NEW FORMS OF FLEXIBILITY IN MARKETS
Elering smart grids conference, Tallinn
3 June 2014

Oliver Pearce
PÖYRY MANAGEMENT CONSULTING – ENERGY

- Europe’s leading specialist energy management consultancy.
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- Providing in-depth market analysis and strategic insight across Europe.
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  - London
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  - Stockholm
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  - Vienna
  - Villach
  - Zurich
PÖYRY MANAGEMENT CONSULTING INVOLVED IN ALL ASPECTS OF SMART ENERGY

From resource to user – and back – we are supporting change

**End-users**
- Industries: complex production, sourcing, self-generation optimisation concepts
- Small-scale: Future of retail 2020 in telecom, media, retail and energy, eVehicles

**Information, analytics and technologies**
- Demand side management, eServices,
- Energy market information processes: ICT, Datahub, Smart meters, CRM, MDM

**Markets and regulation**
- Design and modelling of markets and regulatory systems i.e. for flexibilities and RES
- Helping nations, regions or cities to develop in smart: i.e. London

**Centralised supply and delivery systems**
- Grid optimisation: Distributed generation, storages, eHighways
- Increasing Opex efficiency, sustainability and flexibility capabilities in old power plants

**Decentralized supply and delivery systems**
- Solar, heat pumps,
- New concepts: Storages for electricity and heat: Accumulators, batteries, etc.
CONTENT

1. Why do we need flexibility?
2. What are the alternative sources of flexibility?
3. What are some of the challenges to realization of flexibility?
THE SITUATION TODAY

- Flexibility enables the system to be balanced, physically, at any point in time

- Good flexibility in the Nordics- Baltics
  - Hydro
  - Large industrial units provide some demand response
  - Strong interconnection between markets

- Current interest in developing demand side response
  - Expected increase in balancing requirements, partly due to thermal plant closures, RES and demand increase
  - To support peak demand
  - Contribute to network security
ACROSS MUCH OF EUROPE, THE NEED FOR FLEXIBILITY WILL GROW WITH INCREASING WIND AND SOLAR GENERATION

With new forms of generation, prices and dispatch patterns will be dictated by wind and solar, retirement of existing flexible capacity will also influence the situation.

1. Rate of change in generation and hence volatile residual demand (net intermittent generation)
2. Dislocation between supply and demand leads to network stress
3. Flow patterns match intermittent profiles

Varying types of flexibility are needed.
Capabilities and system needs will evolve.
System context important.
THE NEED FOR WITHIN-DAY BALANCING IS ALSO EXPECTED TO INCREASE

- Weather (wind and solar) forecasting errors will involve larger variations closer to delivery
  - wind in the Nordics and Baltics
  - interconnectors to intermittent regions

- This will lead to increased value for flexibility of demand and generation, increased focus on within-day

- Nordic-Baltic system has significant flexibility through hydro so although the impact of wind and solar is still felt it will be less than thermal Europe

- Opportunity for producers and consumers to respond to within-day price signals
THERE ARE FOUR MAIN SOURCES OF FLEXIBILITY

### Sources of flexibility

**Flexible Generation**
- Peaking capacity for low wind periods
- Flexible plants to deal with short-term variability
- Flexible generation at renewables sites

**Increased inter-connection**
- Interconnection to neighbouring markets
- Full utilisation of network to reduce wind curtailment
- Transmission reinforcement to link wind to demand

**Demand Side Response**
- Incentives for peak demand reduction
- Incentives for peak price avoidance / reduction
- Heat electrification with flexibility potential
- Flexible charging patterns from electric vehicles
- Demand reduction for balancing services

**Electricity Storage**
- Energy export for low wind periods
- Energy import for high wind periods
- Storage at point of generation – small or large
- Full utilisation of network to reduce wind curtailment
- Storage of electrified heat
- Storage linked to electric vehicles
- Provision of national or local for balancing services
RESHAPING OF NETWORKS WILL ENABLE ACCESS TO DECENTRALISED FLEXIBILITY

The customer is currently a passive element of the value chain but will become more active in the future with smart meters as enablers of this change.

One way energy flows, passive customers

Multidirectional flows, active customers

Diagrams source: EURELECTIC
There has been a lot of work on commercial models.

The advent of smart technology represents significant opportunities for different parts of the energy system in terms of new relationships, new commercial arrangements and new solutions.
SMART PROVIDES PLATFORM FOR SYSTEMIC CHANGE

Usage and supply in energy is affected and enabled in various platforms

Key drivers today:

End users
- Fragmented segments from individuals to industries with different needs in energy and other resources
- Total cost of energy a driver, role of other benefits increasing

Information, analytics & technology
- Big data
- Internet of things
- Smart

Market & regulation
- Competition through regulation
- Investment security and right operational signals
- Local, national, regional and global targets

Infrastructure
- Large scale generation
  - Grids: Electricity, Heat, Cooling, Fuels, Water
- Distributed generation & Storage
- Increasing volatility – from 15 min to annual level
- Wind & solar becoming mature – next: MicroCHP, Storage, eVehicles, B-t-L,….?
- Emergence of new business model – holding onto old business models
NEW SOURCES OF FLEXIBILITY BRING TOGETHER DIFFERENT STAKEHOLDERS

Stakeholders may have different views on how to utilise flexibility; recognition of this situation and co-ordination between stakeholders will be key.

Values will be dictated by stakeholders focus (e.g. National v Local)
DEMAND SIDE RESPONSE CAN BE USED TO REDUCE PEAK DEMAND OR PEAK PRICE

Which peak do you target with DSR? Suppliers could have a different answer to DNOs or TSOs

- Price peak – as effect of wind means that thermal generation peaks at 10am
- Demand peak - occurs at 6pm due to coincident heat and lighting loads
STORAGE CAN ACT ACROSS A RANGE OF TIMESCALES TO HELP BOTH THE MARKET AND NETWORKS

- Solutions to meet increased reserve and response needs
  - Short term active demand management
- Lessen within-day volatility
  - Balance portfolio
  - Balance forecast error
- Reduce reserve holding
- Reshape demand
  - Increase off peak demand
  - Reduce peak demand
- Lower day to day volatility
- Longer range interconnection
- Other storage possibilities
- Avoided network and generation capacity

Storage of different types can help deal with all these issues enhancing security of supply and market costs.
Sources of flexibility could have wider system benefits that should be recognised

Example shows a storage project that has revenues attributable to wider system benefits.

In the case that full system benefits were recognised, total revenues would be greater than costs.

However, some of the revenues are not accessible under current arrangements:
- Network capex avoidance (needs to be incentivised)
- Displaced generation

Access to revenues would enhance project viability.

Benefits, costs, revenues of storage

- Total benefits
- Costs
- Realised revenue

Arbitrage
Ancillary services
Freq response
Fast response

Not accessible i.e. avoided network capex or running coal plant
Many European electricity markets have or are developing capacity mechanisms, which will affect the incentives for flexibility.
**SUMMARY – CHALLENGES TO UNLOCK INNOVATIVE DECENTRALISED FLEXIBILITY**

Demonstration projects and supporting regulation are critical

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<tr>
<th>Challenge</th>
<th>Detail</th>
<th>Potential solution</th>
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<tr>
<td>Technical</td>
<td>• Immature technology</td>
<td>• Innovation funding</td>
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<td></td>
<td>• High cost</td>
<td>• Demonstration projects with specific targets and outcomes</td>
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<td></td>
<td>• Functionality questions</td>
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<td>Policy support</td>
<td>• Policy decisions influence revenue streams</td>
<td>• Political support for demonstrations</td>
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<td>• Consumer engagement with technology</td>
<td>• Policy support leading to flexibility incentives</td>
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<td>Stakeholder interaction</td>
<td>• Understand stakeholder interaction e.g. utility/TSO /DNO /supplier /consumer</td>
<td>• Demonstration projects with specific targets and outcomes; Input to regulation</td>
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<td>Regulatory</td>
<td>• Stakeholder co-ordination</td>
<td>• Modified regulation informed through demonstration projects and studies</td>
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<td>• Regulation must facilitate DSR and storage on equal basis with gen.</td>
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THANK YOU!

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