GLASGOW, SCOTLAND | 12-15 JUNE 2017

CIRED Infotag, 30. Jänner 2017

Session 4

Dezentrale Energieressourcen und aktive Verbrauchsteuerung

Berichterstatter: Karl Bauer

Life Is On | Schneider Electric

- 279 Abstracts, 125 ausgewählte Beiträge
  - 6 Beiträge aus Österreich

- <u>Aufteilung</u>
  - 20 in Main Session
  - 13 in RIF
  - ALLE in Poster Session

- 4 Blöcke
  - DER (Dezentrale Energieressourcen) Konzepte, Entwürfe, Studien, Planung, Analysetechniken und Werkzeuge
  - Treiber und Technologien zur DER Integration
  - Technische und kommerzielle Verfahren und Lösungen zur DER Integration
  - DER Integration - Feldversuche, Prüfungen und Normen

- **Chairman**
  - Graham AULT (UK)

- **Special Rapporteurs**
  - Goran STRBAC (UK)
  - Ricardo PRATA (Portugal)
  - Helfried BRUNNER (AT)

Session 4 - Statistik

DER und Netzplanung	23 >>
Demand Response Management	21 >>
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Inverter und Leistungselektronik	13 >>
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Speicher	5 <<
Elektromobilität	2 =
Smart Metering	2 =

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Value of energy storage in future GB low carbon systems

Fei Teng, Marko Aunedi, Roberto Moreira, Goran Strbac
Panagiotis Papadopoulos and Adriana Laguna

- **Energiehandel, Ausnutzun**
  - Teilnahme am Day-Ahead Markt
- **Balancing Services**
  - Teilnahme am Real-Time Balancing Markt
- **Regelenergie**
  - Primär-/Sekundär-/Tertiär-Regeleistung
- **Kapazitätsmarkt**
  - Reduktion Einsatz von Spitzenkraftwerken
- **Netzdienstleistungen**
  - Reduktion von Netzausbauten
- **Low Carbon Generation Mix**
  - Weniger regenerative Erzeuger

Table 1. Service provision by ES across case studies

	Case	Case	Case	Case	Case	Case
Energy	✓	✓	✓	✓	✓	✓
Balancing		✓	✓	✓	✓	✓
PV			✓	✓	✓	✓
Network				✓	✓	✓
PFR					✓	✓
Capacity						✓

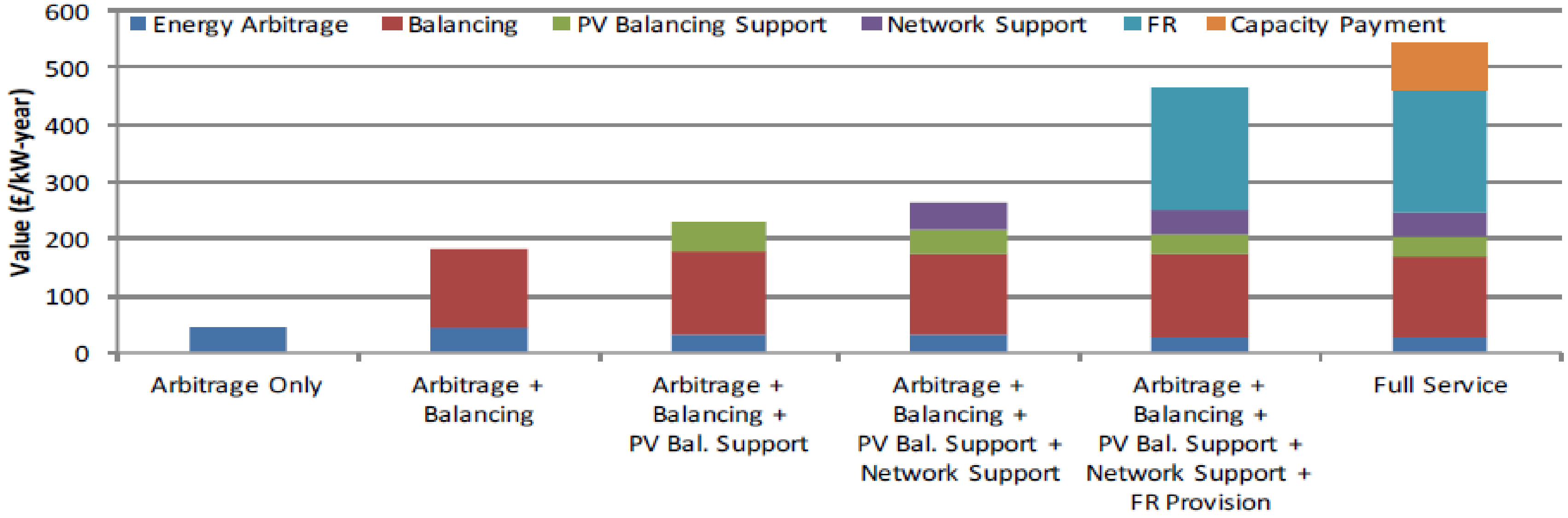
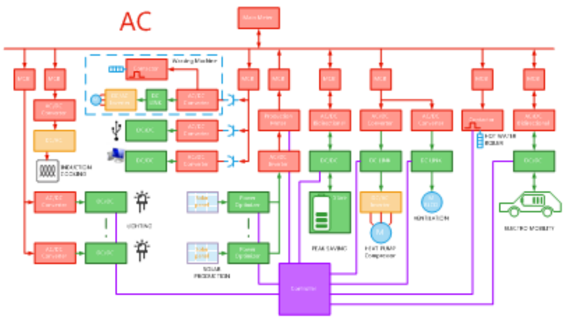


Figure 5. Value of ES with layered service provision

Greenhouse case active DC grid

Converting a 400/690VAC installation to an active DC grid.

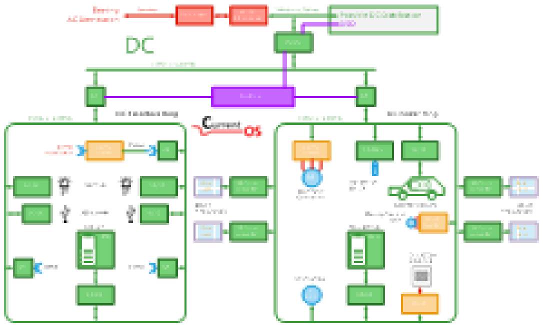
Topology of AC 'smart' grid



Passive AC & DC grids

- Contains autonomously operating components
- Congestion/smart management unreliable as it is only possible through data communication and central control system

Topology Current OS smart grid



Active DC grids

- Contains embedded installation control system
- Congestion management through local voltage measurement at component level

Greenhouse case active DC grid

Converting a 400/690VAC installation to an active DC grid.

2,4 Ha Grundfläche

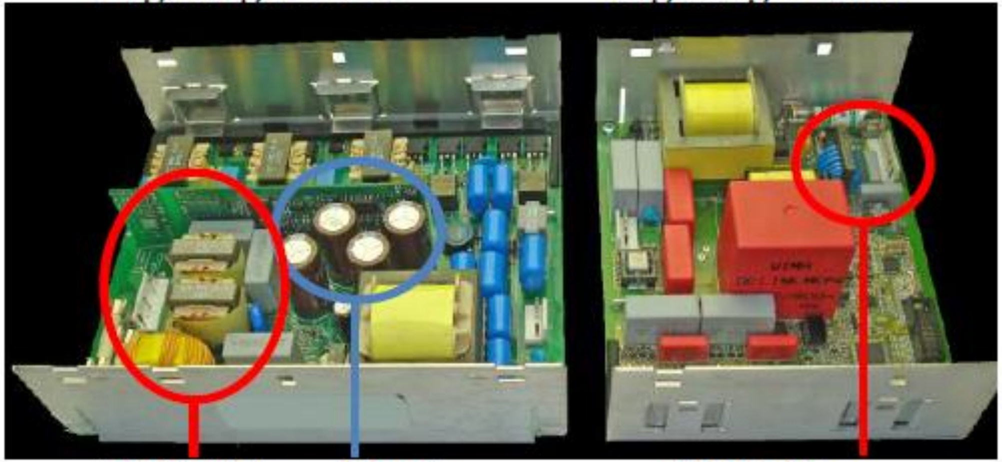
1,4 MW Anschlussleistung

Kosten ELCOs:

15 k€/1000m^2/Jahr

1000W AC/DC Lighting Ballast

1000W DC/DC Lighting Ballast



EMC filter Elco's EMC filter

- Investitionskosten: € 300.000

- Vorteile:
  - Verbesserte Lebensdauer der Dimmer
  - bessere Regelung der KWK,
    Reduktion Gasverbrauch um 33%

- Paybackdauer: ~ 2,5 Jahre

Zusammenfassung

- Positive business cases für aktive DC Netze für Treibhäuser, Industrieanlagen, große Gebäude etc.
- Kleine dezentrale DC Infrastruktur garantiert bessere Energiebilanz, einfachere Realisierung als aktives AC Netz
- DC gehört die Zukunft: Kampf Edison Tesla geht weiter

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COST BENEFIT ANALYSIS OF MV REACTIVE POWER MANAGEMENT AND ACTIVE POWER CURTAILMENT

Leticia DE ALVARO GARCIA, François BEAUNÉ,

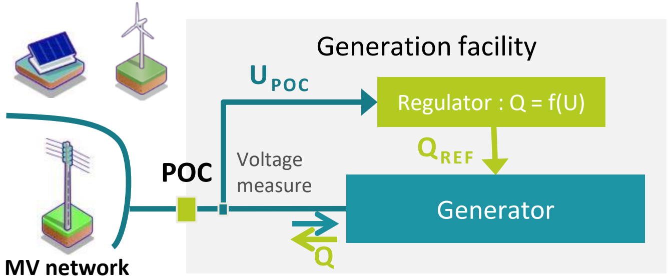
Mathilde PITARD, **Laurent KARSENTI** (Enedis)

CIRED – June 2017

Self-adaptive reactive power regulation

Reactive power can be used to limit voltage rise when connecting DG to MV network

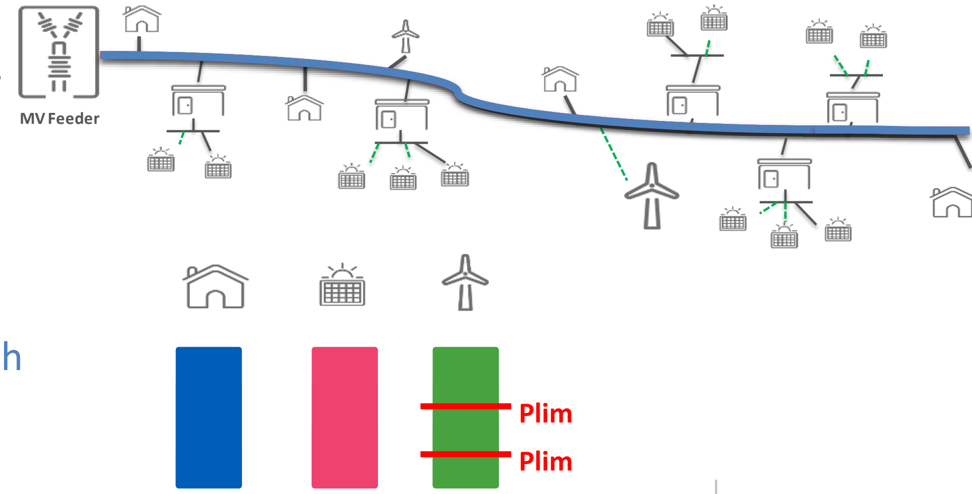
- Classic approach: constant ratio between reactive and active power
- With self-adaptive reactive power regulation "Q=f(U)":
  - Reactive power injection/consumption depends on voltage at point of connection (POC)



Active power curtailment

- Classic approach: network reinforcement used with “fit & forget” approach
- With active power curtailment:
  - Better knowledge of network constraints due to operational planning tools
  - Possible to limit active DG power injection
- **Benefits:**
  - → Possible to avoid technical constraints with a limited impact on network losses
  - → Connection costs reduction

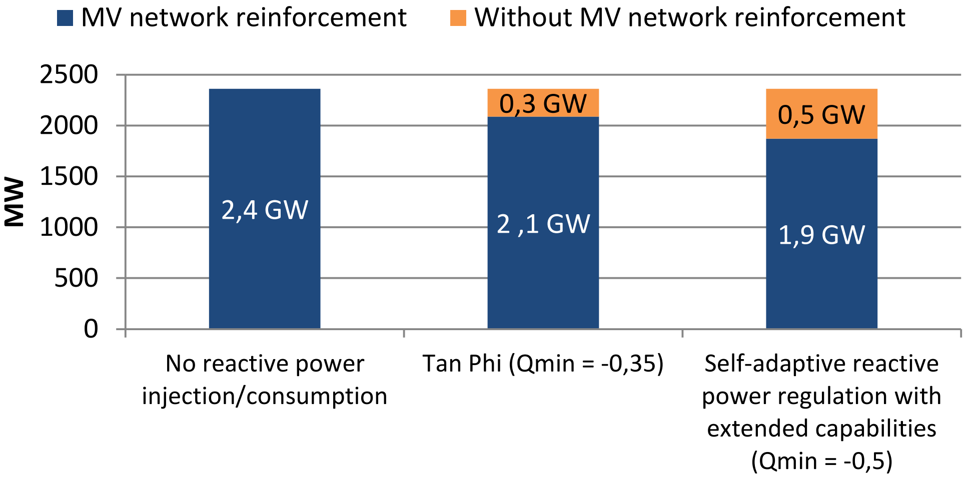
Network constraint solved with MV DG active power curtailement (Plim)



Results for self-adaptive reactive power regulation

- Self-adaptive reactive power regulation decreases both:
  - DG reactive power solicitation
  - Network losses compared to solution with a constant ratio Q/P
- **DG connection cost/benefit results:**
  - **Net reduction cost of 100 k€/MW** when solving voltage constraints
  - **By 2030, + 200 MW** can be connected to existing MV feeders **without network reinforcement** with extended reactive power capabilities

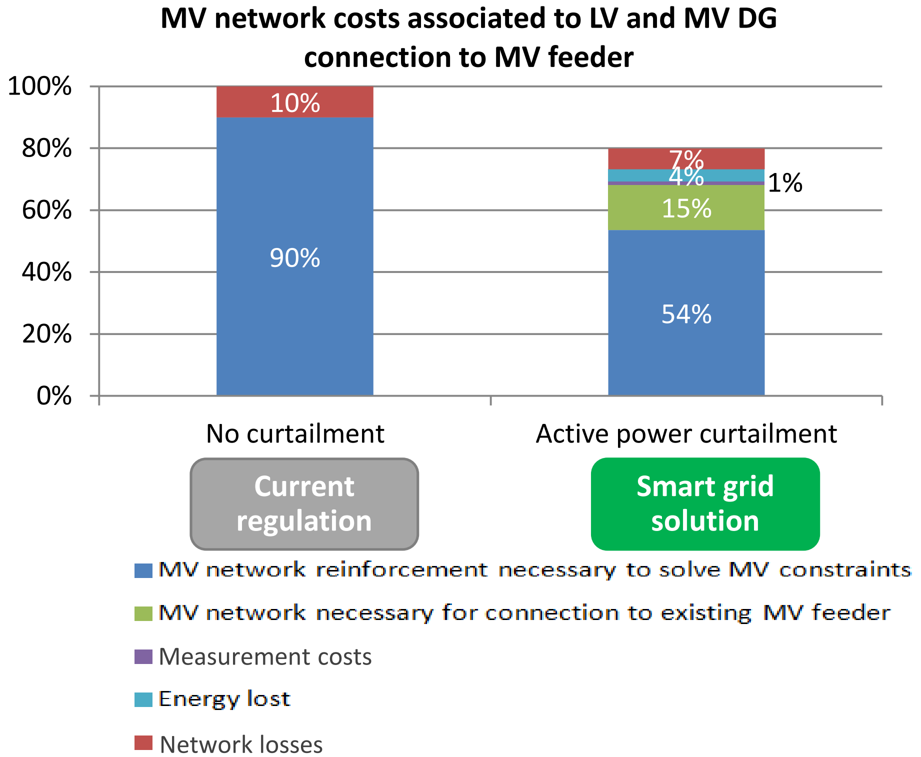
Evolution of MV network reinforcement when using DG reactive power capabilities



No regulation | **Current regulation** | **Smart grid solution**

Results for active power curtailment

- Active power curtailment decreases:
  - Network losses compared to connection to a new feeder (non-existing feeders)
- **DG connection cost/benefit results:**
  - **Net reduction cost of 90 k€/MW** when solving voltage constraints
  - **By 2030, + 700 MW** can be connected without MV network reinforcement when using active power curtailment



Zusammenfassung

- Blindleistungsregelung und Wirkleistungsbeschränkung sind zwei **kosteneffektive Smart Grid Lösungen im Vergleich zum koventionellen Netzausbau**
- Blindleistungsregelung ist bereits **Bestandteil der technischen Richtlinien von Enedis**
- Wirkleistungsbeschränkung mit einer garantierten Mindesteinspeisung **wird 2018 verfügbar sein**

Studies on the Time and Locational Value of DER

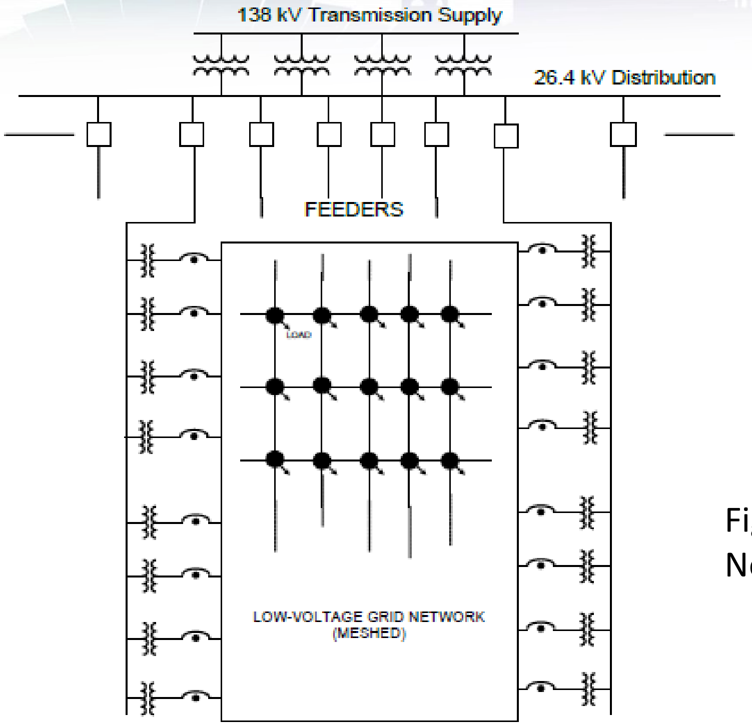
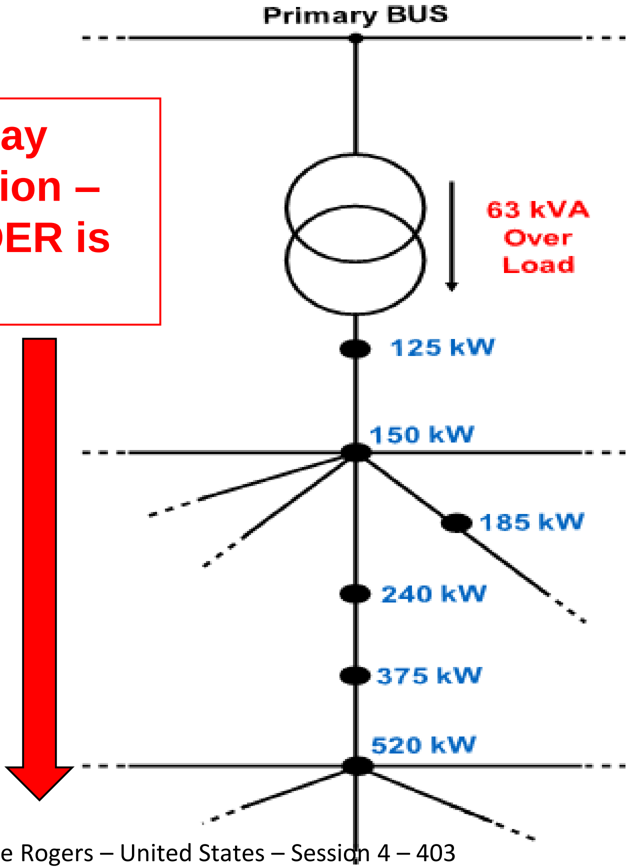


Figure 1. Typical Urban Network Distribution System

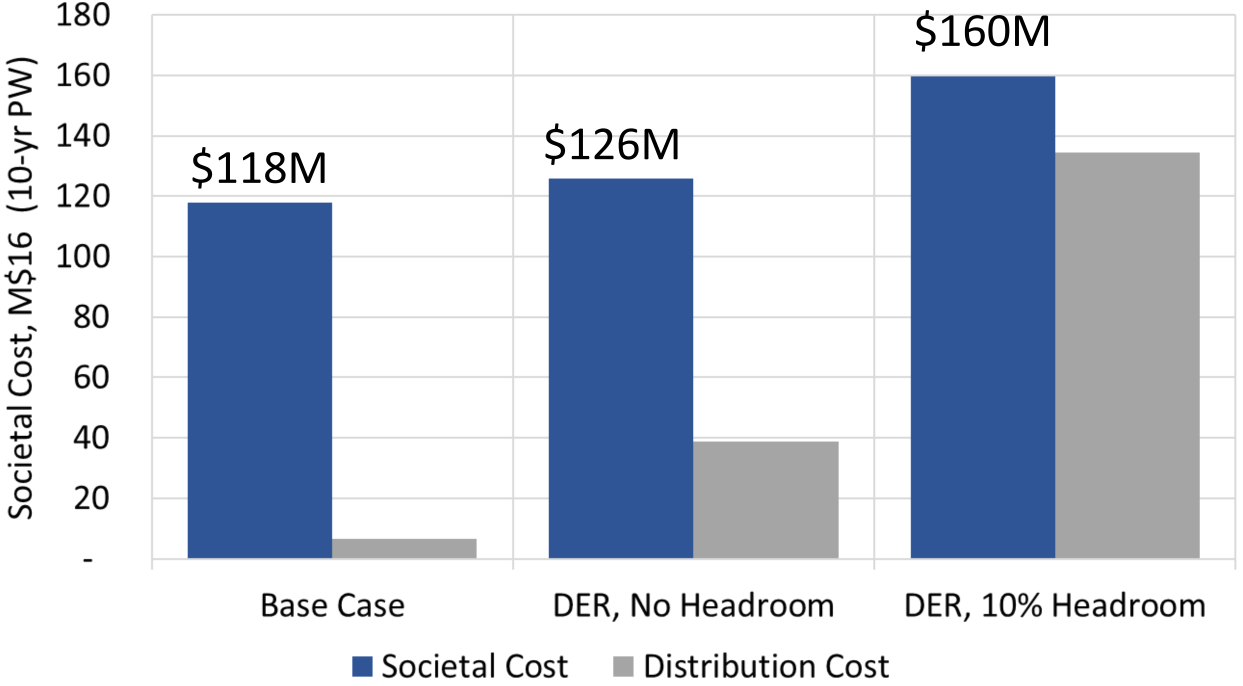
Impact of System Topology in a Mesh Network

Further away from violation – the more DER is needed



- Precise DER placement near the overloaded component is most effective
- DER effectiveness can rapidly dissipate in a network system
- Placing DER at multiple, more distant nodes requires substantially more DER

Con Edison Economic Results Summary



DER solution was slightly higher than traditional solution, but leaves the circuit with no headroom

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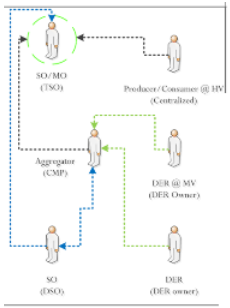
Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation

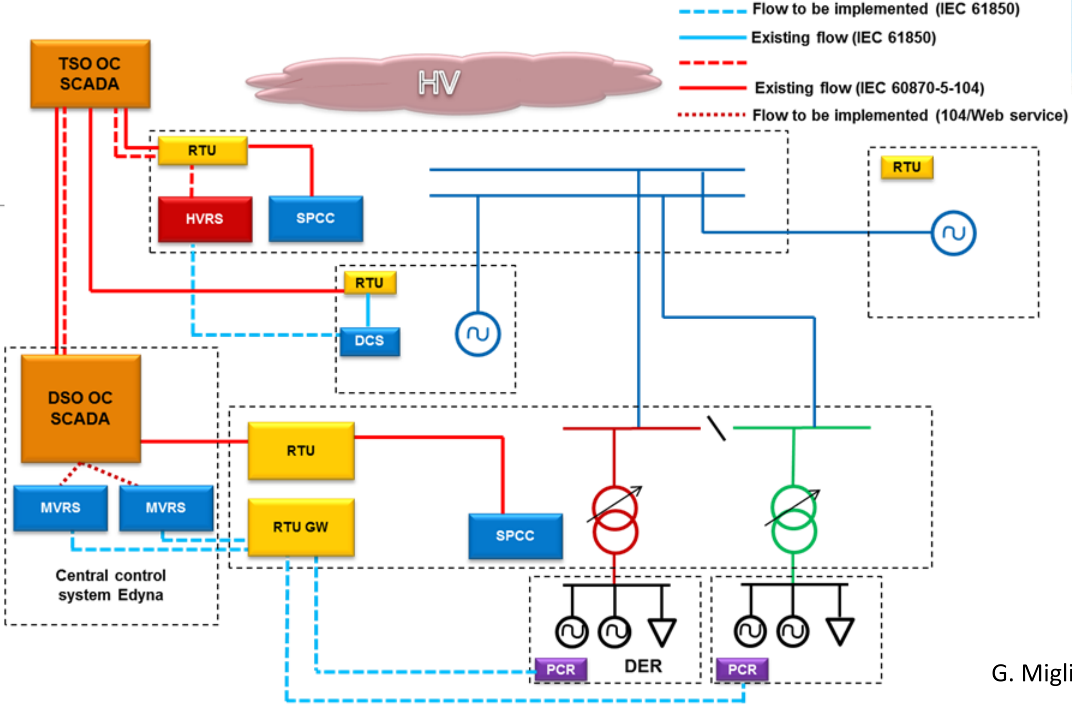
SmartNet: A European research project to study TSO-DSO coordination for ancillary services provision from distribution networks

Gianluigi Migliavacca (RSE)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691405

Pilot A: Distribution monitoring and control





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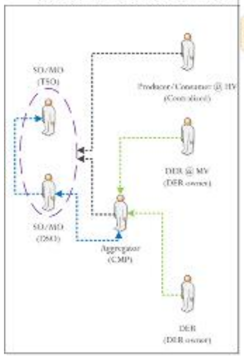
Aggregation of information
in RT at TSO-DSO interconnection (HV/MV transformer)

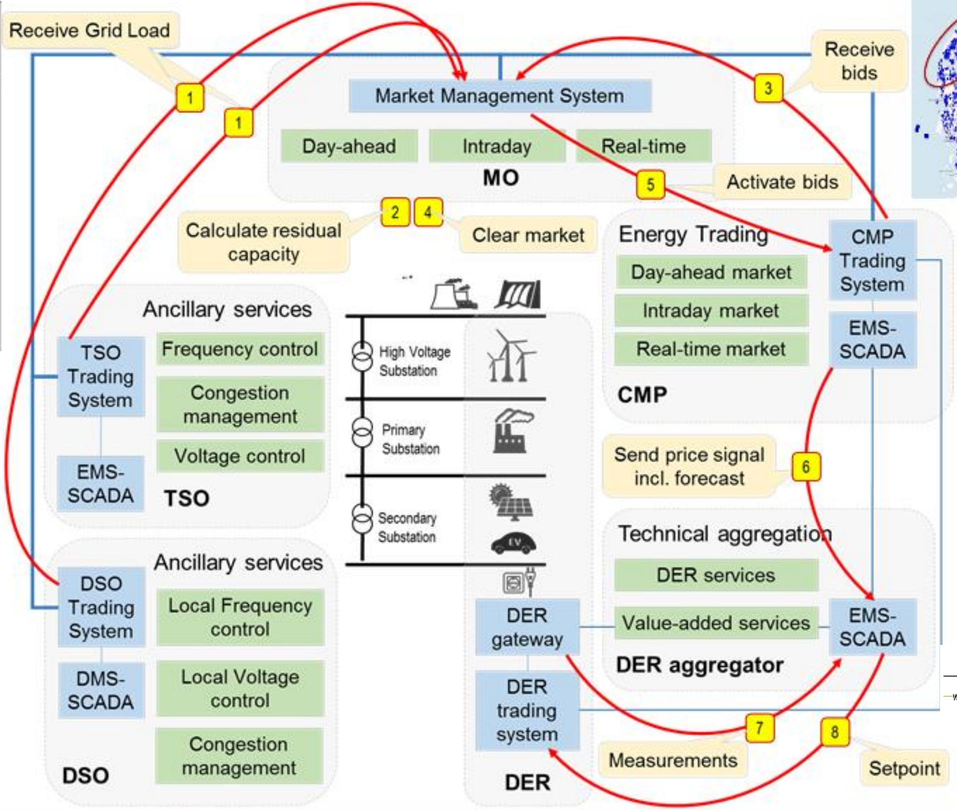
Voltage regulation
by generators connected at HV and MV levels

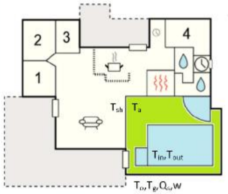
Power-frequency regulation / balancing
by generators connected at HV and MV levels

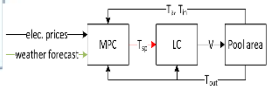
Pilot B: Ancillary services from indoor swimming pools

Common TSO-DSO AS market model









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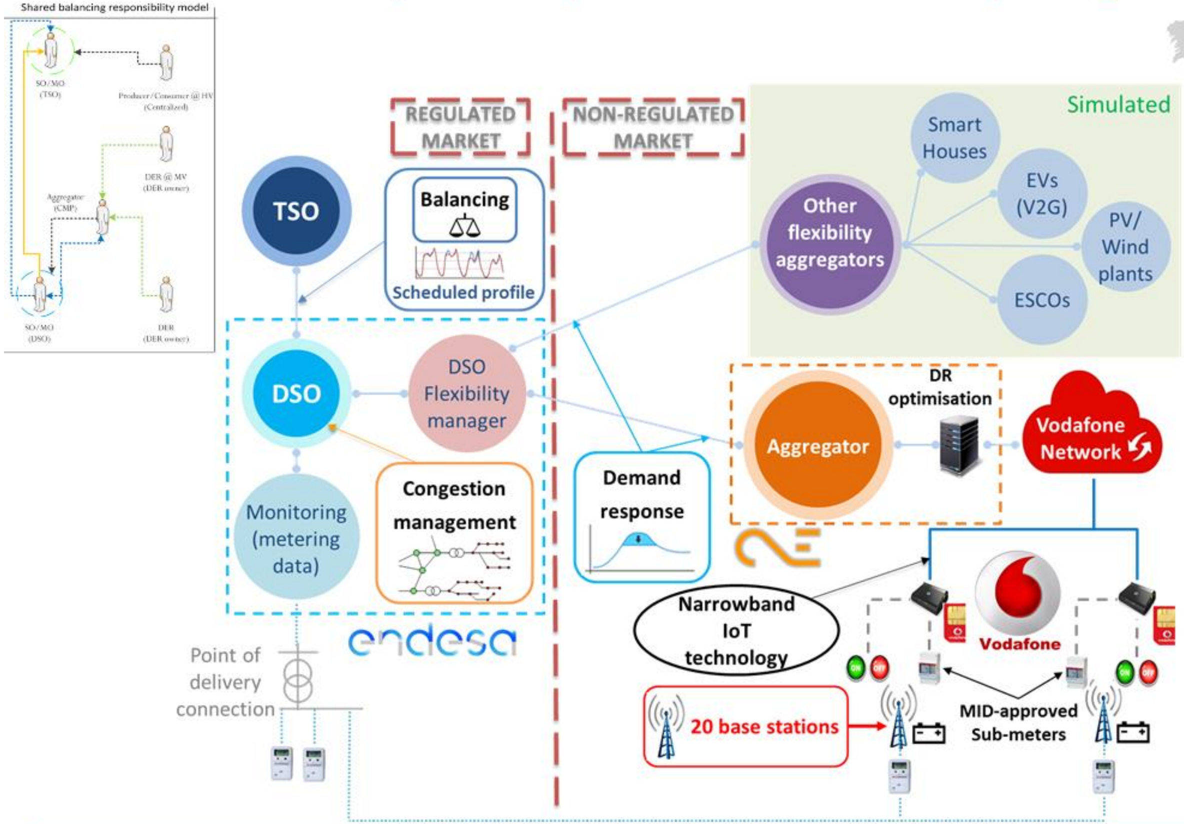
Congestion management
to better integrate PV, EV and HP

Price-based control
of thermal controllers of swimming pools in summer houses

Balancing
of wind power with decreasing contribution of thermal units

Pilot C: Ancillary services from radio-base stations



Congestion management
at DSO level

Demand Response Aggregation
by using storage flexibility (BS and EV)

Power-frequency regulation / balancing
by respecting the exchange program at the TSO-DSO interconnection

Danke !

Fragen ?

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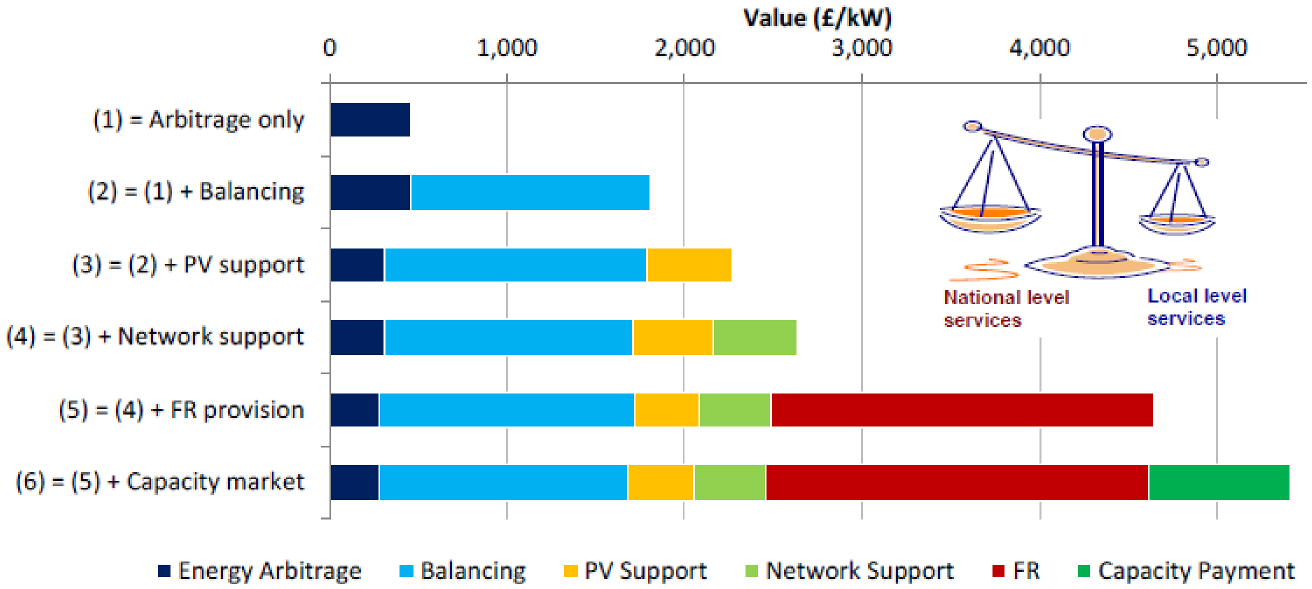
Backup

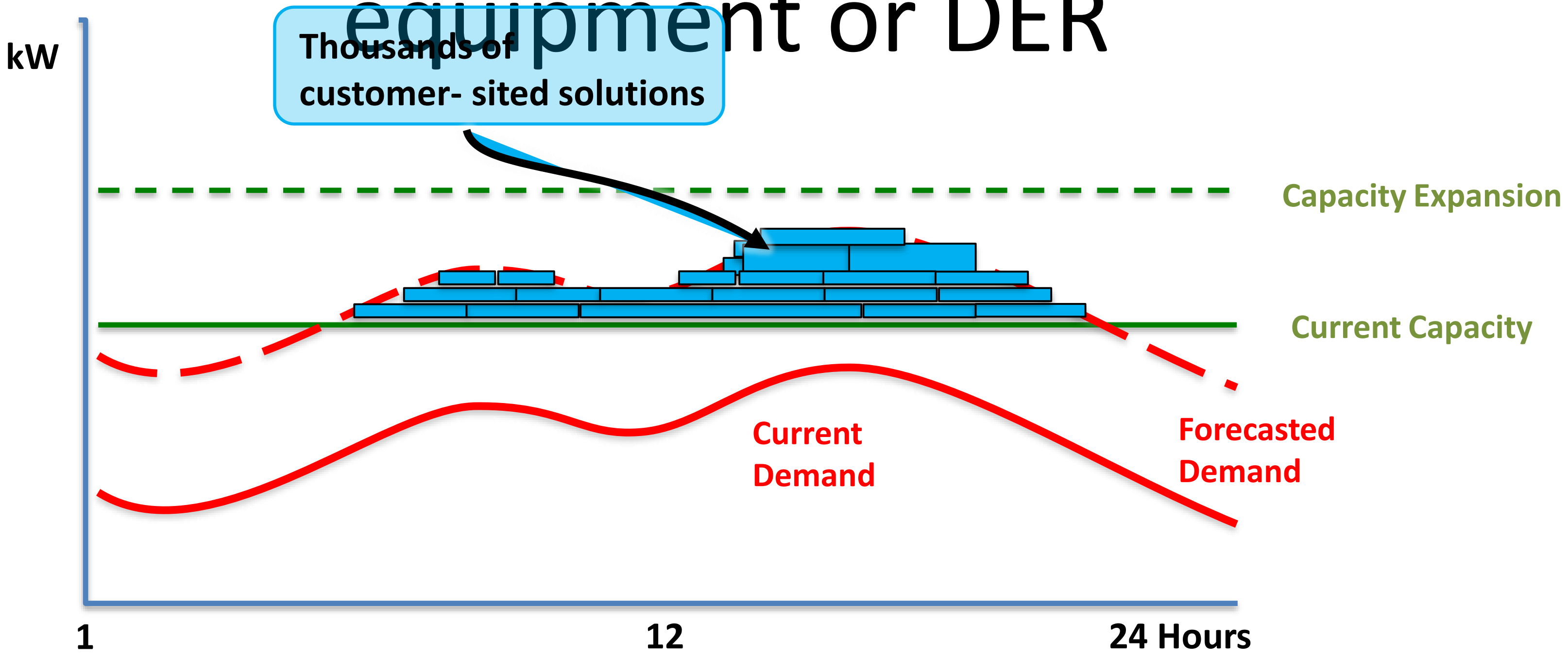
Business case for energy storage: access to both local and national level benefits is critical



Can the market facilitate this?

Flexibility- industry business model?

Capacity upgrades with utility equipment or DER

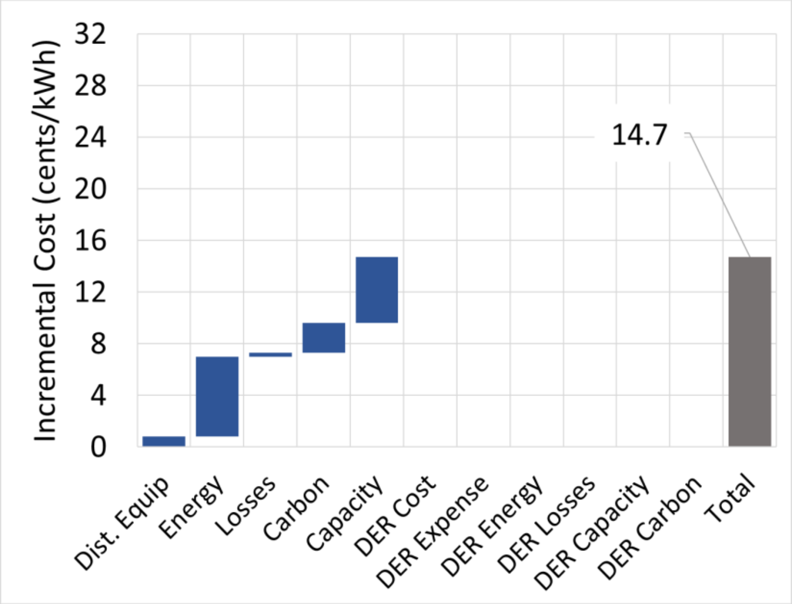


Capacity upgrades must be available, dependable, and durable

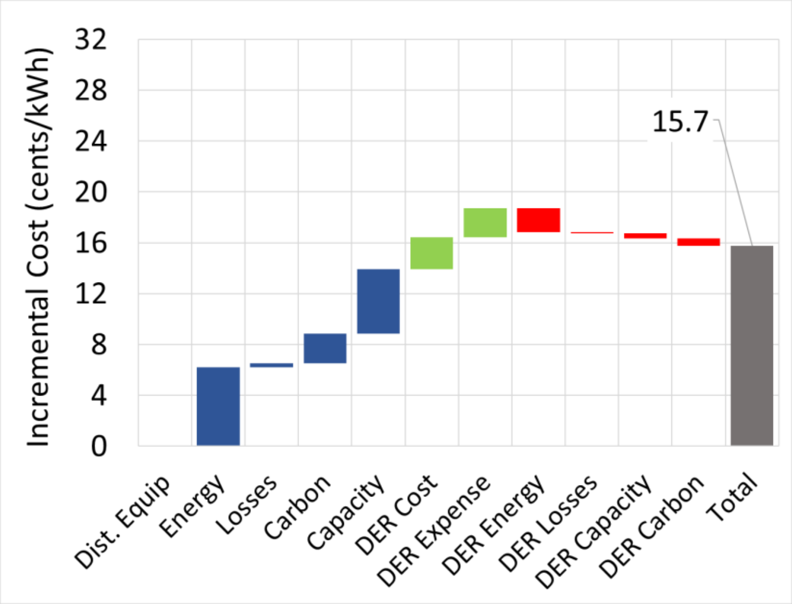
Conclusions from Study

- **Comprehensive and objective methods** are needed
- **Time and locational impacts** are key determinants to valuing the deferral benefits of DER
- **Hard to generalize the net benefits of DER as a non-wires alternative** to conventional grid investments
- **It takes a portfolio of DER** to meet system and customer needs and defer traditional assets cost-effectively.

Example Results – Traditional and DER Solution



Cost to Meet Load Growth –
Traditional Utility Solution



Cost to Meet Load Growth –
DER Solution No Headroom

Waterfall charts illustrate how costs and benefits are incurred

SmartNet-Project.eu

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