SmartNet

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

Arona (IT) | May 16th, 2019

Regulatory Guidelines

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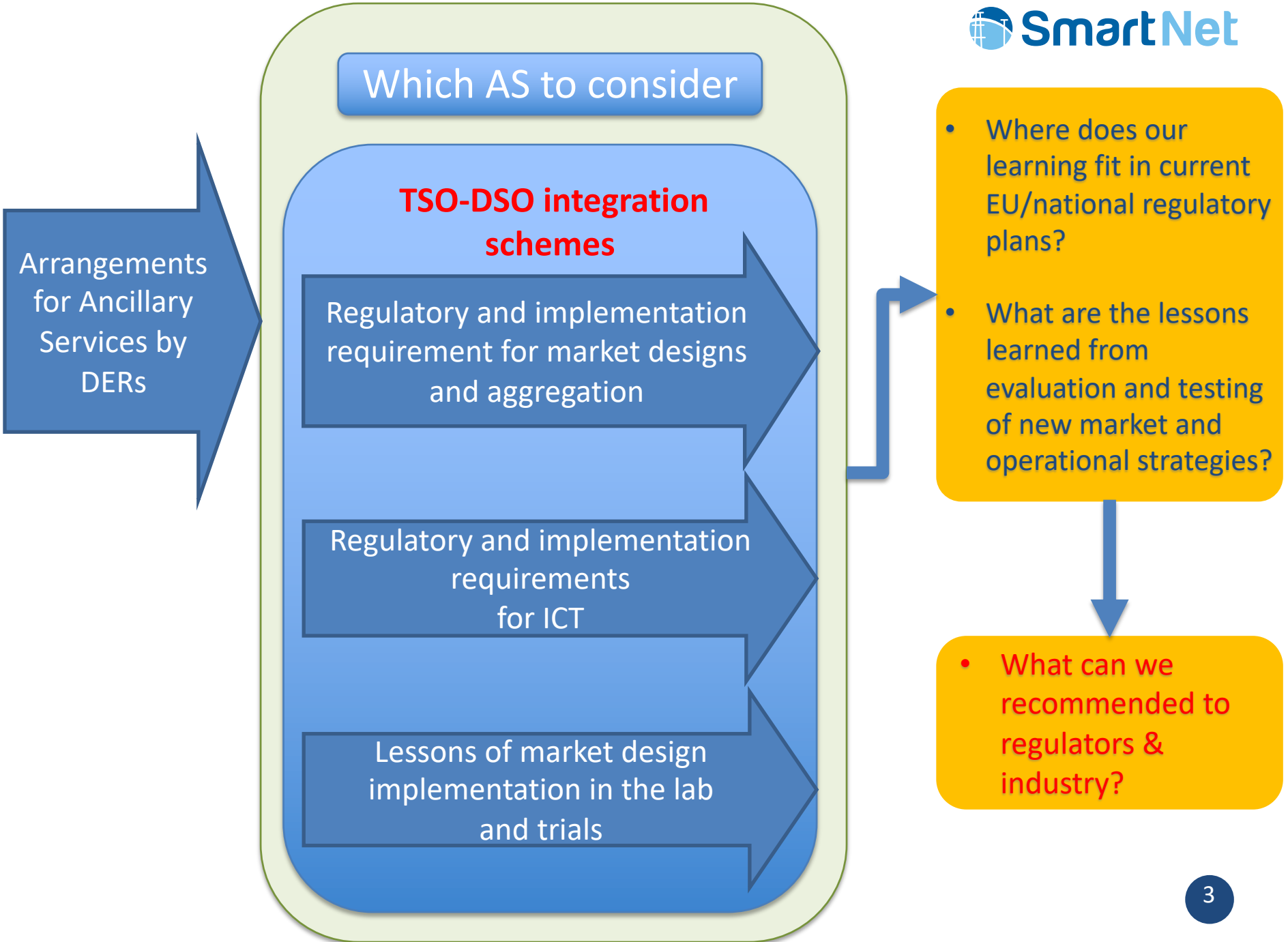
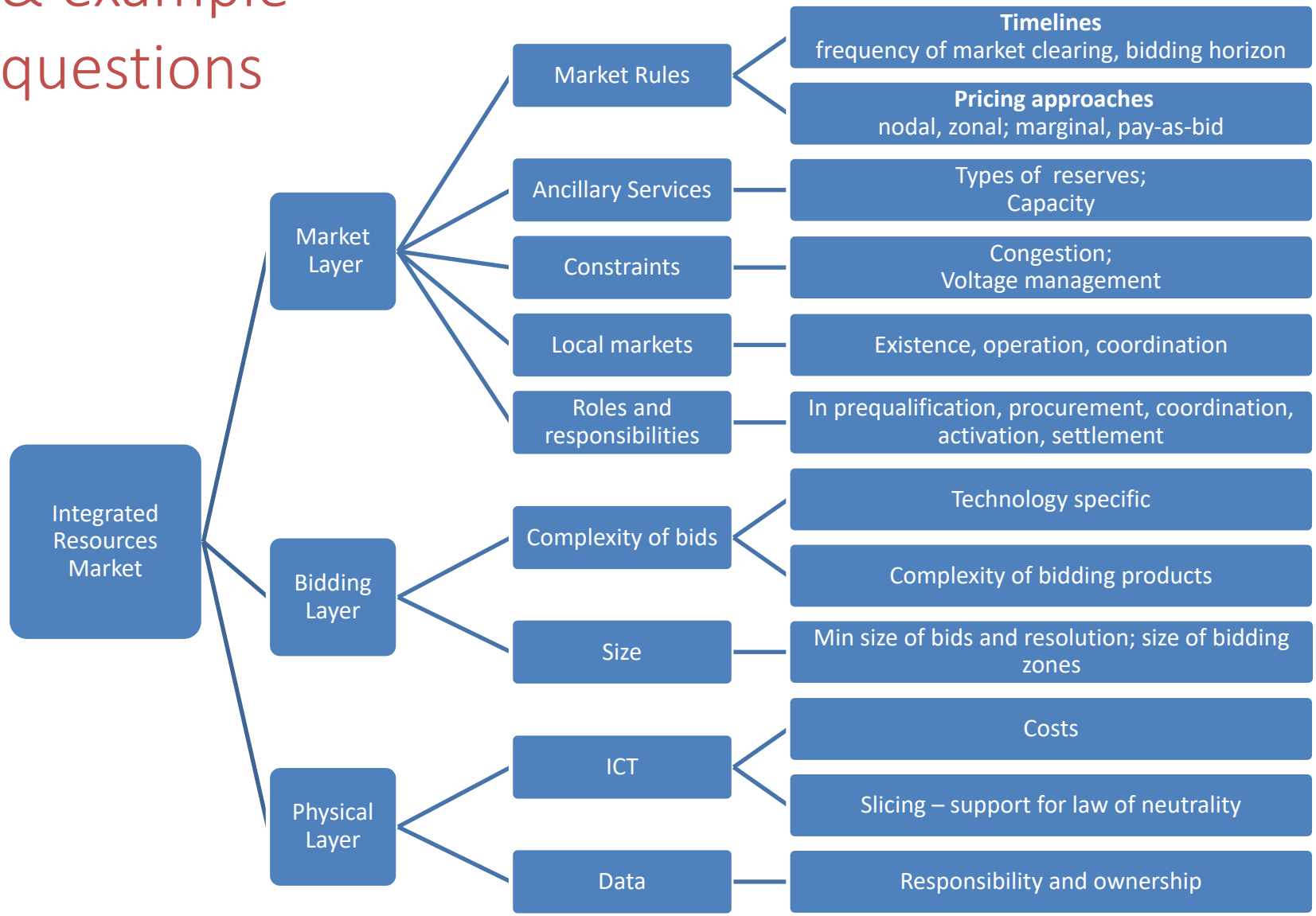
Regulatory analysis

- Evaluate which policies are needed to enhance TSO-DSO integration and overcome potential barriers for DER participation in provision of AS
  - How proposed market architectures and operation/planning strategies relate to current EU and national (Denmark, Italy, Spain, Nordic, UK..) regulation/roadmaps
  - Lessons learned from evaluation and testing of new market and operational strategies
  - Produce a set of regulatory guidelines that reflect learning outcomes of the SmartNet project


Which AS to consider
Arrangements for Ancillary Services by DERs
TSO-DSO integration schemes
Regulatory and implementation requirement for market designs and aggregation
Regulatory and implementation requirements for ICT
Lessons of market design implementation in the lab and trials
Where does our learning fit in current EU/national regulatory plans?
What are the lessons learned from evaluation and testing of new market and operational strategies?
What can we recommended to regulators & industry?

Structure of Analysis & example questions



Regulatory alignment: screening documents

- The aim is to evaluate how SmartNet aligns with the regulatory and legislative framework, as well as stakeholders' positions (over 40 documents)
  - which has already been implemented
  - has been suggested for the implementation or are in development
- Evaluation of regulatory alignment
  - Legislation
  - Regulation
  - Strategies
- Stakeholders' views
  - Position papers
  - Roadmaps
  - Other

Foreseen tasks for the new DSO

- The foreseen tasks for the new DSO entity are as follows:
  - coordinated operation and planning of transmission and distribution networks
  - integration of renewable energy resources, distributed generation and other resources embedded in the distribution network such as energy storage
  - development of demand response
  - digitalisation of distribution networks including deployment of smart grids and intelligent metering systems
  - data management, cyber security and data protection
  - participation in the elaboration of network codes

Regulatory alignment and learnings

- Market modelling and timelines
  - In SmartNet simulations time step has been selected as 15min
  - In line with regulation that from 1st January 2025, the imbalance settlement period should be 15 minutes in all control areas.
  - Further considerations
    - Latency issues and network slicing
    - Frequency of market clearing vs. accuracy of results
    - Inclusion of a rolling horizon in the market clearing
    - Understanding behaviour of market participants

Regulatory alignment and learnings

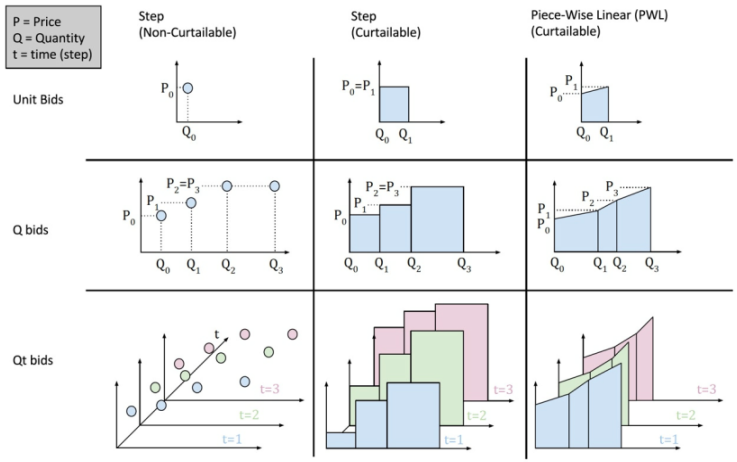
- The market objective
  - Maximisation of the social welfare prevails even if some present real time markets, by contrast, minimize purchase costs of the needed services
  - In the SmartNet the approach is that the total cost of deploying the flexibility (procurement and activation) are minimized
    - maximizing the welfare by avoiding unnecessary activation - only activations that contribute towards releasing congestion or voltage violations will be used

Regulatory alignment and learnings

- Accounting for technical DER constraints
  - No present legal requirements for inclusion of device-related constraints - proposal for inclusion of certain requirements on portfolio-level are advanced by stakeholders
  - Who should account for this and how?
    - directly accounted by a market design and optimization formulation – in SmartNet
    - to expect market participants, and in particular aggregators, to develop bidding strategies that include those constraints indirectly
  - The way in which this is done in the market design will directly influence the definition of bids, i.e. products

Regulatory alignment and learnings

- Complexity of bids
  - A simple bids that will not reflect technical characteristics of DERs and their operation, leaving to the more complex market clearing algorithm to model these constraints
  - More complex bids that reflect DERs technical characteristics
    - This is adopted in SmartNet
    - range of bidding products is ono of the strengths of the SmartNet as is allow detail descriptions of available bid types



Regulatory alignment and learnings

- Minimum bid size and resolution
  - EU regulation does not consider this, however, in some countires Balancing Guideline foresees movement towards smaller balancing products
  - In local markets it is necessary to have small size bids in order to enable adequate liquidity – in SmartNet min size is 1kW per node in distribution level

Regulatory alignment and learnings

- Management of voltage constraints
  - Voltage control is formally defined as non-frequency ancillary service and TSOs and DSOs should agree on voltage control parameters at the border of the networks
  - This requires more accurate AC modelling of distribution networks
  - Modelling of non-linear constraints, and in particular combined with the binary variables, is computationally challenging task
  - Modelling of the distribution network in the SmartNet simulator is based on simplified Dist-flow optimisation model
  - Transmission networks has been modelled using DC network approximation

Regulatory alignment and learnings

- Relationship with previous markets
  - several initiatives are ongoing in Europe to promote further harmonization and integration of the EUs internal energy market. The market coupling of day-ahead markets is close to being finalized and the coupling of intraday markets is ongoing
  - Intraday markets should bring gate closure as close as possible to real time
  - In Smartnet the outcome of the intraday market clearing is used as the baseline for the SmartNet Markets

Deliverable 6.3 in consultation

Deliverable 6.3

Policy recommendations

to implement and/or overcome barriers

and enable TSO-ISO integration

www.smartnet-project.eu

Consultations

References - SmartNet Deliverables

www.smartnet-project.eu

publications/deliverables

- D1.3 - Basic schemes for TSO-DSO coordination and ancillary services provision
- D2.1 - Aggregation models
- D3.2 - ICT Architecture Design Specification
- D4.3 - Cost-benefit analysis of the selected national cases
- D4.4 - Lab-environment set-up and simulations
- D5.1 - Results of Pilot A (Italy)
- D5.2 - Results of Pilot B (Denmark)
- D5.3 - Results of Pilot C (Spain)

Agenda

- Item 1: The evolution of the role of the DSO
- Item 2: Coordination schemes assessment
  - CS-A
  - CS-B
  - CS-C
  - CS-D
- Item 3: Other regulation remarks

Evolution of the DSOs figure

Prequalification

Evolution of the DSOs figure

Prequalification

Local congestion management market

Evolution of the DSOs figure

Prequalification

Local congestion management market

Local congestion management & balancing market

Evolution of the DSOs figure

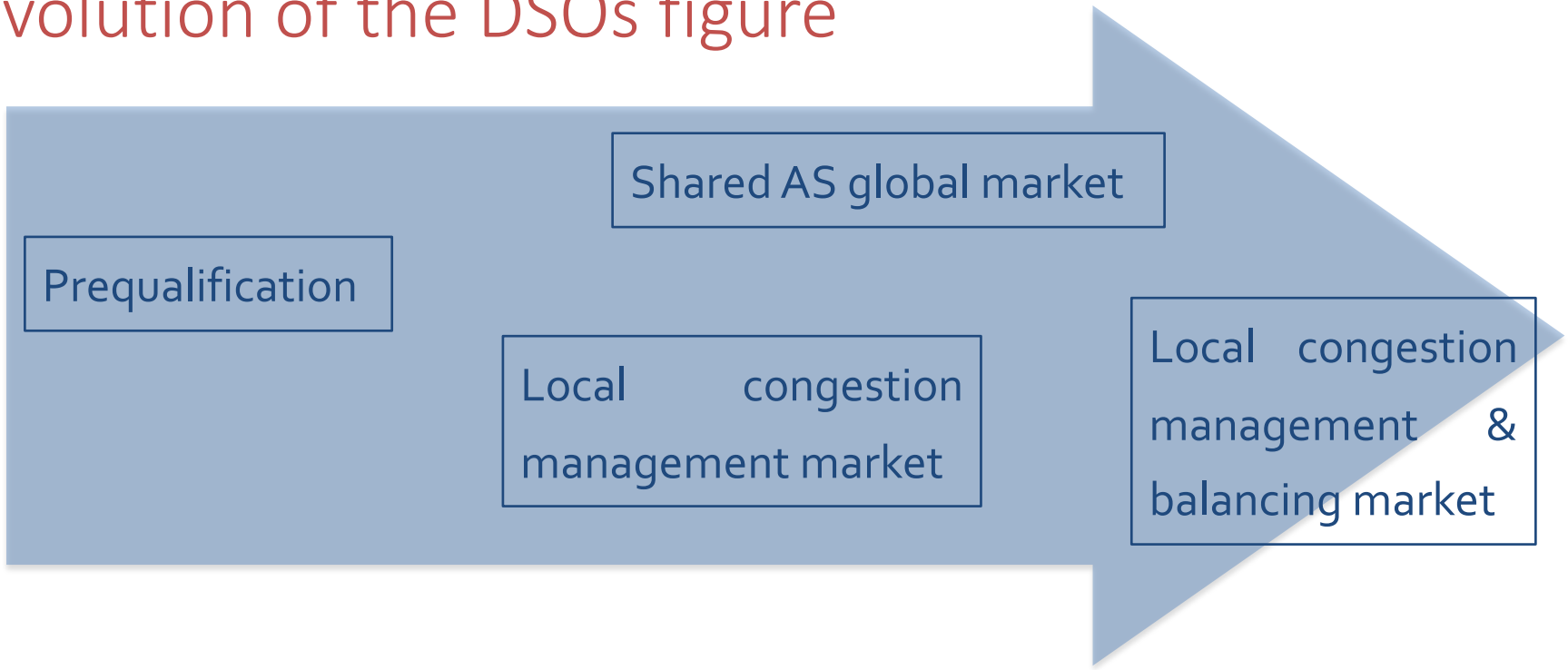
Shared AS global market

Prequalification

Local congestion management market

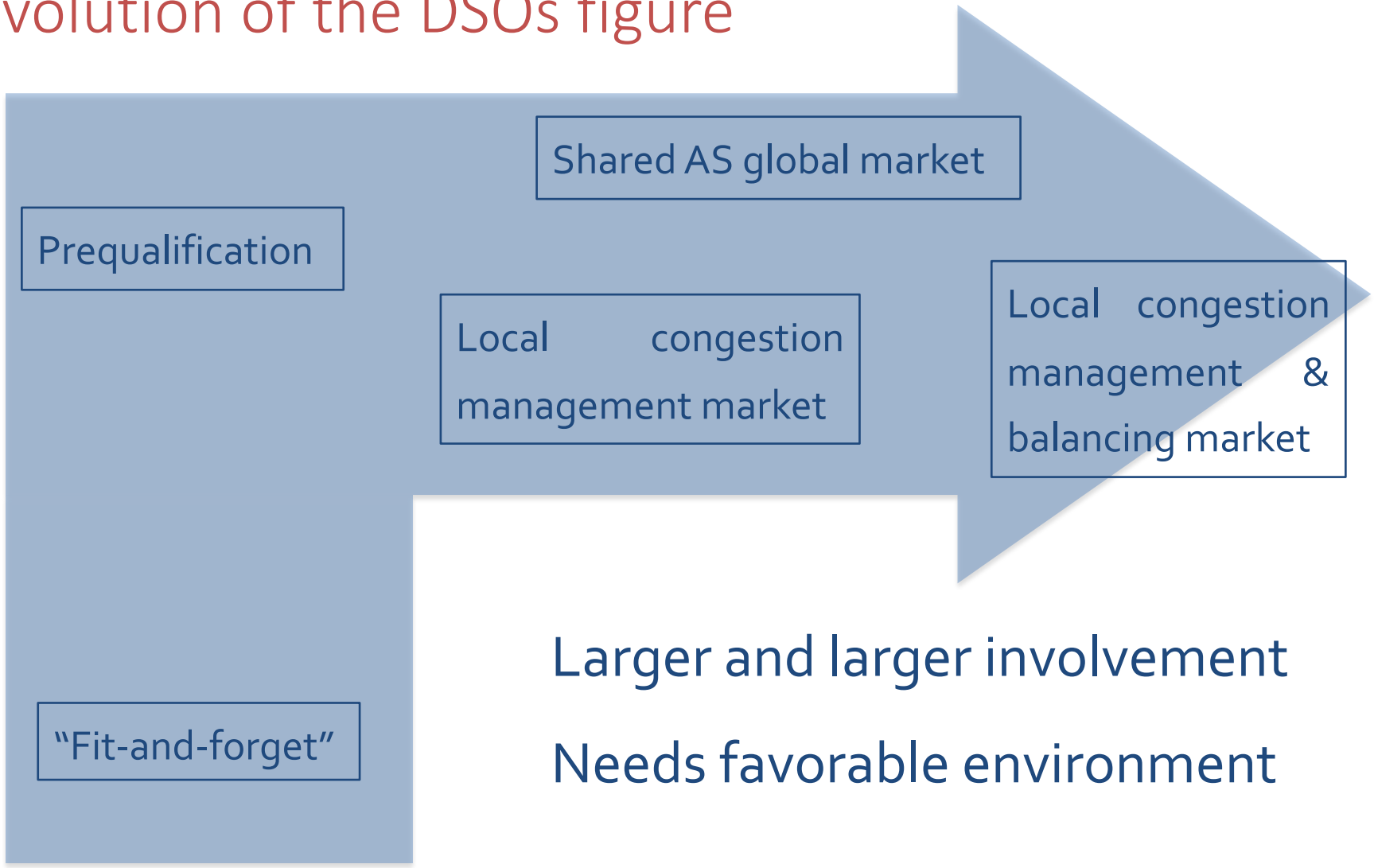
Local congestion management & balancing market

Evolution of the DSOs figure



Larger and larger involvement

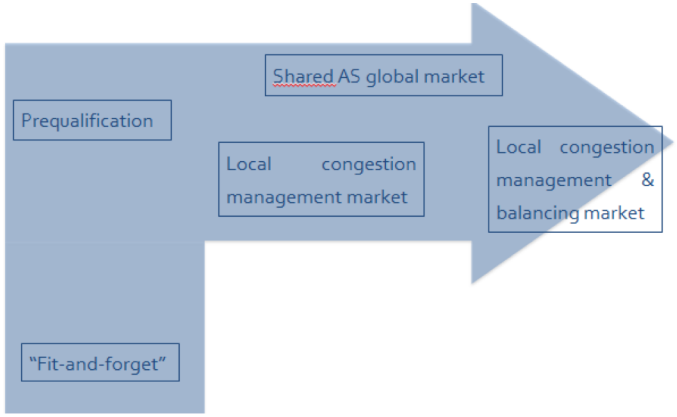
Evolution of the DSOs figure



Larger and larger involvement

Needs favorable environment

Evolution of the DSOs figure



Needs favorable environment

- Regulation

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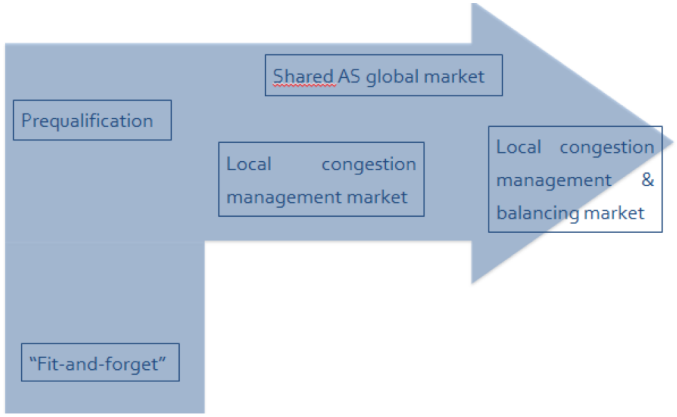
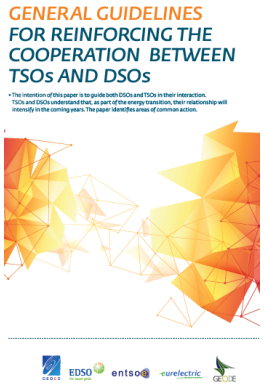


Needs favorable environment

- Regulation
- Cooperation w. TSOs



Coordination Schemes Assessment CS-A

- Prequalification i.e. “Full” control on DN

$\Rightarrow$ investment in ICT

Coordination Schemes Assessment
CS-A

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  ⇒ investment in ICT

  to be compared with “fit and forget”

Coordination Schemes Assessment
CS-A

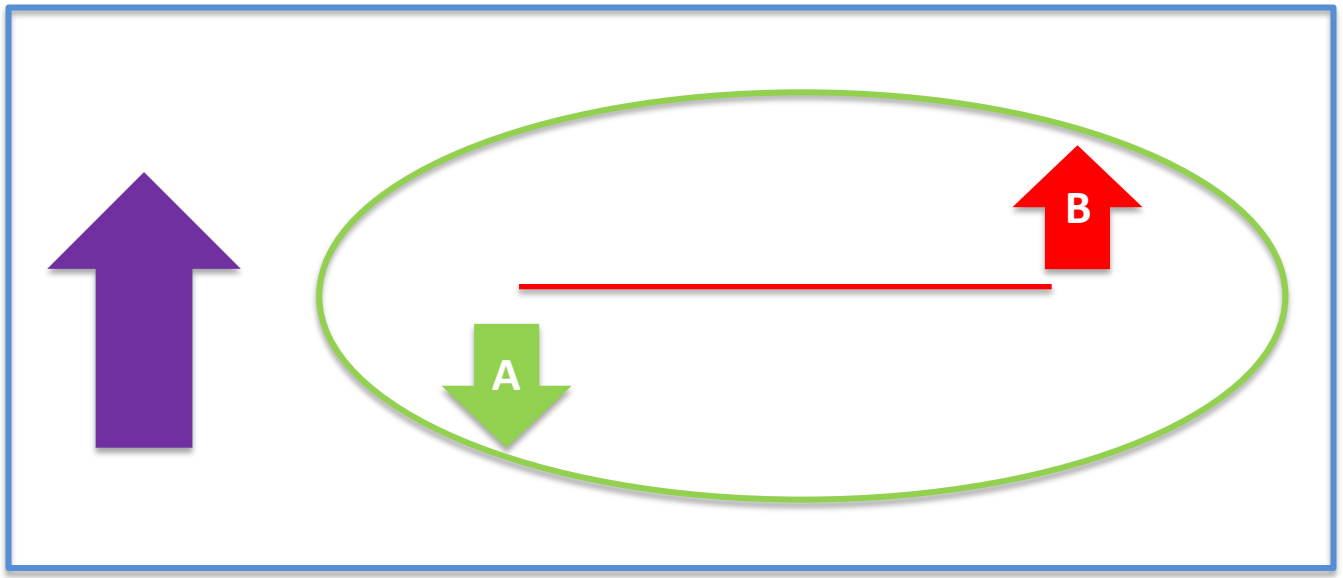
- Prequalification i.e. "Full" control on DN

> ⇒ investment in ICT
>
> to be compared with "fit and forget"

Long Term planning in cooperation w. TSO

Coordination Schemes Assessment
CS-B

- Local Congestion Market
  - 2-step solution procedure i.e. suboptimality
    - Math
    - Tech



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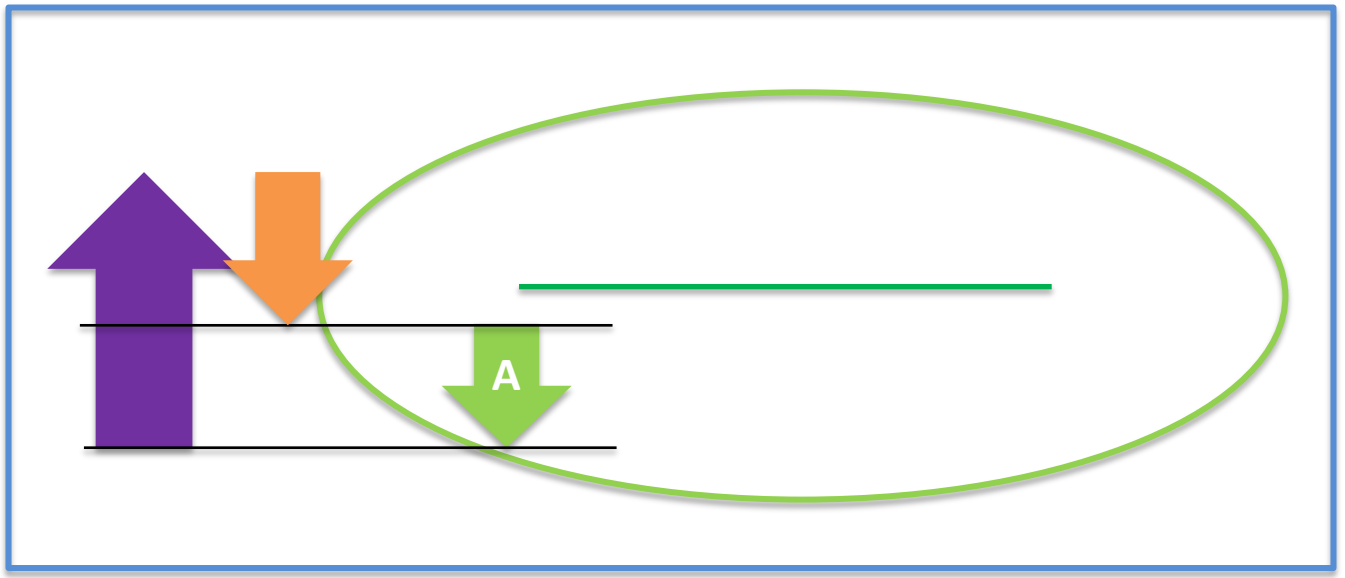

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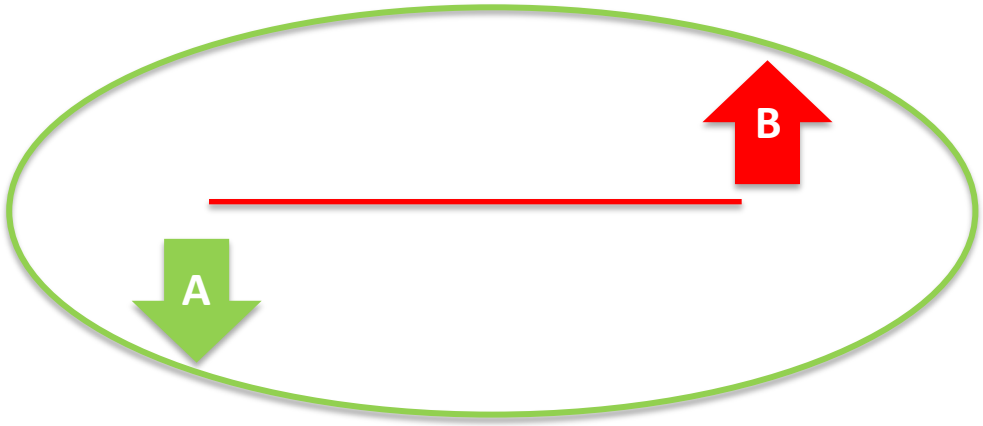

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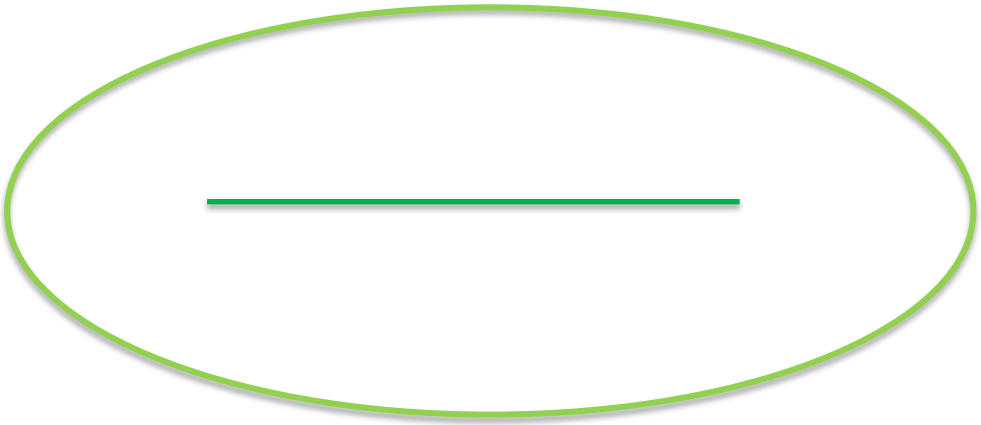

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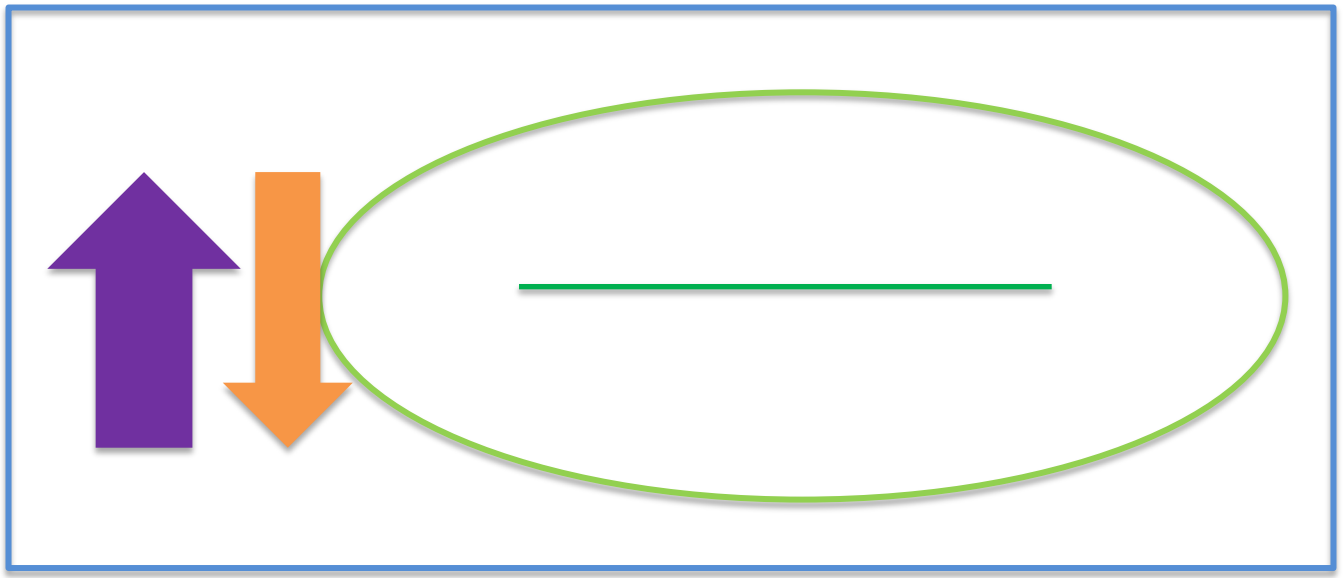

Coordination Schemes Assessment
CS-B

- Local Congestion Market
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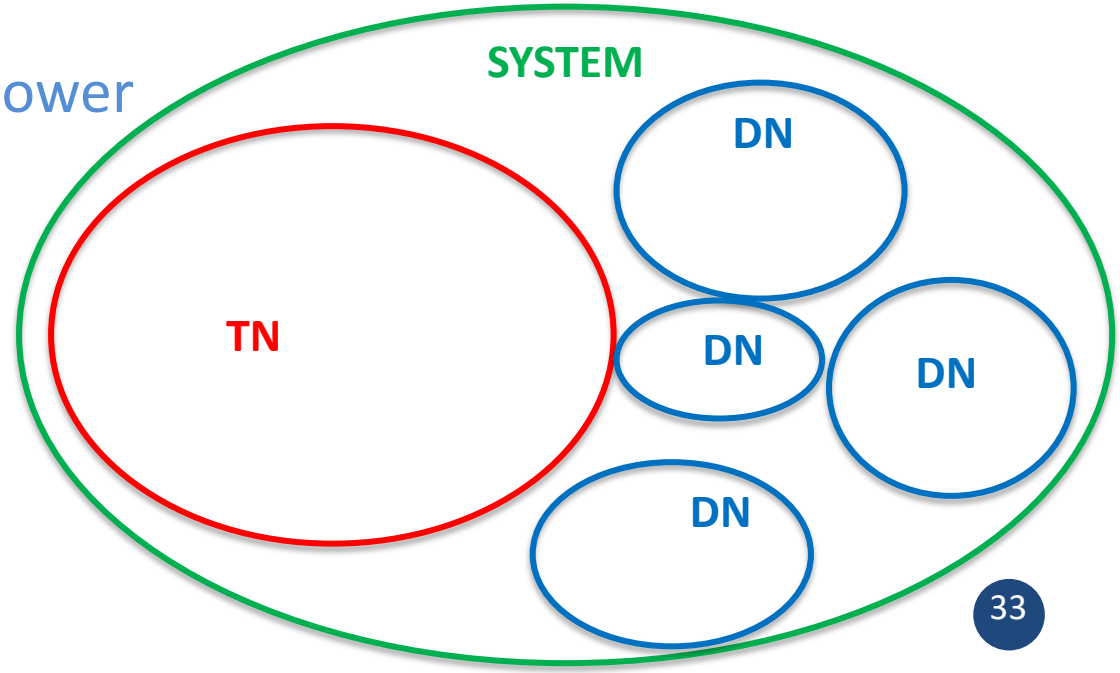
    - Tech
  - Liquidity / Market power



Coordination Schemes Assessment
CS-B

- Local Congestion Market
  - 2-step solution procedure i.e. suboptimality
    - Math
    - Tech
  - Liquidity / Market power

⇒DSO join up

⇒tailored products

to allow resources w. strong technical constraints into the market

Coordination Schemes Assessment
CS-B

- Local Congestion Market
  - 2-step solution procedure i.e. suboptimality
    - Math
    - Tech
  - Liquidity / Market power

    $\Rightarrow$DSO join up

    $\Rightarrow$tailored products
  - Timing w.r.t. balancing market

Coordination Schemes Assessment
CS-B

- Local Congestion Market
  - 2-step solution procedure i.e. suboptimality

More possibilities for DSOs to solve congestions (Pilot B)

⇒DSO join up

⇒tailored products

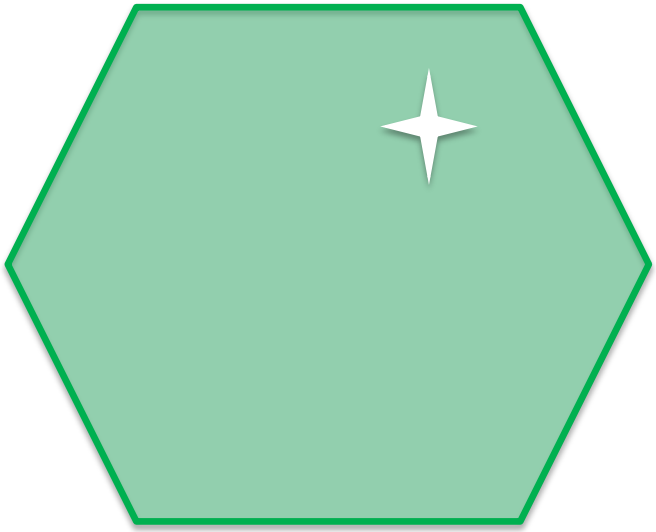
  - Timing w.r.t. balancing market

Coordination Schemes Assessment CS-C

- Shared Balancing Responsibility
  - High control on DN

Coordination Schemes Assessment
CS-C

- Shared Balancing Responsibility
  - High control on DN
  - Fixed Exchange w. TN: strong constraint → suboptimality



Coordination Schemes Assessment
CS-C

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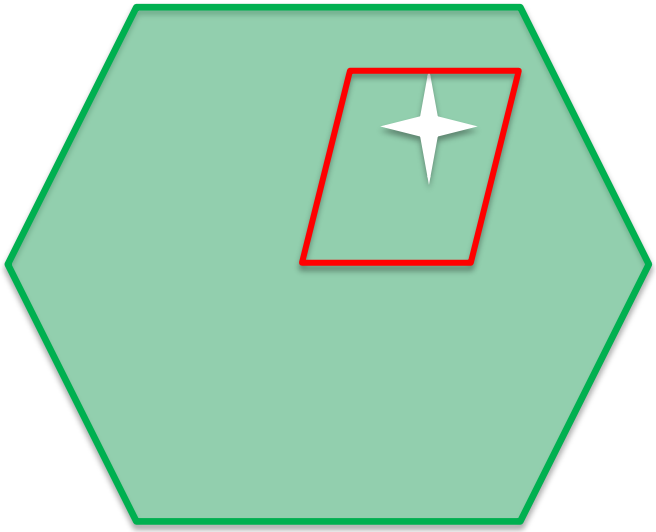

Coordination Schemes Assessment
CS-C

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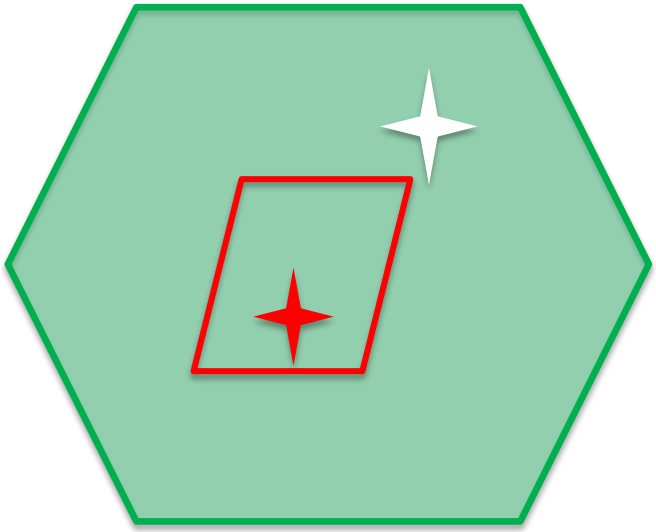


Coordination Schemes Assessment CS-C

- Shared Balancing Responsibility
  - High control on DN
  - Fixed Exchange w. TN: strong constraint
  - Complete separation
    - No price spreading ✓
    - No info exchange DN↔TN ✗

Coordination Schemes Assessment CS-C

- Shared Balancing Responsibility
  - High control on DN
  - Fixed Exchange w. TN: strong constraint
  - Complete separation
    - No price spreading
    - No info exchange DN↔TN
    - Liquidity / Market power

Coordination Schemes Assessment
CS-C

- S

Simulations showed high inefficiency

- No info exchange DN↔TN
- Liquidity

Coordination Schemes Assessment
CS-C

- S

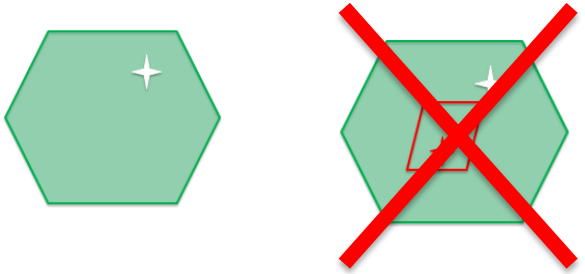
Simulations showed high inefficiency

Balancing should be coped with globally

- No info exchange DN↔TN
- Liquidity

Coordination Schemes Assessment
CS-D

- Common TSO-DSO Ancillary Services Market
  - Only technical constraint
    - High economic performances



Coordination Schemes Assessment
CS-D

- Common TSO-DSO Ancillary Services Market
  - Only technical constraint
    - High economic performances
  - Impact of forecasting error (imbalances that don't realizes)

    ⇒push gate closure as close as possible to real time and increase clearing frequency

    BUT technical constraints (ramping, clearing time)

Coordination Schemes Assessment
CS-D

- Common TSO-DSO Ancillary Services Market
  - Only technical constraint
    - High economic performances
  - Impact of forecasting error (imbalances that don't realizes)

    ⇒push gate closure as close as possible to real time and increase clearing frequency

    BUT technical constraints (ramping, clearing time)
  - TSO-DSO cooperation

Other Regulation Remarks

- Interaction with other markets
- ICT
- Technological response limits

Deliverable 6.3 - Policy recommendations to implement and/or overcome barriers and enable TSO-ISO integration

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Consultations

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Thank You

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