



Enfo AS

# Enfo business areas

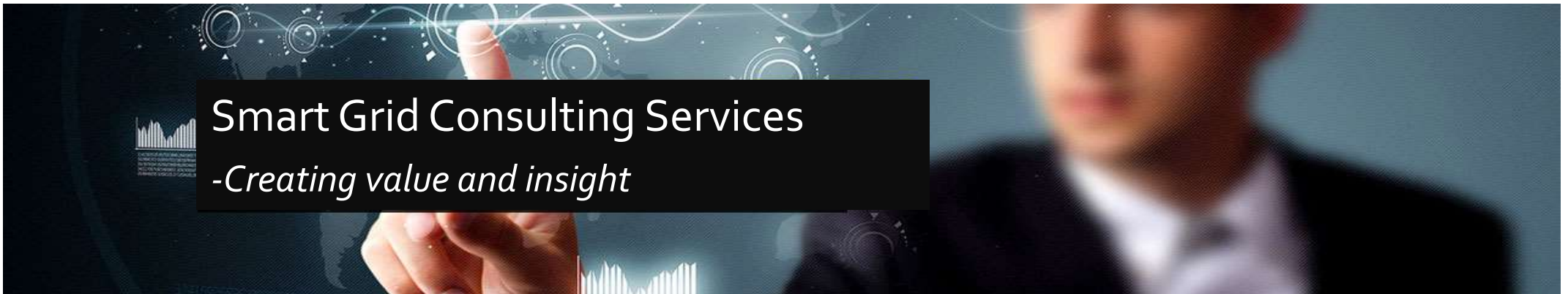
Demand Response & Energy Management



BI, fault analytics and decision support

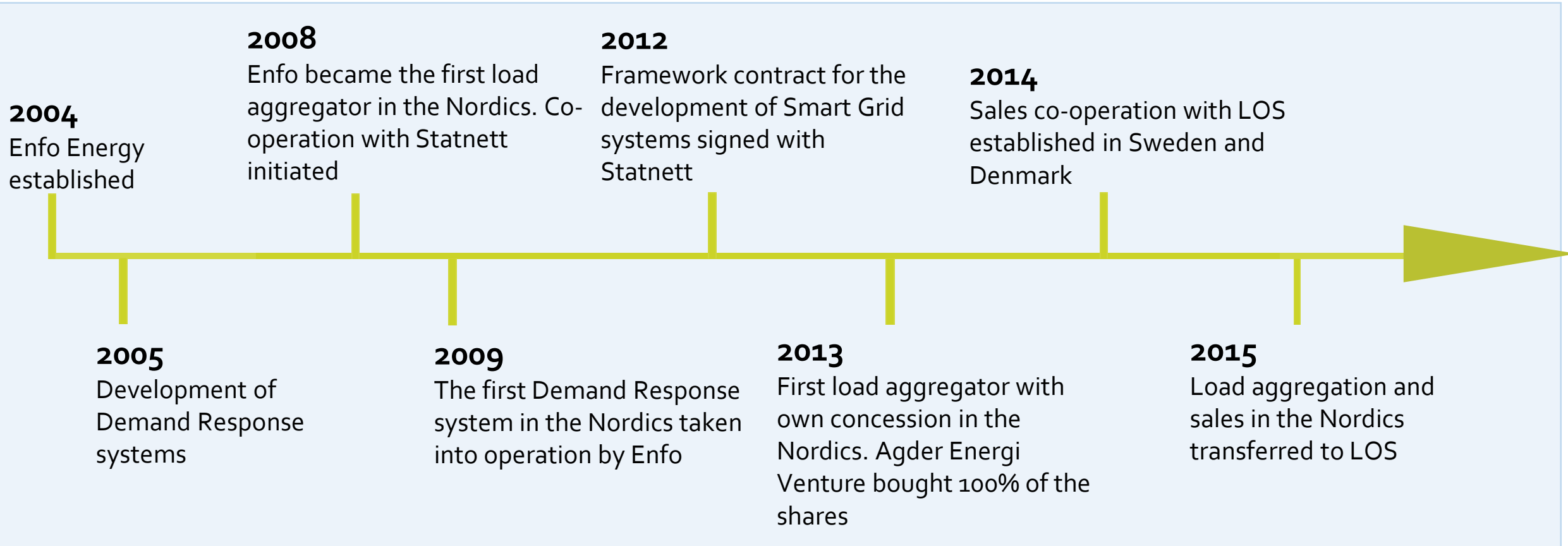


Smart Grid Consulting Services  
*-Creating value and insight*

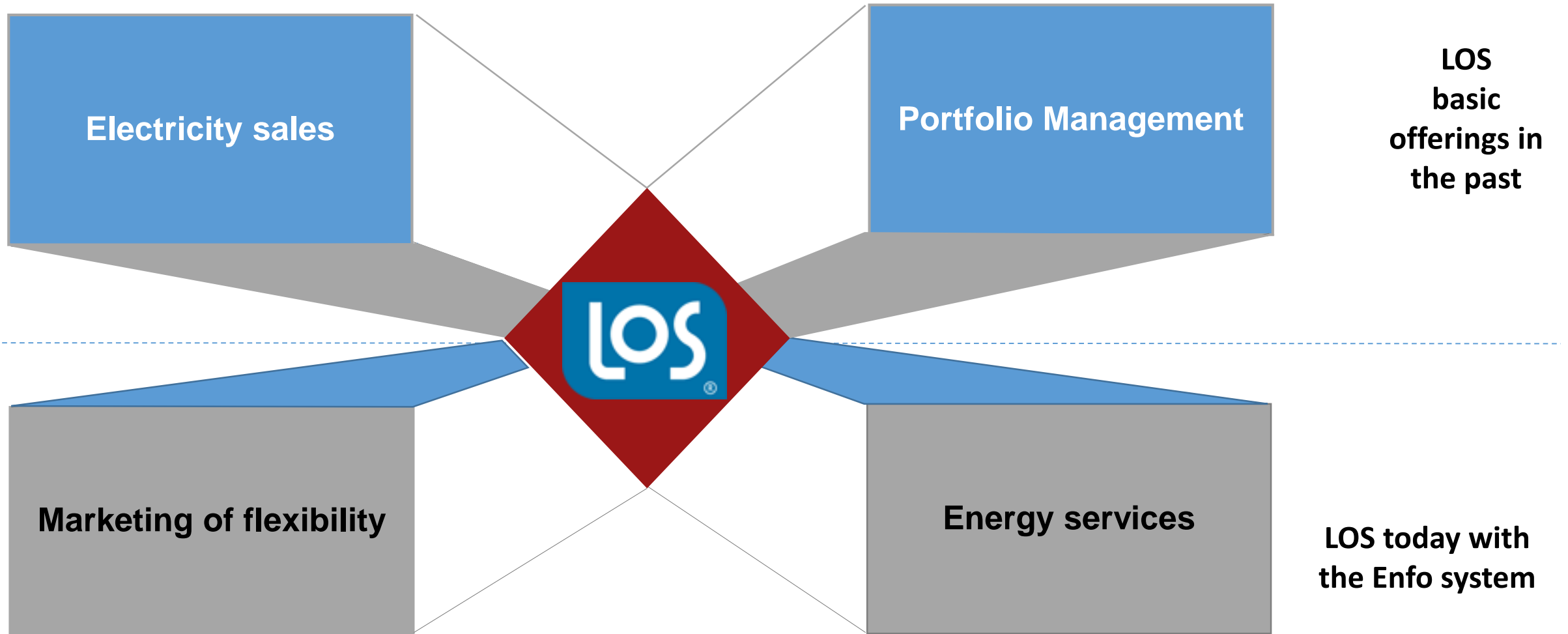


# Enfo AS

## Smartgrid Systems & Services



# LOS uses Enfo ESS as its systems platform for key services

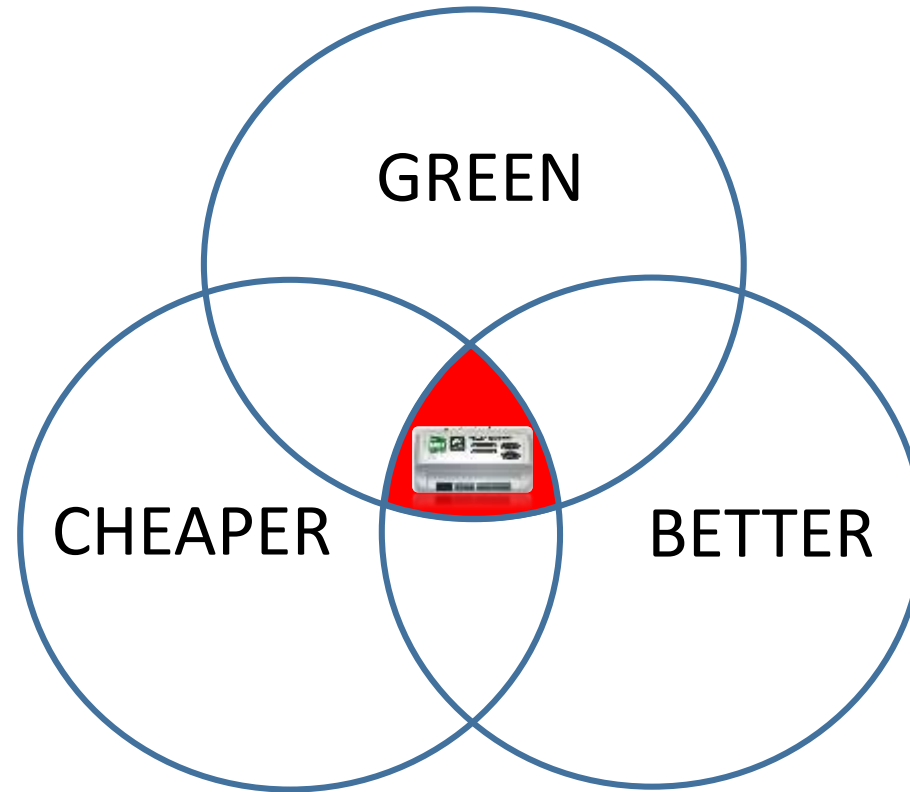


LOS  
basic  
offerings in  
the past

LOS today with  
the Enfo system

# Environmentalism is not enough

3 criteria must be fulfilled for a product to win:



*"The general who wins a battle makes many calculations in his temple before the battle is fought" Sun Tzu*

# The climate issue is not going away....

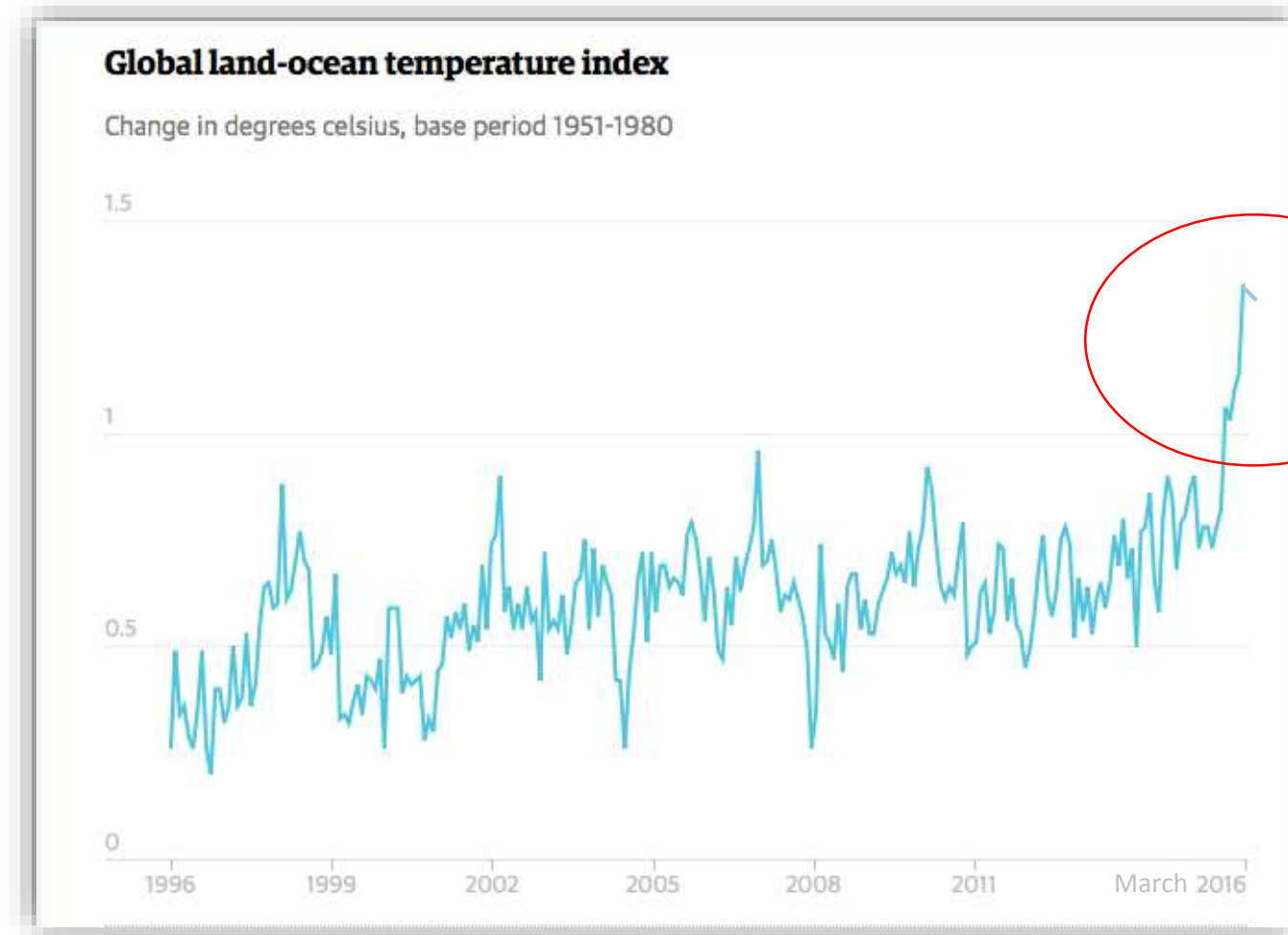
“The last time atmospheric CO<sub>2</sub> was this high, global sea levels were [at least six metres higher](#). We find ourselves confronted with ice-sheet disintegration that, in some susceptible areas, already [appears unstoppable](#). In the currently overloaded CO<sub>2</sub> climate, it’s just a matter of time until hundreds of millions of people will be displaced from coastal regions, their agricultural lands and groundwater destroyed by saltwater intrusion from sea rise.”

***Professor Jason Box,***  
***(<http://jasonbox.net/>)***



**DARK SNOW**

In fact, it seems to be even worse than what the pessimists have forecasted



Source: NASA

Are you part of the problem or part of the solution?

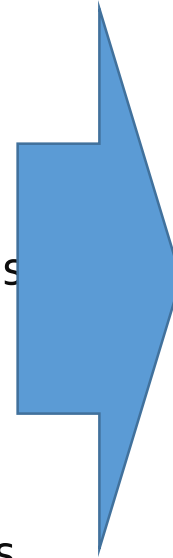




# When the effects of global warming become apparent, many solutions will suddenly appear «less radical»

Increasingly Radical

- Energy Efficiency
- New build will exclusively be renewable energy production capacities (Solar/Wind/Hydro)
- Build Energy Storage solutions (Batteries/other)
- Energy De-centralization/Demand Response
- «The electrification of everything»: Bikes, Cars, Boats, Lorries, Busses, Planes, Trains, Heating, Cooking.
- Plant Massive amounts of trees (<http://www.biocarbonengineering.com/>)
- Forced Closure of all Coal/Gas/Oil fired Generation Capacities
- DAC – Direct Air Capture (e.g. <http://carbonengineering.com/air-capture/>)

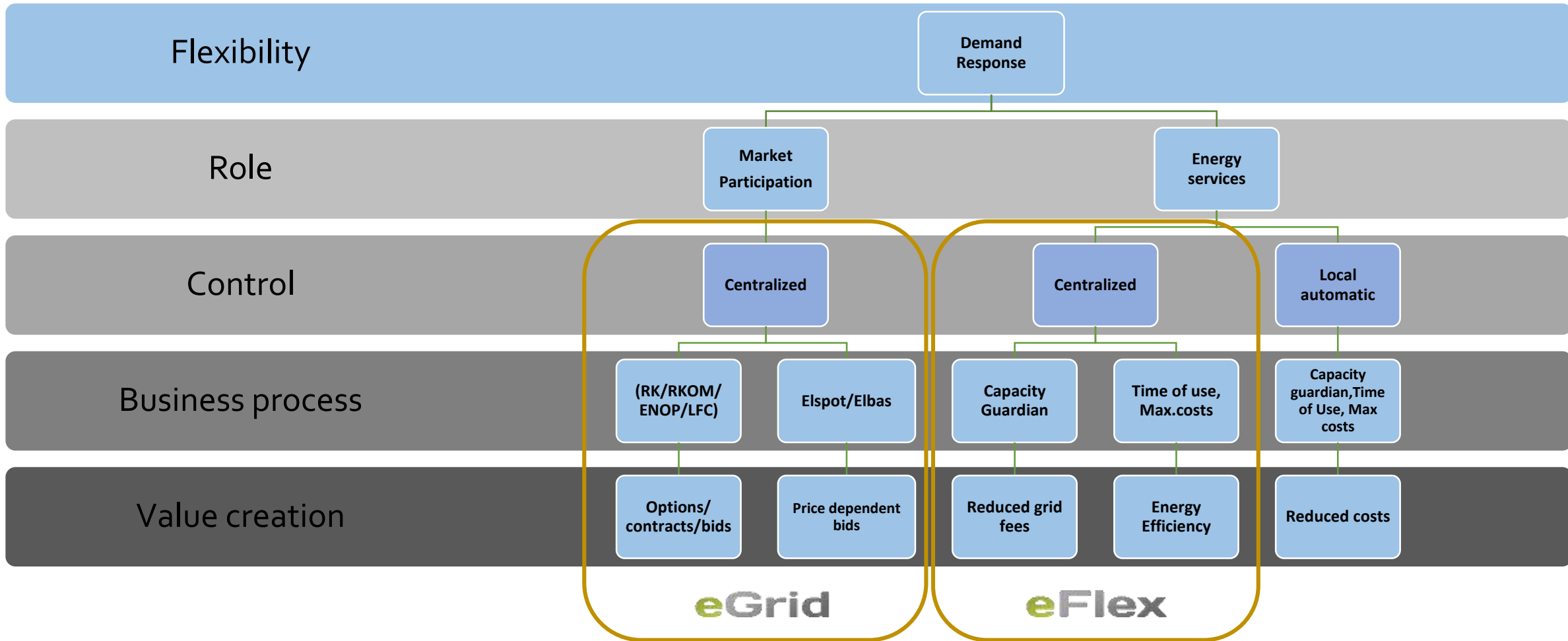


**Create an urgent need for key «enablers» :**

- Smart grids
- End user flexibility
- Integrators/Aggregators
- Open Standard Technology



# What is Demand Response - Definiton

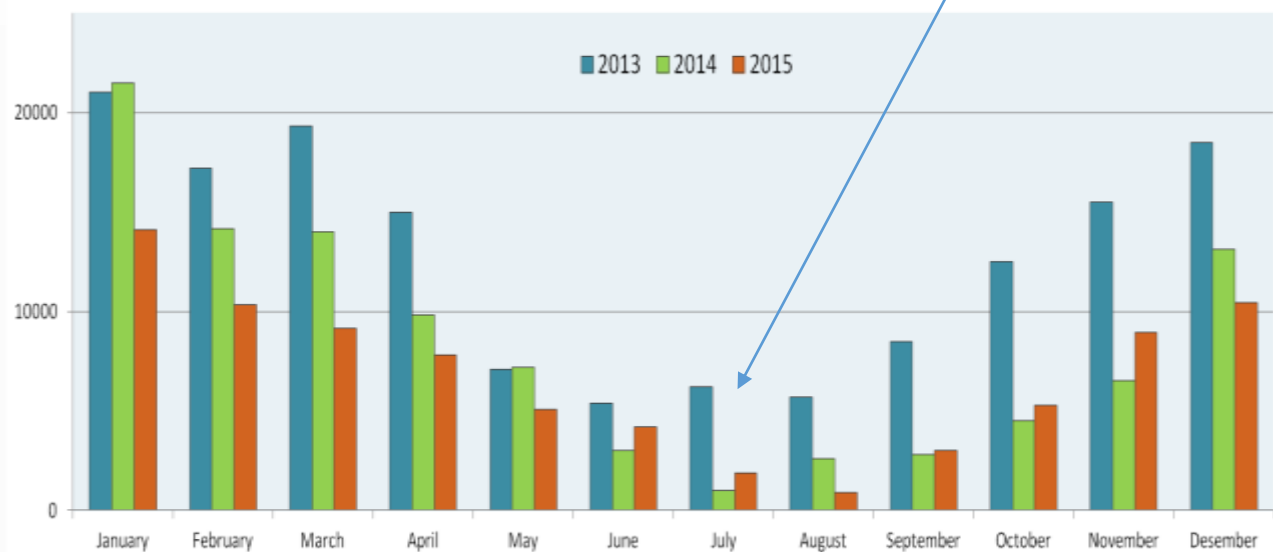


# There is still a big potential in «boring» Energy efficiency

Åfjord Church in Trønderlag



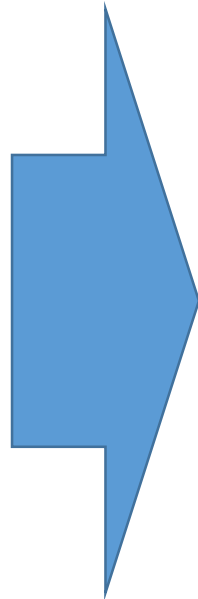
Enfo System Installed summer of 2014



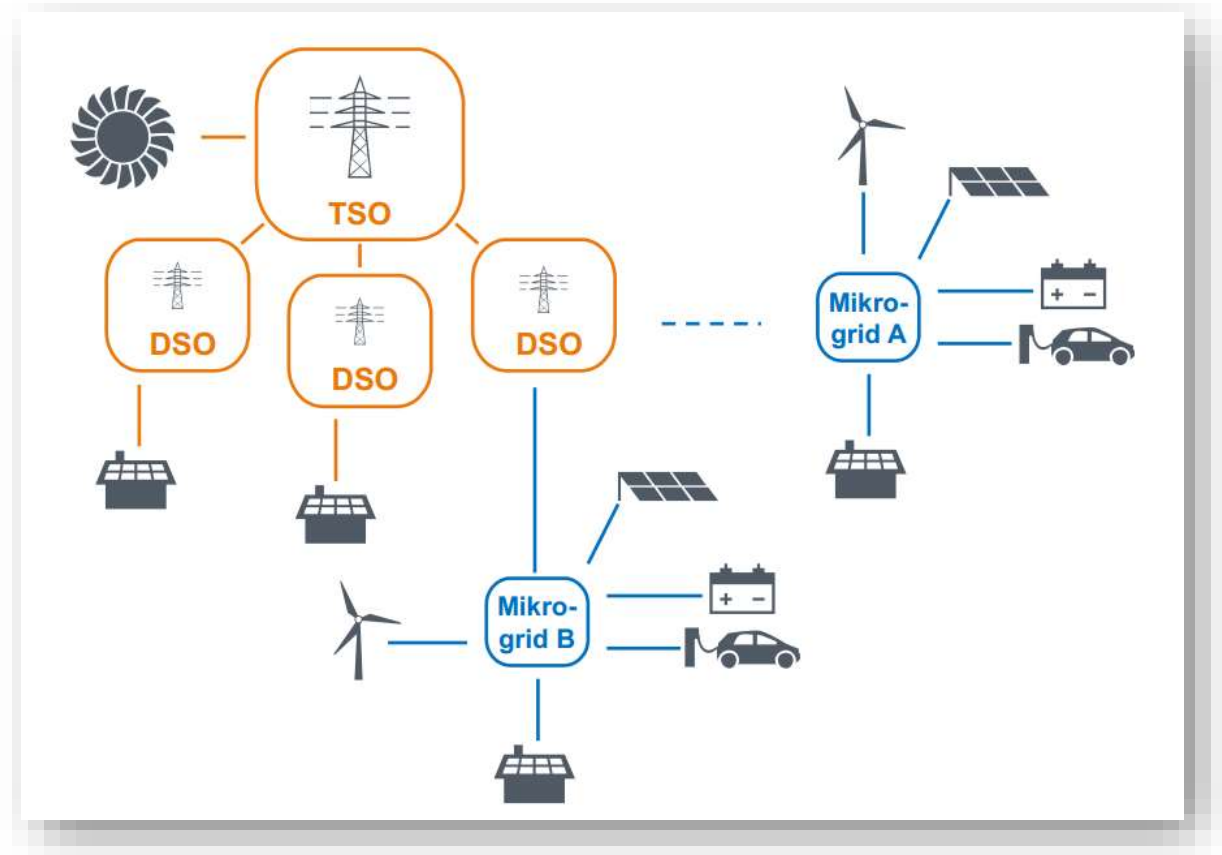
Compared to 2013, the total consumption in the church was reduced by 34% in 2014, and by 46% in 2015.

# Not just «crazy hippies» wanting to go «off-grid» anymore

Past «off-Gridders»:

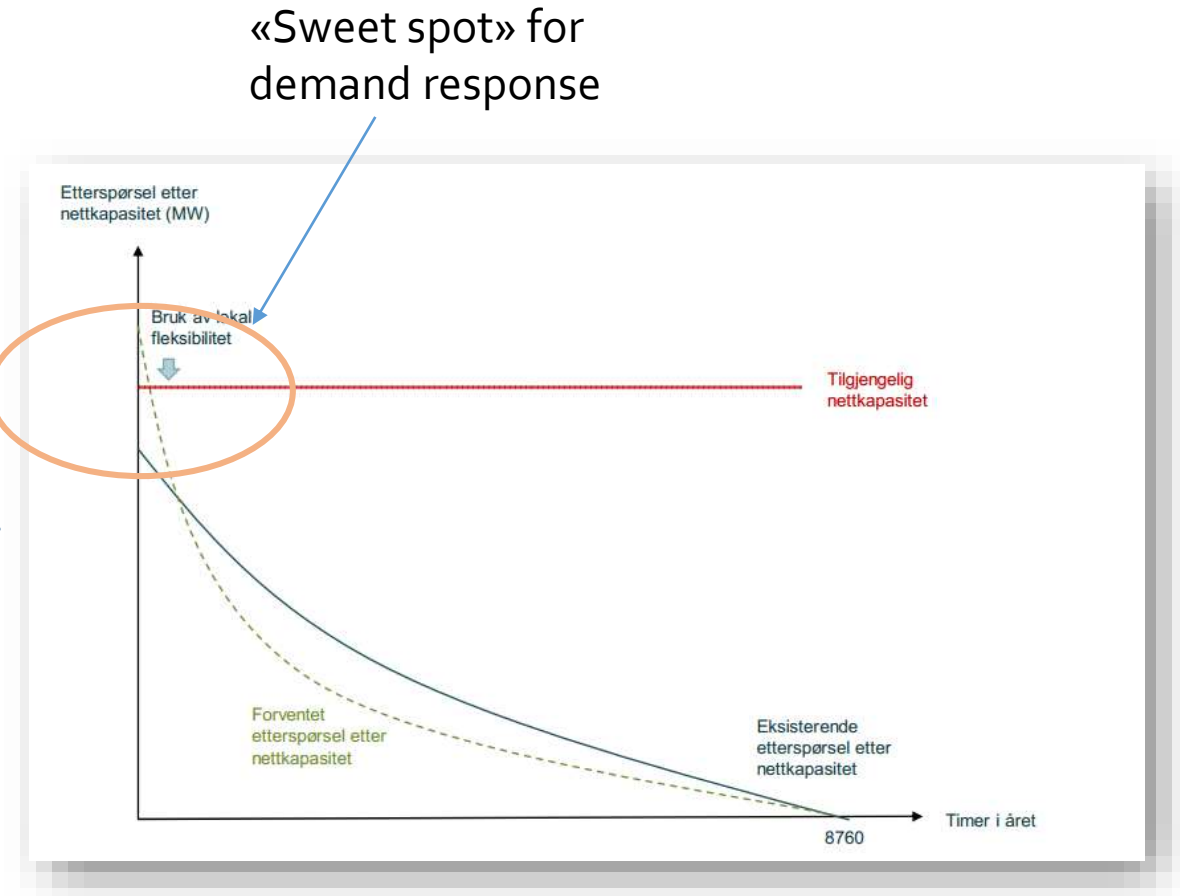


Future:



# New reality for Grid Companies,

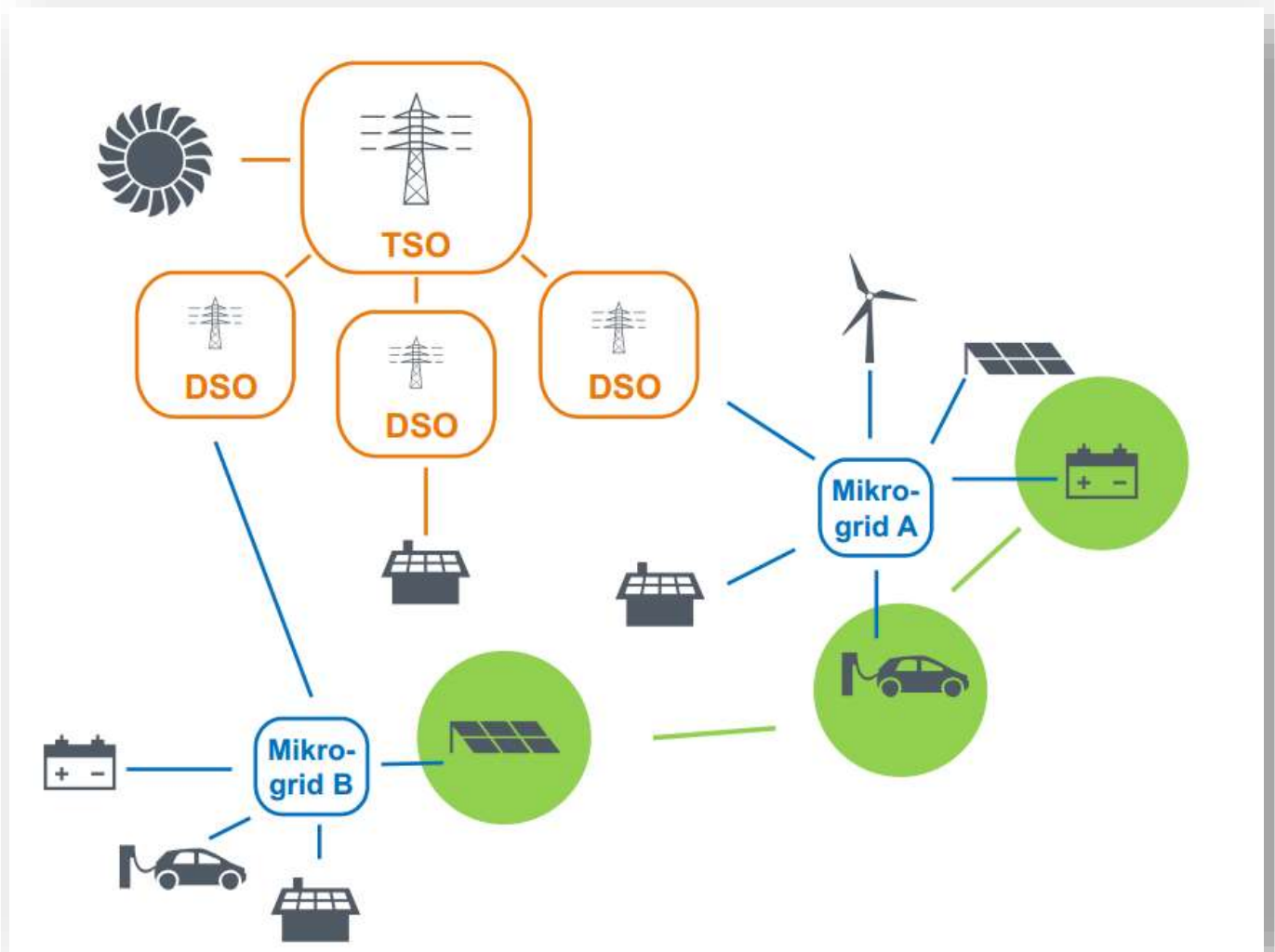
- Their Natural monopoly will be challenged by micro grids and «Off Gridders».
- Customers will not accept any new amounts of grid fees and grid related taxes.
- This is probably the worst time to «overinvest» in Grid infrastructure.
- All available utility «CAPEX» must be channeled to renewable production capacity.




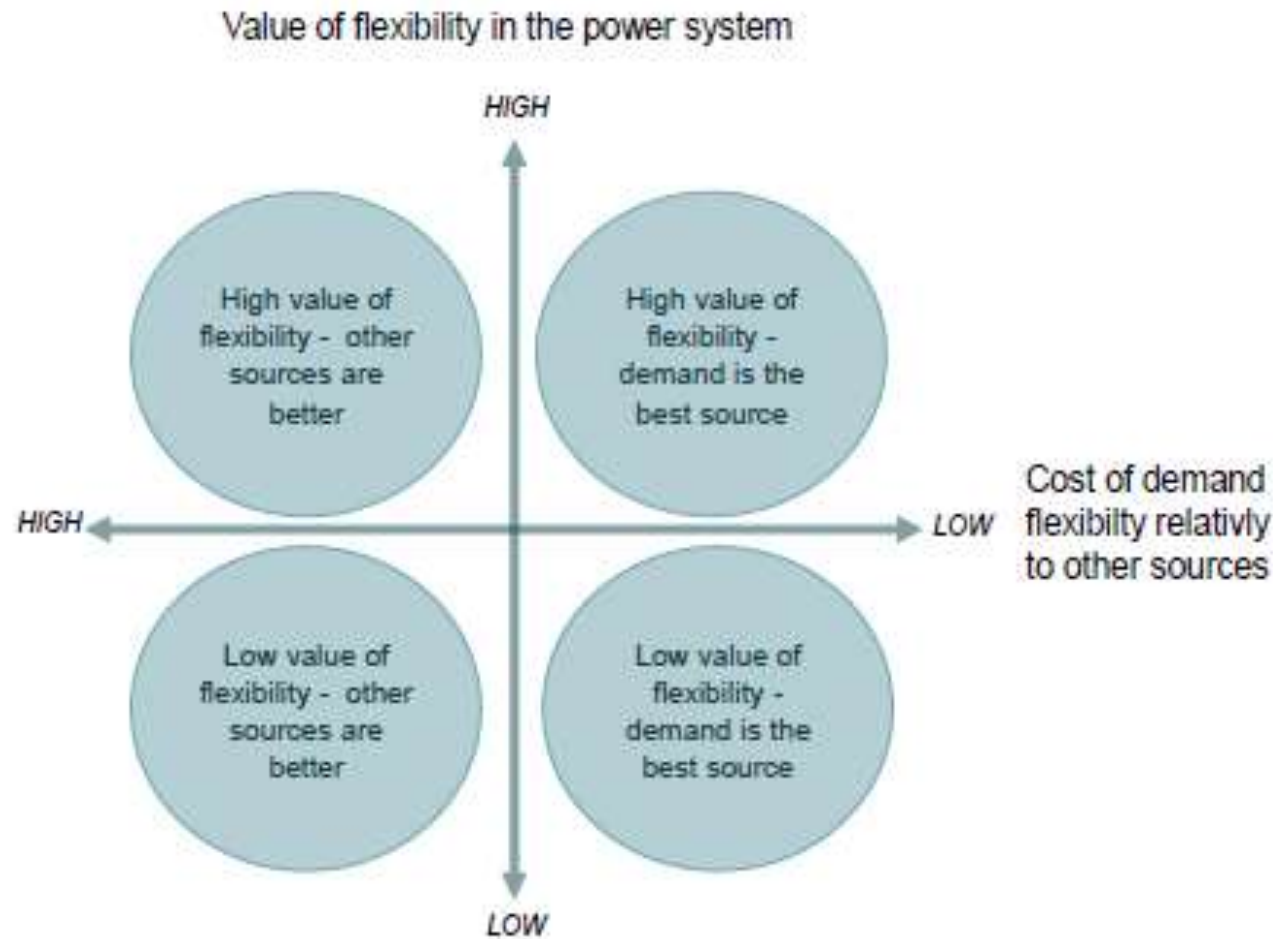
Source: Thema

# Prosumer-to-Prosumer

or: When will electricity be traded on eBay?



# What kind of flexibility is needed and when?



Flexibility may become a lot cheaper before it becomes a lot more valuable

# Big savings already in Switzerland

## Swissgrid spart bei Regelernergiekosten

**(Montel)** Der Schweizer Übertragungsnetzbetreiber Swissgrid senkt 2017 die Tarife für Verbraucher, mit denen die Systemdienstleistungen wie Regelernergie bezahlt werden, um 11% zu diesem Jahr, unter anderem weil die Beschaffung günstiger geworden ist, teilte der ÜNB am Mittwoch mit.

„Neben dem voraussichtlich geringeren Beschaffungsaufwand trägt (sogar noch ein wenig stärker) auch die abgebaute Unterdeckung zur Senkung bei“, teilte Swissgrid-Sprecherin Irene Fischbach Montel per E-Mail mit.

Der Grund für die tieferen Beschaffungskosten liege darin, dass die Preise für Primär-, Tertiär- und Sekundärregelenergie 2015 im Vergleich zum Vorjahr deutlich gesunken seien, während die beschaffte Menge in etwa gleich geblieben sei, fügte Fischbach hinzu, ohne dies genau zu quantifizieren.

Regelernergie wird zum Ausgleich von Schwankungen im Stromnetz benutzt und muss je nach Art innerhalb von 30 Sekunden, 5 Minuten oder 15 abrufbar sein. Die Schweiz schreibt den Bedarf teilweise im Netzregelverbund aus, zu dem auch Deutschland und Österreich zählen.

Die Preise am vormals lukrativen Markt stehen durch eine wachsende Anbietervielfalt zunehmend unter Druck.

Eine 2013 entstandene Unterdeckung sei inzwischen abgebaut worden, so der ÜNB. Diese habe sich ergeben, weil die tatsächlichen Ausgaben und Einnahmen von den Prognosen abgewichen seien.

Der allgemeine Systemdienstleistungstarif für Endverbraucher sinkt damit von 4,50 CHF/MWh in 2016 auf 4 CHF/MWh (3,68 EUR/MWh) in 2017, so Swissgrid.

*(1 EUR = 1,09 CHF)*



# Demand for capacity is expected to grow much faster than demand for energy – Example Norway

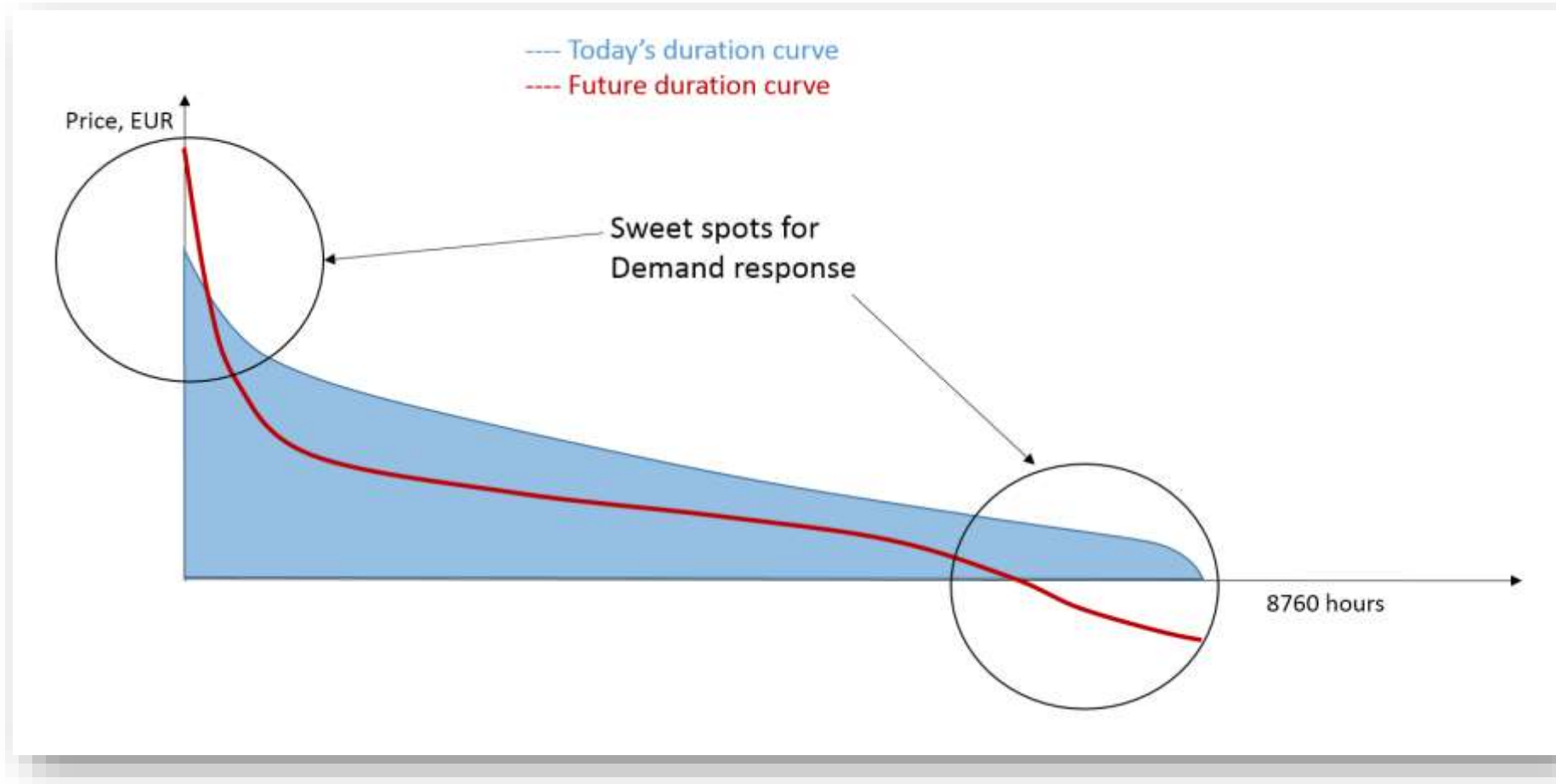
Figur 4: Historisk og mulig utvikling av samlet årlig energibruk og maks effektuttak



Kilde: NVE

# Even from an «Energy only» perspective, demand response has it's place

Price duration curves



# Statkraft has calculated that Demand Response is the most efficient way to mitigate capacity Challenges

Case of Swedish Nuclear Shutdown

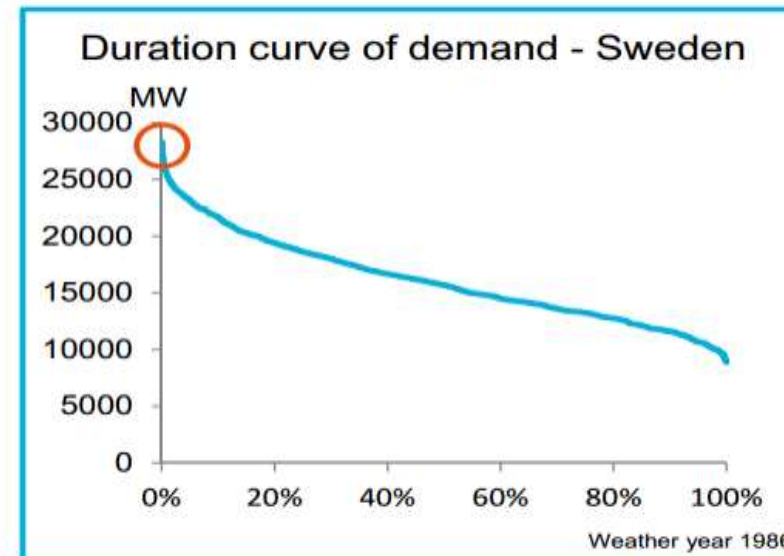
## Mitigating action

## Peak load reduction through demand flexibility

Reducing peak load by demand response is mitigating capacity challenges

Price sensitive demand 2030	Expected capacity deficit
Full nuclear phase-out	20 h/year
6 % demand response	12 h/year
12% demand response	3 h/year

Rapid technology development plays an important role



# Status Demand Response

- Barriers are mainly regulatory and market design.
- Increasing number of providers of Demand Response services. Some consolidation likely.

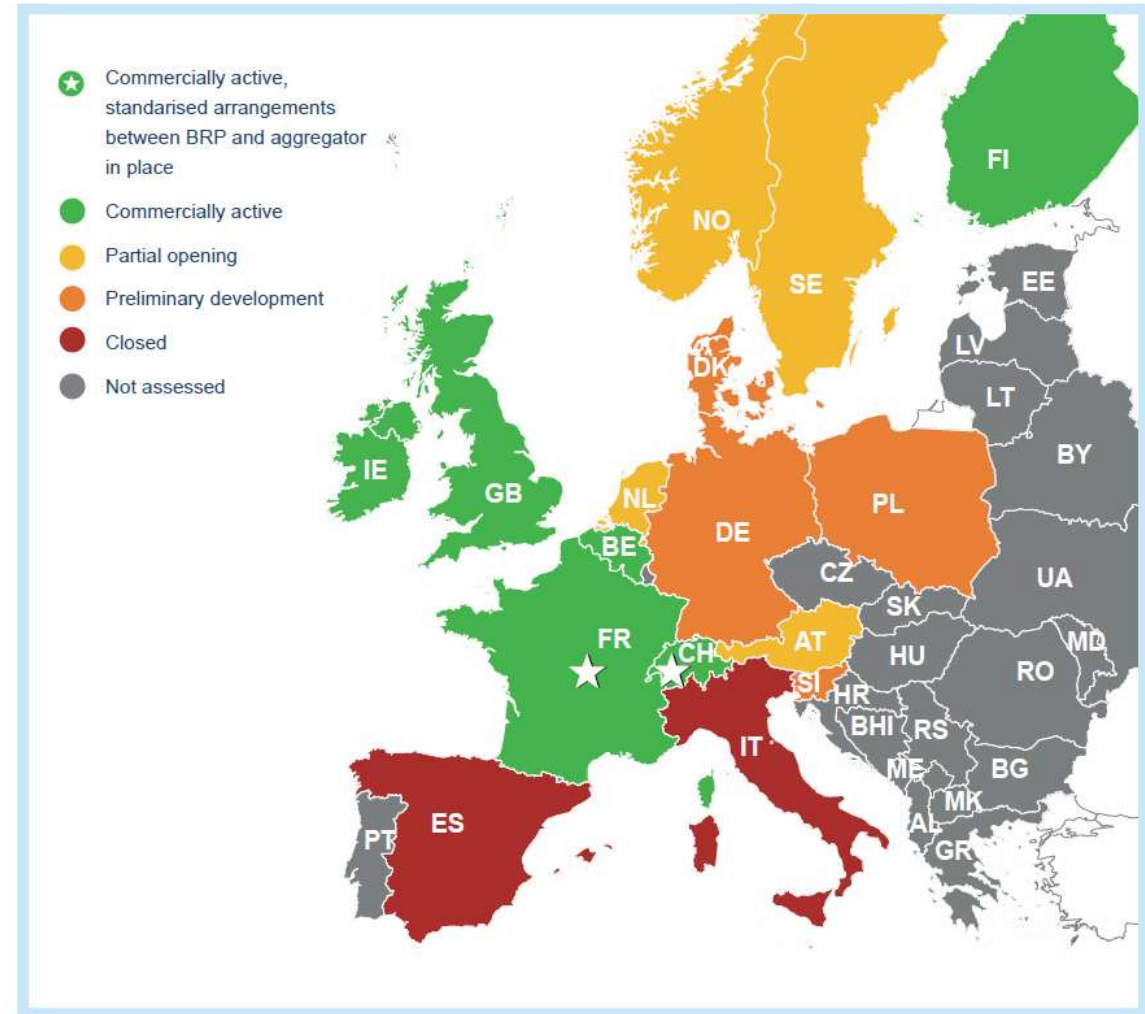
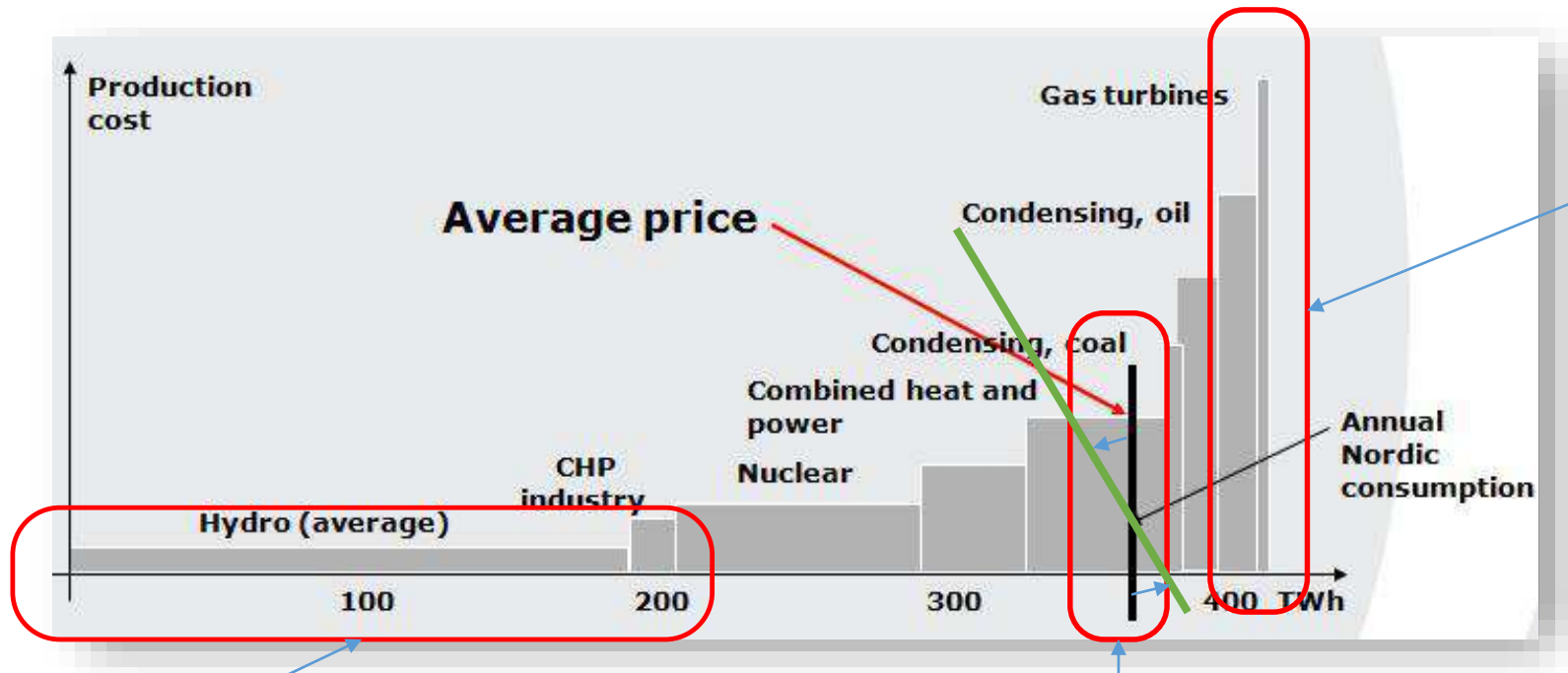


Figure 1: Map of explicit demand response development in Europe Today (SEDC, 2015).

# Capacity markets vs. Flexibility markets



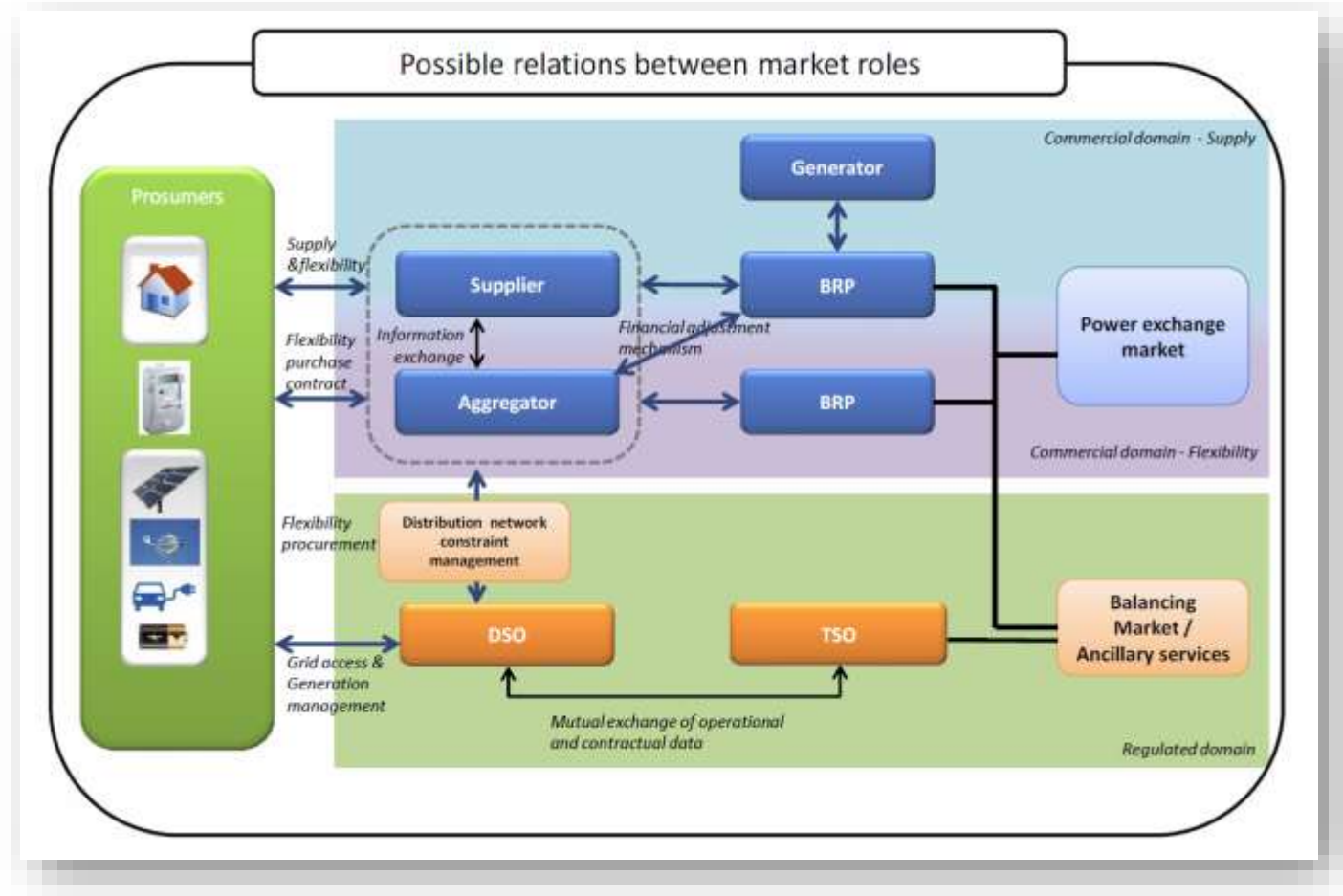
ENTSO-e wants to safeguard the profitability of critical capacity to ensure security of supply

Subsidies for Renewables lead to more hours of negative prices.

EU Commission is working on creating a market design that incorporates end user flexibility in the price formation and system operation.

# The role of the aggregator: Regulations are still unclear

- Pricing of reserves?
- Separate Markets?
- First priority during bottlenecks?
- How to define the Aggregator
  - Technically
  - Commercially
- Roles and balancing responsibility



# Enfo has the tools to be able to be a part of the anticipated end state.....Globally

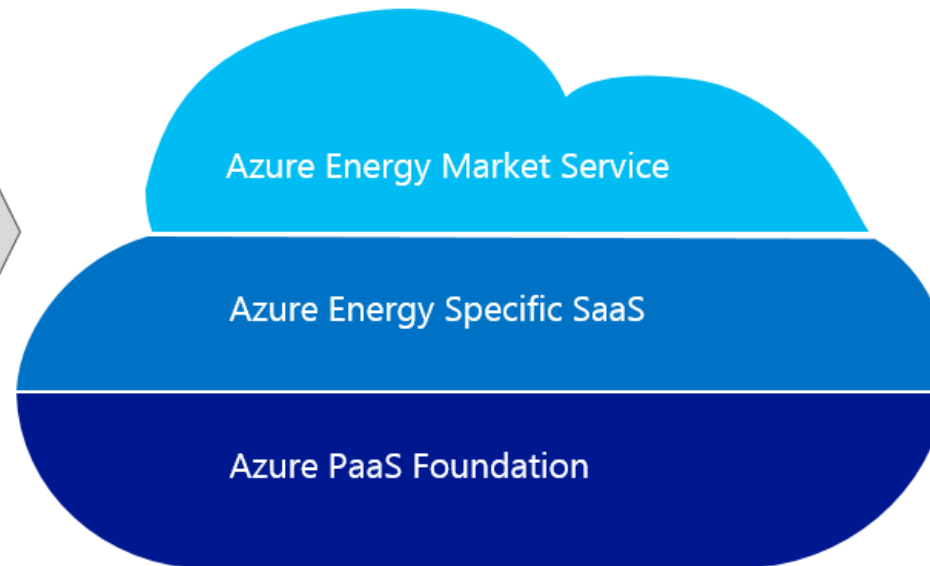
## Microsoft Energy Market Platform

"The only way [electric utilities] can find a place in this value chain...is by being the smart entity that has real-time information at any given point in time on the behavior of the grid. *The big gap...is a system that allows us to be aware of, in real time, the behavior of every device and be able to predict that behavior.*"

-Kamal Ballout, VP Alcatel-Lucent

### Current Industry State

- › Utilities lack tools to predict, control, and incentivize behavior
- › Sub-optimal investments in central and distributed leads to redundancy and underutilization
- › Increasing costs associated with stranded resources
- › Decreasing reliability due to lack of coordination
- › Grid defection becomes a viable alternative for end-users



### Anticipated End State

- › Dynamic market provides transparent price signals to grid operators and distributed resource
- › Grid investments optimized to least cost outcomes, minimizing redundancy
- › Cost savings passed through to customers
- › Improved reliability and grid stability
- › New tools enable dynamic planning an operation, creating insights from data analysis

# DSM Pilot Project Estonia

## EMS in building in Estonia

Enfo AS is planning the installation of a eFlex Energy Management System in a pilot project in Estonia, together with Norwegian project developer Nordic Commodities AS and Estonian energy service company Energiateenus

The planned start up is in summer 2016

## The planned results

The eFlex system will give energy savings for the consumer, as well as maintaining good indoor climate.

The project will also be used to develop the future possibility for DSM and use of consumer flexibility to balance the power market.

## Long term vision

The goal is to participate in the development of a more efficient power market and also to establish similar pilot projects in other countries.



[www.enfo.no](http://www.enfo.no)

