Power flexibility in summer houses
TSO and DSO interactions

Claus Amtrup Andersen, EURISCO

Thomas Kieldsen, NOVASOL

Juan Miguel González, DTU Compute
Anders Bavnhøj Hansen,Energinet.dk

Introduction and problem statement regarding Demand Response for Residential Premises

Novasol Smart House – case studie

Power Consumption Flexibility from Summerhouses – **DSO and TSO** interactions

What does it take to make Demand Response feasible for Residential Premises

The following slides will give more questions than answers

Problem statements

- The ratio between investment and revenue is too small for Demand Response in residential premises – or not?
- What is the price threshold for a residential premises to participate in Demand Response? 500 Dkr. per Year?
- PSO has from 2013 to 2014 gone up 65% to 1.317 Dkr. per average family
  http://ing.dk/artikel/pso-afgiften-eksploderer-elkunder-skal-betale-26-mia-kr-ekstra-168898
- 'Eco branding' – State-of-Green, Dansk Design – Export and business?
- Where is the limit when it comes to a compromise on the comfort zone?

  No compromise – but add on (next slides)

Problem statements

What does it take to make Demand Response feasible for Residential Premises

Demand Response with Value Added Services

DR+

DR

DR+

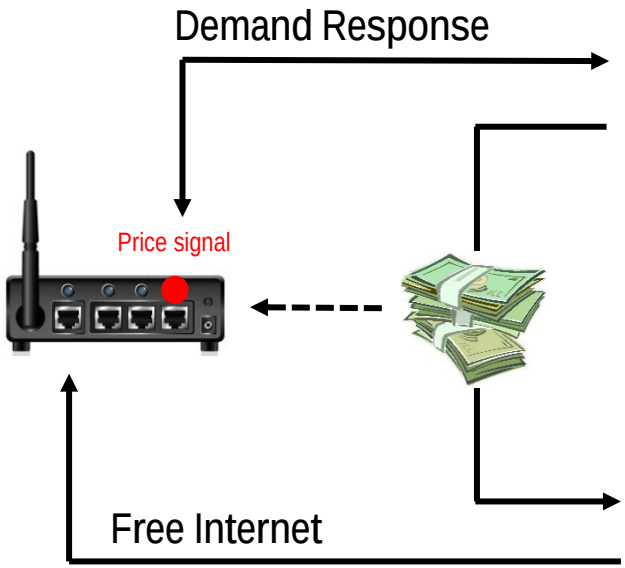
It is the cream and cherry's that sells the cake…

What does it take to make Demand Response feasible for Residential Premises

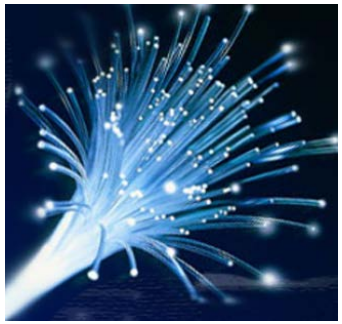
Win-Win

Free Internet

Demand Response Residential Premises



Distribution System Operator



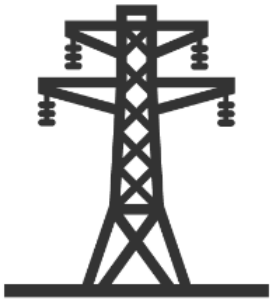
This slide is pure fiction and only made to initiate alternative way of thinking Demand Response concepts

EURISCO
RESEARCH & DEVELOPMENT

What does it take to make Demand Response feasible for Residential Premises

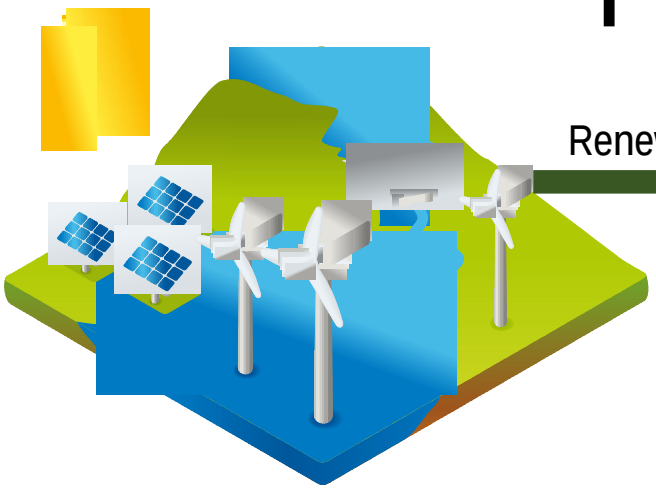
Win-Win

Free Electricity

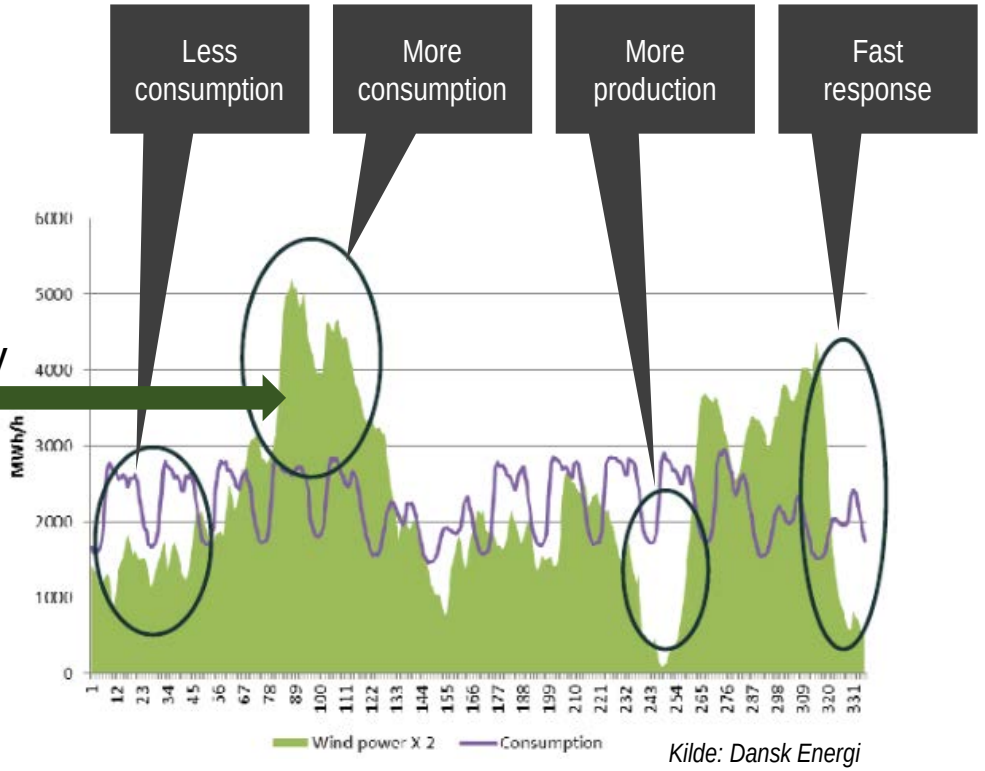


No congestion on specific low voltage feeder

+



Renewable energy



Kilde: Dansk Energi

This slide is pure fiction and only made to initiate alternative way of thinking Demand Response concepts

EURISCO
RESEARCH & DEVELOPMENT

Free
Home and Building Automation System

Win-Win

- Climate control and monitoring
- Burglar alarm
- Remote controlled front door
- Video surveillance

Hardware + sensor	4.000 Dkr.
Installation + maint.	2.000 Dkr.
Operation (per year)	500 Dkr.
Total	6.500 Dkr.
Feed-in (tax reduction)	-6.000 Dkr.
DSO-DR fee (per year)	-500 Dkr.
Total	-6.500 Dkr.

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EURISCO
RESEARCH & DEVELOPMENT

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WYNDHAM

EXCHANGE & RENTALS

Novasol Smart House

Thomas Kieldsen

Smart Grid – as big the invention of the Internet

NOVASOL dansommer CUENDET

Our interpretation of the DTU Cities project

Background:

- Cities account for 80% of global energy consumption
- Cities is an integrated approach that facilitates **flexibility** throughout the energy system in order to gain possible efficiency, **cost** and **emissions savings**
- Cities will, in collaboration with its industrial and academic partners, conduct research with a view to developing tools for the implementation of integrated energy system solutions

Objectives:

- Societal -pathway towards ultimate **independency from fossil fuels**
- Scientific – develop methodologies and ICT solutions for analysis, operation and development of fully integrated solutions
- Educational – form collaborative and integrated context
- Commercial perspective – identify and establish solutions which can opportunities

Our interpretation of the DTU Cities project

- CITIES will result in models and controllers for heating/cooling **property management**
- CITIES will deliver modular and **aggregate models of energy supply**, consumption and transmission resources, suitable for implementation in energy system simulation, control and optimization framework.
- CITIES will help its partners to develop well-structured, searchable, open access databases for analysis and visualization of existing energy data and the **big data** generated in an intelligent energy system
- CITITES will result in new methods for **demand side management** in order to obtain **balance** between production and demand which in the case of NOVASOL is one of the cornerstones in the value proposition parameters in the Smart House project.

NOVASOL Group

NOVASOL provides holidays in privately owned holiday homes

NOVASOL offers more than 40,000 holiday homes in 29 countries

NOVASOL offers holidays in private atmosphere

NOVASOL offers holidays in authentic surroundings

WYNDHAM WORLDWIDE

WYNDHAM HOTEL GROUP

- WYNDHAM Hotels and Resorts
- WYNDHAM GRAND COLLECTION
- TRYP BY WYNDHAM
- WINGATE BY WYNDHAM
- HAWTHORN SUITES BY WYNDHAM
- ph planet hollywood
- DREAM HOTELS
- NIGHT
- RAMADA WORLDWIDE
- Super 8
- Days Inn
- BAYMONT INN & SUITES
- Microtel Inns & Suites
- Howard Johnson
- Travelodge
- Knights Inn

WYNDHAM EXCHANGE & RENTALS

- RCI
- The Registry Collection
- cottages4you
- Landal GreenParks
- Canvas Holidays
- ResortQuest By Wyndham Vacation Rentals
- English Country Cottages
- NOVASOL
- Hoseasons
- James VILLA HOLIDAYS

WYNDHAM VACATION OWNERSHIP

- WYNDHAM VACATION RESORTS SM
- WorldMark BY WYNDHAM
- WYNDHAM VACATION RESORTS ASIA PACIFIC

Honors

KING FREDERIK IX's AWARD FOR
EXCELLENCE IN DANISH EXPORT

Honors

- In 2013, NOVASOL highlighted in the Danish Export Canon and honored for its achievements as a Danish services export company and for its contribution to Danish national economy and well-fare!

Our organization

- We are present in 29 countries
- We speak the native languages
- We face very different challenges from market to market
- We have a common ”Count on Me” culture
- More than 27 different nationalities with different culture
- In high season up to 1,500 employees
- The NOVASOL academy provides education & training to employees & partners
- Selection of key locations:

  Copenhagen, Risskov, Oslo, Göteborg, Hamburg, Berlin, Tilburg, Paris, Cannes, Monteriggioni, Venice, Pula, Siofok, Prague, Innsbruck, Zurich, Barcelona, Warsaw, Stettin
- Additionally more than 30 local service offices.

Count On Me – our culture!

- Great goals must be supported by a common corporate culture. Our mindset is:
  - To be responsive
  - To be respectful
  - To deliver a great experience

- Count On Me! is our united starting point and the foundation of our corporate culture towards each other and our customers

What we do: NOVASOL basics

Owners

- No hassle
- A house with a heart
- Stability
- Security
- Local presence
- Service for house owners on different levels
- Free catalogues, Internet, travel agents
- No costs for house owners
- Monthly payment of the rent, even before the customer arrives
- Payment of the rent even in case of cancellation on short notice

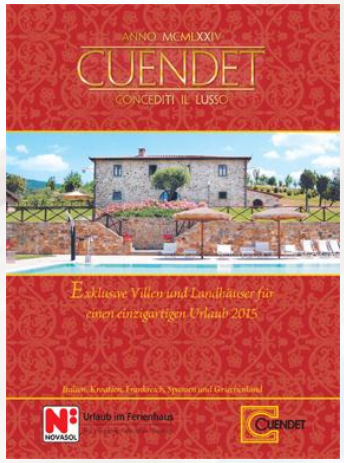
- We rent out ***privately owned*** holiday cottages on an ***exclusive basis*** to customers (tourists)
- All cottages are exclusive for NOVASOL.

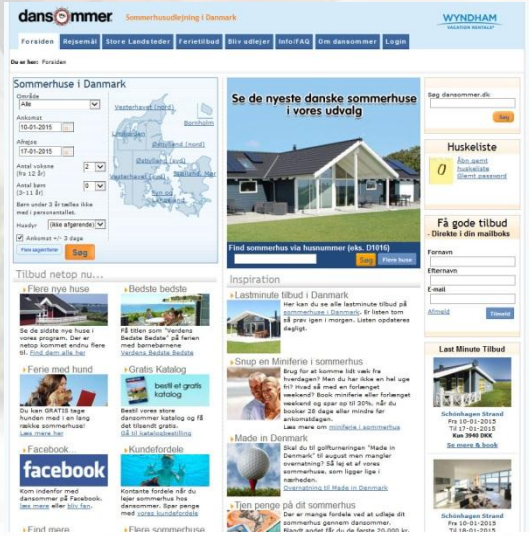
  No ownership of houses and no guarantees
- All contracts with house owners are in the name of NOVASOL A/S, and all customers are buying from NOVASOL A/S
- Other NOVASOL offices acts as Agents (commission), Service centers or Representative offices
- With our system and definitions, we bring stability and trust into a rental market, which is chaotic – like a ”Turkish Bazaar”

Guests

- Do-it-yourself
- Individual holiday
- Peace and quiet
- Authentic holiday
- Stability
- Security
- Local presence of NOVASOL
- Best price guarantee
- Service guarantee
- Various concepts with price offers and values
- Guarantee that each house has been inspected and categorized by NOVASOL.
- Guarantee of quick help in case of problems.

3 sales brands





NOVASOL – Denmark, Sweden, Norway






NOVASOL – Southern Europe






NOVASOL – Central Europe






NOVASOL multi-channel strategy

Multi-channel Strategy

We meet the customer where the customer is and when the customer wants to
Two sets of customers: guests and house owners

Offline

19 different destination catalogues
15 regional catalogues
More than 20.000 travel agencies
Flyers, posters, display, magazines, newspapers
Cross marketing with partners
Fairs

Online

Customer websites in 14 languages and 11 currencies
6 different systems for online partners
E-mail marketing
Social media
Google ad-words
Search engine optimization

”A house with a heart ♥”

- NOVASOL is dedicated to house owners, who have a “*house with a heart*
- That makes NOVASOL a “*business with a heart*”
- We believe that the strongest motivator for our employees is to make a difference in the world
- We are so fortunate to be in a business, where we can really make a difference to lots of people
- This is what makes us get up in the morning – we make customers happy
- ’A house with a heart’ is closely linked to our vision and count on me culture!

Novasol Business Development

Revolutionary improvements in 2015 and beyond:

- Novasol Smart House
  - Smart Grid & Grid Management
  - Intelligent remote control of the house
  - Elimination of high resource demanding tasks with low value

Conceptual:
Novasol Smart house

Cloud Connection

- Keyless entry
- Presence detector (day-night setting, Occupied modus, Econ modus)

- Power metering
- & billing
- Energy consumption & efficiency

- Heating & Ventilation
- Set comfort levels & set-points

- Welcome light
- Night modus
- Anti theft modus
- Alarm modus

- Water Quality (PH, temperature, chlorine, etc)
- Power Consumption & control
- Water meter

Smart House benefits for house owner

- Asset management:
  - Desktop services vs. on-site services:
- Less Power usage – in DK this is the largest money saver due to taxes
- Energy advise on his house compared to similar houses
- Smart Grid – demand response :
  - Common purchase of power
  - Discount on kWh – in DK only 18% of kWh price is negotiable
  - Forecasting models for use in demand response and load balancing
  - Utilities are required to achieve energy savings
  - Energy efficiency, use the power when it (**renewable**) is there not when you need it
    - So what happens is we consider the pool as a big **energy storage**

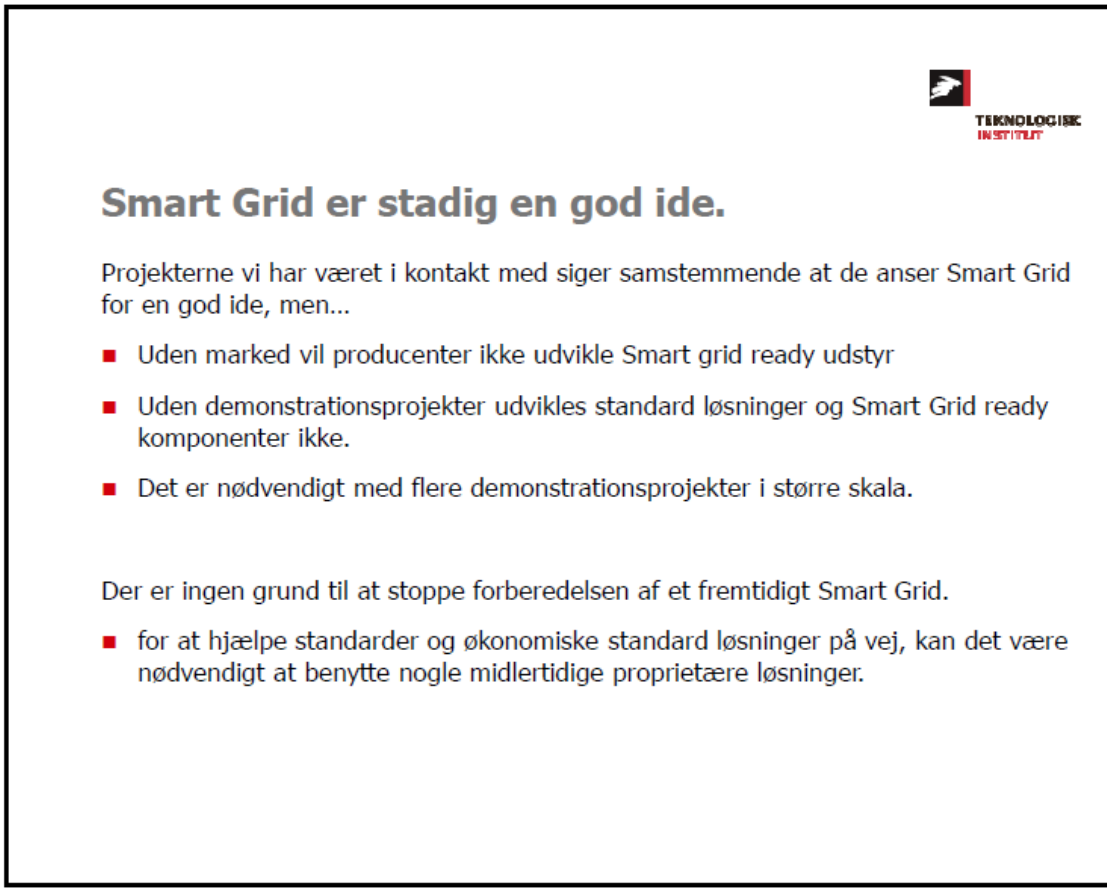
Some statistics

Type	Antal	kWh			I alt	
		Bolig total	Pool / opvarmning	Alle boliger	kWh	DKK
Pool	851	31.400	25.400	26.721.400		
Spa	3.692	6.900	3.900	25.474.800		
Sauna	702	4.700	1.700	3.299.400		
Trad	4.790	2.600	1.100	12.454.000	67.949.600	135.899.200
Udland	26.500	2.600	1.100		68.900.000	103.350.000
Gennemsnit		**8.600**	**5.975**			
I alt	**36.535**			**67.949.600**	**136.849.600**	**239.249.200**

Komplet liste over DREAM fuldt Smart Grid ready apparater

1. .
2. .
3. .

Liste slut

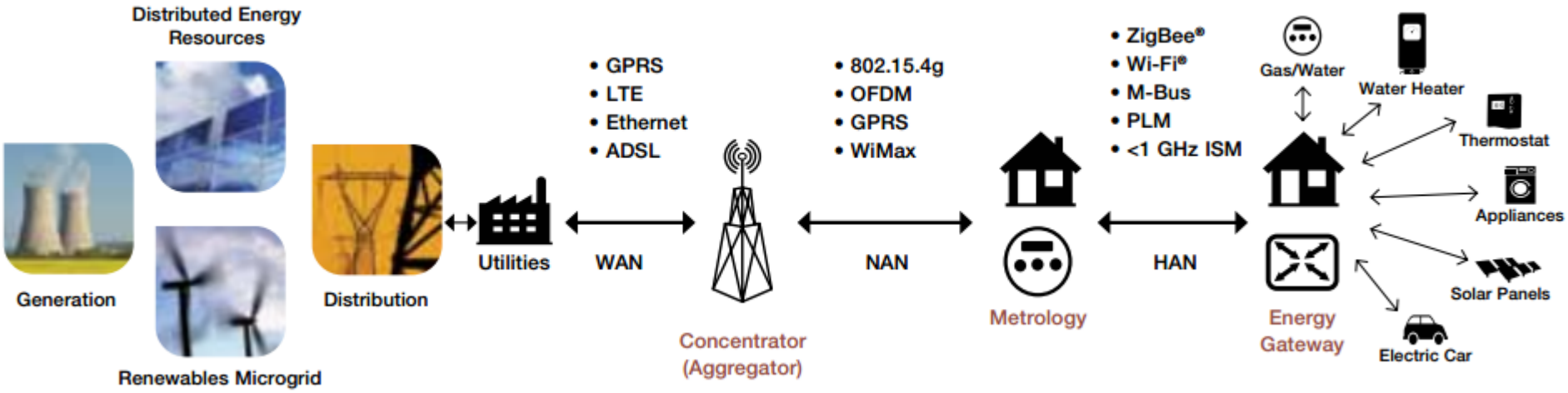


SMART GRID

- Drivers behind:
  1. Demand response – allow **owners** to participate in the **supply curve** of energy. Automate the metering function. A way to reduce cost is to drive reduction in demand via house area network connected to a Smart meter. Ability of owner to take advantage of **respond to power prices** in real time.
  2. Increasing need for reliability of the grid.
  3. Distributed generation

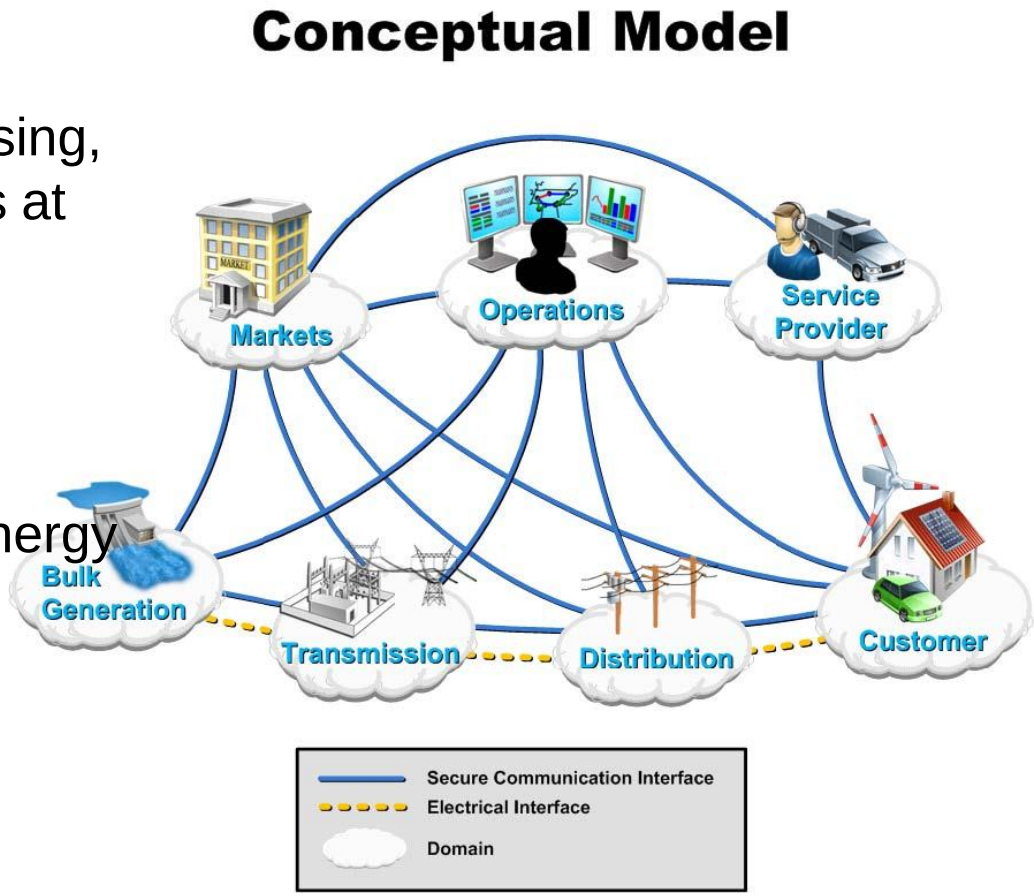
- It represents a strategy, it is not an individual initiative or project nor technology
- It is a portfolio of initiatives like Smart meters, distribution automation (automating power grid) but also include more capabilities in the houses. Some initiatives are more mature than others
- Home area network. Utility send info into the house to enable customers and house owner to have more control over how they use electric power

Value chain House owner side



Macro view - SMART GRID

- Smart grids require multiple sensing, monitoring, and control functions at various levels
- Smart grids will become more interdependent on increasingly complex systems including renewable energy integration, energy storage, and electric vehicles.



QUESTIONS ?

Feel free to contact me at thomas.kieldsen@novasol.com or
Cell phone +45 31267783

THANK YOU !

Power Consumption Flexibility from Summerhouses – **DSO and TSO interactions**

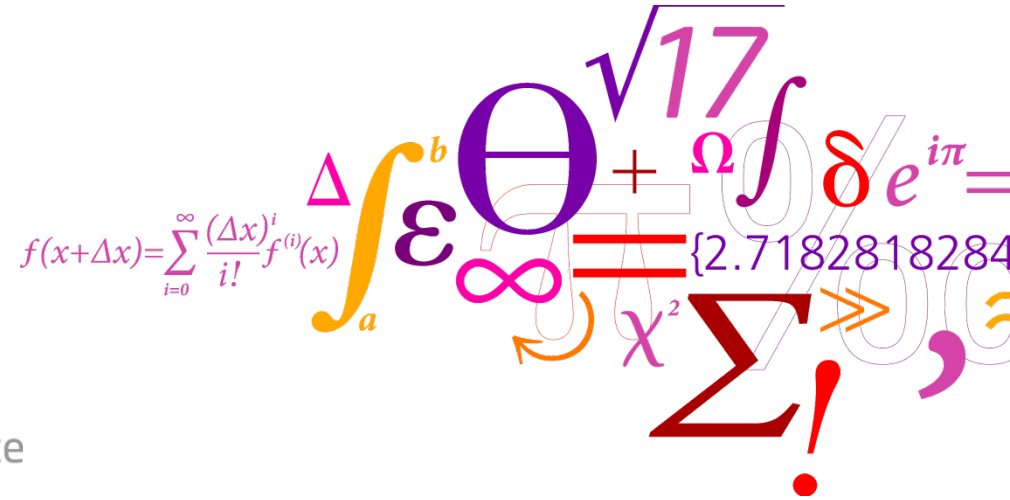
Collaborative demonstration project among DTU Compute, NOVASOL, NYFORS, Energinet.dk and EURISCO

Juan M. Morales

CITIES Consortium Meeting

DTU Lyngby

27 May 2015



DTU Compute
Institut for Matematik og Computer Science

The Big Picture

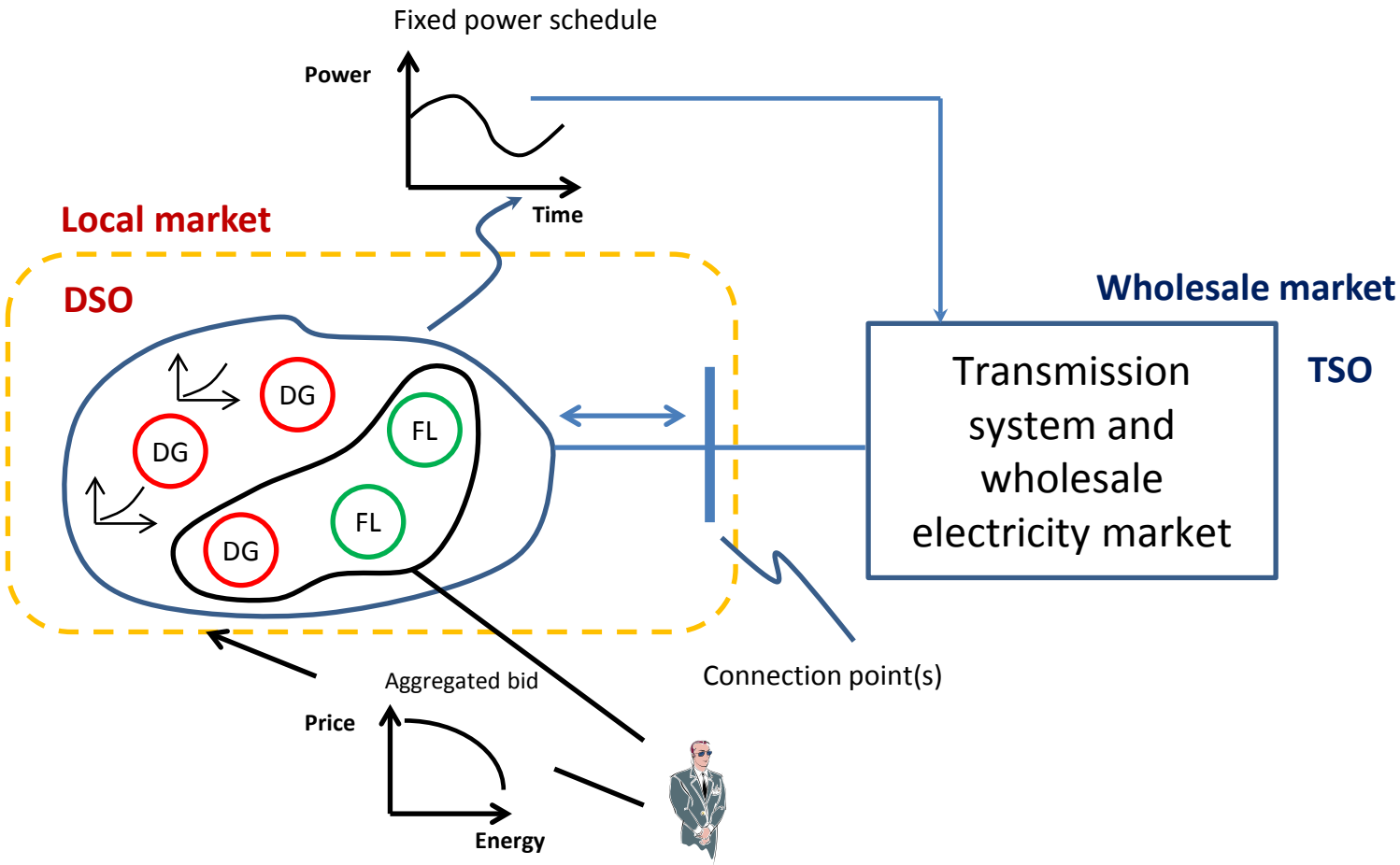
- DTU Compute is leading the *design of the market architecture* (mathematical models and algorithms) to exploit *distributed energy sources*

- Involves a DSO (NYFORS), a TSO (Energinet.dk), the provider of the flexible power loads (NOVASOL), a developer of the communication infrastructure (EURISCO), and an aggregator (Danske Commodities)

- The project places special emphasis on TSO-DSO coordination schemes (implemented through a market)

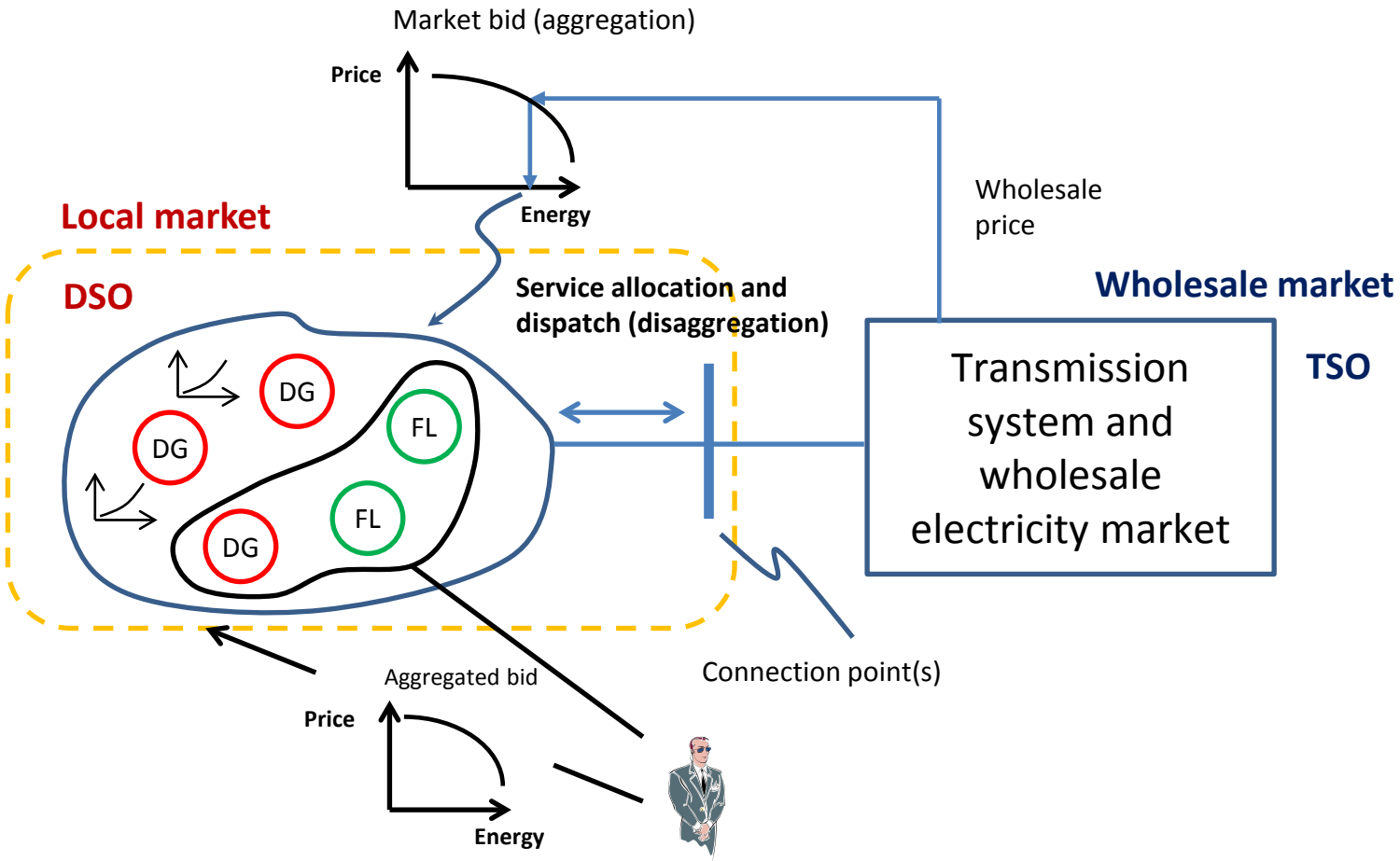
TSO-DSO Coordination Schemes

1. The DSO “confiscates” the benefits of DERs’ flexibility



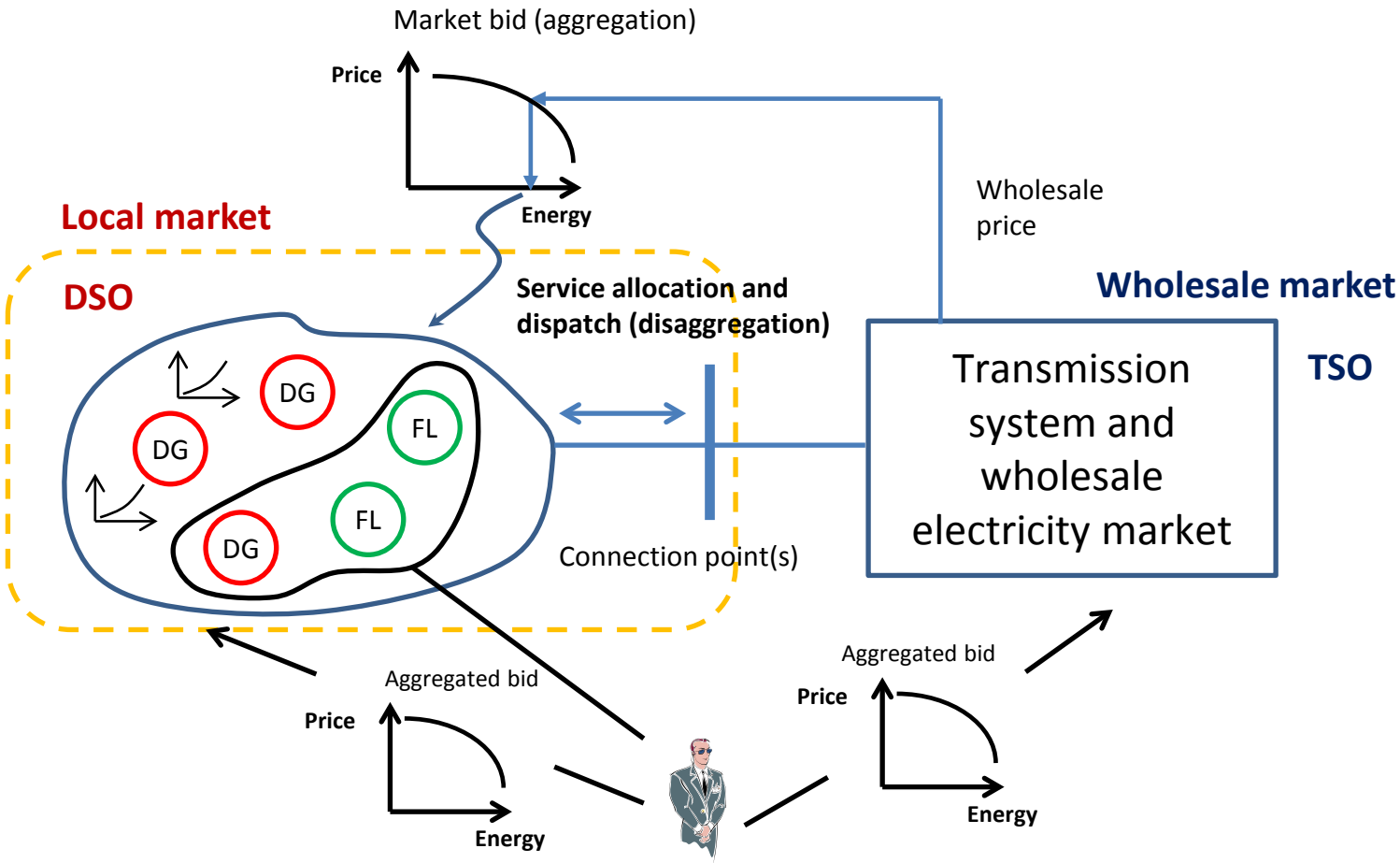
TSO-DSO Coordination Schemes

2. The DSO puts the remaining DERs' flexibility at the disposal of the TSO through an aggregated bid



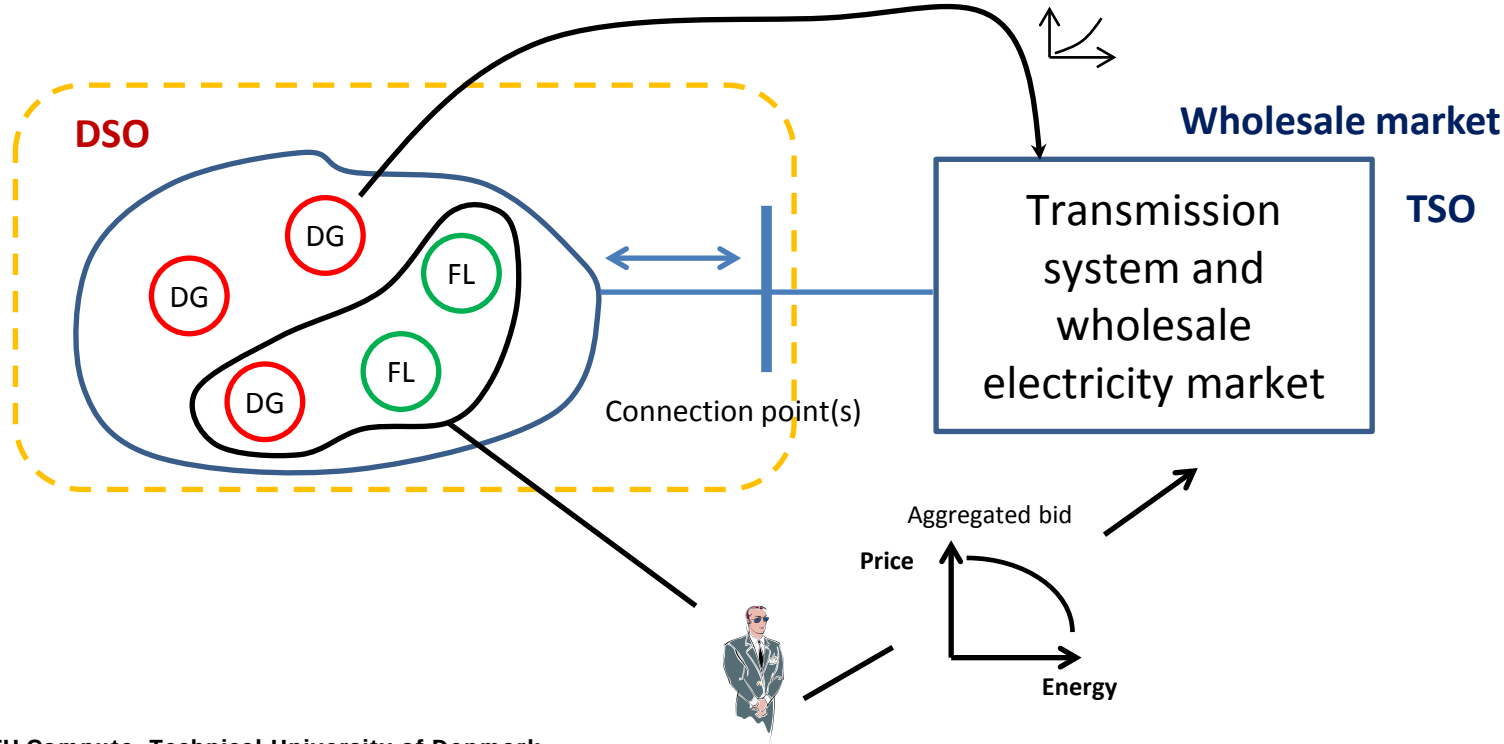
TSO-DSO Coordination Schemes

3. The DSO and TSO share the exploitation of DERs' flexibility



TSO-DSO Coordination Schemes

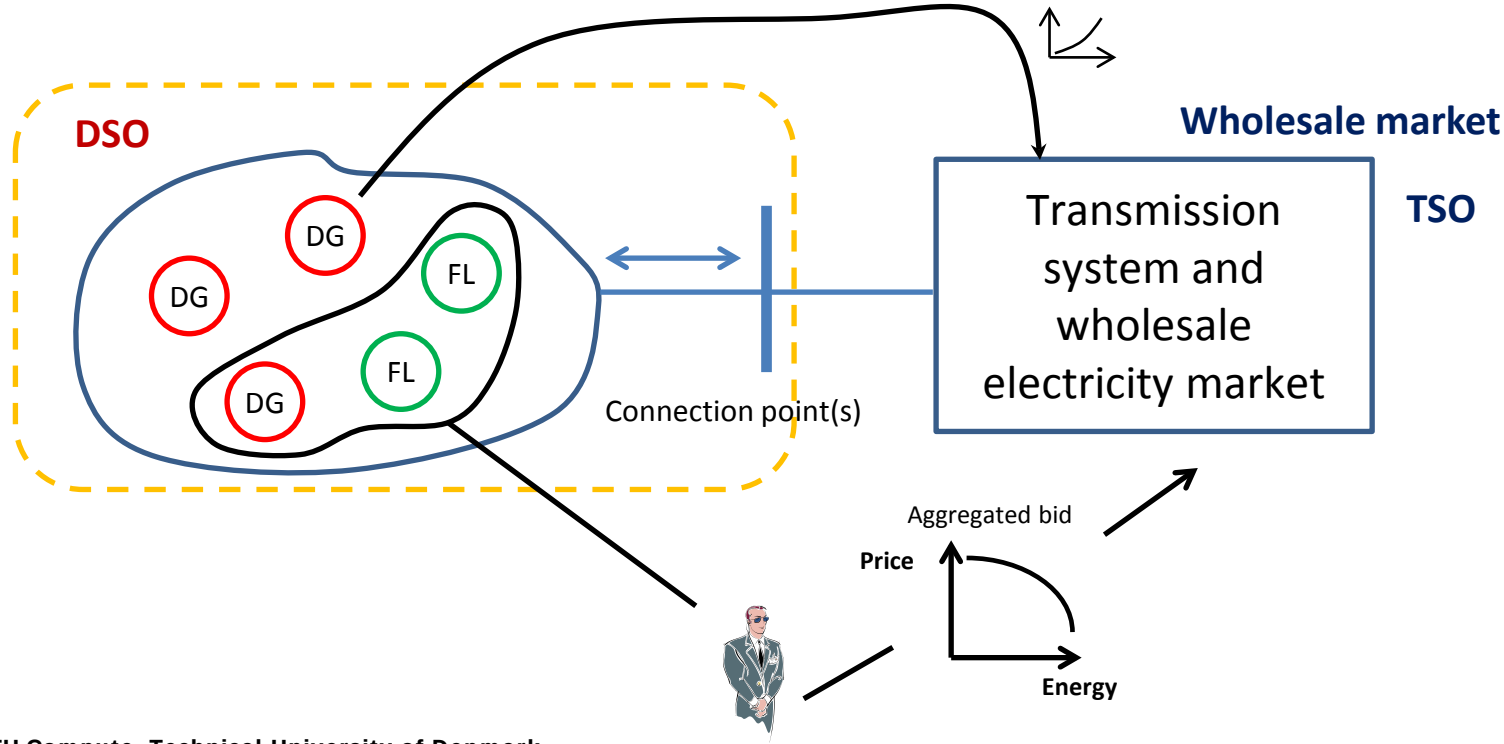
4. TSO centralizes the exploitation of DERs: the DSO only guarantees that the disaggregated dispatch is viable (and perhaps runs a countertrading mechanism if it is not)



TSO-DSO Coordination Schemes

4. TSO centralizes the exploitation of DERs: the DSO only guarantees that the disaggregated dispatch is viable (and perhaps runs a countertrading mechanism if it is not)

5. Other schemes may be possible.



Intelligence to be developed

- Market architecture:
  - ✓ Type of market: bid-based, bilateral, pool …
  - ✓ Hierarchy and clearing sequence
  - ✓ Pricing scheme and financial settlement: locational prices, long-term contracts…
  - ✓ Clearing algorithms
- Models for aggregations of DERS
- Procedures for disaggregation (to efficiently allocate the provision of ancillary service among DERs)
- Procedures to account for distribution network constraints within the market architecture (f. ex., countertrading mechanisms, simplified models for distribution networks for pool auctions …)

Thanks for your attention!

Questions?