Network Code on Operational Security

DSO Associations views on the final version of 27 February 2013

David Trebolle,
Chair of DSO TF System Operation Codes

ACER Workshop,
Ljubljana, 9th April 2013

DSOs acknowledge improvements in the Code

- **DSO is now included for recovery of costs derived from the obligations in the network code that are assessed as efficient, reasonable & proportionate**

- **Definition of responsibility area is now included**

But the key concerns raised in our letter to ENTSO-E (dated 01/03/12) prevail

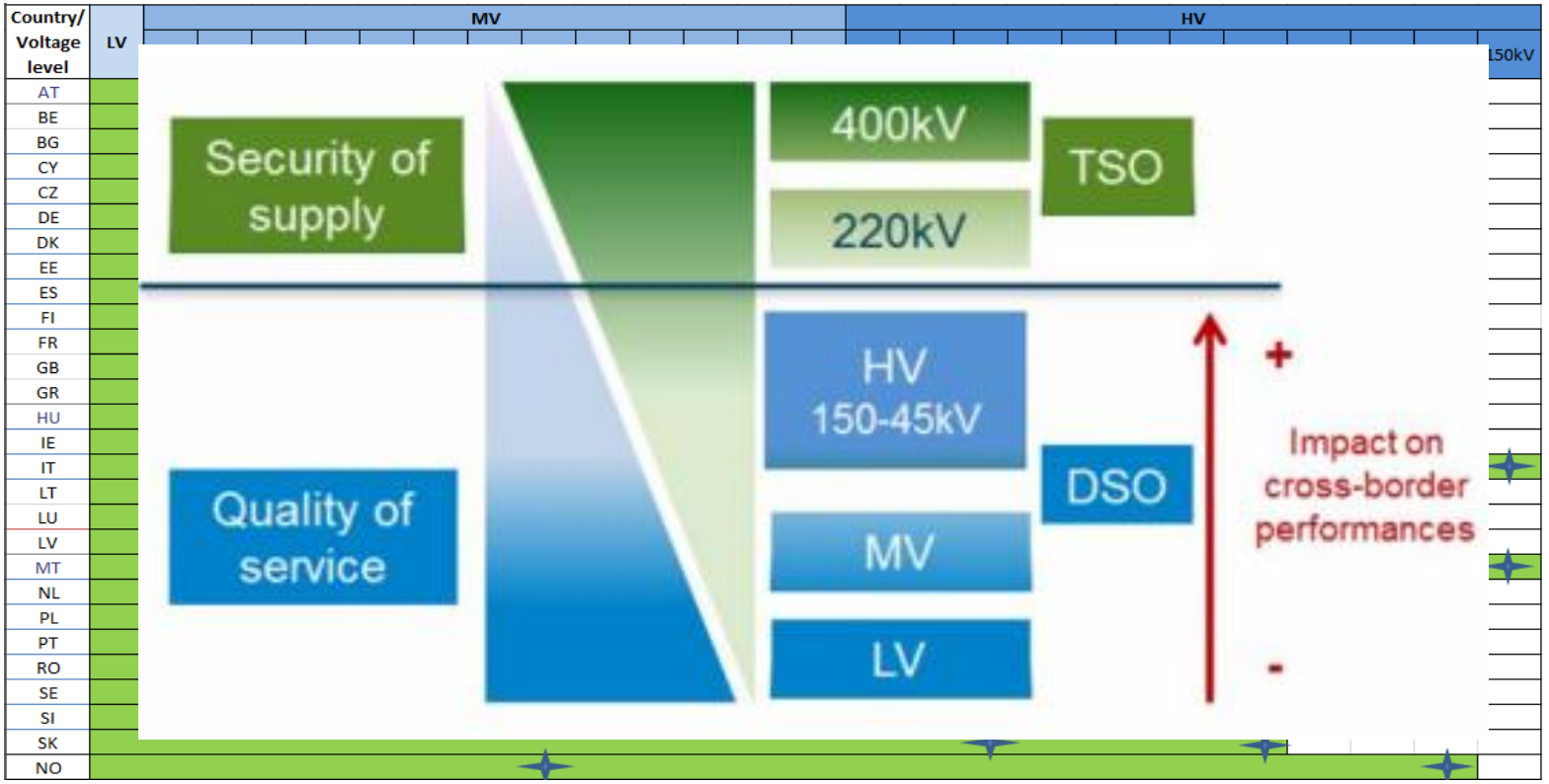
- **The NC is not in line with the principal ACER FG objective of 'achieving and maintaining a satisfactory level of operational security allowing for efficient utilization of the power system & resources' (p.16) with respect to:**

1. **Applicability to all DSOs**
2. **Reactive Power Requirements at T/D connection points**
3. **Compliance monitoring & testing**

- **Requirements for coordinated information exchange between TSOs, DSOs & network users (p.16) required by ACER FG are not fulfilled!**

4. Not respecting DSO Role as a System Operator

1. Significance of grid users is defined but due to prevailing one-size-fits-all approach towards DSOs, the proposed rules are inefficient



Source: EURELECTRIC

Note that European DSOs differ widely with respect to the voltage levels they operate and the degree of penetration of distributed generation

1. DSO Proposal: Amend definition of Observability Area

Observability Area *means*

- *the own Transmission System and the relevant parts of Distribution Networks and neighbouring TSOs' Transmission Systems, ~~on~~for which TSO ~~implements real-time monitoring and modelling~~ needs data (amongst other structural & real time data) to ensure Operational Security in its Responsibility Area;*
- *the own Distribution system, the relevant SGUs connected to distribution networks, neighbouring DSOs and neighbouring Transmission Systems for which DSO needs data to ensure reliability and quality of service and thereby provide the necessary contribution to Operational Security*

1. DSO Proposal (ctnd): add new point 8 to art. 16

"8. Each TSO, in coordination with the DSO directly connected to its Transmission system, shall define the Observability Area of the Distribution Networks with Connection Point directly to its Transmission System, which is relevant to accurately and efficiently determine the System State and to run the common grid model, based on the methodology developed according to the provisions of [NC OPS] considering the following criteria:

- Voltage at Connection Point between TSO and DSO;
- For a Connection Point between TSO and DSO, the ratio between the total installed capacity of Power Generating Modules and the total installed capacity of the transformer at the Connection Point; or
- For a Connection Point between TSO and DSO, the ratio between the total demand capacity taking part in DSR (as defined in NC DCC) and the total installed demand capacity.

In those cases where a Distribution Network does not have a Connection Point directly to the Transmission System, the capacity of the installed Power Generating Modules and/or demand has to be added to the capacity at the Connection point between TSO and DSO with the Connection Point."

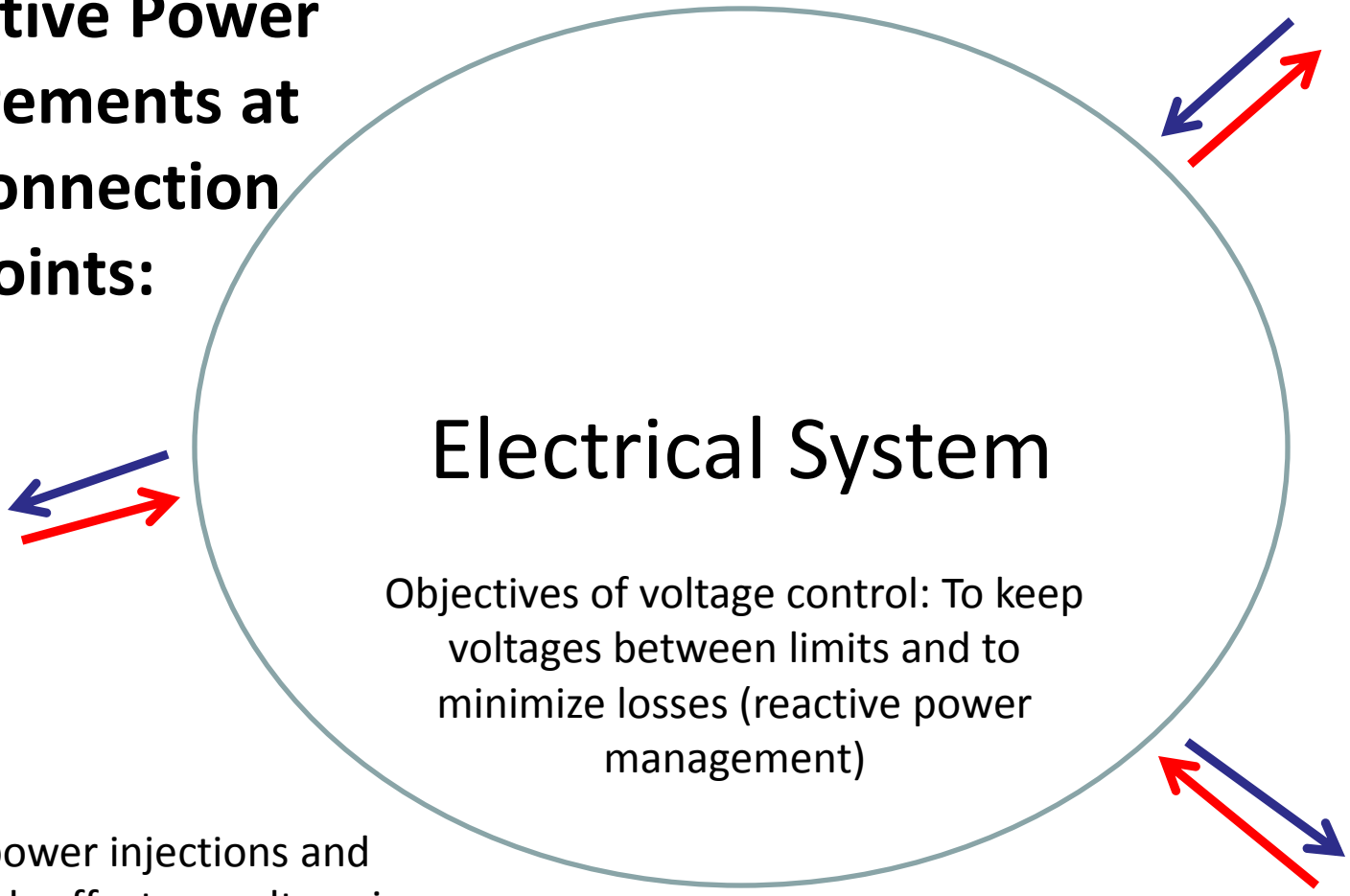
2. Reactive power control based on fixed and specific power factor or reactive power setpoints

(art. 10.12 & 10.16 in particular) will lead to higher system losses and costs than when the requirements are determined in cooperation of both system operators.

- **The proposed approach is not cost reflective, does not allow for a system approach and cost-effective integration of renewables to achieve 20/20/20 targets**

- **Regarding voltage control DSOs should be treated as system operator and not system users**

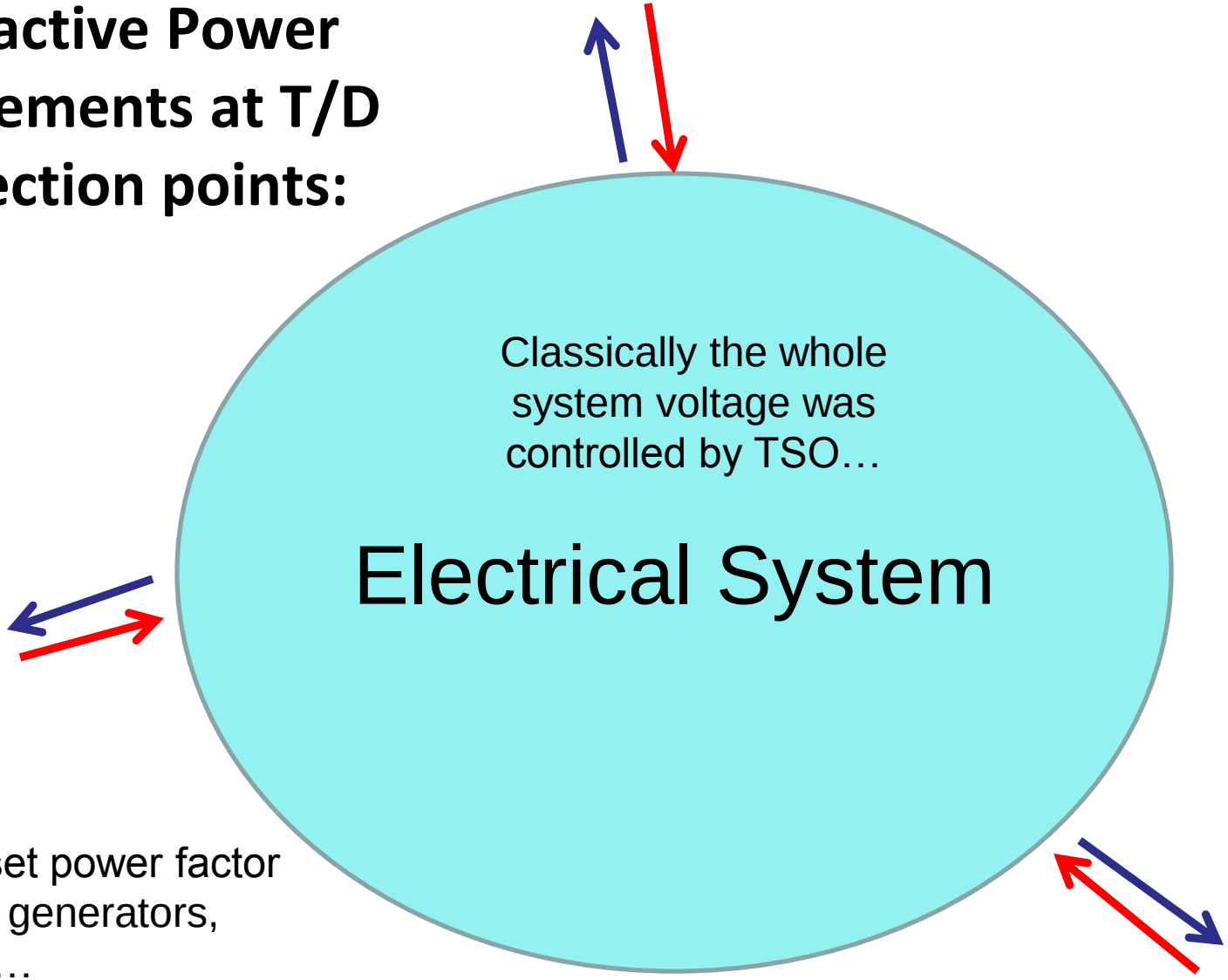
2. Reactive Power Requirements at T/D connection points:



Reactive power injections and withdrawals effect on voltage is controlled by means of fixing power factor or reactive power requirements to the system users.

Arrows represent injections and withdrawals limits

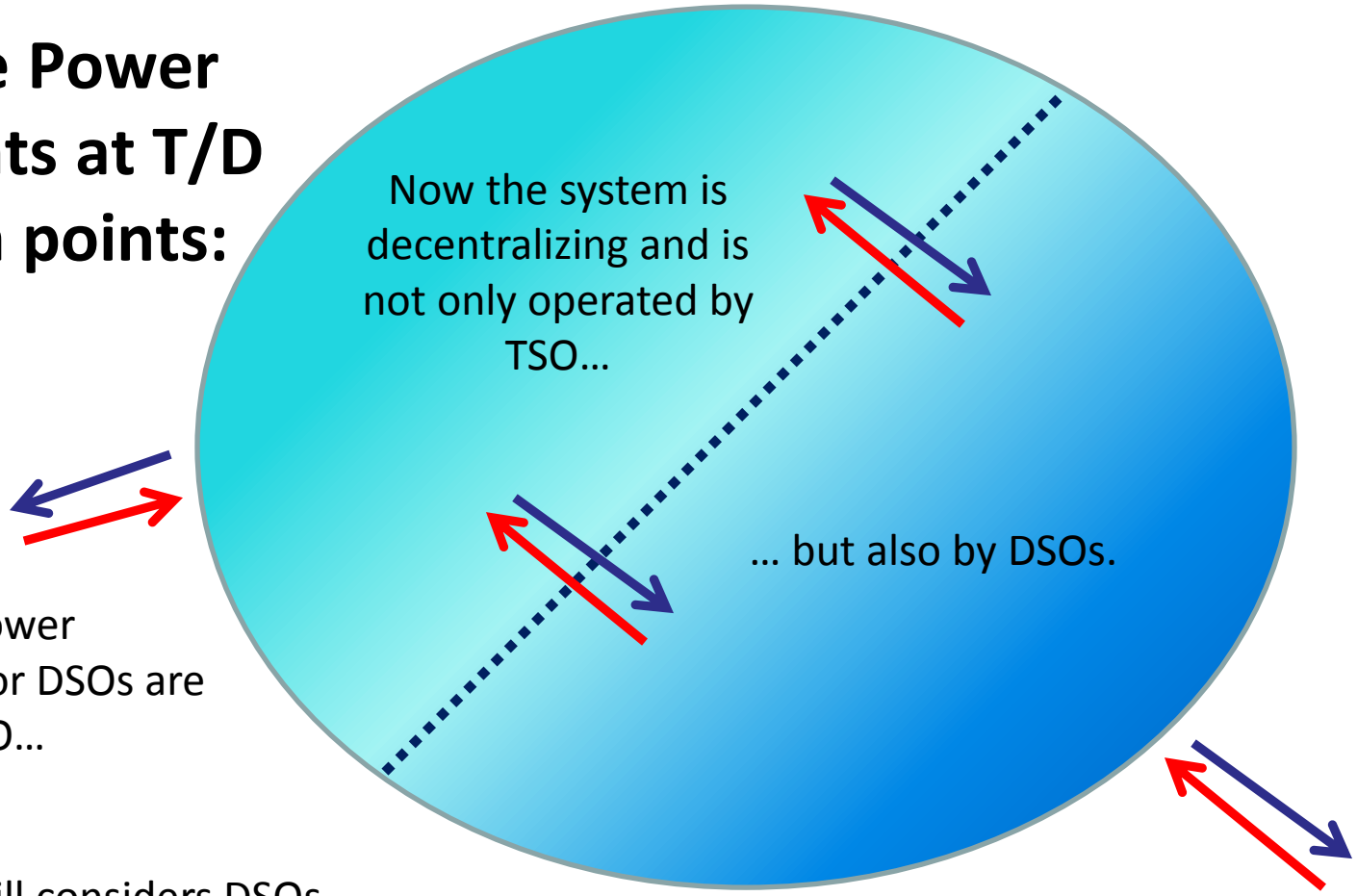
2. Reactive Power Requirements at T/D connection points:



… who set power factor limits for generators, demand…

… and DSOs with fit and forget approach.

2. Reactive Power Requirements at T/D connection points:

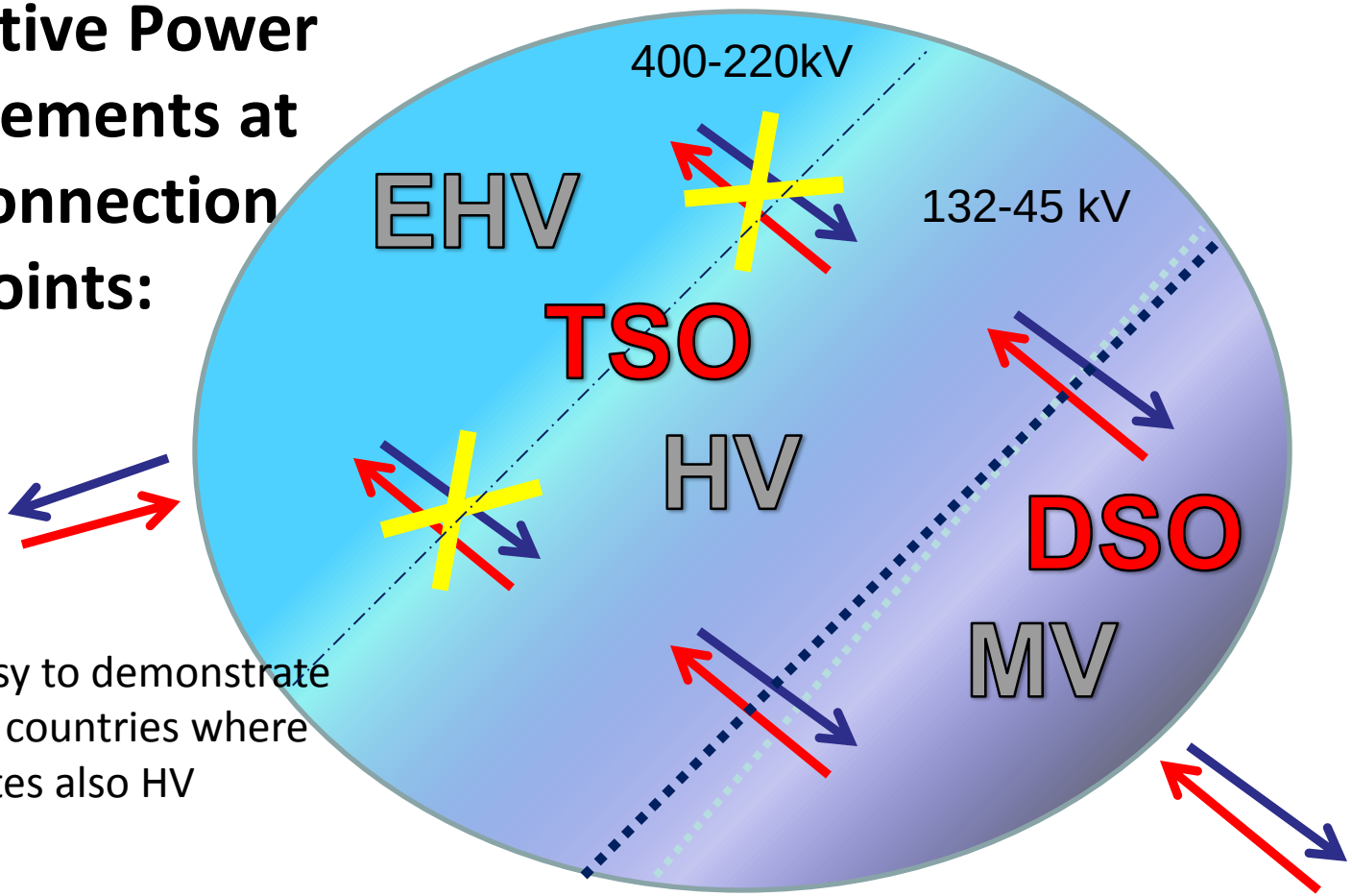


BUT reactive power requirements for DSOs are still fixed by TSO…

… who still considers DSOs as a system user…

… LACKING OF SYSTEM APPROACH BECAUSE ASSETS PROPERTY IS CONFUSED WITH SYSTEM MANAGEMENT.

2. Reactive Power Requirements at T/D connection points:

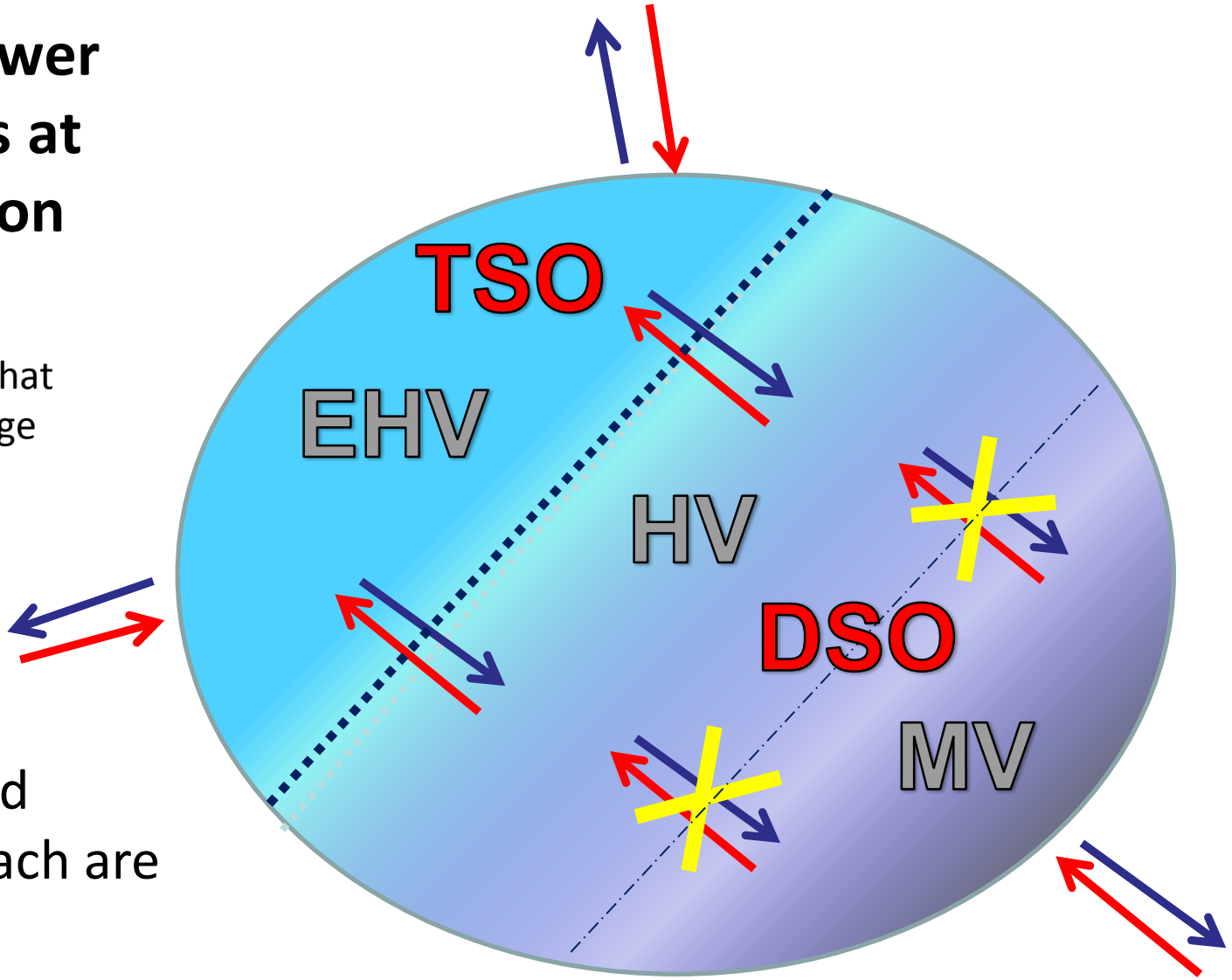


What is easy to demonstrate because in countries where TSO operates also HV networks…

It does not set any reactive power requirement for the connection points: TSO takes the most efficient solution!

2. Reactive Power Requirements at T/D connection points:

Nor does the DSO that operates high voltage networks.



Ownership and system approach are mixed up

2. Reactive Power Requirements at T/D connection points

Estimated comparative Investment costs for compliance with reactive power requirements (Conservative):

The cost implication for a real network has been evaluated by means of simulations. Results cannot be extrapolated to the whole Europe due to distribution networks diversity, but the costs variations among current and 2020 scenario clearly demonstrate inefficiency of this approach.

T/D connection points	Cost Increase to comply with the requirements in 2020
HV (TSO)/HV (DSO)	138 %
HV (TSO)/MV (DSO)	287 %

And what happens when DSO is able to control reactive power from grid users?

Then investment cost tends to 0 € as DG penetration increases (25 % DG in 2020)

2. DSO proposal of rewording of art. 10: flexible solution in coordinated by TSOs and relevant DSO

- *12. Each TSO shall define the Reactive Power set-points, power factor ranges and voltage set-points for voltage control in accordance with [NC DCC], which shall be maintained by the Significant Grid Users and shall agree with ~~or~~ DSOs with Connection Point directly to the Transmission System for all SGU connected to distribution networks.*

  Each significant DSO shall define the Reactive Power set-points, power factor ranges and voltage set-points for voltage control in accordance with [NC DCC], which shall be maintained by the Significant Grid Users connected to DSOs and shall agree with TSOs with Connection Point directly to the Distribution System.

- *16. Each TSO shall maintain voltage ranges and ~~each DSO and~~ Significant Grid User which is a Demand Facility with Connection Point directly to the Transmission System shall maintain the power factor or Reactive Power flows at Connection Points within the ranges specified in Article 10(12) ~~and in Article 16 of [NC DCC]~~, unless an agreement is defined between the TSO and the DSO foreseeing the active voltage control by the DSO in accordance with Article 16(1)(c) of [NC DCC], or unless another value is defined in accordance with national legislation for Significant Grid Users with Connection Point directly to the Transmission System who are not subject to or are derogated from [NC RfG].*

IN ADDITION: corresponding articles in NC DCC (art. 16) must be changed to allow for joint analysis by TSO & DSO and common finding an optimal solution

3. The inclusion of Redispatching Aggregators, Demand Aggregators and Providers of Active Power Reserve as

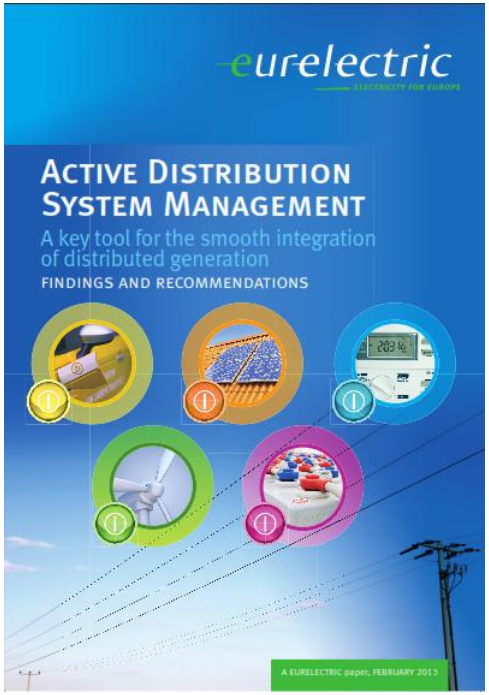
Total compliance costs estimation for the EU by 2020: ~ **4 billion €**

The compliance tests are not the same as in the network codes RfG & DCC! → THE COSTS ADD UP!

Country	2020 Scenario: expected no. of small units ≥ 5kW (65% generators, 35% DSR)	Estimated compliance cost
AUSTRIA	205.500	76 M€
GERMANY	2.700.000	1.000 M€
BELGIUM	675.000	253 M€
ITALY	783.000	294 M€
UK	472.500	117 M€

4. The negative impacts of by-passing the DSOs as SYSTEM OPERATORS

DSOs primary mission = operating their networks at high levels of realibility and quality of service

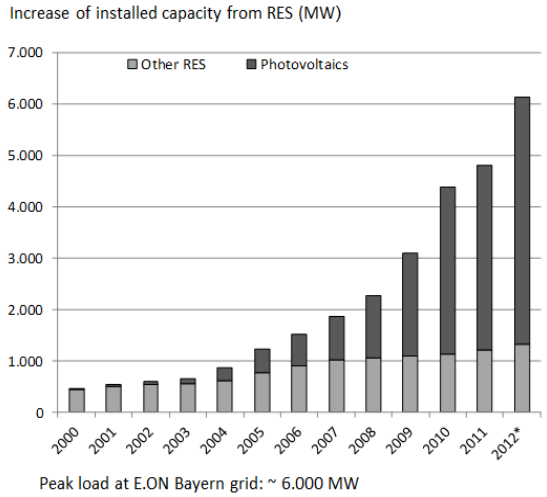


'Significant DSOs' need relevant operational tools to contribute to the overall system security & efficient RES integration:

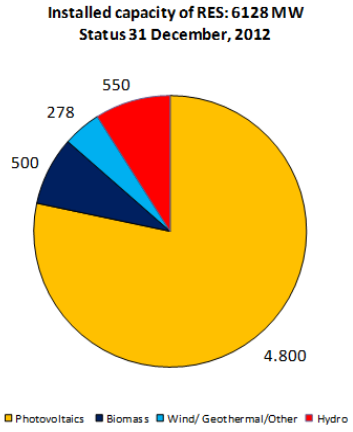
- **Information exchange (→ reciprocity) BUT DSOs 'Observability Area' and information exchange missing**
- **Congestion management**
- **Voltage control**

4. Most RES to achieve 20% target by 2020 will be connected to DSO networks

Example #1: E.ON Bayern



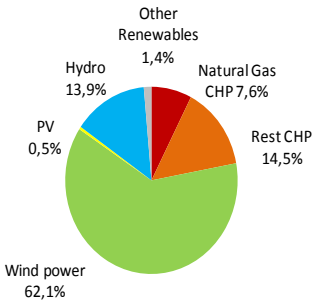
Peak load at E.ON Bayern grid: ~ 6.000 MW



Number of PV installations: ~ 225.000

Example #2: Galicia, Spain

	Installed Capacity (MW)	Percentage (%)
CHP (Natural Gas)	166,9	7,6
Rest CHP	319,4	14,5
Wind Power	1.369,5	62,1
Photovoltaic (PV)	10,3	0,5
Hydro	306,1	13,9
Other Renewables	31,4	1,4
TOTAL Generation	2.203,6	100

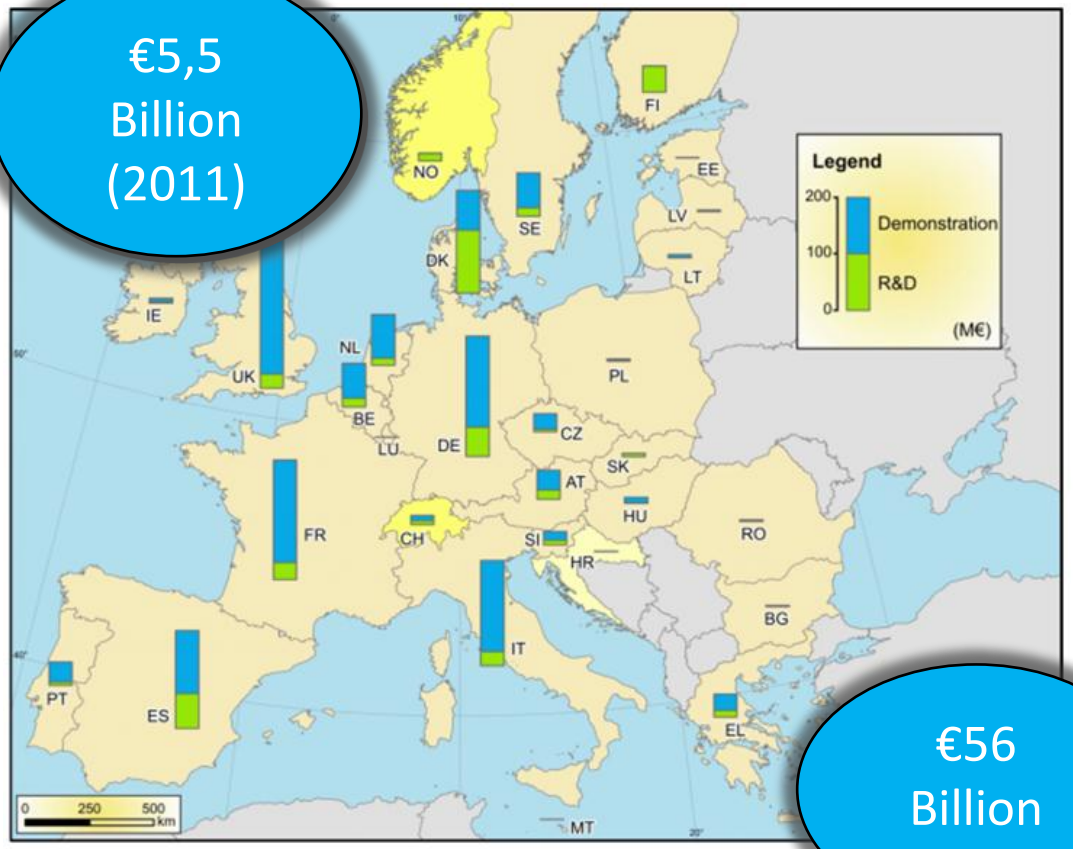


	Max. Hourly Average capacity (MW)
Galicia Demand	1.842

Already today, distributed generation output often exceeds demand at distribution level, and sometimes is even several times higher. In addition, voltage problems are becoming more frequent.

4. Smart Grids will be a key for maintaining high level of system security in an efficient and sustainable way

€5,5 Billion (2011)



€56 Billion (2020)

Source: EC JRC (2013)/ (2012)

EC Communication 'Making the 'Internal Energy Market Work':

'In electricity, new technical rules such as on cross-border balancing markets and on liquid intra-day markets, should, in combination with smart grids, help improve system flexibility and the large-scale integration of electricity from renewable energy sources and participation of demand response resources alongside generation.'

4. The NC does not allow for synergies that are key for cost-effective development of Smart Grids

By permitting direct orders and information exchange from TSO-DN user (being both unsecure and inefficient, see later) direct communication channels are set.

If those channels pass through DSO, TSO could manage Operational Security with no difference, BUT THESE CHANNELS COULD BE USED BY DSO TO ENABLE SMART GRID FUNCTIONALITIES.

Examples:

Article 29: Data exchanged between TSO and Demand Providing DSR (Aggregated or not) '…shall communicate to its TSO or via its DSO to the TSO…'

Article 27: Data exchanged between TSO and Power Generating Facility Owners

'...shall, if requested by the TSO, provide to the TSO all the information specified in…'

Those DSR Providers and generators could provide market based services to both TSO and DSO. Making direct channels to the TSO increases the barriers for such services at DSO level

4. Direct Orders from TSOs / Direct information DN user-TSO are clearly inefficient & may be unsecure

TSO order may trigger a constraint worse than the one wanted to be solved. Legal Responsibility of the Network lies with the DSO: In most countries, DSO is responsible if a direct TSO order causes an incident! But DSO does not know what happens in its network!

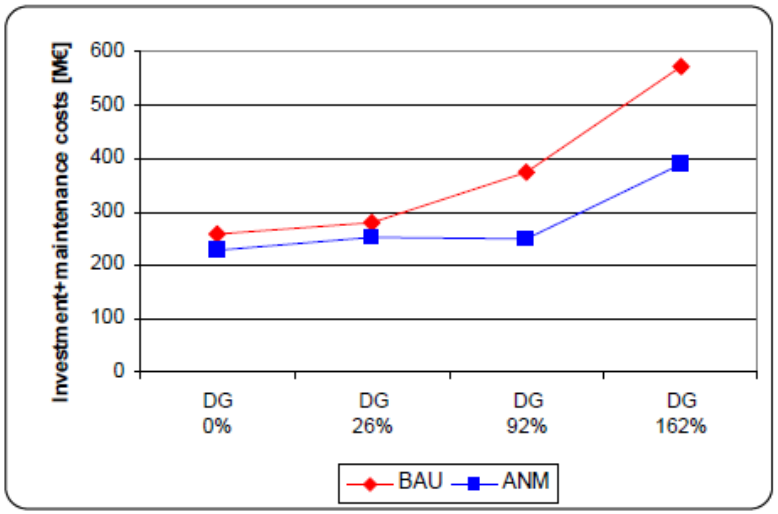
Estimated extra cost for double communication channels (**one with DSO and another with TSO** (conservative):

Ø cost per communication channel = 25.000 €/user (Assumption: Current costs maintained)

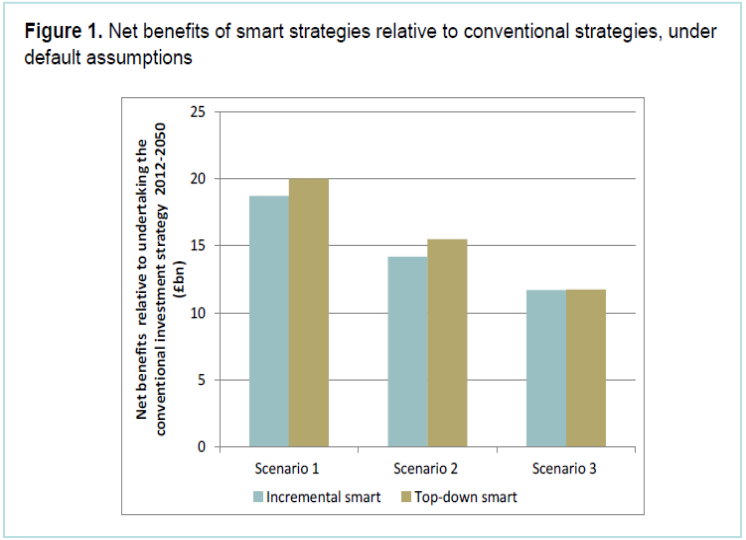
Country	2020 Scenario: expected no. of units >1MW (65% generators, 35% DSR)	Estimated cost of duplicated communication channels
AUSTRIA	3.240	81 M€
GERMANY	39.950	1.249 M€
GB	13.500	338 M€
ITALY	8.100	203 M€
SPAIN	4.050	101 M€
SWEDEN	4.050	101 M€

These countries represent 55 % of EU population. Total estimated EU costs by 2020: **~ 4 billion €**

4. Operational tools for DSO



Example 1: IMPROGRESS PROJECT (Intelligent Energy Europe): case study in a network in the Netherlands



Example 2: Frontier Economics for OFGEM ('A framework for the evaluation of smart grids'): Net benefits for different scenarios of technology and flexibility penetration and their division by source

Operational tools for DSO maximize RES integration in distribution networks in the most efficient way

According to different studies and European projects savings could be quantified in billions of € across Europe

Additional Issues Include:

1. Impractical requirements for system emergencies:

Article 9(7) contains requirements for resynchronization that are likely to be either impossible or very costly. At the very least any proposals by TSOs in relation to this paragraph must be subject to a cost benefit analysis before introduction.

2. NRA approval seems to be limited to an inappropriately small subset of the code (Article 4)

In former version 47 references to NRA involvement, now only 9 -> TSO allowed to come with requirements with no checks by the NRA impose them on DSOs and generators in breach of the law and exposed to enormous costs?

3. Art. 15 on stability issues needs clarification

How are DSOs are involved as for system stability studies (DSA) and in operational actions to fulfill stability criteria? When a minimum level of inertia is defined – who (PGF) should be pointed out to deliver that inertia and who should be switched off (of course wind and solar – but who)? NRA must be involved in this process.

Conclusions & Recommendations

Initial CBA revealed substantial inefficiencies of the code:
Preliminary estimation reveals additional cost that can be avoided of at least 6 billion €

ACER & the European Commission should ensure consistency in their policies & take a system approach

- **The OS code should fully consider Significant DSOs as System Operators and not as System Users.**
- **Prevent creation of additional barriers to smart grids development which is key for integration of renewables and demand response programmes.**
- **Explore synergies that are necessary for development of smart grids in a most cost-effective way possible**
- **Take a system approach: allow for flexibility & do not allow short term interests to result in system in higher costs for final customers in the long term**