



STEMINARIUM INTERNATIONAL

MAKING SCIENCE ENGAGING

MOSCOW
2020

TEACHING NEW ENERGY TO NEW GENERATION

We should ask ourselves whether future generations will say “**thank you**” for the World they will inherit from us. **Sustainable energy** is the practice of using energy in a way that “meets the needs of the present without compromising the ability of future generations to meet their own needs”. Meeting the world's needs for electricity, heating, cooling, and power for transport in a sustainable way is one of the greatest challenges facing humanity in the 21st century. Transition to sustainable energy calls for deeper education of new generation in many scientific and engineering subjects.



The broad and growing interest of the US public in new energy, combined with growing demand for STEM (Science, Technology, Engineering, Mathematics) education, creates a perfect opportunity for an energy techno-classes.

STEMINARIUM project fits into both categories: new energy and STEM education.



WHAT IS STEMINARIUM

GENERAL DESCRIPTION:

We have developed **STEM curricula** and **teaching aids** allowing students to run various laboratory tests in the field of **new energy**. Our solutions are linked into a single information environment, teaching materials, demonstration, research and production equipment, as well as specialized software.

It is an **educational environment of a new level**, allowing training of specialists capable of developing new energy sources and managing them – energy specialists of the future.

BENEFITS: NOT JUST HARD SCIENCE BUT SOFT SKILLS AS WELL

With focus on **group activities** and development of students' own **initiative** and **creativity**, our classes have proven to be very efficient in fostering and developing soft skills, such as interpersonal communications, team work and leadership. Focus on **case studies** and **analysis of practical engineering situations** allows to acquire in addition to academic knowledge, useful practical skills and "holistic" view on engineering problems, as opposed to knowledge, compartmentalized along formal academic disciplines.

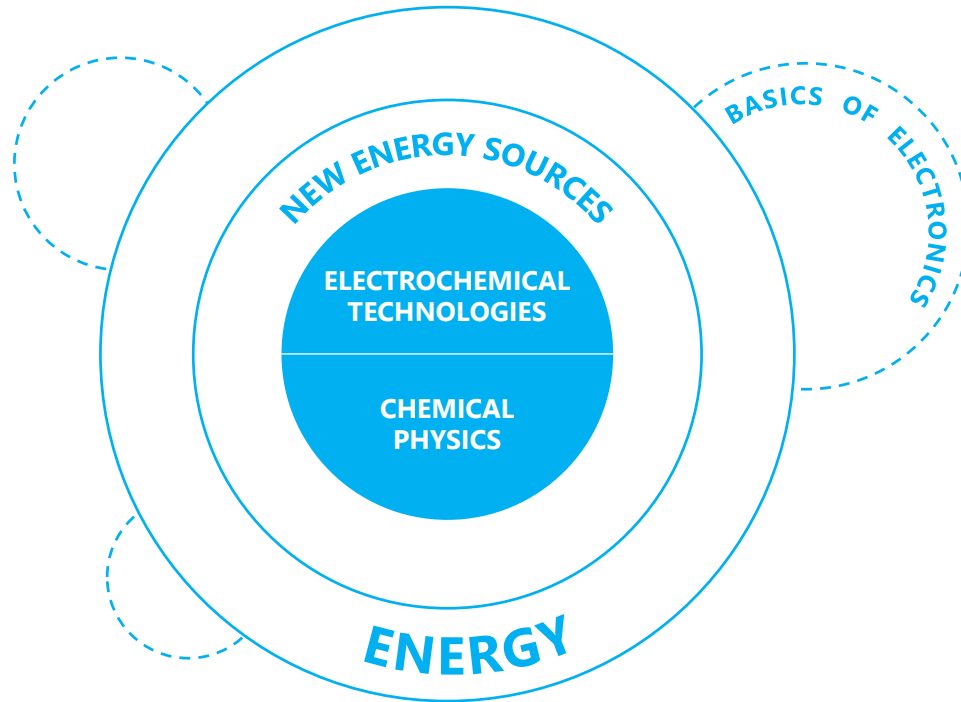
WHO DO WE TEACH AND WHERE?

The target audience for **STEMinarium** classes is **10 years old and above**. The courses could be used both as part of regular school curriculum, or could be part of extracurricular activity.

The formats of activities include: seminars, laboratory works, competitions, summer camps and even racing....



“SUBJECT MATTERS”: CURRICULUM



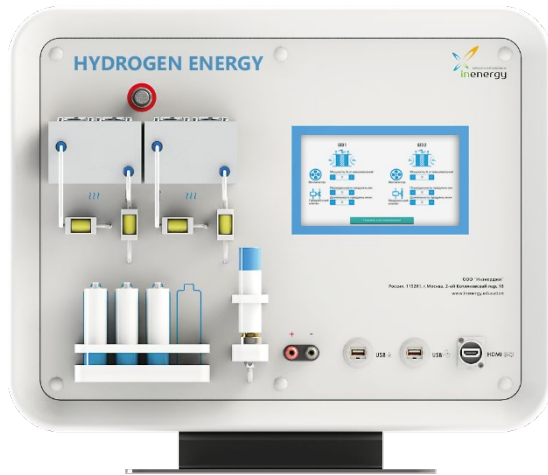
With some degree of simplification, the subject areas covered by our courses can be represented in the form of three concentric circles: the general theme is energy, the narrower focus is new energy sources, and within this topic there is an emphasis on electrochemical technologies and chemical physics. This picture is complemented by some important topics from related fields of knowledge, such as the basics of electronics.

THE KEY TOPICS SUBJECTS ARE:

- Solar energy
- Wind energy
- Fuel cells
- Hydrogen energy for robotics class
- Redox flow batteries
- Energy storage systems
- E-mobility
- Basic electronic schematics
- Super-high pressure
- Ultra-high frequencies in telecommunications

HARDWARE FOR HARD SCIENCE

WE USE FOR OUR TEACHING AIDS REAL-LIFE MINIATURE SCIENTIFIC INSTRUMENTS, QUITE SUITABLE FOR SCIENTIFIC LABORATORIES



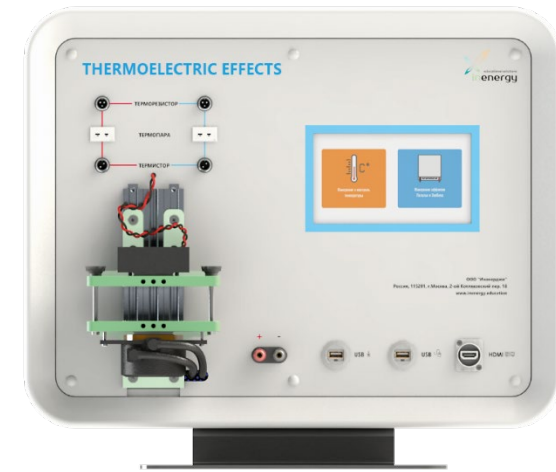
HYDROGEN ENERGY
a twin fuel cell technology demonstration unit

introduces the operating principle of a PEM (Proton-Exchange Membrane) fuel cell and its support equipment



VANADIUM REDOX BATTERY
a technology demonstration unit

visualises an environmentally friendly technology for storing large amounts of electricity



THERMOELECTRIC EFFECTS
a technology demonstration unit

illustrates the phenomena that occur in an electric circuit when temperatures of its components change

CASES: HOW IT WORKED IN RUSSIA

FIRST ELEMENT

First Element program enables students to design and race hybrid 1:10 scale model **hydrogen-powered fuel-cell vehicles**. Project participants acquire knowledge in vast range of discipline ranging from mechanics and electronics to electrochemistry and climate change. They also develop “soft skills” such as team work, leadership and communications. The First Element competition is integrated with Horizon Grand Prix.

- From beginning of the project in 2018 the number of participating teams increased from initial 7 to 50 and keeps growing
- Credentials from students-participants in project acknowledged by leading Russian universities (e.g. Moscow Institute for Radioelectronics and Automation) as extra points for admission

PROJECT H

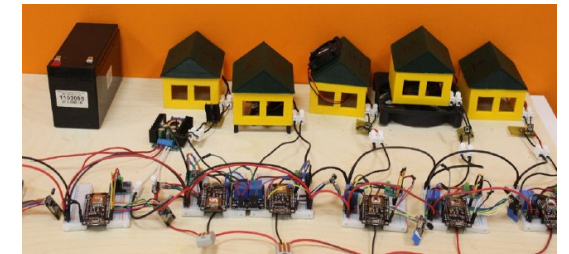
Participants develop “energy in context” **practical solutions for everyday life**, such as:

- Automated street lighting system, sensitive to number of pedestrians in the street
- Portable high energy density charger for notebooks and other electronic devices based on fuel-cells
- Biomass cogeneration system for rural areas

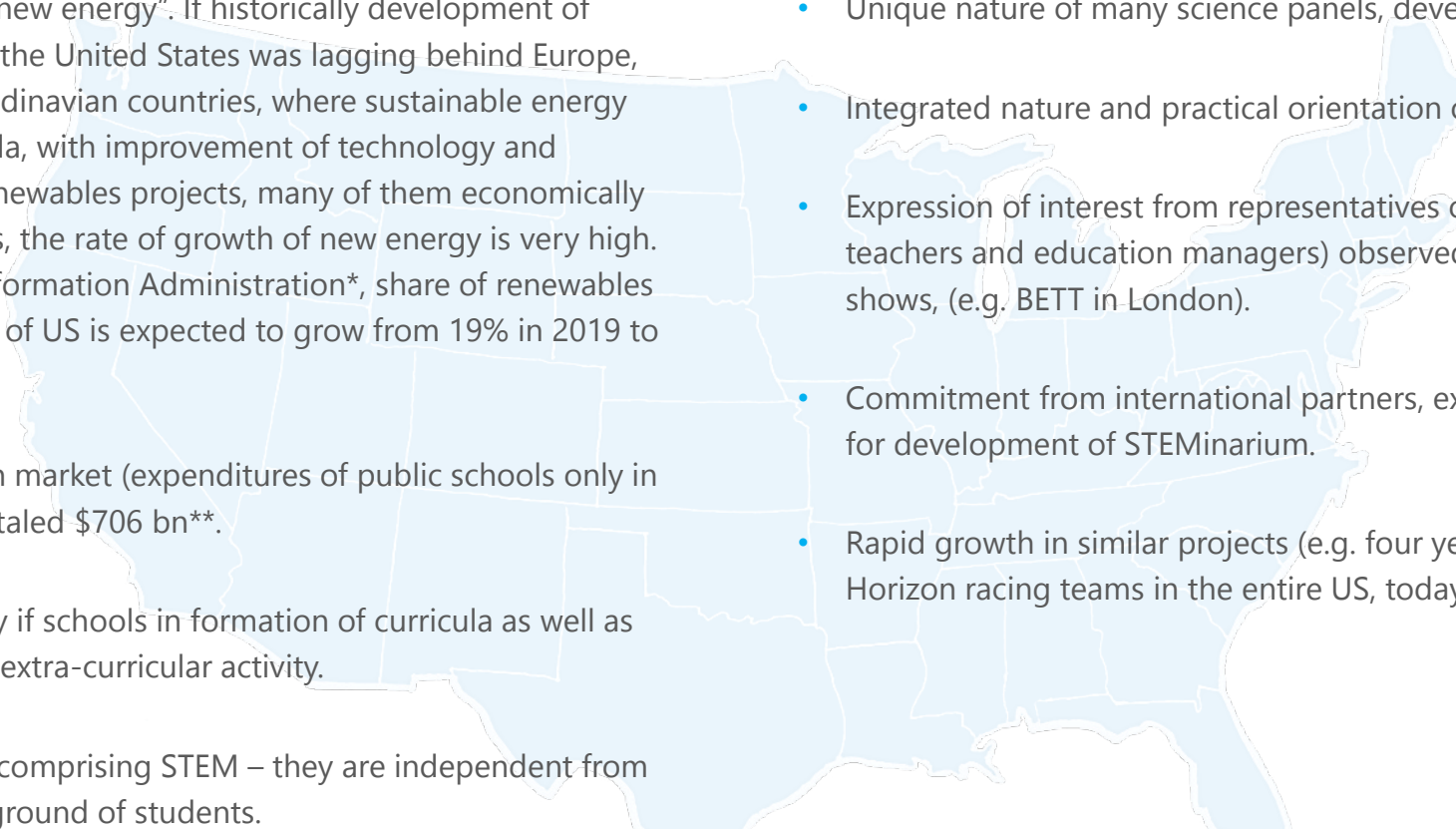


INTERNATIONAL COMPETITION OF ENGINEERING TEAMS “QUANTORICS” (ICCET)

Winners of ICCET-2019 competition, team Iten from the city of Cheboksary, alumni of InEnergy education projects, designed smart grid integrating renewable energy sources. The design is operational and scalable. Works are underway to develop full-size demonstrator of industrial scale energy storage systems and their components.



WHY WE THINK IT WILL WORK IN US

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- Growing general interest in “new energy”. If historically development of renewable energy sources in the United States was lagging behind Europe, especially Germany and Scandinavian countries, where sustainable energy was always high in the agenda, with improvement of technology and economic performance of renewables projects, many of them economically sustainable without subsidies, the rate of growth of new energy is very high. Thus, according to Energy Information Administration*, share of renewables in the overall energy balance of US is expected to grow from 19% in 2019 to 38% in 2050.
 - Large and growing education market (expenditures of public schools only in 2015-2016 schooling year totaled \$706 bn**).
 - High flexibility and autonomy of schools in formation of curricula as well as popularity of STEM-oriented extra-curricular activity.
 - Universal nature of subjects, comprising STEM – they are independent from languages and cultural background of students.
 - Unique nature of many science panels, developed by InEnergy.
 - Integrated nature and practical orientation of curriculum.
 - Expression of interest from representatives of target audiences (students, teachers and education managers) observed at international educational shows, (e.g. BETT in London).
 - Commitment from international partners, expressing interest in joining effort for development of STEMinarium.
 - Rapid growth in similar projects (e.g. four years ago there were only 20 Horizon racing teams in the entire US, today there are 60 in California only).

* Source: Annual Energy Outlook 2020

** Source: National Center for Educational Statistics

THE PROJECT: THREE LEVELS, THREE FUNCTIONS



STEMINARIUM Plus

is a selling showroom where classes are primarily held for teachers, although classes for children are also conducted. It is a platform that allows to get acquainted with standard equipment for the opening of the training center. It is a showcase for the development of the network of STEMinarium Centres as well as for the opening of STEMinarium Classes.



STEMINARIUM Centres

is a center of further education that is completely autonomous from school or college. It works on the principle of leisure entertainment center for children with club activities.



STEMINARIUM Class

is a centre of further education run by a school, college or university. The Steminarium Class program can be either complementary to the school or integrated into it.



THANKS FOR YOUR ATTENTION





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