zoomteam

electro™
power systems

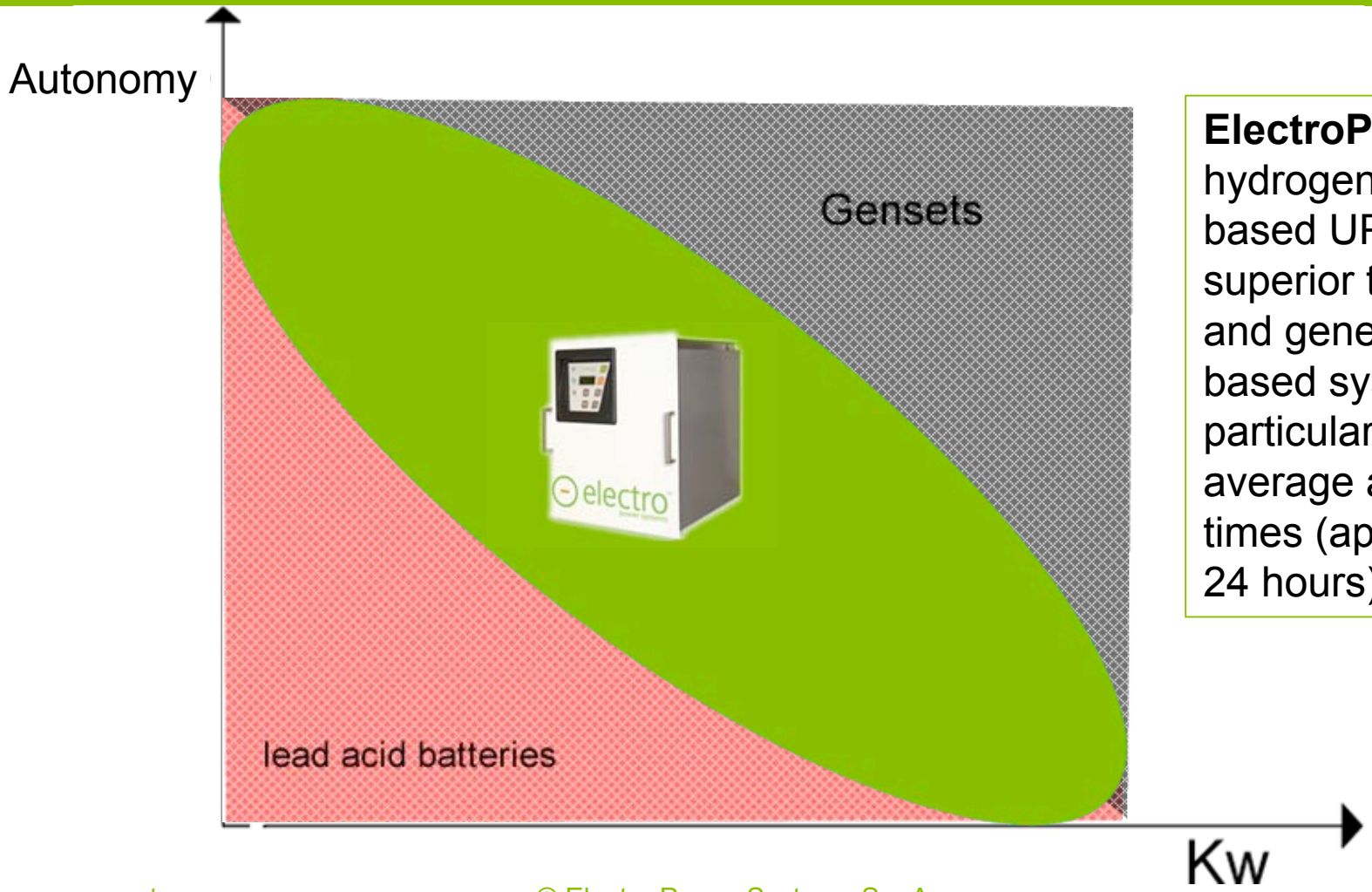
Hydrogen Fuel Cell UPS (Uninterruptible Power Supply)

March 2010

Clean power when and where it is needed

- ElectroPS™ is based on fuel cells and provides, depending on the model 3 - 12 kW of continuous and reliable on-demand power.
- The fuel cells use hydrogen (H_2) as fuel and there is no exhaust of polluting or greenhouse gases and no particulate matter. The reaction with oxygen from the air produces electrical current and the only byproducts demineralized water and waste heat.
- ElectroPS™ is substituting traditional energy stations, battery based UPS and diesel-generator sets for telecommunications, utilities and IT applications.
- Provides backup energy at selectively 48 V DC, 110 V DC, 230 V AC and 400V triphase. Online or offline operation.
- ElectroPS™ is the smallest, lightest and most efficient hydrogen stationary system on the market
- CE certification since November 2006; CSA certification for North America completed in September 2009.
- ElectroPS™ proved its reliability in the field in more than 200 installations in Europe and Asia

Product positioning



ElectroPS™ is a hydrogen fuel cell based UPS and is superior to battery- and generator based systems in particular for average autonomy times (approx. 3 to 24 hours)

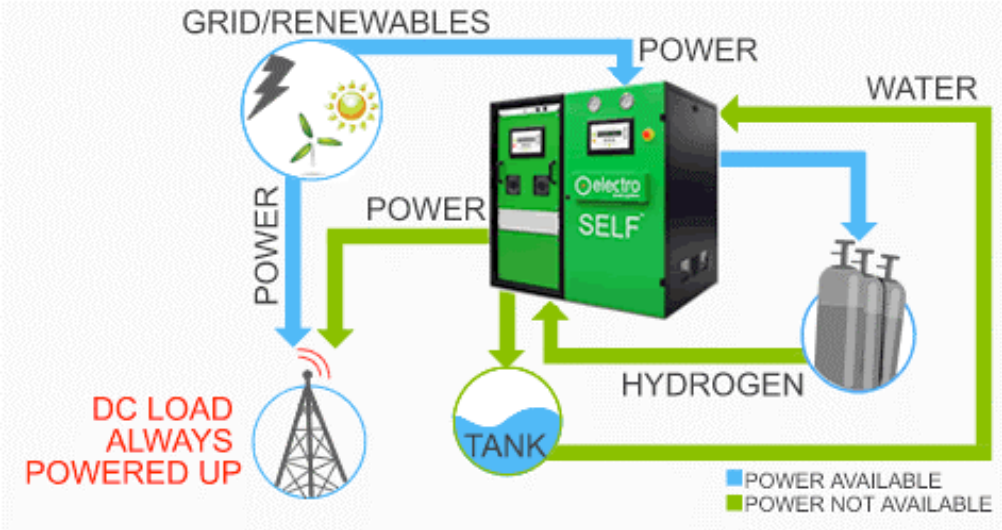
Applications of ElectroPS™

- Mobile telecom base stations
- Broadband mini Pops
- Server rooms
- Broadcasting antennas
- Public utilities (Electricity, Gas, Water, Wastewater)
- Transport infrastructure (Highway, Train, Airport)
- Emergency illumination
- Cash register systems
- Hospitals, Alarm- and Security Systems

ElectroPS Product Families

- Airtech™:
  - Field proven multi-output fuel cell system
  - 19” rack mountable for indoor and outdoor installations.
  - Available in 3 and 6 kW version.
- DOX™:
  - Leveraging the direct injection of both hydrogen and oxygen, ElectroPS DOX Series result in a simplified balance of plant for an enhanced robustness and reliability even in most demanding environment.
  - Works on any altitude and in any air quality condition like heavy polluted areas or during desert storms.
  - Lowest possible noise, weight and maintenance.
  - Available in 6 and 12 kW versions.
- ElectroSelf™:
  - The first self-recharging hydrogen Fuel-Cell UPS with on-site hydrogen production

ElectroSelf™: Self-recharging Fuel-Cell UPS



- Clean on-site hydrogen production, leveraging the water produced by the fuel cell during power shortages
- Designed for most challenging locations: remote, hot, cold, difficult to access
- Works with grid power or off-grid, using solar or/and wind power
- Automatic, remote monitored operation
- No ongoing fuel expenditure or battery replacement cost.

	ElectroPS™	Batteries	Genset
Reliability and autonomy	**Start-up instantaneous** **Affordable long autonomy** (one 50 L Standard Hydrogen bottle lasts for about 2h of operation)	**Start-up instantaneous.** Autonomy proportional to weight, footprint and costs.	**Start-up several minutes** Autonomy proportional to tank size
Environmental impact	**100% Clean** Zero emissions and no battery waste or disposal. Quiet operation. Efficiency: more than 60%	Lead-acid batteries split, leak **acid** and emit lead and sulfuric acid vapors. Can also emit explosive gases.	**Exhaust** (CO_2, dust pollution), **Noise, Vibration**
Installation	**Fairly Easy** It's a plug and play power system with a very small footprint. Standard 19” rack. Requires hydrogen line installation.	**Fairly Easy** Easy installation, but requires electric cables and a cooling system, as well as an air-conditioned room. Heavy!	**Difficult** Separate room. Automatic start-up equipment is necessary
Maintenance	**Easy** No moving parts or other elements that must be replaced. The system can be remotely monitored, thereby reducing costs and the need for qualified personnel onsite	**Difficult** Electrolyte test and substitution every 1.5 years regardless of system use Periodical checks and adjustment to climatic and environmental conditions. Continuous consumption of energy for cooling and recharge.	**Very Difficult** Many moving parts Periodical test start-ups Requires maintenance and cleaning of the tank

Reduction of OPEX and increase of product flexibility (i.e. different product configurations available according to customer needs).

The modules of ElectroPS™

Hydrogen-vessels

19” Standard rack

External split heat exchanger
Release of residual heat. External Installation

Power conversion electronics
Optional: AC/DC converter and/or DC/AC converter (mono or triphase)

The core
Hosts the hydrogen fuel cell stack (PEMFC) where the electrochemical reaction takes place, as well as the central power electronics

Control interface
Including remote monitoring and -control

Auxiliary start-up
Delivery of electrical power during the startup time of the fuel cell (approx. 20 seconds).
Options: maintenance free battery or supercap.

Technical Details

- PEM Fuel Cell Stack (PEMFC)
- Hydrogen consumption: approx. 0.9 m^3/kWh (up to 12 kWh electrical energy from one 50 l/200 bar H2-bottle)
- Power consumption (standby): approx. 22 W
- Start-up time: 20 sec (bridging by long-life battery or supercap)
- Operational temperature: 0 to +45°C (on request: -20 to + 45°C)
- Operational life expectancy: more than 2500 h production of electrical power
- Noise level: 60 dB (in operation; neglectable in standby)
- 19“ Rack-Modules
- Indoor and outdoor models
- Up to 8 systems can be installed in parallel.

Operation and Maintenance

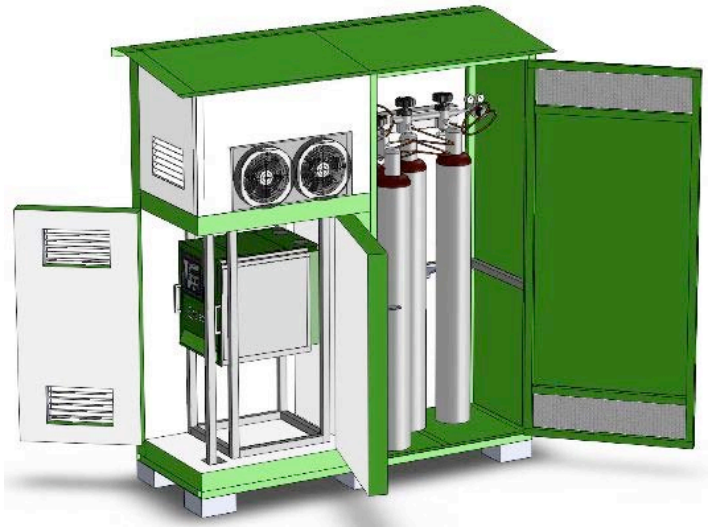
- Control-Electronics
  - Monitoring and control of the overall system: safety, measurement and control of autonomy, recording of all relevant operating parameters
  - Regulation of the optimized operating procedure
- Automatic Self-Tests
  - Programmable and automatic self diagnosis
  - More than 30 parameters are continuously monitored
- Alarms
  - Connections to network management systems and SMS alerts
- Remote monitoring and remote control
  - Potential free contacts (up to 8 Output, 3 Input), Internet (SNMP) or wireless through GPRS/3G modules
- USB 1.1, RS485, RS232, SNMP, GSM/GPRS, PLC, CANOpen, Ethernet etc

Why ElectroPS™?

- **Reduce business continuity costs.** Low Standby energy consumption, no need for air-conditioned rooms, small footprint and low maintenance cost lead to significant reductions on overall costs.
- **No unexpected costs.** Switching to ElectroPS™ allows you to plan fixed costs and eliminate variable costs throughout the entire life cycle. (Traditional solutions are subject to increasing and unforeseen battery and maintenance costs).
- **Reliable real-time diagnostic.** ElectroPS™ comes with real-time system diagnostics for 24/7 system visibility. Our business continuity system can be remotely controlled and supervised, thereby eliminating the need for on-site check-ups. The remote diagnostics also enable you to instantly check working conditions and autonomy thresholds.
- **Virtually unlimited autonomy.** Just one standard vessel of hydrogen provides up to 2 hours of autonomy (Electro7™) at full load. More vessels, more autonomy - meaning you can easily increase autonomy without additional investment and little additional footprint and weight.
- **100% Clean.** Zero emissions and no battery waste or disposal helps you meet your corporate responsibility objectives. Ideal component of a green-IT scenario!
- **Plug & play.** Easy installation, modular set-up, seamless system integration and the choice of DC and/ or AC, tri-phase voltage output. Easy system expansion.

Our Minishelter: a complete outdoor solution

- The entire power system is accommodated inside a mini-shelter and is composed of two distinct sections:
  - a thermally insulated and fire resistant cabinet (R.E.I.120) in which the power system and its auxiliary components are installed
  - a section containing up to 6 vessels and pressure reduction stages
- The weight of the complete system is approximately 350 kg plus 65 kg/vessel
- Dimensions: 2000x750x2200mm(*)
  (*)adaptable



OPEX reduction with Green Shelter

- Traditional BTS shelters rely on battery back up, which require cooling.
- “Green Shelter” by ElectroPS can reduce the OPEX of mobile base stations up to 70% as it eliminates the necessity of air conditioning systems and thus has much lower energy consumption.
- “Green Shelter” fits very well into “Green-IT” concepts.
- The ventilation air flows along plates that contain PCM (Phase Change Material), which absorb excess heat during the day maintaining a stable temperature level and release it during the night, using free cooling in combination with Fuel Cell UPS.
- The Fuel Cell UPS as well as state of the art telecom equipment can work at higher temperature than in the past (around 35° - 40°C).

Our three levels of commitment

Green

Clean, long-lasting and reliable power generation, based on proprietary technology, with **no polluting or greenhouse emissions**.

Hi-tech

Breakthrough technology for business continuity solutions that are flexible, plug-and-play, multi-output, modular, remote controllable and long-lasting.

Low-cost

Our **CE certified** fuel cell systems guarantee **significant reductions** on overall business continuity **costs**. Switching to ElectroPS™ allows you to plan fixed costs and eliminate variable costs throughout the overall life cycle.

CO_2 savings on three levels

@ the beginning

1 ton of **CO_2** saved to produce Electro7™ (7kVA, 10 hours autonomy) compared with traditional lead acid solutions

During the use

Around **2 ton** of **CO_2** produced to replace 60kWh of batteries and **1,5 tons CO_2** per year saved to maintain them

On lifecycle basis

10 years of use of Electro7™ reduces up to **95%** the overall **CO_2** emissions (ISO 14040)

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