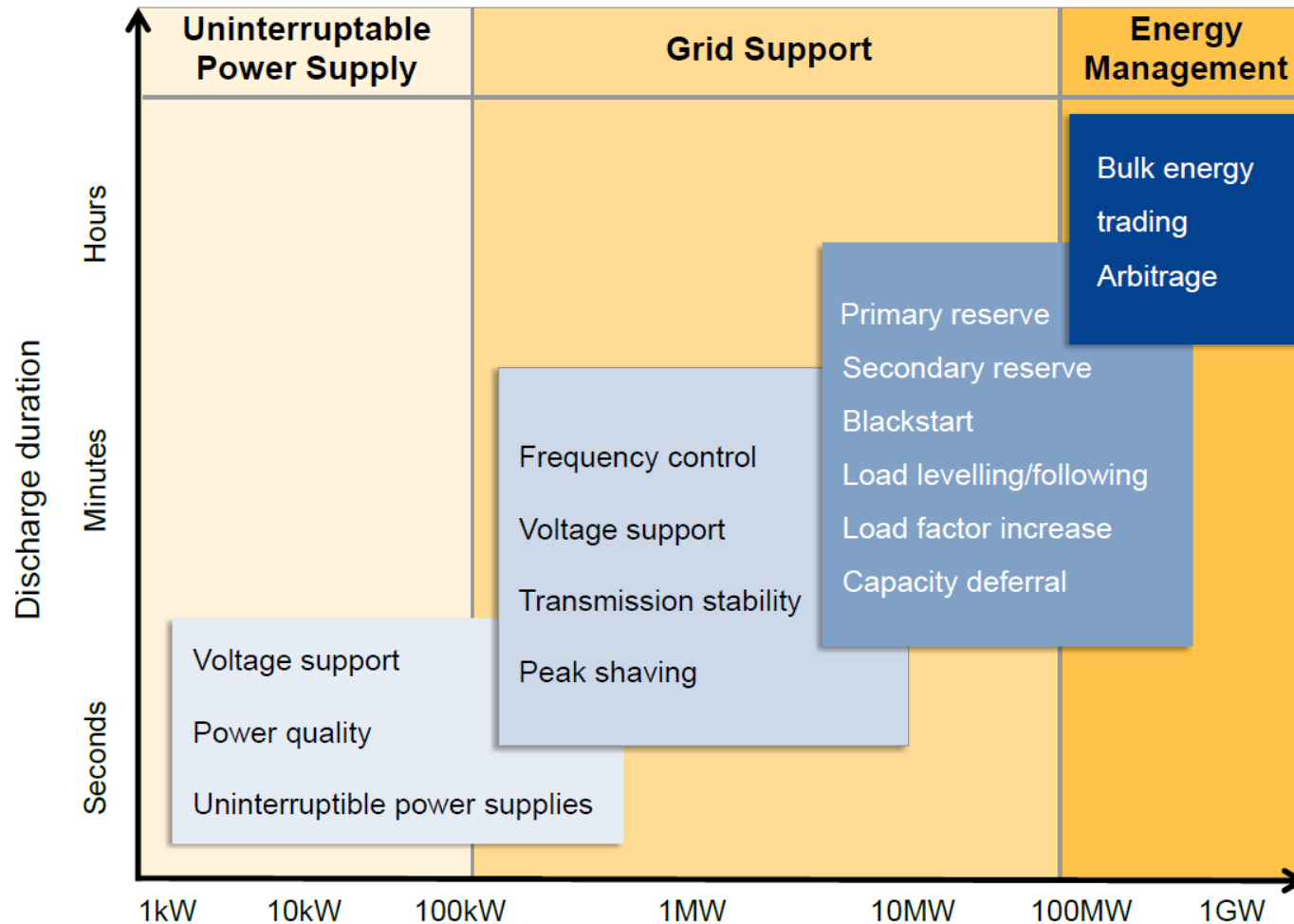


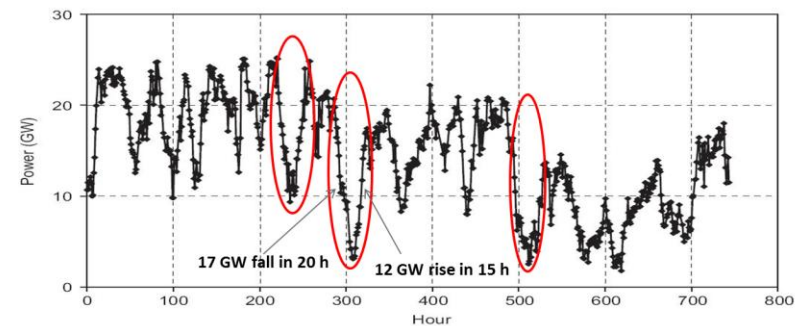
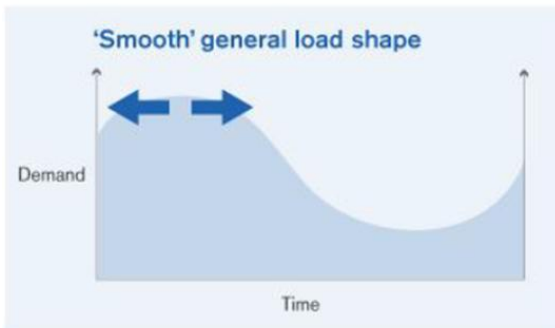
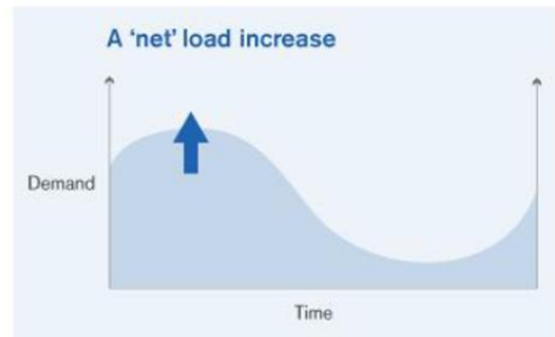
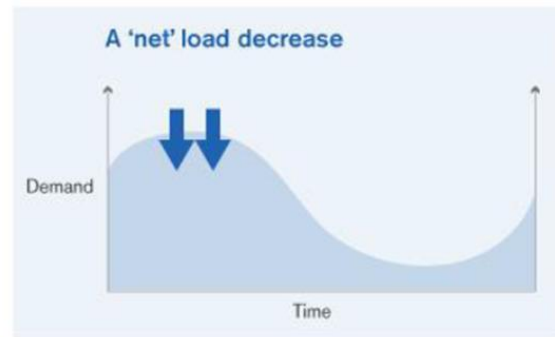
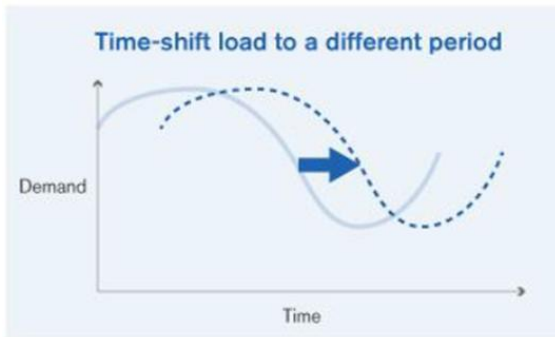
Regulatory and commercial framework for storage in interconnected European electricity systems

Christos Vasilakos Konstantinidis
Goran Strbac
Marko Aunedi
David Newberry

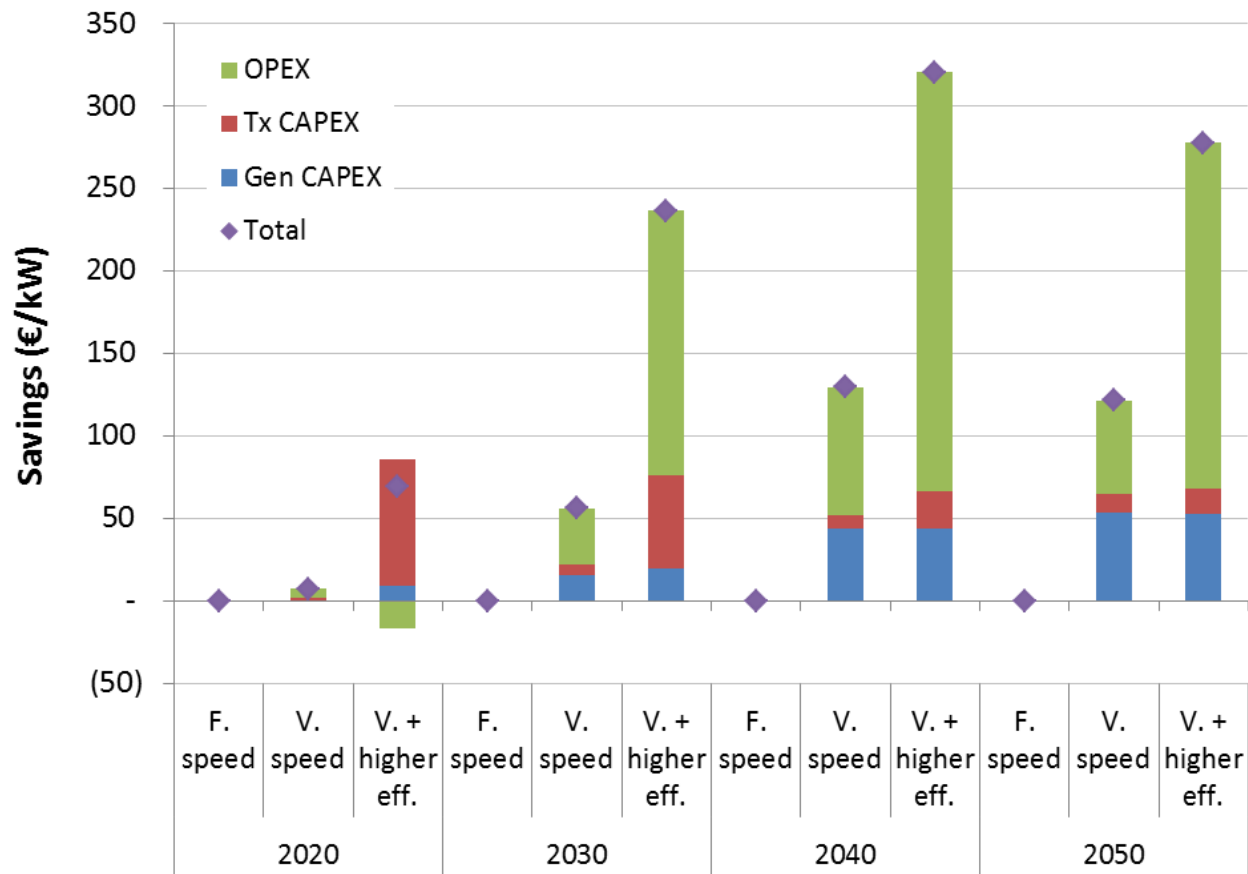
Range of Storage Applications



Value of Flexibility



System Benefits of Variable-Speed PS



- Reduction in G+T infrastructure requirements
- Generation: improving the availability during peak demand
- Transmission: management of constraints
- OPEX: reduction in peaking output
- More profound in future – with higher RES
- Higher savings obtained by improving the efficiency of PS

Regulatory and Commercial Framework

Regulatory
Framework

How is storage treated (demand, generation, storage)?

Value
Remuneration

Do market arrangements support the remuneration of the value that storage brings in the system?

Business
Models

What business models can be developed given the regulatory and market frameworks?

Regulatory and Commercial Framework/2

Storage Assets Regulatory and Commercial Framework Considerations

Dx Connected

Tx Connected

Regulatory Definition (Demand, Generation, Storage) and requirements (applicable grid codes, licencing)

Applicable Charges/Benefits (Dx, Tx, Capacity, System costs, subsidies etc)

Market Participation Options based on technical and regulatory requirements (energy, ancillary services, balancing, capacity market)

Efficiency of Market Design for Value Remuneration (Dx, Tx pricing, Short term markets and Imbalance Charges, Balancing Mechanism structure, capacity payments)

Ownership and business models options

EU Regulatory Framework and Cross-border value realisation

Regulatory and Commercial Framework – E-Storage

Transmission Connected Only Storage Typically Classified as Generation Asset subject to ownership unbundling (licencing implications and grid code requirements)

- Transmission charging
- Energy management (short term, balancing responsibility and imbalance charges)
- Balancing mechanism participation & ancillary services product definition and procurement
- Capacity remuneration

Transmission Charging

Why?

Storage can help alleviate Tx congestion and investment

How?

Tx Opex & Capex value captured through locational pricing and transmission tariffs

Current Situation

Lack of locational pricing, uniform transmission tariffs in most target countries

Best In Class

Locational marginal pricing, beneficiary pays for Tx investment

Energy Management

Why?

Energy arbitrage and imbalance charges hedging

How?

Energy trading and selling hedging services

Current Situation

Dual imbalance charge based on average pricing, improper pricing of reserves, BRP plant or portfolio level

Best In Class

Liquid and transparent short term markets – Cost reflective imbalance pricing, plant level BRP

Balancing Mechanism and Ancillary Services

Why?

System services provision expected to out-weight energy management – increased system need for flexibility

How?

Balancing mechanism participation (upwards/downwards adjustment)

Current Situation

Small percentage of total revenue – disparate approaches to balancing, ancillary services product definition and procurement

Best In Class

Co-ordinated balancing markets with homogeneous products and possible cross border participation – open question on type of products and procurement process

Capacity remuneration

Why?

Capacity payments/markets introduced in a number of countries – storage treated as generation might not be appropriate

How?

Capacity payments/capacity markets/

Current Situation

Disparate approaches across countries for capacity remuneration – unclear participation of storage

Best In Class

Market based approach to capacity procurement – storage introduced as a separate asset class

E-storage Regulatory and Market Framework Analysis

Scope

Country cases

- Overview of power markets and systems and need for flexible storage
- PS regulatory review
- Real time pricing and balancing responsibility
- Ancillary services and balancing markets
- Capacity Payments/Markets
- Country Scorecard
- UK/Ireland/Germany/Switzerland/France/Belgium

Review of EU framework

- Review of relevant PS regulation
- Review of Network Guidelines (CACM and Balancing Code)

Gap analysis and policy proposals on specific countries and EU regulatory and market framework

Thank you

Questions?