3rd International Conference on Integration of Renewable and Distributed Energy Resources

# Large scale experiments of grid connected PV systems with energy storage

## The German-French approach within SOL-ION Project

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# INTRODUCTION (1)

- Energetic revolution will induce, in the next decade, dramatic changes and will lead to a tremendous growth of renewable energies.
- In this context, PV systems offer a universal, distributed, flexible and economical (in a medium term) way to produce electricity.
- To overcome barriers like :
  - intermittence of renewables
  - grid instability or weakness
  - peak power demand

  and to allow
  - smooth management of the energy
  - dispatching in a predictable way of PV electricity into periods of high demand
  - self consumption of the electricity produced
  - large development of self sufficient houses and buildings

  PV systems needs flexible energy storage devices

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# INTRODUCTION (2)

- To be competitive, industry has to create innovative concepts and products based on technological and economical breakthrough in order to provide new services and added value to all the stakeholders (users, grid operators…)

THIS IS THE REASON WHY GERMAN AND FRENCH INDUSTRIALS AND INSTITUTES HAVE DECIDED TO JOIN THEIR FORCES WITHIN THE SOL-ION PROJECT

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# STRATEGIC GOALS

- Insure industrial partners leadership in dispatchable PV power.
- Provide high value products and solutions in preparation of:
  - evolution of regulatory frameworks from direct feed-in to grid support and/or self consumption
  - development of smart networks
  - evolution towards self sufficient houses and buildings.
- Penetrate the market of distributed PV systems by 2012.

# SOL-ION PROJECT OVERVIEW (1)
# Partnership

Coordinator - Lithium-Ion energy storage development

System development - Energy conversion and management - Deployment in Germany

System development - Energy conversion and management - Deployment in France

System modelling

System functionalities, grid connection issues and economical assessment

System modelling and inverter studies

Field demonstration: data acquisition and analysis

Sites selection and grid connection

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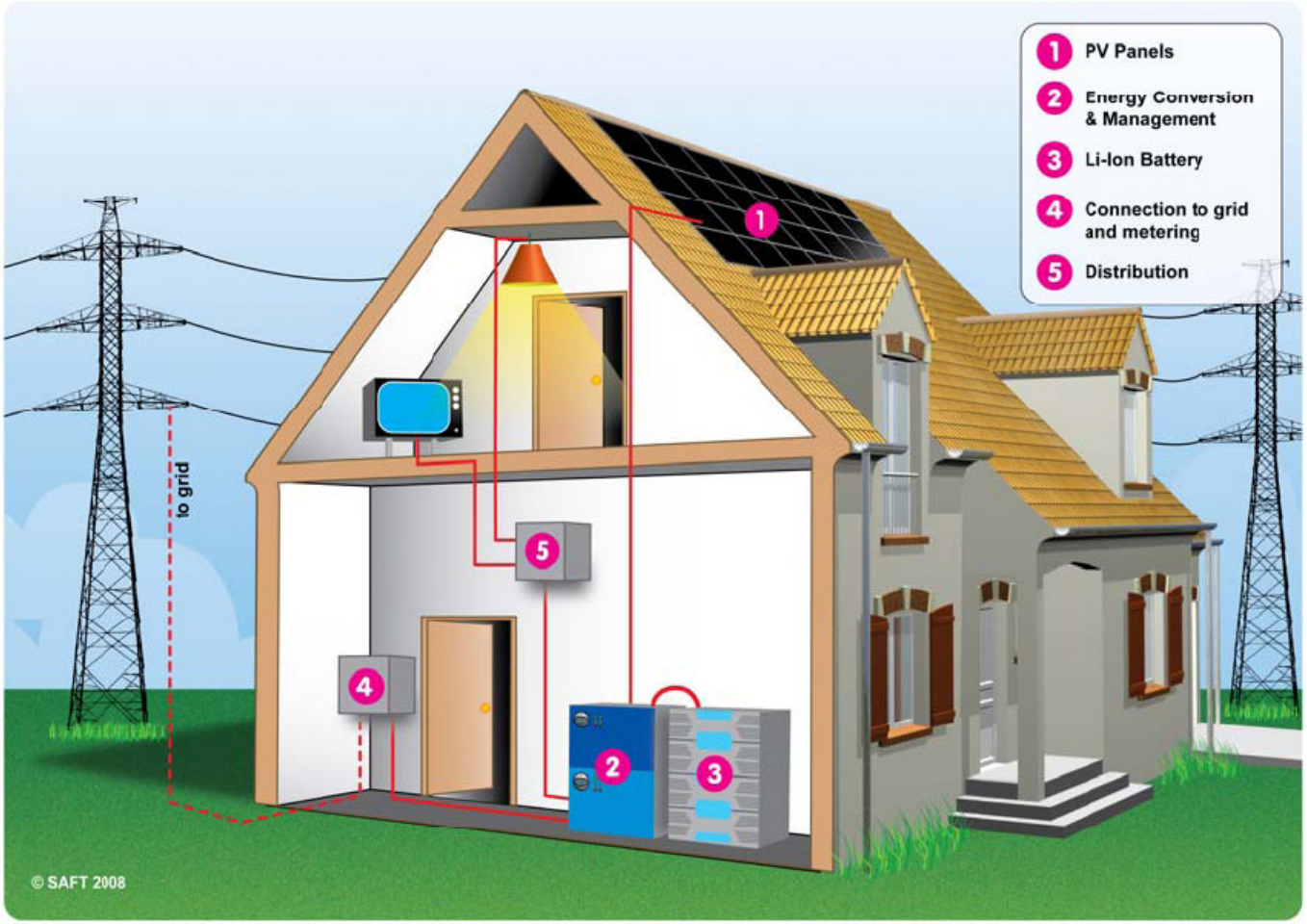
# SOL-ION PROJECT OVERVIEW (2)
# Objectives

- Provide the European industry with high value technical solutions in orders to offer new services to producer/consumer and to grid operators
- Simulate energy management strategies, their benefits and grid impact
- Demonstrate economical viability and added value of storage
- Develop an innovative, integrated, modular product associating energy conversion/storage/energy management
- Proceed to a large field demonstration with the deployment of 75 systems

# SOL-ION PROJECT OVERVIEW (3)
# Milestones

- Kick-off: March 2008
- Product design review: July 2009
- Systems deployment: December 2009 to June 2010
- Technical and economical outputs: September 2010
- End: September 2011

# PRODUCT CONCEPT AND CHARACTERISTICS (1)
## System architecture

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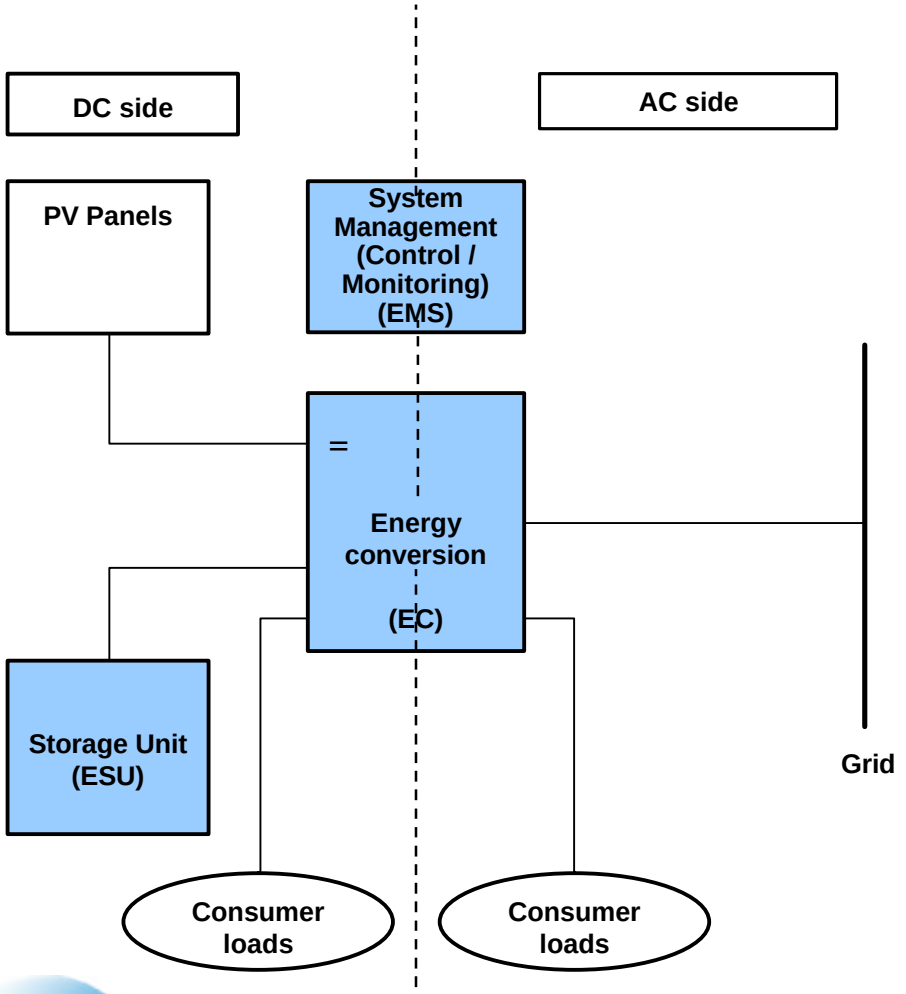
# PRODUCT CONCEPT AND CHARACTERISTICS (2)




## Typical characteristics

- PV:
  - 2 to 5kWp
- Li-Ion Battery:
  - 5 to 15kWh
  - 170V to 650V
  - 20 years lifetime
- System functions
  - multidirectional energy flows
  - self consumption
  - grid support
  - back-up

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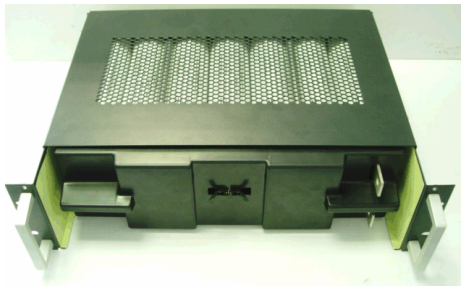
# LITHIUM-ION STORAGE TECHNOLOGY (1)

- Li-Ion is the only battery technology which offers a technological breakthrough and which have the potential to achieve targets on:
  - life time > 20 years w/o maintenance
  - energetic efficiency > 95%
  - flexibility in operation: s.o.c, d.o.d
  - life cycle cost < 3 eurocents per kWh delivered
  - environmental impact
- It is widely used in portable devices and will be dominant tomorrow in hybrid electric vehicles and stationary applications.

# LITHIUM-ION STORAGE TECHNOLOGY (2)



First generation of PV battery deployed in Guadeloupe


HEV battery for Mercedes S-Class and BMW 7 series

Modular unit for FACTS in a 5200V/600 kW battery

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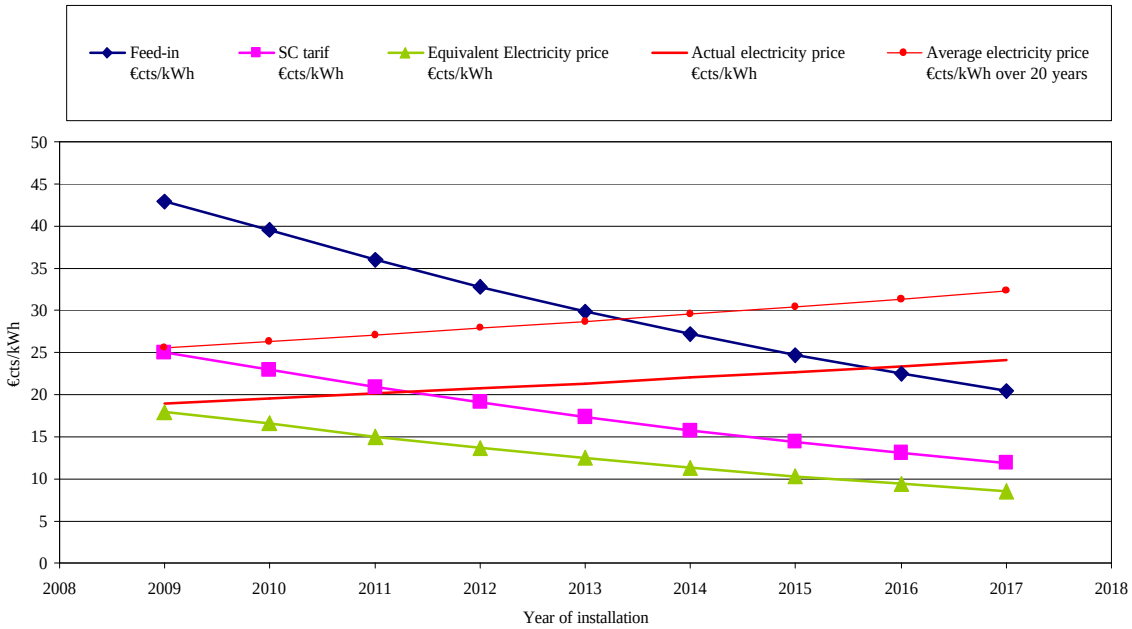
# ECONOMICAL ASSESSMENT AND VALUE OF STORAGE (1)

- The economical assessment takes into account
  - energy management strategies: self consumption, grid support, peak shaving…
  - load profiles and energy flows
  - size of installation and equipments: PV panels, conversion, battery
  - electricity price evolution
  - feed-in tariff and self consumption tariff evolutions
- It has to determine
  - the best strategy for energy management
  - the optimum size of the installation: ratio kW panels/kWh battery
- And to propose a business model

# ECONOMICAL ASSESSMENT AND VALUE OF STORAGE (2)

As an example, the new German law on energy, applicable from 2009, represents a major evolution:

- storage is considered as a part of renewable energies
- incentive for self consumption
- best economical conditions on distributed systems (< 30 kWp)




With such figures, ROI with a SOL-ION product is:

- 8 to 10 years in 2012
- 5 to 8 years in 2020

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# ECONOMICAL ASSESSMENT AND VALUE OF STORAGE (3)

Value of energy storage can be summarised as follow:

- For household:
  - energy self sufficient: local production = local consumption
  - safe against outages
  - high efficiency
  - sell excess of PV energy when demand is high
- For grid operator:
  - reduce peak demand
  - avoid disturbances (voltage, frequency…)
  - defer grid upgrades
- Socio-economic
  - allow to increase PV electricity in energy mix
  - facilitate energy savings

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# CONCLUSIONS AND PERPECTIVES

- Distributed PV systems with energy storage make energy available where and when it is needed
- SOL-ION concept brings most added value to stakeholders
  - houses self sufficient
  - grid support and stabilisation
  - ...
- SOL-ION product gives a competitive advantage to the European industry
- Next step, beyond SOL-ION, will be large deployments (thousands of systems), in Europe, before commercial introduction from 2012

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# Thank you for your attention

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