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[1]
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[2]
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 hWh

BUSINESS HAS BECOME MATURE

In 2010, focus was on DC to AC conversion in the best possible way.

In 2016: Integration into complex systems is key.

2010
Installer business

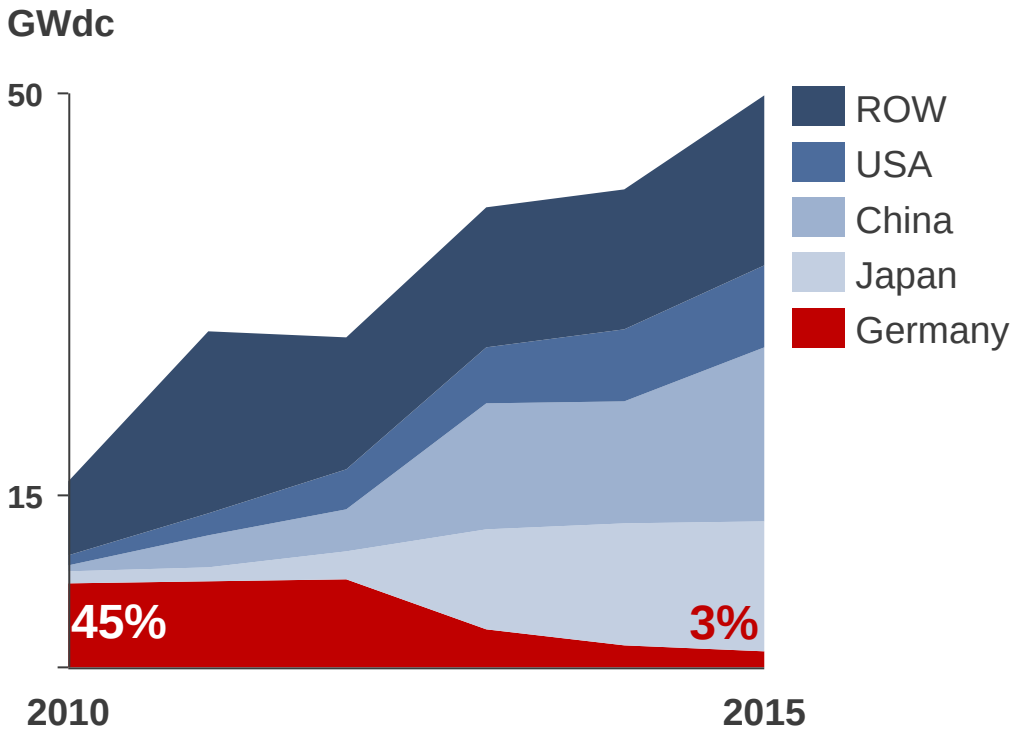
2016
Systems and Project Business

- **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

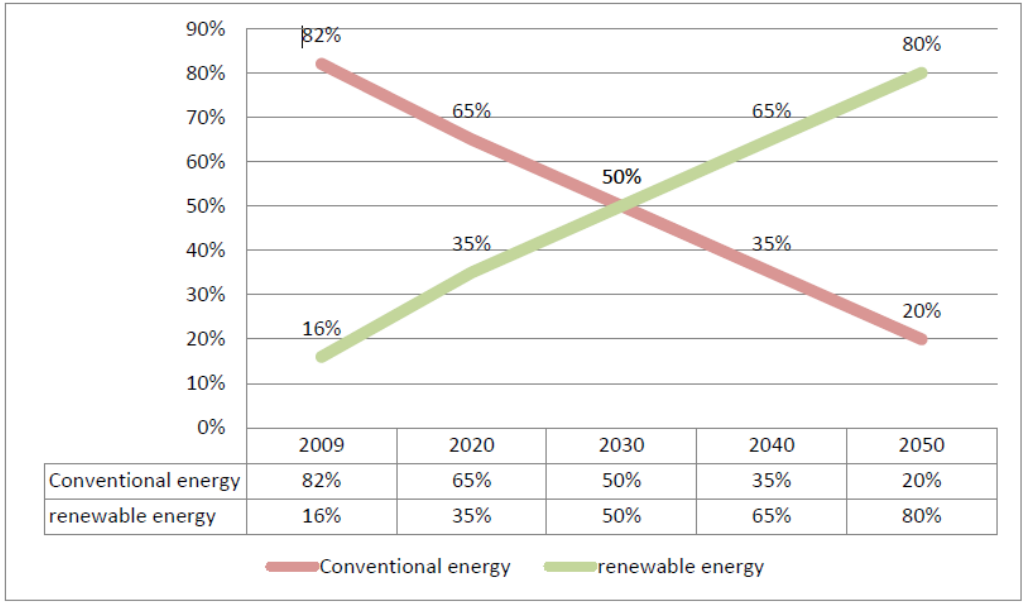
In 2010, Germany had 45% of the world PV market.

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



	2009	2020	2030	2040	2050
Conventional energy	82%	65%	50%	35%	20%
renewable energy	16%	35%	50%	65%	80%

The Energy Transition (example: Germany)

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

1. Source: EE plus White Paper

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

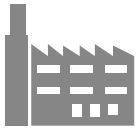
SMA'S COMPLETE PRODUCT PORTFOLIO OFFERS SOLUTIONS FOR ALL REQUIREMENTS WORLDWIDE

SUNNY CENTRAL

24 GW cumulative installed inverter capacity

Utility

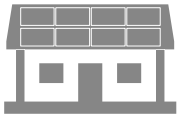
SUNNY TRIPOWER



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

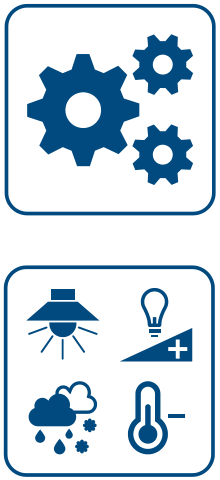
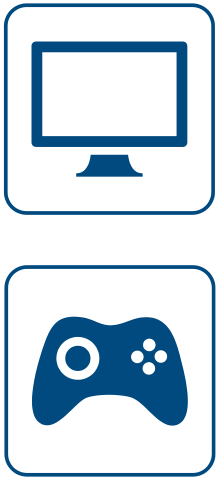
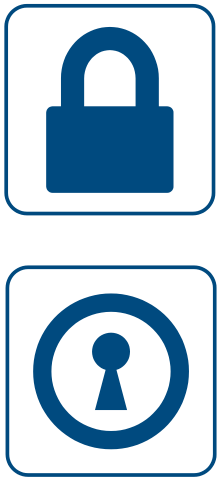
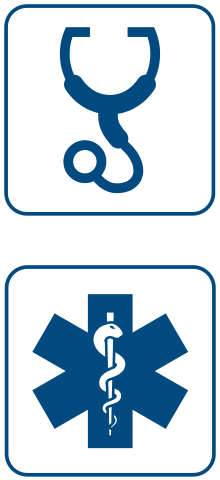
Energy Management	Storage Technology	Data-based Business models
SMA SMART HOME	TESLA DAIMLER	TenneT
		
Enhanced self-consumption through intelligent system technology	Intelligent integration of (stationary) batteries into energy management	Supply of power generation and consumption data

- **With innovations and partnerships, SMA is well-prepared for the new requirements**

SMA SMART HOME

WHAT IS THE MEANING OF **SMART HOME**?

SMART HOME

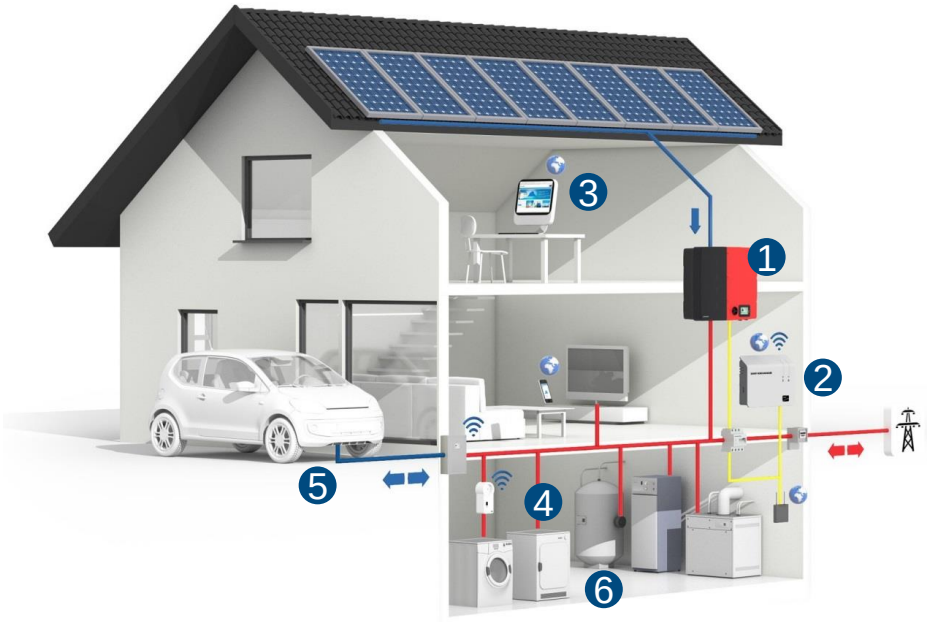
Home Automation	Entertainment Systems	Security (Peace of mind)	Healthcare Systems	Energy Efficiency
				• Energy Monitoring • Energy Management • Smart Metering • HVAC control • Demand response access

All devices interconnected in local network and via Internet cloud (IoT*)

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

*IoT = Internet of Things

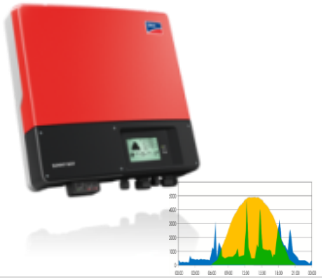
LOCAL ENERGY MANAGEMENT IN A SMART HOME



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**

	Energy Management		
Basic Inverter System	**Sunny Home Manager System**	**Integrated Storage System**	**Flexible Storage System**
Sunny Boy	Energy Management	Inverter integrated battery	PV inverter and battery inverter
			
Only SunnyBoy PV inverter • "Natural" self consumption: 20% (typical) • Reduction of energy costs: 25% (typical)	**Sunny Home Manager + RC sockets** • Self consumption: **45%** (typical) • Reduction of energy costs : 45% (typical)	**SunnyBoy Smart Energy** • Self consumption: **55%** (typical) • Reduction of energy costs: 52% (typical)	**SunnyBoy + Sunny Island** • Self consumption: **65%** (typical) • Reduction of energy costs: 57% (typical)
*) based on 5000kWh production per year	*) based on 5000kWh production per year	*) based on 5000kWh production and consumption per year, battery size: 2kWh	*) 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**

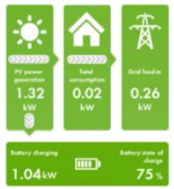
FUNCTIONALITIES

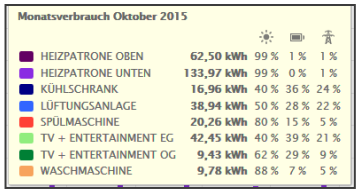
Measure

SMA Energy Meter

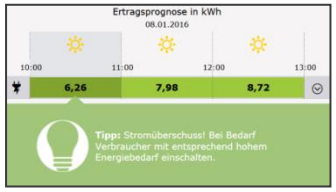
Compatible RC-sockets

Visualize





Analyse and Control



CUSTOMER BENEFIT

Always informed:

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

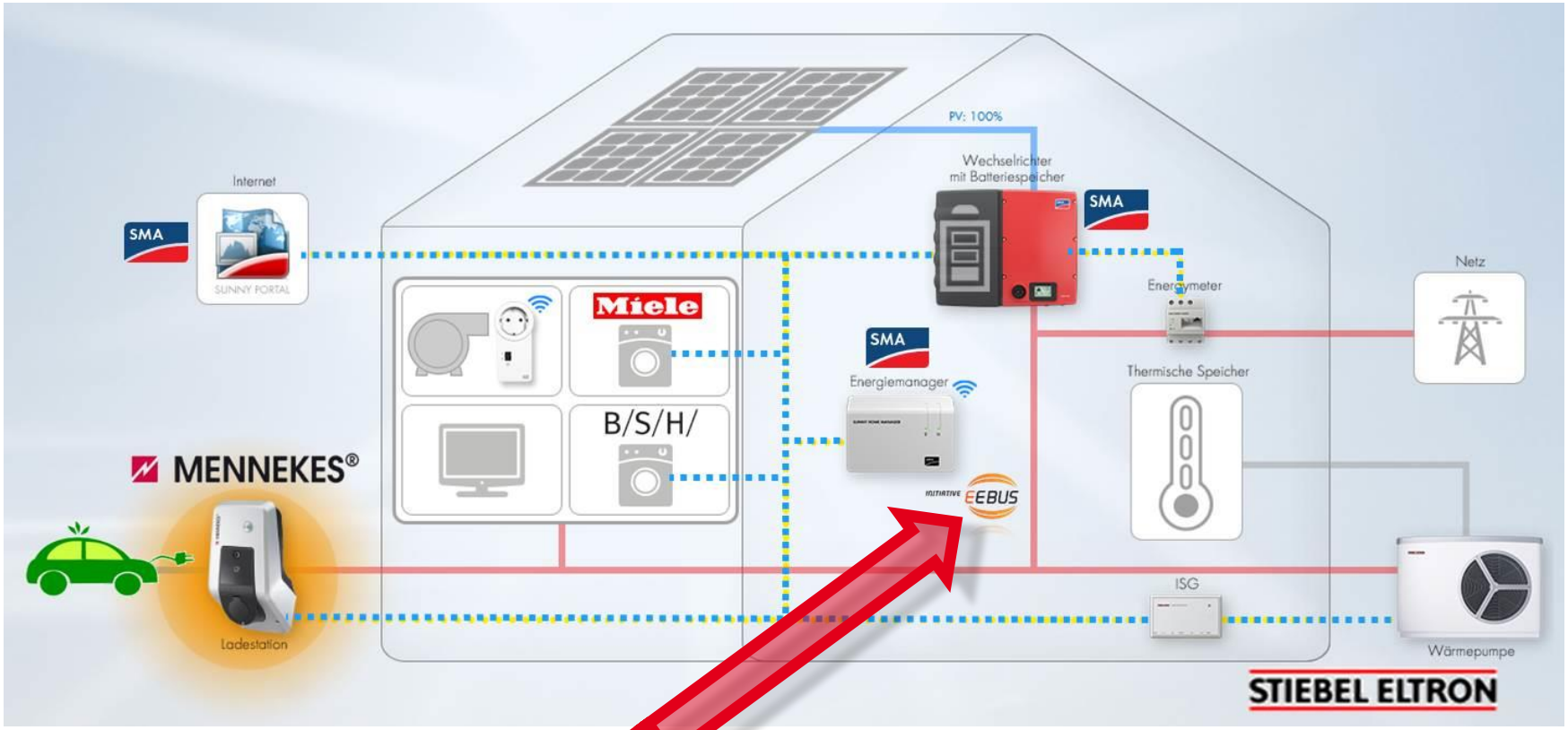
Transparency and knowledge:

- 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?

Suggestions to increase energy efficiency

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

ENERGY APPLIANCES CONNECTED …
… AND NOW IT ALL WORKS TOGETHER!



PARTNERS IN SMA SMART HOME

STIEBEL ELTRON
(Wärmepumpen)

Miele
(Weissware)

MENNEKES®
(Ladestationen für Elektroautos)

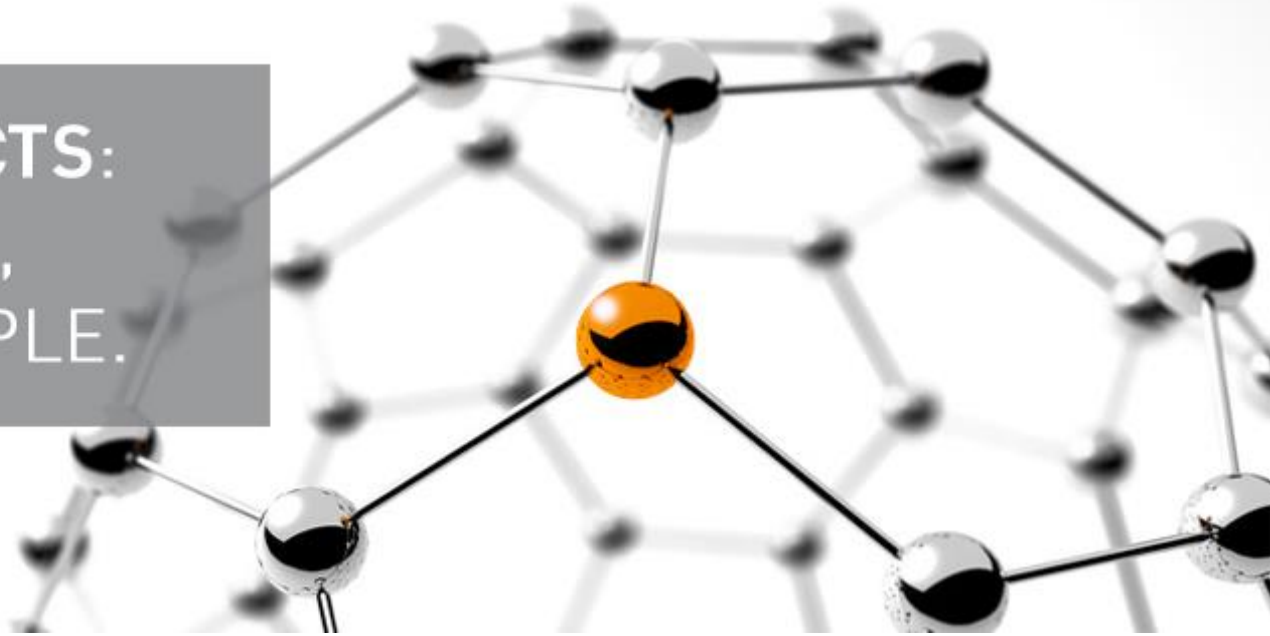
B/S/H/
(Weissware via EEBUS (ab Q3 2016))

- **Plug & Play**
- **Easy does it**

INITIATIVE EEBUS

SMA

EEBUS **CONNECTS**: TECHNOLOGIES, MARKETS, PEOPLE.



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).

European Commission

INITIATIVE EEBUS

SMA

www.eebus.org

E-MOBILITY


2
Allianz
energie
BZ


SUNNY HOME MANAGER
SMA
2,2 kW
1,1 kW
0 kW


SMA

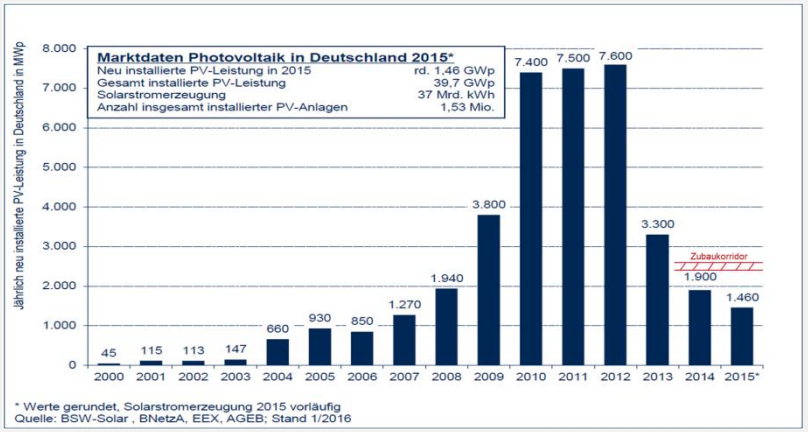
PHOTOVOLTAICS AND E-MOBILITY ARE BEHIND SCHEDULE IN GERMANY (AND ELSEWHERE…)

Photovoltaics

> Solar & Wind are main factors in energy transtion

> 19,3 % of gross electricity production in 2015

> Since 2014 new installations behind plan



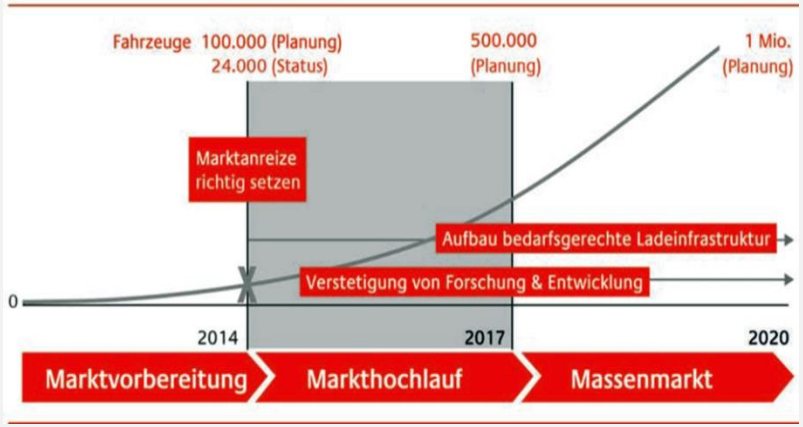
Quelle: BSW: „Meldedaten PV Bundesnetzagentur 2014/2015“, Berlin, 1.2.2016

E-cars

> E-mobility is key for an ecological mobility transition

> E-cars have a clearly lower CO_2 footprint

> Batteries solve the volatility of renewables in the Smart Grid



Quelle: Fortschrittsbericht 2014, Nationale Plattform Elektromobilität, Berlin, Dezember 2014

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

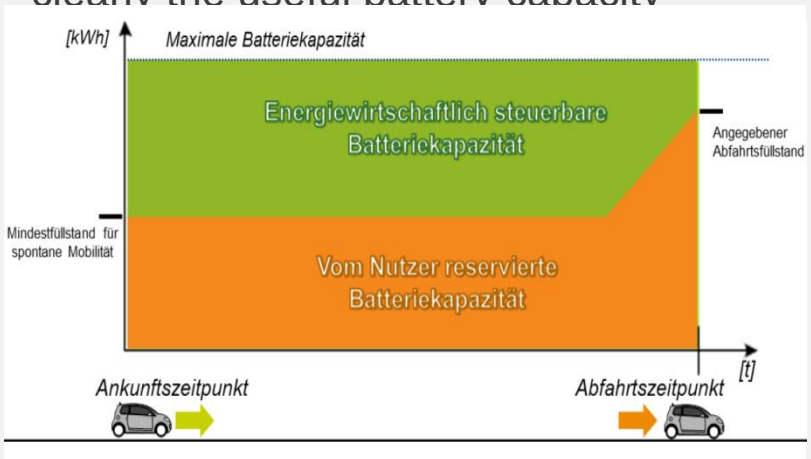
VEHICLE-TO-GRID INTEGRATION

Utilization of the flexibility in buildings

> E-vehicles connected to local EMS

> „Green Area“ usables in a competitive way
(in INEES about 30 %)

> User settings and needs indfluence clearly the useful battery capacity



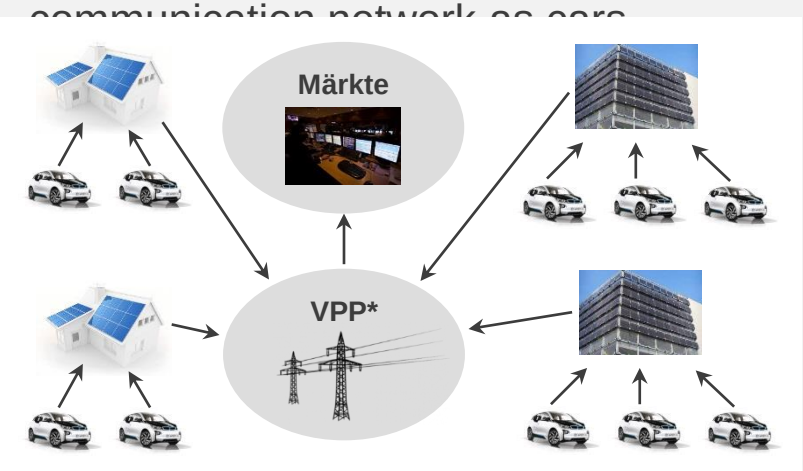
Connecting buildings to the Markets

> „Virtual Power Stations“

> Competitiveness strongly Regulation dependent

> Many preconditions already fulfilled

> Biggest obstacle: double use of the same communication network as cars



> The first generation e-vehicles changes the car industry.

> The next generations will gradually change the energy transition.

*: VPP = Virtual Power Plant = Virtuelles Kraftwerk

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

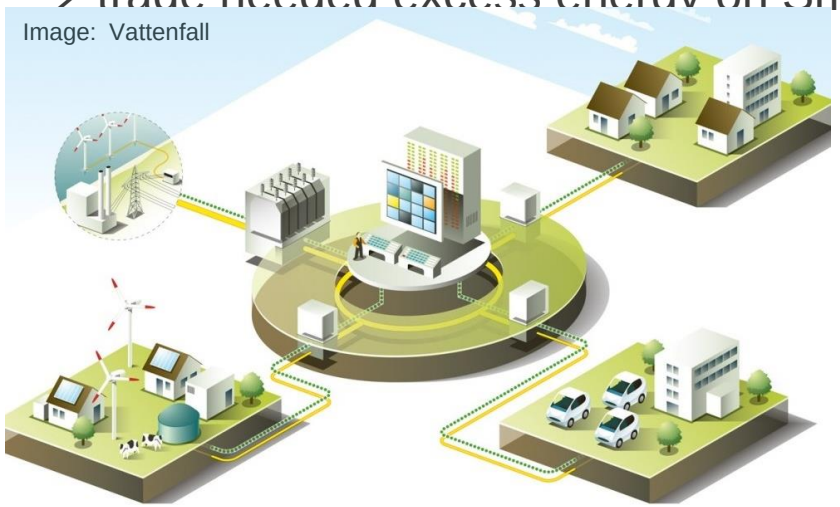
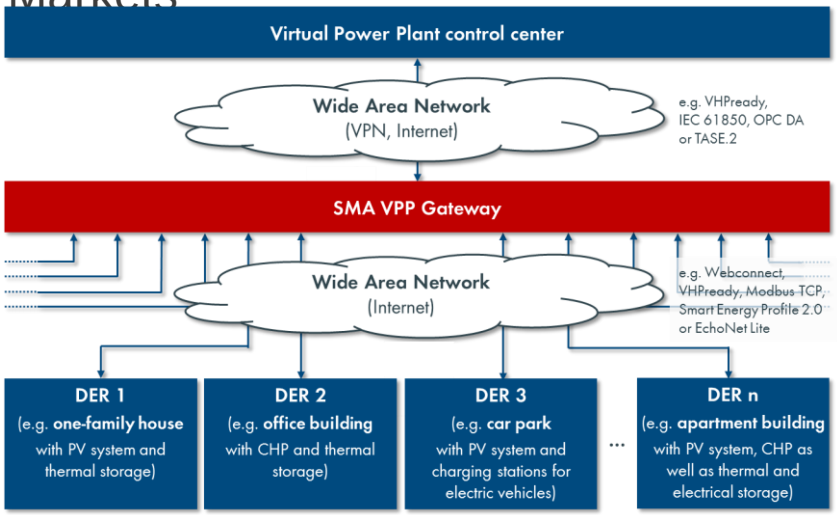


Image: Vattenfall



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 schedule according to **predicted** consumptio and renewables generation
- Renewables are **volatile**
- Local **energy management and storage** tighten the situation

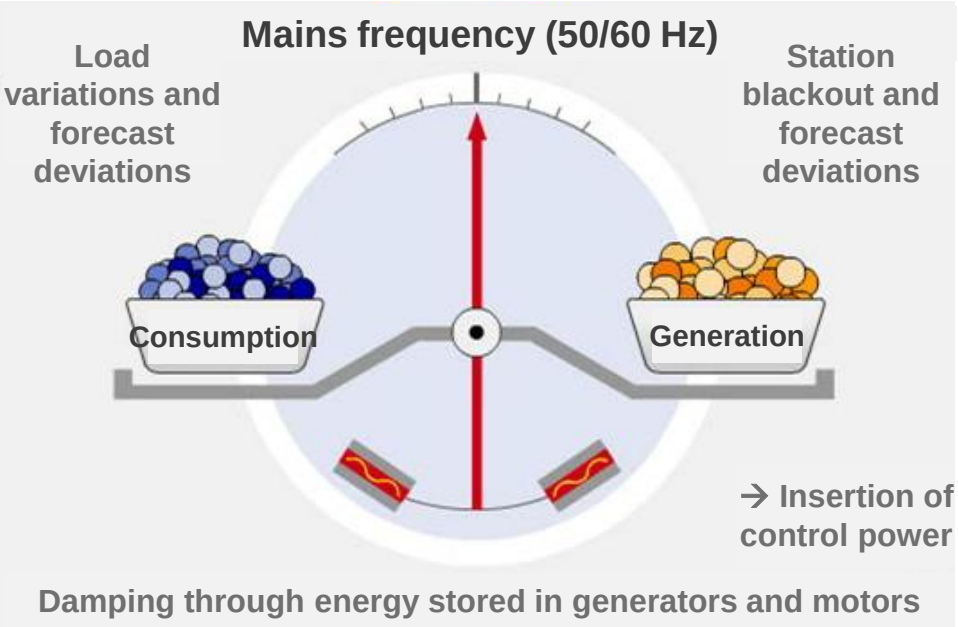
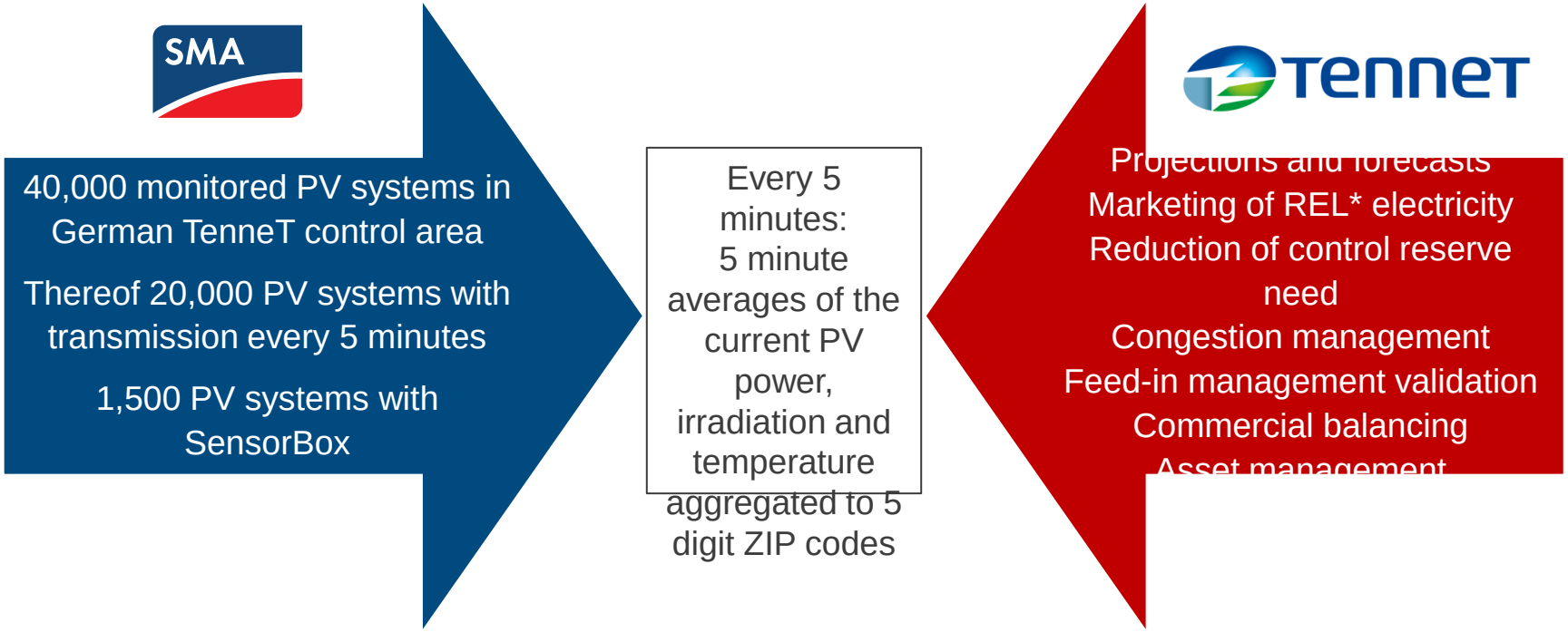


Image: TenneT TSO

- 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**
- They need near-time photovoltaic (PV) projections and forecasts based on **available measured data**
- **Measuring network would have to be precise, secure and cost effective**

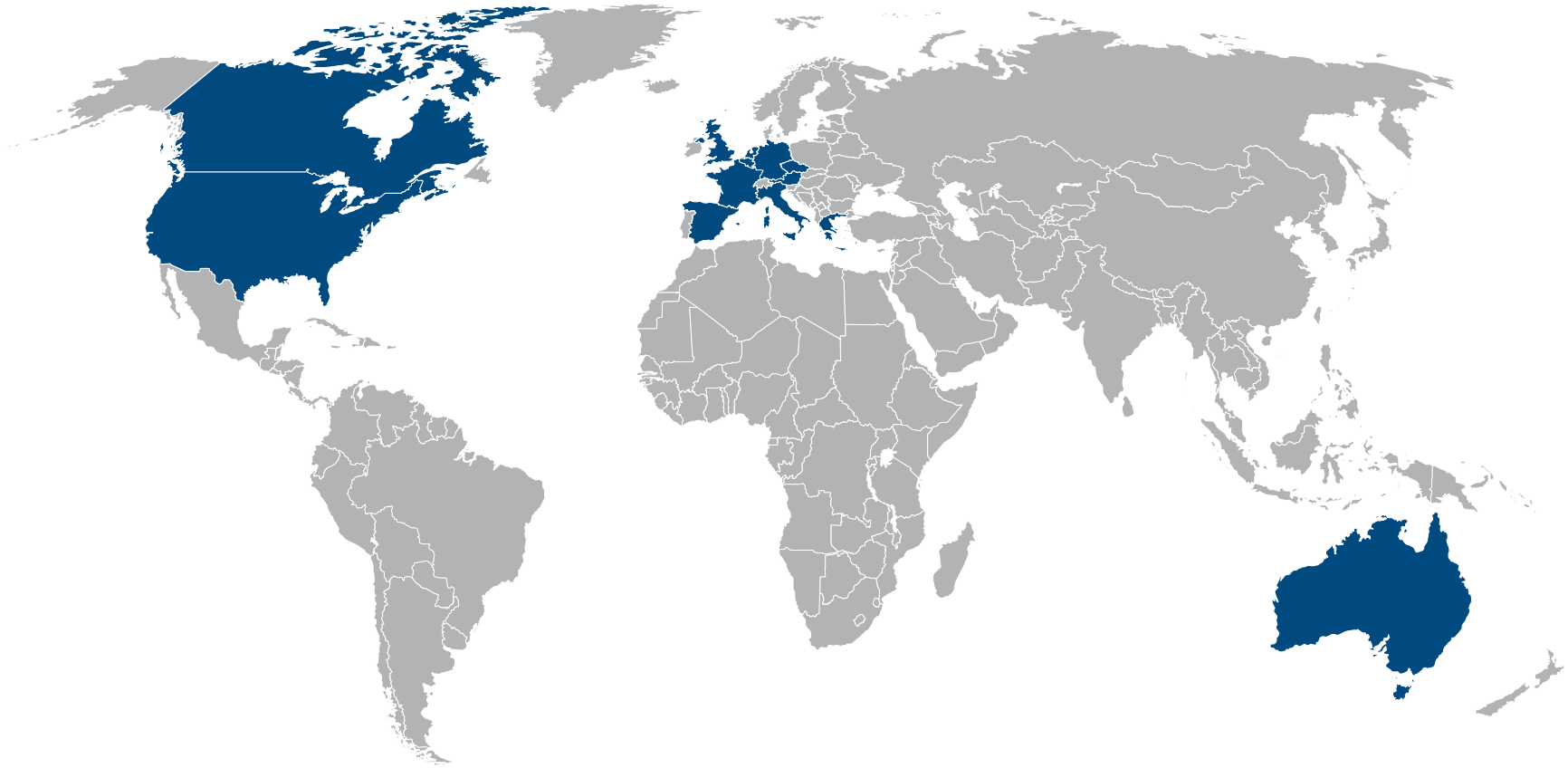
DATA SUPPLY PILOT WITH TENNET TSO
PROJECT OVERVIEW



TenneT will considerably reduce the current projection delay

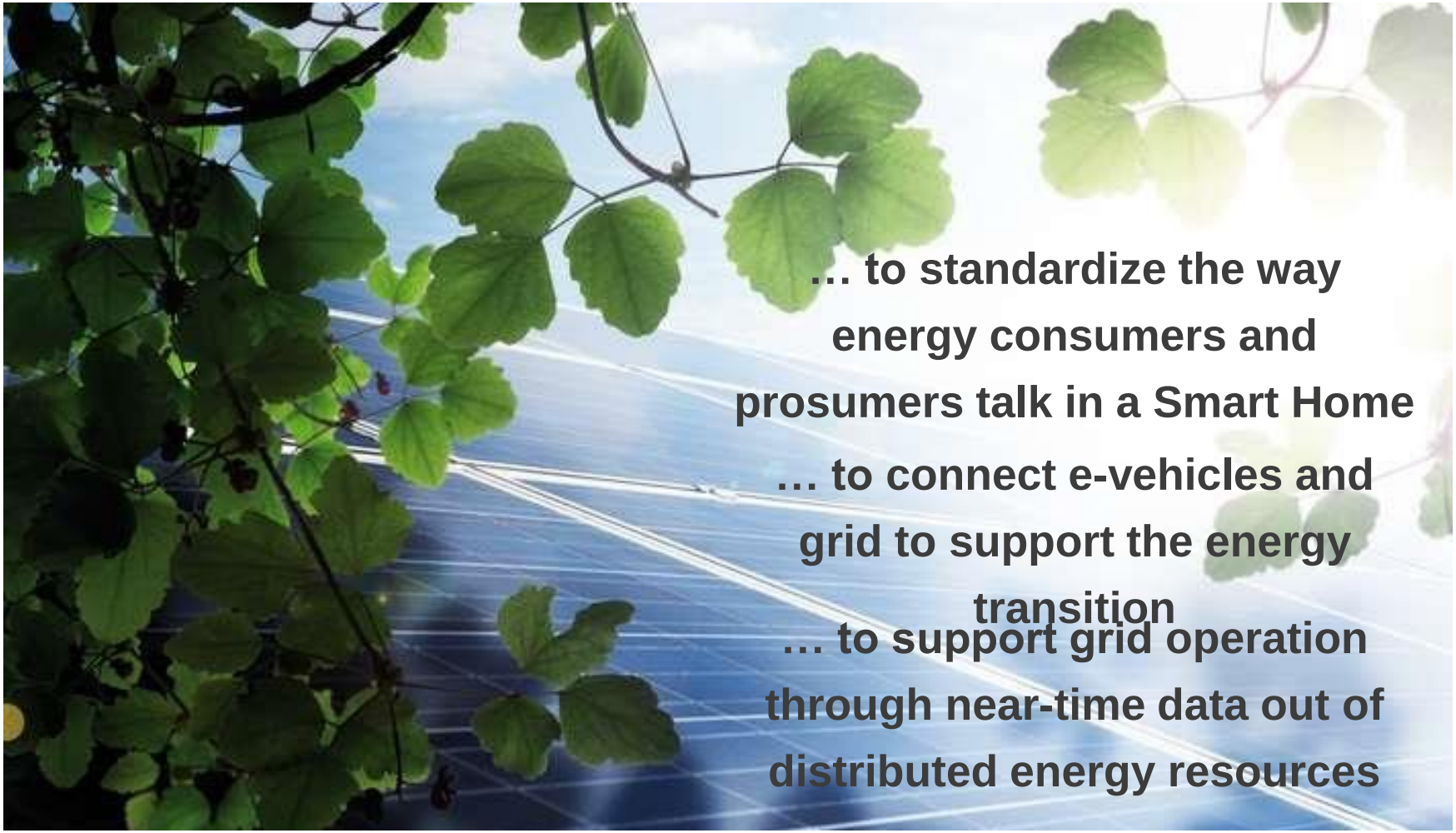
REL = Renewable Energy Law (Germany)

FURTHER DEVELOPMENT OF THE SMA ENERGY SERVICES



- **International rollout to regions with high PV penetration**
- **Measures to continuously enhance data quality and quantity**

THE TIME HAS COME …



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

ENERGY
THAT
CHANGES

SMA

SOCIAL MEDIA
www.SMA.de/Newsroom