NEXT GENERATION OF SMART INVERTERS AND ASPECTS WITH RESPECT TO THE ENERGY TRANSITION
DISCLAIMER

IMPORTANT LEGAL NOTICE

This presentation does not constitute or form part of, and should not be construed as, an offer or invitation to subscribe for, underwrite or otherwise acquire, any securities of SMA Solar Technology AG (the "Company") or any present or future subsidiary of the Company (together with the Company, the “SMA Group”) nor should it or any part of it form the basis of, or be relied upon in connection with, any contract to purchase or subscribe for any securities in the Company or any member of the SMA Group or commitment whatsoever.

All information contained herein has been carefully prepared. Nevertheless, we do not guarantee its accuracy or completeness and nothing herein shall be construed to be a representation of such guarantee.

The information contained in this presentation is subject to amendment, revision and updating. Certain statements contained in this presentation may be statements of future expectations and other forward-looking statements that are based on the management’s current views and assumptions and involve known and unknown risks and uncertainties. Actual results, performance or events may differ materially from those in such statements as a result of, among others, factors, changing business or other market conditions and the prospects for growth anticipated by the management of the Company. These and other factors could adversely affect the outcome and financial effects of the plans and events described herein. The Company does not undertake any obligation to update or revise any forward-looking statements, whether as a result of new information, future events or otherwise. You should not place undue reliance on forward-looking statements which speak only as of the date of this presentation.

This presentation is for information purposes only and may not be further distributed or passed on to any party which is not the addressee of this presentation. No part of this presentation must be copied, reproduced or cited by the addressees hereof other than for the purpose for which it has been provided to the addressee.
NEXT GENERATION OF SMART INVERTER SYSTEMS AND ASPECTS WITH RESPECT TO THE ENERGY TRANSITION
SOLAR PV IS ON ITS WAY TO COMPETITIVENESS IN MORE AND MORE REGIONS AROUND THE WORLD

Atomic Power Plant Hinkley Point C in Somerset, UK

- Construction time: c. 10 years, to be commissioned 2025
- Operator: Électricité de France (EdF)
- Power production p.a.: c. 26,000,000 MWh
- Electricity price per kWh: c. €0.12 ($0.13)

PV Power Plant in Lackford, UK

- Construction time: c. 4–5 months, commissioned 2014
- Operator: Low Carbon
- Power production p.a.: c. 20,168 MWh
- Electricity price per kWh: c. €0.09 ($0.10)

➢ In Germany’s latest round of PV auctions in April 2016, €0.07 to €0.08 ($0.08 to $0.09) were granted to the bidders.

1. Annual power production sufficient to supply c. 7,428,571 households with an average demand of 3,500 kWh
2. Annual power production sufficient to supply c. 5,762 households with an average demand of 3,500 kWh
In 2010, focus was on DC to AC conversion in the best possible way.

In 2016: Integration into complex systems is key.

The energy market is in on the move. The energy transition is and will be a fundamental change.
BUT THE STRUGGLE REMAINS: POLITICAL DECISIONS CAN QUICKLY CHANGE A FRONTRUNNER’S POSITION

In 2010, Germany had 45% of the world PV market.

Today, Japan, China and the USA have taken over the pole position.

To get back on top, Europe has to become the frontrunner again in the energy transition.
3 STEPS TO FACILITATE THE ENERGY TRANSITION

1. STANDARDIZATION – being SMART about SMART HOME

2. Bring in more PV DRIVERS to ACCELERATE THE ENERGY TRANSITION

3. PROVIDE DATA SERVICES FOR GRID STABILITY and to SUPPORT the ENERGY TRANSITION
SMA IS THE CLEAR #1 IN THE GLOBAL PV INVERTER INDUSTRY

Key Facts

Headquartered in Niestetal since 1981

Cum. nearly 50 GW installed worldwide

Sales of 1 billion EUR in 2015

> 3,500 employees, thereof 500 in R&D

Present in 20 countries; 4 production sites

Stock-listed since 2008
SMA’S COMPLETE PRODUCT PORTFOLIO OFFERS SOLUTIONS FOR ALL REQUIREMENTS WORLDWIDE

SUNNY CENTRAL
- 24 GW cumulative installed inverter capacity
- Utility

SUNNY TRIPower
- 13 GW cumulative installed inverter capacity
- Commercial

SUNNY BOY
- 13 GW cumulative installed inverter capacity
- Residential

SUNNY BOY STORAGE
- SUNNY CENTRAL STORAGE
- SUNNY ISLAND

Off-Grid & Storage

O&M / WARRANTY EXTENSION
- Service

SMA’s cumulative installed power of nearly 50 GW is the basis for a successful service and storage business.
SMA POSITIONED ITSELF EARLY ON FOR THE DIGITIZATION OF THE ENERGY SECTOR

Energy Management

SMA SMART HOME

Storage Technology

TESLA

DAIMLER

Data-based Business models

TenneT

Enhanced self-consumption through intelligent system technology

Intelligent integration of (stationary) batteries into energy management

Supply of power generation and consumption data

With innovations and partnerships, SMA is well-prepared for the new requirements
SMA SMART HOME
**WHAT IS THE MEANING OF SMART HOME?**

|-----------------|-----------------------|--------------------------|-------------------|-------------------|
| ![Home Automation Icon](image) | ![Entertainment Systems Icon](image) | ![Security Icon](image) | ![Healthcare Systems Icon](image) | • Energy Monitoring  
• Energy Management  
• Smart Metering  
• HVAC control  
• Demand response access |

---

**SMA Smart Home is a subset of the general definition of „Smart Home“**

*IoT = Internet of Things*
LOCAL ENERGY MANAGEMENT IN A SMART HOME

1. **Sunny Boy Smart Energy** converts direct into alternating current and buffers up to two kilowatt-hours of solar energy.

2. **Sunny Home Manager** ensures the temporally optimized balance of generation and consumption.

3. **Sunny Places** for energy forecasts, remote monitoring and household energy management.

4. **Controllable loads**, that do not require a specific operation time, can be activated by Sunny Home Manager.

5. **Electric vehicle** can be used as additional electricity storage when combined with a corresponding wallbox.

6. **Thermal storages** have big capacity and are more cost effective than a battery.

Electrical and thermal storage combined with intelligent energy management is ideally suited to make distributed generation more flexible.
### SMA’S ENERGY MANAGEMENT AND STORAGE SOLUTIONS FOR OPTIMIZED SELF CONSUMPTION

<table>
<thead>
<tr>
<th>Energy Management</th>
<th>Sunny Home Manager System</th>
<th>Integrated Storage System</th>
<th>Flexible Storage System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Inverter System</td>
<td>Sunny Boy</td>
<td>Energy Management</td>
<td>Inverter integrated battery</td>
</tr>
</tbody>
</table>

#### Only SunnyBoy PV inverter
- **“Natural” self consumption:** 20% (typical)
- **Reduction of energy costs:** 25% (typical)

*) based on 5000kWh production per year

#### Sunny Home Manager + RC sockets
- **Self consumption:** 45% (typical)
- **Reduction of energy costs:** 45% (typical)

*) based on 5000kWh production per year

#### SunnyBoy Smart Energy
- **Self consumption:** 55% (typical)
- **Reduction of energy costs:** 52% (typical)

*) based on 5000kWh production and consumption per year, battery size: 2kWh

#### SunnyBoy + Sunny Island
- **Self consumption:** 65% (typical)
- **Reduction of energy costs:** 57% (typical)

*) based on 5000kWh production and consumption per year, battery size: 5kWh

▶ Increase the self-consumption rate = Use your own PV energy!
HOW MUCH POWER DOES MY HOUSE REQUIRE? … ENERGY MONITORING

FUNCTIONALITIES

Measure

- SMA Energy Meter
- Compatible RC-sockets

Visualize

- Total household consumption figure
- Monitor and remote control of household appliances

Transparency and knowledge:
- Where, when and how much energy does my house consume?
- What did I consume in the last month?
- Which devices are the ‘power hogs’ in my house?

Analyse and Control

Suggestions to increase energy efficiency
- Recommended actions, depending on energy prognosis
- When is the best time to use my solar power?

CUSTOMER BENEFIT

Always informed:
- Total household consumption figure
- Monitor and remote control of household appliances

SMA Solar Technology AG

SMA Smart Home - Energy Monitoring & Management
ENERGY APPLIANCES CONNECTED … … AND NOW IT ALL WORKS TOGETHER!

PARTNERS IN SMA SMART HOME

- Plug & Play
- Easy does it

**STIEBEL ELTRON**
(Wärme­­pumpen)

**MENNEKES®**
(Ladestationen für Elektro­autos)

**Miele**
(Weiss­ware)

**B/S/H/**
(Weiss­ware via EEBUS (ab Q3 2016))
EEBus is an initiative to take energy management in the frame of Smart Homes from proprietary solutions (e.g. Sunny Home Manager with only Miele appliances) to a more generic level (like an Ethernet network, where any device can exchange information with other devices within the network independent from the manufacturer).
PHOTOVOLTAICS AND E-MOBILITY ARE BEHIND SCHEDULE IN GERMANY (AND ELSEWHERE…)

Both technologies are connected.
E-mobility only makes sense if its energy originates from renewable sources

> Solar & Wind are main factors in energy transition
> 19.3% of gross electricity production in 2015
> Since 2014 new installations behind plan

> E-mobility is key for an ecological mobility transition
> E-cars have a clearly lower CO₂ footprint
> Batteries solve the volatility of renewables in the Smart Grid


23.05.2016 ETIP PV - Photovoltaics: centre-stage in the power system
The first generation e-vehicles changes the car industry.
The next generations will gradually change the energy transition.
SUPRA-REGIONAL ENERGY MANAGEMENT THROUGH AGGREGATION IN VIRTUAL POWER PLANTS

- Distributed Energy Resources (DER) in current market not attractive for the energy industry
- In future market design: aggregation in virtual power plants
- Systems pooled in virtual power plants
  > provide flexibility out of generators, consumer loads and storage devices to Smart Grids
  > trade needed excess energy on Smart Markets

> Technology for a flexible, secure and cost-effective connection of DER is available
CHALLENGE FOR TRANSMISSION SYSTEM OPERATORS

- Generation and consumption to be balanced at any time
- Consumption predicted using standard load curves
- Conventional generation scheduled according to predicted consumption and renewables generation
- Renewables are volatile
- Local energy management and storage tighten the situation
- Schedule to reality deviations settled through expensive control power
- Transmission System Operators (TSO) are responsible for the insertion of control power
- Today no measuring network for small and medium size PV plants available
- They need near-time photovoltaic (PV) projections and forecasts based on measured data
- Measuring network would have to be precise, secure and cost effective
DATA SUPPLY PILOT WITH TENNET TSO
PROJECT OVERVIEW

40,000 monitored PV systems in German TenneT control area
Thereof 20,000 PV systems with transmission every 5 minutes
1,500 PV systems with SensorBox

Every 5 minutes:
5 minute averages of the current PV power, irradiation and temperature aggregated to 5 digit ZIP codes

Projections and forecasts
Marketing of REL* electricity
Reduction of control reserve need
Congestion management
Feed-in management validation
Commercial balancing
Asset management

TenneT will considerably reduce the current projection delay

REL = Renewable Energy Law (Germany)
International rollout to regions with high PV penetration

Measures to continuously enhance data quality and quantity
THE TIME HAS COME …

… to standardize the way energy consumers and prosumers talk in a Smart Home

… to connect e-vehicles and grid to support the energy transition

… to support grid operation through near-time data out of distributed energy resources
Thank you for your interest!

Jan Van Laethem  
Regional Manager SMA Western  
Europe  
(Benelux, UK, France)  
SMA Solar Technology AG  
Sonnenallee 1, 34266 Niestetal,  
Germany  
+49 561 9522 0  

Jan.VanLaethem@SMA-Benelux.com