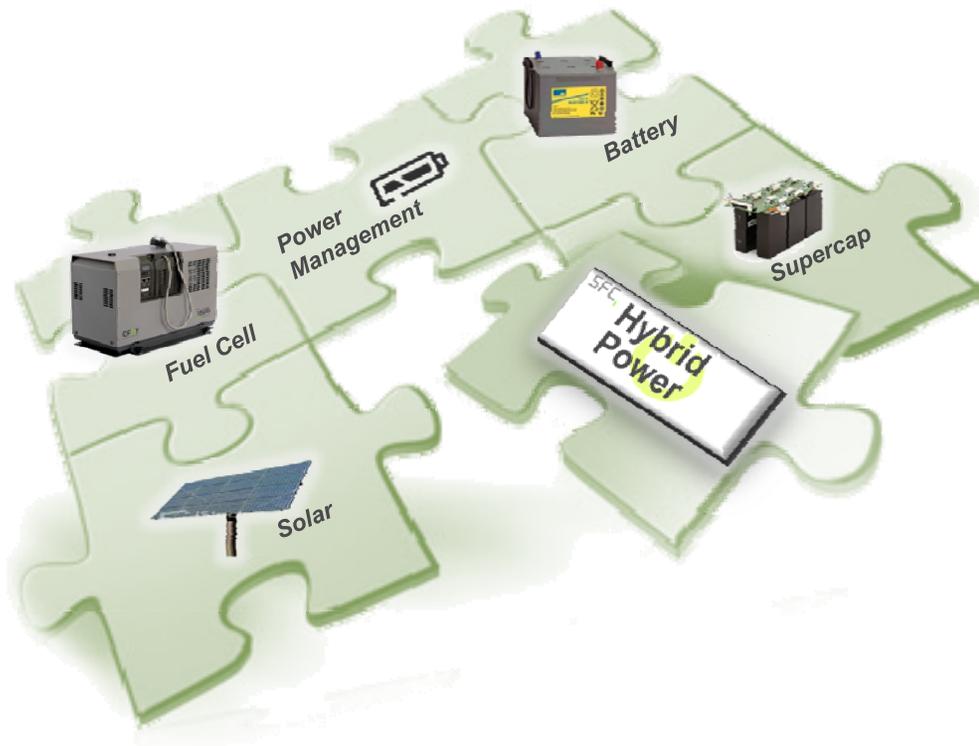




## Presentation for

DOE Hydrogen and Fuel Cell Technical Advisory  
Committee

June 15, 2011



***Clean hybrid power  
for off-grid applications***

# SFC Energy AG & Inc.



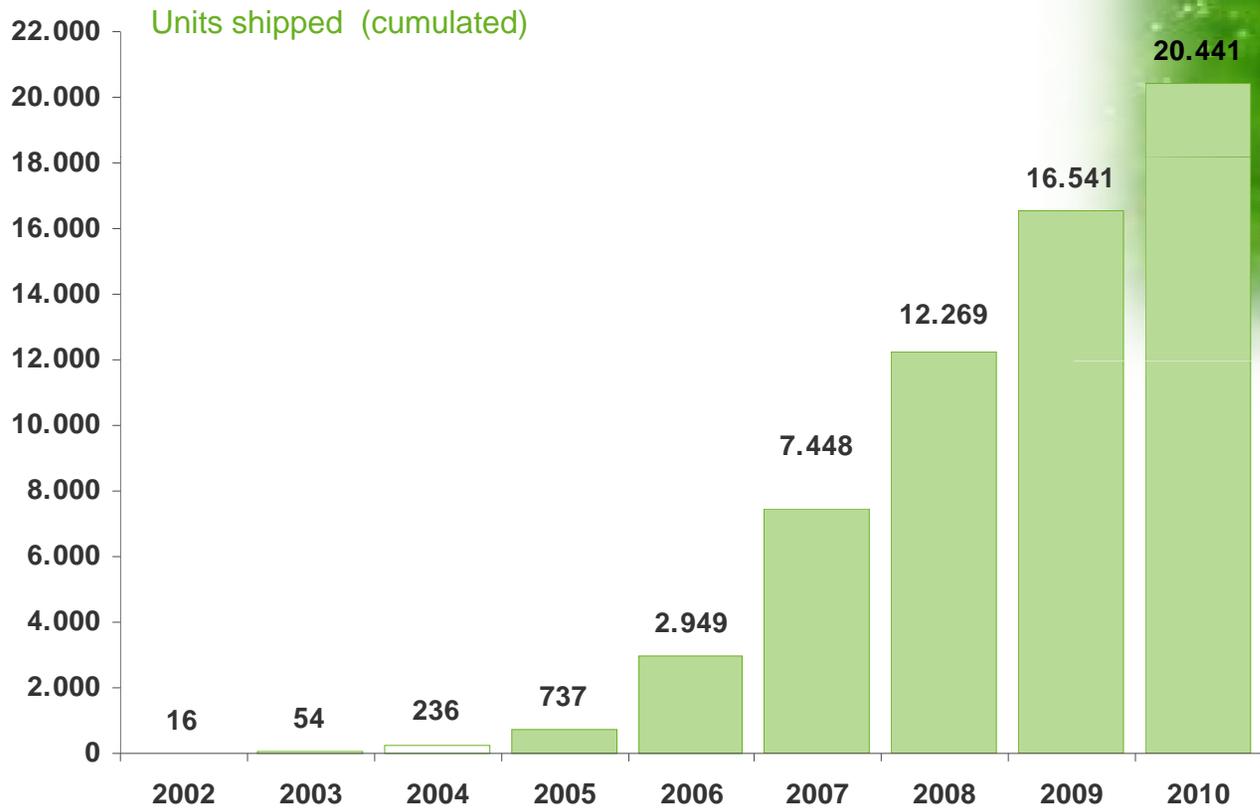
## Facts and figures

- 🔌 Founded in 2000
- 🔌 Sole company developing, producing and selling commercially available DMFC products
- 🔌 Locations
  - SFC Energy AG: Brunnthal, Germany
  - SFC Energy Inc: Rockville, MD
- 🔌 100 employees



# Market Traction

- As of today, more than 21,000 fuel cell systems shipped
- > 8 million operating hours in end user environments
- Fully functional fuel infrastructure established in core markets



## Product Readiness

EFOY-Series



EFOY Pro



Jenny



Power Manager



## Liquid Fuel Infrastructure

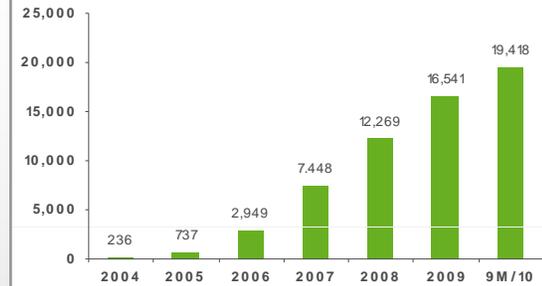
### Market Presence



Coverage with SFC points of sale and methanol cartridges outlets (Leisure market)

## Substantial Market Traction

Units shipped (cumulated)

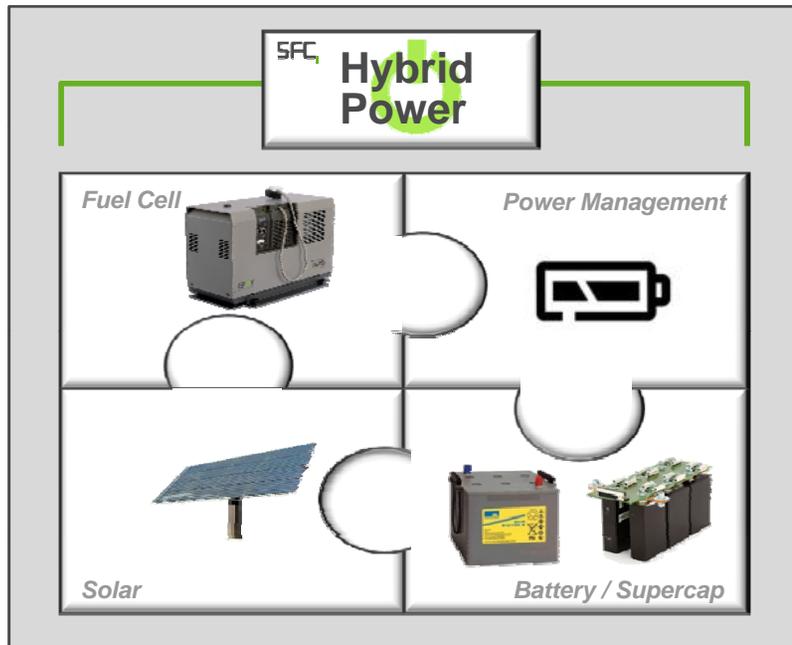


### Customers



Sustainable growth of commercial fuel cell business

## SFC's Enabling Power Supply Solution



Single Customer Interface



Customer

- ⚡ **Compatibility** with incumbent solutions → **low or no complexity** of integration; ideal **retrofit market opportunities**
- ⚡ EFOY closes “**power gap**” of existing solutions – **augmentation**, not direct competition
- ⚡ **Load sharing** between battery and fuel cell [and solar panel] → **size and cost minimization** for both
- ⚡ **Prior investment costs are not lost** → elimination of psychological purchase barriers

SFC's hybridization concept enables superior product advantages and capturing the full off-grid market potential

## Macro-Economic Drivers

-  Electrification and Digitalization
-  Clean Energy
-  Security
-  Reduction of Dependency on Fossil Fuel

## Micro-Economic Drivers

-   On Board Power – Increased Demand for Functionality & Comfort
-   Increasing Off-Grid Power Needs
-   Digitalization of Military and Security Forces
-   Increasing Need for Backup Power Supply
-   Increased Demand to Intelligently Use and Manage Power
-   E-Mobility

**SFC's product solutions serve multiple mega-trends.**

# Energy Density Comparison

## Different ways to provide 11 kWh electricity

**Methanol**



**Hydrogen**



**Lithium-Ion Batteries**



**Lead-Acid Batteries**



<b>Weight</b>	17 lbs	180 lbs	235 lbs	600 lbs
<b>Volume</b>	10 l	60 l	60 l	140 l

**Methanol combines superior energy density with easy handling and low cost.**

# SFC Market Segments

## Leisure

**Comfortonomy for:**  
Motor Homes, Cabins  
and Boats



## Remote Industry

**Dependability and  
Low Maintenance Cost  
for:**  
Traffic Technologies,  
Security, Environmental  
Monitoring



## Defense

**Weight Saving and Non-  
Detectability for:**  
Portable Power



**Reliability and  
Non-Detectability  
of On-Board Power for:**  
Tactical Vehicles



## Mobility - APU

**Reliability of On-Board  
Power and Reduction of  
Fleet Operating Costs  
for:**

Special Purpose Vehicles



## E-Mobility

**Combined Heat and  
Power Source for:**

Increased performance  
and user acceptance of  
battery vehicles



## Rationale

- ❶ SFC fuel cells are unique enabling components – but hardly plug & play solutions so far  
⇒ demand for **whole product solutions**
- ❷ Strategic advantages of energy solution provider over component supplier:
  - ⇒ direct customer access
  - ⇒ stronger market position + margin protection
- ❸ Today's market access and market fragmentation limit growth speed
- ❹ First SFC whole-product solutions / systems (e.g. EFOY ProCube, energy network incl. Power Manager) very well received on the market



EFOY Energy Rack

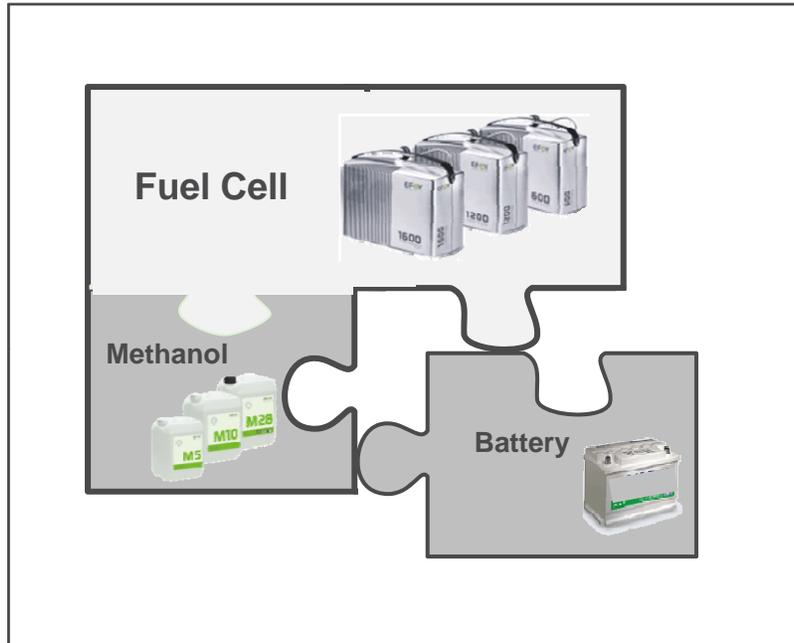


EFOY ProCube

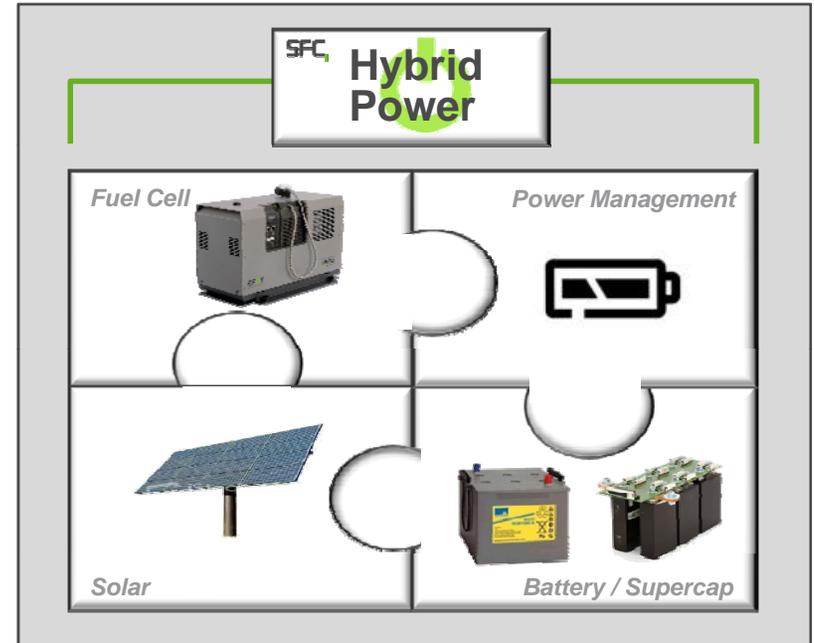


SFC Power Manager 3G

## Hybrid Product Concept



## Broadening of Business Model

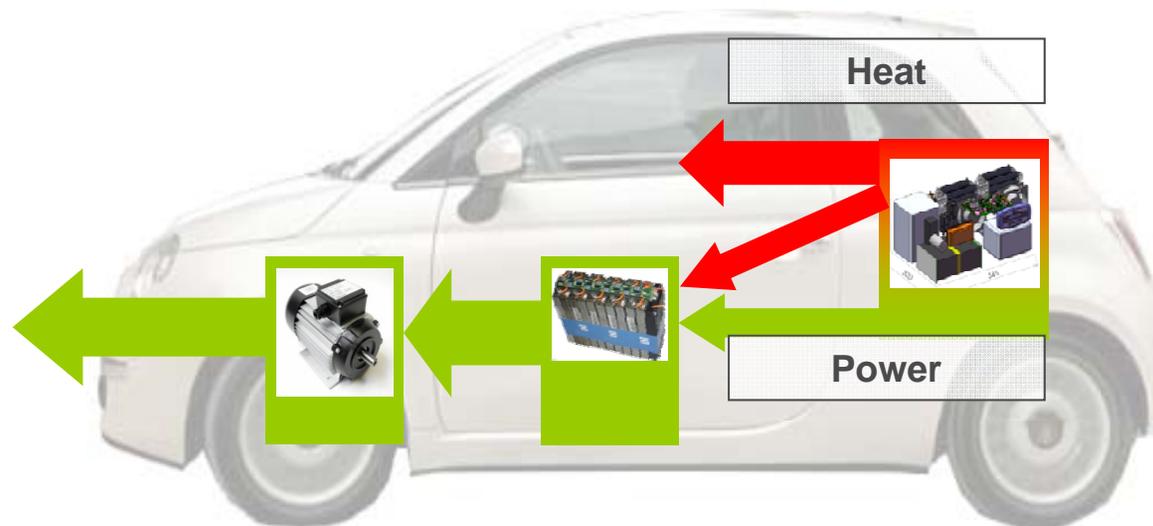


Create leading solution provider for clean hybrid off-grid power.

## E-Mobility without limitations

### Combined Heat and Power (CHP) Concept

- On-board generation of power and heat makes electric vehicles fit for everyday use - even in winter
- Increased range and fully automatic off-grid recharging upon demand improve customer acceptance
- SFC presents concept together with the renowned automotive engineering partner “ESG Elektroniksystem- und Logistik-GmbH”



**Innovative CHP (Combined Heat and Power) Concept for Electric Vehicles with SFC Fuel Cells**



### Range extender and on-board charger:

Light electric vehicles - based on commercially available EFOY fuel cell products – achieved important milestones re. range, grid independence, regulatory approvals

2008: first DMFC hybrid vehicles hit the road

## Fuel cells as APU for special-purpose vehicles

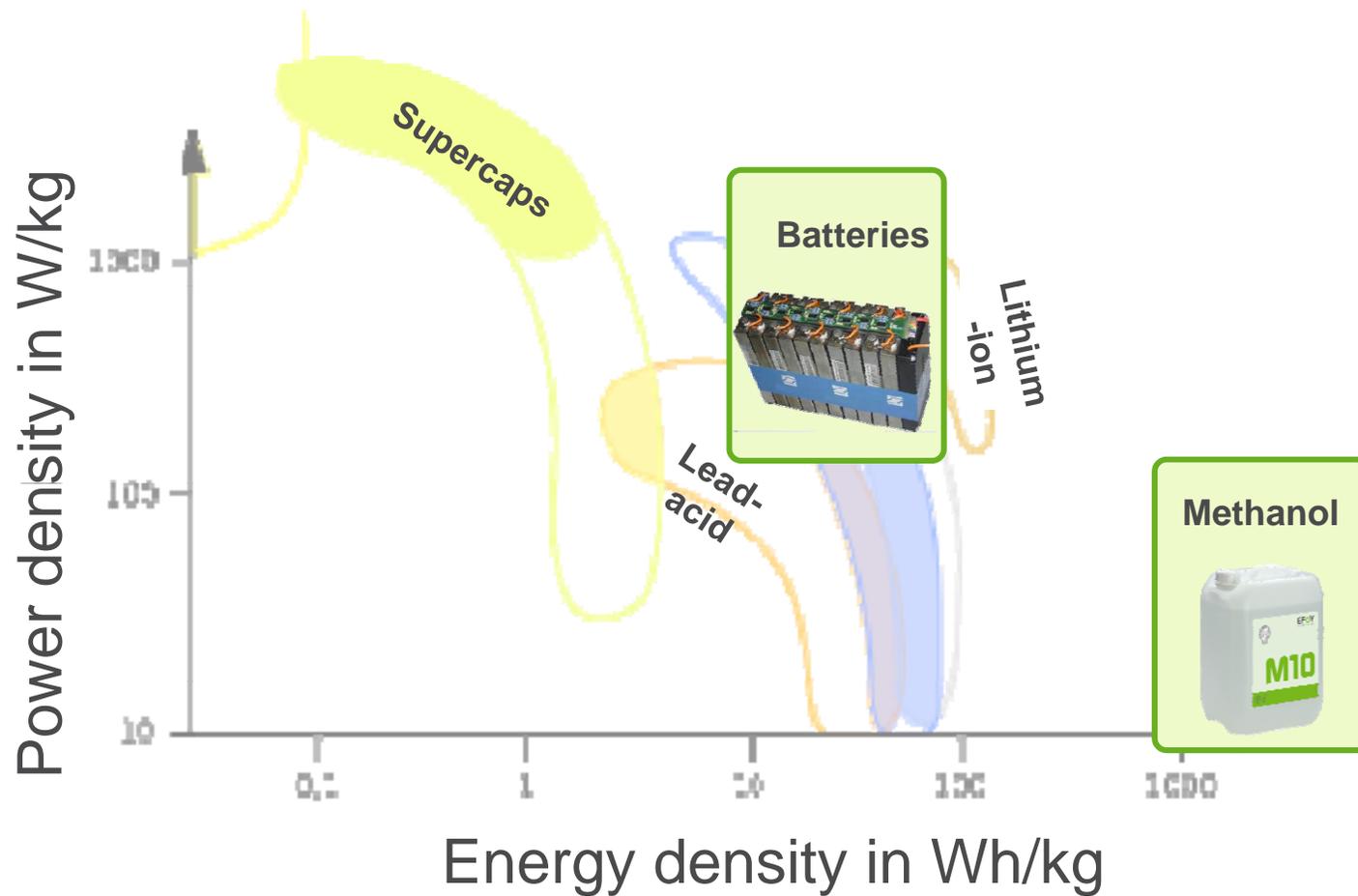


**OEM  
customers:**



- Silent, powerful, efficient on-board power source → increased functionality
- Already over 400 vehicles "powered by SFC" in daily use by authorities
- Massive savings in operating cost for fleet managers
- Powerful logistics network for fuel cartridges – more than 1,500 points-of-sale in EU

2009: first volume orders by VW and Mercedes - APU for special-purpose vehicles



Hybrid approach combines superior energy density with required power density

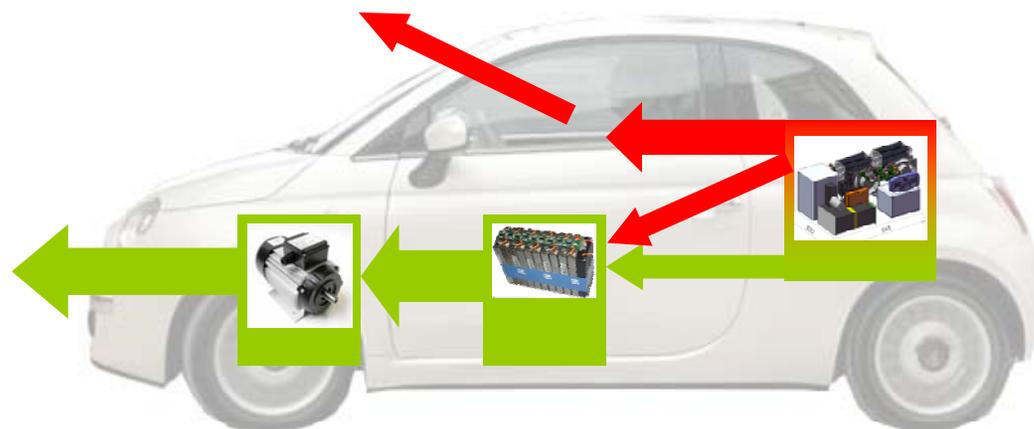
## The Battery Power Gap (1) - Capacity Limitations

- Theoretical capacity assumes cycling from 100 % SOC to 0 % SOC
- Neither 100 % SOC nor zero % SOC are achievable in reality
- Cell balancing eats up significant fraction of capacity

→ Theoretical battery capacity is never available in practice

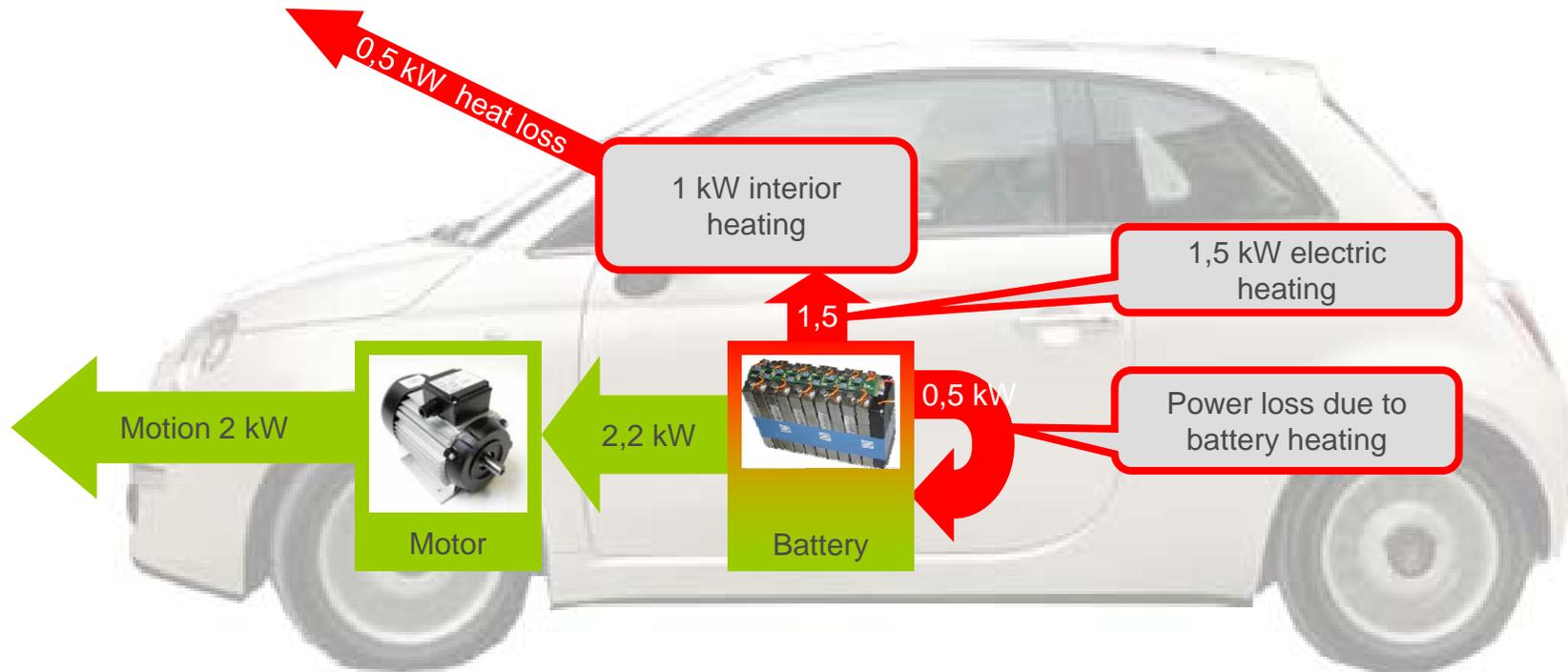
## The Battery Power Gap (2) - Thermal Issues

- ❶ Battery capacity + ability to accept charge are strong functions of temperature
  - ❶ Lithium-plating effect prohibits charging below freezing
- ❷ Battery capacity is too precious to be wasted for heating purposes
- ❸ Winter conditions: High energy demand meets poor battery capacity



→ A source of heat is required on board

Example: compact car, urban driving at -10 °C, battery only



Winter driving: Power consumption out of the battery doubles due to heating requirements  
At the same time, battery capacity goes down dramatically

Battery vehicles: winter conditions lead to an unresolved power gap

# SFC Awards (2002-2010)



Promobil Beste Marken (2010)



Technology Innovation Award (2009)



Cleantech Award (2009)



Promobil Beste Marken (2009)



MMM Award (2009)



Wearable Power Prize (2008)



Deloitte's Fast 50 List (2008)



Frost & Sullivan's Market Leadership Award (2008)



Industriepreis Energie (2008)



Promobil Beste Marken (2008)



Technology Pioneer (2005)



Top 100 Innovators Red Herring (2004, 2002)



SailOvation Award (2004)



DAME Innovation Award (2004)



Inspire Technology Award (2004)



IF Design Award (2004)



F-Cell Award (2004)



German Founders' Prize (2003)



Business Leader Energy (2002)



Best High-Tech Company in Energy Field (2002)

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