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# Applications

- Grid independant power supplies for
  - Remote measuring sites (weather, wind, water quality, water level monitoring for rivers etc.)
  - Parking display system
  - Mobile traffic signs
  - Telecommunicaton equipment (satellite and wireless communication etc.)
  - Mobile surveillance systems, cameras on construction sites etc.



# Mobile Traffic Signs

- Problem:  
Batteries last for max. 20h of operation – then battery recharging is required
- Solution:  
2 x EFOY-PRO 2400 installed in OUTDOOR Box provide 5 days of continuous operation with a 10 liter Methanol cartridge



# Ice warning system

- Problem:  
No grid power available, solar power not sufficient
- Solution  
EFOY-PRO-2400 in combination with solar module provides reliant and affordable power.



# Speed Control System

- Problem:  
No grid power available
- Solution:  
EFOY-PRO 2400 as remote  
power supply
  - Methanol consumption:  
app. 10 liters/week



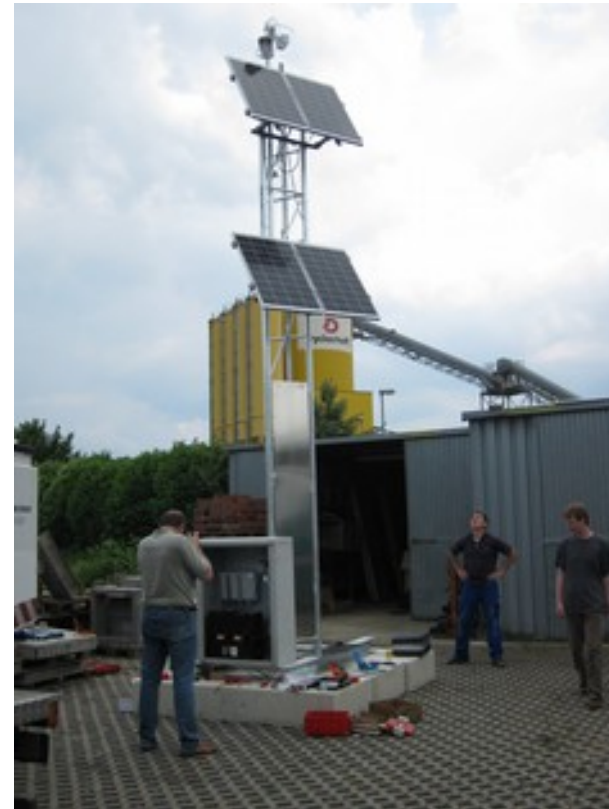
# Relais station for WIFI

- Problem:  
Quality of service: Solar and wind do only provide power for 90% of time.
- Solution  
EFOY-PRO-2400 in combination with solar module provides reliable power 365 days/year.



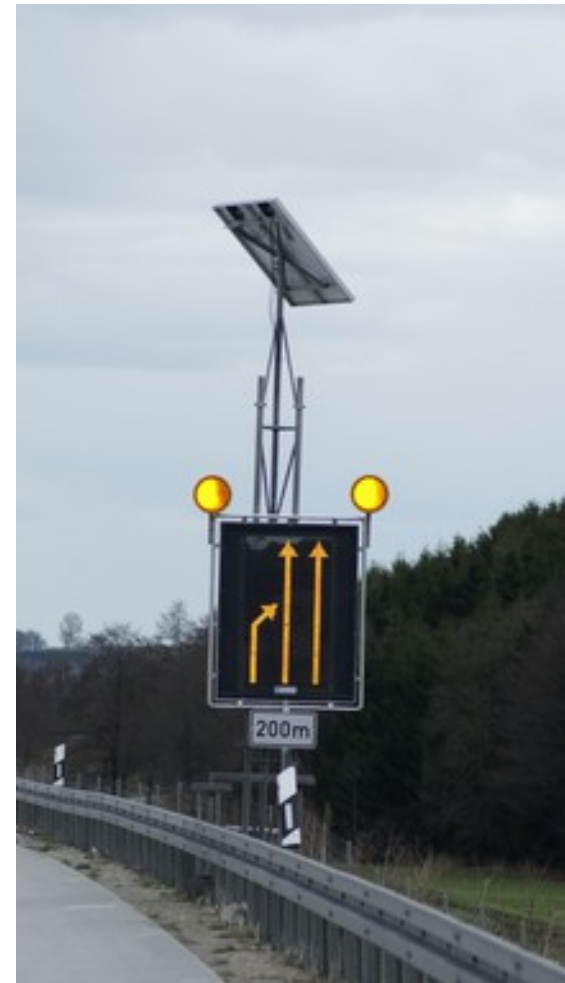
# Traffic Monitoring with IP Cameras

- Problem:  
No grid connection available. PV only not possible (50 Watt cont.)
- Solution:  
EFOY-PRO-2400 in combination with 390 Watt Peak solar installation for all year operation



# LED sign for construction site

- Problem:  
No grid connection available. PV not sufficient in winter (50 Watt cont.)
- Solution:  
EFOY-PRO-2400 in combination with 180 Watt Peak solar installation for all year operation





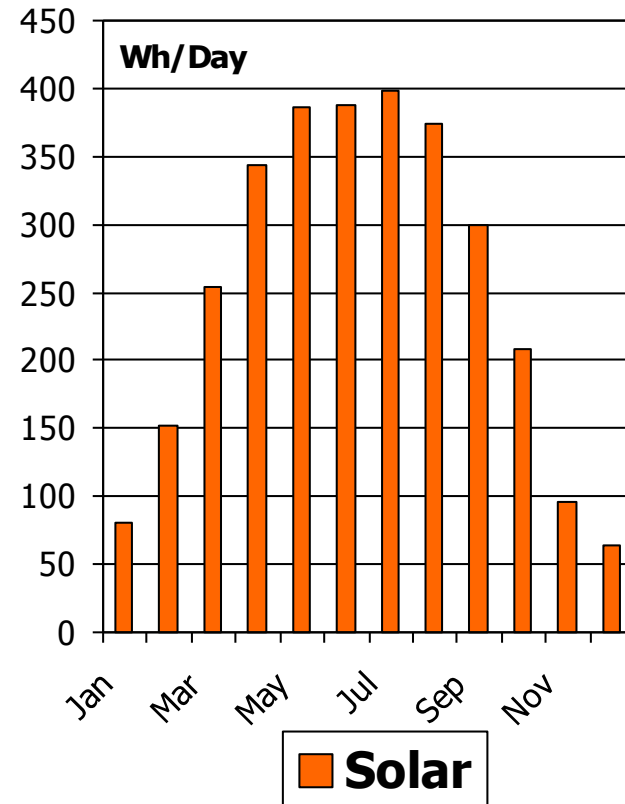
# Offshore wind speed measuring

- Problem:  
No grid connection available. PV only not possible (50 Watt cont.)
- Solution:  
EFOY-PRO-2400 in combination with 390 Watt Peak solar installation for all year operation



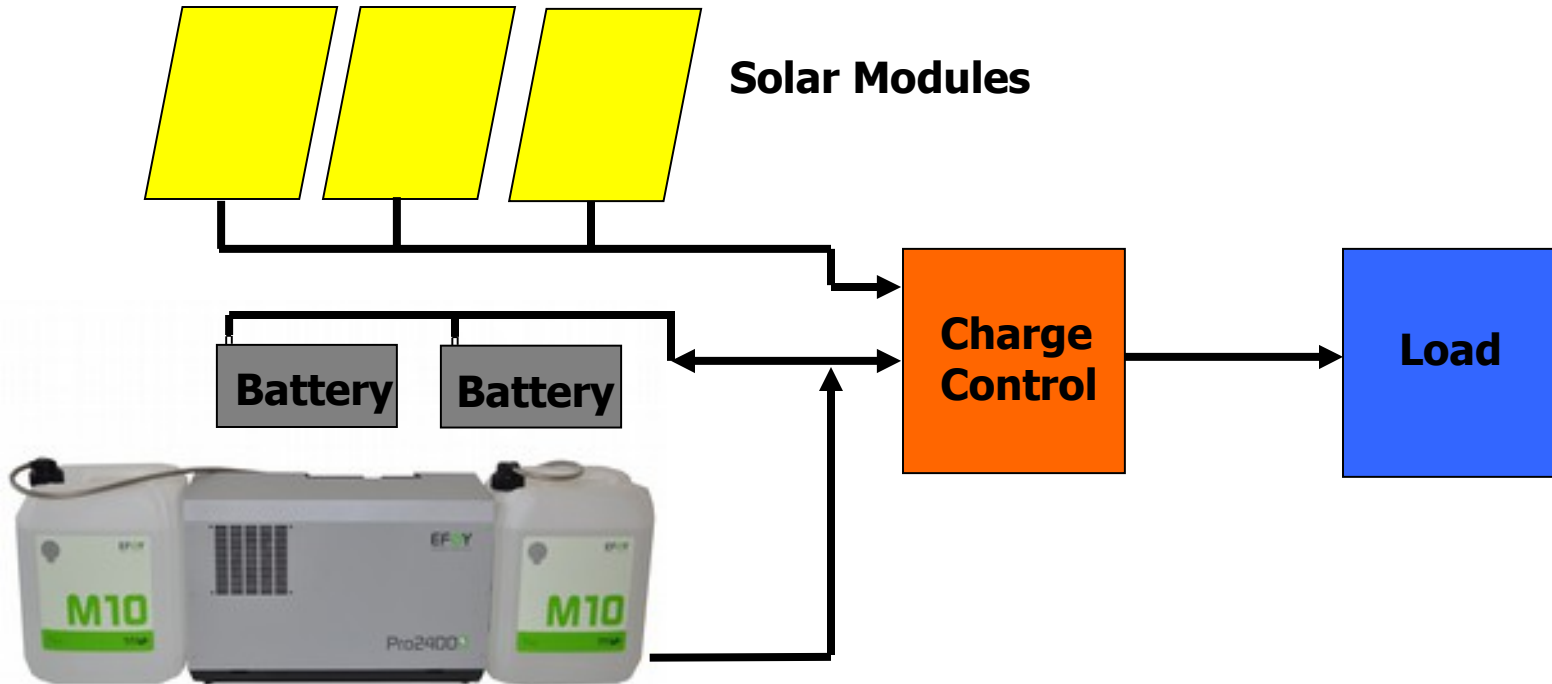
# Problem

- Reliable all year power supply based on photovoltaic and battery is difficult
- For 1 Watt of continuous output power, app. 40 Watt peak solar installation is required in central Europe
- Solar modules are difficult to protect against theft and vandalism



Energy generated from a 100Wp Solarmodul, orientation south 30°, location Berlin.

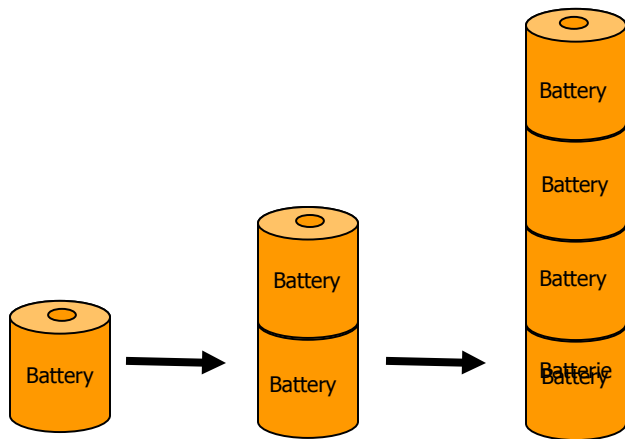
# Solution: Fuel Cell – Solar – Hybrid System



**EFOY-PRO Duo**

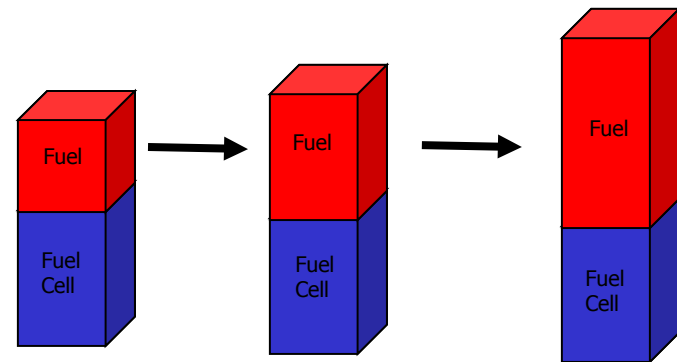
# Fuel Cell versus Battery

- Battery



Doubling the capacity results in doubling volume and weight

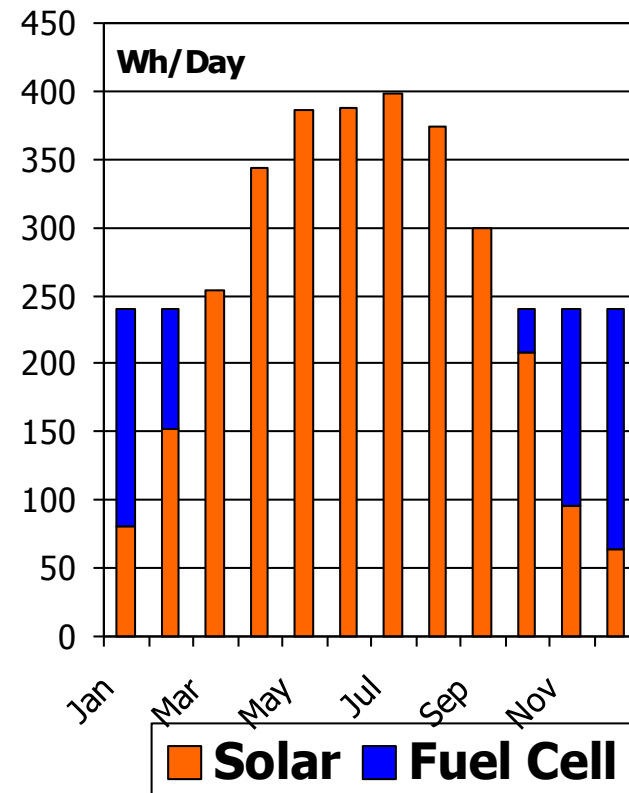
- Fuel Cell



Since energy conversion and energy storage are separated, increasing the capacity can be achieved at lower volume and weight increases than with battery technology

# Dimensioning a fuel cell-PV hybrid system

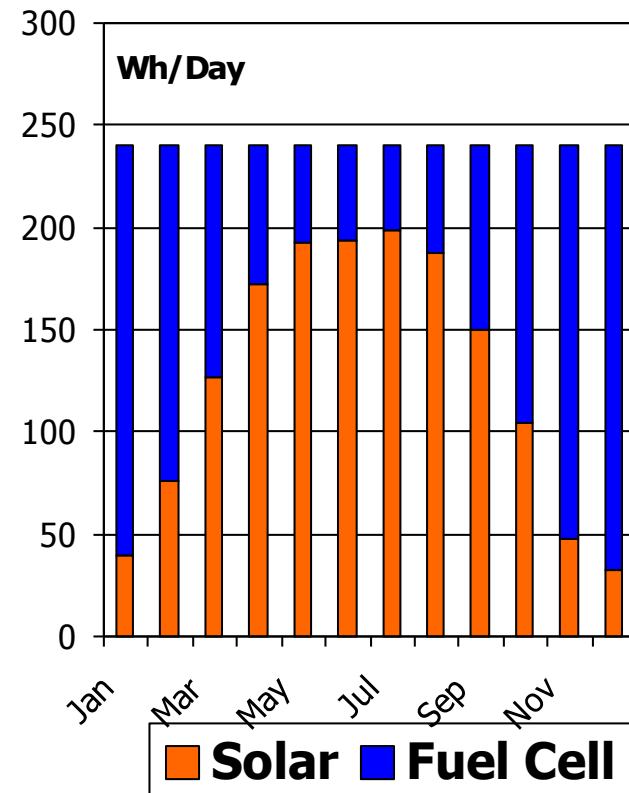
- Dimensioning a fuel cell PV hybrid system for a remote measuring system with a power demand of 10 Watt continuous → 240Wh/day.
- Solar module installation
  - $10 \times P_{\text{continuous}} = 100\text{Wp}$
- Fuel Cell EFOY-1200-PRO with max. 1200Wh/day



Energy generated from a 100Wp solar module, orientation south 30°, location Berlin. Load 10 Watt (continuous) – 240Wh/day

# Dimensioning a fuel cell-PV hybrid system

- Dimensioning a fuel cell PV hybrid system for a remote measuring system with a power demand of 10 Watt continuous → 240Wh/day.
- Solar module installation
  - $5 \times P_{\text{continuous}} = 50\text{Wp}$
- Fuel Cell EFOY-1200-PRO with max. 1200Wh/day



Energy generated from a 50Wp solar module, orientation south 30°, location Berlin. Load 10 Watt (continuous) – 240Wh/day

# EFOY-PRO-SERIES

- Direct Methanol Fuel Cell system (DMFC)
- Power: 2 versions with 45 and 110 Watt (800, and 2400Wh/day)
- Voltage: 12/24VDC, automatic battery charger
- Duo version with 2 fuel connectors
- Fuel consumption: app. 0.9l Methanol/kWh



# EFOY-PRO-SERIES – 2<sup>nd</sup> Generation

EFOY-PRO-SERIES	800	800 DUO	2400	2400 DUO
Voltage	12/24 V	12/24 V	12/24V	12/24V
Current	max:3.75/2.1A min:1.88/1.05A	max:3.75/2.1A min:1.88/1.05A	max:9.17/6.7A min:4.58/3.3A	max:9.17/6.7A min:4.58/3.3A
Recommended Battery Size	40-160Ah 12V 10-100Ah 24V	40-160Ah 12V 10-100Ah 24V	60-350Ah 12V 30-175Ah 24V	60-350Ah 12V 30-175Ah 24V
Default Charging Parameters	On: 12.3/24.6V Off: 14.2/28.4V			
Noise	42/25 dB(A) (in 1m/7m distance)			
Ambient Temperatures	-20°C to +50°C			
Warranty	24 months or 4.500h			
Weight	8kg	8.3kg	9kg	9.3kg



# Methanol Cartridges

- Methanol cartridges:
  - M5, 5liters, 4.3kg→5.5kWh
  - M10, 10liters, 8.3kg→11.1kWh
  - M28, 28liters, 25kg→31.1kWh
- Comparison: Lead acid battery with 230Ah/12V (70kg) stores max. 2.76kWh, only 50% can be used without damaging the battery (deep discharge)



# EFOY-OUTDOOR

The reliable OUTDOOR power supply for remote locations



ProCube



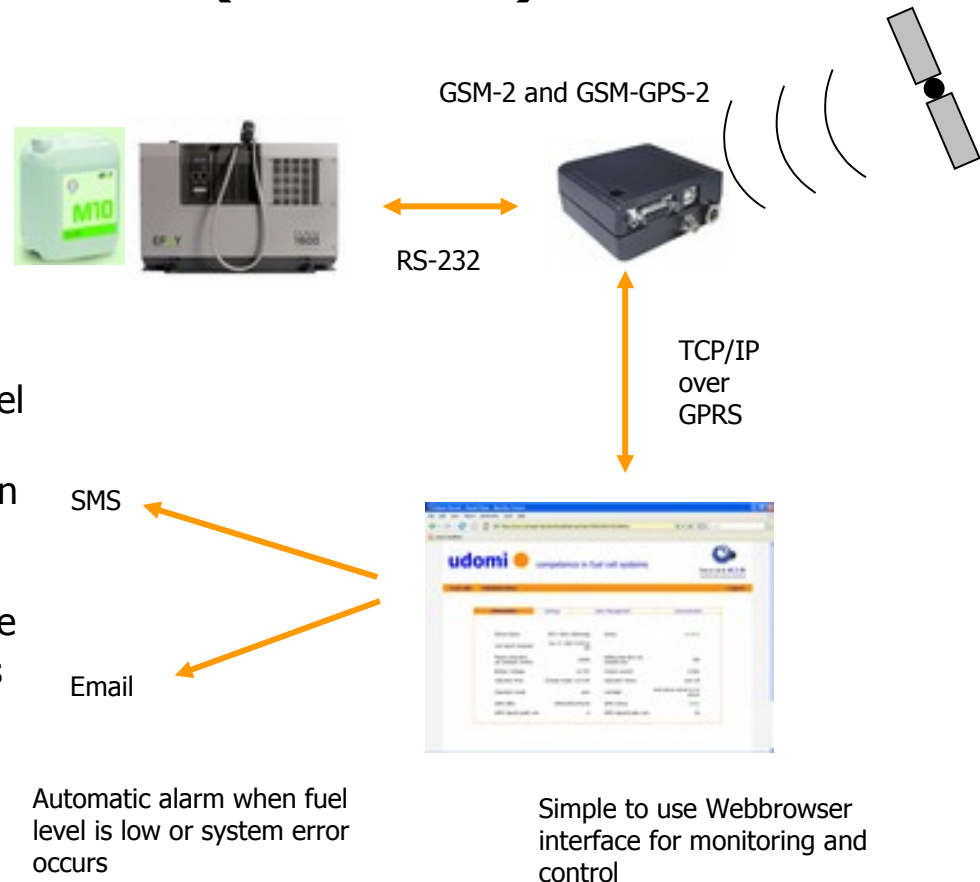
OUTDOOR-ALU-XL Box



OUTDOOR-CABINET-XL

# EFOY-ONLINE (GSM-2)

- Monitoring and control of EFOY fuel cell via Webbrowser
  - [www.m2mgate.de/udomi/](http://www.m2mgate.de/udomi/)
  - Try demo access
    - user: demo
    - password: demo
- Sends SMS/Email automatically when fuel level is low or system error occurs
- Errors can be located and fixed online (in most cases it is not required to send service personal to fuel cell location)
- EFOY fuel cell can be reconfigured online
- Monthly communication traffic (GPRS) is typically below 1MB
- GSM-GPS-2 combines GSM-2 functions with GPS tracking. Allows user to find current location of EFOY system via Google Maps.



Thank you for your interest!