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PV GRID Make it smart!

Recommendations, analysis of regulatory barriers and technical solutions that can allow a large scale penetration of PV

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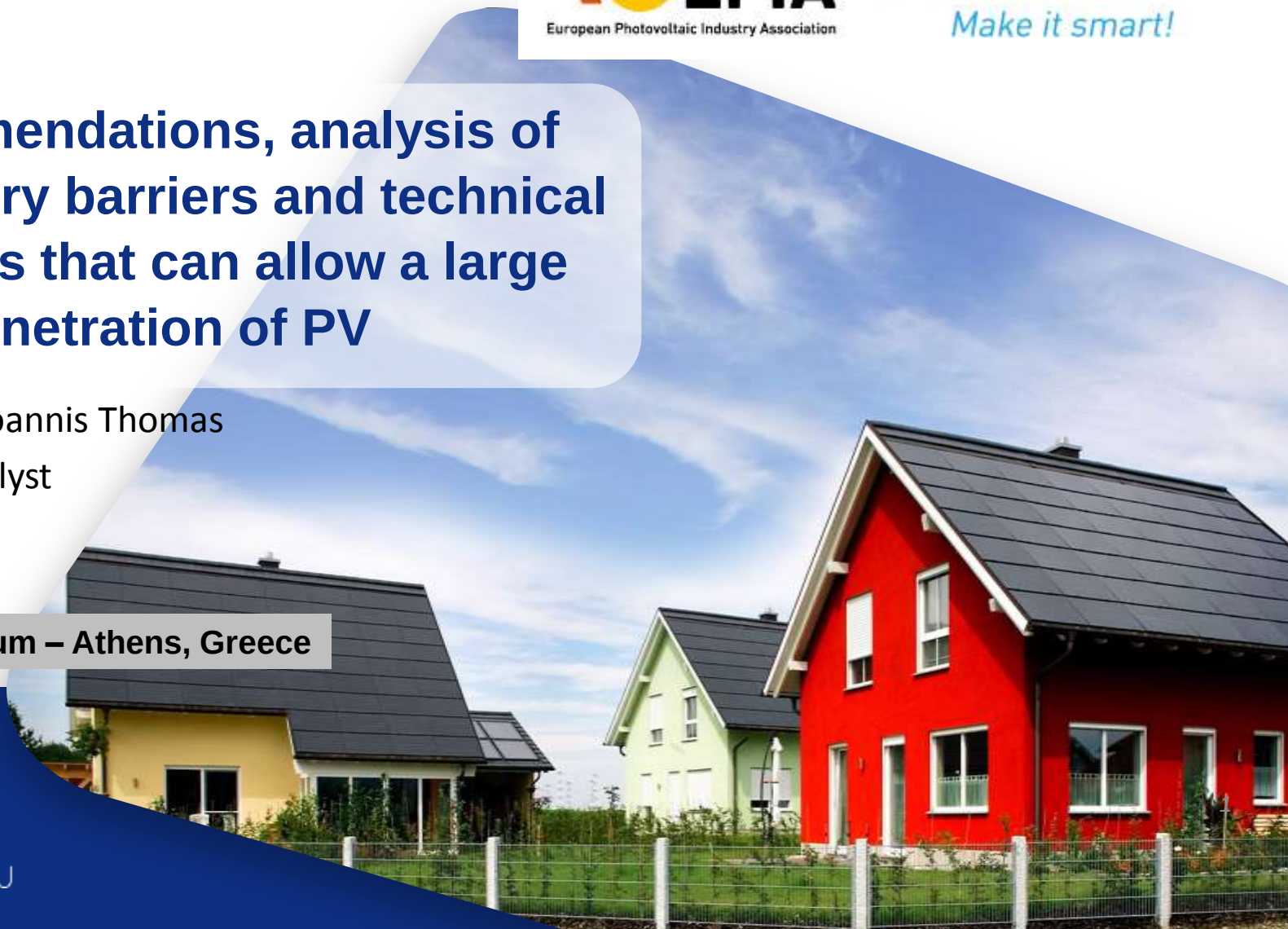

Outline

1. Technical solutions
2. Barriers and recommendations
   - ❑ Regulatory
   - ❑ Administrative
   - ❑ Grid codes

1

Technical solutions

Constraints for large scale PV integration

One goal of the PV GRID project is to identify the preferred technical solutions for solving voltage control and thermal limits issues.

Which technical solutions are available for increasing the grid hosting capacity ?

Category	Technical solution
DSO	Network Reinforcement
	On Load Tap Changer for MV/LV transformer
	Advanced voltage control for HV/MV transformer
	Static VAr Control
	DSO storage
	Booster Transformer
	Network Reconfiguration
	Advanced Closed-Loop Operation
PROSUMER	Prosumer storage
	Self-consumption by tariff incentives
	Curtailment of power feed-in at PCC
	Active power control by PV inverter P(U)
	Reactive power control by PV inverter Q(U) Q(P)
INTERACTIVE	Demand response by local price signals
	Demand response by market price signals
	SCADA + load control
	SCADA + PV inverter control (Q and P)
	Wide area voltage control

Preferred solutions in MV grids

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Technical solution	CZ	DE	ES	IT
Network Reinforcement				
Reactive power control by PV inverter Q(U) Q(P)				
Curtailment of power feed-in at PCC				
Active power control by PV inverter P(U)				
Network Reconfiguration				
SCADA + PV inverter control (Q and P)				
Advanced voltage control for HV/MV transformer				

Adoption of solution requires regulatory development

Should be applied where problems occur

Preferred solutions in LV grids

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Technical solution	CZ	DE	ES	IT
Curtailment of power feed-in at PCC				
Network Reinforcement				
Reactive power control by PV inverter Q(U) Q(P)				
Active power control by PV inverter P(U)				
Prosumer storage				
On Load Tap Changer for MV/LV transformer				

Adoption of solution requires regulatory development

Should be applied where problems occur

2.1

Regulatory barriers and recommendations

Regulatory Barriers (I)

Smart meter deployment

- 80% of consumers shall be equipped with intelligent metering systems by 2020.
- A **new target** for photovoltaic installations is required.

Source: http://www.cypresscreekestates.com

Source: http://www.upm.es/ETSINavales

Voltage regulation in LV networks

- On load tap changers for MV/LV transformers are one of the technical solutions.
- DSO should at least **measure** the voltage in the most critical nodes.

Regulatory Barriers (I)

Storage

- PV fluctuations could be compensated with storage.
- The **ownership** of the batteries and the **incentives** associated have to be defined.

Source: http://www.saftbatteries.com

Source: www.iit.upcomillas.es

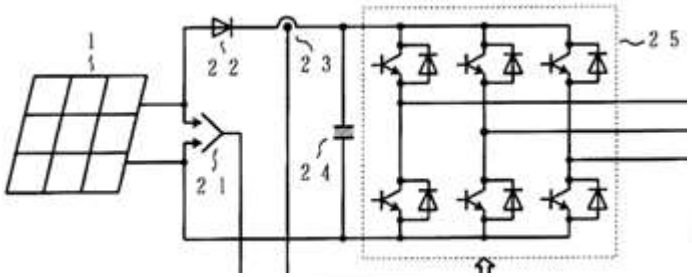
Self-consumption legislation

- New norms for self-consumption with net metering should be approved.
- This would require revising the **tariffs**, so that each term reflects real costs.

Regulatory Barriers (III)

Advanced inverter capabilities

- **Access** to inverters and control over their capabilities should be granted to DSOs.
- Boundary conditions must be defined in technical standards (e.g. maximum reactive capabilities)



Source: http://www.freepatentsonline.com

Source: http://www.louyeh.com

PV energy curtailment

- Currently curtailment is accepted only in **emergency** situations.
- Curtailing small quantities of energy could increase the hosting capacity of PV.

2.2

Administrative barriers and recommendations

1. Inefficient permitting and administrative procedures

Affecting civil works and hardware replacements

- Causes:
  - Complex procedures
  - Non homogeneous procedures
  - Unrealistic deadlines
  - Lack of stakeholder participation

GRID connection phase!

- Possible solutions:

Analysis	Organisation	Processes
• Identification of existing inefficiencies	• Shift of workload to private actors • Harmonisation and simplification of requirements	• Fast-track procedure for specific projects • One-stop-shop procedure • Involvement of stakeholders

Source: RES Integration

- Normative references:
  - Art. 16 of Directive 2009/28/EC sets the framework
  - Proposal for a Regulation of the European Parliament and the council on guidelines for trans-European energy infrastructure (not in force yet): it has to be ensured efficient administrative processing of the files related to projects of common interest (Art. 8)

2. Lack of coordination between national and regional authorities

Affecting national targets

GRID connection phase!

- Causes:
  - Discrepancy between national energy plans and local interests
  - Lack of stakeholder participation (NIMBY)

- Possible solutions:
  - Member States shall designate one national competent authority which shall be responsible for facilitating and coordinating the permit granting process for projects of common interest
  - The competent authority may overrule an individual decision of another authority, if it considers that the decision is not sufficiently substantiated

- Normative references:
  - Proposal for a Regulation of the European Parliament and the council on guidelines for trans-European energy infrastructure (not in force yet), Art. 9, 10

3 Insufficient planning

Afecting proper network development

- Causes:
  - Unavailability of data
  - Planning laws impede long-term view
  - Lack of awareness/political will
  - Insufficient communication
- Possible solutions:

Data	Planning	Cooperation
• Clear data basis of existing and planned RES-E plants • Ambitious long term targets (2020-2050)	• Master plans including overall electricity sector (Planning process in Estonia, TYNDP)	• Dedicated regional platforms (All Island project – Ireland) • Development in neighbouring countries process (Austria)

Source: RES Integration

Insufficient grid development

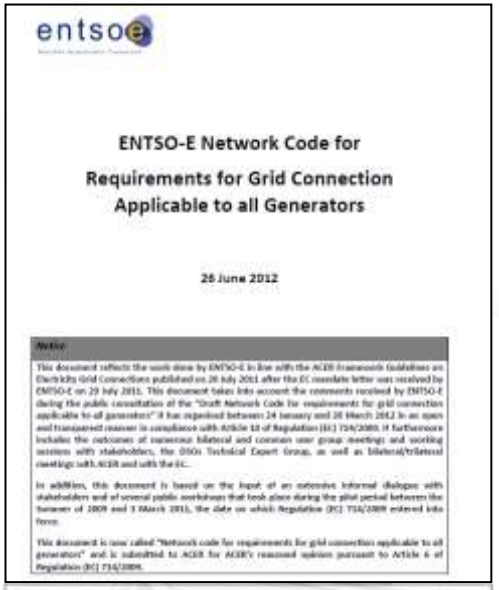
- Normative references:
  - ENTSO-E Ten Year Network Development Plan
  - Proposal for a Regulation of the European Parliament and the council on guidelines for trans-European energy infrastructure (not in force yet), Art. 9

2.3

Grid code barriers and recommendations

Grid code barriers

- All Power generating modules will be equipped with a **logic interface**.
- Common EU-wide requirements should be defined


entsoe

ENTSO-E Network Code for

Requirements for Grid Connection Applicable to all Generators

26 June 2012

- The **Eco Design Regulation** for Transformers tries to mandate a very low level of energy losses
- Costs would be prohibitive for on load tap changers in MV/LV transformers

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Thank you for your attention

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