Twenties
Transmitting wind

WP15 Economic impacts of the demonstrations, barriers towards scaling up and solutions

Javier García González, Comillas-IIT

EWEA, Brussels, 11 June, 2013

SEVENTH FRAMEWORK PROGRAMME
EUROPEAN COMMISION

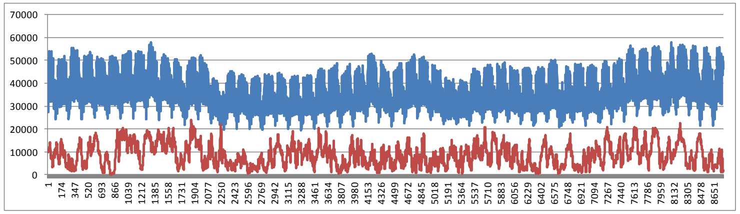
Objectives

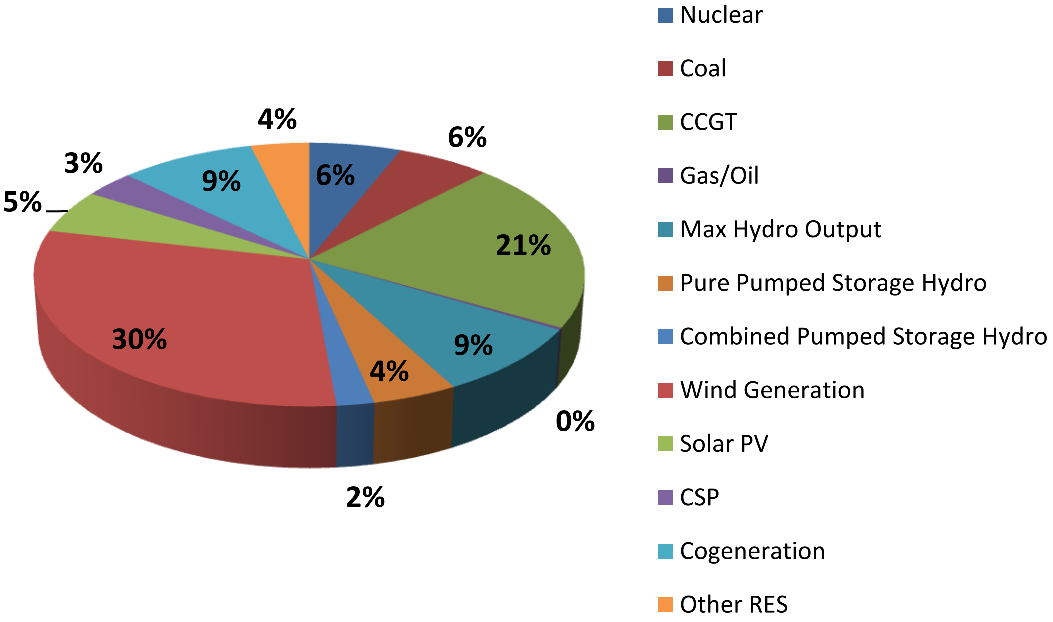
- **The main goals of WP15 were to assess the economic (TF1 & TF3) and technical (TF2) impact of each demo tested in the Twenties project, in order to identify barriers and to propose regulatory recommendations to overcome those barriers.**

TF1: SYSERWIND

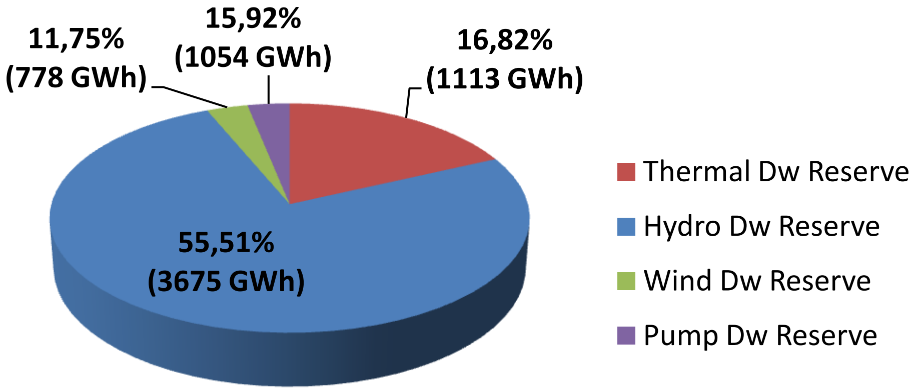
2020 Input data

Energy	[TWh]	331
Winter Peak	[MW]	58000
Summer Peak	[MW]	53000
Min Load	[MW]	19246



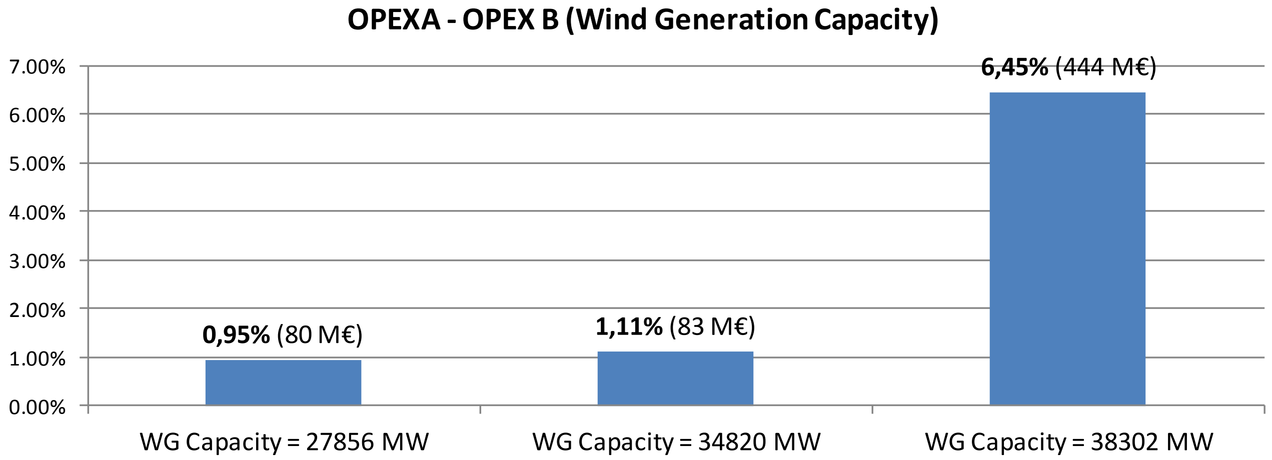


2020 Results



		CASE A	CASE B	Difference	Difference [%]
Operating Costs	[M€]	7444	7361	83	**1,1%**
CO2 emissions	[MTCO2]	48,9	49,0	-0,1	-0,2%
Wind generation	[TWh]	72,9	72,80	0,14	0,2%

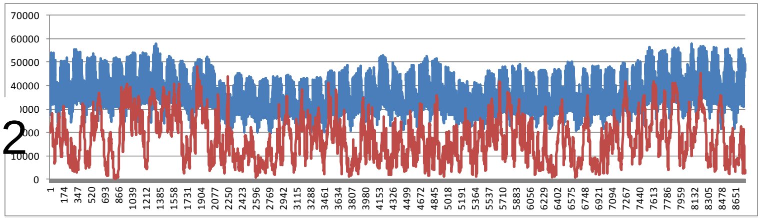
- **The economic impact increases with increasing wind power capacity**



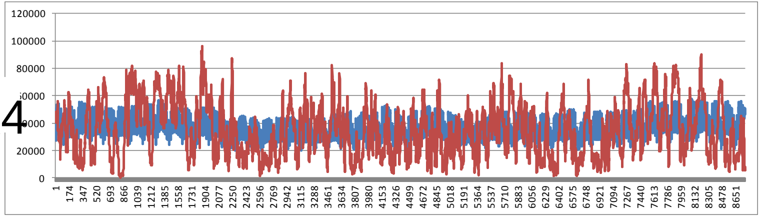
WG Capacity= 38302 MW	Unit	CASE A	CASE B	Difference [%]
Wind Output	%	92,8%	94,9%	-2,1%
Wind Spillage	%	7,2%	5,1%	2,1%
CO2 Emissions	MtCO2	43,3	42,2	2.4%

What if

X2



X4



Figures per year

	X1	X2	X4
Nuclear	58587.2	58587.2	58587.2
Coal_Old_NoScrubber	24724.7	10768.9	1904.6
Gas_GT	0.0	0.0	0.0
Gas_CCGT	58095.3	24151.4	3589.8
Oil	2.0	2.4	0.7
Diesel	0.0	0.0	0.0
Hydro	27429.3	27425.4	27270.3
PS_Hydro_Pure	680.7	1232.0	1996.2
PS_Hydro_Combined	619.3	962.5	1354.1
Thermal_Cost [M€]	6595.2	2901.7	671.0
Emission [MtCO2]	46.3	19.5	3.1

- Twenties has overcome a major technical barrier preventing better use of WG
- Other barriers remain to be addressed: primary regulation, inertia, …

Impact of the voltage control provision on the power losses

Proportional control

- **Active voltage control**
- **Increases slightly** the power losses

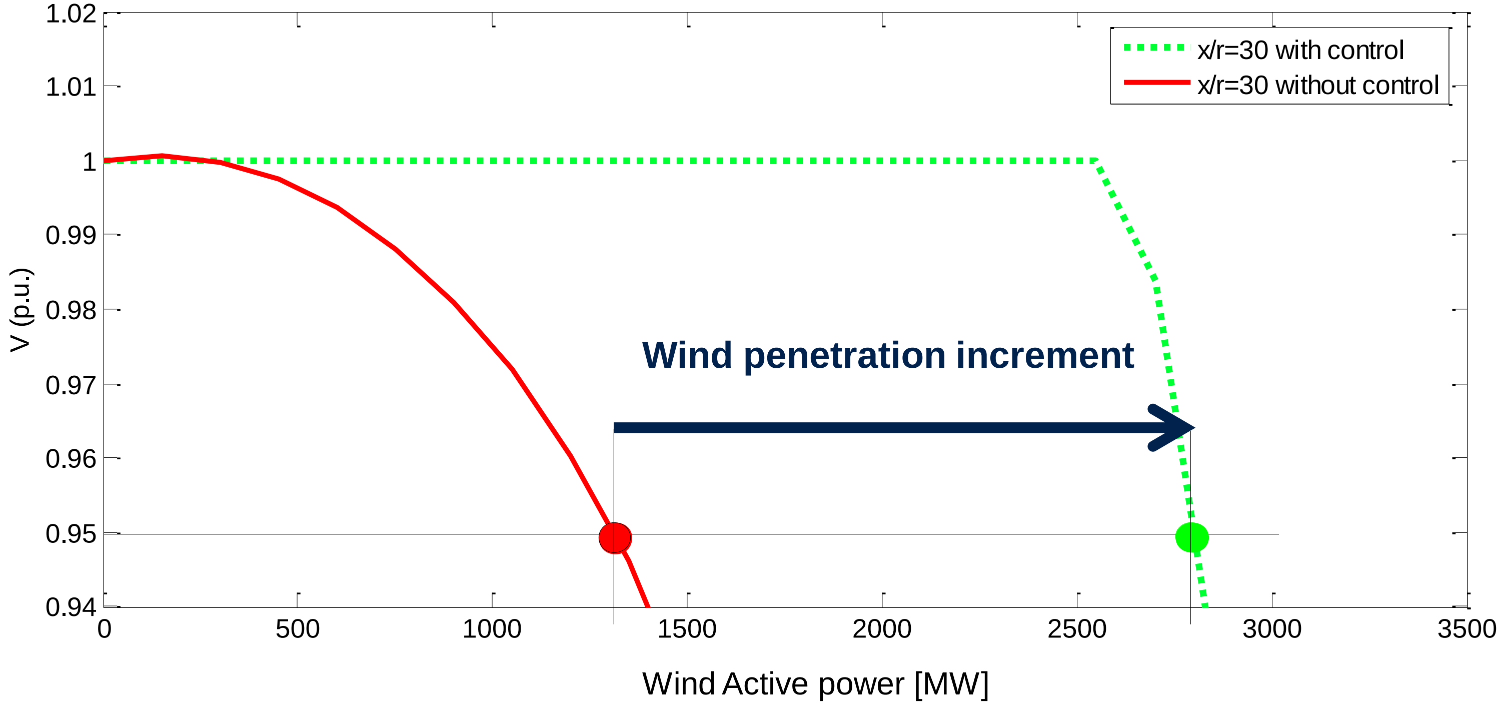
Optimal control (OPF)

- Similar behavior than the **current situation** from the voltage control point of view
- **Minimizes** the power losses

The impact on power losses is very dependant on the network evaluated.

Wind power penetration limits without voltage control from the voltage point of view

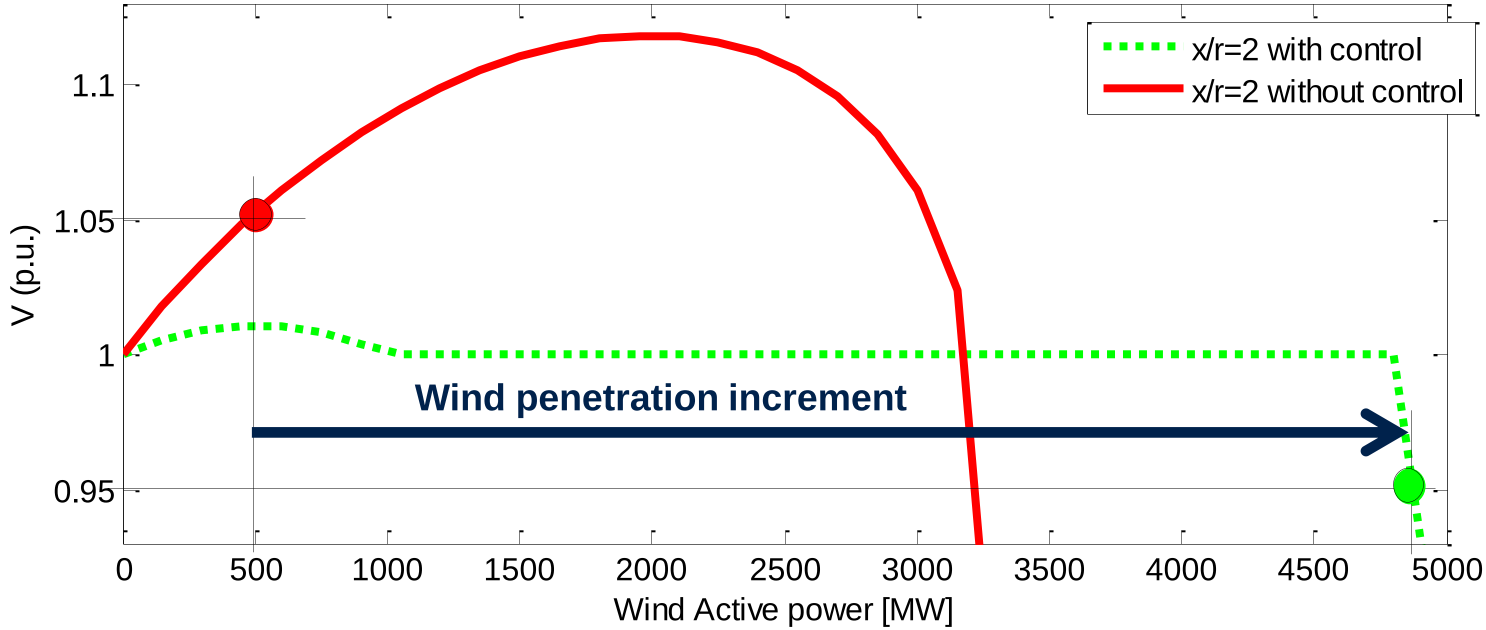
1 Low voltages



Wind power penetration limits without voltage control from the voltage point of view

2

High voltages



Wind power penetration limits without voltage control from the voltage point of view

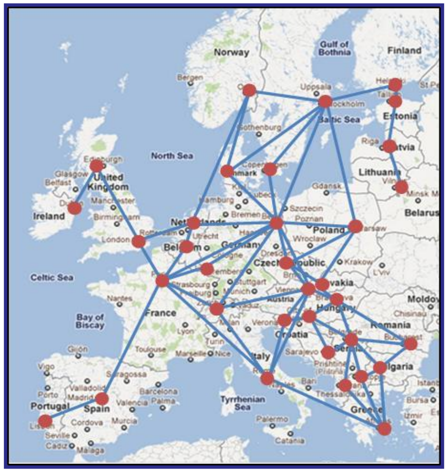
✓In the majority of the buses the **wind penetration** will **not be limited because of voltage reasons**.

✓In these cases the **wind penetration** will be **limited because of transmission capacity constraints**.

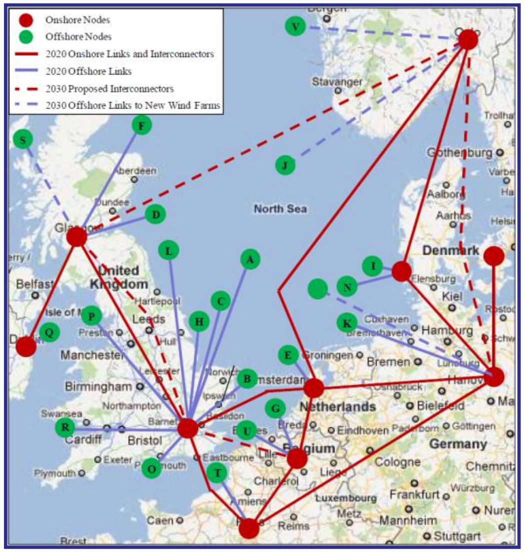
✓In the event that the wind power is limited because of voltage reason the **voltage control allows avoid this limitation**

TF2

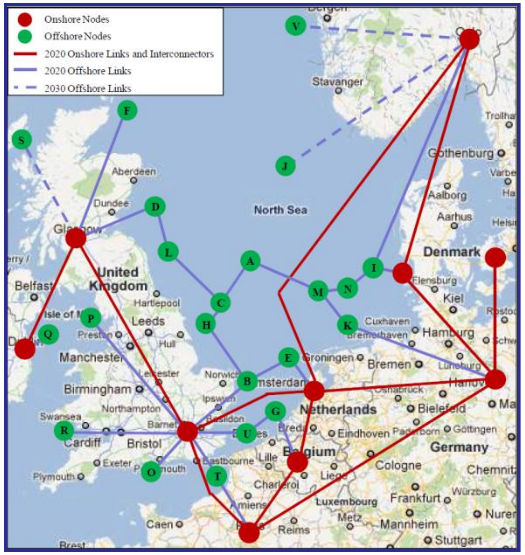
Analysis of European system operation and power flows with ANTARES tool



European network model



Radial offshore single connections with and without new inter-area interconnectors



Multiterminal meshed offshore network

TF2

- Results suggest that new offshore network capacity to allow increased exchange of power between different countries will be important for realising the full potential of new wind power developments.
- Local surpluses of wind power to be used elsewhere but it also facilitates reserve power to be held remote from a particular area.
- However, it might also allow cheap generation with high carbon emissions in remote areas to be used instead of lower carbon fossil fuelled plant in a local area.
- In addition, as offshore wind power is concentrated in relatively small geographical areas, critical weather conditions can lead to large variations in offshore wind power production.
- The New Storm Control can help to diminish reserve requirements, reducing the maximum reserve to approximately 50% of the one corresponding to the old control case.

TF 3 Main findings

- **Scaling-up of Demo 5 NETFLEX (Elia) in CWE**

  - PFC and DLR bring benefits for the system with **lower implementation costs** and **time** than conventional assets

    - Smart-controller of PFC in **Belgium** borders could **reduce** system **costs** by **50 M€ (250 M€** if fully deployed in **CWE)**

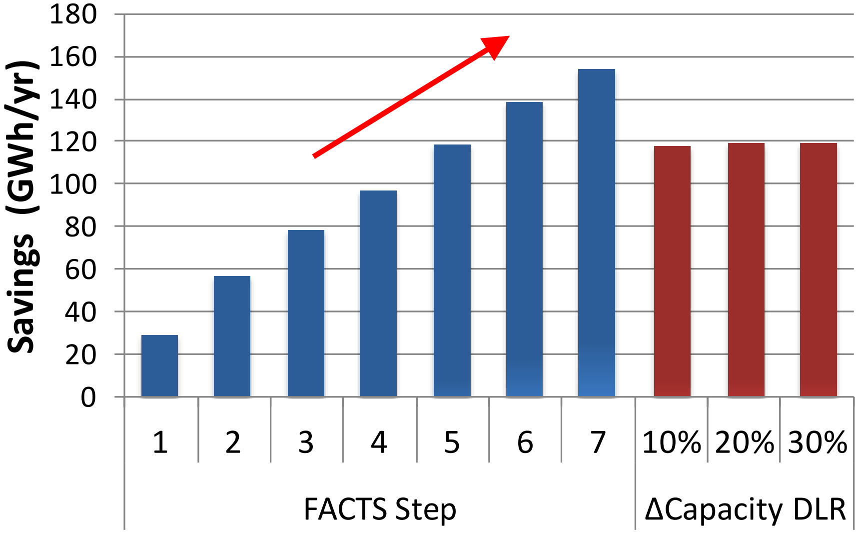
    - Broad DLR deployment in **CWE** would **reduce** system operational **costs** in **125 M€**

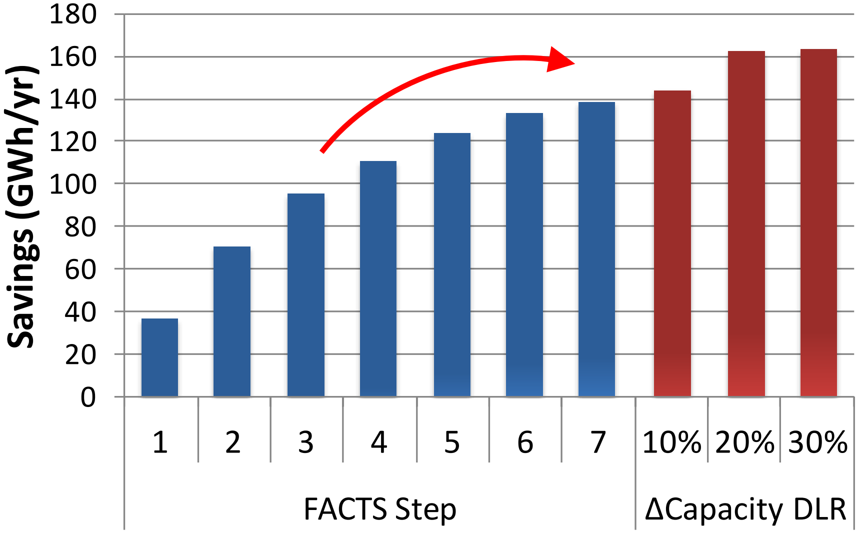
TF 3 - Economic impact of FACTS and DLR in Spain Demo #6 – GRIDFLEX (REE)

Avoided Conventional Generation Redispatch / year

Case Study: 5 critical areas
(500 GWh/year: 5% of total redispatch in Spain)

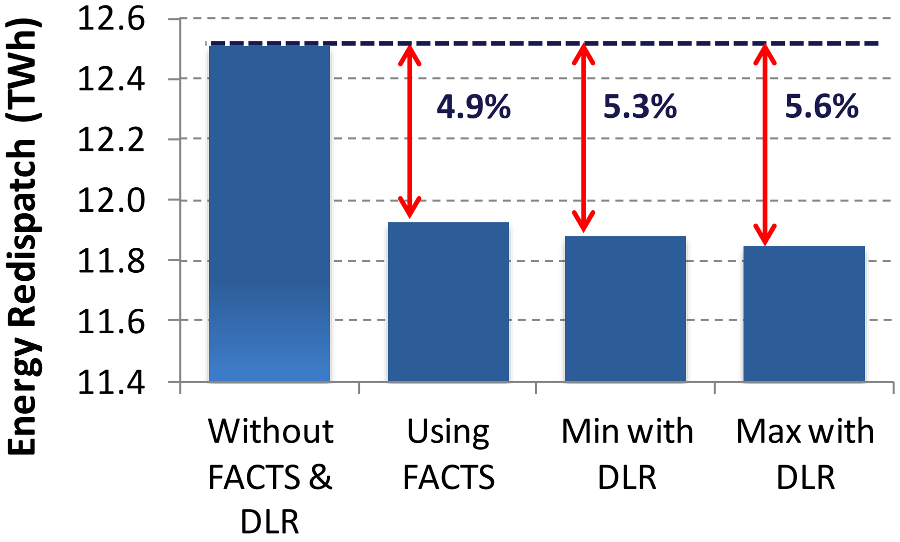
Examples


EAST AREA


SOUTH AREA

TF 3 - Economic impact of FACTS and DLR in Spain Demo #6 – GRIDFLEX (REE)

Annual Generation Redispatch in Spain (TWh)



Net Benefit (M€ / year)	
FACTS	32
DLR (Average ΔCapacity = **10%**)	39

Main source of regulatory barriers for each TF

- TF 1: **market arrangements**
  - Do not favor the participation of RES and (at least small) consumers in electricity markets
- TF 2: **network and market arrangements**
  - National frameworks for transmission planning, financing & operation
  - Offshore generation: support schemes, priority access, curtailment, etc.
  - Market designs: CACM, balancing
- TF 3: **network arrangements**
  - National frameworks for infrastructure planning, financing & operation

Recommendations & some initiatives

TF 1

- Day-ahead markets for minimum services
- Flexible market adapted to RES & loads

Twenties
REserviceS

TF 2

- Common framework for offshore generation
- Role of offshore generation
- Harmonize market designs
- Framework for balancing sharing

EU Target Model
ENTSOE NC
NSCOGI Initiative

TF 2 & TF 3

- Definition of roles & responsibilities
- Coordination for planning infrastructure
- Harmonization of network codes for grid operation
- Development of joint support mechanisms for grid financing

ENTSOE NC
NSCOGI Initiative