

SMA Solar Technology AG

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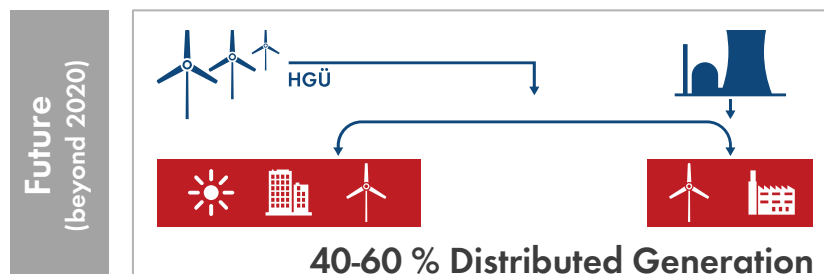
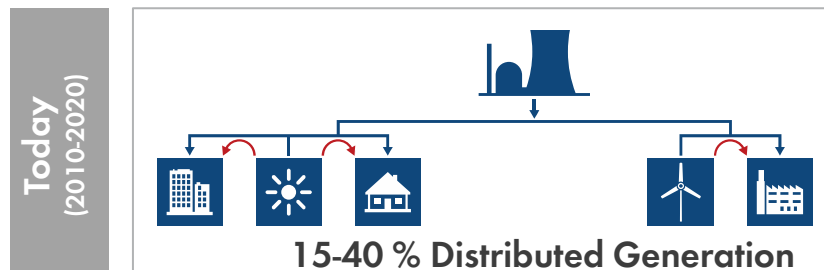
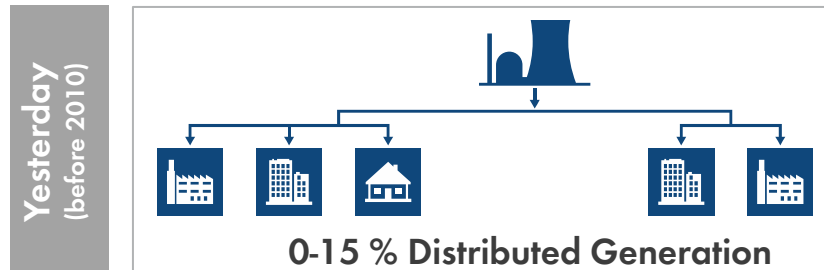
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Fundamental Transition Towards Distributed Power Generation Shakes Up the Energy Sector

Development of Power Generation



Impact

- > Electricity produced increasingly decentral, close to the customer. Conventional energy sources like coal and gas will take a back seat
- > With many “energy producers” the energy market is far more fragmented than before
- > Peak loads and seasonal peaks are reduced
- > Utilities lose market share and are forced to implement a strategic reorientation



- > Largely autonomous units produce their electricity demand by themselves and balance over- and undersupply
- > Techn. developments will lead to convergence between power generation/thermal energy, generation/demand and generation/storage

> The solar inverter is the core of integrated, sophisticated systems.

Supporting Mechanisms for Renewable Energy Will Change With a Higher Share of Distributed Generation



PV DRIVERS TO DATE

Tax Credit
(e.g., USA)

Net-Metering
(e.g., CA, US, IN, IT)

FIT
(e.g., DE, FR, NL, UK, JP)

Ren. Portfolio Standard
(e.g., AU, CN, JP, KR, US)

Tax Depreciation
(e.g., IT)

Direct Financial Support
(e.g., HR)

FUTURE SITUATION

**Self-consumption;
excess energy is
traded**

**Direct sale of PV
energy/ virtual
power plants**

**Collaboration with
utilities for balance
energy**

> Framework to support distributed power generation and new business models is necessary.

The Solar Industry Will Transform From a Pipeline to a Platform Business – Cyber Security Becomes Important



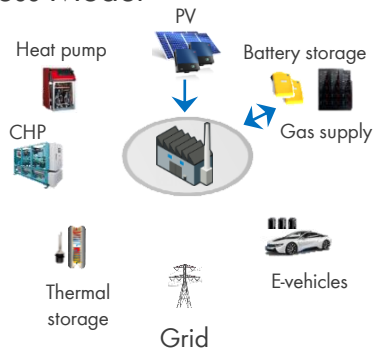
TRANSFORMATION

Pipeline Business Model



- > Linear series of activities
- > Assets: IP, low cost manufacturing, market access

Platform Business Model



- > High value exchange between producer & consumer
- > Assets: information and interactions

IMPACT

- > Renewable energy becomes the backbone of the energy supply. Modern communication systems are required to allow a fast convergence between supply and demand
- > Solar inverters are the core of integrated, sophisticated systems. Therefore, solar inverters are considered as safety relevant control systems
- > Surveillance technology could be built in PV system technology. Compromised equipment could cripple a nation's civilian infrastructure
- > Transparent company structures¹, equipment with high security standards² as well as IT server infrastructure located in countries with high security standards are therefore paramount for a successful transition into a platform business model

> **Only equipment free of any cyber-security concern shall be used to build up the new energy system.**

1. No undisclosed connections to the government

2. Only PV equipment that is free of software to facilitate cyberwarfare (confirmed by independent test)

The Platform Business Model Will Change the Traditional Energy Sector



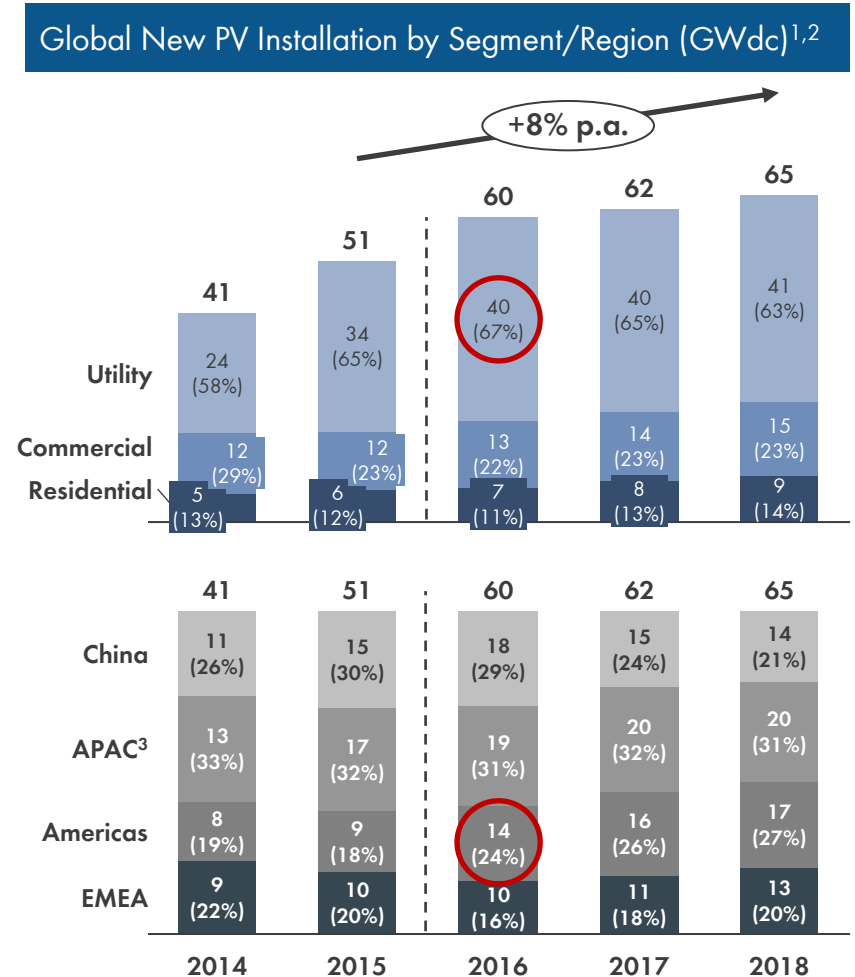
	Generation	Trading	Sales	Grid
Mid-Term	Accelerated Replacement of traditional power generation with high risks/CO ₂ emissions (e.g., nuclear, coal)	New player will develop analytics to improve trading of decentralized power generation.	System change will impact margin and volume . Traditional providers will exit the market. New incumbents.	Grid expansion follows power generation. Data collection to prepare for decoupling.
Long-Term	Ultimate shutdown of traditional power generation. Capacity of renewable energy accounts for > 50% of power generation.	Direct trading between producers and consumers through platforms. Margin squeeze results in lower cost of electricity.	Economies of scale will lead to a new oligopoly . New business models in a new eco-system	New micro-grids with island character are established.

> Incumbents are moving toward orchestrating external networks that can complement or entirely replace the activities of once-internal functions.

SMA Expects New PV Installations to Reach 60 GW in 2016, Thereof 60% in China, the U.S. and Japan



- > SMA reduced its mid-term outlook due to the reduced national targets in China. We expect growth of approx. 8% p.a. in global new installations until 2018. The main drivers are among others long-term incentive programs (e.g., ITC in the U.S.) and CO₂ emission targets.
- > Americas and India will become the driving force of new installations. EMEA will regain importance and account for 20% of global new installations in 2018. In contrast, the relevance of China will decrease in future years.
- > There will be no significant change in breakdown of the segments Residential, Commercial and Utility in the next years. The Utility segment will play the major role covering almost two thirds of the market and will be dominated by China, India and the U.S. by 2018.
- > The emerging markets of South East Asia, Latin America and Middle East show a promising potential and account for more than 10% of global demand.



> The reduction in the national target in China will accelerate the consolidation process

1. SMA MI Market Model Q2 2016

2. Incl. 1 GW off-grid installations: residential, remote and micro-grid applications

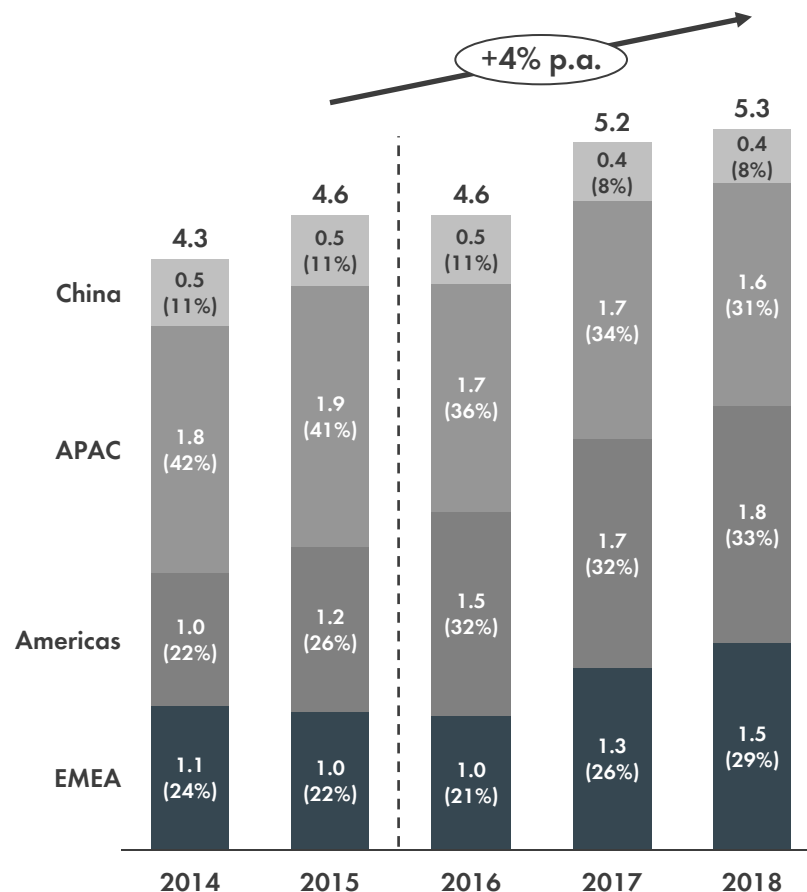
3. w/o China

Americas and EMEA Will Become the Value Drivers of the Solar Industry—China Accounts for Less Than 10% of Global Sales



- > SMA estimates an acceleration in price pressure in all regions and segments due to the consolidation process. Global inverter sales are expected to grow by up to 4% p.a. to €5.3 billion until 2018.
- > Revenues in China are expected to decline by 20% to only €400 million. This represents 8% of global sales.
- > Revenues in Japan benefit from strong pipeline of already approved PV projects. However, already implemented FIT-cuts will almost half revenues until 2018. India is expected to see lower price reductions because current price levels are already low. Other markets in APAC are expected to develop positively.
- > The extension of the ITC will support attractive growth rates in the U.S. Other markets in the Americas region (e.g., Brazil, Chile, Mexico) will experience sales growth as well.
- > The European markets are expected to decline, mainly due to unfavorable incentive schemes. However, Africa and Middle East have a chance to overcompensate the sales decline in Europe.

Global Inverter Revenues by Region (bn EUR)^{1,2}



> **Global weighted average levelized cost of electricity from photovoltaics is estimated to be on the level of onshore-wind by 2025³.**

1. Prices for revenue calculation according to IHS (EUR/Wac); SMA MI Market Model Q2 2016

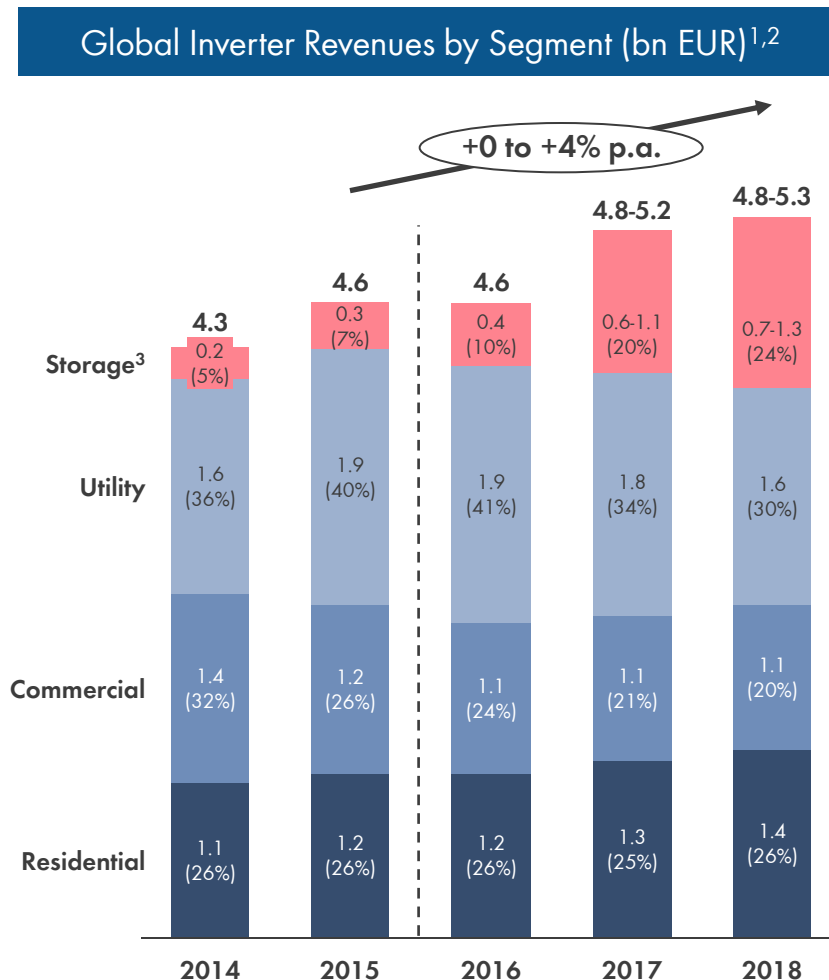
2. Incl. system technology for storage applications (best case scenario)

3. International Renewable Energy Agency: 2025 PV: 0.06 \$; Onshore Wind: 0.05 \$

System Technology for Storage Applications Will Drive Global Inverter Revenues



- > The storage market is in a very early development stage. Therefore, revenues from system technology for storage applications are very difficult to estimate. In the best case, this segment accounts for up to 24% of global sales in 2018.
- > Revenues for the utility and commercial segments are impacted by share of countries with ultra-low average selling prices (e.g., China, India).
- > Growth in global residential sales is very much driven by strong U.S. demand.
- > Only inverter manufacturers with a complete product portfolio for all solar applications (incl. system technology for storage), a truly global presence as well as a good quality of the balance sheet have a chance to benefit from the market development.
- > The ability to transform the business model towards a platform business will become paramount for solar inverter players.



> **Sales with system technology for storage applications extremely driven by the development of battery costs.**

1. Prices for revenue calculation according to IHS (EUR/Wac); SMA MI Market Model Q2 2016

2. Incl. demand for replacement inverters

3. Incl. all applications (e.g., hybrid, behind the meter, in the grid, co-located, etc.)

SMA Increased Its Claim to the Growing Market of Energy Management and Services



Photovoltaic Solutions

- Operations & Maintenance
- Energy management
- Service

Photovoltaic Systems

- Medium-/high-voltage technology
- System technology for storage and hybrid
- Communication products
- Sunny Portal

Photovoltaic Products:

- Solar Inverter
- Smart Module Technology (MLPE)
- Battery inverter



➤ **Our main goal is to easily integrate PV in existing and new energy infrastructure and optimize its use at lowest energy costs.**

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



Storage

O&M / WARRANTY EXTENSION



Service

> SMA's cumulative installed power of nearly 50 GW forms the basis for a successful service and storage business.

ENERGY
THAT
CHANGES



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