DEMAND SIDE RESPONSE AS A SOURCE FOR FLEXIBILITY

Elering conference on smart grids

15 October 2015

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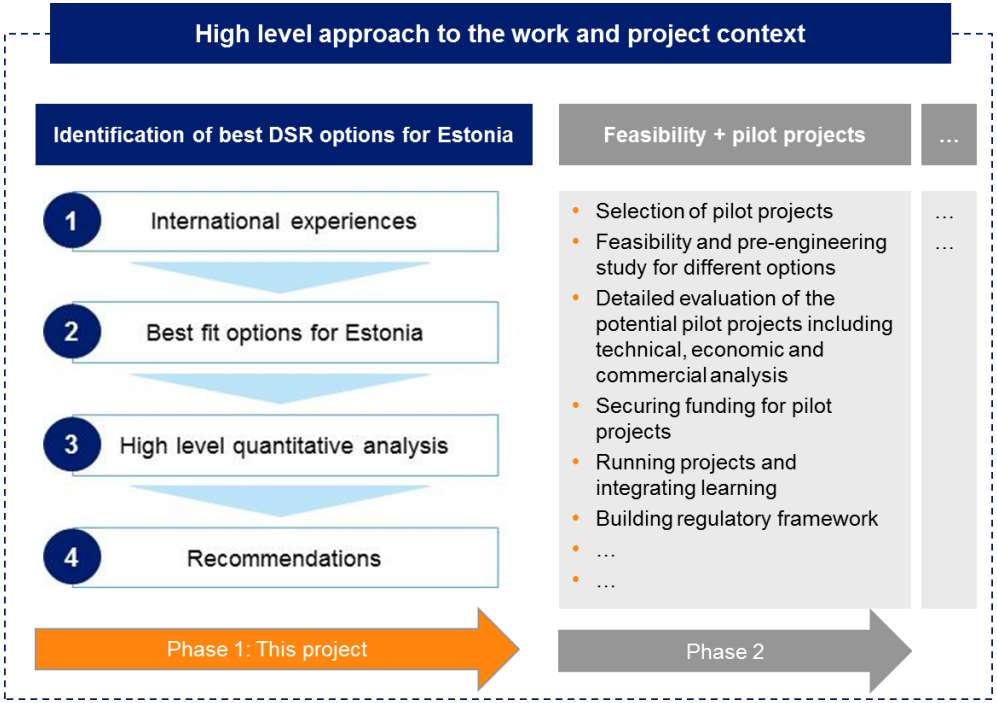
INTRODUCTION AND OVERVIEW

Elering commissioned a study to understand how DSR may be used in Estonia to balance the system and contribute to meeting their security of supply needs

Project description

Client	Elering AS
Duration	~5 months
Objective	A view of the preferred DSR options for Estonia and a high level understanding of their potential economic benefits as well as understanding the market and regulatory changes needed
Stake-holders	• DSO • Supplier/BRP • Aggregator • Estonian Renewable Assc. • Regulator (regulator) • Ministry of Economic Affairs and Communication



KEY RESULTS AND RECOMMENDATIONS

- The socio-economic value of DSR to the Estonian system rises over time and varies according to uses by stakeholders
  - DSR could help provide reserve when Baltics desynchronise
  - Day ahead and within day market value of DSR increases over time
  - DSR contributes to Estonian security of supply
  - DSR is valuable to the DSO

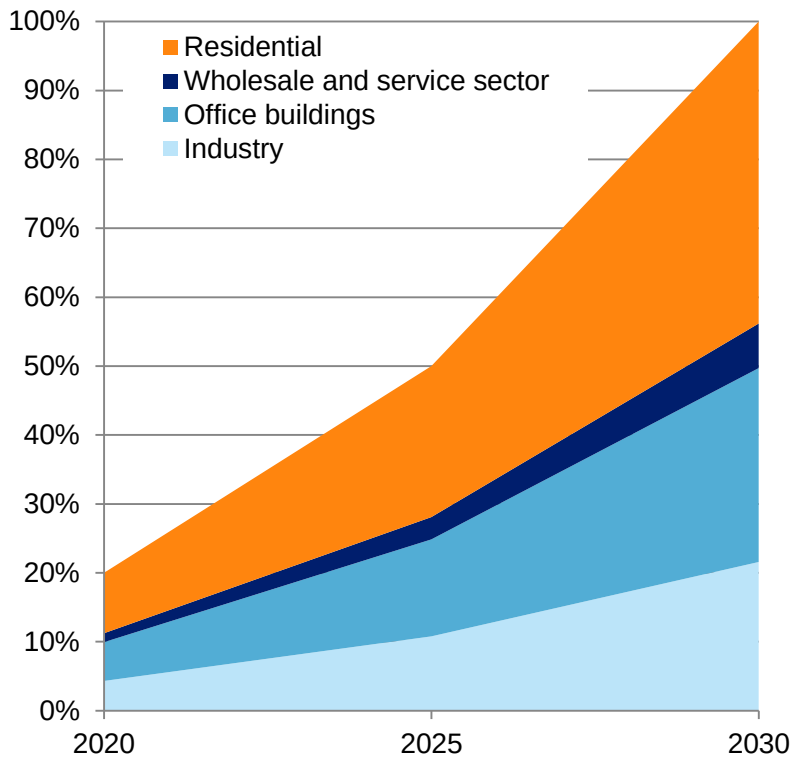
- There is a case to design a commercial and regulatory framework to enable benefits and costs of DSR to be shared efficiently between the different stakeholders
  - DSR has the potential to provide benefits to multiple Estonian stakeholders, but the benefits are not distributed evenly
  - Regulatory framework needs to develop to all DSR to compete

- DSR could be rolled out in advance of replacement of substations for the DSO in a way that permits the use of resources by the TSO later for system services
  - The roll out should include trials and demonstrations involving all stakeholders
  - The roll out should enable use of resources by other stakeholders at a later date

DESCRIPTION OF THE DSR DEPLOYMENT SCENARIO

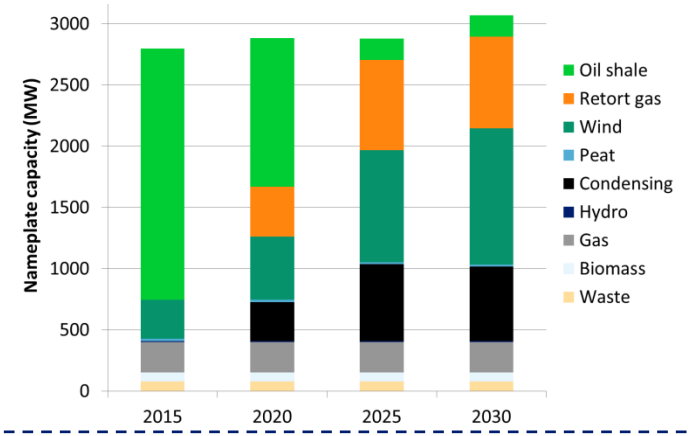
DSR potential comes from mostly non-industrial sectors while generation mix is dominated by the conversion of shale oil, and the significant increase in wind capacity

DSR potential per segment (MW)

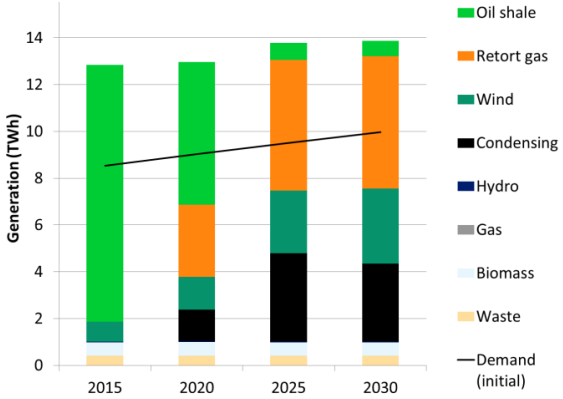


Source: Tallinn University of Technology

Installed capacity (MW)

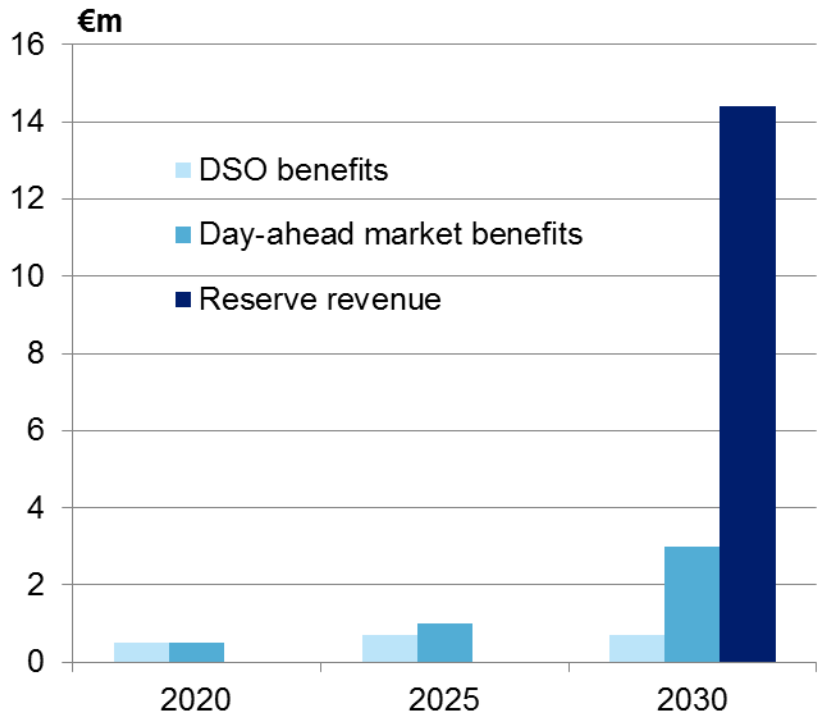


Generation and demand (TWh)



THE SOCIO-ECONOMIC VALUE OF DSR TO THE ESTONIAN SYSTEM RISES OVER TIME

DSR benefits



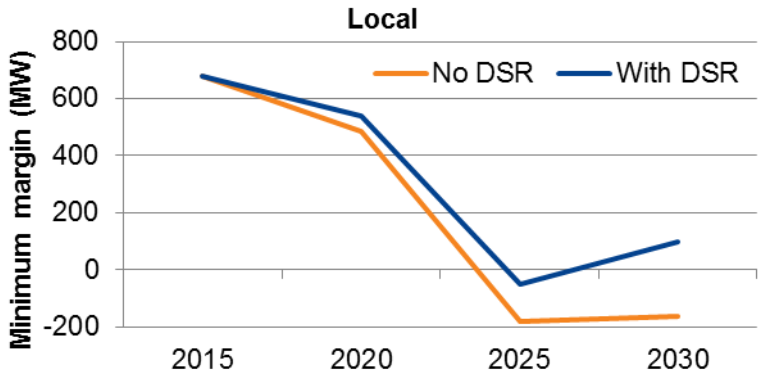
- Benefits for balancing and intra-day market benefits were not quantified in the scope of this study
- The modelling of holding reserve was assumed to be relevant 2030. Benefits than earlier can be estimated by linearly interpolating the benefits of 2030 based on the available DSR capacity

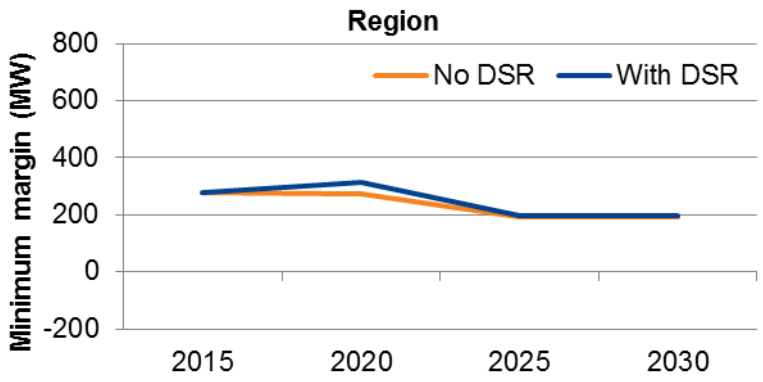
Comments

- DSR value for the purposes of optimising day-ahead market costs in Estonia, rises over time
- The value in intraday and balancing markets will increase due to increased wind penetration, but only to a limited extent
- DSR contributes to Security of Supply
- When Estonia desynchronises, DSR could play a key role in the provision of holding reserve and deliver significant cost saving potential for the Estonian system and avoided investment costs (approx to half the cost of building the Kiisa 2x125MW units, i.e. €68m)
- Local level benefits to the DSO could be accessible in the near term (depending on the DSO schedule to reinforce substations and DSR availability)

DSR CAN CONTRIBUTE TO ESTONIAN SECURITY OF SUPPLY

Effect of DSR on Security of Supply



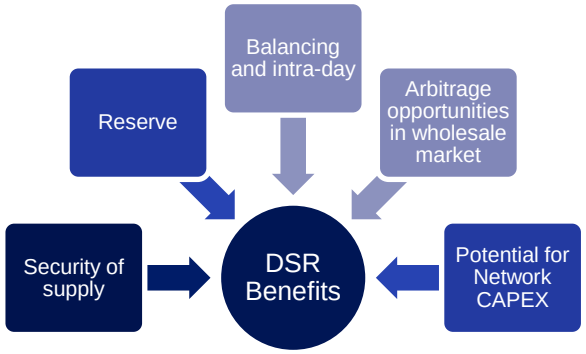


- Estonian minimum system margin can be greatly improved by DSR and helps ensuring Estonia's independence
  - The minimum margin is close to -200 MW in 2025
  - DSR could help to avoid an investment in e.g. a gas-fired peaking plant
- Taking a regional perspective, the margin stays positive overall and DSR does not have a significant effect on the overall capacity margin in Estonia
- The current way of measuring Security of Supply is on a national level, but the direction is to promote regional cooperation on Security of Supply measures (EU Energy Union)
- Elering's Security of Supply report reveals that under N-1-1 conditions there could be a lack of capacity, which would push back towards the Local case

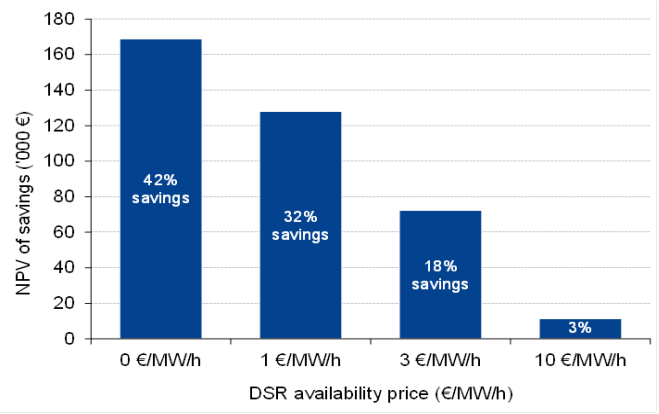
MULTIPLE REVENUE STREAMS OF DSR NEED TO BE ACCESSIBLE

There is a case to design a framework to enable benefits and costs of DSR to be shared efficiently between the different stakeholders

DSR has multiple value streams



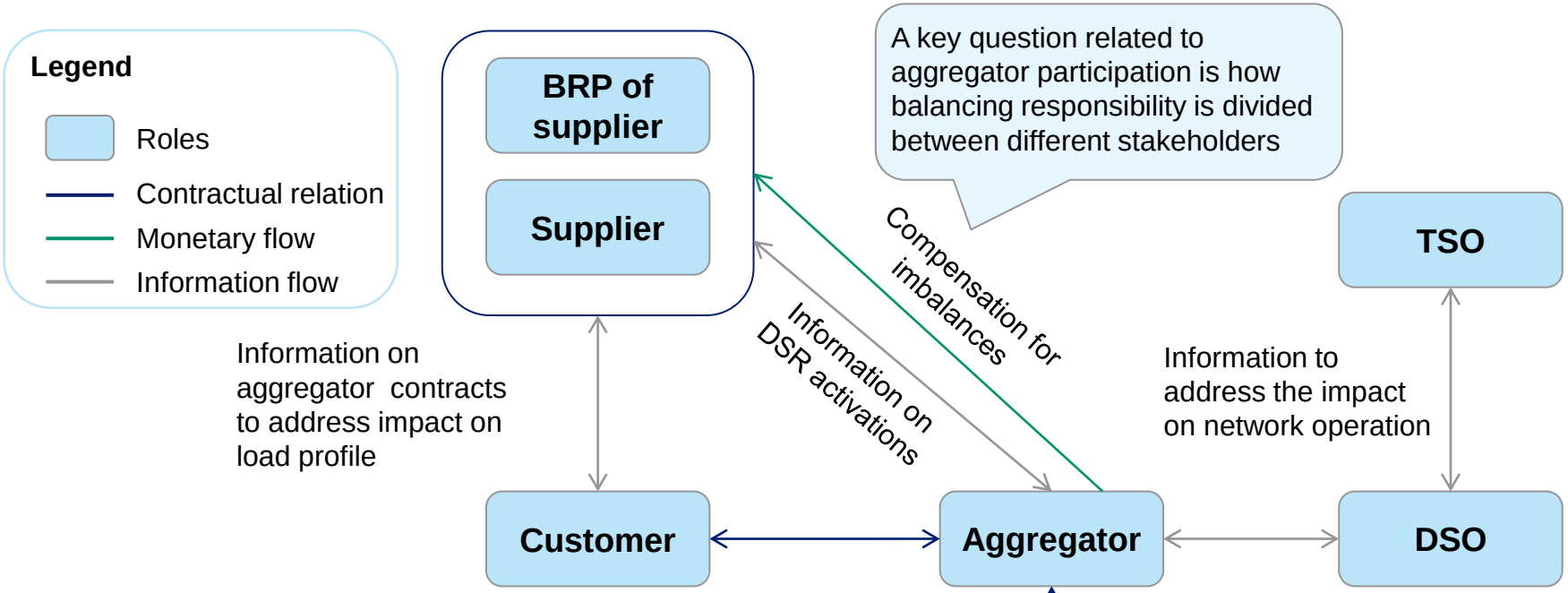
Sharing costs builds DSR business case



NPV of savings as a percentage of reinforcement costs

- DSR has the potential to provide benefits to multiple Estonian stakeholders, but the benefits are not distributed evenly
- For example, most DSO schemes will require sharing of DSR to achieve a significant economic benefit
- Appropriate sharing schemes and/or regulations facilitate the efficient use of DSR from a system perspective
- Analysis shows that conflicts in the use of DSR are likely to be rare
- This logic should be applied to trials and pilot projects

AGGREGATOR PARTICIPATION AND BALANCING RESPONSIBILITY REQUIRES ATTENTION



Key questions to consider in the Estonian context:

- Can aggregated load participate in all markets?
- Can the aggregator act without permission of the BRP?
- Is compensation for imbalances required? At what price?
- What information is needed from aggregator to BRP in advance and in real time? Is there time for the BRP to re-trade?
- What rights are the customers deemed to have over their option to select their service provider?

Source: "Designing fair and equitable market rules for demand response aggregation" – EURELECTRIC

EMERGING ROLE OF THE DSO IN ESTONIA

- There is a need for an efficient coordination of operations and new investments between TSOs and DSOs on their respective “electrical borders” to support decarbonisation and decentralization
- DSO needs to smarten its network but what activities should a DSO be allowed to use DSR for?
  - Network constraints? Security of supply? Something else?
  - The above operations and interactions will need to be co-ordinated with the TSO
  - One possible issue is if TSO or market activated DSR causes local hotspots on the distribution network, which then requires more active management
- The existing network regulatory model (similar to the model in Finland) needs to be reconsidered to incentivise using DSR to avoid/defer capital expenses (CAPEX)

CEER analysed activities on DSO involvement	Core activities	Potentially allowed	Forbidden activities
Penetration of RES plants and demand for flexibility			
• **Local dispatching of local resources** • Using batteries and other accumulation systems for congestion resolution		✓	
Activities in which the DSO should not be involved			
• Energy production and supply			✓
• Exception to allow bargaining temporary local production to grant supply continuity • **Exception as last resort supply of electricity**		✓	
Activities related to retail market liberalization			
Interaction with suppliers	✓		
• DSO activities on request of suppliers (e.g . switches) • Commercial data management related activities		✓	

Source: “The Future Role of DSOs A CEER Public Consultation Paper” – CEER C14-DSO-09-03

HIGH LEVEL ROADMAP FOR THE DEVELOPMENT OF DSR (1/2)

DSR could be rolled out in advance of replacement of substations in a way that permits the use of resources by the TSO later for system services

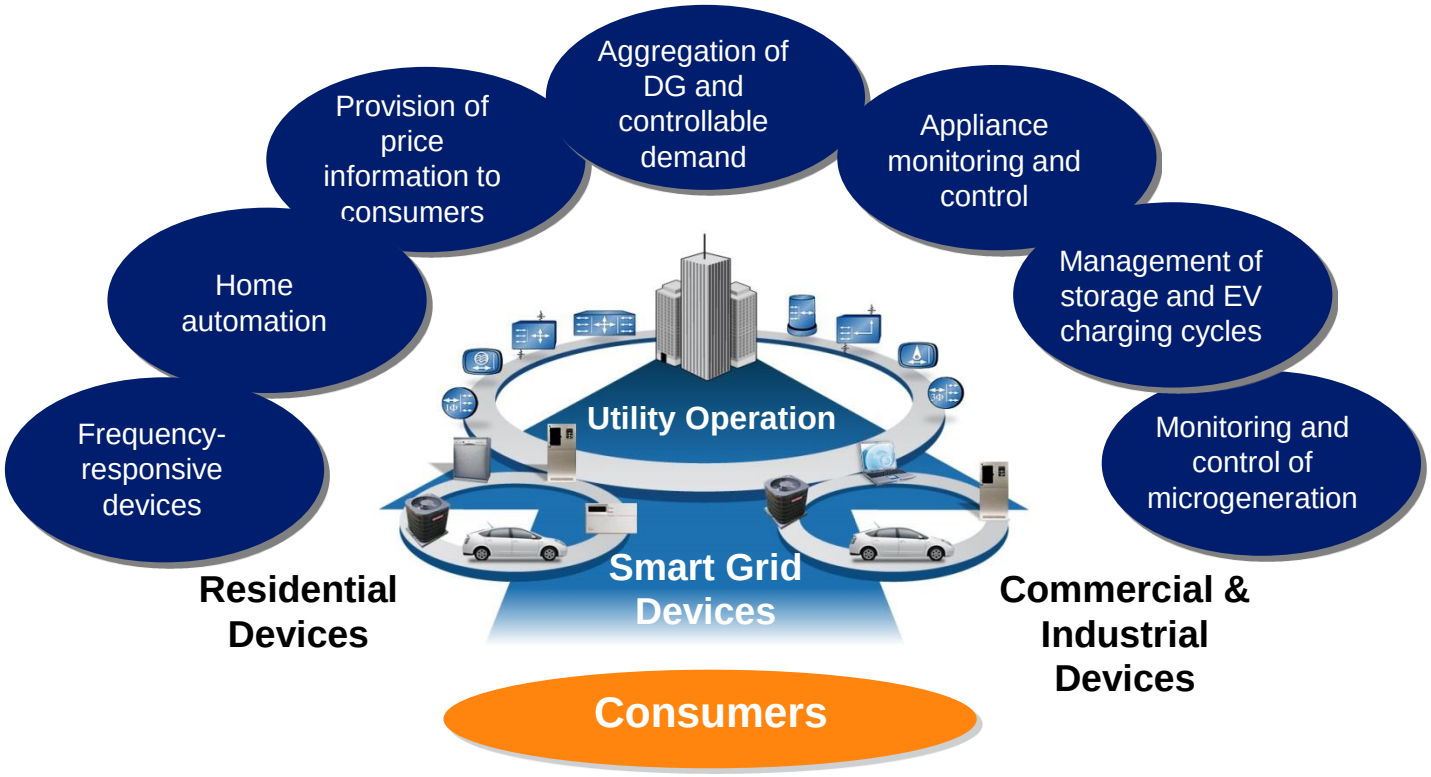
	2015-20 Continued integration of wholesale energy markets	2020-25 Integrated Baltic market and preparing for desynchronization from the UPS/IPS system	2025-30 Desynchronized from the UPS/IPS electricity system

Market trends	• Creation of common Baltic balancing market, including standard products for balancing
	• Preparing for integration in the Nordic balancing market
	• Preparing for following phases i.e. regulatory and commercial framework suitable for DSR
		• Creation of common Nordic-Baltic balancing market
		• Preparing for desynchronization from the UPS/IPS system
		  • Requirements and pilot tests for primary and secondary reserves
		  • Preparations for island operation of the Baltic system
			• Operating the Estonian and Baltic electricity systems independently
			• Well integrated markets with other Baltic and Nordic countries

Potential use of DSR	• First DSR trials, pilots and implementation for specific purposes such as manual frequency restoration reserves; use by DSO and suppliers	• Expanding the use of DSR and including more DSR resources in desynchronization pilot tests	• Consumers active participants in the electricity markets • Increased familiarity with DSR and its possible applications and business models

ADAPTING DOWNSTREAM MARKETS

Consumers will no longer be simply a service taker but will increasingly become a service provider. This process entails learning and hence trials



CONSIDERATIONS WHEN DESIGNING A TRIAL

1

- What is the hypothesis we are trying to answer?

2

- What methodology should be used?; how will the trial be designed?; and what is the proposed outcome?

3

- What is the justification for the project, including how the commercial arrangements will work

4

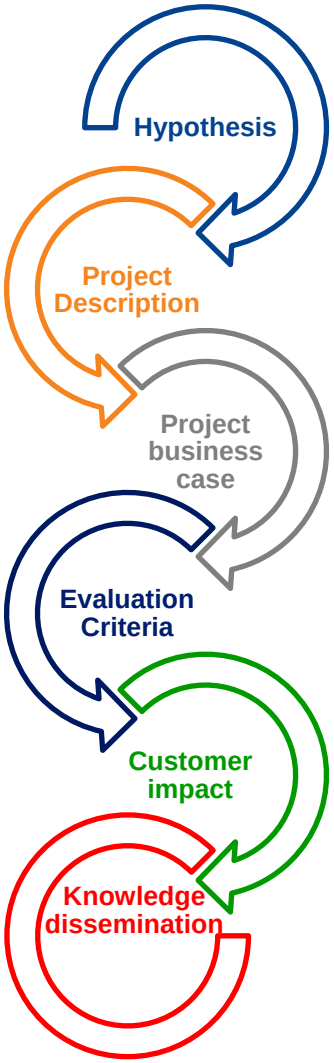
- There must be a clear understanding of the of the criteria against which the project will be assessed.

5

- Understand how customers will be affected – will the trial impact on customer bills or supply?

6

- Identify how to capture the key learning points and disseminate the information to key stakeholders



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