



# SED: SONNE IM TANK NiCd, NiMH und Li-ION von SAFT



# A world leader in high technology batteries



Saft is the world's leading designer, developer and manufacturer of advanced technology batteries for industrial and defence applications.



The group is now very well-positioned on the developing markets of clean vehicles and renewable energy storage.



With 4,000 employees worldwide, Saft is present in 18 countries.

# Saft. Technological Leader



The world's leading manufacturer of industrial nickel-based batteries for use in air and rail transportation, standby power applications and emergency lighting;



The world's leading manufacturer of primary lithium batteries for the electronics and defence industries;



The leading European supplier of specialised, advanced technology batteries for defence and space applications and n° 1 worldwide in lithium-ion commercial satellite batteries.

# An International manufacturing network close to its customers



- **Specialty Battery Group production site**  
Batteries primaires et rechargeables de haute performance pour les applications électroniques, de la défense et de l'espace
- **Industrial Battery Group production site**  
Batteries rechargeables à base de nickel et batteries de nouvelles technologies pour applications industrielles
- **Rechargeable Battery Systems production site**  
Petites batteries rechargeables à base de nickel pour applications professionnelles

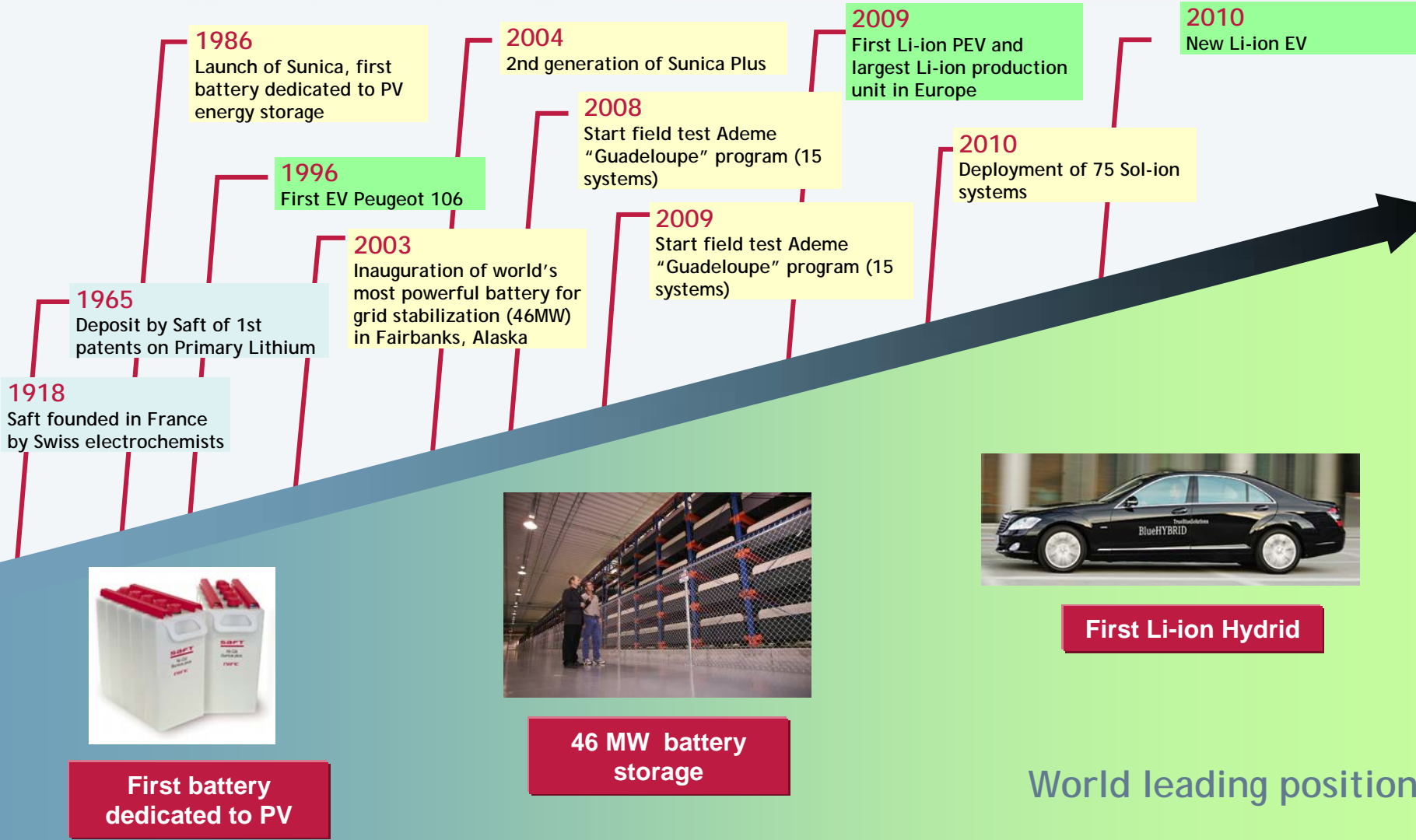
▲ **Johnson Controls-Saft** (Saft 49% Saft, Johnson Controls Inc. 51%)

# Saft in 2009 - Key figures





# Saft PV and Automotive experience



**First battery dedicated to PV**



**46 MW battery storage**



**First Li-ion Hybrid**

World leading position



# Technologies



# Saft. Technological Leader



Systems based on Ni-Cd cells



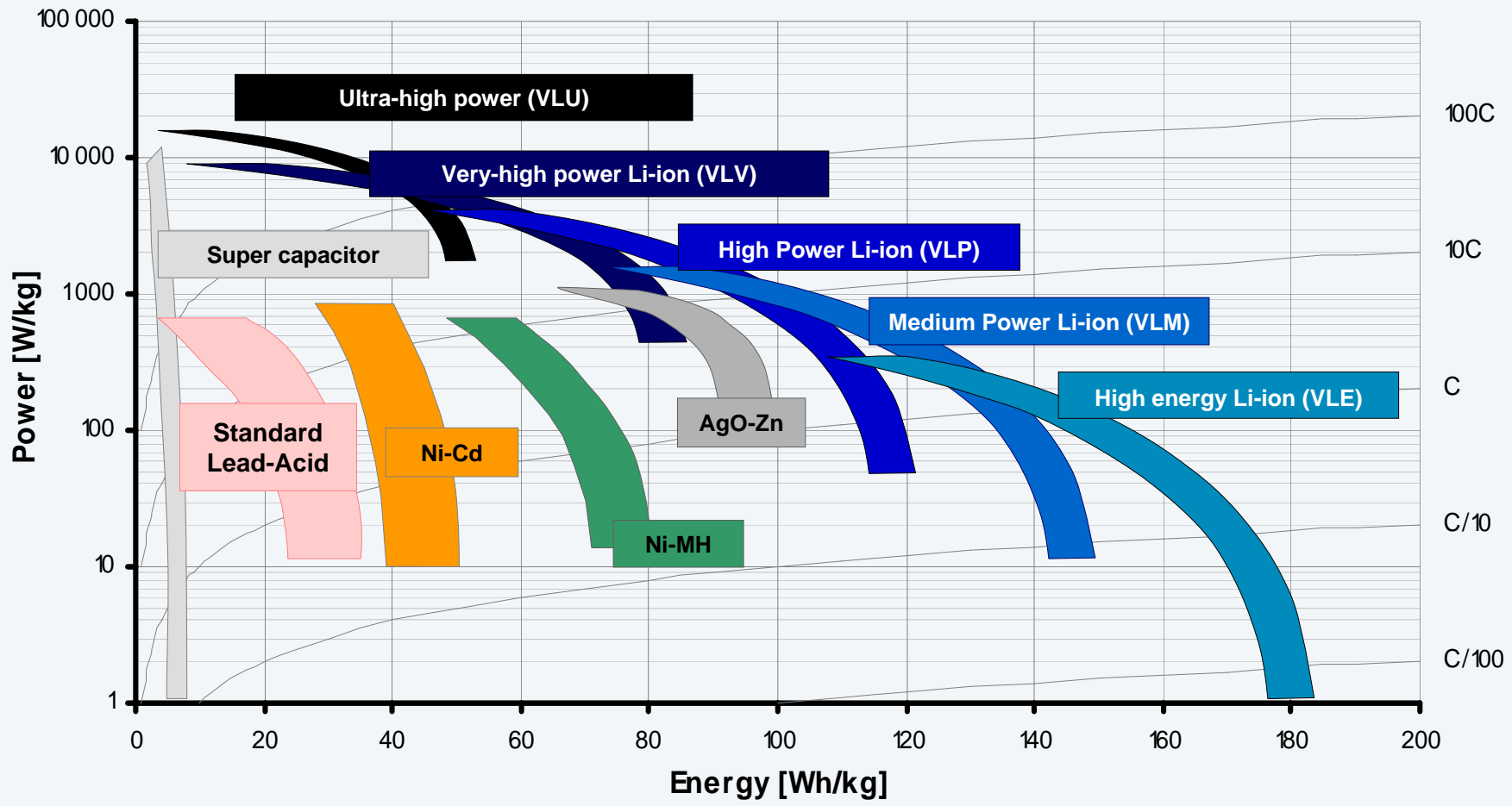
Systems based on Ni-MH cells



Systems based on Li-ION cells



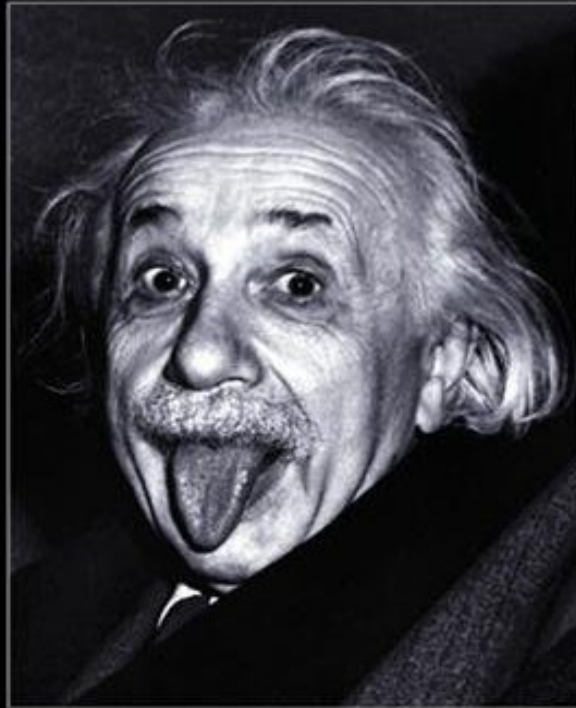
# Performance comparison of rechargeable battery technologies (cell level)



Ragone diagram



## ALBERT EINSTEIN



"He who joyfully marches to music in rank and file has already earned my contempt. He has been given a large brain by mistake, since for him the spinal cord would suffice. This disgrace to civilization should be done away with at once. Heroism of command, senseless brutality, deplorable love-of-country stunts, how violently I hate all this, how despicable and ignominious war is; I would rather be torn to shreds than be a part of so base an action! It is my conviction that killing under the cloak of war is nothing but an act of murder."

Alles  
ist  
relativ!

# Nickel Cadmium Benefits

## ■ Ni-Cd, Benefits:

- longterm experience
- good electrical abuse resistance
- good mechanical abuse resistance
- fully recyclable
- operation in extreme temperatures:  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$   
(but can tolerate extremes of temperatures of  $-50^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ )
- long life-cycle: 8 000 cycles at 15% depth of discharge
- easy to maintain

SUNICA: More than 4 years without topping-up - specifically rated for discharge times from hours to days

- simple charging system
- no corrosive vapors given off

# Nickel Cadmium Applications

## ■ Ni-Cd, Main applications:

- photovoltaic energy systems
- solar & wind hybrid systems
- navigation aids, signalling , offshore and remote lighthouses, beacons and buoys
- utilities
- telecommunication networks



# Nickel Metal Hydride Benefits

## ■ Ni-MH, Benefits:

- energy density (power and weight)
- long life
- environmental friendly
- battery monitoring abilities
- high cycle life
- good mechanical abuse resistance
- no corrosive vapors given off (safety)
- easy to maintain
- no water replenishment
- low life cycle cost

# Nickel Metal Hydride

## ■ Ni-MH, Main applications:

VH/VHT (1,2V, bis 16Ah):

- personal mobility (electric and assisted bikes, scooters, golf caddies, electric wheelchairs, assisted systems for disabled persons, ...)

NHP (1,2V, bis 68Ah):

- hybrid vehicles, buses, trucks, boats
- hybrid tram systems

NHE (1,2V, bis 200Ah):

- PV (photovoltaic) installations, especially on remote sites
- Renewable Energy Systems (RES)
- offshore installations
- all types of pure electric and hybrid vehicles



## Li-ion, Benefits

### ■ Li-ION, Benefits:

- potential of development and cost reduction
- small footprint/volume/weight
- ability to communicate with the battery
- maintenance free
- capability to discharge at  $-50/+60^{\circ}\text{C}$
- no memory effect
- non-toxic
- long cycle-life

(80% of initial capacity remaining after 5,000 cycles at 100% DOD / over 1 million hybrid electric vehicle shallow cycles); projected 10 to 15 years service life

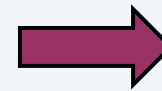
- fast continuous charge capability

## ■ Li-ION, Main applications:

- photovoltaics and other renewable energies:  
load shifting, load shaving
- decentralised energy networks
- micro-grids and decentralized, energy resources:  
spinning reserve
- PV and other Renewable Energy Systems
- industry: High power UPS systems, DC Power Supplies in confined areas
- electric bikes and personal mobility
- military electric and hybrid vehicles
- underwater vehicles

# Lithium-Ion cells

Energy Applications  
(EV or Plug-In Hybrid)



Power Applications  
(Full Hybrid)

	VL45E	VL41M	VL22M	VL6P	(VL7P)	VL30P
<b>Capacity (Ah)</b> C/3 @ 4V	45	41	27	6.5	7	30
<b>Dia. (mm)</b>	54	54	54	38	41	54
<b>Length (mm)</b>	222	222	145	145	145	222
<b>Weight (kg)</b>	1.07	1.07	0.65	0.36	0.37	1.10
<b>Volume (dm<sup>3</sup>)</b>	0.51	0.51	0.33	0.16	0.19	0.51
<b>Energy (Wh)</b>	160	146	78	22	25	107
<b>Power (W)</b> Current limit (A)	710 250	850 300	710 300	730 250	670 250	1250 500
<b>Power (W)</b> V limit, 2.5 V				1100	850	2300

30s – 50%SOC

✓ + Very high power cell - for hybrid military application,  
(65Wh/kg & 140Wh/l ; 7kW/kg (2s) and 5kW 18s)



# Examples

# Ni-Cd Battery Energy Storage BESS

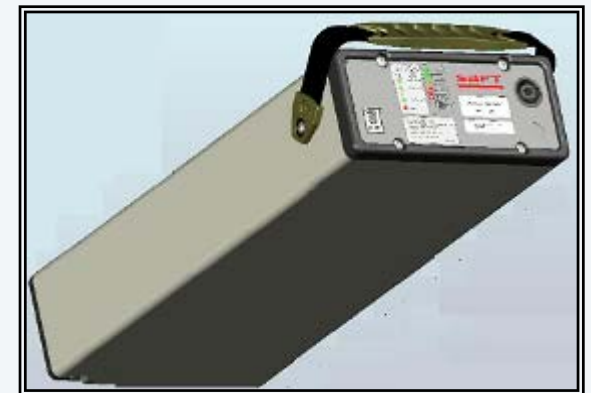
- Golden Valley Electric Authority (GVEA), Fairbanks, Alaska
- Ni-Cd Battery
  - Nominal voltage 5,000 V
  - Storage capacity 3,680 Ah
- World's most powerful battery: discharged for 5 minutes at the full converter capability of 46 MW
- Prevented some 300,000 customer disconnections in one year.



# Smart VHT Module for small PV

## ■ Ni-MH

- Parallel assembly of 10Ah modules:  
energy on-demand !
- 12V, 24V, 36V platforms
- Enhanced communication protocol  
(RS232 compatible)
- Charge possible directly to PVP
- Ruggedized Aluminum Casing option  
(IP54 waterproof)



# The emergence of lithium-ion

## ■ Saft and ABB

- Integration of Li-ion into SVC Light pilot system
- 200 kWh, 600 kW / 15 min.
- Operation to 5.8 kV

## ■ Mitigate short term load and supply variations

- Electricity distribution grids
  - Mitigate intermittency
  - Maximize network utilization (defer upgrades)
- Industries with high short term power demands



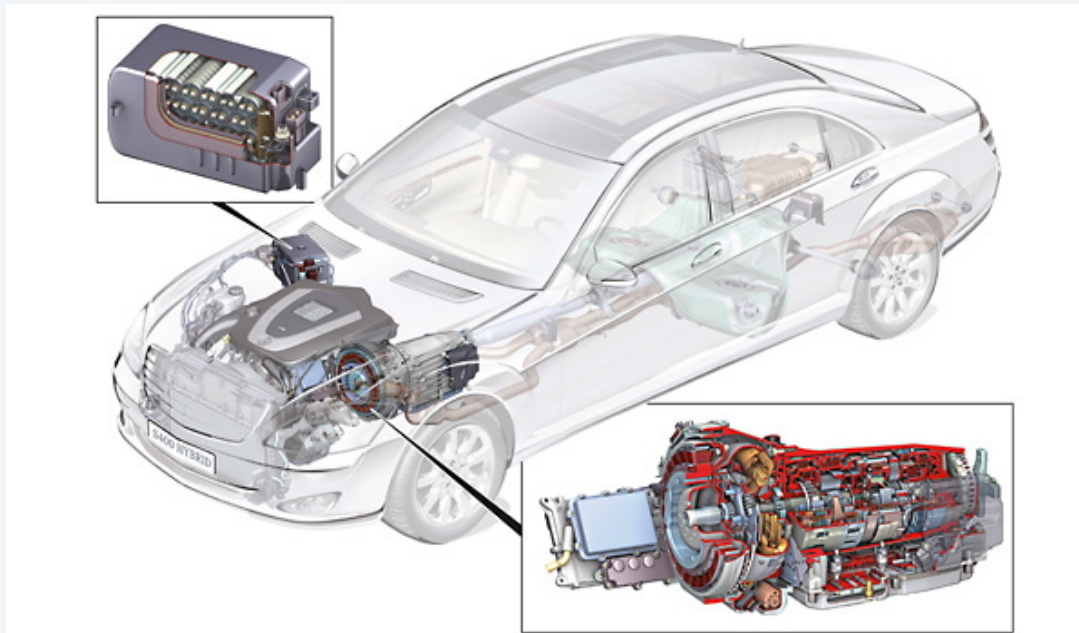
- Li-ion Battery**
- 8 units 646 V = 5170 V
  - 40 Ah
  - 13 power modules
  - 1 control module
  - Optical communication



## Mercedes S Class (source JC-S)

Nouvelle S-class Mercedes - "S400 Blue hybrid"  
équipée de batteries Li-ion Johnson-Controls Saft

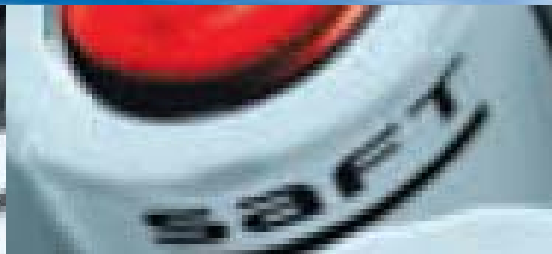
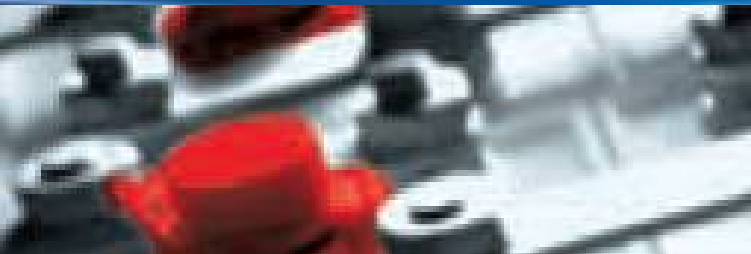
- Mild-Hybrid (hybride doux)
- 19 kW boost
- Production série depuis mi-2009
- Batterie logée sous capôt moteur





**Soft.**

**Your partner for tomorrow's  
infrastructures**





## Solardachstein

saubere Energie - saubere Umwelt

clean Energy - cleaner Environment

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# Ich danke für Ihre Aufmerksamkeit!

