



Sol-ion Project

The solution defined, designed,
delivered

Press Conference at Intersolar
Munich, June 9, 2010

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LIPPERT, Michael (Saft)

Supported by :



Recognized by :





- Introduction to the Sol-ion Project
- System solution
- Field trial
- Conclusion & Perspectives



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- **French and German industries and institutes join forces to develop an innovative, competitive PV energy system providing added value to all stakeholders.**

Objectives



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- Develop an innovative, integrated, modular product associating
 - Energy conversion
 - Energy storage
 - Energy management
- Simulate energy management strategies, their benefits and grid impact
- Demonstrate economical viability and added value of storage
- Proceed to a large field demonstration
- Provide a marketable high value industrial solution offering new services to producer/consumer and to grid operators

Project March 2008 - December 2011

Who does what ?



- Saft Global Coordinator
Lithium-ion energy storage development

VOLTWERK

- Voltwerk System development - Energy conversion and management
Coordination & Deployment in Germany

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- Tenesol System development - Energy conversion and management
Deployment in France



- INES System modelling

- Fraunhofer System functionalities, grid connection issues and
economical assessment

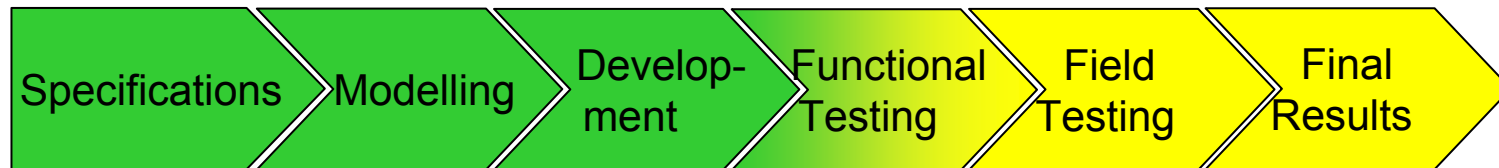
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- ISEA System modelling and inverter studies

- ZSW Field demonstration: data acquisition and analysis



- EON Sites selection and grid connection





- **Integrated Energy System**

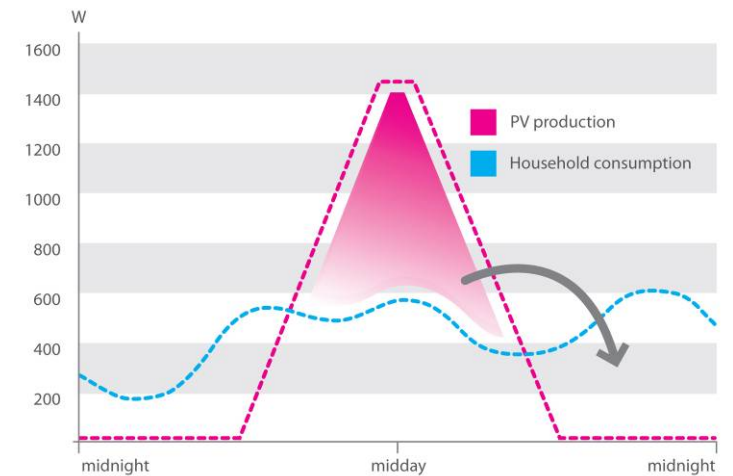
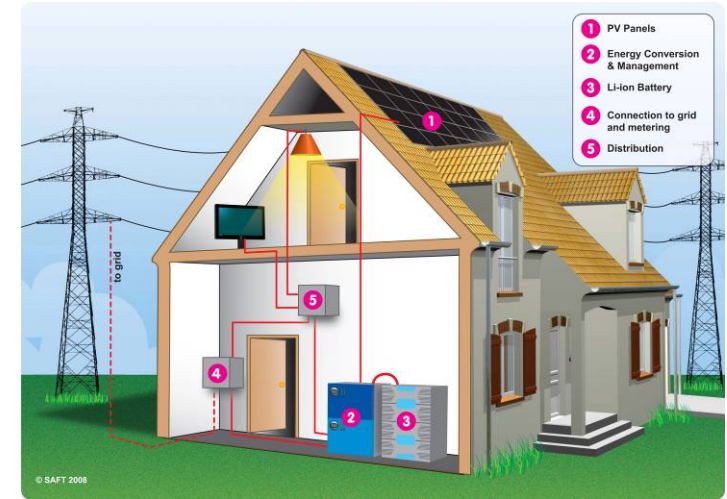
- Conversion, storage & management of PV Energy
- 75 systems in France & Germany

- **Maximise Self-Consumption**

- Towards energy autonomous buildings

- **Demand Side Management**

- Peak Shaving effect
- Integrating future smart grid





The System Solution

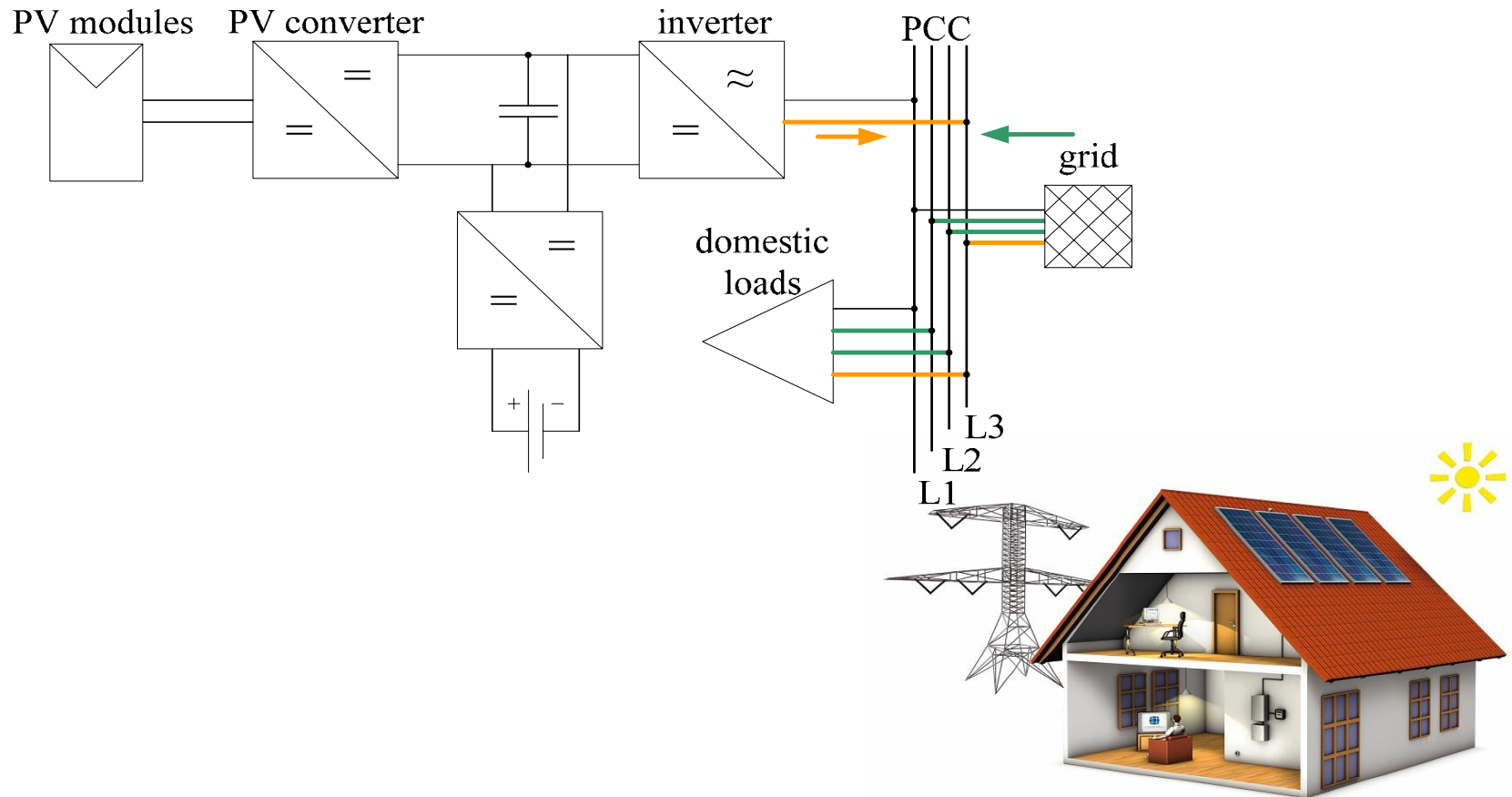
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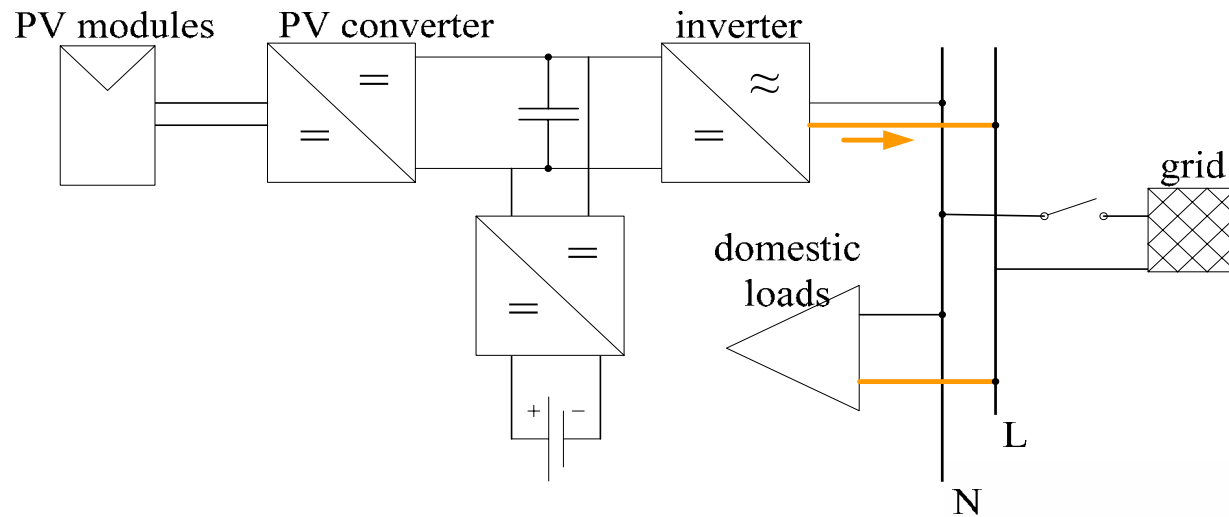
Self-consumption in Germany



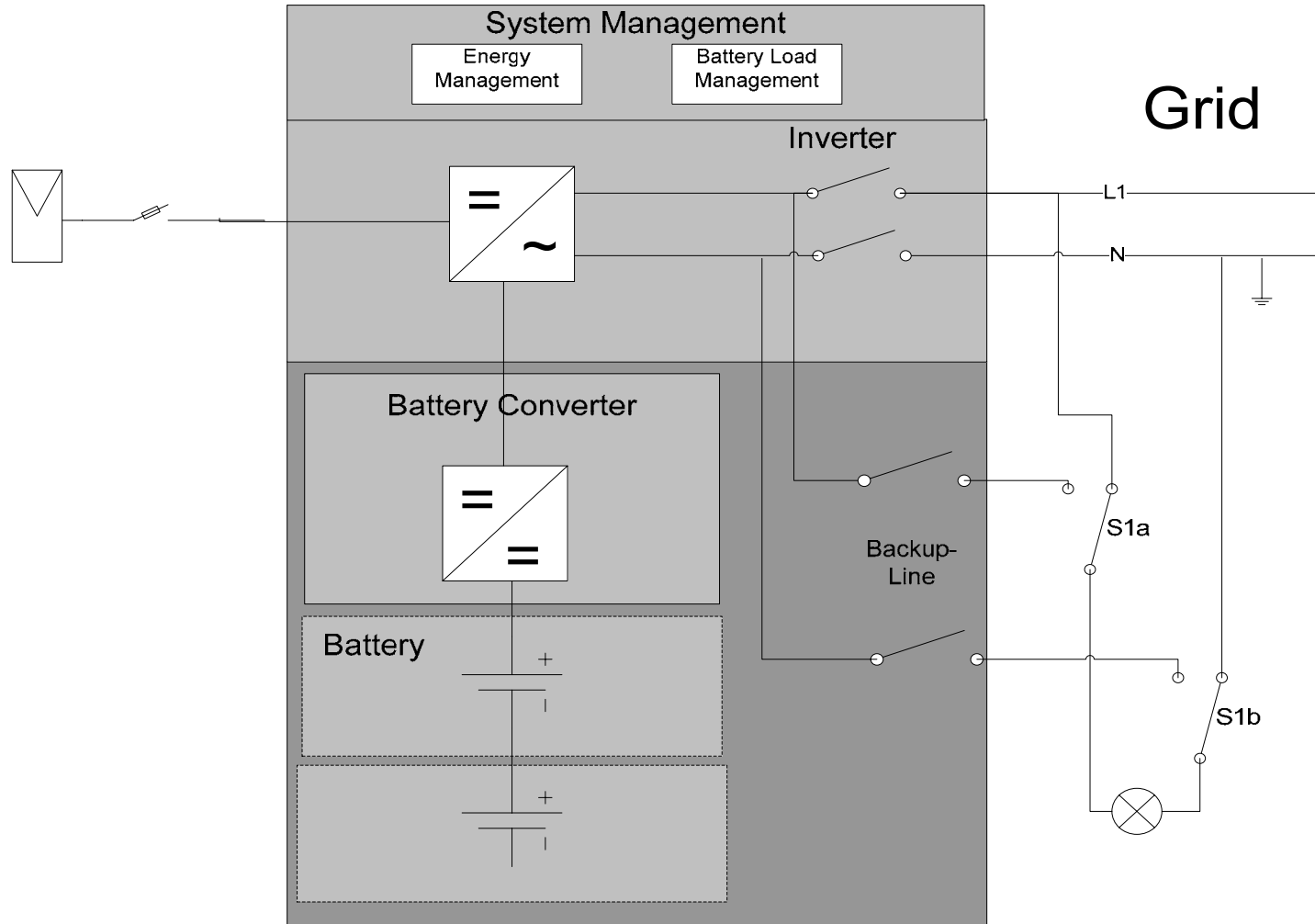
- | Self-consumption of solar power, while household is connected to the grid.
- | Parallel feed in of solar power and consumption.
- | Simple installation. No complex load management necessary.
- | Solution is independent from number and size of loads in the house.



Self-consumption in France



- | Self-consumption of solar power, while household is disconnected from the grid.
- | Loads are limited to 5kW. In case of overload, grid connection is established.
- | Household is independent from weak grid.
- | Additional Service: Demand driven injection.





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Energy Management System



Inverter

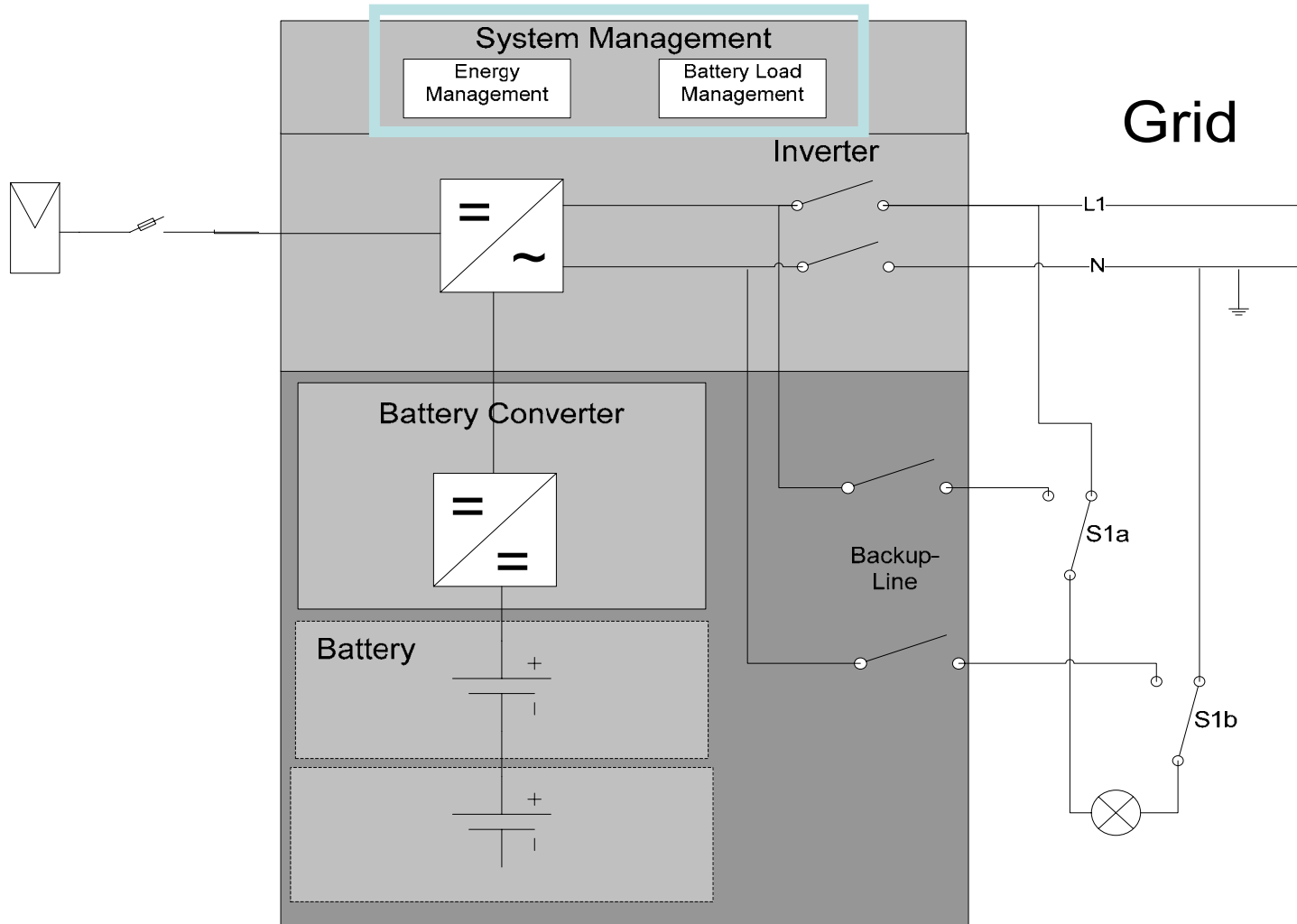


Battery converter



Battery

System Architecture



Maximising Local Self-Consumption of PV Energy



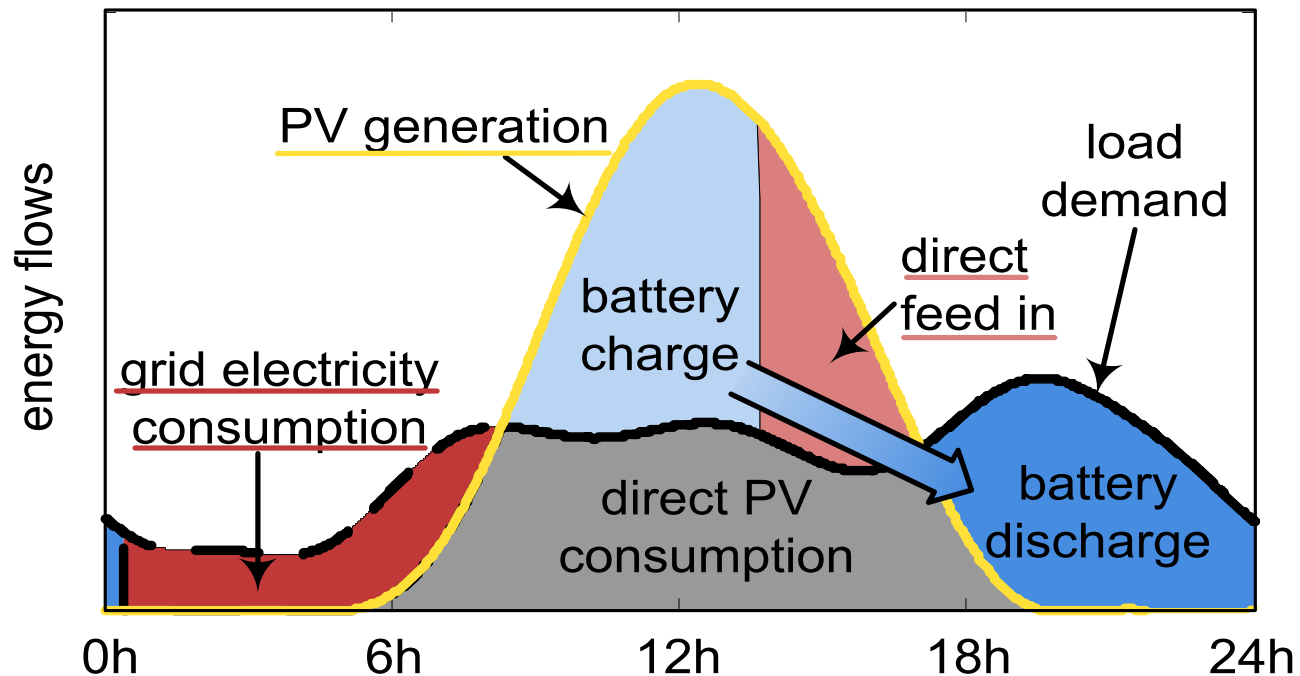
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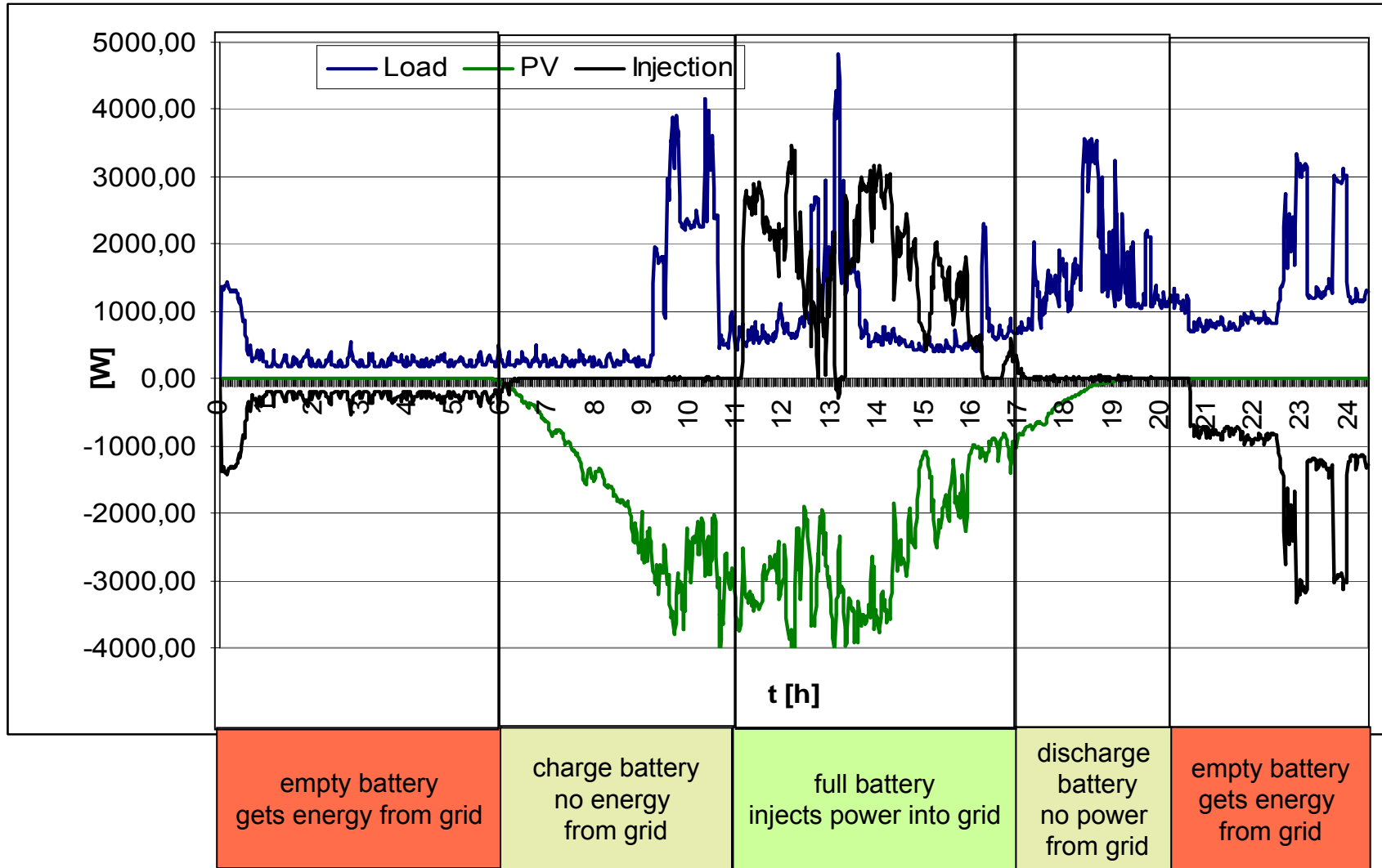


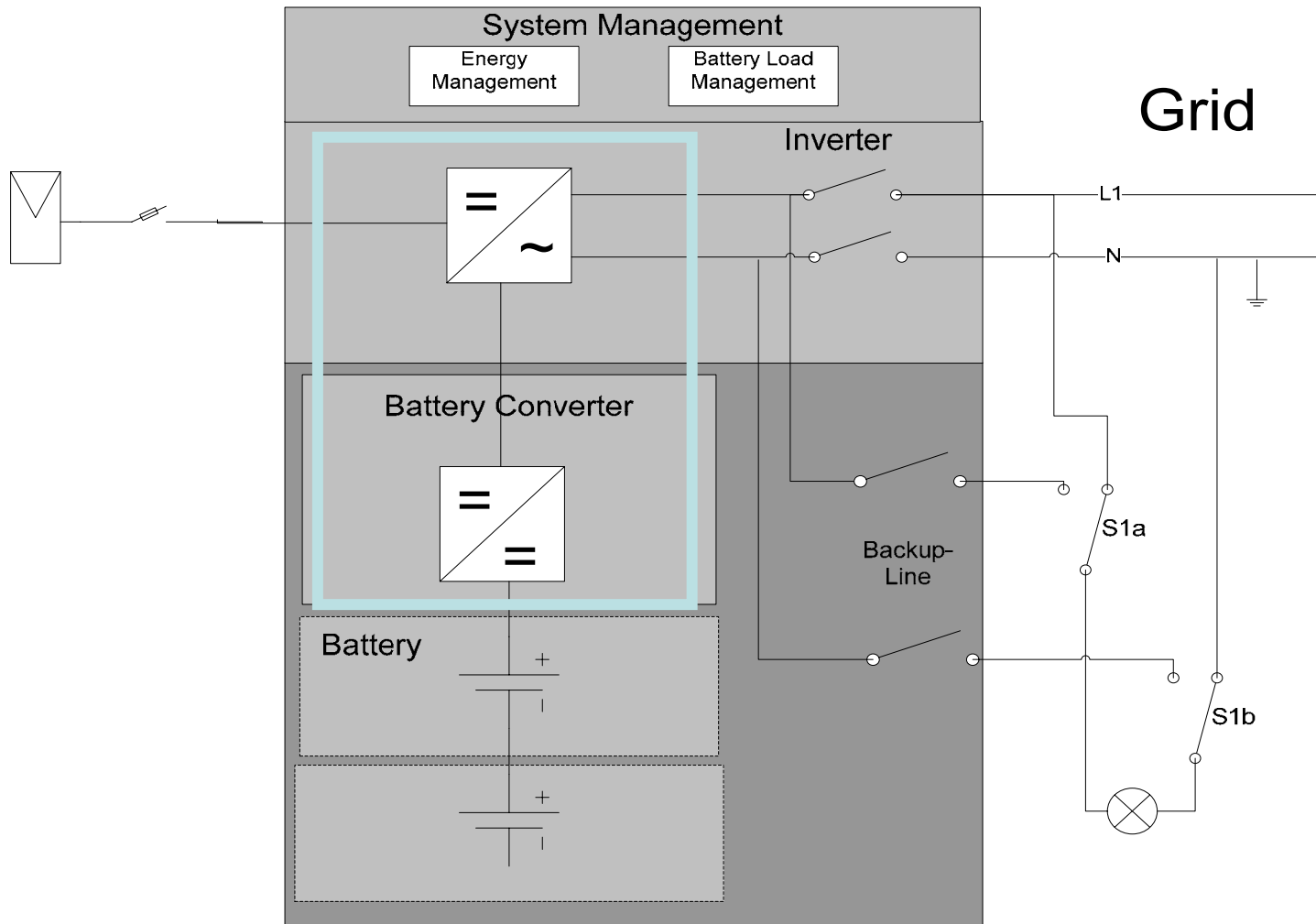
Scheme of one day with PV generation and load demand

- Conventionally, PV energy already partly self-consumed
- Use of battery increases self-consumption

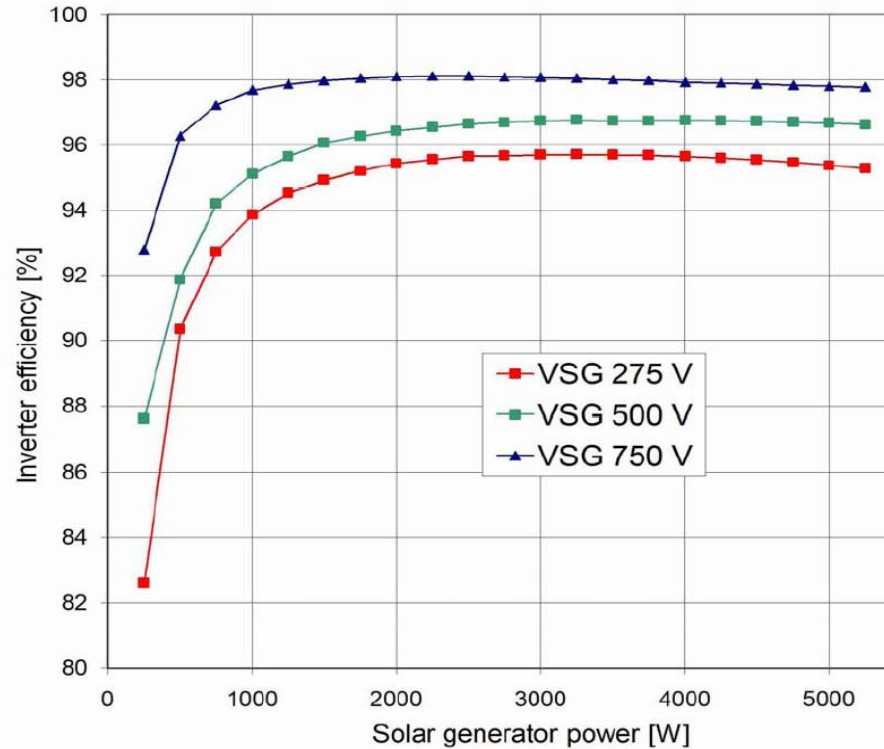


Energy Management System

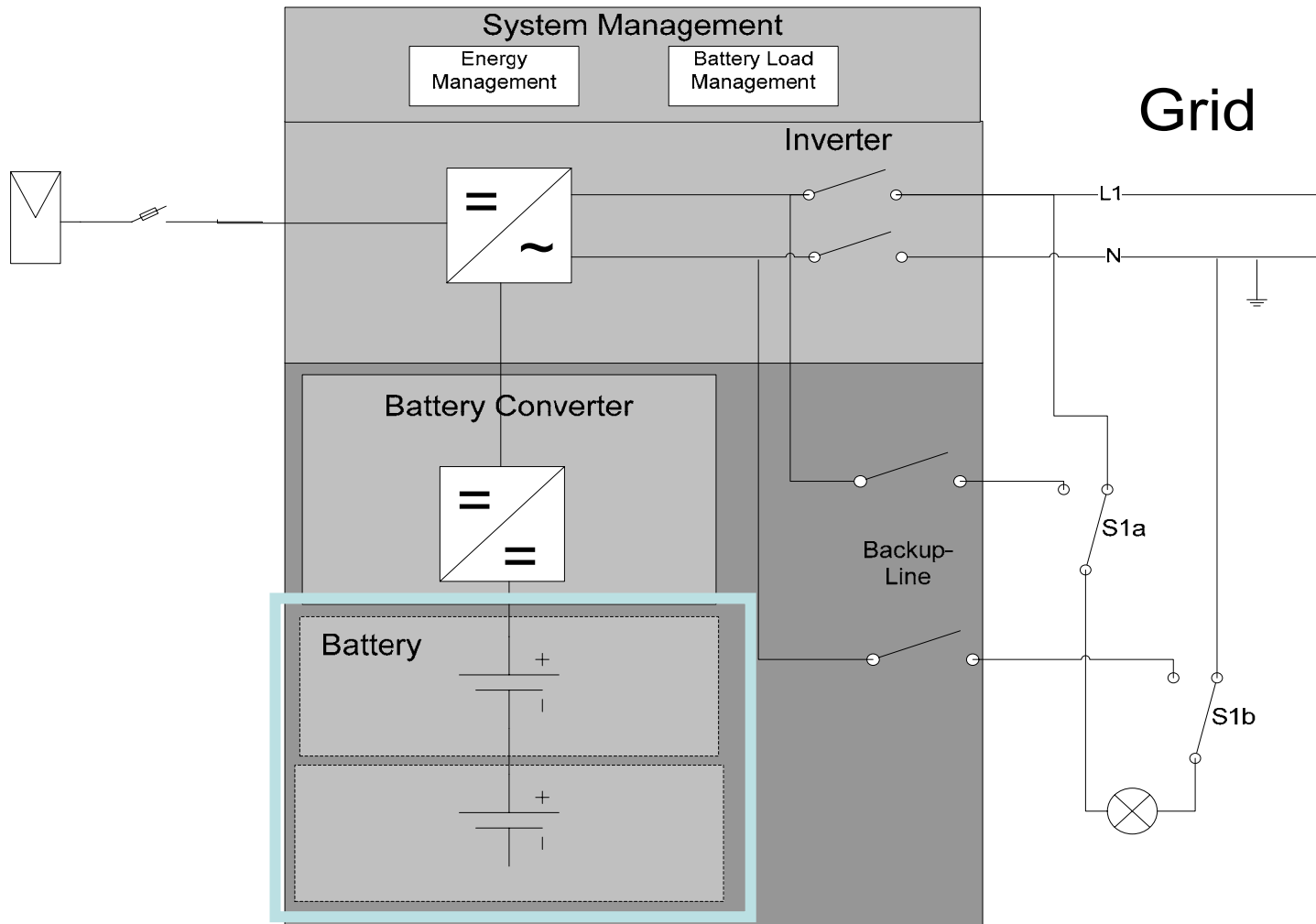




Inverter and Battery Converter



- | The interaction of inverter and battery converter is optimised for an optimal overall system performance.
- | Both components have a high efficiency (>97%)
- | Battery converter charges and discharges the battery.
- | Battery converter improves efficiency of the inverter to optimize overall system performance.
- | In Backup-Mode or Island-Mode the battery converter additionally stabilizes the DC link of the inverter.



The Li-ion Battery System



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Modular Design

- **Energy Modules 48V, 2.2 kWh**
 - 14 Li-ion VLE cells
 - Cell balancing
 - Voltage & temperature control

- **BMM (Battery Management Module)**
 - CanOpen bus communication
 - | SOH, SOC *)
 - | Operating conditions
 - | Alarms
 - Battery protection

*) SOC: state of charge SOH: state of health



Example of battery system
288V, 13kWh

Why Li-ion ?



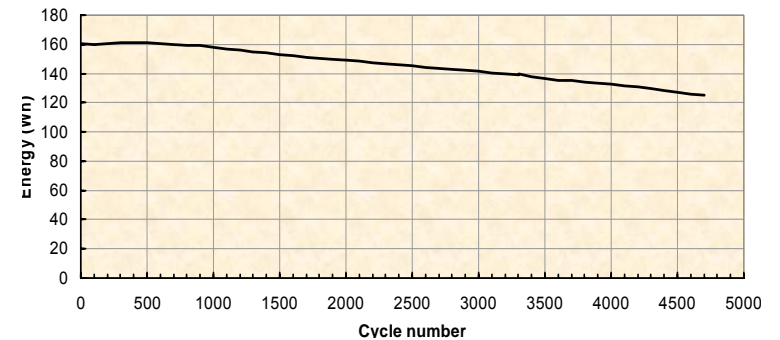
● Features

- Compact, sealed, w/o maintenance
- Very high efficiency: 95%
- Long calendar and cycle life
20 years at 60% DOD / day
- SOC indication
- High flexibility in operation
 - | Energy / power
 - | Entire DOD available, partial cycling

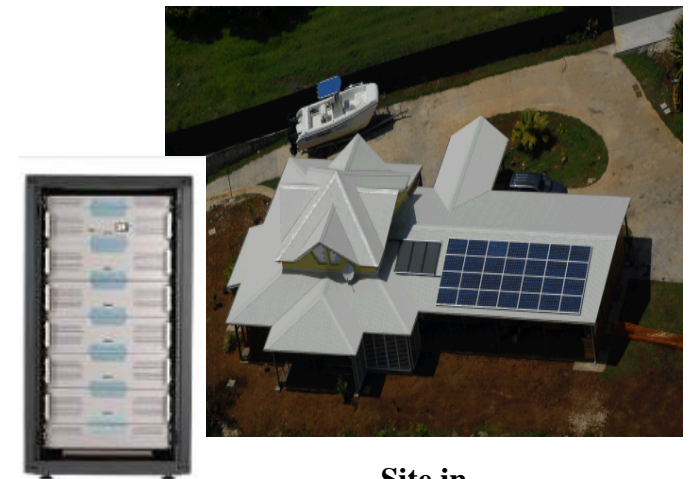
● Experience

- Exploration since 2005 (INES)
- Guadeloupe field test 2008/10
 - | 97% efficiency
 - | 50% daily cycling
 - | Grid support

*) DOD depth of discharge



Cycle life assessment at 20°C at 80 % DOD



Site in
Guadeloupe

Achievements



- **Industrial Design**
- **System Approach**
- **High Reliability & Safety**
 - Safety driven development
 - IEC 61508 methodology (functional safety)
 - | SIL-2 level
- **Battery Qualifications**
 - UN, EMC, SIL
- **System Safety**
 - Full compliance to IEC 60950-1 and IEC 62040 *)
 - IP, insulation, IK, stability, access, ...
 - Battery abuse testing
 - Qualification by VDE underway

*) IEC 60950-1 Information technology equipment – safety, general requirements
IEC 62040 general & safety requirements for UPS used in operator access areas



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Field Testing

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Field Trial



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- Field trial will start after intensive testing at partner institutes in the next months.
- Targets
 - Verify rate of self-consumption for different private households
 - Compare the different concepts of self-consumption
 - Measure the influence of Sol-ion installation on the low voltage grid
- The field trial will be monitored by IWES, INES and ZSW.
- A large amount of field data will be collected to verify existing models about system and component performance.
- ISEA and ZSW also verify the aging of the Lithium-Ion batteries.

Field Trial Germany



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- Sol-ion partners decided to install systems in the Bavarian region around Schwandorf.
- This region is monitored by Eon.Bayern.
- IWES, Eon.Bayern and Voltwerk have already talked to dedicated system installers.
- A catalogue for test criteria has been defined.
- ~ 20 systems for different user groups will be installed.
- First installations will start in fall 2010.



Field Trial France



- Installation will start in fall 2010
- The German self-consumption mode will be compared to the „French“ mode.
- Tenesol and INES have started to investigate possible installations at Guadeloupe, Corsica and France mainland.
- Field trial will be monitored by ZSW and INES.
- ~ 40 systems at different locations Guadeloupe, Corsica, France.





Is Energy Storage Competitive ?

What are the roadblocks ?

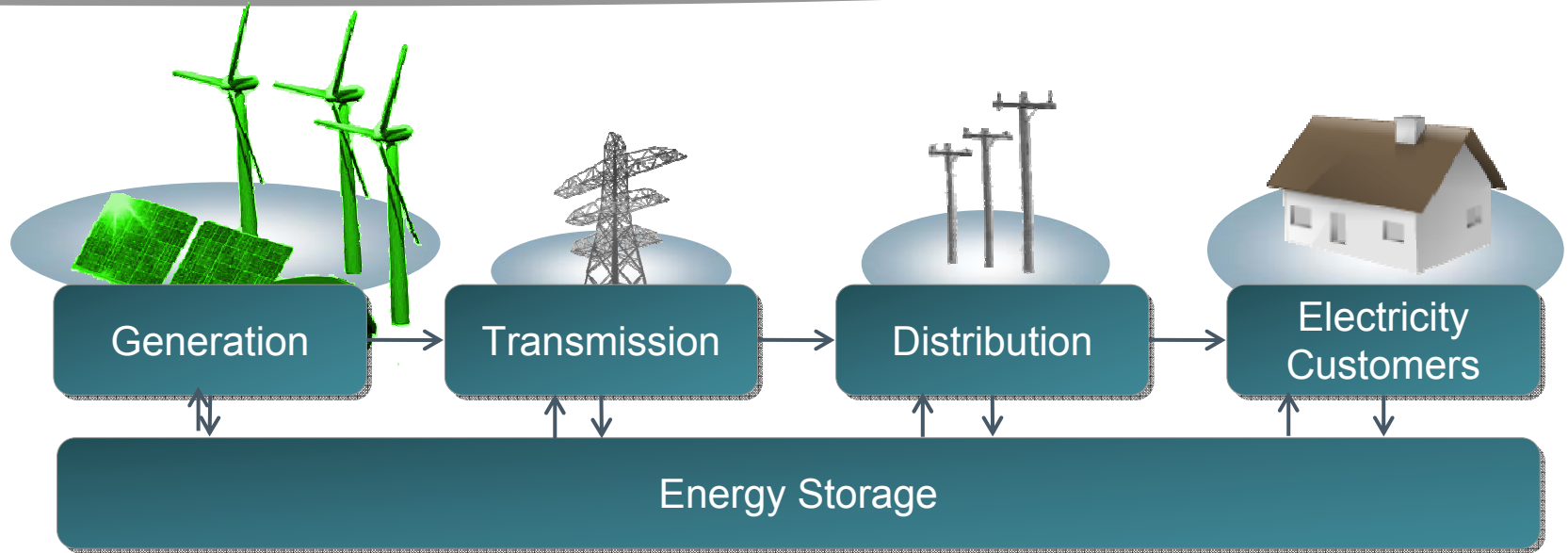
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Energy Storage Value Chain



Storage

- Can be located at all places along the value chain
- Can provide value simultaneously to different stakeholders

BUT

- No compensation schemes for storage among stakeholders
- No clear ownership and operating models
- No models for materializing value streams



Materialise the Value



Mechanisms to materialise ESS value streams

- **Cost avoidance**

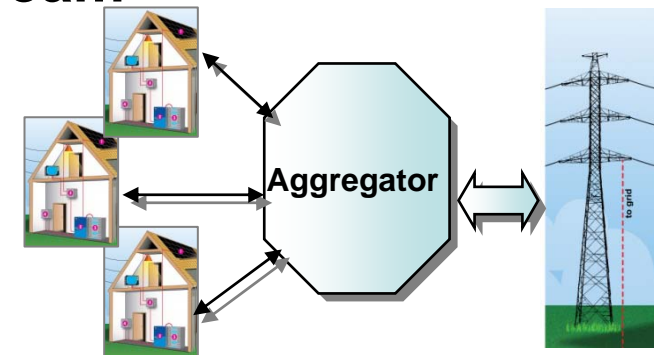
- Grid upgrades
- Substitute conventional ancillary services
- Substitute conventional peak power generation

- **Selling services upstream / downstream**

- **Aggregate distributed generation**

- **Increase value of clean energy**

- Time of use pricing (offer / demand market mechanisms)
- Peak demand charges
- « Stability Bonus » (Germany)





Thanks for Your Attention

Questions ?

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