InGrid

Intelligent Grid

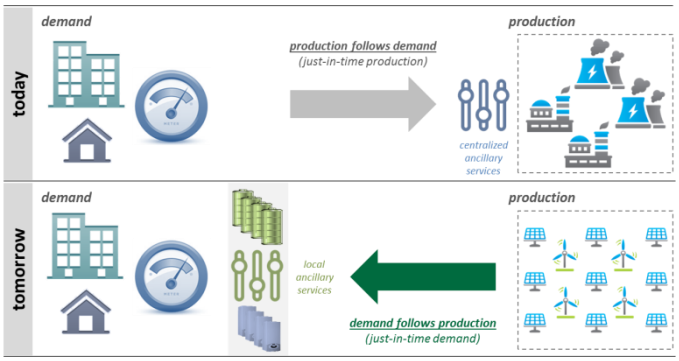
The intelligent way to integrate renewable energy

How to solve the conflict between decentralized production and centralized supply structure

November 2014

Paradigm shift and self-sufficient prosumers

Paradigm shift is about to happen



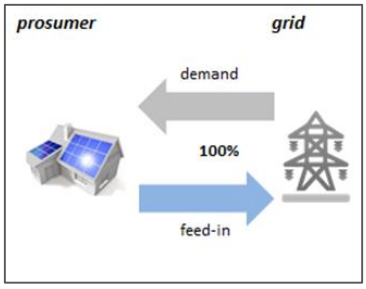
Traditionally, power was produced in large-scale power plants attached to the HV-grid and distributed to the consumers. To balance load and production, production followed demand supported by centrally deployed ancillary services.

From just-in-time production to just-in-time demand

Renewables are intermittent and often attached to the MV- or the LV-grid. To balance load and production, demand has to be made flexible through local storage / switchable loads (buffering temporary energy excess). Ancillary services move down to MV- and LV-grid.

Prosumers become more and more self-sufficient (independent of state subsidies)

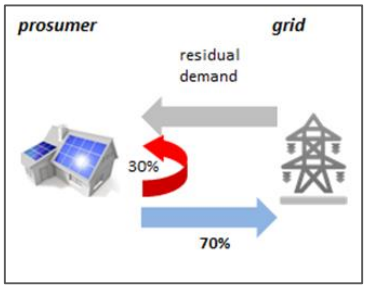
YESTERDAY



Driver
Expansion of PV production driven by state subsidies

Prosumer objective
Maximum feed-in of own PV production

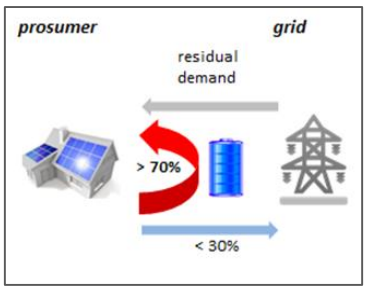
TODAY



Drivers
Grid-parity of PV production reached;
Technological advances in battery technologies

Prosumer objective
Self-consumption of own PV production

TOMORROW



Drivers
Grid-parity of PV production and local battery reached;
Increased use of ICT

Prosumer objectives
1) Optimize cost of energy
2) Maximize self-consumption

Self-sufficient prosumers impact energy supply and grid infrastructure of utilities

Economic consequences are – among others:

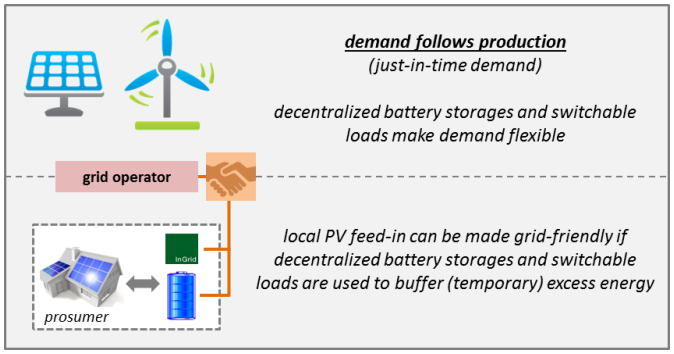
- Reduced turnover (-70%) from energy sales to households with PV and local storage
- Increased costs of power supply from non-predictable production patterns (PV volatility)
- Increased costs for reinforcing or extending existing grid infrastructure
- Increased costs for voltage control and ancillary services in the local grid
- Grid infrastructure may become the next stranded assets for utilities

Technological consequences are – among others:

- Increased accuracy of energy demand predictions for prosumers (PV production, charge level of local batteries, load shifting behavior of prosumers)
- De-synchronization of production and load
- Problems to control voltage in the local grid
- Transmission bottlenecks

InGrid: The intelligent way to integrate renewable energy

InGrid: Shared benefits between grid operators and prosumers

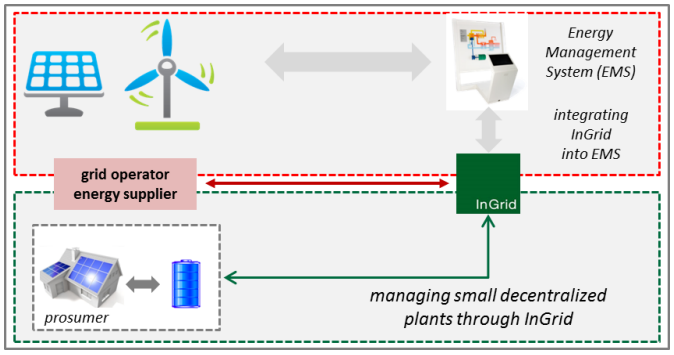


Grid-friendly integration of renewable energy production plants and decentralized battery storages

Benefits for grid operators and prosumers

- InGrid is smoothing feed-in peaks
  … no need to switch off PV systems at peak times
  … minimizing grid reinforcement and/or grid extension
- InGrid reduces complexity (data handling and processing)
- InGrid buffers excess energy (local ancillary services)
- InGrid increases self-consumption and profitability of installed systems (at prosumer's premises)

InGrid: Additional benefits for grid, suppliers, and prosumers



With InGrid, utilities can prevent local fluctuations in demand and production with negligible investments, thereby facilitating the management of the local energy system

Additional benefits for

- Grid operators (enhanced local ancillary services) and
- Energy suppliers (balancing energy, arbitrage at peak times, intra-day decoupling of procurement and supply)

New business opportunities for utilities (among others)

- Storage system planning and optimization
- Sale, installation, and maintenance of storage systems
- Battery sharing / leasing

InGrid: How does it work?

Mode of operation

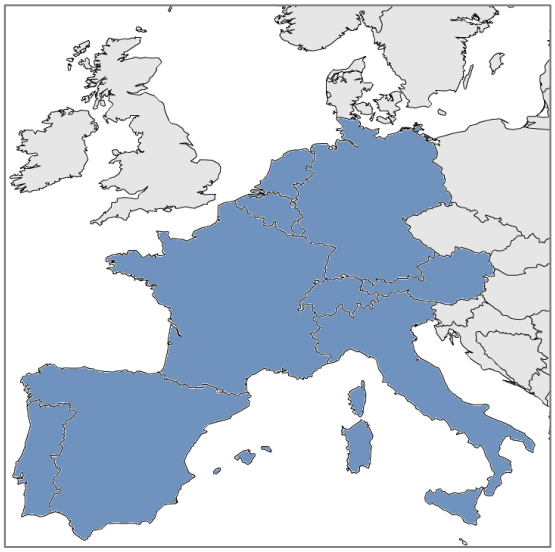
- Smart, learning algorithm (artificial intelligence)
- Measuring voltage and frequency at the socket and using as decision criteria (peak shaving | voltage maintenance)
- Controlling all storage types (thermal, electrical, chemical)
- Can start and stop production and appliances
- Can connect to modern uni- and bidirectional communication systems (smart meters, ripple control systems)
- Works in every grid of this world as it is based on physical parameters (voltage and frequency)

Stage of development

- Scientific evidence provided
- Prototype ready for(grid) deployment
- Patent pending

InGrid: A novel value proposition for utilities

Huge market potential



Distributed grid storage (residential): market potential in selected countries

PV plants (5 to 30 kWp)	2013	2020E
Portugal	6'500	80'600
Spain	114'000	395'000
France	120'000	865'000
Benelux	102'000	485'000
Germany	790'000	1'950'000
Switzerland	18'000	160'000
Austria	28'000	300'000
Italy	460'000	1'200'000
PV plants total (rounded)	**1'640'00**	**5'435'000**
combined with local storage/battery (assumption)		*50%*
market potential InGrid-control-system (rounded)		**2'718'000**

A novel value proposition for utilities

macro-economic

- *Investment protection for existing grid infrastructure*
- *Ancillary services (voltage control) are managed locally (relief for grid control)*
- *Integration of PV production into existing energy system (no feed-in capping)*
- *Gradual small investments in local storage*

utility

- Starting point for a new set of business models
- New role as local system manager
- Massive reduction of complexity on local grid (self-control vs. central-control)
- No centralized control system necessary (no significant upfront investments)
- Deferral/prevention of grid reinforcements/ grid extensions

prosumer

- *Minimized cost of energy / optimized self-consumption*
- *Starting point for integrated smart home solutions*
- *Further cost reduction through battery sharing*
- *Energy management services provided by local utility(all-round carefree)*

About InGrid AG

InGrid

Intelligent Grid

InGrid is an independent Swiss company founded in summer of 2013 by Innovenergy GmbH, Battery Consult GmbH, and Swiss Utility Solutions AG.

InGrid is a specialist for integrating renewable energies into existing grid infrastructure.

For contact details and further information, please refer to:

www.ingridag.com