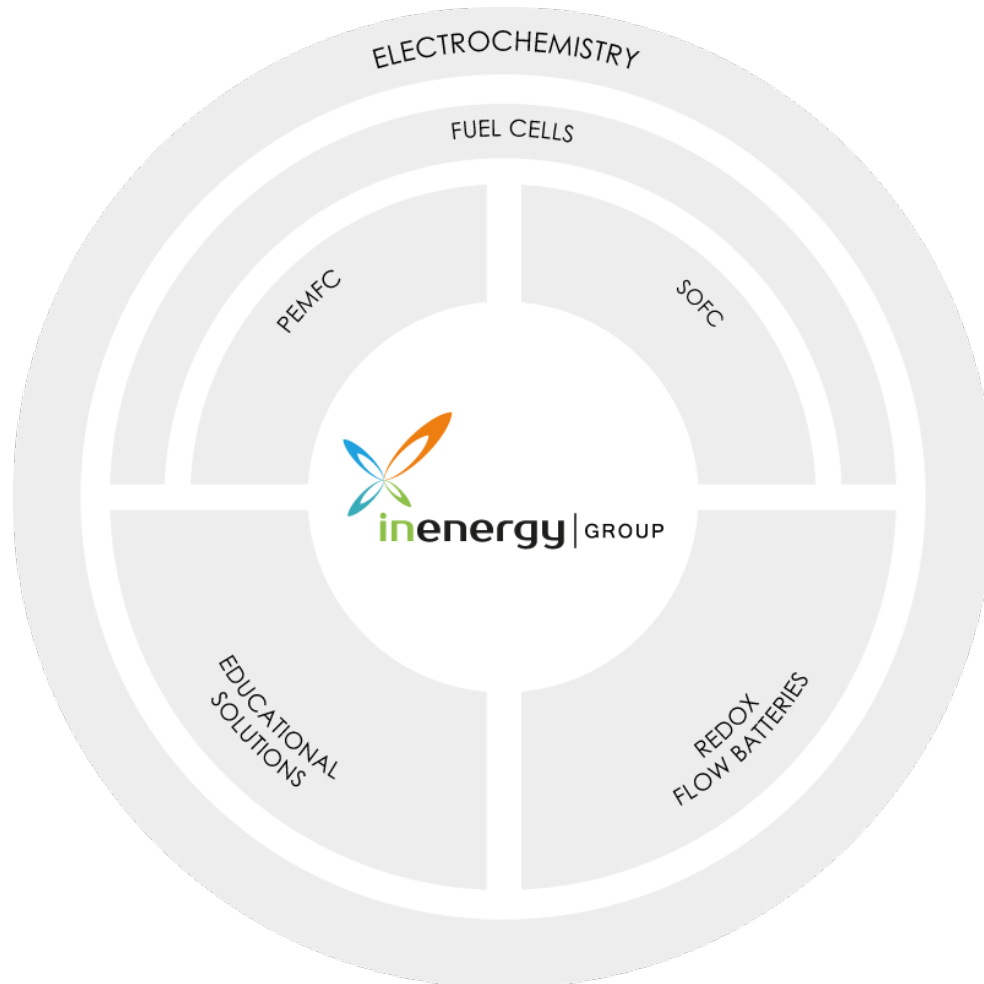


INENERGY GROUP

GENERAL PRESENTATION

MOSCOW
2020



WHAT MAKES OUR COMPANY UNIQUE?



We have 4 companies in our portfolio covering a full value-add chain – from raw material via research and development, design and production to full turn-key-solutions



We have one-a-kind Research and Development Center with 60 experts in electrochemistry field. 15 of them are researchers holding Ph. D. degrees



14 joint laboratories with leading scientific institutes



We have own production facilities, Technology and Research Park, which brings together innovative enterprises in a single location



We have created a unique platform that allows you to develop complex scientific and technological projects in the field of electrochemistry and bring them to the global markets of energy systems, using the capabilities of the best experts in the field of science and project management

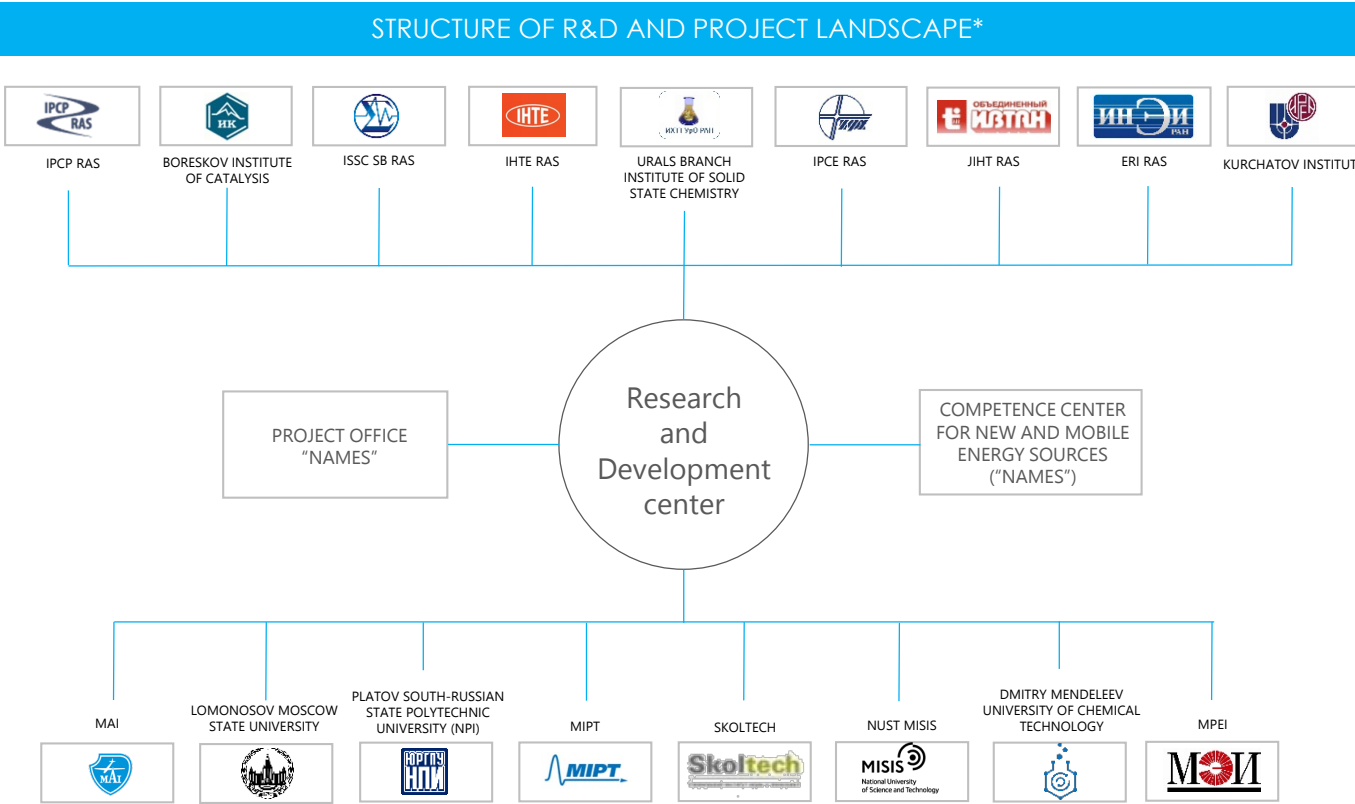
INENERGY GROUP

MAKING A DIFFERENCE WITH ELECTROCHEMICAL TECHNOLOGIES



Distributed R&D center with the leading research institutions of the Russian Federation allow us to solve fundamental and applied problems for the development of principally new products for the global market

JOINT PROJECTS



* For more information, please visit the website: www.inenergy.eu

CENTER OF COMPETENCE FOR NEW & MOBILE ENERGY SOURCES ("NAMES")

Leading Russian scientific and educational centers, innovative enterprises and foreign organizations joint consortium for the implementation of the program NAMES



THE TEAM

InEnergy management is a coherent team of professional, combining in a synergetic way experience of strategic management, knowledge of Russian and international markets and expertise in fundamental electrochemical science.

MANAGEMENT



Alexei Kashin
CEO, Chairman of the BoD



Andrey Golodnitskiy
Chief designer



Alexander Goldin
Marketing Director



Yuri Dobrovolsky
Chairman of Scientific council



Nurbulat Duysinaliev
Director Oil&Gas



Michael Kozlov
Chief Development Officer



Alexander Perchikov
Product Director



Evgeny Sarak
Chief Financial Officer



Alexander Sivak
Chief R&D Officer



Andrei Tomin
Chief Technical Officer



Yuna Tkachuk
Administrative Director

PRODUCTS LINEUP

InEnergy develops advanced technologies and products in the field of fuel cells and energy storage.

PRODUCTS



ASTRA AND COMPONENTS

Modular autonomous platform
for permanent, back-up and
emergency power supply running
on PEM fuel cells, 100 W – 30 KW



TOPAZ

Modular platform
for permanent, back-up
and emergency power supply
running on microtubular
solid oxide fuel cells,
10 W – 1000 W



STEMINARIUM

Educational resource kits
and curricula for study of fuel cells
and other “new energy” basics



ENERGY STORAGE SYSTEMS AND COMPONENTS

Redox flow batteries, hybrid energy
storage systems and V_2O_5 electrolyte.

PARTNERS AND CUSTOMERS

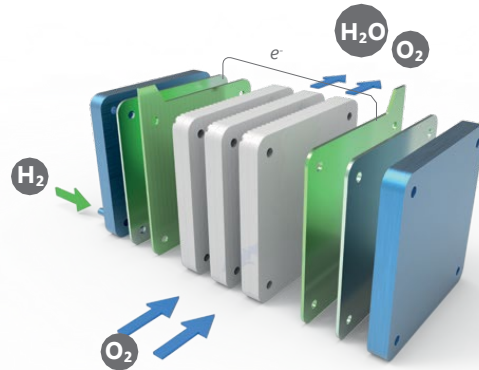


EFFICIENT, HIGH ENERGY DENSITY AND ENVIRONMENTALLY FRIENDLY POWER SOURCES

Environmentally clean and silent hydrogen-fueled power source with capacity in the range of **100 W – 100 kW** for e-mobility and stationary solutions

ADVANTAGES

- High efficiency
- High specific energy density
- The only reaction product is distilled water
- No moving parts (silent work, high reliability, long service life)



Energy conversion efficiency of PEMFC reaches **60%**, and pure water is the only waste produced by the technology

APPLICATIONS

Transport:

- unmanned aerial vehicles
- motorbikes and scooters
- trucks and cars
- forklifts
- trains
- ships

Stationary:

- environmentally friendly back-up power sources instead of diesels
- distributed electricity generation (and cogeneration) for households
- off-grid micro- and mini- power supply grids



TOP PERFORMING COMPACT OFF-GRID ENERGY SOURCES

Electrochemical fuel cell generators are most efficient power sources in the capacity range from few watts to kilowatts.

Topaz is a product line of electrochemical generators, based on solid oxide fuel cell (or SOFC) technology.

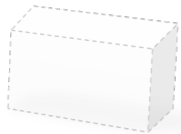
The technology enables high efficiency and is applicable in portable autonomous systems for broad market of small and medium capacity electronics, as well as stationary power sources.



TOPAZ-S
A PORTABLE OFF-GRID
GADGET CHARGER

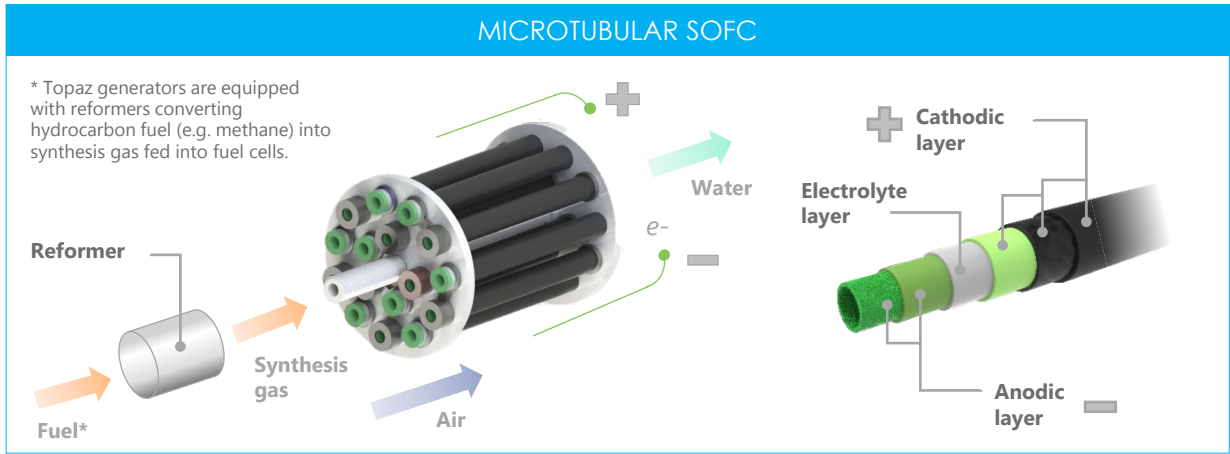


TOPAZ-M
MOBILE POWER UNIT
for small robots



TOPAZ-L
STATIONARY
POWER UNIT

Capacity limit	100 W	300 W	1 kW
Main fuel	propane-butane	propane-butane	natural gas
Service life	10 000 hours	10 000 hours	60 000 hours
LCOE (Levelized Cost of Energy)	\$7,2 / kW·h	\$1,2 / kW·h	\$0,2 / kW·h



Fuel cells are **transforming chemical energy** contained in fuel **directly into electricity** without intermediate stages of converting chemical energy into heat and mechanical energy

A D V A N T A G E S O F T O P A Z P R O D U C T L I N E

- High specific power density in conjunction with high electric efficiency – ideal combination for power source for field conditions, lighter and smaller than internal combustion engine of comparable capacity
- Easily available fuel (methane, butane, LNG, etc., unlike other types of fuel cells)
- No self-discharge in stand-by regime (unlike accumulators of all types)
- Ability to operate under low temperatures (unlike accumulators of all type)
- Stable operation independent from weather conditions and time of the day (as opposed to wind and solar generation)

STEMINARIUM – EDUCATIONAL SOLUTIONS

STEMINARIUM is a set of STEM educational programs based on teaching aids (educational panels and resource kits) complete with software and methodological materials. The programs are designed for secondary schools, extracurricular activities and pre-university training. The topics are primarily focusing on electrochemistry and chemical physics forming theoretical basis of new energy but also cover other important areas of science and engineering.

The methodological approach pays special attention to creative activity of students, teamwork and developing “soft skills”.

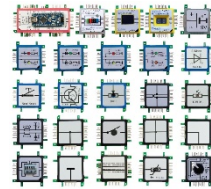
BASIC COURSES



LASER TECHNOLOGY
AND OPTICS



ENERGY COURSE

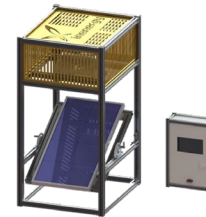


CIRCUITS AND
ELECTRONICS COURSE

THE MAIN AIM OF INENERGY EDUCATION TECHNOLOGIES IS TO:

- Promote the basics of power generation and use of electric energy
- Prepare a younger generation to embark on their carriers/professions of XXI century and develop their respective areas of competence

BASIC PRODUCTS



SOLAR ENERGY



VANADIUM REDOX BATTERY



HYBRID CAR MODEL
WITH BLUETOOTH CONTROL



HYDROGEN ENERGY
FOR ROBOTICS



THERMOELECTRICITY



HYDROGEN ENERGY

VANADIUM REDOX FLOW BATTERY. HYBRID ENERGY STORAGE SYSTEM

Redox flow battery is an electrochemical storage device in which energy is stored in electrolytes

The storage capacity is determined by the volume of the electrolyte, **the power** is determined by the discharge characteristics of the membrane-electrode block

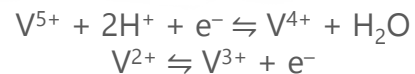
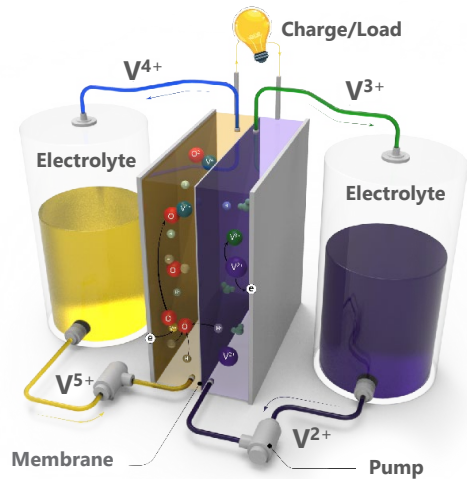
Redox flow batteries are scalable and can be easily adapted to the needs of the consumers.

APPLICATIONS:

- Grid scale peak shaving and load leveling for 35–110 kV. Demand Response utility.
- Distributed renewables integrating with Hybrid ESS
- Back up battery. Emergency storage. Bill management



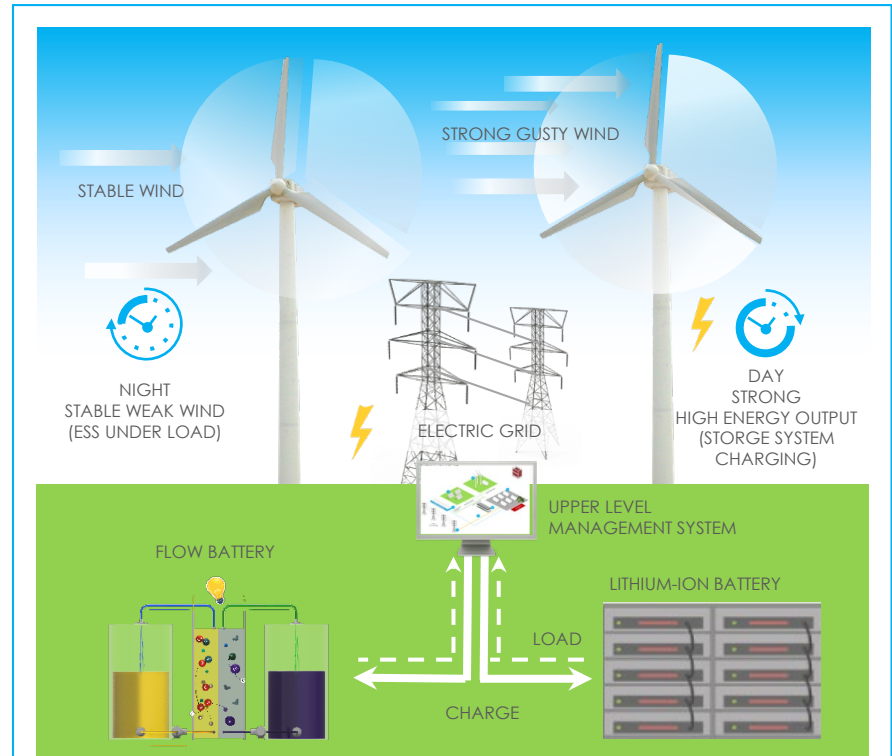
THE TECHNOLOGY



ADVANTAGES

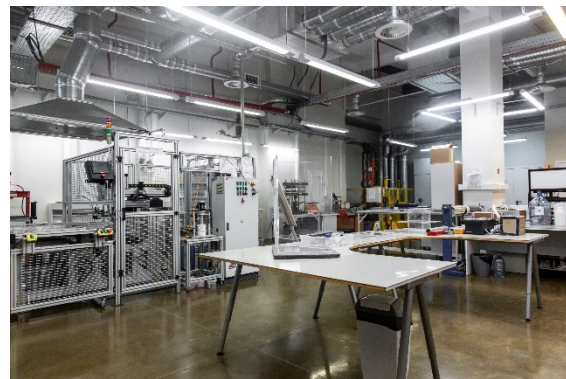
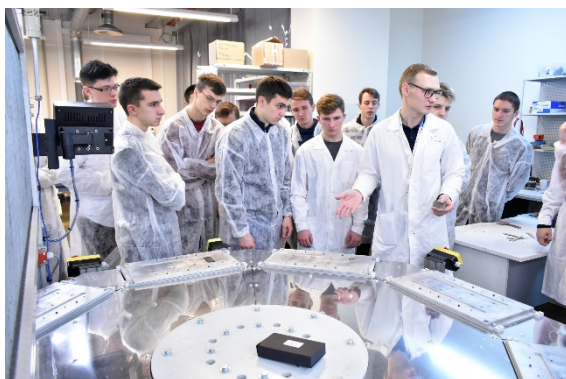
- Low LCOS among electrochemical energy storage systems*
- High cyclical resource **20 000** cycles
- Capacity and energy density can be increased independently from each other
- Fire and explosion safe
- **-30 ... +60 °C**
Operations in broad range of temperatures
- Efficiency – **75%**
- Service interval **1 year**

*Lazard's Levelized Cost of Storage Analysis v.4.0



Containerized hybrid energy storage system (ESS) combining **lithium-ion** and **flow batteries**.

- **Adaptability** – Hybrid ESS can be customized by setting number of Li-ion and RFB modules.
- **Affordability** – LCOS of hybrid system lower than in cases of stand-alone RFB or Li-ion systems.



SERVICES OF THE RESEARCH AND DEVELOPMENT DEPARTMENT

- Manufacturing catalysts on the customer requirement
- Design development and MEA manufacturing
- Stacks development for industrial solutions
- Components design and prototyping
- Development and production of laboratory and testing equipment for research institutions and customers
- Testing and certification of power sources

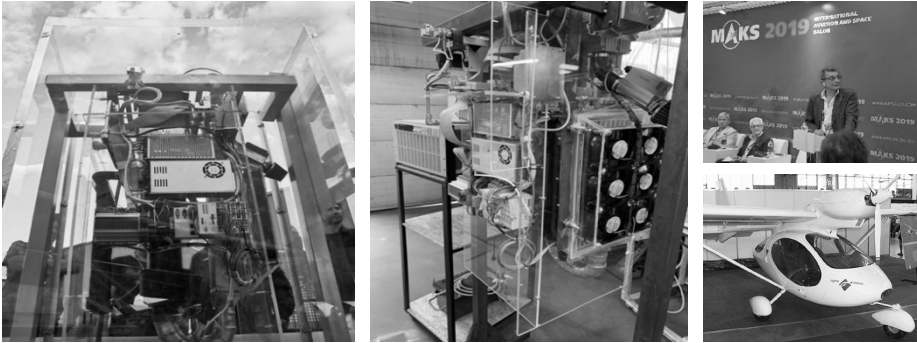
OUR ADVANTAGES

- Development of digital product models, full cycle modeling and testing
- Development of technologies and materials for the whole cycle of added value in fuel cells
- Cooperation with leading world manufacturers and developers of technologies and materials for chemical energy sources
- Proprietary test equipment and SW
- Testing base for single FC and power supply systems of up to 100 KW
- Gas infrastructure supply (hydrogen, methane, propane)

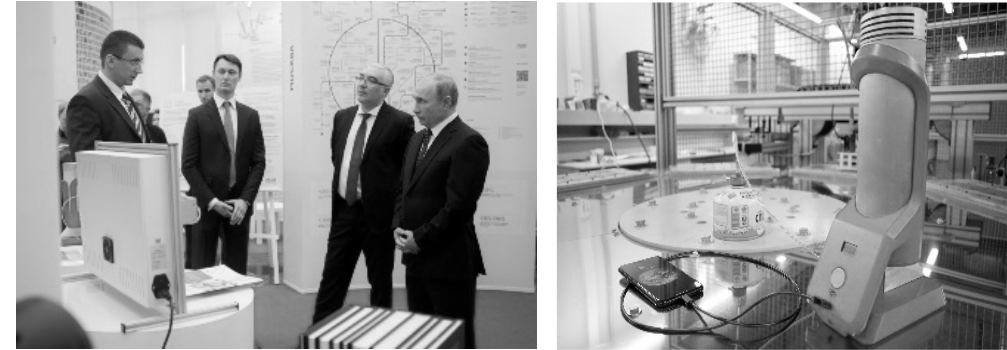
KEY CUSTOMERS



ELECTROCHEMICAL GENERATORS: OUR EXPERIENCE



Electrochemical generation with ASTRA system, designed specifically for light-engine aircraft



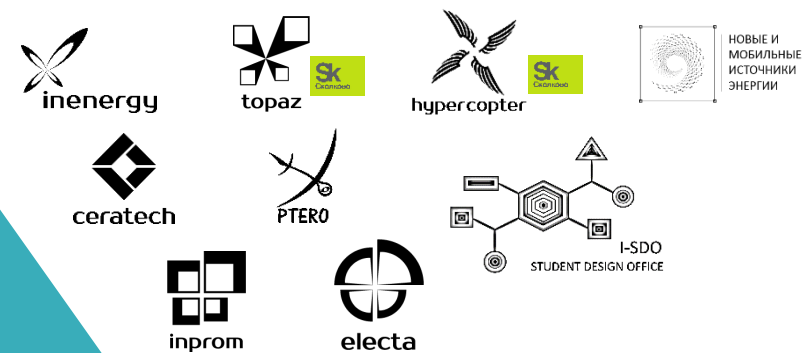
Portable generator TOPAZ-S (10 W) was presented to the President of Russia in 2019



The first Russian electric car with ASTRA fuel cell range extender. It increased its range from 200 km to 400 km.



Pilot project with MTS – Base station power supply ASTRA system 7,5 kW



INENERGY GROUP

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