

Energy Solutions for Security and Industrial Applications

Fuel Cells
Energy Solutions
Power Supplies





SFC Energy

SFC Energy is a leading provider of hybrid solutions to the stationary and portable power generation markets. While you are reading this, energy solutions from SFC are supplying electrical power all over the world from Japan to Antarctica, for measuring and early warning stations, defense applications, traffic monitoring systems, mobile homes, sailing yachts and much more.

With thousands of fuel cells sold worldwide, SFC Energy is the number one supplier of fuel cells. We sell our comprehensive portfolio of multiple award-winning products on markets with strong growth, such in security and industry applications and on the consumer market.

For all of our energy solutions, the customer's needs are our number one priority. We supply not only innovative fuel cells, but also fully integrated systems containing everything needed for the application in question. To help us do this, we work closely with integrators and suppliers across every stage of the added value chain.

In our solutions, we combine energy production, power management and system integration in line with the application's needs and take care of all the services required. SFC Energy operates an international network of fuel cartridges to provide methanol for our fuel cells.

Thanks to our international distribution network, our fuel cells and fuel cartridges are now available in numerous countries worldwide. This too is a clear expression of our commitment to mobility without limits: power any time and any place.

In addition to the head office in Brunnthal near Munich, Germany, SFC Energy has production facilities in the Netherlands, Romania and Canada, as well as sales offices in the USA and Canada.

SFC is certified to ISO 9001 and ISO 14001. SFC Energy AG is listed in the Prime Standard of the German stock exchange (WKN: 756857 ISIN: DE0007568578).



For demanding applications: Industry, Security and Oil & Gas

Our energy solutions are used anywhere that solar modules, diesel generators and batteries reach the limits of their capabilities: fuel cell products from SFC Energy provide energy directly on site in a reliable, environmentally friendly and quiet manner for the interruption-free operation of the equipment they power. They do this in all weathers, at all times of year, in temperatures from -40 °C to +50 °C, integrated into weather-proof boxes, control cabinets or in vehicles, concealed or underground, on their own or in hybrid operation with other power generators. Their biggest advantage is that they safeguard equipment autonomy over the long term, enabling huge savings in terms of logistics and operating costs.

For greater comfort: Home and Leisure applications

For many years, the popular EFOY COMFORT fuel cells from SFC Energy have been providing power for equipment in mobile homes, chalets and sailing boats. We are planning to strengthen this sector even further with back-up and emergency power supply systems for households as well as further leisure and outdoor activities.

Smart energy solutions for Defense and Security

SFC Energy has developed a comprehensive product portfolio for the demanding requirements of military users and low enforcement authorities.

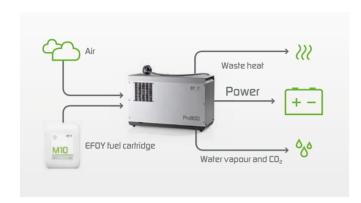
SFC Energy offers small, lightweight and flexible power supply solutions for modern task forces. For surveillance missions and covert operations, SFC Energy supplies fuel cells for vehicle integration. Semi-stationary and stationary surveillance systems are often used where there is no mains connection. Sometimes surveillance systems must be camouflaged or buried. This results in high demands on the power supply's independence and can be covered with solutions from SFC Energy.



More information can be found al: www.sfc.com

SFC Fuel Cell Technology

All fuel cells from SFC are based on DMFC (Direct Methanol Fuel Cell) technology. An environmentally friendly catalytic process is used in which methanol is converted directly, efficiently and without intermediate stages into electricity. As a result, this technology represents one of the cleanest options for generating power.



Ideal energy solution for off-grid and mobile applications

Connect - switch on - forget. SFC fuel cells are intelligent power generators that can be used to continuously and fully automatically recharge batteries. The fuel cell is connected directly to the battery supplying the consumer and monitors its charge status. Depending on the requirements, the fuel cell switches on automatically, recharges the battery and then returns to standby mode - without any maintenance or user intervention required.

More power than solar

The EFOY Pro fuel cell supplies electricity 24/7 and is independent of the weather. The EFOY Pro supplies 3 to 10 times more power than a solar system with the same output throughout the year. To generate as much power in one year as an EFOY Pro 800, for example, you will need a system with a nominal power of up to 1600 Wp, depending on the country and the time of year.

Longer autonomy than batteries

Batteries have a very limited autonomy. Whether it be in a commercial vehicle, on a construction site or in a control cabinet, if an application is supplied only by batteries, frequent battery changes will be needed and therefore application running costs will be extremely high. With an EFOY Pro fuel cells, deep-discharges of batteries can be avoided, increasing autonomy by many times, minimizing downtimes and service intervals and therefore considerably reducing costs.



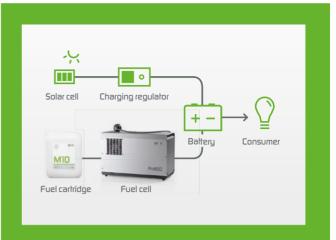
More environmentally friendly than generators

Generators are not just loud and dirty, but they also have to be topped up with fuel frequently and require regular oil changes. EFOY Pro fuel cells, on the other hand, are quiet, emit only pure CO_2 in small quantities and guarantee long periods of autonomy without any need for maintenance. EFOY Pro fuel cells can be used in vehicles, in nature conservation areas and generally in closed spaces without any concerns. Could you do that with a generator?

Verified safety



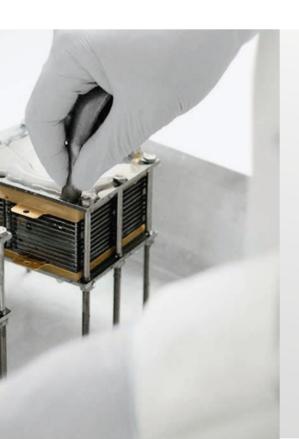




Tip

Supplement your stand-alone solar power system with an EFOY Pro fuel cell

The perfect solution for delivering 100% availability with minimal fuel consumption is the use of the EFOY Pro fuel cell as a hybrid energy supply with a solar-powered energy system. As soon as the solar-powered energy system stops delivering sufficient power, perhaps due to periods of bad weather, the fuel cell switches on automatically and bridges the energy gap. Complex constructions for large solar-powered systems can therefore be avoided and the system's reliability significantly increased.





EFOY Pro Fuel Cells



EFOY Pro fuel cells are SFC Energy's industrial fuel cell series and have been developed especially to meet the needs of professional users. Fuel cells from SFC for industrial applications are now available in their second generation. The experience and requirements of our customers have been brought together in this generation and used to drive the technological development of the EFOY Pro.

The advantages at a glance



100% reliability and operating safety



Lightweight and compact



Long autonomy life, maintenance-free



Quiet and environmentally friendly



Remote monitoring



For more detailed technical data. visit

www.efoy-pro.com

Performance classes

The EFOY Pro fuel cells are available in various performance classes, with outputs ranging from 45 W for small-scale power systems through to a 500 W module for UPS solutions. With the Cluster Controller, up to five EFOY Pro fuel cells can be connected in parallel to deliver a maximum output of up to 2.5 kW.

Technical data

EFOY Pro	800	800 Duo	2400	2400 Duo	12000 Duo	
Max. output [1]	45 W		110 W		500 W	
Min. output (1)	25 W		80 W		400 W	
Nominal voltage	12 V / 24 V		12 V / 24 V		24 V / 48 V	
Charging current at nominal voltage	2.1 A / 1.05 A		6.7 A / 3.3 A		20.8 A / 10.4 A	
Weight	8.0 kg	8.5 kg	9.0 kg	9.5 kg	32 kg	
Dimensions L x W x H	433 x 188 x 278 mm			640 x 441 x 310 mm ⁽²⁾		
Number of fuel cartridges that can be connected (with DCS1)	1 (2)	2 (4)	1 (2)	2 (4)	2 (4)	
Operating temperature	-20 °C to +50 °C					
Nominal consumption	0.9 l/kWh					

 $^{^{1}}$ Nominal power decreases with the number of hours of operation. Information valid within the warranty period.

All technical data under test conditions of 20 °C.

² Dimensions without 19" frame



The EFOY Pro 800 and EFOY Pro 2400

EFOY Pro fuel cells, with their compact construction, deliver a lot of energy in the tiniest of spaces. The fuel cartridges can be exchanged quickly and easily, even by untrained personnel. The EFOY Pro 800 delivers a maximum output of 45 W. It is ideal for applications with low energy requirements. The EFOY Pro 2400 delivers a maximum output of 110 W. To ensure longer autonomy without user intervention, a model with two cartridge connectors has been developed for both power classes of the

EFOY Pro fuel cell - namely the EFOY Pro 800 Duo and the EFOY Pro 2400 Duo. These allow two and, with two optional DuoCartSwitches, even up to four fuel cartridges to be connected to a single fuel cell. This ensures even longer autonomous power delivery to off-grid systems such as measuring stations in the mountains, wind measurement systems for wind farm planning or cameras for monitoring pipelines.



The EFOY Pro 12000 Duo

The EFOY Pro 12000 Duo, our 500 W fuel cell, delivers 100% reliable off-grid, on-board and back-up power. Its compact design makes it ideal for installation in a 19" control cabinet. By parallely connecting multiple modules, higher outputs are also available. Through the increased output to 500 W, the EFOY Pro 12000 Duo can also be used to cover the needs of applications with higher power requirements. Typical areas of application include back-up power supplies for wind and telecommunications systems, off-grid power supplies for monitoring, traffic management and environmental sensors and the on-board power supply of official, service and control vehicles.

Example of application with cont. 25 W							
EF0Y Pro	800	800 Duo	800 Duo with 2 DuoCartSwitches				
Connected fuel cartridge	1x M28	2x M28	4x M28				
Autonomy	51 days	103 days	207 days				





EFOY Fuel Cartridges

EFOY Pro fuel cells are Direct Methanol Fuel Cells that are operated with the fuel methanol. The methanol is stored in EFOY fuel cartridges especially designed for this purpose. Depending on requirements, EFOY fuel cartridges are available in 5, 10 and 28 litre capacities. Ultra-pure and clean methanol is required for the reliable operation of EFOY Pro fuel cells. To ensure compliance with the strictest safety standards, each filling operation is supervised by SFC quality management. Only when original EFOY fuel cartridges are used can the maximum operating life of the fuel cell be guaranteed. The high energy density of methanol gives you a lot of energy in a very small space with EFOY fuel cartridges. As a result, the autonomy of your off-grid application can be increased by many times over.

Fuel cartridges	M5	M10	M28	MT60
Contents	5 l / 1.32 US gallons	10 l / 2.64 US gallons	28 l / 7.4 US gallons	60 l / 15.8 US gallons
Weight	4.3 kg / 9.5 lbs	8.4 kg / 18.5 lbs	23.4 kg / 51.6 lbs	55 kg / 121 lbs
nominal capacity	5.5 kWh	11.1 kWh	31.1 kWh	66 kWh
Size L x W x H	190 x 145 x 283 mm	230 x 193 x 318 mm	420 x 280 x 360 mm	340 x 390 x 670 mm
Autonomy @ 20 W cont.	11.5 days	23 days	65 days	65 days

The advantages of EFOY fuel cartridges



Extremely high energy density

10 l (2.64 US gallons) of methanol have a capacity of 11.1 kWh of energy and weighs just 8.4 kg (18.5 lbs). To deliver the same amount of energy, around 280 kg of lead-gel batteries would be needed.



Safety-tested

EFOY fuel cartridges have been designed to meet the strictest safety standards and have received UN approval for transportation by sea, road and air. Their design ensures that the user is never at risk of coming into contact with their contents.



Global fuel cartridge logistics

SFC has established a global logistics network for the sale of EFOY fuel cartridges. EFOY fuel cartridges are available from SFC dealers worldwide. EFOY fuel cartridges can also be transported on pallets via road, sea and air.

Accessories

Cost saving through remote monitoring

SFC offers a variety of accessories for the remote monitoring of your system. The RS232 communications interface (Modbus RTU, ASCII) of the EFOY Pro fuel cells allows remote control via a separate modem or through integration into an existing communications network. As a result, the fuel cell can be interrogated, monitored and managed remotely. It is also possible to connect a fuel cartridge sensor. With a sensor and modem connected, you will be automatically notified by SMS or e-mail as soon as the fill level of the fuel cartridge falls below a certain level. As a result, you will have enough time to take a new fuel cartridge to the system and avoid downtimes.

Longer autonomy

With a DuoCartSwitch, the number of fuel cartridges connected to one EFOY Pro can be doubled. As a result, in ideal situations, up to four fuel cartridges can be connected to a single fuel cell, prolonging the application's autonomy many times over. The EFOY Pro recognises when the fuel cartridge is empty and automatically switches to the next one.

EFOY GO!

Strictly speaking, the EFOY GO! is a battery. But what a battery! With an integrated inverter and four power connectors, you also have convenient power - plug and play away from the grid. Whether for a smartphone, a camera or a laptop, the compact, lightweight EFOY GO! uses state of the art lithium technology to deliver ultimate power with the smallest of dimensions.





EFOY Energy Solutions



As a system solutions provider, SFC Energy is constantly working to develop complete solutions for various requirements. EFOY Pro energy solutions combine power generation by EFOY Pro fuel cells and energy storage with batteries in a suitable housing. There is still sufficient space for custom-specific adaptations. All complete energy solutions for EFOY Pro fuel cells can be found at www.efou-pro.com.

EFOY ProCabinet

Stationary Energy Solution

The EFOY ProCabinet product line is a series of outdoor complete energy solutions for the autonomous stationary provision of energy with EFOY Pro fuel cells without any grid connection. The EFOY ProCabinet comprises of a control cabinet which provides space for one or more EFOY Pro fuel cells, M28 fuel cartridges and batteries. The EFOY ProCabinet can be designed in accordance with individual requirements and therefore offers sufficient space for customized installations. A GSM modem can also be installed as an option, e.g. for remote system monitoring, a solar charge regulator or a voltage transformer for voltage adaptations. The EFOY ProCabinet is suitable for stand-alone operation, for example, or as back-up for an uninterruptible power supply (UPS) and is available for the EFOY Pro 800, 2400 and 12000 series in various designs.





EFOY ProCube

Mobile Energy Solution

The EFOY ProCube is a mobile, maintenance-free complete solution for off-grid power supplies - instantly ready for use at all times and in any location. The EFOY ProCube is an outdoors-compatible box in which the fuel cell, fuel cartridge and battery are integrated. The EFOY ProCube can be used temporarily, e.g. on construction sites, or permanently in hard-to-access areas.

- The EFOY ProCube is pre-configured and can be customized to the client's requirements through the choice of EFOY Pro, fuel cartridge and battery size.
- Ideal for outdoor applications or undercover operations.
- Compatible with hybrid mode e.g. as back-up or as an expansion for solar-powered systems.





EFOY ProEnergyBox

Energy Solution for extreme weather conditions

The EFOY ProEnergyBox has been developed especially for use in extreme weather conditions at temperatures from -40 °C and +50 °C. One EFOY Pro fuel cell, up to three batteries and two M28 fuel cartridges can be integrated into this box. Effective temperature regulation means that the waste heat from the EFOY Pro fuel cell can be used when the temperature is below zero to keep the energy solution warm and to prevent the battery and electronics from freezing. For high ambient temperatures, an effective heat conduction system has been created to protect the components in the box from heat. There is also space for customer-specific installations so that these too can be protected from external weather conditions and operated in protected environments.

EFOY ProTrailer

Trailer-based Energy Solution

The EFOY ProTrailer integrates the popular EFOY Pro fuel cell from SFC Energy with up to four solar modules. As with all EFOY Pro energy solutions, the new EFOY ProTrailer offers extremely long power autonomy without any need whatsoever for user intervention. The trailer is equipped with an EFOY Pro 2400 Duo, two or four fuel cartridges, up to four solar modules with a maximum total output of 1,000 Wp, two or four batteries and a 60 A solar charge regulator. This ensures maximum flexibility for the application in question. The EFOY ProTrailer can be adapted flexibly to the specifications and power requirements of the installation involved.

- Reliable mobile power supply for security and surveillance cameras, communications equipment, oil and gas and traffic management applications
- Fully automatic power supply over many months without user intervention
- Hybridisation with solar safeguards power availability 24/7 at attractive operating costs



EFOY Pro Reference Applications



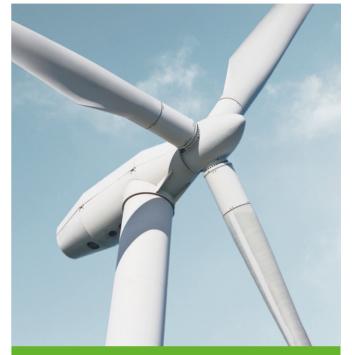
Reliable data capture and transfer from measuring stations

Output requirement: 8 – 100 W

Energy requirement: 192 – 2400 Wh/day

SFC solution: EFOY Pro 800 Duo or EFOY Pro 2400 Duo (depending on output requirements) integrated into an EFOY Pro Energy Box or EFOY ProCabinet, including DuoCartSwitch with four connected M28 fuel cartridges. It can also be combined with solar - allowing the solar panel to be made smaller.

Applications in the field of measurement technology: measurement of water levels, documentation of weather and climate data, seismic movements or gas and radiation levels



Energy solutions for obstruction lighting and wind measurement systems

Output requirement: 25-100 W

Energy requirement: 600 – 2400 Wh/day

SFC solution: an EFOY ProEnergyBox allows a reliable, mobile, plug & play power supply

Other areas of application in the wind industry: wind speed measurements with LIDAR and SO-DAR equipment. Data recording for the analysis of potential wind farms.





100% autonomous power supplies for **SCADA** applications

Output requirement: 5 – 20 W

Energy requirement: 120 – 480 Wh/day

Autonomy requirement: at least 4 months (especially during winter)

SFC solution: EFOY Pro 800 Duo with DuoCartSwitch allows up to four M28 fuel cartridges to be connected. Integrated into an insulated EFOY ProEnergyBox or the EFOY ProTrailer, the SFC solution provides seven months of reliable, maintenance-free electricity based on a 25 W application. If necessary, the application can also be combined with solar power. The EFOY Pro's communications modbus allows remote control to be integrated directly into a SCADA system.

Other areas of application in the oil & gas sector: chemical injection pumps, air compressors, surveillance, to name but a few



On-board power supplies for control and service vehicles

Output requirement: 50 – 100 W

Energy requirement: 1200 Wh – 2400 Wh / day

SFC solution: an EFOY Pro 2400 is integrated into the vehicle and connected to the on-board or secondary battery. A 10-litre fuel cartridge will give up to four weeks of autonomy.

Applications in vehicles: e.g. official vehicles, service vehicles, control vehicles, and measurement vehicles

EFOY Pro Reference Applications



Uninterruptible power supply for telecommunications equipment

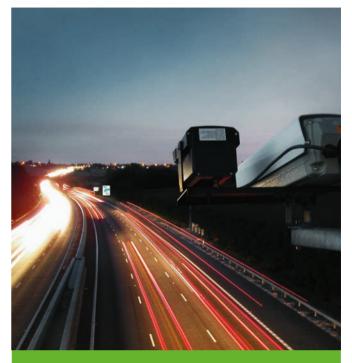
Output requirement: 300 W - 2 kW

Energy requirement: 7.2 - 48 kWh / day

Autonomy requirement: for 72 hours

SFC solution: with the EFOY Pro 12000 Duo for uninterruptible power supply, mains network failures are no longer a problem. Critical infrastructure objects such as digital radio for authorities and organisations with a security role must continue to be supplied with unlimited power in the event of a mains grid failure. With the EFOY Pro 12000 Duo, an uninterruptible power supply is guaranteed and large banks of batteries can be avoided.

Application for UPS systems: critical infrastructure systems, TETRA radio masts, on- and offshore wind turbines



Off-grid power for traffic management systems

Power requirement: 20 – 100 W, 400 W peak power

Energy requirement: 480 Wh – 2400 Wh / day

SFC solution: an EFOY Pro 2400 integrated into an EFOY ProCube for the temporary use of radar cameras. The integration of an EFOY Pro 2400 Duo into the EFOY ProCabinet is ideal for the stationary setup of a radar camera in a location without a power connection. The fuel cells cover the basic demands for electricity, while the battery provides the current for the brief peaks in output.

Other applications in traffic management: include road weather indicators, control vehicles, traffic cameras and counters



Monitoring of critical infrastructures

Continuous output requirement: 10 - 20 W

Energy requirement: 300 – 400 Wh/day

SFC solution: EFOY ProCabinet including an EFOY Pro 800 Duo connected to four M28 cartridges, two DuoCartSwitches and accumulators for high currents. With this energy solution in use, autonomy of up to a year can be achieved without any costly servicing.

Applications for stationary monitoring: event surveillance, monitoring of animals and plants in the wild, pipeline monitoring, off-grid applications such as points and signalling technology with multiple short power peaks per day



Covert surveillance without user intervention

Continuous output requirement: 15 – 100 W

Energy requirement: 360 – 2400 Wh/day

Autonomy requirement: up to 12 weeks

SFC solution: EFOY Pro 800 or EFOY Pro 2400 (depending on power requirements) with a DuoCartSwitch and two connected M28 fuel cartridges in order to guarantee an operating period of up to 65 days. Energy solutions with the EFOY Pro are quiet, generate no heat and guarantee long periods of operation without any user intervention.

Applications for covert surveillance:

e.g. undercover investigations, border security

PBF Power Supplies and Coils



PBF Service Portfolio

- Standard switching power supplies and DC/DC converters
- AC/DC and DC/DC power supply systems as well as pulsed current systems
- Power range from < 20 W to 150 kW and beyond
- Customer-specific power supply systems and performance electronics (design-in, design-to-cost)
- Mains transformers (5 to 60 kVA)

The PBF Group B.V., a company within the SFC Energy Group, develops and produces customized power supply systems that are renowned for their quality and reliability. Its customers include well-known OEMs and system suppliers in its home country and abroad. PBF works intensively with its customers to develop tailored solutions such as power supplies, power cabinets and special coils.

Its product portfolio in terms of construction ranges from relatively simple Open Frame to the highly complex and powerful Power Cabinet, in small to medium-sized volumes that can be anything from a few to several tens of thousand each year.



PBF Reference Applications



AC power supply unit for use on material processing laser systems

Power requirement

- Powerful 1- and 3-phase AC power supplies
- Scalable outputs up to 100 kW

Important characteristics

- Adaptation to the laser system's technical requirements
- Use of the laser system's existing water cooling circuit to control the temperature of the power supply
- Power outputs are modular and scalable for various laser powers

PBF solution

Development of a power platform for modular setup. Flexible options for integration into existing laser systems - 19" systems can be assembled.

Adaptation to existing cooling systems.

Modular setup and scalable in power increments from 1.5 kW to 100 kW.



Coils and power supply units for electron microscopy

Power requirement

Customer-specific coils and power supply units for high-end microscopes

Important characteristics

- AC/DC power supply unit with ultra-low ripple at the output in order to avoid influences to the electron stream on the microscope
- High efficiency, resulting in a long service life for the microscope
- Customer-specific deflection coils that were developed in collaboration with the client especially for the individual device properties in order to achieve optimum performance

PBF solution

Development of an AC/DC power supply unit with an efficiency of over $95\,\%$ and a ripple & noise level of < 10 mVpp at the voltage output.

SFC Energy Group

Simark Controls



Simark Service Portfolio

- Mobile and off-grid energy solutions
- Power supply components and drives
- SCADA & automation
- Gas & fire alarm systems
- Instrumentation and measurement systems
- Customer-specific solutions

Simark Controls AG, a company within the SFC Energy Group, is a service-focused sales company specialising in customer-specific solutions. Since 1971, Simark Controls has had its head office in Calgary, Canada, and has earned a reputation for itself in the manufacture of a wide range of industry-specific quality products. A team

of specialists delivers both turnkey and tailor-made solutions in order to meet the specific needs of their customers. Systems from Simark Controls are developed, produced and licensed in accordance with the requirements of the CSA and UL 508 standard. Development and production take place in Calgary.







Simark Reference Applications



Integrated measurement technology

Power requirement

- Compliant with Regulation 17
- Operating interface and data integration
- Customer-specific designs

Important characteristics

- ERCB Regulation 17 Section 10
- API 2540 2004 calculations
- API 11.1 crude oil applications and 11.2 (LPG applications) calculations

Simark solution

- Single and multi-station measurement buildings
- Intuitive operating interface without high training requirements and easy to operate
- Extended results logging
- Customer-specific measurement stations



Energy solution for the safeguarding of critical infrastructure

Power requirement

45 - 100 W

Safeguarding the surveillance and CCTV of construction sites and remote locations, such as mining or oil pipelines. The energy requirement is around 1080 - 2400 Wh per day.

Important characteristics

- Long autonomy
- Easy installation
- No maintenance outlay
- 100% reliable, off-grid energy

Simark solution

For security applications, the EFOY ProTrailer can be equipped with cameras with a total of 70 W (continuously), the EFOY Pro 2400 Duo, four 28-litre M28 fuel cartridges and 560 Wp solar. The annual methanol requirements for this version is around 140 l or five fuel cartridges. As a result, the EFOY ProTrailer can be operated for almost an entire year without any user intervention whatsoever.

Energy around the world



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