managers:  
Dr. Ronny Timmreck  
Michael Dietrich  
Local court Dresden HRB 22097



▲ leXsolar headquarters  
X leXsolar local offices  
● leXsolar partner



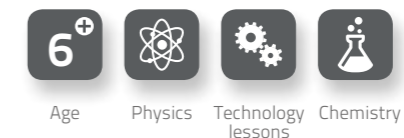
understanding new energies

# Contents All at a glance

About leXsolar	04
leXsolar areas of expertise	06
Product overview	08
leXsolar novelties	10
leXsolar-NewEnergy World	12
leXsolar-PV	22
leXsolar-Wind	30
leXsolar-H <sub>2</sub>	36
leXsolar-BioFuel	42
leXsolar-ThermalEnergy	46
leXsolar-EMobility	50
leXsolar-SmartGrid	56
leXsolar-ESave	60
leXsolar-Hydropower	62
leXsolar-SmartControl	66
leXsolar-Academy	72
Education projects	80
Social Media and international	84
Branding and Service	86

## Fields of application

On the product pages, the following symbols will show you which curriculum this product is designed for.



# Together with you we will ...

- ... explain renewable energy technologies – from the scientific principles to their applications – to let students and adults understand new energy.
- ... develop enthusiasm for renewable energy.
- ... contribute to the energy transition.



understanding new energies

Scan  
and watch the video:



# What we stand for:

- Our products and our service are oriented towards you! You, as customer, are our focus.
- We are innovative! Only modern teaching materials ensure a successful learning.
- We provide the highest quality: durable products with experiments that can be used during the lessons.



„I work for renewable energy 100%. With leXsolar I am able to provide the education system with the necessary knowledge.“

**Dr. RONNY  
TIMMRECK**

Founder and  
General Manager



„New energy means to me: new technologies, new education, new jobs, new perspectives! leXsolar makes your perspectives possible!“

**MICHAEL  
DIETRICH**

Founder and  
General Manager



„My job is to ensure that our products are always on the cutting edge of technology“

**DMITRY  
KUSHNIKOVSKIY**

Chief Technology  
Officer



„I guarantee the high didactic quality of leXsolar products and their instruction manuals.“

**ANJA  
WEITHÄUSER**

Product Manager



„I check the quality of our products and look forward to your suggestions for further improvements.“

**KRZYSZTOF  
SZYNAL**

Quality and  
Production Manager



„As your first point of contact I am pleased to support you in all your concerns. Furthermore I am responsible for the processing as well as the dispatch of your order.“

**NICOLE  
OLOTH**

Management  
Assistant



„My goals are vivid products, a comprehensible portrayal of reality as well as didactically valuable training exercises. This is how you understand renewable energies.“

**ANITA  
RASCHE**

Product Developer



„In order to meet your expectations and our quality standards I am constantly on the lookout for high-grade material attaching importance to innovative resources and manufacturing technologies“

**KRISTIN  
MAAB**

Quality Management  
Assistant



„It is my job to work on creative and technical solutions to ensure an efficient visual communication“

**TAMARA  
SOTO**

Graphic and  
Product Designer



„Understanding new energies‘ means to me strengthen the synergy between education and to reach this purpose, I develop individual and creative strategies for you.“

**MARIA  
KOWALOW**

Sales Manager



„From the moment of ordering, I make sure that your products arrive safely and in perfect condition at their destination.“

**IVONNE  
MACIELAG**

Production and  
Distribution



„I apply our high quality standards in production – which is why I rarely have to deal with repairing.“

**MANUELA  
FISCHER**

Production  
and Service

# The leXsolar areas of expertise

The leXsolar areas of expertise reflect the wide spectrum of renewable energies. You can find specialized educational products for nearly all the practical relevant technologies.

Even for related technologies that will play a decisive role in the future of our energy supply, like energy storage and energy efficiency, leXsolar offers suitable products.



understanding new energies



**leXsolar-NewEnergy World**  
Experiment with photovoltaics, wind- and hydropower, electromobility, energy storage and fuel cells and learn to understand renewable energies.



Page 12 ▶



**leXsolar-Wind**  
Wind power currently has the largest share of the renewable energy production.



Page 30 ▶

# Energies powering us


## Technology-spanning Topic Areas

leXsolar-SmartControl ist the innovative measuring and control system for all leXsolar experiments.

With the leXsolar-Academy you have access to an extensive training program in all of these topics. Here, all leXsolar products are fully integrated for maximum learning accomplishments.



**leXsolar-PV**  
Photovoltaic (PV) is the direct conversion of light into electricity through solar cells.



Page 22 ▶




**leXsolar-ESave**  
Energy efficiency and energy saving are core elements for the creation of a renewable energy supply.




Page 64 ▶




**leXsolar-Academy**  
leXsolar Academy connects you with the knowledge to deal with all the energy technologies and makes you a highly-qualified contact for students and colleagues.



Page 72 ▶




**leXsolar-SmartGrid**  
The term SmartGrid stands for the connection and control of energy producers, stores and consumers into an „intelligent power grid“.




Page 60 ▶




**leXsolar-EMobility**  
The use of storage technologies is a requirement for a sustainable energy revolution.




Page 54 ▶




**leXsolar-ThermalEnergy**  
Solar thermal technologies can not only be used to heat energy. Concentrated solar thermal energy can also generate electricity!




Page 50 ▶




**leXsolar-H<sub>2</sub>**  
Fuel cells can convert hydrogen (H<sub>2</sub>) into electricity – one possible solution to the storage problem of renewable energies.




Page 36 ▶




**leXsolar-BioFuel**  
Bio fuels can easily be stored and replace fossil fuels in transportation.




Page 42 ▶




**leXsolar-Hydropower**  
Hydropower was the first renewable energy source that was used by man and is subject to few fluctuations.



Page 66 ▶



**leXsolar-BioEnergy**  
Discover how biomass can be grown and the energetic use of different degradation processes. Experience the whole biomass cycle!



Seite 46 ▶

- ▶ Every age bracket and educational group has specific needs and different learning methods. To ensure a maximal learning success for every user, the leXsolar-product families are divided into different product series.

▶ understanding new energies

## leXsolar elementary school products

From an early age, children exhibit a natural urge to explore everything around them. At the same time kindergarten and elementary school provide the basis for a solid education. With our new leXsolar-Basics, which are available for different topics, children can playfully follow their pursuit of knowledge and develop a conscience for renewable energies.

For example, they can discover which energy sources there are and how they work. With our new leXsolar-NewEnergy Minikit, you will have all leXsolar-Basics in one box and can discover the world of

renewable energies together with your children.

*Note:*  
You are looking for a combined product for kindergarten/elementary school and high school? With our new leXsolar-NewEnergy Ready-to-go you will find all leXsolar-Basics for both age groups in one handy case and are ready to experiment any- and everywhere.



## leXsolar junior high school products

In junior high school, established knowledge is enlarged upon and strengthened, first more qualitatively, later increasingly through scientific work. Building upon the leXsolar-NewEnergy Minikit, leXsolar provides the leXsolar-NewEnergy kit for students of junior high school. With the experience-oriented experiments you will inspire your students and focus their attention towards every following experiment.

*Hinweis:*  
*Note:* You are looking for a combined product for kindergarten/elementary school and high school? With our new leXsolar-NewEnergy Ready-to-go you will find all leXsolar-Basics for both age groups in one handy case and are ready to experiment any- and everywhere. Use the advantages of our Ready-to-go series. Developed



*for junior and senior high school, these sturdy aluminum cases contain all necessary equipment such as cables and measuring devices and are ready to use anytime. You can use these in schools as well as anywhere else to experiment with your students on any leXsolar topics in renewable energies.*



## leXsolar senior high school products

Senior high school prepares students for their subsequent job training or college education. To meet these standards, with the help of the leXsolar Large series, you can conduct practice-oriented experiments as well as experiments examining the scientific foundation of renewable energies.

The product line mainly allows for quantitative student experiments and especially focuses on physical principles of every renewable energy source. Additional devices like

cables, multimeters, etc. are not provided.

*Note:*  
Use the advantages of our ready-to-go series. Developed for junior and senior high school, these sturdy aluminum cases contain all necessary equipment such as cables and measuring devices and are ready to use anytime. You can use these in schools as well as anywhere else to experiment with your students on any leXsolar topics in renewable energies.



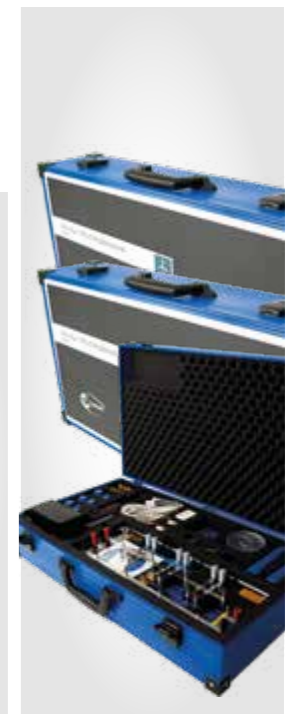
## leXsolar technical education products

Specialized systems for technical colleges and S&T education are available for the topics leXsolar-PV, leXsolar-Wind, leXsolar-EMobility, leXsolar-ThermalEnergy, leXsolar-H<sub>2</sub> and leXsolar-Smart-Grid.

You can find further information on these products in our catalog for technical education.



Professional Catalog available





## New area of expertise: leXsolar-BioEnergy Understanding the biomass cycle



## New education project : leXsolar Events Emil's World Tour



## Expansions of th leXsolar-Academy: leXsolar-Webinars

# leXsolar novelties

### 1 leXsolar-BioEnergy

In addition to produce bioethanol and FAME with our BioFuel system, our newest product BioEnergy Ready-to-go allows you to understand the whole biomass cycle. From the sprouting and growth of the plants to the aerobic and anaerobic degradation and the use of produced biogases – all of these steps can be performed and understood with our new system. For that you won't need any additional equipment, everything from seeds, fertilizer and hydroculture boxes to compost container, Erlenmeyer flask, tubings and measuring instruments is ready-to-go in the leXsolar-BioEnergy system.

*Please find further information starting on page 46.*

### 2 leXsolar-Events: Emils Weltreise

The educational project „Emil's World Tour“ introduce students to the world of renewable energies in a playful way, leXsolar develops a full program for the schools and supports them during the project.

*Please find further information starting on page 80.*

### 3 leXsolar-Webinar

Our trainings are now also available online. The experiment systems can also be used outdoors. We explain the experiments while you are at home, in the garden or at the office. With leXsolar-Webinars you can attend online from anywhere.





leXsolar-NewEnergy gives you the opportunity to conduct experiments spanning various topics of renewable energies from kindergarten to junior high school and to allow your students excellent access to the world of renewable energies.



## leXsolar-PV Basic

With the leXsolar-PV Basic you and your students will have the opportunity to conduct fundamental experiments on photovoltaics and solar energy in a playful way. Apart from qualitative experiments with solar cells and optical elements, many more experiments on photovoltaics are possible with this inexpensive experimenting kit. (For details see page 27)



## leXsolar-Wind Basic

With the leXsolar-Wind Basic the "wind of change" will blow through your classroom. Make your own wind, turn your wind turbine and drive various consumers. Experience the influence of different wing designs and conduct qualitative experiments with ready-to-use rotor blades. (For details see page 33)



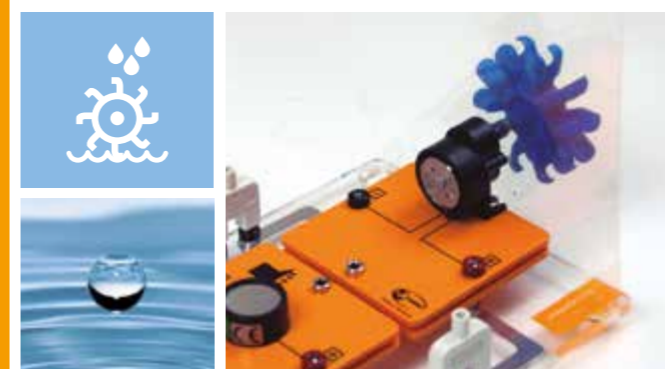
## leXsolar-H<sub>2</sub> Basic

With the leXsolar-H<sub>2</sub>-Basic you will be able to convey the basic principles of this topic area and perform electrolysis with your students. The experiments are easy to handle and the distilled water is already provided. (For details see page 39)



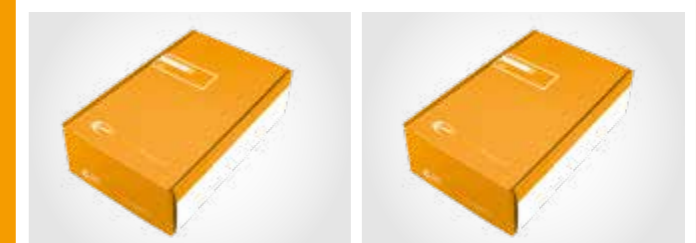
## leXsolar-EMobility Basic

Experience electromobility first hand! The leXsolar-EMobility Basic combines storage technologies and the electric car, and allows you to conduct practical and qualitative experiments. (For details see page 56)



## leXsolar-Hydropower Basic

Explain the world of hydropower through fundamental experiments. With the Pelton turbine and the enclosed tube, you can conduct many qualitative experiments and show your children the fun and joy of experimenting everywhere. (For details see page 69)



## leXsolar-Minikit Basic und -Kit Basic

To experiment with the leXsolar-Basics, you will need the leXsolar-Minikit Basic. This contains a base unit and cables as well as shorting plugs to interconnect the modules. To provide the current, a manual crank is provided for your students to playfully generate energy by their own muscular strength.

The leXsolar-Kit Basic allows for qualitative experiments with the leXsolar-Basics. With the provided SmartControl components you will have an innovative measuring and control system at hand and with the large base unit many different experiments are possible.

▶ With the leXsolar-NewEnergy MiniKit you will find all leXsolar-Basics combined in one box, allowing you to explore the world of renewable energies with you kindergarten and elementary school kids.

◀ Building upon the leXsolar-NewEnergy MiniKit, we give your junior high school students the leXsolar-NewEnergy Kit. You will inspire your students with experience-driven experiments and raise their awareness for renewable energies.

## leXsolar elementary school products

leXsolar-PV Basic (For details see page 27)

leXsolar-Wind Basic (For details see page 33)

leXsolar-H<sub>2</sub> Basic (For details see page 39)

leXsolar-EMobility Basic (For details see page 56)

leXsolar-Hydropower Basic (For details see page 69)

leXsolar-Minikit Basic

hand generator + base unit + cables



## leXsolar-NewEnergy Minikit

(For details see page 16)



## leXsolar-NewEnergy Ready-to-go

(For details see page 20)



## leXsolar-NewEnergy Kit

(For details see page 18)



## leXsolar-NewEnergy Ready-to-go

(For details see page 20)



## leXsolar junior high school products

leXsolar-PV Basic (For details see page 27)

leXsolar-Wind Basic (For details see page 33)

leXsolar-H<sub>2</sub> Basic (For details see page 39)

leXsolar-EMobility Basic (For details see page 56)

leXsolar-Hydropower Basic (For details see page 69)

leXsolar-Kit Basic

SmartControl + base unit large + cables







## leXsolar-NewEnergy Minikit ▶

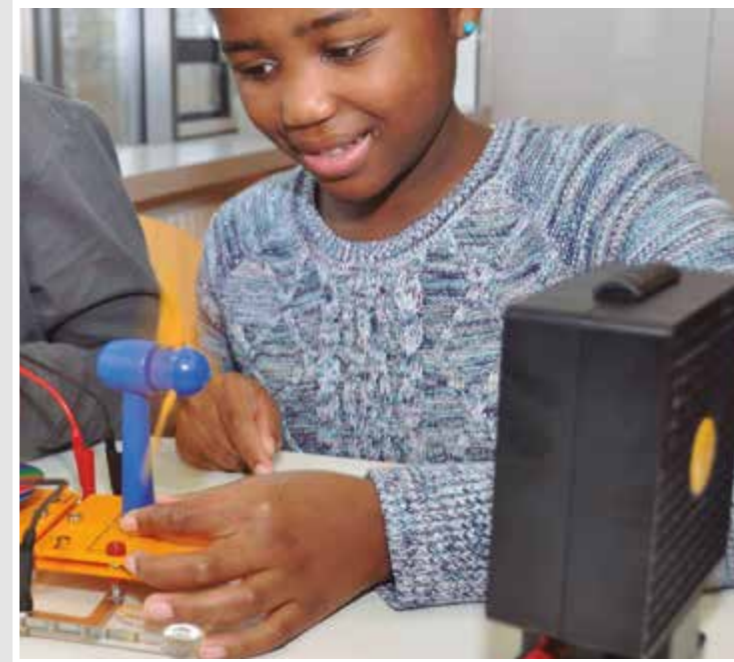
Item-No. 2001

leXsolar-NewEnergy Minikit is the optimal beginner package for the topic of renewable energies.

The experimental system is specifically adapted for young students in Elementary School and playfully provides an understanding of the topics photovoltaic, wind power, hydro power, electric mobility and fuel cells.



Playfully explain new energies in kindergarten and elementary school.



### Key data

- Renewable energies in primary school
- Experiments with solar, wind, water power, electric mobility and fuel cell technology combined in one product
- Extensive experimental system with high didactic quality

### Topics

The new energy world in one product!

- Solar energy
- Wind energy
- Hydropower
- Fuel cell
- Energy storage
- Electromobility

### Experiments

- Energy forms and energy conversion
- Electrical energy and electrical circuits
- The solar cell as energy source
- The orientation of the solar cell to light
- Difference between solar cells and solar panels
- Partial shading of the solar panels
- Wind energy conversion
- The influence of wind direction
- The influence of number of rotor blades
- The influence the rotor blade shape
- The influence of the rotor blade pitch
- Energy from water power
- Energy conversions at the water turbine
- Influence of the water head
- Influence of the angle of incidence
- Operation of a solar-powered electric car
- The speed of the electric car depending on the sunlight conditions
- Operating an electric car with the capacitor
- Energy storages
- Solar energy storage
- Wind energy storage
- Optional fuel cell expansion: generation of hydrogen
- The properties of a fuel cell
- The properties of an electrolyzer
- Saving Energy
- Comparison light bulb and LED

### Components

- 1 x 1100-02 Solar module 0.5 V, 840 mA
- 1 x 1100-07 Solar module 1.5 V, 280 mA
- 1 x 1100-20 Lighting module
- 1 x 1100-25 Buzzer module
- 1 x 1100-26 Light bulb module
- 1 x 1100-27 Motor module without gear
- 1 x 1100-28 Color discs - Set 1
- 1 x 1100-29 Solar cell cover set (4 pieces)
- 1 x 1100-31 Solar module 2.5 V, 420 mA
- 1 x 1600-02 Capacitor module 5.0F/5.4V
- 1 x 1400-08 LED-module 2mA, red
- 1 x 1400-12 leXsolar-Wind rotor set
- 1 x 1400-19 Wind machine
- 1 x 1400-21 Wind rotor set (assembled)
- 1 x 1400-22 Wind turbine module
- 1 x 1602-01 Base unit small
- 1 x 1602-02 Hand generator
- 1 x 1800-15 Distilled water (100 ml)
- 1 x 1801-02 Electric model car
- 1 x 1900-01 Water wheel module
- 1 x 2001-01 Box 2001
- 1 x L2-02-051 Silicone tube 12 mm
- 1 x L2-06-014 Test lead black 50 cm
- 1 x L2-06-015 Test lead red 50 cm
- 2 x L2-06-033 Short-circuit plug
- 1 x L2-06-067 Reversible Fuel cell
- 2 x L3-01-013 Lid for tray
- 1 x L3-01-104 Padding universal wind
- 1 x L3-01-174 Insert NewEnergy Kit
- 1 x L3-03-218 Layout diagram 2001 NewEnergy Minikit
- 1 x L3-03-220 Instruction for use of finger protector
- 1 x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.





## leXsolar-NewEnergy Kit▶

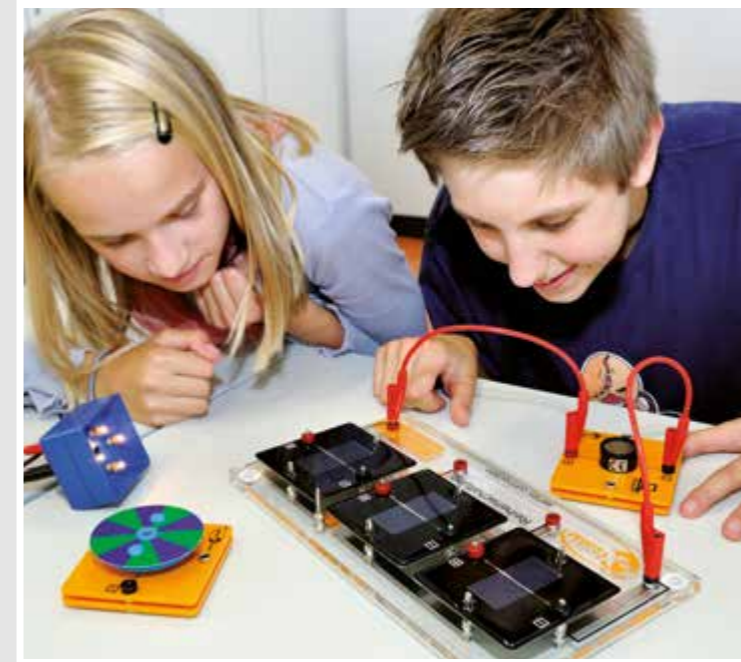
Item-No. 2002

With the leXsolar-NewEnergy Kit you and your junior high school students can conduct qualitative experiments with a high didactic quality on the topics of photovoltaics, wind- and hydropower, electromobility, and energy storage.

The SmartControl components provide you with high-quality measuring and control systems, and all necessary equipment like meters, voltage sources and cables are already included.



Qualitative experiments about different topics are possible



### Key data

- Renewable energies in Junior High School
- Experiments with solar, wind, water power, electric mobility and fuel cell technology combined in one product
- All necessary accessories like power supply, cables and measuring devices already included
- Extensive experimental system with high didactic quality

### Topics

The new energy world in one product!

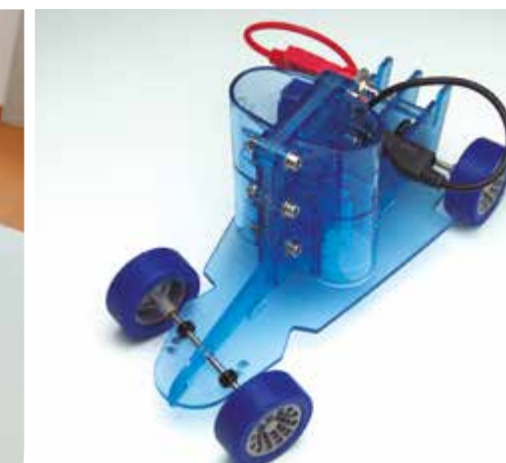
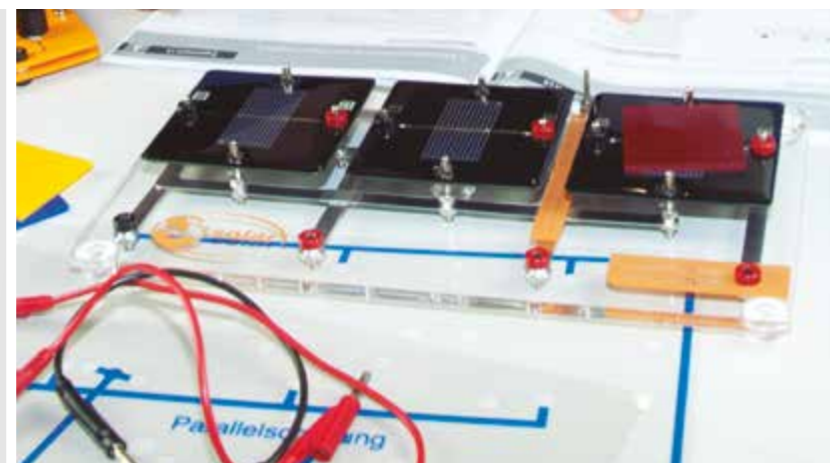
- Solar energy
- Wind energy
- Hydropower
- Fuel cell
- Energy storage
- Electromobility

### Experiments

- Forms of energy and consumers
- Dependence of power of a solar cell on its area
- Dependence of solar cell power on angle of incidence of light (qualitative and quantitative)
- Dependence of power of a solar cell on the illumination intensity
- Dependence of solar cell power on load
- The I-V-characteristics and filling factor of a solar cell
- Dependence of I-V-characteristics of a solar cell on illumination
- Influence of changing wind speeds
- Influence of wind speed on the wind turbine
- Start-up wind speed at a wind turbine
- Changing the turbine voltage by connecting several consumers
- Characteristic curves of a wind turbine
- Influence of the number of rotor blades
- Influence of the wind direction
- Influence of the rotor blade pitch
- Influence of the blade shape
- Influence of the rotor blade shape
- Water as an energy source
- Influence of the water falling height
- What does an electrolyzer?
- What does a fuel cell?
- Characteristic curve of the electrolyzer
- Characteristic curve of the fuel cell
- Operation of the electric car with the reversible fuel cell

### Components

- 1 x 1100-02 Solar module 0.5 V, 840 mA
- 1 x 1100-07 Solar cell cover set (4 pieces)
- 1 x 1100-19 leXsolar-Base unit Large
- 1 x 1100-20 Lighting module
- 1 x 1100-23 Potentiometer module
- 1 x 1100-25 Buzzer module
- 1 x 1100-26 Light bulb module
- 1 x 1100-27 Motor module without gear
- 1 x 1100-28 Color discs - Set 1
- 1 x 1100-29 Solar cell cover set (4 pieces)
- 1 x 1100-31 Solar module 2.5 V, 420 mA
- 1 x 1118-11 Capacitor module Pro
- 1 x 1400-08 LED-module 2mA, red
- 1 x 1400-12 leXsolar-Wind rotor set
- 1 x 1400-19 Wind machine
- 1 x 1400-21 Wind rotor set (assembled)
- 1 x 1400-22 Wind turbine module
- 1 x 1800-15 Distilled water (100 ml)
- 1 x 1801-02 Electric model car
- 1 x 1900-01 Water wheel module
- 1 x 2002-01 Box 2002
- 1 x 9100-03 AV-Modul
- 1 x 9100-05 PowerModul
- 1 x L2-02-051 Silicone tube 12 mm
- 1 x L2-06-012 Test lead black 25 cm
- 1 x L2-06-013 Test lead red 25 cm
- 1 x L2-06-014 Test lead black 50 cm
- 1 x L2-06-015 Test lead red 50 cm
- 1 x L2-06-067 Reversible Fuel cell
- 2 x L3-01-013 Lid for tray
- 1 x L3-01-104 Padding universal wind
- 1 x L3-01-174 Insert NewEnergy Kit
- 1 x L3-03-216 Layout diagram 2002 NewEnergy Kit
- 1 x L3-03-220 Instruction for use of finger protector
- 1 x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.





## leXsolar-NewEnergy Ready-to-go ▶

Item-No. 2003

The leXsolar-NewEnergy Kit is specifically adapted for young students in Primary and Junior High School and provides by qualitative and quantitative experiments an understanding of the topics photovoltaic, wind power, hydro power, electric mobility and fuel cells. With the enclosed Smart Control components, an innovative measuring and control system is available and all necessary accessories like power supply, cables and measuring devices are already included.

Like the other products of the Ready-to-go line, the leXsolar-NewEnergy Ready-to-go amazes with its flexible and location-independent usability that doesn't require any additional equipment.

- Renewable energies in Primary and Junior High School
- Experiments with solar, wind, water power, electric mobility and fuel cell technology combined in one product
- All necessary accessories like power supply, cables and measuring devices already included
- Flexible usage



Combination of leXsolar-NewEnergy Kit and leXsolar-NewEnergy Minikit



## Experiments

### Primary level

- From muscular strength to current...to light, motion or noise
- The solar cell drives a motor
- The solar module powers a buzzer or a LED
- The larger the solar cell, the ...?
- From the solar cell to the solar module
- Shading of solar modules
- The wind turbine powers a buzzer or a LED
- Influence of the wind direction, the rotor blade shape or the wind speed.
- The water wheel powers a buzzer
- Influence of the water falling height
- Storage of solar energy and wind energy
- What is an Elektrolyzer?
- How can water be split?
- What is a fuel cell?
- The fuel cell drives the motor
- The fuel cell powers the buzzer
- Energy demand of several consumers
- Comparison of light bulb and LED
- Storage and output of energy...EMobility

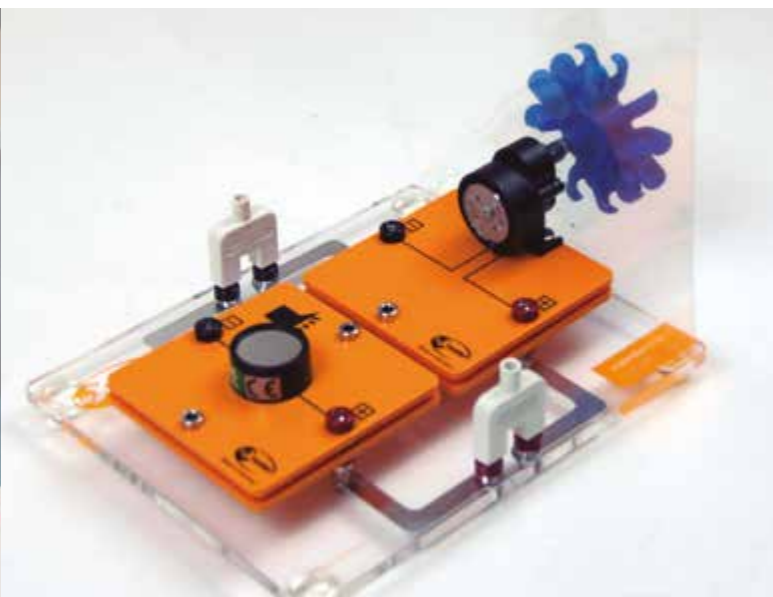
## Experiments

### Secondary level

- Forms of energy and consumers
- Basic structure: rotation discs, color qualities, mixing colors, color-deception with the Benham-disk and relief-disk
- Dependence of power of a solar cell on its area
- Dependence of solar cell power on angle of incidence of light
- Dependence of power of a solar cell on the illumination intensity
- Dependence of solar cell power on load
- The I-V-characteristics and filling factor of a solar cell
- Dependence of I-V-characteristics of a solar cell on illuminance
- Influence of changing wind speeds
- Influence of wind speed on the wind turbine
- Start-up wind speed at a wind turbine
- Changing the turbine voltage by connecting several consumers
- Characteristic curves of a wind turbine
- Influence of the number of rotor blades
- Influence of the wind direction
- Influence of the rotor blade pitch
- Influence of the blade shape
- Water as an energy source
- Influence of the water falling height
- What does an electrolyzer?
- What does a fuel cell?
- Characteristic curve of the electrolyzer and the fuel cell
- Operation of the electric car with the reversible fuel cell

## Components

- 1 x 1100-02 Solar module 0.5 V, 840 mA
- 1 x 1100-07 Solar module 1.5 V, 280 mA
- 1 x 1100-19 leXsolar-Base unit Large
- 1 x 1100-20 Lighting module
- 1 x 1100-23 Potentiometer module
- 1 x 1100-25 Buzzer module
- 1 x 1100-26 Light bulb module
- 1 x 1100-27 Motor module without gear
- 1 x 1100-28 Color discs - Set 1
- 1 x 1100-29 Solar cell cover set (4 pieces)
- 1 x 1100-31 Solar module 2.5 V, 420 mA
- 1 x 1118-11 Capacitor module Pro
- 1 x 1400-08 LED-module 2mA, red
- 1 x 1400-12 leXsolar-Wind rotor set
- 1 x 1400-19 Wind machine
- 1 x 1400-21 Wind rotor set (assembled)
- 1 x 1400-22 Wind turbine module
- 1 x 1602-01 Base unit small
- 1 x 1602-02 Hand generator
- 1 x 1800-15 Distilled water (100 ml)
- 1 x 1801-02 Electric model car
- 1 x 1900-01 Water wheel module
- 1 x 9100-03 AV-Modul
- 1 x 9100-05 PowerModul
- 1 x L2-02-051 Silicone tube 12 mm
- 1 x L2-06-012 Test lead black 25 cm
- 1 x L2-06-013 Test lead red 25 cm
- 1 x L2-06-014 Test lead black 50 cm
- 1 x L2-06-015 Test lead red 50 cm
- 2 x L2-06-033 Short-circuit plug
- 1 x L2-06-067 Reversible Fuel cell
- 1 x L3-01-175 Insert NewEnergy Ready-to-go 2003
- 1 x L3-03-220 Instruction for use of finger protector
- 1 x L3-01-187 Case NewEnergy Ready-to-go 2003
- 1 x L3-03-258 Info sheet initial startup
- 1 x L3-03-259 Layout diagram 2003 leXsolar-NewEnergy Ready-to-go
- Manuals available to download: find further information on page 70.





Photovoltaics (PV) is the direct conversion of light into electrical energy through solar cells. it is possible to learn the principles regarding this technology and its practical application.

## Topic Photovoltaic

### 1 leXsolar-plug-in/plug-out security system

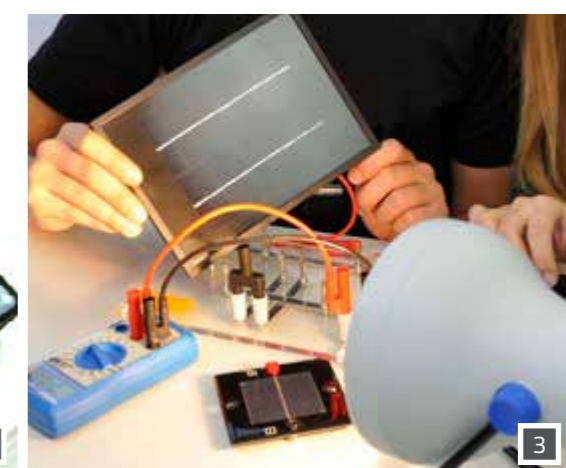
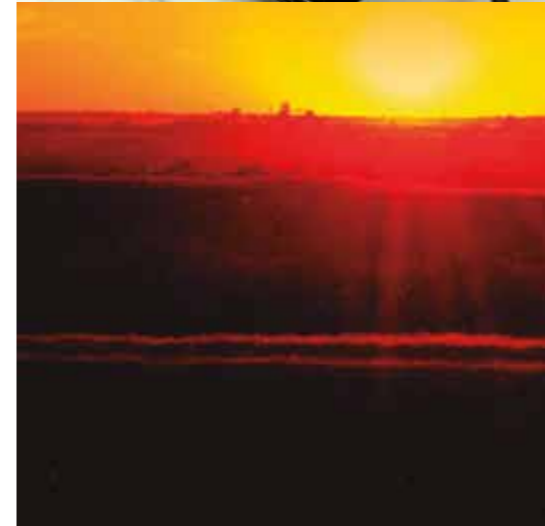
PWM regulator, MPP tracker, deep-charge protection, shunt and series regulator, DC/AC inverter are important parts of each professional photovoltaic system. With these components we have created the fastest and easiest handling training system worldwide. With our high innovative leXsolar-plug-in/plug-out security system your students can execute more than 30 experiments – everywhere!

### 2 leXsolar-Illumination module

The leXsolar-Illumination module allows reproducible illumination conditions in experiments with solar cells. The module supersedes the use of energy intensive and heat producing halogen lamps, so that there is no danger of burns and furthermore you create much less energy losses. But more importantly, it does not create the impression that solar cells have to be illuminated with hundreds of watts. This system allows research experiments in basic level and provides a high cost value solution instead of trainer systems with cost intensive PV simulators.

### 3 leXsolar-Solar modules

leXsolar exclusively uses highly efficient solar cells with excellent low light behavior. Especially in the classroom it is important that all experiments work reproducibly, even under bad lighting conditions. leXsolar therefore only uses high-class brands of solar cells and checks the low light behavior for each cell. Different modules for the plug-in– plug-out security system and one industrial standard module for PV PICO Systems build a perfect bridge to the next level trainer systems.



5+



## leXsolar-sunstick ▶

Item-No. 1101

Discovering solar energy in a playful way is the basic idea of the leXsolarsunstick. Thanks to playful experiments, children from 5 years old can learn how photovoltaic works. As a result, a first awareness for these future technologies can be raised from an early age.

The leXsolar-sunstick meets the highest requirements for both product quality and didactical quality as well. It is extremely robust, and that is why it is perfectly suitable for kindergarten and elementary schools.



## Experiments

- Fascinating optical illusions and effects
- The sunstick as propeller
- The carousel on your desk
- The sunstick as engine with slow or fast spinning driving wheel
- The sunstick as mobile
- The sunstick as alarm device (with the horn module)
- The pocket light without battery (with the lamp module) and many more

## Components

- 1x 1101-01 leXsolar-sunstick crank wheel
- 1x 1101-02 leXsolar-sunstick wooden stand
- 1x 1100-03 leXsolar solarmodule, 1,5V, 420mA
- 1x 1101-03 leXsolar-sunstickwood wheel
- 1x L2-03-002 leXsolar-sunstick foot
- 1x L3-01-002 Packing
- 2x L2-02-007 Rubber band for the crank
- 1x L2-06-002 Connection wire, 25cm, black
- 1x L2-06-003 Connection wire, 25cm, red
- 1x L2-02-006 Propeller
- 1x L2-06-005 Sunstick horn module
- 1x L2-06-004 Sunstick LED module
- 1x 1100-56 Color disks Set II



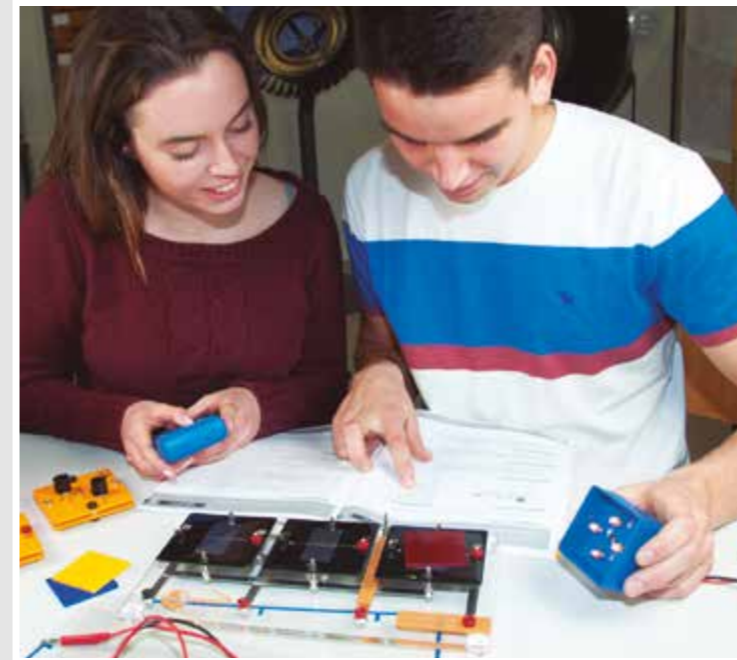


## leXsolar-PV Large ▶

Item-No. 1103

Correlating school physics with practical usage of the photovoltaic cells is a specialty of this system. These unique didactic innovations are the premier choice when it comes to experiments related to solar energy since it has won the Worlddidac Award. The system has been conceived in such a way that most experiments can be conducted in normal room lighting. An external power supply is

not necessary for these experiments. The leXsolar lighting module (included) is required only for a few experiments - which can be operated with a student's power supply.



### Key data

- Basics of photovoltaics learnable
- Mainly quantitative experiments
- Expandable for age group 12 to 15 years

### Components

- 3x 1100-01 Solar module 0.5 V, 420 mA
- 1x 1100-02 Solar module 0.5 V, 840 mA
- 1x 1100-07 Solar module 1.5 V, 280 mA
- 1x 1100-19 leXsolar-Base unit Large
- 1x 1100-20 Lighting module
- 1x 1100-21 Diode module
- 1x 1100-22 Resistor module
- 1x 1100-23 Potentiometer module
- 1x 1100-24 Gear motor module
- 1x 1100-25 Buzzer module
- 1x 1100-27 Motor module without gear

- 1x 1100-28 Color discs - Set 1
- 1x 1100-29 Solar cell cover set (4 pieces)
- 1x 1100-30 Color filters
- 1x 1103-01 Box 1103
- 1x 1400-07 Capacitor module 220 mF, 2.5V
- 1x L3-01-004 Vacuum-padding leXsolar-experiment top, black
- 2x L3-01-005 Vacuum-padding leXsolar-experiment below, black
- 1x L3-01-013 Lid for tray
- 1x L3-03-129 Layout diagram PV Large 1103
- 1x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.

### extras needed

- 1x 9100-03 AV-Module
- 1x 9100-05 PowerModule
- 2x L2-06-012 Test lead black 25 cm
- 2x L2-06-013 Test lead red 25 cm
- 1x L2-06-016 Laboratory thermometer

### Experiments

- Power dependence on the area of the solar cell
- Power dependence on the angle of incidence
- Power dependence on the level of illumination
- Determination of efficiency ratio of energy conversion
- Internal resistance of solar cells
- Dark characteristic curve of solar cell
- Inhibiting and conducting direction in illumination and darkness
- IV characteristic and fill factor of the solar cell
- IV characteristic of the solar cell in dependence on the level of illumination
- Dependence of the solar cell power on temperature
- Shading of solar cells in series connection
- Shading effect of solar cells in parallel connection
- The solar cell as a transmission measure
- Power dependence on the frequency of the incident light



## leXsolar-PV Basic ▶

Item-No. 1130



### Components

- 1x 1100-02 Solar module 0.5 V, 840 mA
- 1x 1100-07 Solar module 1.5 V, 280 mA
- 1x 1100-20 Lighting module
- 1x 1100-25 Buzzer module
- 1x 1100-27 Motor module without gear
- 1x 1100-28 Color discs - Set 1
- 1x 1100-29 Solar cell cover set
- 1x L3-03-202 Layout diagram PV Basic
- 1x L3-03-258 Info sheet initial startup

### Key data

- Understanding how a solar cell works by playing and interacting with it
- Qualitative and quantitative experiments with solar cells
- Specially designed for primary and Junior High School
- High quality and durable components





## leXsolar-PV Ready-to-go ▶

Item-No. 1105

The name says it all: this fully equipped experiment system can be used wherever you are without further components. This kit already includes all necessary ancillary equipment, like measuring equipment, and is delivered in an aluminum case with heavy-duty foam inserts. The scope of experiments ranges from simple trials that show the basic characteristics of the solar energy, to more challenging experiments dealing with topics like IV characteristics or temperature dependency of solar cells.

Because of the large range of potential experiments, the product is also suitable for internal workshops in companies as well as a demonstration kit for sales representatives.



## Components

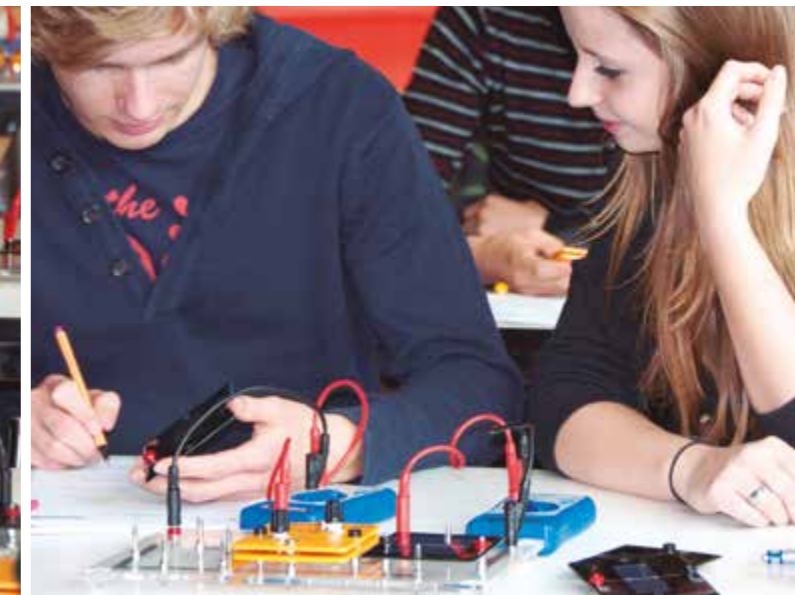
- 3 x 1100-01 Solar module 0.5 V, 420 mA
- 1 x 1100-02 Solar module 0.5 V, 840 mA
- 1 x 1100-19 leXsolar-Base unit Large
- 1 x 1100-20 Lighting module
- 1 x 1100-21 Diode module
- 1 x 1100-22 Resistor module
- 1 x 1100-23 Potentiometer module
- 1 x 1100-24 Gear motor module
- 1 x 1100-25 Buzzer module
- 1 x 1100-07 Solar module 1.5 V, 280 mA
- 1 x 1100-27 Motor module without gear
- 1 x 1100-28 Color discs - Set 1
- 1 x 1100-29 Solar cell cover set (4 pieces)
- 1 x 1100-30 Color filters
- 1 x 1400-07 Capacitor module 220 mF, 2.5V
- 1 x 9100-05 PowerModul
- 1 x L2-05-024 Hook weight 20g
- 2 x L2-06-011 Digital multimeter
- 1 x L2-06-012 Test lead black 25 cm
- 1 x L2-06-013 Test lead red 25 cm
- 1 x L2-06-016 Laboratory thermometer
- 1 x L3-01-009 Aluminium case PV Ready-to-go 1105
- 1 x L3-01-047 Insert PV-Ready to go
- 1 x L3-03-130 Layout diagram 1105 PV Ready-to-go
- 2 x L2-06-014 Test lead black 50 cm
- 2 x L2-06-015 Test lead red 50 cm
- 1 x L2-06-034 Luxmeter
- L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.

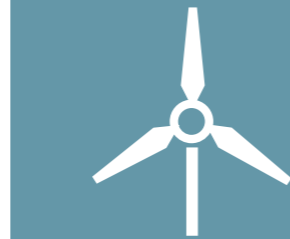
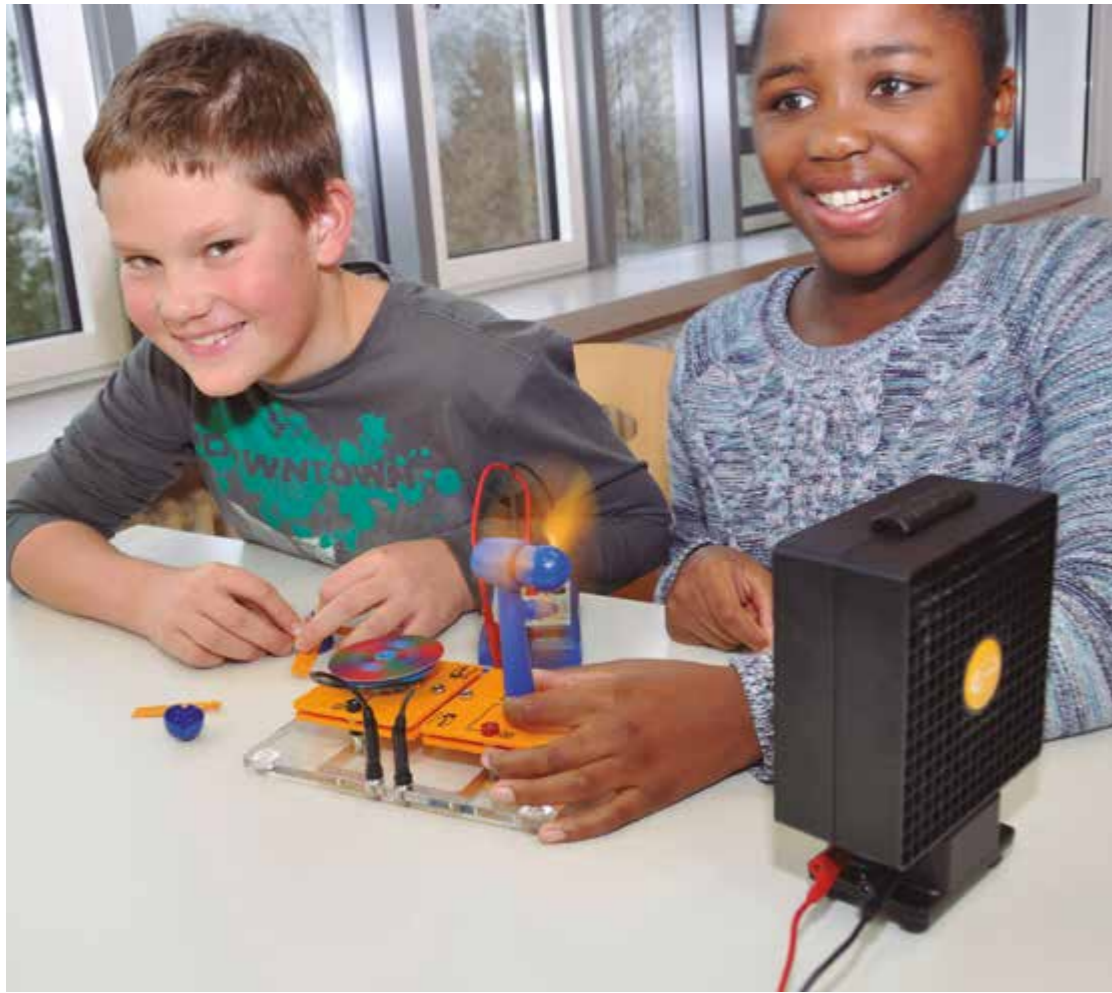
## Key data

- Extensive experimental system photovoltaics
- All necessary equipment is included
- Qualitative and quantitative experiments

## Experiments

- Understanding the leXsolar base unit
- Optical illusions: color disks, color qualities, additive color mixing, Benham disks, relief-disk
- Experiments about different kinds of radiation
- The influence of diffuse and direct radiation on solar cell power
- The intensity of albedo-radiation of different substances
- Dependence of solar cell power on its area
- Dependence of solar cell power on angle of incidence of light
- Dependence of solar cell power on illuminance
- Dependence of solar cell power on temperature
- Dependence of solar cell power on frequency of incident light
- The diode character of a solar cell
- The dark characteristics of a solar cell
- The internal resistance of a solar cell depending on reverse or forward biasing or in the dark or under illumination
- The I-V-characteristics of a solar cell
- Dependence of solar cell power on load
- The I-V-characteristics and filling factor of a solar cell
- Dependence of I-V-characteristics of a solar cell on illuminance
- Behavior of voltage and current in series and parallel connections of solar cells
- Behavior of voltage and current of series and parallel connection of solar cells depending on shading
- Simulation of a stand-alone grid with photovoltaic station
- Characteristic graphs of a capacitor
- Characteristic graphs of a capacitor charged by a solar cell
- Discharging process of a capacitor
- Determination of efficiency of some energy conversions
- Rotational direction and speed of a motor
- Starting and running current of a motor





With the leXsolar – Wind area of expertise you develop an understanding of the physical basics of wind energy utilization and the practical application of this technology.

## Topic Wind

### 1 leXsolar-Wind machine Item-No. 1400-19

To ensure reproducible experiments with wind energy, a laminar flow field is necessary. Until now, this was only possible with big and expensive wind tunnels. The innovative design of the leXsolar-Wind machine achieves this in a compact, competitive device that reaches a wind velocity up to 7m/s. It is powered with 4 ... 12V DC.

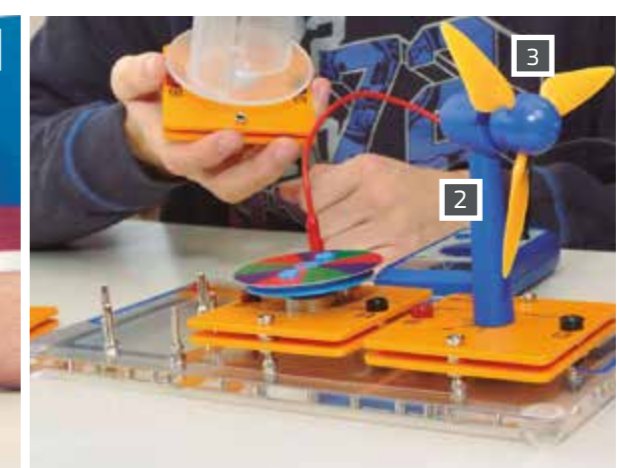
### 2 leXsolar-Windturbine Item-No.1400-22

It is essential for technical training experiments to be as realistic as possible and related to practice in order to keep the students' motivation high. This is why the leXsolar- Wind turbine follows the model of a real wind energy plants and, thus, allows the students to make the connection to the real model.

### 3 leXsolar-Windrotoren Item-No. 1400-12

a twisted shape, based on real rotors. Thus, they are the only ones on the educational market that allow realistic experiments. The innovative and easy system of rotor blades and different hubs allows the setup of a multitude of rotors. The following parameters can be varied:

- Blade profile : optimized profile or „windmill“-style
- Number of blades : 1-,2-,3- or 4-bladed rotors
- Blade angle (the so called pitch) : 20°, 25°, 30°, 50° and 90°







## leXsolar-Wind Large ▶

Item No. 1404

This system provides you with all the answers you need concerning the basics of using wind energy. With the help of curriculum-based trials, it discusses different topics which are necessary for understanding the functions of wind power plants. The study of how wind speed, wind direction or rotor type influences the power output are only some examples of possible experiments. Both qualitative experiments for students from age of 11 to 13, and complete quantitative trials for physics lessons until the age of 19 are described in detail.



## Experiments

- Influence of the wind speed (quantitative and qualitative)
- Start-up wind speed of a wind turbine
- Comparison of the start-up wind speed of a Savonius and a three-blade rotor
- Changing the turbine voltage by connecting several consumers
- Examine the wind speed behind the rotor
- Energy balance sheet of a wind turbine
- Calculating the efficiency of a wind turbine
- Storing electric energy
- Energy conversion in a wind turbine
- Examine color wheels using a wind turbine
- Comparison of a Savonius rotor and a three-bladerotor (quantitative and qualitative)
- Comparison of two, three and four-blade rotors (quantitative and qualitative)
- Characteristic curves of a wind turbine
- Influence of the wind direction (quantitative and qualitative)
- Influence of the rotor blade pitch (quantitative and qualitative)
- Influence of the blade shape (quantitative and qualitative)

## Components

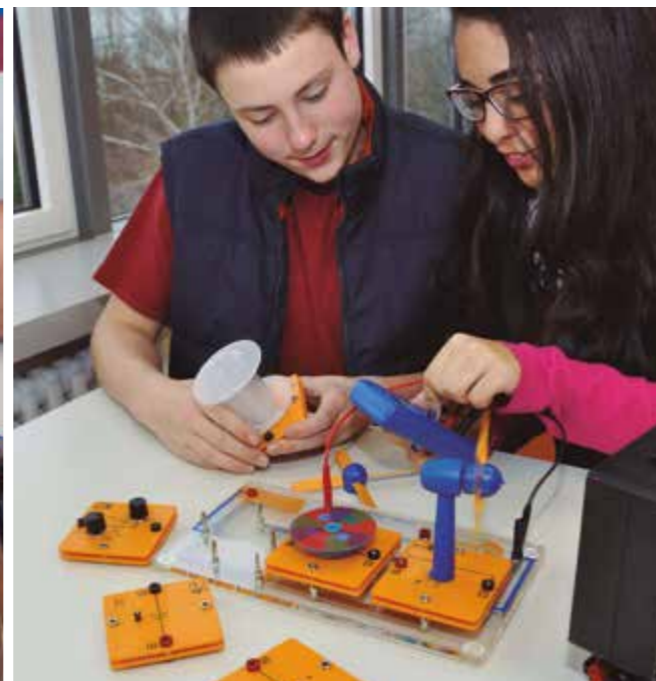
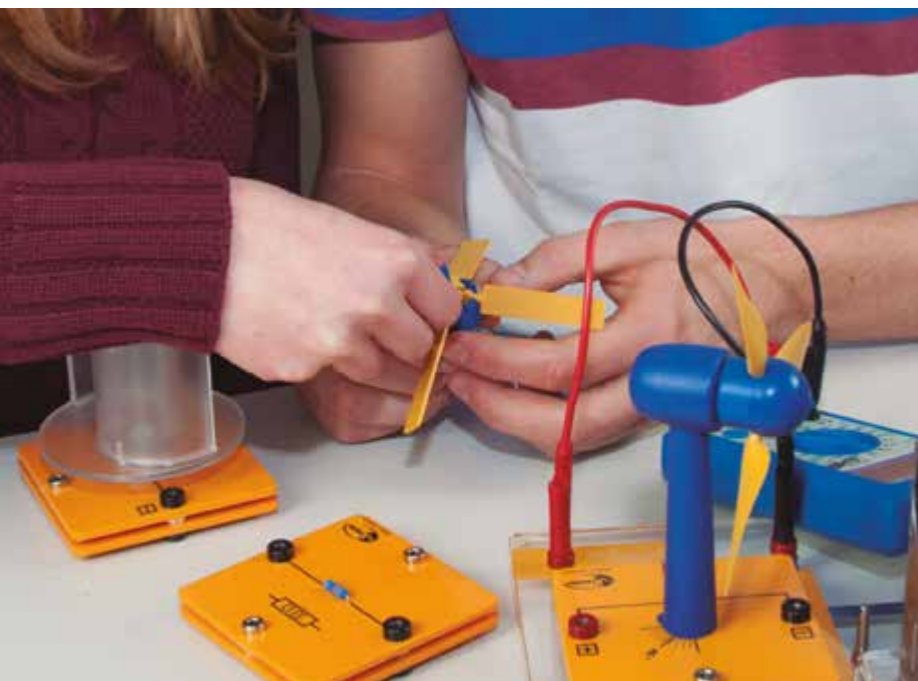
- 1x 1100-19 leXsolar-Base unit Large
- 1x 1100-22 Resistor module
- 1x 1100-23 Potentiometer module
- 1x 1400-01 leXsolar-Savonius rotor modulw
- 1x 1400-07 Capacitor module 220 mF, 2.5V
- 1x 1400-08 LED-module 2mA, red
- 1x 1400-12 leXsolar-Wind rotor set
- 1x 1400-19 Wind machine
- 1x 1400-22 Wind turbine module
- 1x 1404-02 Box 1404
- 1x 1100-25 Buzzer module
- 1x 1100-26 Light bulb module
- 1x 1100-27 Motor module without gear
- 1x 1100-28 Color discs - Set 1
- 1x L3-01-013 Lid for tray
- 1x L3-01-023 Insert Wind Large 1404
- 1x L3-03-132 Layout diagram 1404 Wind Large
- 1x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.

### extras needed

- 1x 9100-03 AV-Module
- 1x 9100-05 PowerModule
- 2x L2-06-012 Test lead black 25 cm
- 2x L2-06-013 Test lead red 25 cm

### extras available

- 1400-02 Anemometer with mount



## leXsolar-Wind Basic ▶

Artikel-Nr. 1430

## Components

- 1 x 1400-08 LED-module 2mA, red
- 1 x 1400-12 leXsolar-Wind rotor set
- 1 x 1400-19 Wind machine
- 1 x 1400-21 Wind rotor set
- 1 x 1400-22 Wind turbine module
- 1 x L3-03-204 Layout diagram Wind Basic 1430
- 1 x L3-03-220 Instruction for use of finger protector
- 1 x L3-03-258 Info sheet initial startup

## Key data

- Understanding wind energy at primary and Junior High School
- Qualitative and quantitative experiments
- Most cost-efficient in its class
- Contains the innovative leXsolar-windrotor set



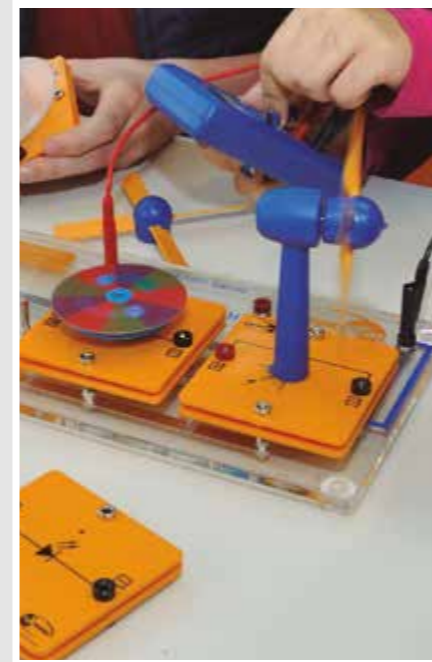


## leXsolar-Wind Ready-to-go 2.0 ▶

Item No. 1405

Following the tradition of Ready-to-go series, this system enables the maximum number of experiments without the need for additional accessories. It is delivered in a sturdy aluminum case and is location-independent. 'Measurements without Measuring' and 'Anemometer' expansions are already included.

With the leXsolar Wind Ready-to-go, you will be able to answer any questions you may have concerning the basic concepts of using wind energy. The leXsolar Wind Ready-to-go is also suitable for in-house workshops, and used by sales representatives.



## Experiments

- Influence of the wind speed (quantitative and qualitative)
- Start-up wind speed at a wind turbine
- Comparison of the start-up wind speed of a Savonius and a three-blade rotor
- Changing the turbine voltage by connecting several consumers
- Examine the wind speed behind the rotor
- Energy balance sheet at a wind turbine
- Calculating the efficiency of a wind turbine
- Storing electric energy
- Energy conversion in a wind turbine
- Examine color wheels using a wind turbine
- Comparison of a Savonius rotor and a three-blade rotor (quantitative and qualitative)
- Comparison of two, three and four-blade rotors (quantitative and qualitative)
- Characteristic curves of a wind turbine
- Influence of the wind direction (quantitative and qualitative)
- Influence of the rotor blade pitch (quantitative and qualitative)
- Influence of the blade shape (quantitative and qualitative)

### Other Application Tests

These additional interesting experiments are included in the curricula but only have an indirect correlation to the subject of wind energy:

- Air resistance of different objects
- RPM Measurement of the wind generator

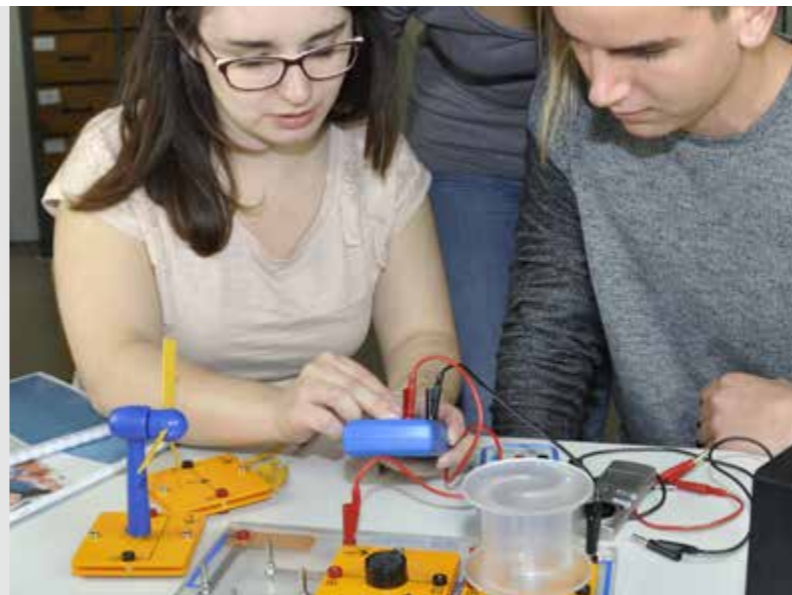
## Components

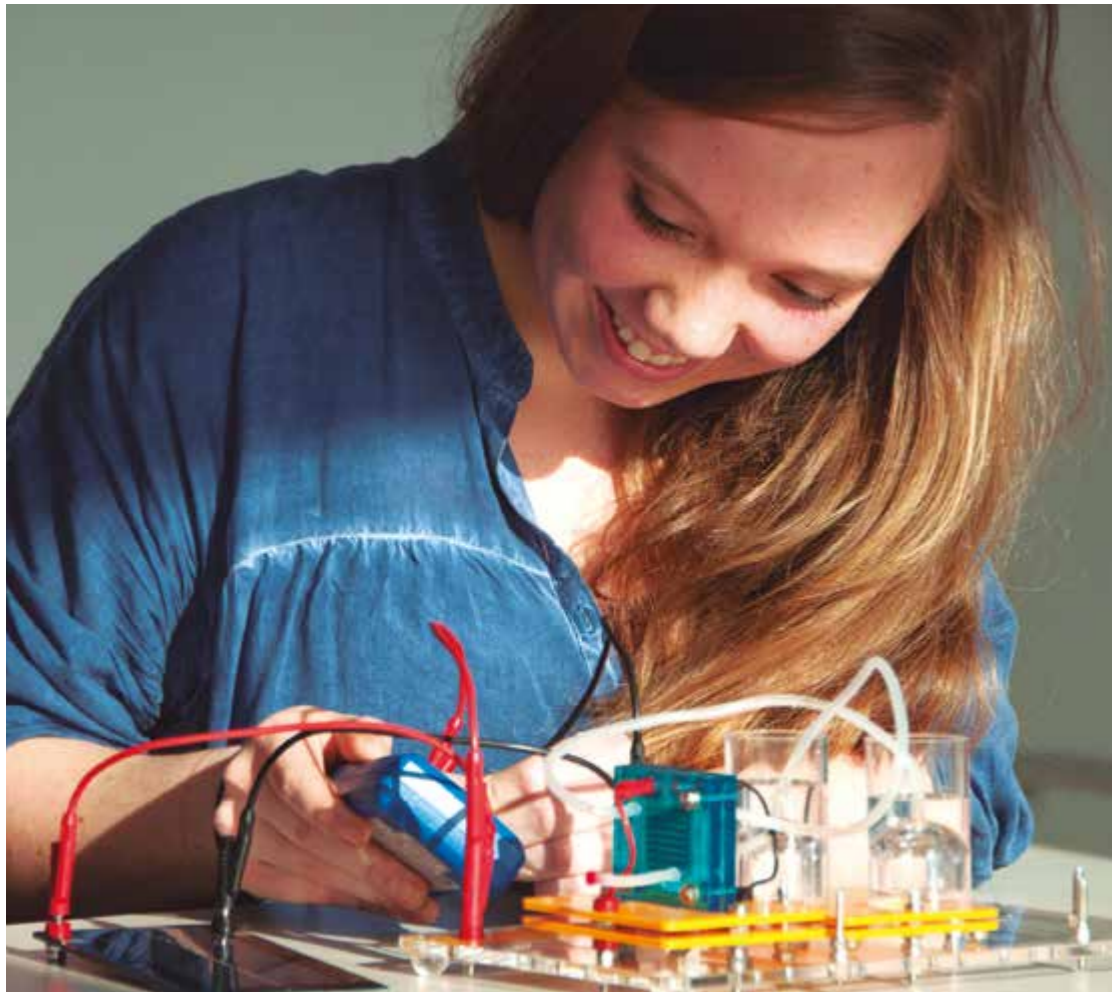
- 1x 1100-19 leXsolar-Base unit Large
- 1x 1100-22 Resistor module
- 1x 1100-23 Potentiometer module
- 1x 1100-25 Buzzer module
- 1x 1100-26 Light bulb module
- 1x 1100-27 Motor module without gear
- 1x 1100-28 Color discs - Set 1
- 1x 1400-01 leXsolar-Savonius rotor modulw
- 1x 1400-19 Wind machine
- 1x 1400-22 Wind turbine module
- 1x 1400-07 Capacitor module 220 mF, 2.5V
- 1x 1400-08 LED-module 2mA, red
- 1x 1400-12 leXsolar-Wind rotor set
- 1x 1400-16 stator for anemometer
- 1x 9100-05 PowerModule
- 2x L2-06-011 Digital multimeter
- 1x L2-06-012 Test lead black 25 cm
- 1x L2-06-013 Test lead red 25 cm
- 2x L2-06-014 Test lead black 50 cm
- 2x L2-06-015 Test lead red 50 cm
- 1x L2-06-027 Anemometer
- 1x L3-01-024 Aluminum case Wind-Ready to go

- 1x L3-01-050 Insert Wind Ready-to-go
- 1x L3-03-133 Layout diagram 1405 Wind Ready-to-go
- 1x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.

## Key data

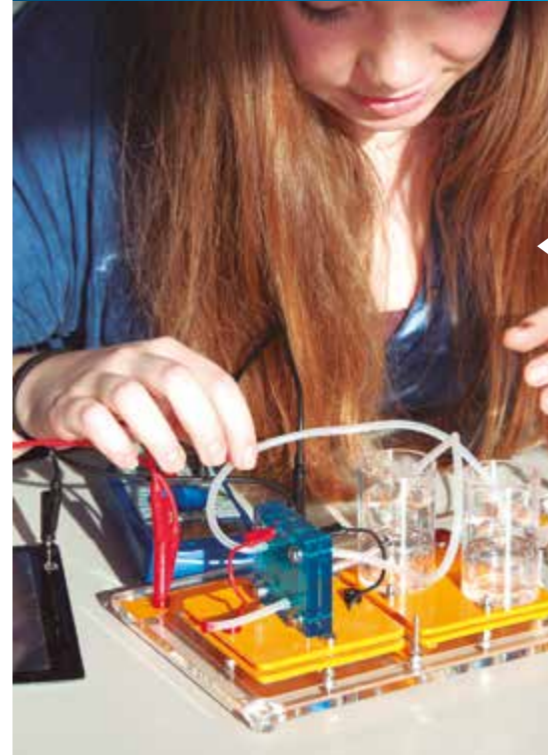
- Wind energy experiments for all ages
- Understanding wind energy: from physics to application
- Contains the innovative leXsolar-Wind rotor set
- Delivered in a stable aluminium case with all accessories





The hydrogen fuel cell technology is a potential key component to solve the problem of storing renewable energies. That is because renewable energy can be stored as hydrogen (H<sub>2</sub>) and then later transformed into electricity. The leXsolar-H<sub>2</sub> allows for basic and practice-related experiments for physics and chemistry classes.

## Topic H<sub>2</sub>



### 1 leXsolar-PLUG-IN- PLUG-OUT fuel cell stack

Electric mobility is a very present topic in the automotive industry as well as in politics. If you engage with this topic you will also find that fuel cells are very present too. To use fuel cells not just in laboratory but in everyday applications you will need so called stacks of them.

With the leXsolar-PLUG-IN-PLUG-OUT fuel cell stack it is easy to create parallel or serial connection of two or three single fuel cell systems to understand how they work. Together with the innovative H<sub>2</sub> Charge and H<sub>2</sub> Storage solution you can create your hydrogen infrastructure in lab scale size.

### 2 H<sub>2</sub> Charger Item No. 1200 -17

The H<sub>2</sub> Charger allows the easy and safe generation of hydrogen. You only need a power socket and water. The H<sub>2</sub> Charger is instantly ready to use. The hydrogen can then be stored with the H<sub>2</sub> Storage.

### 3 H<sub>2</sub> Storage Item No. 1200 -18

The H<sub>2</sub> Storage allows the easy and safe storage of hydrogen with a metal hydride storage tank and, thus, omits the need for gas containers. The stored hydrogen can also be used for other applications within the leXsolar experimentation systems.



1



2



3





## leXsolar-H<sub>2</sub> Large 2.0 ▶

Item No. 1218

This product has been completely revised and now contains the world's first SOFC-fuel cell for educational purposes. Together with the already established PEM-fuel cells and the components of a complete solar-hydrogen cycle (electrolyzer, PEM fuel cell and solar module), this product represents the most comprehensive fuel cell-experimentation system on the educational market. The electrical consumer (motor) allows for realistic and demonstrative experiments. Highly didactic instruction manuals complete the product. leXsolar-H<sub>2</sub> Large can be used in physics and chemistry classes as well as in technology classes. The product can be expanded with two additional PEM-fuel cells to illustrate the stacking of fuel cells. The expansion ethanol-fuel cell demonstrates a third fuel cell technology.



## leXsolar-H<sub>2</sub> Demo ▶

Item No. 1209

leXsolar-H<sub>2</sub> Demo is a complete experimentation system that conveys the basics of PEM-Fuel cell technologies on the basis of diverse demonstration experiments.

For this reason, leXsolar-H<sub>2</sub> Demo can be optimally used as an introductory explanation of the experiments. Within the teacher-centered instruction, the leXsolar-H<sub>2</sub> Demo replaces student experiments completely. Altogether more than 20 experiments from chemistry and physics education are possible.



### Key data

- Understanding the physical basics of electrolysis and the fuel cells
- Mainly quantitative experiments
- Three different fuel cell technologies
- Highly didactic instruction manuals

### Experiments

- Set up of an electrolyzer and the different fuel cells
- Characteristics of an electrolyzer
- Operation of an electrolyzer
- Characteristics of a PEM-Fuel cell
- Operation of the PEM-Fuel cell
- Characteristics of a SOFC-Fuel cell
- Operation of the SOFC-Fuel cell
- Faraday and energy efficiency of the electrolyzer
- Faraday and energy efficiency of the PEM-fuel cell

### extras needed

- 1 x L2-04-022 Lamp with table clamp
- 2 x L2-06-012 Test lead black 25 cm
- 2 x L2-06-013 Test lead red 25 cm
- 1 x 9100-05 PowerModul
- 1 x 9100-03 AV-Modul

### Components

- 1x 1218-02 PEM-Fuel cell module
- 1x 1218-03 Electrolyzer module 2.0
- 1x 1218-04 Box 1218
- 1x 1100-23 Potentiometer module
- 1x 1100-27 Motor module without gear
- 1x 1100-31 Solar module 2.5 V, 420 mA
- 1x 1213-01 Gas storage module
- 1x 1100-19 leXsolar-Base unit Large
- 1x L3-01-013 Lid for tray
- 1x L3-01-117 Insert H<sub>2</sub> Large
- 1x L3-03-258 Info sheet initial startup
- 1x L2-02-017 Propeller
- 1x L3-03-164 Layout diagram 1218 H<sub>2</sub>-Large
- Manuals available to download: find further information on page 70.

### extras available

- 1x 1218-02 PEM-Fuel cell module
- 1x 1700-01 leXsolar ethanol fuel cell module
- 1x 1200 -17 H<sub>2</sub> Charger
- 1x 1200 -18 H<sub>2</sub> Storage

### Key data

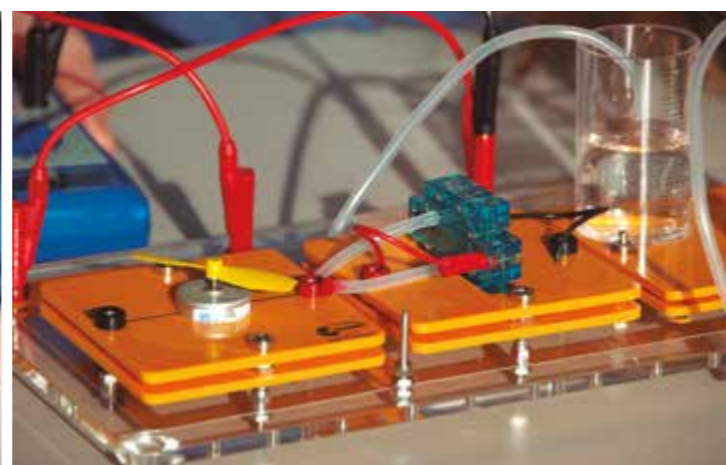
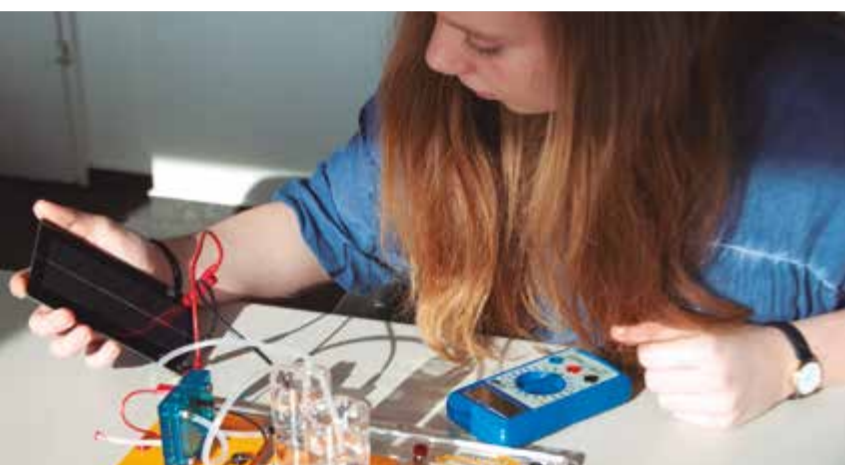
- Simple and fast set up
- Demonstration kit for teacher-centered approach.
- Both teacher and professors appreciate it

### Experiments

- Characteristics of a solar module
- Dependence of photocurrent from the distance and angle of incidence
- Characteristics of an electrolyzer
- Water = 2 parts Hydrogen + 1 part Oxygen
- Characteristics of a fuel cell
- Parallel- and serial connection of fuel cells
- More than 20 experiments in physics and chemistry

### Components

- 1x Solar module
- 1x PEM electrolyzer
- 1x PEM double-fuel cell
- 1x Consumer module
- 1x Measurement device
- 1x Supporting frame
- 1x Manual
- 1x Lamp with illuminant
- Hoses, hose clamps, wires



## leXsolar-H<sub>2</sub> Basic ▶

Item No. 1230

### Components

- 1 x 1100-26 Light bulb module
- 1 x 1800-15 Distilled water (100 ml)
- 1 x L2-06-067 Reversible Fuel cell
- 1 x L3-03-208 Layout diagram H<sub>2</sub> Basic 1230
- 1 x L3-03-258 Info sheet initial startup

### Key data

- Understanding how a fuel cell works by playing and interacting with it
- Qualitative and quantitative experiments with a fuel cell
- High-quality instructions





## leXsolar-H<sub>2</sub> Ready-to-go 2.0 ▶

Item No. 1219

leXsolar-H<sub>2</sub> Ready-to-go offers the entire spectrum of current fuel cell technology for the classroom. The product was completely reworked and now contains the world's first SOFC-fuel cell for educational purposes. Solar module, electrolyzer, and fuel cell permit the assembling and examination of a solar-hydrogen cycle. Working principles, efficiency and characteristics curves of electrolyzer and fuel cell are just some of the topics covered.

Beside the PEM-fuel cell and the SOFC-fuel cell, it also contains an ethanol-fuel cell in order to compare the different technologies. H<sub>2</sub> Charger and H<sub>2</sub> Storage allow for the easy generation and storage of hydrogen. True to the traditions of the Ready-to-go series all ancillary equipment is already included in the robust aluminum suitcase.



## Key data

- Comprehensive experimentation system on fuel cell technology
- Three different fuel cell technologies: PEM-, Ethanol- and SOFC-Fuel cells
- Buildable fuel cell stacks with three PEM-Fuel cells
- Easy hydrogen generation and storage with H<sub>2</sub> Charger and H<sub>2</sub> Storage
- Includes all ancillary equipment

## Experiments

- Set up of an electrolyzer and the different fuel cells
- What does an electrolyzer do?
- I-V curve of an electrolyzer
- Hydrogen generation with the H<sub>2</sub> Charger
- Hydrogen storage with the H<sub>2</sub> Storage
- What does a PEM-Fuel cell do?
- I-V curve of a PEM-Fuel cell
- What does an Ethanol-Fuel cell do?
- I-V curve of an Ethanol-fuel cell
- Characteristics of the SOFC-Fuel cell
- Application of the SOFC-Fuel cell
- Faraday and energy efficiency of the electrolyzer
- Faraday and energy efficiency of the PEM-Fuel cell
- Parallel- and series connection of the PEM-Fuel cell

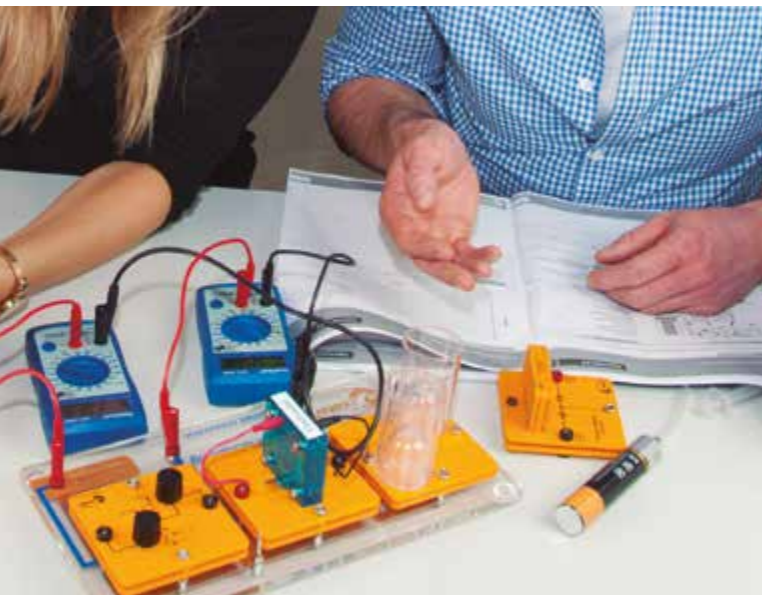


## Components

- 1x 1100-19 leXsolar-Base unit Large
- 1x 1100-23 Potentiometer module
- 1x 1100-27 Motor module without gear
- 1x 1100-31 Solar module 2.5 V, 420 mA
- 1x 1200-17 H<sub>2</sub> Charger
- 1x 1200-18 H<sub>2</sub> Storage
- 1x 1213-01 Gas storage module
- 3x 1218-02 PEM-Fuel cell module
- 1x 1218-03 Electrolyzer module 2.0
- 1x 1700-01 leXsolar ethanol fuel cell module
- 1x 1219-01 Koffer 1219
- 0,15x L2-02-048 Silicone tube 2 mm
- 1x L2-02-017 Propeller
- 1x L2-04-022 Lamp with table clamp
- 2x L2-06-011 Digital multimeter
- 2x L2-06-012 Test lead black 25 cm
- 2x L2-06-013 Test lead red 25 cm
- 1x L2-06-014 Test lead black 50 cm
- 1x L2-06-015 Test lead red 50 cm
- 1x L2-06-132 Valve for H<sub>2</sub> Storage
- 1x L3-01-103 Insert H<sub>2</sub> Ready-to-go
- 1x L3-03-258 Info sheet initial startup
- 1x L3-03-163 Layout diagram 1219 H<sub>2</sub> Ready-to-go 2.0
- Manuals available to download: find further information on page 70.

### extras available

- 1200-18 H<sub>2</sub> Storage
- L2-04-044 electric grid adapter set
- 1100-63 DC converter 120V - 240V





lexsolar-BioFuel deals with the different technologies of producing and using biomass fuel. Biofuels have two important advantages: they store renewable energies and they can easily replace fossil fuel in transportation.

## Topic BioFuel

### 1 leXsolar-Ethanol-Fuel cell Item No. 1700-01

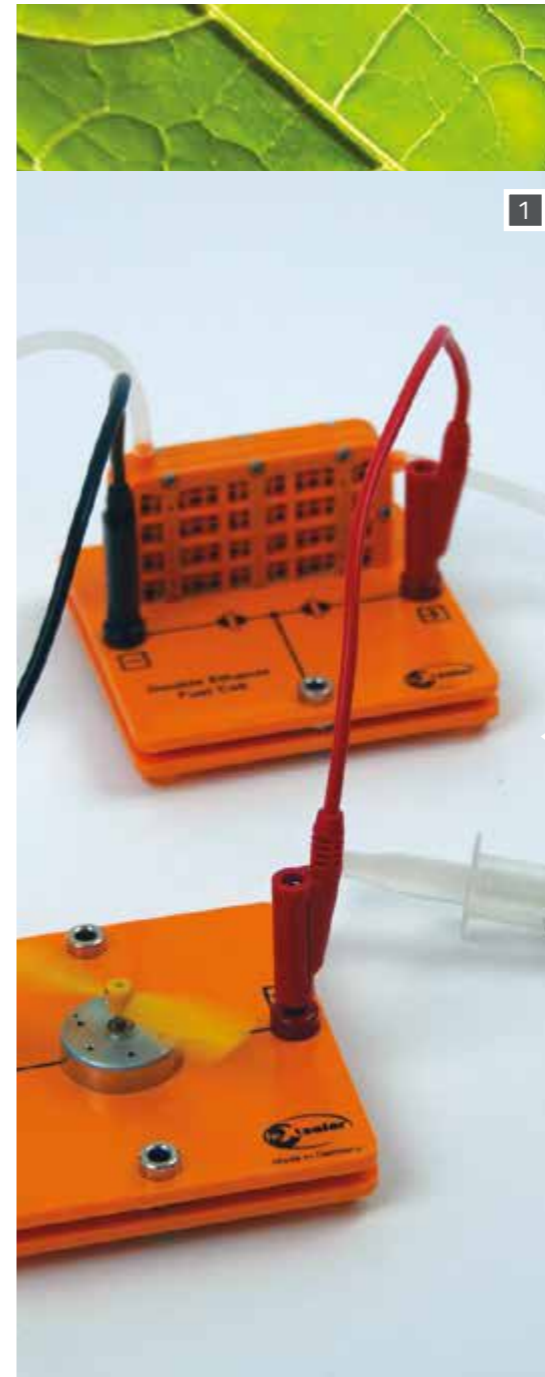
The direct conversion of ethanol into electric energy can be impressively demonstrated with the leXsolar-Ethanol-Fuel cell. The cell is robust, easy to use and the most powerful on the market especially designed for experimentation.

### 2 leXsolar-Condensor Item No. L2-06-071

leXsolar has developed an innovative cooling system that doesn't require a constant flow of cooling water. Instead, one filling is enough to distill up to 0.5 l of liquid. This makes it perfect for classrooms without the need of a direct access to water.

### 3 leXsolar-BioDiesel production set

We know small is beautiful. So again, we created a small and simple combination of necessary components to produce BioDiesel in a laboratory scale. The extraction of fats from edibles or oil crops and the transesterification of these fats into biodiesel (FAME) are only two possibilities to use our BioFuel system. Therefore it is perfect to prepare future engineers with the basics of process engineering and chemistry courses.





## leXsolar-BioFuel Large ▶

Item No. 1702

The entire process of producing biofuels can be demonstrated with leXsolar-BioFuel Large. It starts with the biological step of alcoholic fermentation. Afterwards the produced mash will be distilled with the help of the leXsolar-condenser, which was created just for this experiment. The last step demonstrates the conversion of the produced biofuel into usable energy, such as electrical energy, using the provided Ethanol-Fuel cell.

leXsolar-BioFuel Large does not only cover the topic of the production of bioethanol, but also the production of biodiesel through transesterification of fats.



## leXsolar-BioFuel Ready-to-go ▶

Item No. 1703

The entire process of producing biofuel is demonstrated with leXsolar-BioFuel Ready-to-go as a student experiment. The case contains all necessary components and can be used anywhere.

The first step is resource selection and fermentation. The resulting mash is then distilled with custom-built leXsolar-Condenser, and the ethanol obtained will be characterized.

Lastly, the bio fuel collected needs to be converted into usable energy – for example into electricity with the provided Ethanol-Fuel cell. leXsolar-BioFuel Ready-to-go does not only cover bio ethanol production but also the generation of biodiesel through transesterification of fats.



### Key data

- Production of biofuel displayed in experiments for students
- Covers bioethanol and biodiesel production
- Interdisciplinary experiments for chemistry, physics and biology
- Includes an Ethanol-Fuel cell for the generation of electrical energy out of biofuel

### Experiments

#### Part 1: Biodiesel production

- Transesterification from fat to Biodiesel (FAME)
- Determination of fat parameters
- Extraction of fats from foods and oil plants

#### Part 2: Alcohol fermentation

- Production of a mash/ alcoholic fermentation
- Fermentation of different sugar types (including catalytic splitting of starch)
- Proof of fermentation gases

#### Part 3: Distillation and production of Bioethanol

- Distillation of mash
- Characteristics of the produced Ethanol

#### Part 4: Ethanol fuels

- Introduction Ethanol fuel cell
- I-V curve of Ethanol fuel cells
- Dependency of Ethanol fuel cells on concentration and temperature
- Energy balance of the whole process

### Components

- 1x 1100-23 Potentiometer module
- 1x 1100-27 Motor module without gear
- 1x 1700-01 leXsolar ethanol fuel cell module
- 1x 1702-01 Plug with hose
- 1x 1702-02 Yeast
- 1x 1702-03 Box 1702
- 4x L2-02-016 Bump on transparent
- 1x L2-02-017 Propeller
- 1x L2-06-016 Laboratory thermometer
- 1x L2-06-070 Distilling head, 2 cores 75°, NS 19/26
- 1x L2-06-071 Condenser
- 1x L2-06-072 Alcoholmeter
- 1x L2-06-075 Erlenmeyer flask 1000 ml
- 1x L2-06-076 Airlock
- 1x L2-06-077 Rubber stopper
- 1x L2-06-079 Areometer
- 1x L2-06-082 Beaker 250 ml
- 3x L2-06-083 Test tubes
- 1x L2-06-084 Grip stopper
- 3x L2-06-085 Pasteur pipette
- 1x L2-06-086 Measuring cylinder 100ml
- 1x L2-06-087 Syringe 2ml
- 1x L2-06-110 Silicone ring
- 1x L3-01-013 Lid for tray
- 1x L3-01-078 Padding „BioFuel-Large“
- 1x L3-03-142 Layout diagram 1702 BioFuel Large
- 1x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.

### extras needed

- 1x 1700-02 Chain clamp
- 1x L2-06-118 Stand base plate
- 1x L2-06-114 Bunsen burner
- 1x L2-06-116 Universal stand clamp
- 1x L2-06-119 Stand rod 60cm, M10
- 2x L2-06-120 Double clamp
- 1x 9100-03 AV-Module
- 2x L2-06-012 Test lead black 25 cm
- 2x L2-06-013 Test lead red 25 cm
- 1x L2-06-177 Supplementary BioFuel

### Experiments

#### Part 1: Biodiesel production

- Transesterification of fat into biodiesel (FAME)
- Measurement of fat parameters of biodiesel
- Extraction of fats from edibles or oil crops

#### Part 2: Alcoholic fermentation

- Setting up a mash / fermentation
- Fermentation of different sugars (including catalytic decomposition of starch into monosaccharide)
- Detection of fermentation gases

#### Part 3: Distillation and generation of bioethanol

- Distillation of a mash
- Characterization of the produced ethanol

#### Part 4: Ethanol fuel cell

- Introduction ethanol fuel cell
- Characteristics of ethanol fuel cell
- Dependency of the ethanol fuel cell on concentration and temperature
- Energy balance of the entire process

- Manuals available to download: find further information on page 70.

### extras needed

- 1x L2-06-177 Supplementary BioFuel
- 1x L2-06-114 Bunsen burner

### Components

- 1x 1100-23 Potentiometer module
- 1x 1100-27 Motor module without gear
- 1x 1700-01 leXsolar ethanol fuel cell module
- 1x 1702-01 Plug with hose
- 1x 1702-02 Yeast
- 1x 1700-02 Chain clamp
- 2x L2-06-011 Digital multimeter
- 3x L2-06-012 Test lead black 25 cm
- 2x L2-06-013 Test lead red 25 cm
- 4x L2-02-016 Bump on transparent 1x L2-02-017 Propeller
- 1x L2-06-016 Laboratory thermometer
- 1x L2-06-070 Distilling head, 2 cores 75°, NS 19/26
- 1x L2-06-071 Condenser
- 1x L2-06-072 Alcoholmeter
- 1x L2-06-075 Erlenmeyer flask 1000 ml
- 1x L2-06-076 Airlock
- 1x L2-06-077 Rubber stopper
- 1x L2-06-079 Areometer
- 1x L2-06-082 Beaker 250 ml
- 3x L2-06-083 Test tubes
- 1x L2-06-084 Grip stopper
- 3x L2-06-085 Pasteur pipette
- 1x L2-06-086 Measuring cylinder 100ml
- 1x L2-06-087 Syringe 2ml
- 1x L2-06-110 Silicone ring
- 1x L3-03-258 Info sheet initial startup
- 1x L3-01-107 Insert BioFuel Rtg 1703
- 1x L2-06-116 Universal stand clamp
- 1x L2-06-119 Stand rod 60cm, M10
- 2x L2-06-120 Double clamp
- 1x L2-06-118 Stand base plate
- 1x L3-01-099 Aluminium case BioFuel Rtg 1703
- 1x L3-03-175 Layout diagram 1703 BioFuel Ready-to-go





The new area of expertise leXsolar-BioEnergy allows you to understand the whole biomass cycle. From the sprouting and growth of the plants to the aerobic and anaerobic degradation and the use of produced biogases – all of these steps can be performed and understood with our new system.

## Topic BioEnergy

### 1 leXsolar-Hydroculture

The leXsolar-Hydroculture is a lab scale hydroculture system which allows growing plants with minimal use of space, water and nutrients and no use of soil at all. The plants are placed in individual plant pots with their root tips hanging in a water-fertilizer-dissolution for optimal nutrient and water absorption. Furthermore you'll find plant LED lights with red, blue and white wavelengths to ensure a constant and reproducible light situation and therefore optimal growth of the plants.



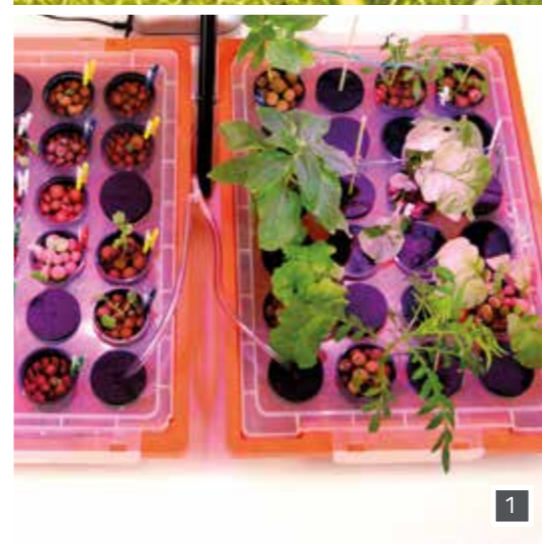
### 2 leXsolar- Composter Item No. 1700-08

The leXsolar-Composter is designed to guarantee optimal conditions for the aerobic degradation of biomass. The holes in the bottom plate provide a constant ventilation to transport oxygen into the compost and ensure the drain of redundant water. The whole compost container is made out of transparent material so that the degradation processes can easily be observed.



### 3 leXsolar-Gas collecting container Item No. 1700-09

With the leXsolar-BioEnergy system the anaerobic degradation processes to produce methane and hydrogen out of biomass can be performed in lab scale. To collect the produced gases from these processes, leXsolar developed a gas collecting container. This container allows collecting the gases to use them in a further step. You can also use the scale to monitor the rate of biogas production depending on different conditions like temperature.





## leXsolar-BioEnergy Ready-to-go ▶

Item-No. 1710

The extensive experiment system leXsolar-BioEnergy Ready-to-go enables you to reconstruct and understand the whole biomass cycle without any additional equipment.

A cultivation box and hydroculture allow the observation of the sprouting and growth of plants. Thereby the water and nutrient consumption can be analyzed in the different growth phases.

Different experiments then show the aerobic as well as the anaerobic degradation of the biomass in a compost or biogas processes. Thus allows the exploration of the energetic use of biomass.



## Experiments

- Germination of plant seeds
- Plant growth in a hydroculture
- Consumption of water and nutrients
- Aerobic degradation of biomass in a compost
- Anaerobic degradation of biomass to form hydrogen
- Anaerobic degradation of biomass to form methane



## Key data

- An experimental system to experience the whole biomass cycle.
- How biomass can be grown under artificial conditions.
- Energetic use of different degradation processes.

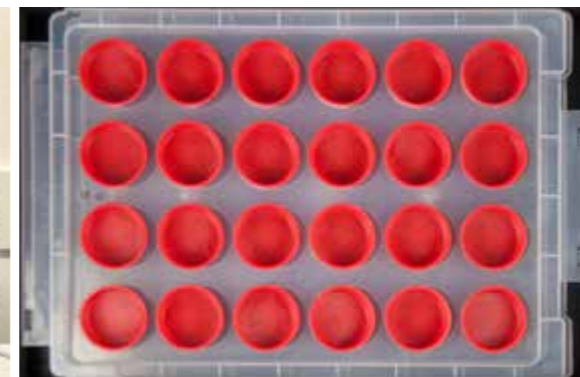
## extras available

- L2-04-044 Electric grid adapter set
- 1100-63 DC converter 120V - 240V



## Components

- 1 x 1100-27 Motor module without gear
- 1 x 1218-02 PEM-Fuel cell module
- 1 x 1602-01 leXsolar-Base unit small
- 2 x 1700-05 Expanded clay pebbles
- 1 x 1700-06 Fertilizer
- 1 x 1700-07 Compost catalyst
- 1 x 1700-08 Composter
- 1 x 1700-09 Gas collecting container
- 1 x 1700-10 Burner
- 1 x 1700-11 Tripod plant lighting
- 1 x 1700-12 Sprout box
- 1 x 1700-13 Box 6 L
- 1 x 1700-14 Tripod
- 1 x 1700-15 Seed set
- 1 x 1700-16 Rubber plug with tube
- 1 x 1700-17 ID tags
- 1 x 1710-01 Aluminum case 1710 silver
- 1 x 1710-02 Aluminum case 1710 blue
- 2 x L2-01-120 Pot holder BioEnergy
- 1 x L2-02-017 Propeller
- 1,5 x L2-02-046 Silicone tube 4mm
- 1 x L2-02-083 Y-switch 4mm
- 2 x L2-04-194 Plant light
- 1 x L2-05-141 Hose clamp
- 1 x L2-06-012 Test lead black 25 cm
- 1 x L2-06-013 Test lead red 25 cm
- 2 x L2-06-033 Short-circuit plug
- 1 x L2-06-075 Erlenmeyer 1000 ml
- 2 x L2-06-185 Timer
- 1 x L2-06-186 Air pump
- 2 x L2-06-187 Aeration stone
- 50 x L2-06-188 Net cup planter
- 1 x L2-06-189 EC meter
- 1 x L2-06-190 Temperature logger
- 1 x L2-06-191 Weight
- 1 x L2-06-192 Tweezers
- 24 x L2-06-199 Stopper red
- 1 x L2-06-200 Nebulizer
- 2 x L3-01-012 Plastic box Gratnells 75 mm deep
- 1 x L3-01-210 Insert BioEnergy Rtg 1710
- 2 x L3-03-258 Info sheet initial startup
- 1 x L3-03-274 Layout diagram 1710 BioEnergy Ready-to-go
- Manuals available to download: find further information on page 70.





The area of expertise leXsolar-ThermalEnergy summarizes all the technologies for renewable heat production. This includes solar collectors as well as the CSP-technology (Concentrated Solar Power) for the production of electricity from solar heat.

## Topic ThermalEnergy

**1** Parabolic collector  
Item-No. 1300-04

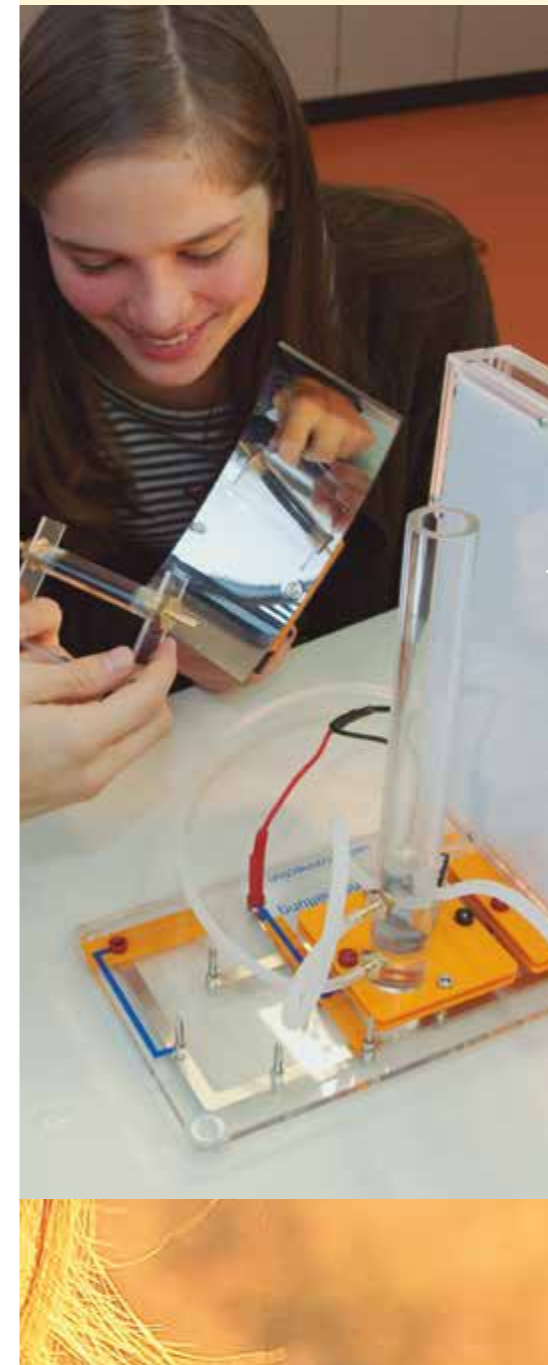
The leXsolar-parabolic collector enables the representation of a parabolic trough power plant on a laboratory scale. The realistic depiction of the basic processes gives students well-grounded information about the application of solar thermal power plants.

**2** Paraffin heat exchanger  
Item-No.1300-12

The paraffin heat exchanger represents a latent heat storage. The physical effect of the phase change of a storage medium is used here to store heat. With the leXsolar-Paraffin heat exchanger, this can be impressively demonstrated with simple experiments.

**3** leXsolar- Peltier module  
Item-No.1300-10

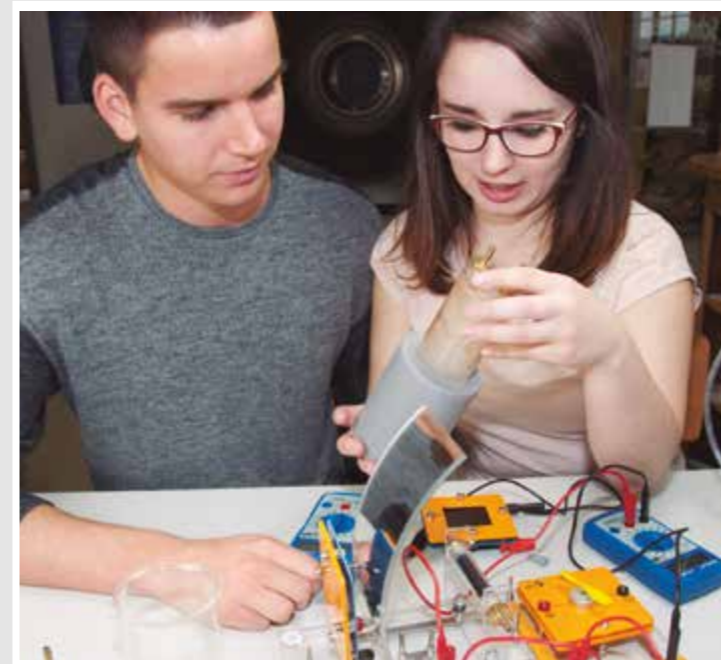
The PLUG-IN leXsolar-Peltier module is a simple and easy to handle thermoelectric cooler. With compact measuring size of the system it gives students a fast impression of the operating principle of a Peltier element. With this component we complete our leXsolar-ThermalEnergy trainer system.





## leXsolar-ThermalEnergy Ready-to-go Item No. 1304

This experimentation system allows for the application of different technologies of solar thermal energy transformation in class. The product does not only contain various solar collector systems, which can be operated with or without pumps, but also CSP-technology (Concentrated Solar Power) and a Peltier element for the direct transformation into electric energy. Another main feature are the experiments regarding the basics of thermodynamics, like absorption of heat radiation and the convective flow of heat, that provide a comprehensive understanding of the applied physical effects. Like the other products of the Ready-to-go line, the leXsolar-ThermalEnergy Ready-to-go amazes with its flexible and location-independent usability that doesn't require any additional equipment.



### Key data

- Experimentation system for solar thermal energy conversion
- Quantitative experiments for different collector systems
- Flexible and location-independent usage

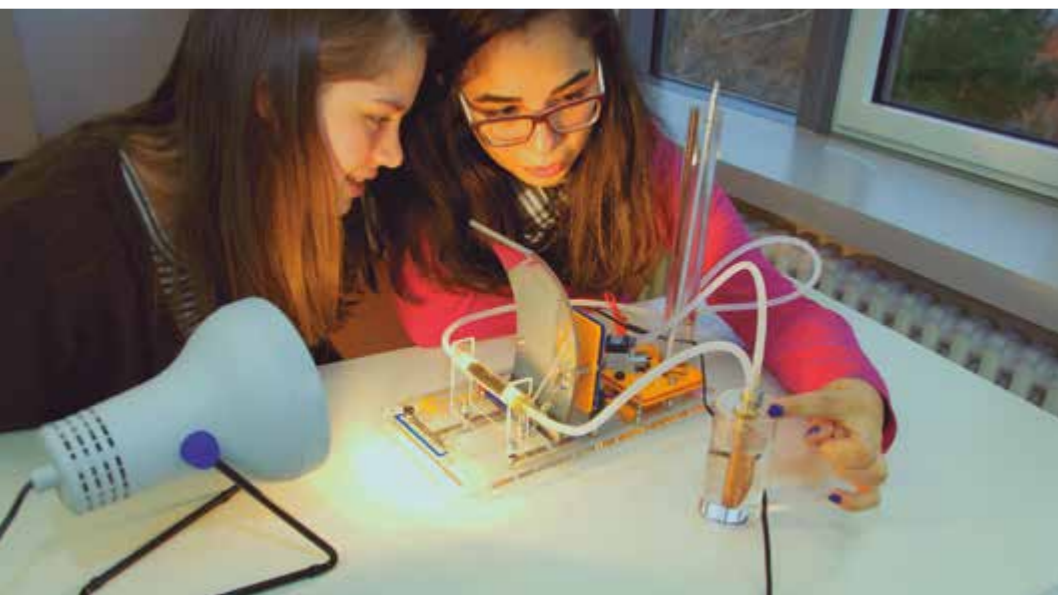


### Experiments

- Absorptivity and reflectivity of different materials
- Focusing of light by a Fresnel lens
- Thermal convection and layering
- Thermal conduction
- Thermal insulation
- Solar thermal collector with pump circulation
- Solar thermal collector with thermosiphon circulation
- Variation of the flow speed
- Collector circuit with heat exchanger
- Collector circuit with paraffin heat reservoir
- Parabolic trough collector with pump cycle
- Defocussing
- Qualitative demonstration of the functional principle
- Investigating the thermoelectric generator
- Quantitative determination of the electrical power

### Components

- 1x 1100-19 leXsolar-Base unit Large
- 1x 1300-03 Solar collector
- 1x 1300-04 Parabolic reflector
- 1x 1300-05 Absorber tube
- 1x 1300-06 Lens module
- 1x 1300-07 Absorber module for lens
- 1x 1300-08 Absorber B/W
- 1x 1300-09 Pump module
- 1x 1300-10 Peltier module
- 1x 1300-11 Heat exchanger water
- 1x 1300-12 Heat exchanger paraffin
- 1x 1300-13 Hose-set
- 1x 9100-05 PowerModule
- 1x 1100-27 Motor module without gear
- 1x L2-04-080 Lamp housing
- 1x L2-04-200 Illuminant infrared 230V
- 2x L2-06-011 Digital multimeter
- 1x L2-06-016 Laboratory thermometer
- 1x L3-01-100 Aluminium case Thermal Energy Ready-to-go
- 1x L3-01-109 Insert ThermalEnergy Ready-to-go
- 1x L2-06-125 Cooling pad
- 1x L2-06-123 Temperature measuring sensor
- 2x L2-02-007 Sorting rubber d=65, mark P
- 1x L2-02-017 Propeller
- 1x L2-06-082 Beaker 250 ml
- 2x L2-06-014 Test lead black 50 cm
- 2x L2-06-015 Test lead red 50 cm
- 1x L3-03-258 Info sheet initial startup
- 1x L3-03-138 Layout diagram 1304 leXsolar-ThermalEnergy Ready-to-go
- Manuals available to download: find further information on page 70.



### leXsolar-Reference ► Energieagentur Regensburg e.V.

„The energy education campaign of the Energieagentur Regensburg e.V. aims at raising awareness in school children all over the county of Regensburg in matters of energy production and consumption. leXsolar's Ready-to-go Kits for wind power, photovoltaics and thermal energy, which we have chosen, are ideal for daily use in classrooms. They are robust, safe versatile. Experiments contained in the kit are quickly and easily usable and are perfectly applicable on the on the practically-oriented energy education campaign. To further inspire students in the field of energy matters, we will continue to rely on leXsolar's authority in experimenting kits.“

Johannes Zange  
Educational Consultant





Traffic and transport are responsible for about one third of the worlds' energy consumption. To date almost all of the energy is provided by fossil fuels. Electromobility is a significant key to increase the amount of renewable energy utilization in this area. Efficient electrical storage devices are fundamental for this endeavor.

## Topic Electromobility

### 1 Model Electric Vehicle

The model car sparks excitement in school children, but at the same time serves in many practical experiments. Both qualitative experiments comparing different types of battery and quantitative experiments on topics like energy- and power-density are possible.

### 2 ChargerModule

The Charger module is an innovative universal charger for different types of battery, the capacitor, and the electrolyzer. With this, you can ensure that batteries are ready to use at all times and avoid deep discharge. This warrants long battery lifetime. Moreover, the ChargerModule allows for numerous experiments on the topic of charging procedures. For example, thy typical CC-CV-procedure can be investigated, but also fixed-current and fixed-voltage methods.

### 3 Reversible Fuel Cell

The reversible fuel cell is highly robust and easy to use for daily handling in schools. After filling with distilled water, it is immediately ready to use. While in electrolyzing mode, oxygen and hydrogen are being stored directly in the integrated tanks – no need for additional tubes. As soon as a consumer is connected, the fuel cell mode starts and hydrogen and oxygen are consumed. The cell works reliably and is very durable.

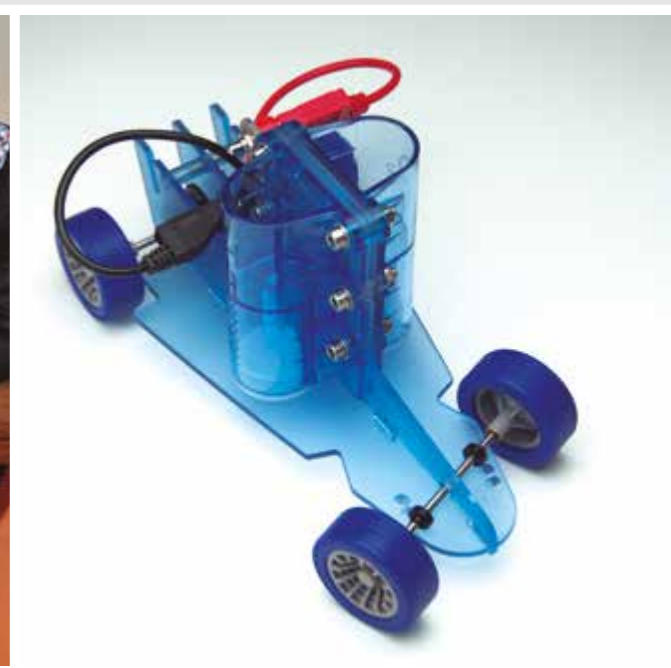




## leXsolar-EMobility Large ▶

Item No. 1802

This product teaches students the physical and technical foundations and applications of different battery technologies. The highly-topical issue of electric mobility is explored with an electric model car. Dimensioning and application of different battery types are just as much a topic as life expectancy or charging methods. The characteristics of various battery types are analyzed with qualitative and quantitative experiments. The product is expandable with a Lithium-Polymer and a lead battery module. Considering the storage problems with renewable energies, these topical issues should find their way into the curriculum.



### Key data

- Battery technology for educational purposes
- Various battery types like NiZn, LiFePo, capacitor
- Includes fuel cell
- E-Mobility with electric model car

### Experiments

- Ohm's law
- Series connection of ohmic resistances
- Parallel connection of ohmic resistances
- Nominal voltage and capacity of voltage sources
- Four-terminal sensing
- Internal resistance of voltage sources
- Series connection of voltage sources
- The capacitance of a battery module
- The energy density of battery modules
- The  $R_i$  efficiency of a battery module
- The total efficiency of a battery module

- Temperature-dependent behavior of the lithium-polymer c
- The charging process of a capacitor
- The discharge process of a capacitor
- I-V characteristics of the single NiMH battery module
- I-V characteristics of the NiZn battery module
- I-V characteristics of the LiFePo battery module
- I-V characteristics of the lead battery module
- I-V characteristics of the lithium-polymer battery module
- I-V characteristics of the triple NiMH battery module
- The charging process of the NiMH battery
- The charging process of the NiZn battery
- The charging process of the LiFePo battery
- The charging process of the lead battery
- The charging process of the lithium-polymer battery
- The discharging process of a battery module
- Hydrogen production in the reversible hydrogen fuel cell
- Characteristic curve of the electrolyzer
- Hydrogen consumption of a fuel cell
- Characteristic curve of the fuel cell
- The efficiency of the hydrogen fuel cell
- Operation of the electric car with several battery modules
- Operation of the electric car with the reversible fuel cell

### Components

- 1 x 1100-62 Potentiometer module 110 Ohm Pro
- 1 x 1118-09 Battery module NiMH 3xAAA Pro
- 1 x 1118-11 Capacitor module Pro
- 1 x 1801-07 leXsolar-Base unit EMobility
- 1 x 1800-01 Resistor module (triple) Pro
- 1 x 1800-03 Resistor plug element 1 Ohm
- 2 x 1800-05 Resistor plug element 10 Ohm
- 1 x 1800-08 Battery module holder 1xAAA Pro
- 1 x 1801-02 Electric model car
- 1 x 1801-06 LiFePo-battery AAA
- 1 x 1802-02 Box 1802
- 1 x 1800-15 Distilled water (100 ml)
- 1 x 1800-04 Resistor plug element 100 Ohm
- 1 x L2-04-102 NiZn-battery AAA
- 1 x L2-06-067 Reversible Fuel cell
- 1 x L3-03-258 Info sheet initial startup
- 1 x L3-01-013 Lid for tray
- 1 x L3-01-070 Insert 4E Energy box 5002
- 1 x L3-03-166 Layout diagram 1802 EMobility Large
- 1 x L2-04-021 NiMH battery AAA

### extras needed

- 1 x 9100-03 AV-Modul
- 1 x L2-06-012 Test lead black 25 cm
- 1 x L2-06-013 Test lead red 25 cm
- 1 x L2-06-014 Test lead black 50 cm
- 1 x L2-06-015 Test lead red 50 cm
- 1 x 9100-13 ChargerModule
- 1 x L2-06-011 Digital multimeter
- Manuals available to download: find further information on page 70.

### extras available

- 1x 1800-07 Lithium-polymer (LiPo)-battery module
- 1x 1800-13 Lead (Pb) -battery module Pro
- 1x 1800-09 Battery adapter cable
- 1x 9102 leXsolar-SmartControl Large



## leXsolar-EMobility Basic ▶

Item No. 1830

### Components

- 1 x 1100-31 Solar module 2.5 V, 420 mA
- 1 x 1118-11 Capacitor module Pro
- 1 x 1801-02 Electric model car
- 1 x L3-03-206 Layout diagram EMobility Basic 1830
- 1 x L3-03-258 Info sheet initial startup

### Key data

- Experimental system on storage technology and electric mobility
- Exciting experiments with the electric car
- With solar module for building a solar car
- Playful understanding of technical knowledge



## leXsolar-Reference ▶

SWE Stadtwerke Erfurt GmbH

After an opening event with subsequent teacher training with leXsolar, the Stadtwerke Erfurt-Gruppe decided on the topics Smartgrid and EMobility, as these are closely linked with our companies' philosophy and are well-implemented in the current school curriculum..

„With leXsolar's Ready-to-go Kits, which, for teachers, are free to lend in the local media center, students are given the possibility to conduct practical-oriented experiments and get to know the Stadtwerke Erfurt as local energy supplier and possible employer. In order to guarantee teachers an optimal and safe handling of these experimenting kits, we will further draw on leXsolar's know-how for training courses.“

Annett Glase  
Corporate Communication





## leXsolar-EMobility Ready-to-go ▶

Item No. 1803

This product teaches the physical and technical foundations and applications of different battery technologies. Eight different battery types like lithium-polymer battery, capacitor or fuel cell allow for the study of characteristics like lifespan and charging methods. Qualitative and quantitative experiments are used to explore the properties of various battery types. The electric car can be run with all included storage types.

With the integrated ChargerModule batteries are always ready to use and battery charging methods can be addressed in experiments.

Like the other products of the Ready-to-go line, the leXsolar-EStore Ready-to-go amazes with its flexible and location-independent usability that doesn't require any additional equipment.



### Key data

- Extensive experimentation system for battery technology
- Eight different storage types
- Various experiments for E-mobility possible
- Including ChargerModule
- No additional equipment needed

### Experiments

- Ohm's law
- Series connection of ohmic resistances
- Parallel connection of ohmic resistances
- Nominal voltage and capacity of voltage sources
- Four-terminal sensing
- Internal resistance of voltage sources
- Series connection of voltage sources
- The capacitance of a battery module
- The energy density of battery modules
- The Ri efficiency of a battery module
- The total efficiency of a battery module
- Temperature-dependent behavior of the lithium-polymer cell

- The charging process of a capacitor
- The discharge process of a capacitor
- I-V characteristics of the single NiMH battery module
- I-V characteristics of the NiZn battery module
- I-V characteristics of the LiFePo battery module
- I-V characteristics of the lead battery module
- I-V characteristics of the lithium-polymer battery module
- I-V characteristics of the triple NiMH battery module
- The charging process of the NiMH battery
- The charging process of the NiZn battery
- The charging process of the LiFePo battery
- The charging process of the lead battery
- The charging process of the lithium-polymer battery
- The discharging process of a battery module
- Hydrogen production in the reversible hydrogen fuel cell
- Characteristic curve of the electrolyzer
- Hydrogen consumption of a fuel cell
- Characteristic curve of the fuel cell
- The efficiency of the hydrogen fuel cell
- Operation of the electric car with several battery modules
- Operation of the electric car with the reversible fuel cell



### Components

- 1x 1118-09 Battery module NiMH 3xAAA Pro
- 1x 1118-11 Capacitor module Pro
- 1x 1800-01 Resistor module (triple) Pro
- 1x 1800-03 Resistor plug element 1 Ohm
- 1x 1800-04 Resistor plug element 100 Ohm
- 2x 1800-05 Resistor plug element 10 Ohm
- 1x 1800-07 Lithium-polymer (LiPo)-battery module
- 1x 1800-08 Battery module holder 1xAAA Pro
- 1x 1800-13 Lead (Pb) -battery module Pro
- 1x 1801-02 Electric model car
- 1x 1801-06 LiFePo-battery AAA
- 1x 1801-07 leXsolar-Base unit EMobility
- 1x 1803-01 Koffer 1803
- 1x 1100-62 Potentiometer module 110 Ohm Pro
- 1x 1800-15 Distilled water (100 ml)
- 1x 9100-13 ChargerModule
- 1x 9100-03 AV-Module
- 1x L3-01-130 Insert EMobility Rtg 1803
- 1x L3-03-258 Info sheet initial startup
- 1x L2-04-102 NiZn-battery AAA
- 2x L2-06-012 Test lead black 25 cm
- 2x L2-06-013 Test lead red 25 cm
- 1x L2-06-067 Reversible Fuel cell
- 1x L3-03-167 Einräumplan 1803 EMobility Ready-to-go
- 1x L2-04-021 NiMH battery AAA
- Manuals available to download: find further information on page 70.

### extras available

- 1800-09 Battery adapter cable



### leXsolar-Reference ▶ Innogy SE

„leXsolar's experimenting kit convinced us upon first opening. Not only do they satisfy our motto „Discover, explore, experience energy“, but also they are composed with attention to detail and instantly invite you to experiment. The sunstick proves excellent for the use in kindergarten and first contact with natural science. The SmartGrid series covers topics like photovoltaics, wind energy and associated storage technologies vary intuitively, while the EMobility-Kit conveys the physical and technical basics of battery- and storage-technologies. All in all this is a great package, which we enjoy using to creatively enthuse young people with energy matters.“

Claudia Bremer  
Educational manager

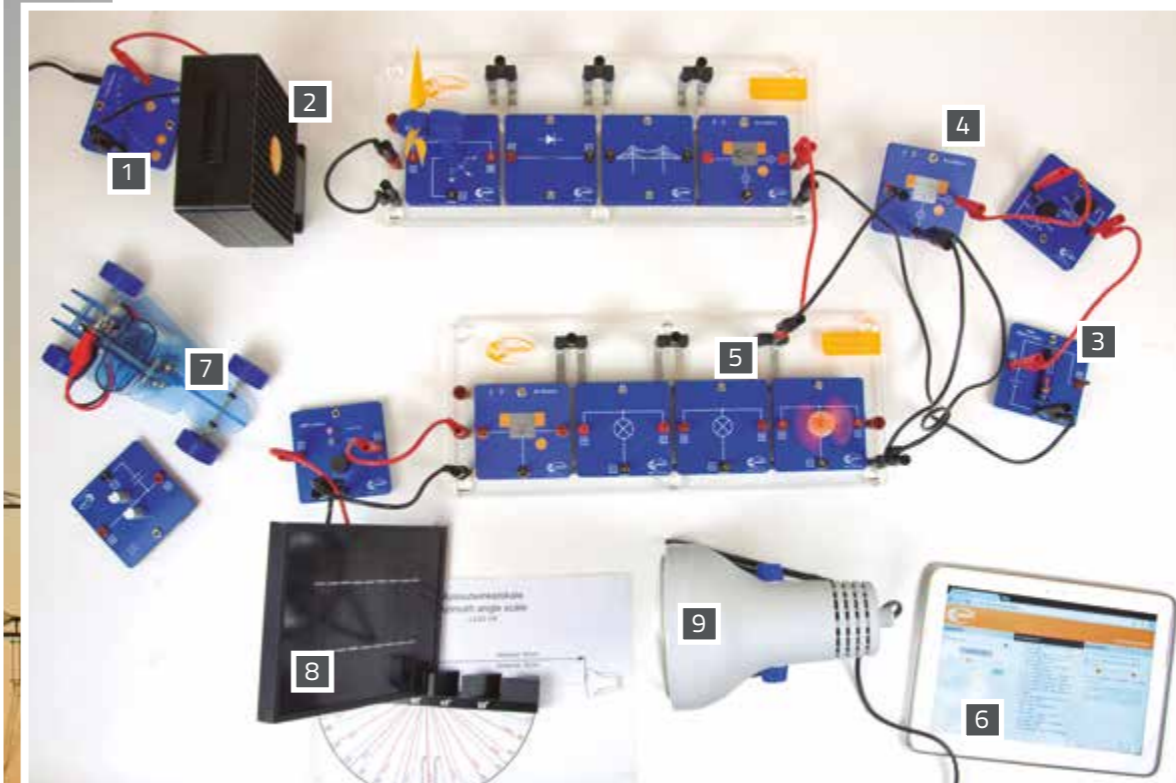




The SmartGrid concept stands for Connection and Control of energy sources; its storage and load owe to an „intelligent“ power grid. Only with Smart Grids can the energy transition to 100% renewables be affordable!

# Understanding the energy transition with leXsolar-SmartGrid

- 1 Daily profile wind velocity**  
Right now there's a stiff breeze –great conditions for wind power plants! The leXsolar-Power module controls the wind speed according to the daily profile.
- 2 Wind farm**  
The wind farms run at full power! Where should the surplus energy go? Do the storages have enough capacity?
- 3 Pumped storage power plant**  
The storage is almost full! Now, the smart e-mobility fleet needs to be involved to provide sufficient storage capacity!
- 4 Smartmeter**  
The grid reports an ample energy supply–time for the smartmeter to start the pre-programmed washing machine. The leXsolar-Smartmeter works like a real intelligent electricity meter. Depending on the energy supply, it can switch consumers on or off and keeps the grid stable and the electricity not expensive.
- 5 Consumers**  
In a real household, different consumers play different roles different times. Thus, their behavior corresponds to a specific consumption profile.
- 6 Network control center**  
This is where all data come together: current energy production, available storage capabilities and the energy consumption. These kind of information enable students to manage their grid by themselves. The communication works wireless with SmartControl technology (see p.14). The integrated platform-independent software allows the control with any mobile device.
- 7 E-Mobility**  
Electronic vehicles are an important part of the SmartGrid of the future! They work as a decentralized „storage fleet“.
- 8 Solar park in South Europe**  
The conditions are bad and the photovoltaic plants are running only at 20% of their capacity! Luckily, the wind farms in the north are running at full speed.
- 9 Sun**  
It's cloudy and the solar radiation is therefore quite weak. The lighting is controlled by the leXsolar-dimmer module according to a pre-set daily profile.





## leXsolar-SmartGrid Ready-to-go ▶

Item No. 1605

Ready-to-go stands for a fully equipped product of the leXsolar-SmartGrid line in a durable aluminum suitcase that is ready to use anytime and anywhere.

leXsolar-SmartGrid Ready-to-go allows the construction of a smart grid with a variety of renewable energy sources on a laboratory scale. It's possible to choose different energy generation profiles and observe their effect on the system. The various available storage units and consumers make for a complex smart grid and a multitude of possible scenarios to analyze.

The energy flows within the smart grid can either be read from the displays of the smartmeters or logged with the SmartControl-software. This enables the students to control the system manually or with the help of the SmartControl-software.

All necessary SmartControl components for measuring and control are already included.

The package includes wind and solar power as well as fuel cell, storage technology and e-mobility components and, thus, also the foundation for a variety of basic experiments.



## Key data

- Fully equipped experiment system for a variety of renewable energy technologies (solar, wind, fuel cell, storage technology, e-mobility)
- Setup of a complete smart grid in the lab
- Generation of different energy source and load profiles
- Manual control or with software
- All additional equipment already included

- 2x 9100-05 PowerModule
- 1x 1100-61 Potentiometer module 110 Ohm
- 12x L2-02-016 Bumpon transparent 5,0 mm height X 11,1mm diameter
- 1x L2-02-017 Propeller
- 1x L2-04-080 Lamp housing
- 1x L2-04-116 Illuminant 120W, 12°
- 4x L2-06-012 Test lead black 25 cm
- 7x L2-06-013 Test lead red 25 cm
- 3x L2-06-014 Test lead black 50 cm
- 1x L2-06-067 Reversible Fuel cell
- 1x L3-01-139 Insert SmartGrid RtG 1605
- 1x L3-01-140 Aluminium case SmartGrid RtG 1605
- 1x L3-03-169 Layout diagram 1605 SmartGrid Ready-to-go
- 1x L3-03-176 Azimuth angle scale
- 3x L2-06-015 Test lead red 50 cm
- 1x L3-03-258 Info sheet initial startup
- Manuals available to download: find further information on page 70.

## Components

- 1x 1100-53 SM 5.22V, 380mA, 4mm plug
- 1x 1100-19 leXsolar-Base unit Large
- 1x 1100-21 Diode module
- 2x 1100-26 Light bulb module
- 1x 1100-27 Motor Module without Gear
- 1x 1118-17 Base for solar panel
- 1x 1400-12 leXsolar-Wind rotor set
- 1x 1400-19 Wind machine
- 1x 1400-22 Wind turbine module
- 2x 1600-01 power grid module
- 1x 1600-02 Capacitor module 5.0F/5.4V
- 1x 1801-02 Electric model car
- 1x 9100-03 AV-Module
- 2x 9100-04 SmartMeter

## extras available

- 1x L2-04-044 Electric grid adapter set
- 1100-63 DC converter 120V - 240V

## Experiments

### 1. Basic experiments on photovoltaic

- The I-V-characteristic of a solar module
- The I-V-characteristic of a solar module depending on the illuminance
- The I-V-characteristic of a solar module depending on the temperature

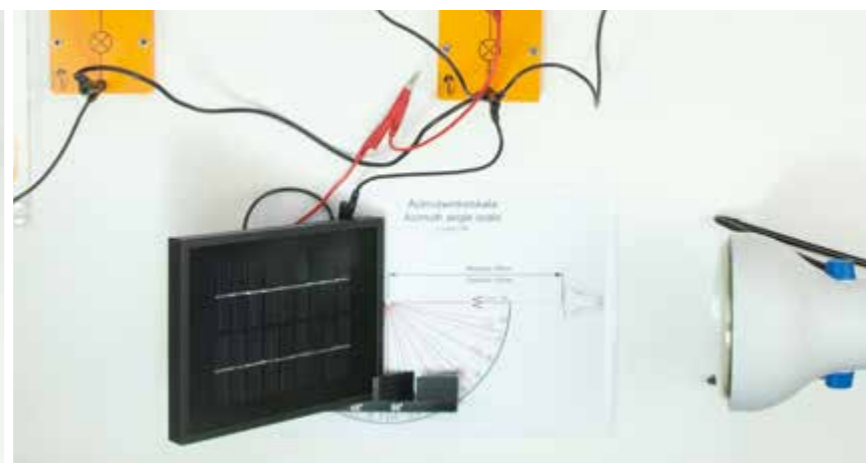
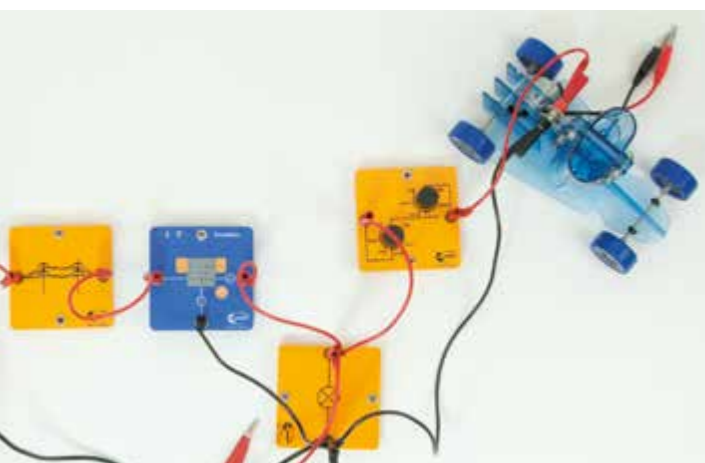
### 2. Basic experiments on wind power

- The dependence of the power on the pitch angle and the blade design
- The dependence of the power on the number of blades
- The dependence of the power on the wind direction

### 3. Basic experiments on energy storage technologies

- The I-V-characteristic of an electrolyzer
- Behavior of the voltage and the current during charging of an electrolyzer
- The I-V-characteristic of a fuel cell
- Behavior of the voltage and the current during discharging a fuel cell
- The t-V- and t-I-characteristic of a capacitor during charging
- The t-V- and t-I-characteristic of a capacitor during discharging
- The use of the electric car with capacitor and fuel cell

- The power fluctuations of a photovoltaic station
- The power fluctuations of a wind turbine
- Energy supply of a building by a power plant
- Energy supply of a building by a power plant and a photovoltaic station
- Energy supply of a building by a power plant, a photovoltaic station and an energy storage
- The behavior of the voltage in a conventional line grid
- The behavior of the voltage in a line grid with photovoltaic station
- The behavior of the voltage in a line grid with photovoltaic station depending on the consumption
- The behavior of the voltage in a line grid with photovoltaic station depending on the distance to the transformer
- The behavior of the voltage in a line grid with photovoltaic station and an intelligent transformer station
- The behavior of the voltage in a line grid with photovoltaic station and an energy storage (fuel cell / E-Mobility)
- The behavior of the voltage in a line grid with photovoltaic station and load management
- Power line monitoring
- Scenario experiment: Smart Grid





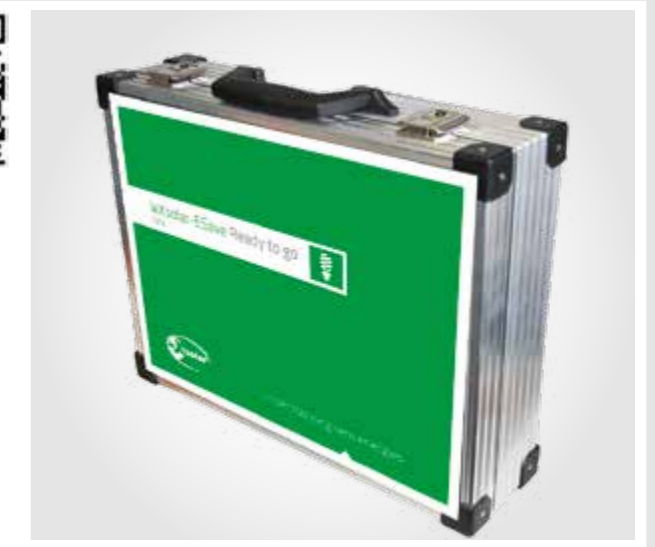


Energy efficiency and energy saving are key elements for the transition to a renewable energy supply, because the mere alternative of power generation capacities through renewables is almost impossible even the demand has to be reduced. The goal of leXsolar ESave is to find out and use the saving potential at its best, without any loss of comfort.



## leXsolar-ESave Ready-to-go ▶ Item No. 1502

Thanks to the leXsolar-ESave Ready-to-go, energy issues become more concrete. Due to the global approach provided, students will focus first on topics like global energy consumption, climate change or household energy consumption. Following the manuals, students will make measurements based on the problem; for instance things like room temperature or climate, water and energy consumption, etc. The goal is to promote the ability to identify potentials for improvements and savings.



### Key data

- With the help of this combination of instruments, the following topics can be analyzed and optimized:
  - Electrical energy consumption.
  - Heating behavior.
  - Air quality.
  - Water consumption of a school / household.
  - Lighting
- Perfectly suitable for energy saving projects in the classroom.
- Many measurements can use an automatic Data Logging System.
- Includes a detailed introduction to the topics for students, exercise for the respective measurements and an experiment guide for teachers.

### Components

- 1 x L2-06-038 Base station including 2 temperature sensors
- 1 x L2-06-054 Power supply
- 1 x L2-06-039 Humidity + temperature sensor
- 1 x L2-06-037 Temperature sensor
- 1 x L2-06-040 Temperature sensor for outside use
- 1 x L2-06-034 Light Meter
- 1 x L2-06-035 Infrared thermometer
- 2 x L2-06-036 Electricity meters
- 1 x L2-06-041 Flow meter
- 1 x L3-01-041 Aluminum case Esave Ready-to-go
- 8 x L2-06-030 Battery AAA LR03 1,5 V
- 1 x L3-01-053 Foam inserts Esave Ready-to-go
- Manuals available to download: find further information on page 70.

### Experiments

#### Understanding Energy

- Primary- and secondary energy, resources and reserves
- Units and conversions, key sizes
- Production of electricity, comparison of power plants
- Worldwide energy consumption
- Climate change and CO2
- Why save energy?
- Where do we need energy?

#### Heating

- Learn more about your school – Which energy sources are used? What are their locations & costs?
- Temperature in the classroom
- Heat loss of buildings
- Air quality
- Heating and ventilating: correct behavior
- Humidity

#### Water

- Learn more about your school – Where does drinking water come from? Where does the used water go? What are the annual consumption & costs, etc.
- Hot water preparation
- Where is water consumed: correct behavior

#### Electricity Consumption

- Learn more about your school – Which energy supplier are use? What are the annual consumption & costs?
- Electrical energy in everyday life
- Electrical energy in the kitchen
- Energy guzzler
- Hidden loss: stand-by-mode and the 'off' position.

#### Light

- Light in the classroom
- Comparison of different light sources
- Researching different brightnesses





Hydropower was the first renewable energy source that was used by man to produce electrical energy. Even if its potential is limited in many countries, it plays an important role in the energy mix, as it is less prone to fluctuations like other renewable energy sources.

## Topic Hydropower

### 1 Interchangeable Turbines

Due to the interchangeable turbines, leXsolar-Hydropower is not only suited for quantitative, demonstrative experiments, but also for numerous praxis-oriented experiments. You can, for instance, compare the efficiency factor for a Pelton- or cross-flow turbine for different rates of flow. This way, students not only learn about the physical principles different types of turbines but also about their respective areas of application.

### 2 The hydropower click-in infrastructure system

leXsolar featuring Gardena and created an easy and simple to use click-in system for necessary elements of the leXsolar hydropower system. With this simple connection the different entrances of the turbine housing can be used easy and fast. An integrated measuring system for water pressure and flow volume makes the system complete and ready to use for everyone.

### 3 leXsolar- Induction generator

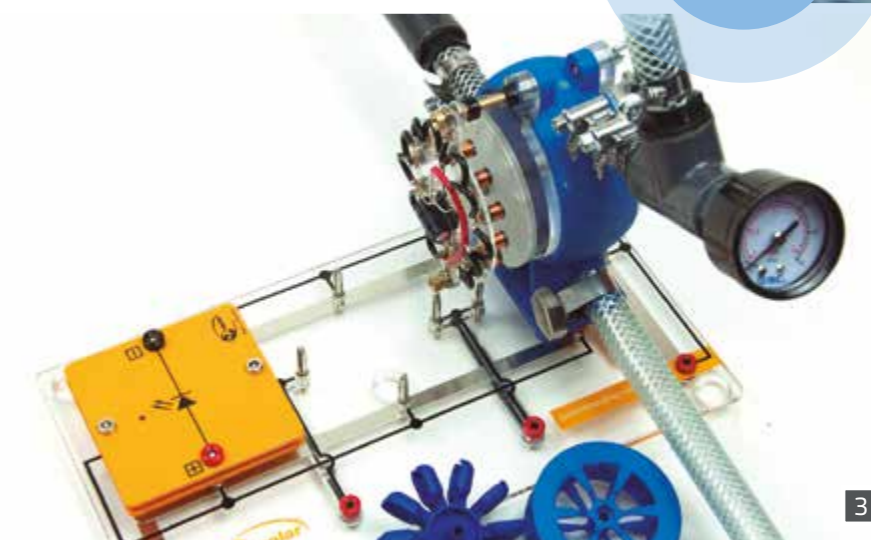
The small induction generator used in the hydropower system is a development directly from the leXsolar development team and one of the most efficient systems in the world. With 12 electric coils and magnets the generator makes it very clear and easy to understand the principle of electromagnetic induction of electric power. That allows you to compare the generated power of the three different turbines with the same set-up and without long modification times.



1



2



3



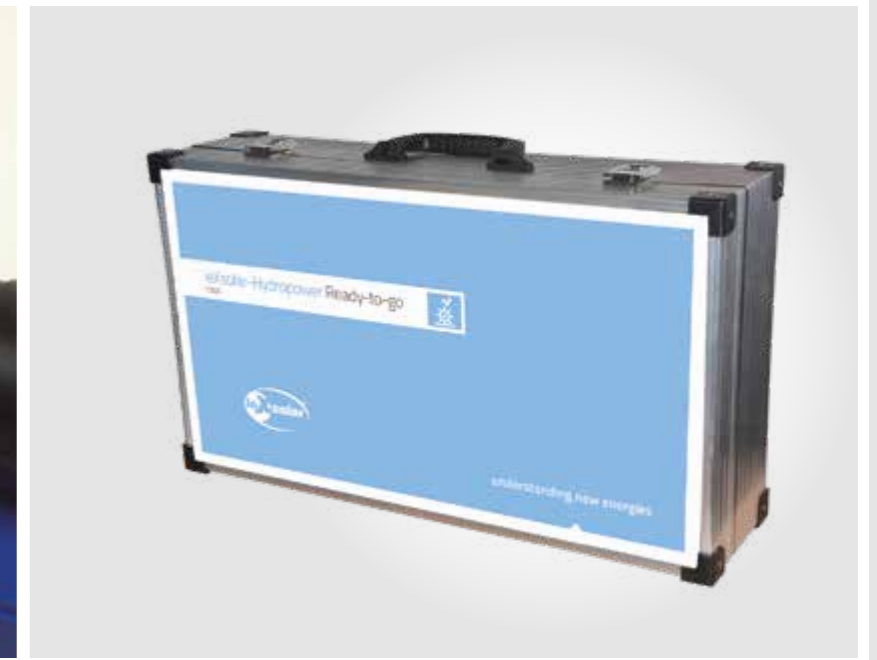


## leXsolar-Hydropower Ready-to-go ▶

Item No. 1905

Besides qualitative experiments as introduction into the topic hydropower usage for high school students and basic experiments in technical training, this experimenting kit offers fundamental quantitative experiments on the physics of water turbines.

A foundation in reality enjoys, as with all leXsolar products, a high priority. leXsolar-Hydropower Ready-to-go is therefore equipped with different types of turbines - from a simple water wheel to a modern, highly efficient Pelton turbine.



### Key data

- Fast assembly by GARDENA plug system
- Various adapters for water-tap is include
- Observation of the functionality of the electrical generator during the operation
- Three different types of turbines
- Fundamentals of fluid dynamics

### Experiments

- Volume flow, flow velocity and power as a function of the height of fall
- Volume flow, flow velocity and power as a function of the pipe cross-section
- Comparison of the functionality of pelton turbine, crossflow turbine and waterwheel
- Comparison of the performance of the pelton turbine, crossflow turbine and waterwheel in dependence to the volume flow and pressure

### Components

- 1x 1900-02 Water turbine casing
- 1x 1900-03 Turbines set
- 1x 1900-05 Manometer set 2 bar
- 1x 1900-06 Manometer set 4 bar
- 1x 1900-07 Intake connector
- 1x 1900-08 Flow set 4 mm
- 1x 1900-09 Flow set 8 mm
- 1x 1900-10 Flow set 12 mm
- 1x 1905-02 Induction generator 12 fold
- 1x 9100-03 AV-Module
- 1x 1100-26 Light bulb module
- 1x 1400-08 LED-module 2mA, red
- 1x 1100-25 Buzzer module
- 1x 1100-27 Motor module without gear
- 1x 1100-19 leXsolar-Base unit Large
- 1x 1100-22 Resistor module
- 1x 1900-11 Flow box
- 1x 1100-28 Color discs - Set 1
- 1x 1900-12 Connection set
- 1x L3-01-202 Aluminium case PV Professional 1905
- 1x L2-02-066 Water flow meter

- 2x L2-05-131 Schlauchschelle
- 1x L3-03-258 Info sheet initial startup
- 1x L3-03-272 Layout diagram 1905 Hydropower Ready-to-go
- 0,2x L2-02-062 Textile tube 12/18mm
- 1x L2-06-014 Test lead black 50 cm
- 1x L2-06-015 Test lead red 50 cm
- 1x L2-06-012 Test lead black 25 cm
- 1x L2-06-013 Test lead red 25 cm
- 1x L3-01-197 Container box 6 L
- 1x L3-01-194 Insert HydroPower RtG 1905
- Manuals available to download: find further information on page 70.

Scan the code!



### extras available

- L2-04-044 Electric grid adapter set
- 1100-63 DC converter 120V - 240V



## leXsolar-Hydropower Basic ▶

Item No. 1930



### Components

- 1x 1100-25 Buzzer module
- 1x 1900-01 Water wheel module

### Key data

- Fundamental experiments on hydropower
- Advanced Pelton wheel module
- Simple qualitative experiments
- Mobile application due to enclosed tube



## Student's Manual ▶ to download

Every leXsolar product includes a comprehensive and age-appropriate instructions manual with various experiments. The manuals can be printed out and used as a guideline to follow. The experiments are then performed step by step through experiment-description and a layout. Table and diagram templates are already included.



## Teacher's Manual ▶ to download

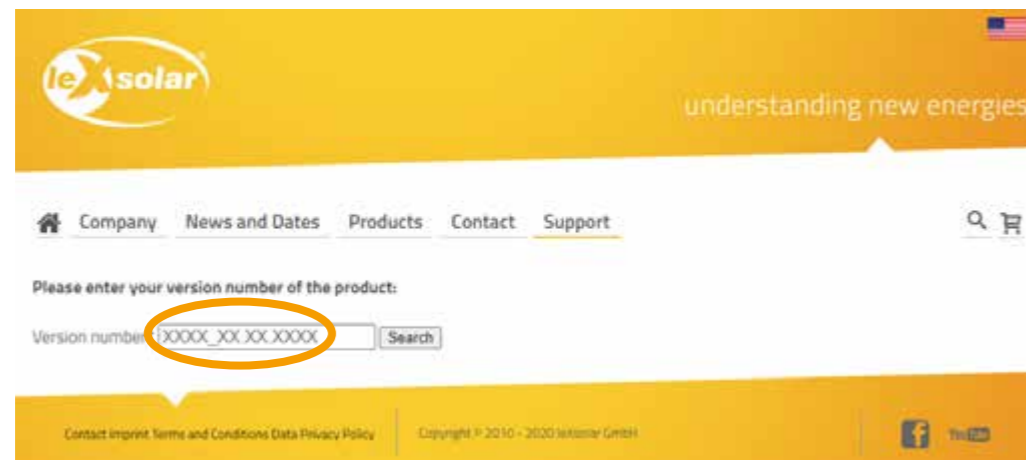
In addition to the student's manual teachers have also their own manual with all the solutions and further background information for all experiments. In this way they can easily compare students results with answer provided in the manual and give them further explanations.



Every product includes Manuals that can be downloaded from [www.lexsolar.com](http://www.lexsolar.com).

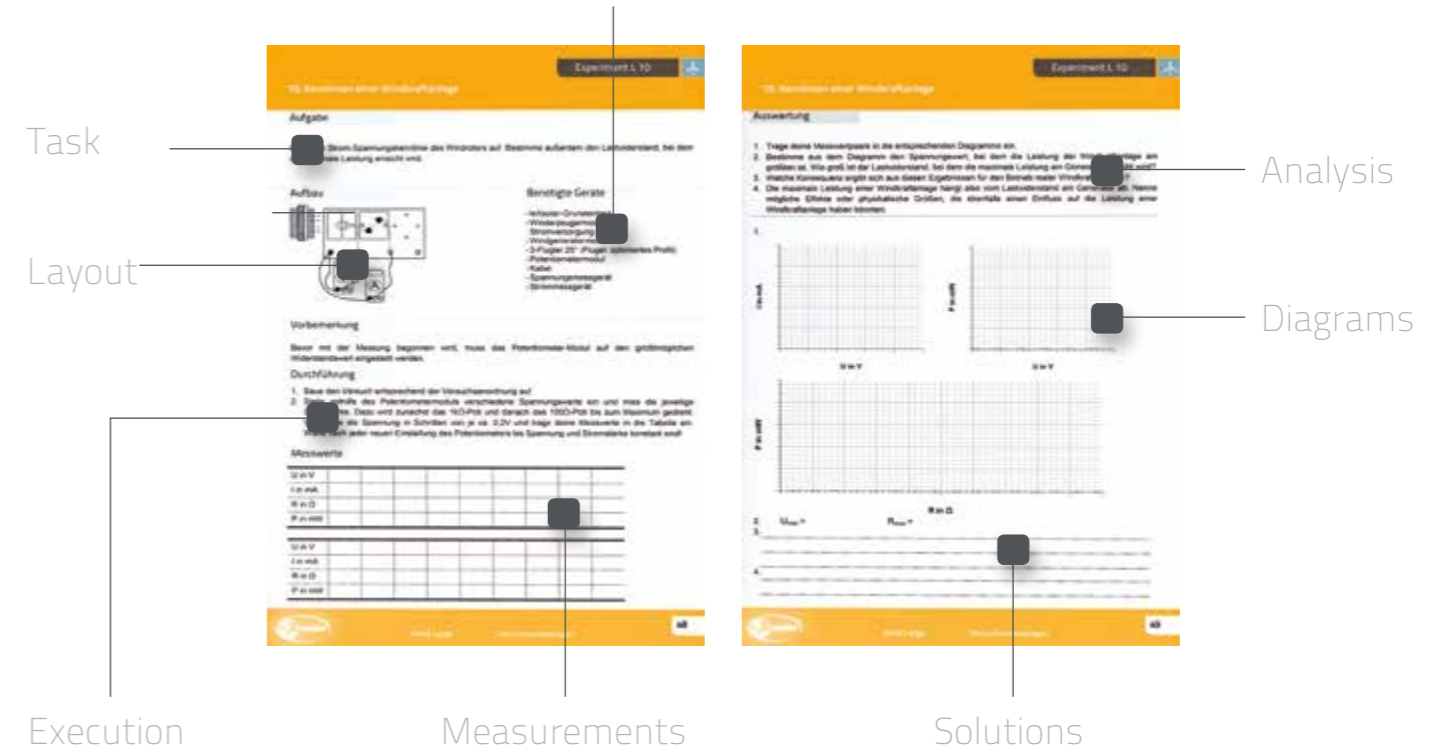
The version number of the products „XXXX\_XX.XX.XXXX,“ can be found in the Layout diagrams in the position described below.

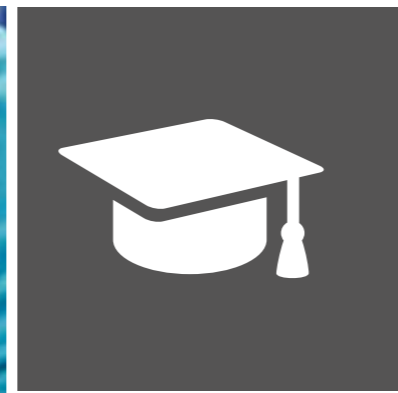
In the download folder you will find Student's and Teacher's Manual.



Just enter the version number of the product on our website in „Support“ and a folder with Student's and Teacher's Manual will be available to download.

## Equipment needed





## leXsolar-Academy

Apart from our convenient and practical experimenting kits, leXsolar offers to communicate theoretical knowledge within the framework of several different events.

### leXsolar-Teacher training courses

With our teacher training courses leXsolar offers a new service of connecting education- and cooperation partners. The aim of this event is to intensify the communication between partners and teachers and to realize new educational projects.

### leXsolar-Training exercises

On these topical training events participants can gain theoretical knowledge on the chosen topic, learn the handling of the experimenting kits or single modules and can practice experimenting. After such an event, everyone will be able to confidently pass on this knowledge.

### leXsolar-Events

Whether it is at private company functions, public street festivals or school events: With leXsolar you will have a partner, that can excellently and individually guide through your event and will flexibly and didactically communicate the topic of renewable energies in your name.

The leXsolar Academy provides you with the necessary knowledge to all renewable energy technologies and makes you a competent contact person on this topic for their students and colleagues.



# leXsolar- Teacher Training Courses

Prior to any educational project, two questions have to be answered: Which forms of renewable energies are teachers interested in and which form of support do they wish for?

In order to determine this, leXsolar organizes teacher training events, which bring together teachers with local cooperation partners.

To start with, leXsolar informs about different kinds of renewable energies and different forms of support by cooperation partners. These will in turn provide information on current projects in schools and educational institutions. In the practical part, teachers will be given an overview over different experimenting kits by our product developers and will be given the opportunity to freely experiment, ask questions and make suggestions.

These will later be evaluated and create the basis for a successful realization of educational projects.



Which **topics** are most relevant to you?



Which **type of students** are you interested in?



In which kind of **situations** would you be using the experimental setups?





# leXsolar-Training Exercises

In order to learn about the usage of the experimental setups and the facts and theory of different types of renewable energies, leXsolar-Academy offers different types of training courses.

## Photovoltaics



### Key data:

- Physical basics and aspects of photovoltaics
- A solar module design
- Current facts and data
- Practical experimenting

## Wind energy



### Key data:

- Wind formation
- Types of wind energy plants
- Physical aspects of wind power
- Current facts and data
- Practical experimenting

## Fuel cells



### Key data:

- Hydropower technologies and types of fuel cells
- Physical basics and aspects of fuel cells
- Current applications
- Outlook on fuel cell usage
- Practical experimenting

## Biofuel



### Key data:

- Comparison with non-biological production methods
- Consideration of industrial usage of biodiesel and bioethanol
- Bioethanol production via distillation
- Use of bioethanol in an ethanol fuel cell
- Esterification of oil into biodiesel (fatty acid methyl ester (FAME))

## Solar thermal installations



### Key data:

- Physical basics
- Industrial usage of solarthermics
- Current facts and data
- Practical experimenting

## Energy storage



### Key data:

- Types of energy storage
- Types of batteries and characteristic values
- Current state of electromobility and comparison with fuel and hydrogen engines
- Practical experimenting

## SmartGrid



### Key data:

- Physics of a solar cell
- Physics of wind power
- Physics of electrolysis and fuel cells
  - Types
  - Hydrogen production
  - Setup
  - Working principle of a PEM fuel cell
- Smart grid
  - Layout and working principle of a conventional power grid
  - Challenges and issues due to the implementation of renewable energies
  - Smart concepts to maintain security of supply
- Practical experimenting

## ESave



### Key data:

- Energy consumption
- Heating behavior
- Air quality
- Water consumption in schools and homes
- Lighting
- Practical experimenting

# leXsolar-Events

You, as a company, want to appear more publicly, cultivate your corporate image and present yourself as local authority in questions of renewable energies?

You are looking for a competent partner to successfully realize joint functions, events, or fair exhibitions in the field of renewable energies?

You want to organize a project day, at a school, an educational institute, or a company and need assistance by an experienced advisor?

# Events organisieren

We are happy to realize your events on renewable energies for you and your guests, and guide you with theoretical knowledge and practical experimental setups.

Every event will be conducted by a leXsolar event companion and a product developer.

This way, you will be supported both in organization and in content and in case of questions about the product line, you will have our developer at your service.







## leXsolar-Education Project Emils World Tour

### Description

„Emil“ is a penguin living in the Antarctic with his family and friends. Due to the global warming the ice of Antarctica is melting. He is really worried about his living environment and is asking himself, what the world is doing against the climate change. He starts a long journey to seek more information about renewable energies all over the world and also about local specifications.

During „Emil's Day on Electromobility“ the students get to know everything about electro mobility and will then send Emil to various locations on earth. During this journey the students periodically will receive postcards or online presentations from the locations and the different projects. They will have to do a quiz about what they learned and try to score some points in the overall competition.

While Emil is traveling the world, students have the chance to get more point on „Emil's Experimentation Day“ and „Experiments in Class Day“ – two more possibilities for more exciting experimentations all over renewable energies. On the final day („Emils Final“) the classes with the most points gathered get into direct competition. They have to present their knowledge on all the projects in a final quiz to get the last points.

Winner of Emils world tour is the class with most of the points.

### Object and ambition

- Adenvturous and descriptive introduction into renewable energies and climate change
- Support interests and understanding of renewable energies through permanent engagement
- Getting to know different big renewable energy projects from all around the world
- Motivation through competition by different schools and classes
- Inspire young people for education and renewable energies

### Target audience

- Students by the age of 13 - 15

### Program and content



#### I. Beginners and Information Day

- Showing first impressions of „Emils World Tour“

#### II. Emils Day on Electromobility

- Introduce the whole theme of electromobility to the students
- Teach the important aspects in a practical and interactive way

#### III. Emil is traveling the world

- Eventful and colorful introduction into renewable energies and climate change
- Promote the understanding for the necessity of renewable energies
- Getting to know some bigger project on unusing renewable energies
- Get motivated by competition between different schools and classes

#### IV. Emils experimentation day

- Getting to know renewable energies by experimenting
- Link between theory and practice

#### V. Experimentation in class

- Getting to know renewable energies by experimenting
- Link between theory and practice

#### VI. Emils final

- Award ceremony
- Possible exchange of opinions and know-how in Emils World Tour



# leXsolar- education projects

Everybody is talking about renewable energies. Wind and solar power are already widely taken for granted. But how do these technologies work and with whose assistance can teachers convey this kind of information?

To successfully teach children, students and trainees in topics of renewable energies, you will often need the assistance from local cooperation partners.

Through a plethora of projects, these ecoconscious institutions support education and encourage a close relationship with the local population.

leXsolar is very glad to have such partners and want to present some of them on the following pages.



© Fotocredit – PREFA/Croce & Wir



© by ENERVIE - Südwestfalen Energie und Wasser AG



„After an opening event with subsequent training for teachers from Aurich, the „Energie-, Bildungs- und Erlebniszentrum (EEZ) Aurich“ decided on the topics SmartGrid and Wind, as these are closely connected with the interactive display we have in our institution, and can serve as educational link to our experientarium/ future-lab. With leXsolar’s „Ready-to-go“ kits, which students and teachers from Aurich can freely use in our labs, students have the possibility to conduct practical experiments and get to know the EEZ as local educational partner. In order to allow teachers to optimally and safely use these experimenting kits, we will further draw on leXsolar’s know-how within the scope of training events in our facilities.“

Stefan de Jonge  
Manager Energie-, Bildungs- und Erlebnis-Zentrum (EEZ)  
Auricher Bäder- und Hallenbetriebsgesellschaft mbH & Co. KG

**EEZ** Energie-, Bildungs- und Erlebnis-Zentrum Aurich

„Our own studies on energy education have shown the importance of introducing children to the topic of renewable energies as early as possible. The results of our studies are alarming, as children show a startling lack of fundamental knowledge. Teachers would love to change this, but schools are lacking the corresponding materials and equipment. This is where the enviaM-group comes in: For several years, we have been engaged in supplying teachers with the necessary equipment. leXsolar’s products aid to vividly enhance the lesson program. leXsolar’s experimenting kits convince through practical relevance and high educational value. At enviaM, we decided on the topics „SmartGrid“, „Photovoltaics“, and „Windpower“. Additionally, enviaM encourages adequate teacher training courses, which will be fostered by leXsolar..“

Susanne Weiß  
Corporate communications  
envia Mitteldeutsche Energie AG



„Since 2010, as part of our program to support secondary schools, we rely on leXsolar products and services. We are highly satisfied with the innovative experimenting kits. Workshops with developers and the overall service of the leXsolar-Academy regularly convince teachers of their didactic capabilities, so that they instantly feel ready to answer their student’s questions on renewable energies and future concepts. We are always pleased to use the ‘leXsolar-EStore Ready-to-go’ kit to highlight electro mobility and battery technologies and their use in storing renewable energies as well as giving schools the opportunity to experiment with different types of battery, fuel cells, and the model electric car.“

Karen Herrmann  
Enervie Gruppe  
Corporate communications

**> Enervie**  
Südwestfalen Energie und Wasser AG

„The MINTmobile of the registered club „experiMINT e.V.“ aims at experience-driven classes on the topic of renewable energies in the region around Herford and Bielefeld. After an in-house fair, both the club and local teachers decided on the ‘Ready-to-go’ kits on the topics of wind and photovoltaics. The MINTmobile can either be used by a teacher or can be booked in combination with a teamer e.g. for school projects on renewable energies. That way, students can conduct practically relevant experiments and simultaneously get to know future-oriented jobs and trades. Teachers use leXsolar’s comprehensive teaching material to plan their own classes and are supported and kept up-to-date by experiMINT in cooperation with leXsolar“

Martina Zurmühlen  
Project management experiMINT e.V.

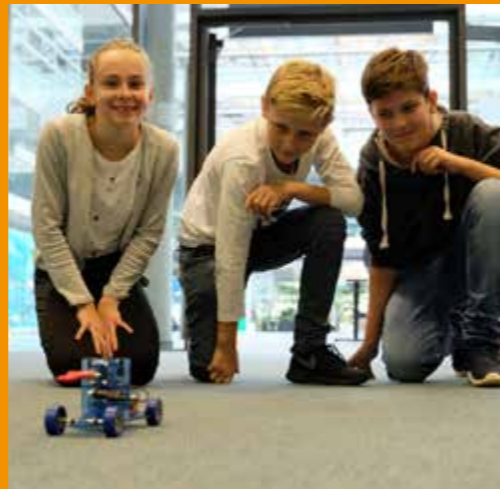
experiMINT®

# leXsolar- education projects

Together with a multitude of corporations, energy suppliers and agencies we contribute to the success of renewable energies.

With our many years of experience, high quality standards and great innovational strength we were able to convince a range of partners and realize joint educational projects.

We would be pleased, to customize your projects, as well.



„One of the priorities of Klimaallianz Bamberg is the support of environmental protection in the area of environmental education in schools and kindergartens in Bamberg city and the district of Bamberg. The purpose of environmental education is to raise the sense of responsibility and the awareness of the importance to support nature, environment and climate protection actively. The company leXsolar from Dresden offers innovative teaching systems for renewable energies. These high-quality training kits are suitable for the educational standards of the tenth grade in the subject physics. Several training kits had been tested by the Staatliche Realschule Scheßlitz, with the result, that the training kits are suitable perfectly for teacher-based experiments in a very modern and methodically attractive way. We are looking forward to the cooperation with leXsolar and the realization of following education projects in order to further encourage our student's engagement in the area of environmental education.“

Klimaallianz Bamberg



„After an introductory course, we decided to buy the solar kit and want to use this to introduce students from Jena to the principles of energy matters, specifically renewable energies, from a very early age. We hope that with these free, lendable solar kits, we can generate joy in experimenting and spark an interest in energy matters.“

Bert Rupprecht  
Energy consultant  
Sales Stadtwerke Energie Jena-Pößneck GmbH



„The feedback of our elementary school kids was great. In other words: With our school project, we were able to inspire a lot of students and maybe spark a long-lasting interest in power industry. The well-executed Academy as well as the simple and quick commission and shipment of the leXsolar products speak for themselves: We believe to have positively influenced the image of the Staetische Betriebswerke Luckenwalde GmbH, even though the actual project with the high school students has not even started, yet. Of course, we will use the leXsolar know-how for additional training courses, allowing teaches an ideal and safe handling of the experimenting kits.“

René Lehmann-Rotsch  
Sales manager



„Emil's Weltreise“- A penguin discovers the world of renewable energies. In September 2018 began the world tour of Emil - who explores the world looking for renewable energies and solutions to the climate change. On his virtual world tour, Emil" is accompanied by six classes over a school year. At the end of each stage, the students answer questions about global energy projects to get points.

In an exciting final at SWE Stadtwerke Erfurt GmbH, the students were able to creatively present their different travel routes to the other classes and the jury.

SWE Stadtwerke Erfurt GmbH



# leXsolar- education projects

We would be happy to design individual educational projects with you!



*„Vivid learning through independent experimenting – this is one of the biggest assets of the leXsolar experimenting kits. As local power supplier, we at the SUC regard it as our duty, to raise young peoples’ awareness for renewable energies. Lending these photovoltaics kits to local schools is an important component in this endeavor.“*

Ferenc Bályi  
Chief Department Manager Sales/Energy Management



*„leXsolar „Ready-to-go“ kits for the topics of wind power and photovoltaics expand the already extensive educational service of RheinEnergie. By lending these kits free of charge, RheinEnergie promotes practical education in local schools and nurtures students’ expertise in these topics. RheinEnergie wants to inspire young people – inside and outside school settings. With this, we hope to spark interest in natural and engineering sciences, very early on.“*

Elfgard Pfahlbusch  
Senior Kommunikations Manager Kids/Youth/Education



*„Basic idea of our project was the question, how the principles of energy production from sunlight, wind and water could be broken down to teach elementary school children. After extensive research on this topic, leXsolar’s experimenting kits stood out. These illustrate the topic very child- and activity-oriented, which led to our school project being awarded with a local environment award. Thus the desire arose, to visualize and explain these forms of energy production to as many students as possible. Some students (from the environment committee) were chosen to teach their peers, how natural energy sources can be made usable on a larger scale.“*

Astrid Schrögl  
Environmental officer of the ‘Elementary school Braugasse’, Neumarkt/Opf



*„The Bavarian State Office for the Environment (LfU) has energy boxes available for loan, free of charge, since summer 2019. Our special class set ‘Renewable Energies Energy Box’ includes the leXsolar- NewEnergy Ready-to-go from leXsolar GmbH. The product are easy to use, robust and clearly arranged in suitcases. For example, users can measure the electricity generated by a photovoltaic cell with a small measuring device and for that the components are inserted on a base plate.“*

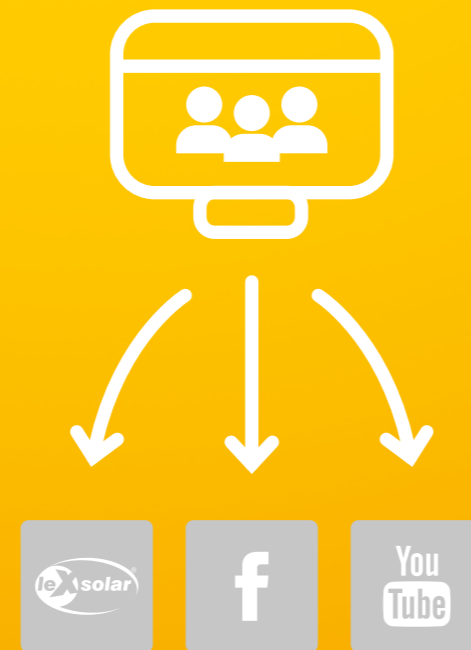
Kemp da Silva  
State Office for the Environment - Bavaria



# leXsolar- Social Media

Learn more about our product line on [www.leXsolar.com](http://www.leXsolar.com)

Find out about current and future events or conveniently order from our web shop.

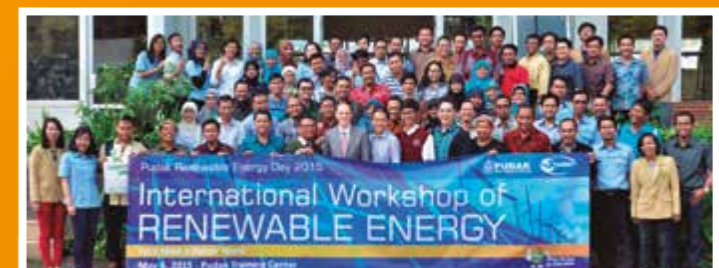
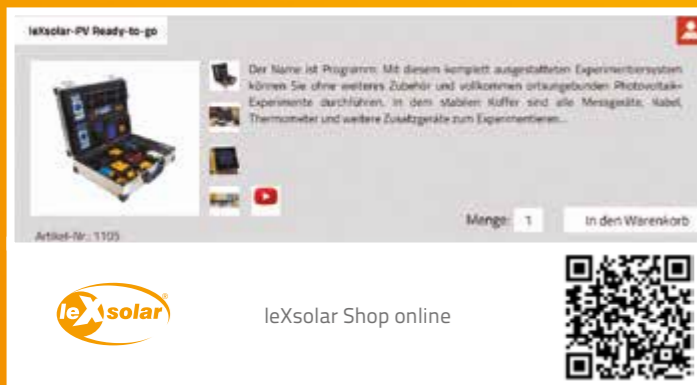


Poland Turkey  
Indonesia  
Russia USA

# leXsolar- International

We are internationally present with workshops and partners.

We offer international training courses, present our products on *road trips* and exhibit at international trade fairs.



International Workshop of Renewable Energy, Bandung, Indonesia  
As part of a two-day course, leXsolar-Academy showed teachers of Indonesian colleges and trade schools the fundamentals of photovoltaics and wind power.



Istanbul  
On our roadshow 2015 through Poland, Czech republic, Romania and Turkey, we visited several teachers and corporate partners, to inform on our experiments and news on electromobility.



International Seminar on Renewable Energies, Pune, Indien  
As part of a seminar lasting several days, leXsolar-Academy was booked to introduce participants into the topics photovoltaics, energy storage technologies, and electromobility.

# leXsolar-Branding

We design leXsolar products especially for you:

From a printed logo to a highly customized product – everything is possible. Brand you kits and modules fully to your liking.



# leXsolar-Service

Whether it's product samples, quality, return of flawed products or your feedback...

leXsolar stands for exceptionally friendly customer service.



**Module Branding**  
 - Logo stickers  
 - All leXsolar modules with your logo, any color



**Product Samples**  
 Are you interested in our products? Then borrow them and see for yourself!



**Kit Branding**  
 - Kits with all-over print  
 - Any color, any background color



**Repair, Warranty, Retour**  
 High quality is our goal. Only a happy customer is a good customer. In case of warranty we will replace you defect components and send them back to you.



**Complete Branding**  
 Altered set assembly, adaption of your corporate design, use of your materials.



**Feedback**  
 Your opinion is important to us! We can only advance with your feedback!

# leXsolar innovation and quality made in Dresden

The source of innovation and quality ...

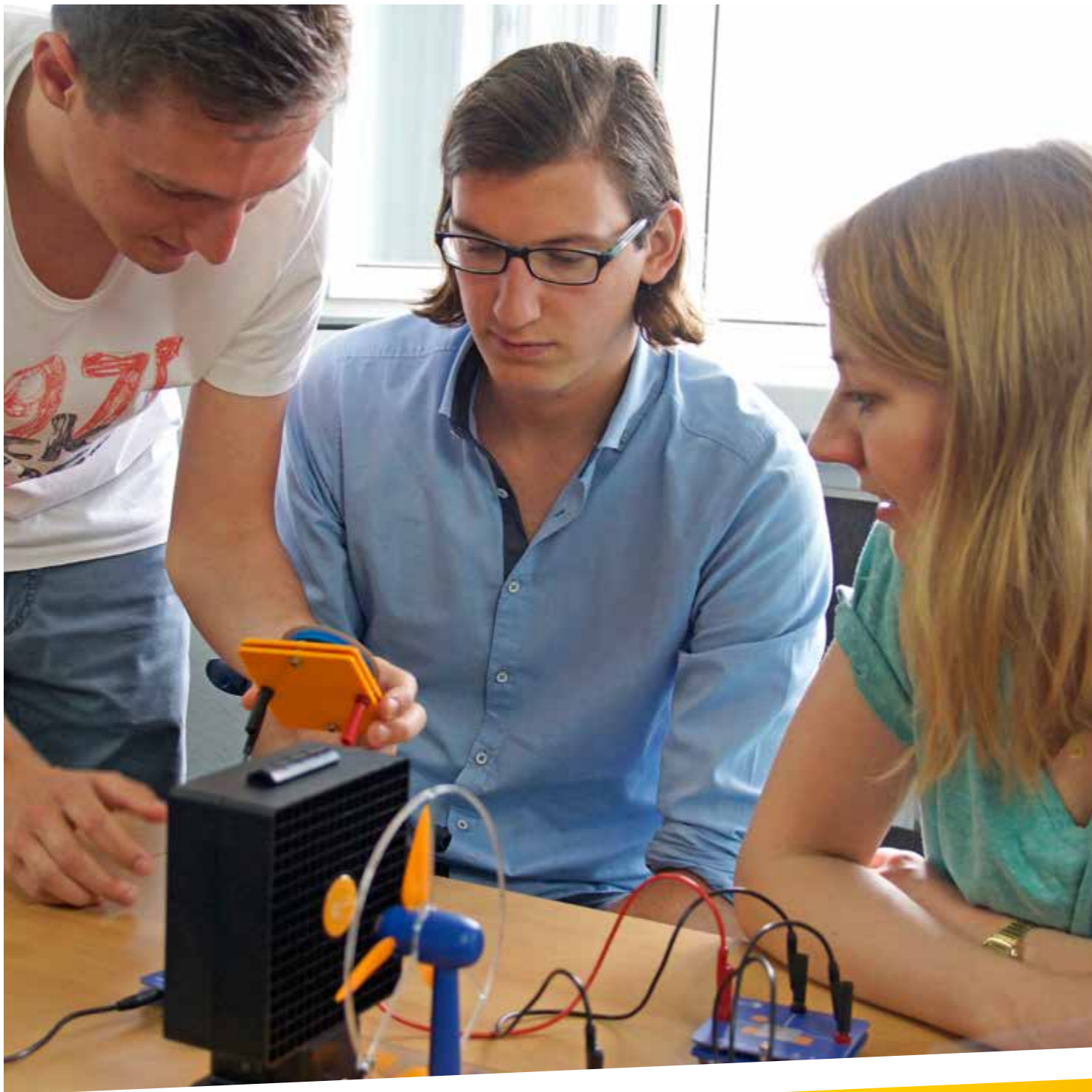
of the leXsolar products is located in the capital of Saxony and not without reason. In Dresden you can find both qualified scientific centers and an unique cultural scenery.

Ten universities and colleges, three Max Planck-, four Leibnitz- and eleven Fraunhofer-institutes are accompanied by numerous competence centers and facilities for the transfer of technologies.

On the other side, Semperoper, GrünesGewölbe, Sächsische Staatskapelle or the Frauenkirche offer an unique cultural richness.

Through this inspiring background, it is possible to develop further ideas that will help you and your students to understand new energies.





neue energien verstehen

[www.leXsolar.de](http://www.leXsolar.de)