

Market and Network studies provisional results: Comparison between Vision 1 “slow progress” and Vision 4 “green revolution” and Project assessment results

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Overview of the presentation

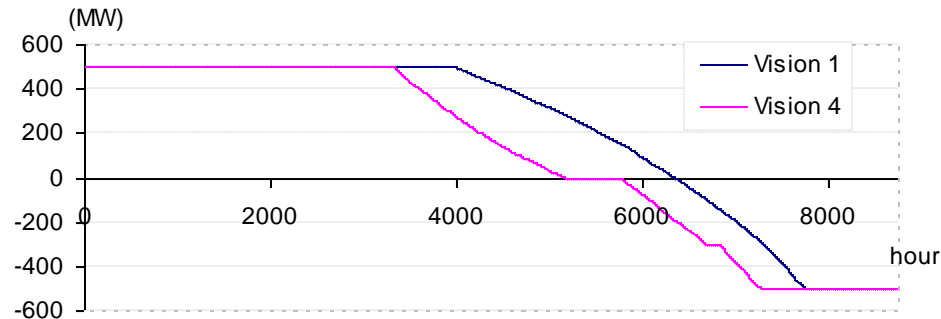
- Assumptions regarding power flows at the boundaries of the Region, generation and demand
- Market studies results in terms of annual energy balances, generation mix and main energy flows
- Bulk power flows and key drivers for the development of the Regional network
- Overview of CBA indicators and assessment of specific projects
- Main messages

Comparison of Vision 1 and Vision 4 general characteristics

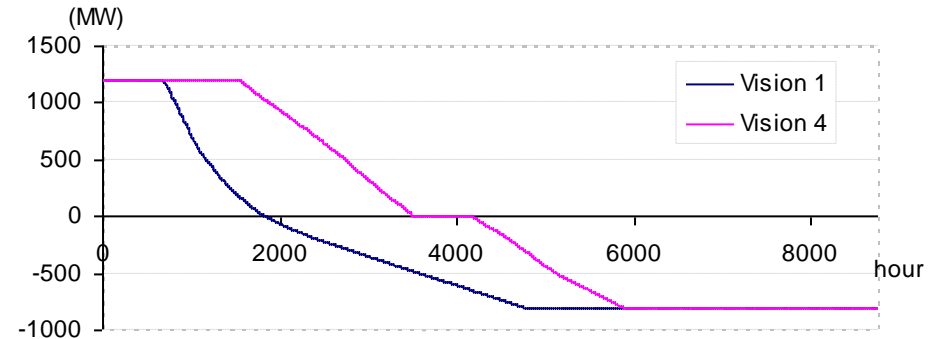
	Vision 1: Slow progress	Vision 4: Green revolution
Economic and financial conditions	Less favorable	Favorable
Focus on energy policies	National	European
CO2 prices and primary energy prices	Low CO2 price and high primary energy prices	High CO2 prices and low primary energy prices
Electricity demand	Lowest level	Higher level
Nuclear	National view	Public acceptance

Assumptions of the power flows at the boundaries of the Region in the two visions (1/2)

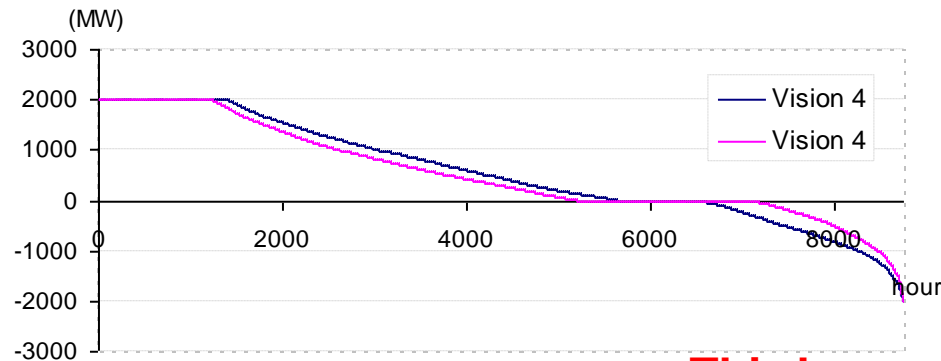
Net Imports from IT-GR



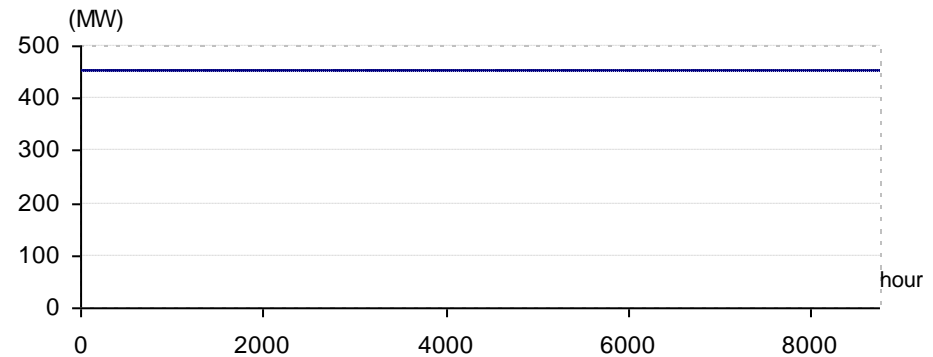
Net Imports from AT-HU



Net Imports from SK-HU



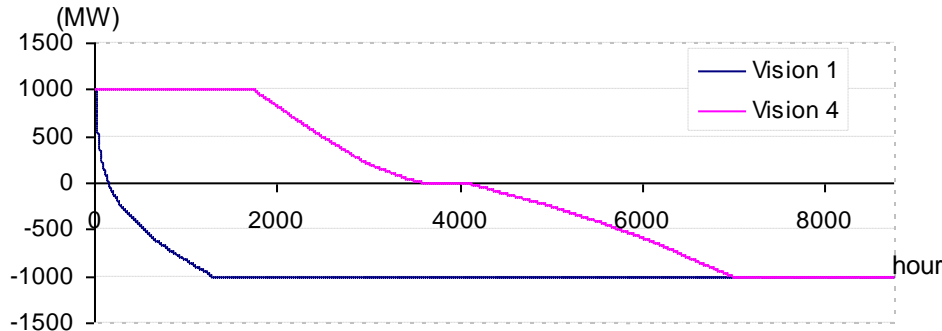
Net Imports from UA-HU



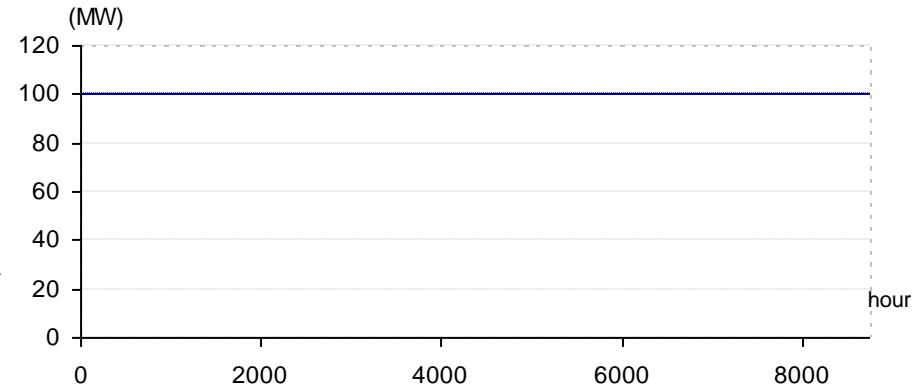
Third countries are represented as a constant power flow at the respective borders

Assumptions of the power flows at the boundaries of the Region in the two visions (2/2)

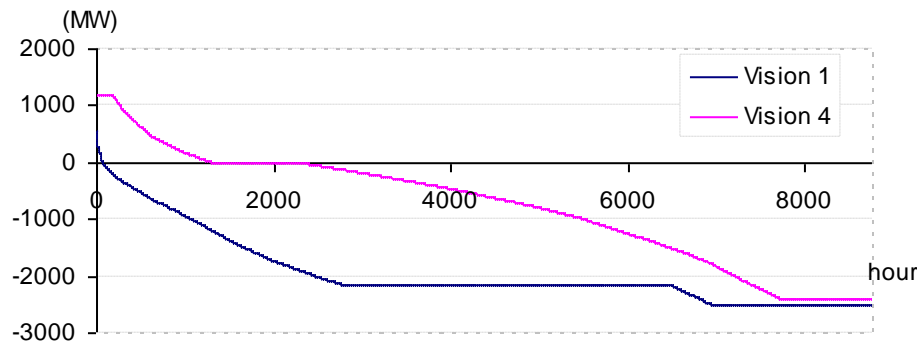
Net Imports from IT-ME



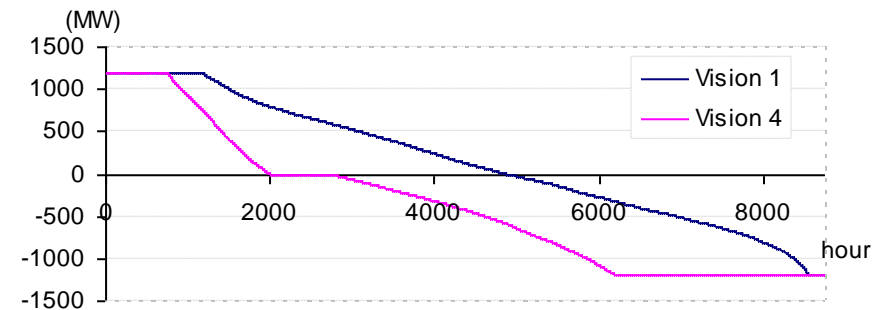
Net Imports from UA-RO



Net Imports from IT-SI



Net Imports from AT-SI



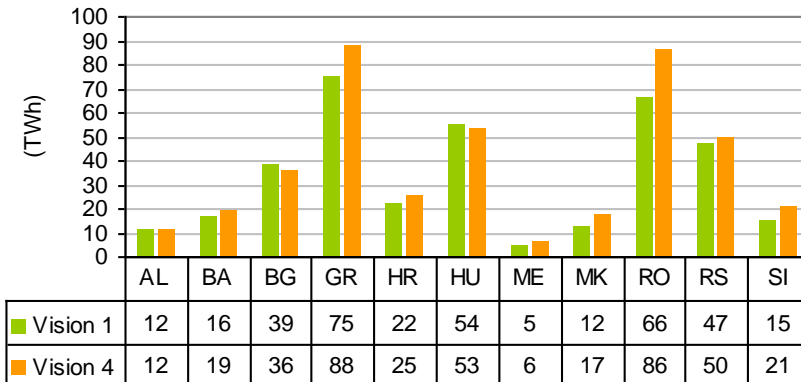
• In Vision 1 the area exports all the time to Italy

• In Vision 4 power flows in both directions

Continental South East RG: Load forecast in the two visions

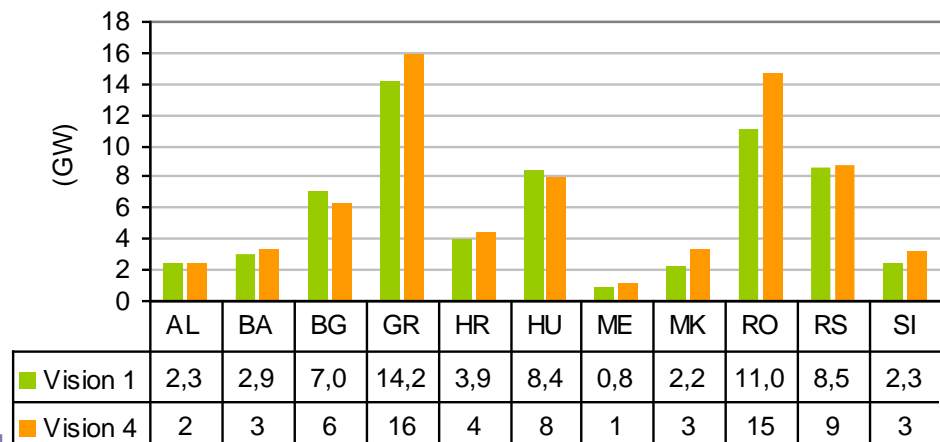
Annual Demand

(CSE total: Vision 1 = 363,5 TWh, Vision 4 = 411,9 TWh)



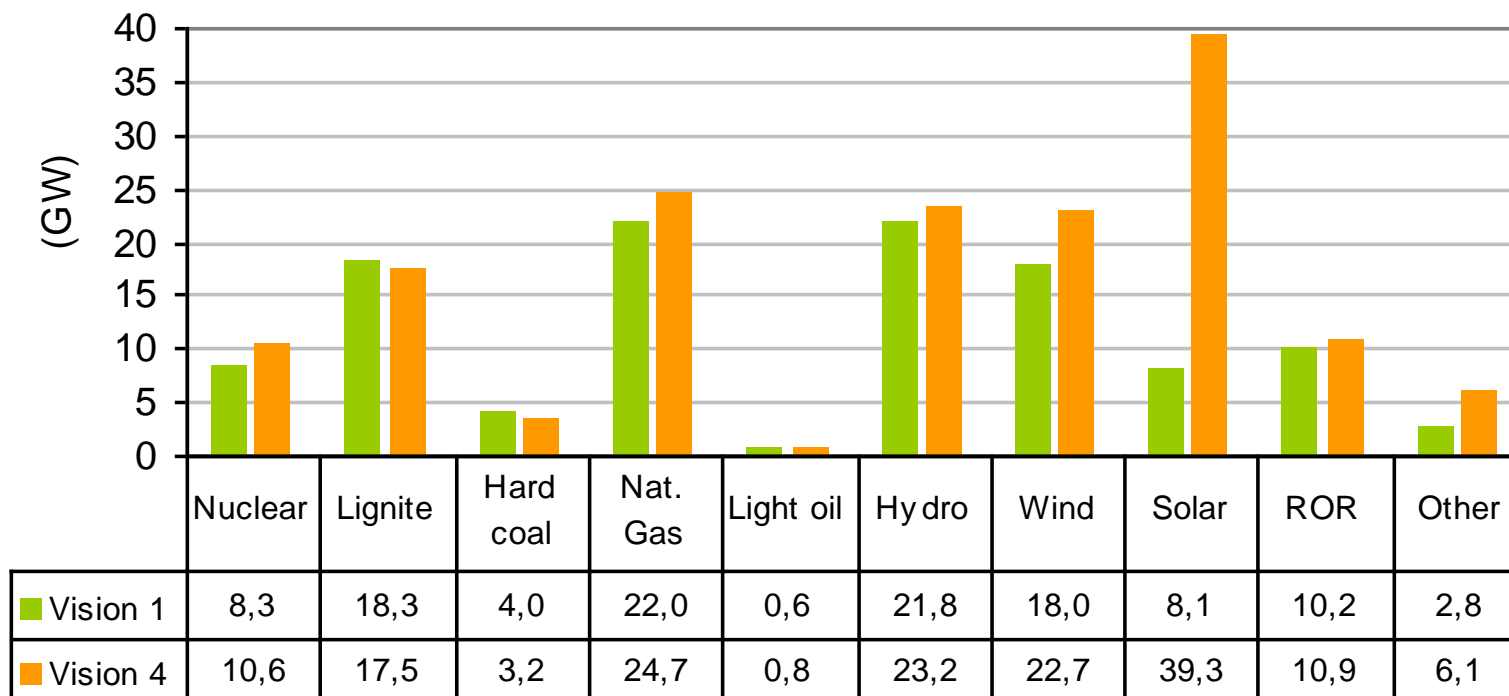
Annual Peak Load

(CSE total: Vision 1 = 58,8 GW, Vision 4 = 65,1 GW)

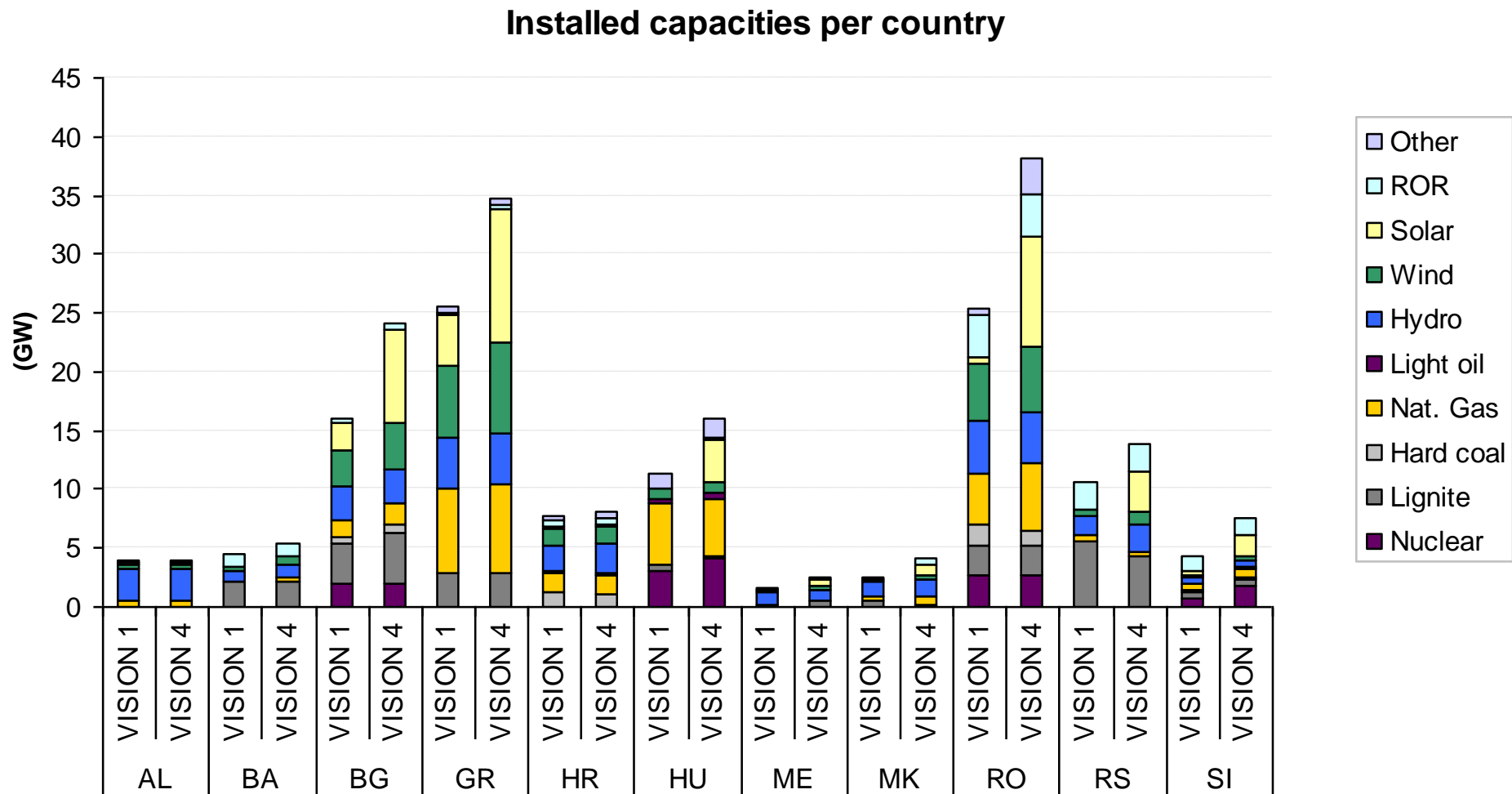


Continental South East RG: Aggregated installed capacities in the two visions

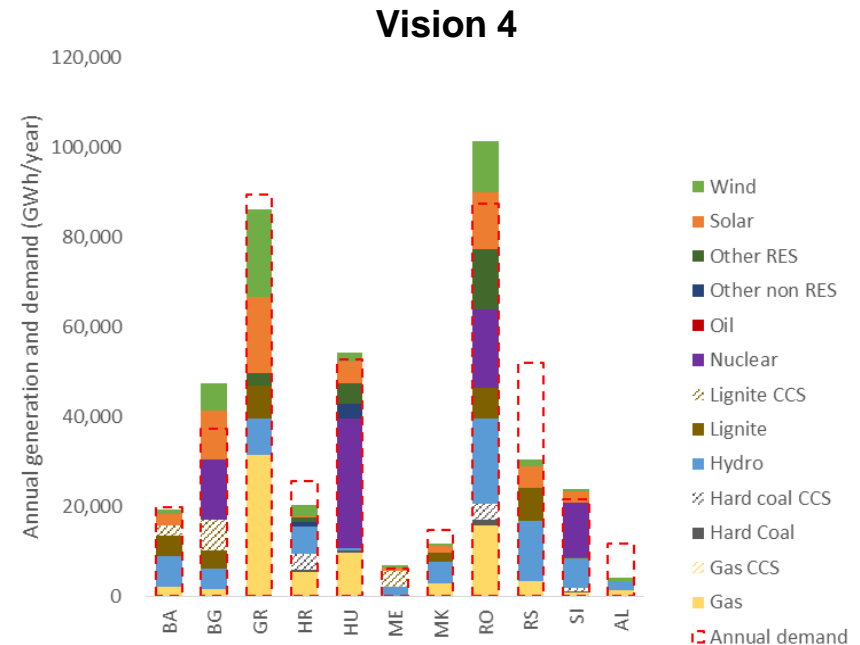
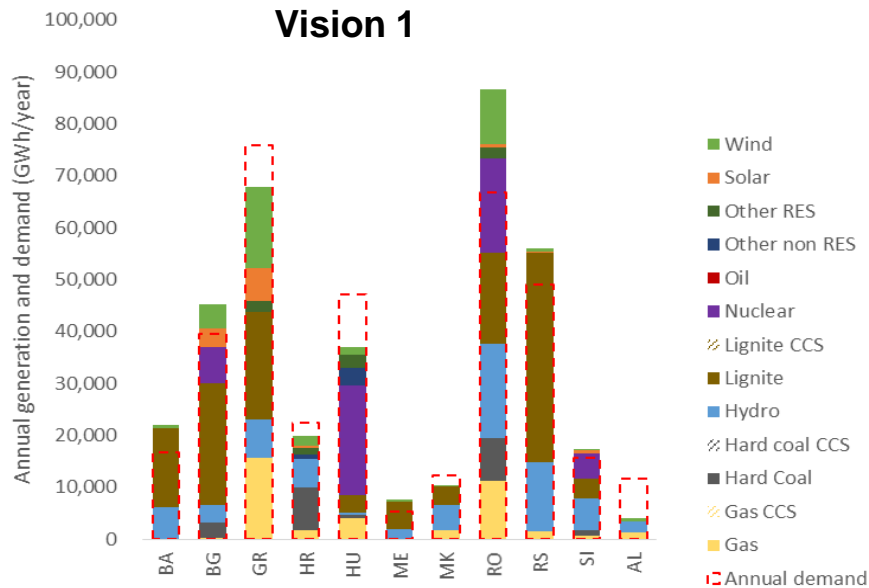
Aggregated installed capacities in CSE (RG CSE total: Vision 1: 114 GW, Vision 4: 159 GW)



Continental South East RG: Installed capacities per country



Annual market studies results – Generation mix



Higher CO2 price in V4 results in a shift from lignite to nat. gas units



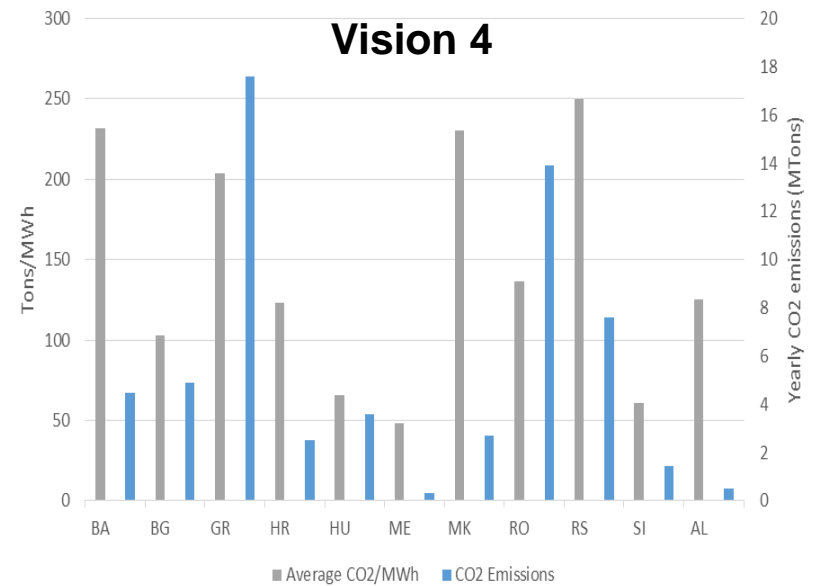
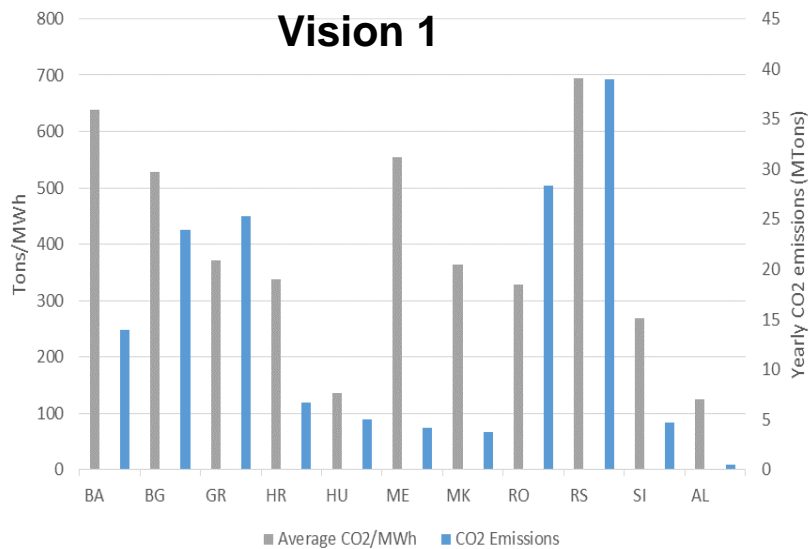
Vision 1

- **A clear pattern of N->S and E->W power flows**
- **The Region imports from the North borders and exports towards Italy**

Vision 4

- **The trend of N->S and E-W energy flows exists in this Vision also**
- **In specific borders like IT-ME , HR-BA and south RS borders, market exchanges in both directions appear.**

Annual Market Results – CO2 emissions



Examined scenarios at a glance



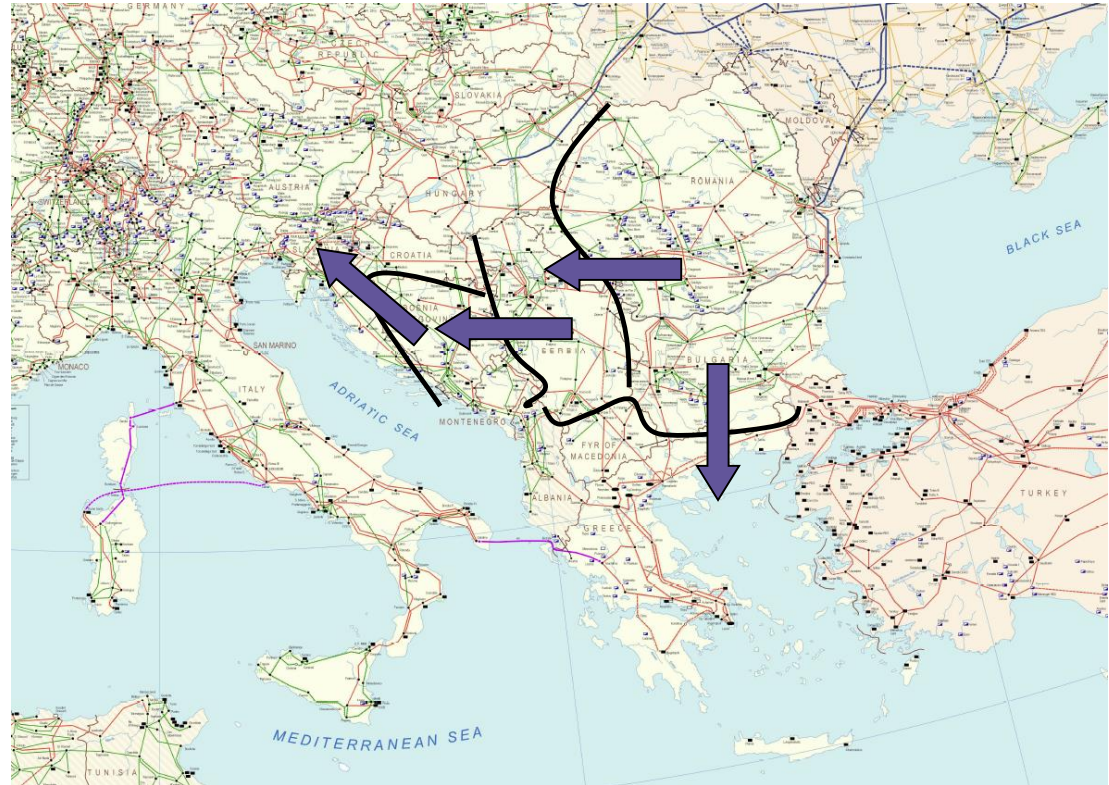
	Vision 1: Slow progress	Vision 4: Green revolution
	TWh	
Demand (excluding pumping)	363.5	412
Exports	12.4	4.5
Wind	37	42
Solar	12	44
Lignite	109	55
Natural Gas	61	93



Bulk power flows and key drivers for grid development in SE Europe

Investigation for transmission reinforcement needs

- Having discussed about annual energy flows in the 2 visions, a next step in regional studies is to investigate if the reference network is adequate to cope with expected bulk power flows.
- Based on market studies results and TSOs expertise, network boundaries where an increase in transfer capacity is needed are defined.
- Assessment of bulk power flows is done using yearly DC load flow calculations coupled with the market studies.



Bulk power flows in Vision 1



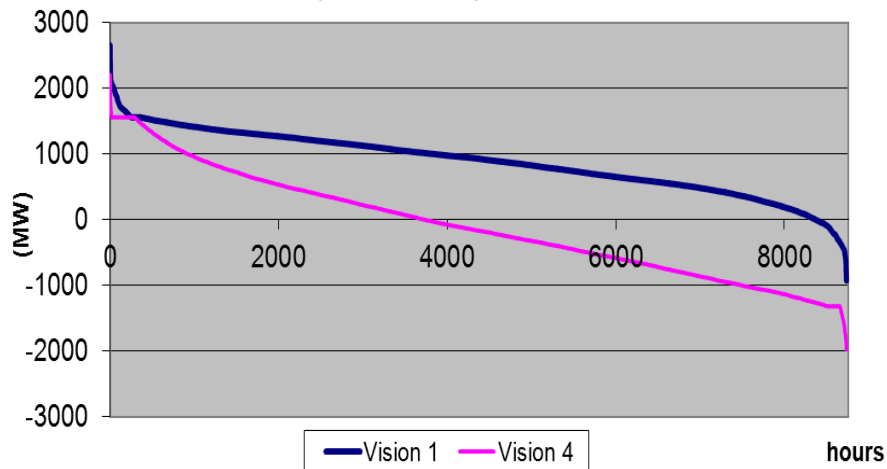
Bulk power flows in Vision 4



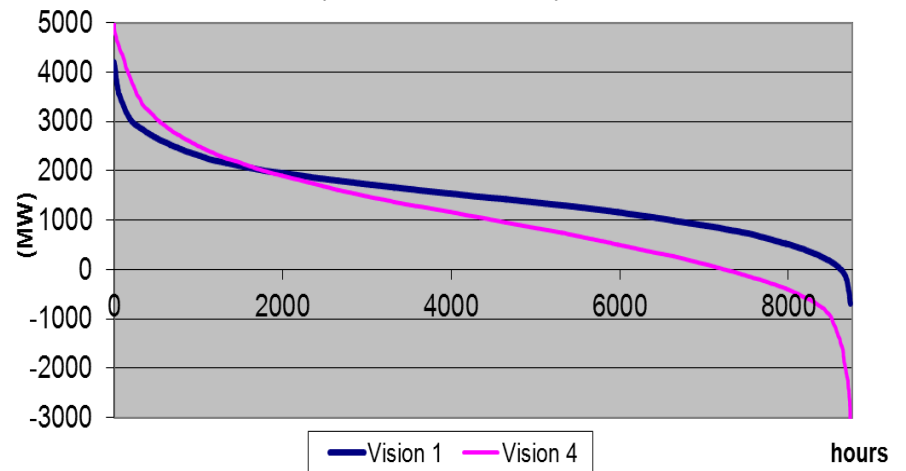
Power flow duration curves in the selected boundaries



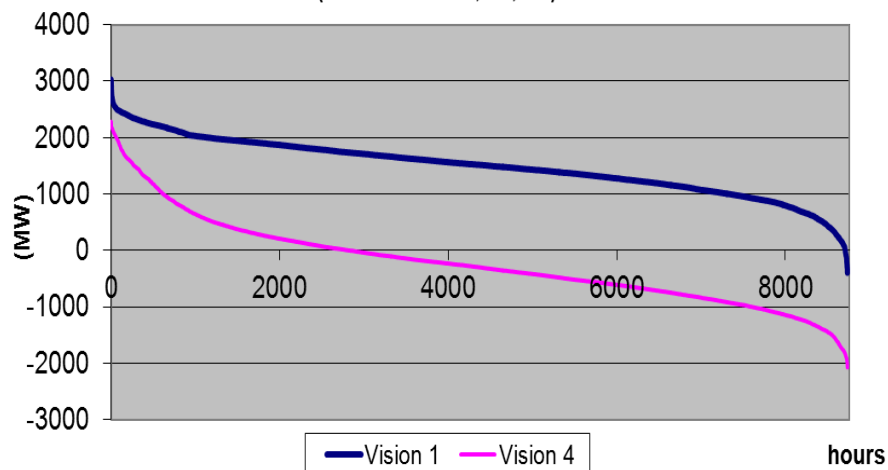
(From BA to HR)



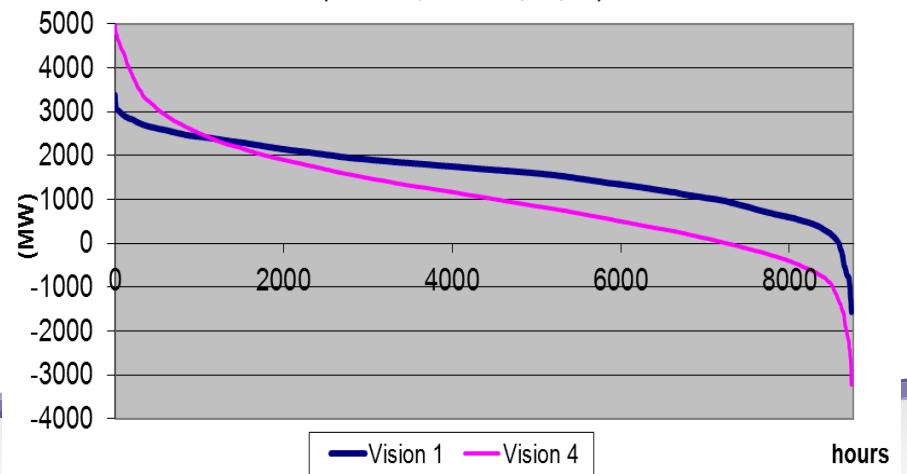
(From RO,BG to HU,RS)



(From RS to HR,BA,ME)



(From RS,BG to AL,MK,GR)



Key drivers for grid development in CSE Europe



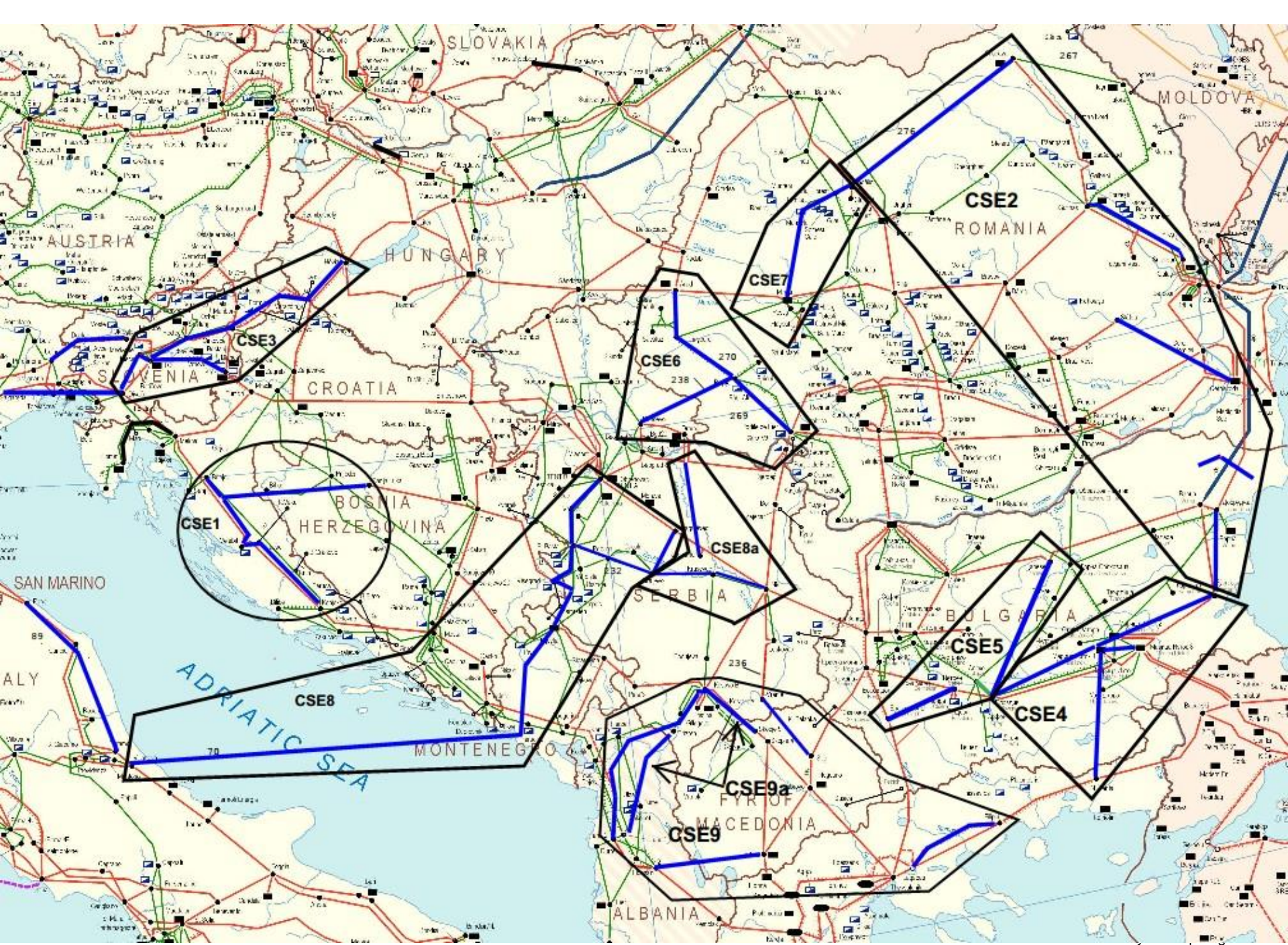
- **Relatively sparse network**
- **Main drivers for network reinforcements:**
 - To increase the transfer capacities in the predominant power flow directions (E->W especially to accommodate exports to Italy and N->S)
 - To cope with the development of RES power plants



Overview of CBA indicators and assessment of specific projects

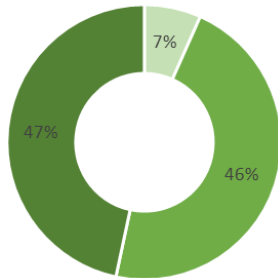
Clustering of investments into projects and assessment according to CBA methodology

- One of the major scopes of regional market and network studies is to assess on a regional basis transmission investments proposed by TSOs and 3rd parties as well
- Clustering of investments into projects is based on the principle that each considered investment contributes in order to achieve a desired effect which is the increase of Grid Transfer Capacity across a predefined boundary
- Each project fulfills the criteria of “Pan-European” interest
- For the assessment of each project the so call “Take Out One at the Time” (TOOT) approach is used.
- The results presented here should be considered preliminary. Final results will be available when the TYNDP 2014 will be published



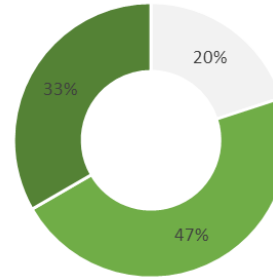
Overview of the CBA indicators for the CSE Region in the two visions (1/2)

SEW increase

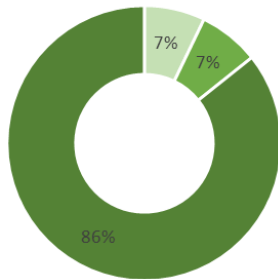


Vision 1

CO2 emissions reduction

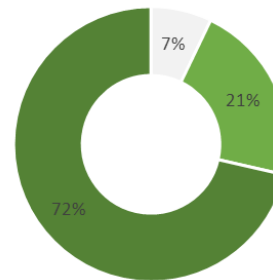


SEW increase



Vision 4

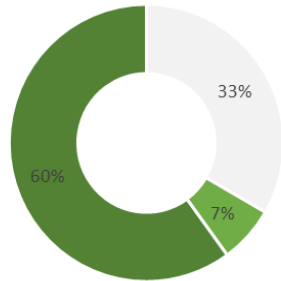
CO2 emissions reduction



More RES and a higher CO2 price in V4 result in higher price differences and therefore in higher SEW values and larger CO2 emissions reduction

Overview of the CBA indicators for the CSE Region in the two visions (2/2)

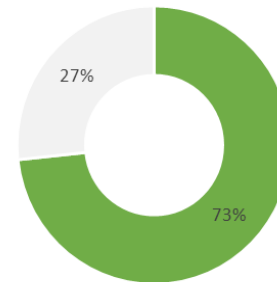
RES integration



- Neutral effect (<100 MW or <50 GWh)
- 100 - 500 MW or 50 - 300 GWh
- >500 MW or > 300 GWh

Vision 1

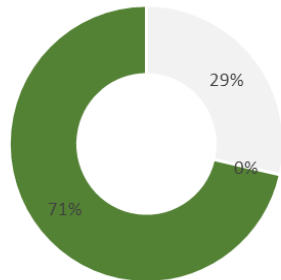
Losses variation



- Decrease losses
- Increase losses

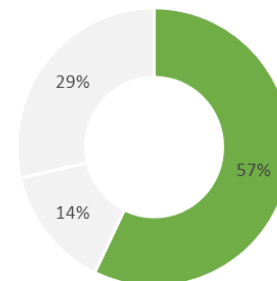
Vision 4

RES integration



- Neutral effect (<100 MW or <50 GWh)
- 100 - 500 MW or 50 - 300 GWh
- >500 MW or > 300 GWh

Losses variation



- Decrease losses
- Neutral
- Increase losses

Projects in both visions assist in RES integration and 70% of them hasn't a negative impact on network losses

Mid Continental East Corridor



Mid Continental East corridor

Short description

Enhancement of GTC along the N-S/ E-W corridors in SE and Central Europe; direct access of >1000 MW wind generation which will be directly connected to the transmission grid in Banat area (Serbia & Romania); access of the region to the expected 1000 MW hydro pumped storage plant in NW Romania.

Investments included in the project

New_400 kV OHL RO-RS (Pancevo-Resita 400 kV) Western Corridor Romania

GTC Increase

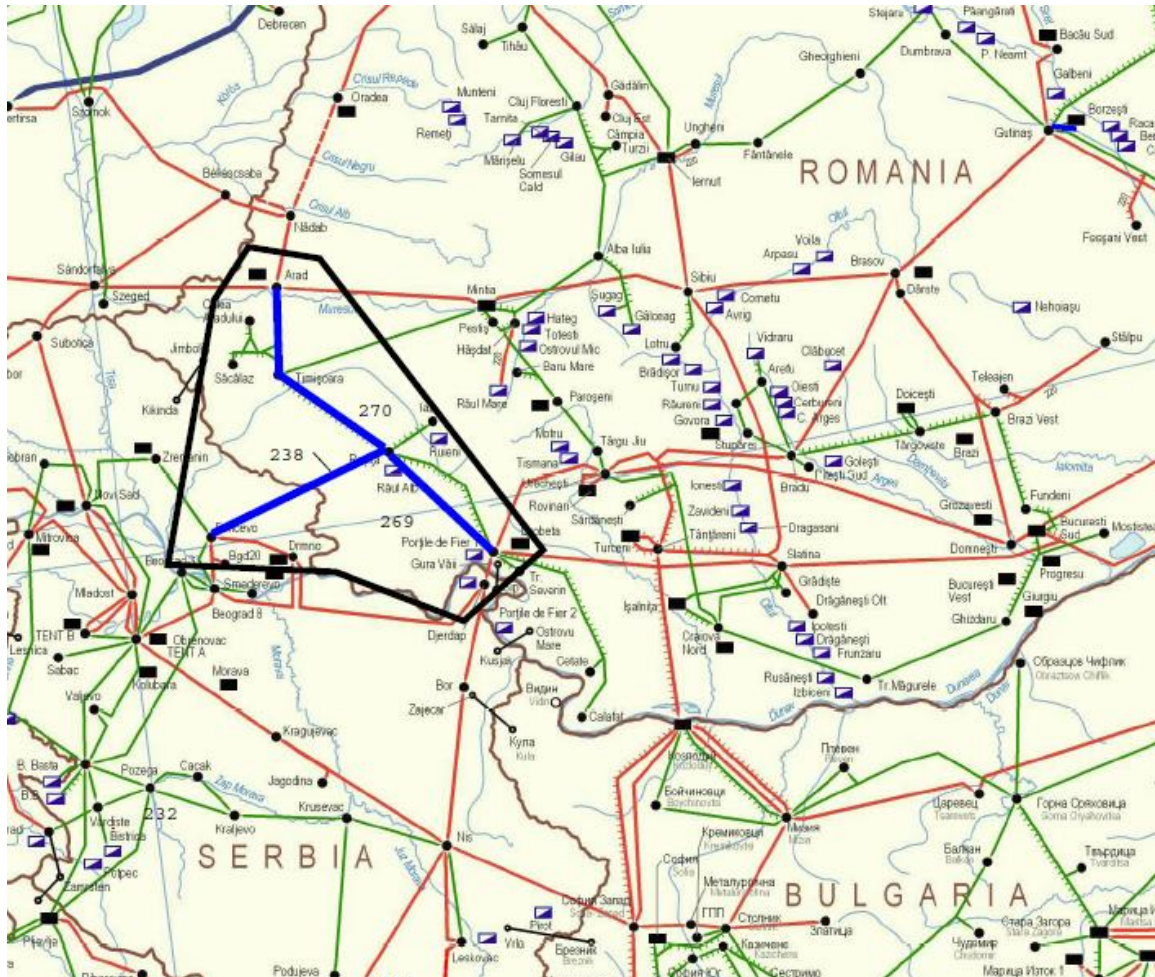
500-700 MW (both directions)

B1: Security-Of-Supply

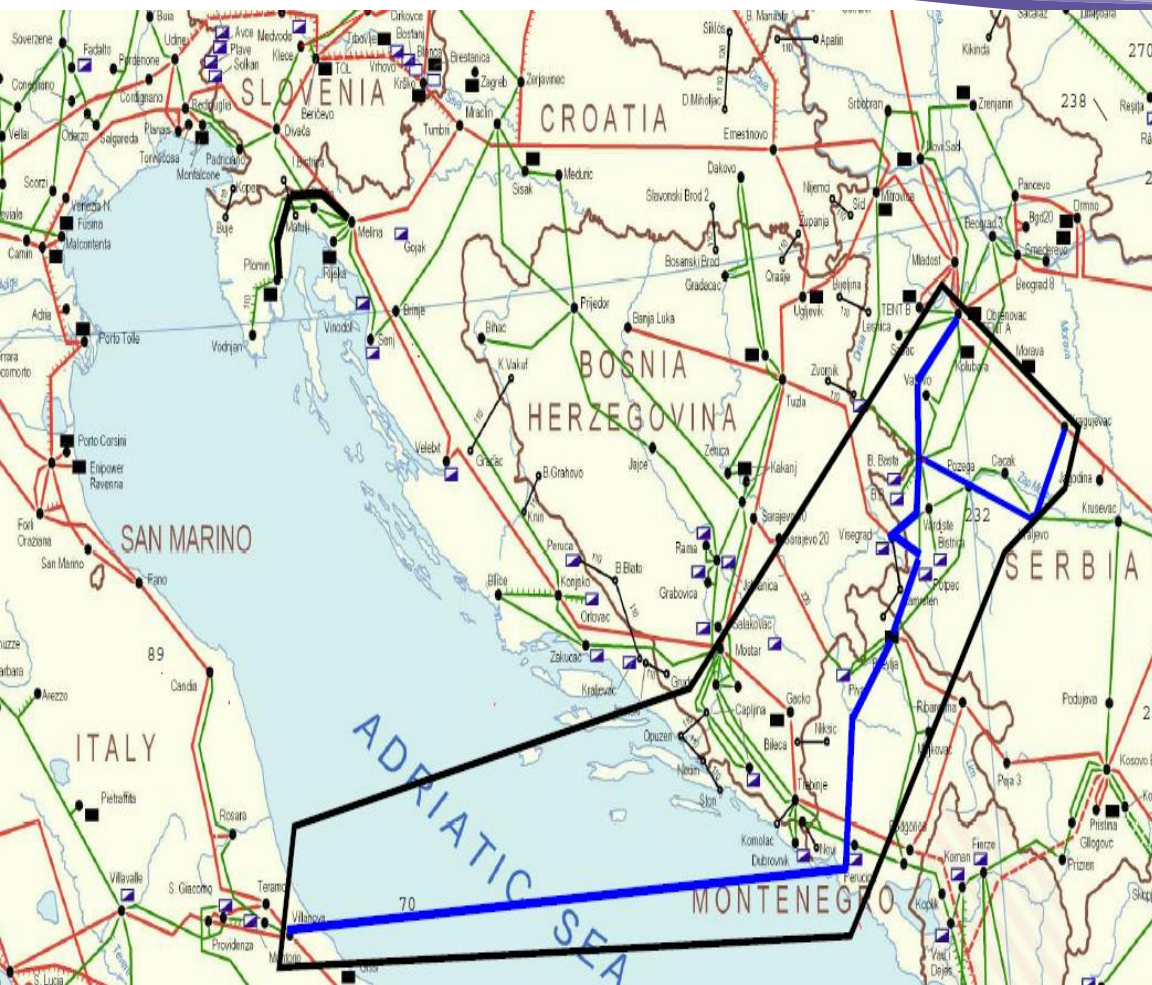
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B3: RES Integration

1750 MW (of which 750MW requested direct connection in the new lines)



Transbalkan Corridor



TransBalkan corridor

Short description

The project contains investments in the south-east Europe region planned with the purpose of supporting increase of power transfers from north-west towards south-east part of this area and enabling further market integration.

Investments included in the project

New_400 kV lines in RS and ME
New 400kV RS-BA and RS-ME interconnections
dc ME-IT interconnection

GTC Increase

500-800 MW (both directions)

B1: Security-Of-Supply

0

B3: RES Integration

~2TWh

Adriatic sea corridor



Adriatic Sea Corridor

Short description

The project will support market and RES integration in the area – South and Mid Croatia and North and Mid Bosnia and Herzegovina. The increased transfer capacity will enable higher diversity of supply & generation sources and routes, increasing resilience and flexibility of the transmission network.

Investments included in the project

New 400kV lines and substations in Croatia
New 400kV BA-HR interconnection

GTC Increase

600MW (both directions)

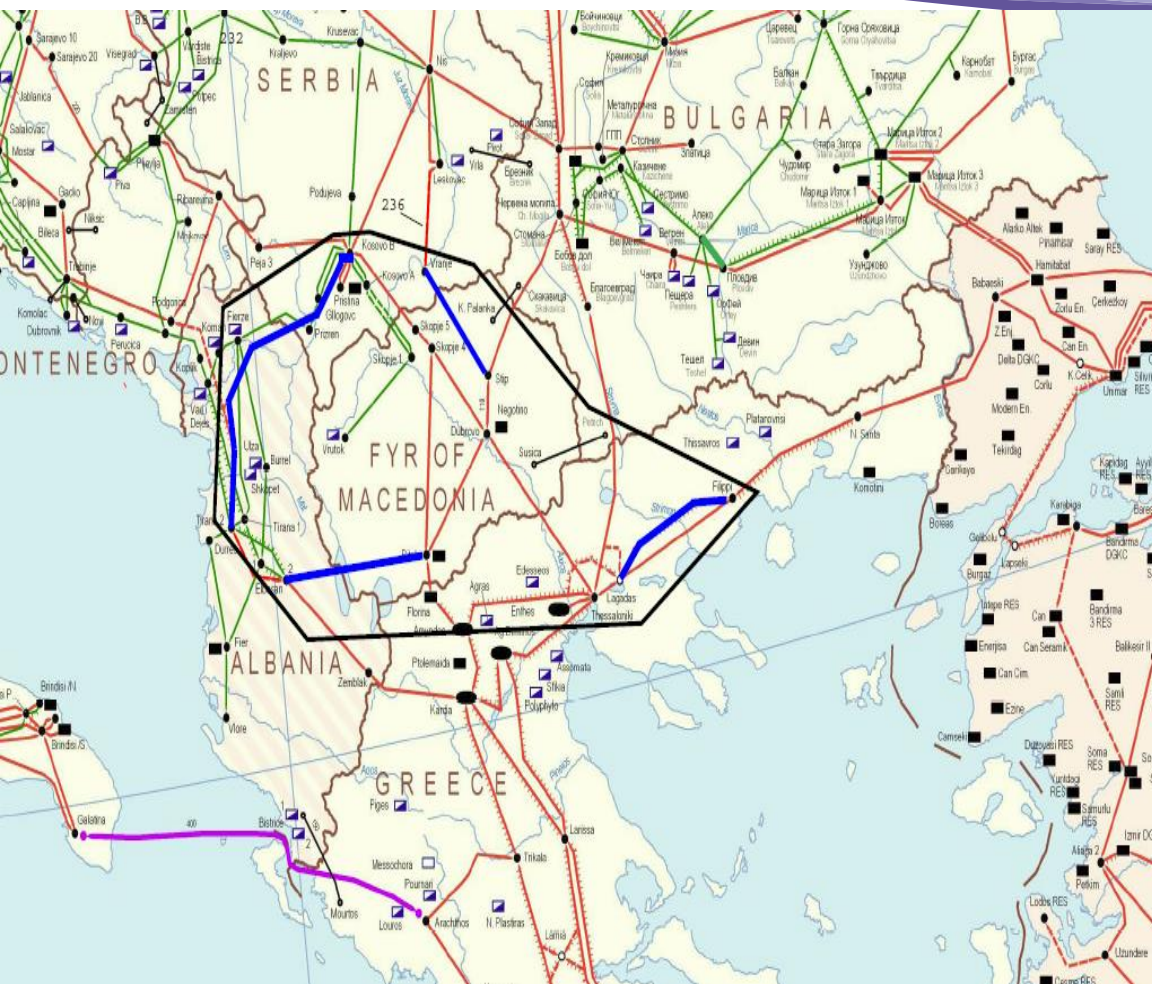
B1: Security-Of-Supply

0

B3: RES Integration

800-900 MW

South Balkan Corridor



South Balkan Corridor

Short description

The project aims to increase the transfer capacity in the predominant North-South direction that is from Romania, Serbia and Bulgaria towards Greece, FYR of Macedonia and Albania. In addition, a part of this project will increase the security of supply in the South West part of the FYR of Macedonia.

Investments included in the project

New 400kV RS-MK interconnection
New 400kV RS-AL interconnection
New 400kV AL-MK interconnection
New 400kV line in GR

GTC Increase

~1000MW in the N-S direction

B1: Security-Of-Supply

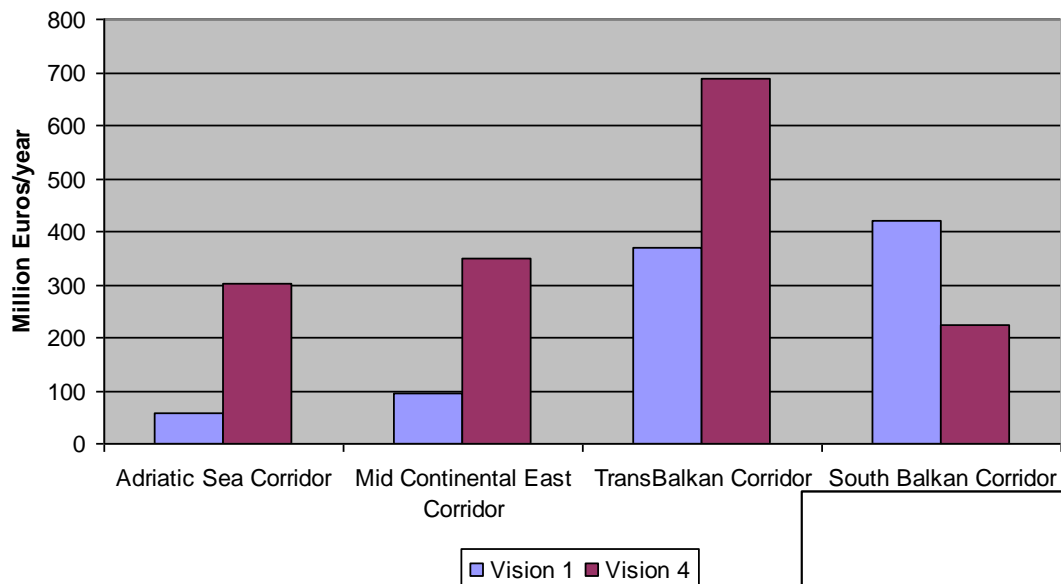
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B3: RES Integration

657GWh

Market Based Indicators

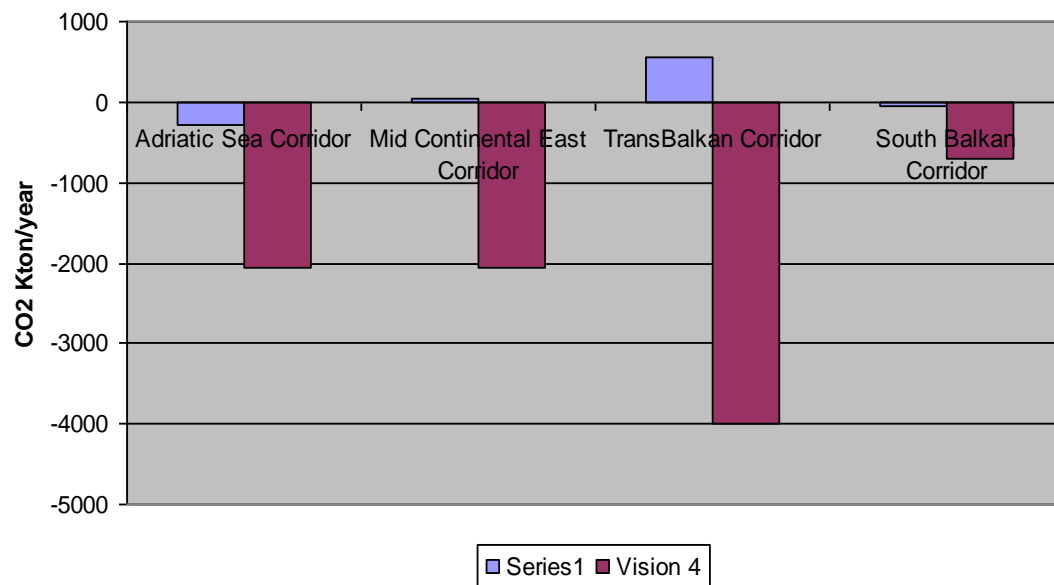
Socio Economic Welfare



- In most of the cases SeW is higher in Vision 4
- For the project TransBalkan Corridor, the SeW of the Italian power system is also taken into account

- Higher CO2 prices resulted in higher CO2 emissions reduction for all projects in Vision 4

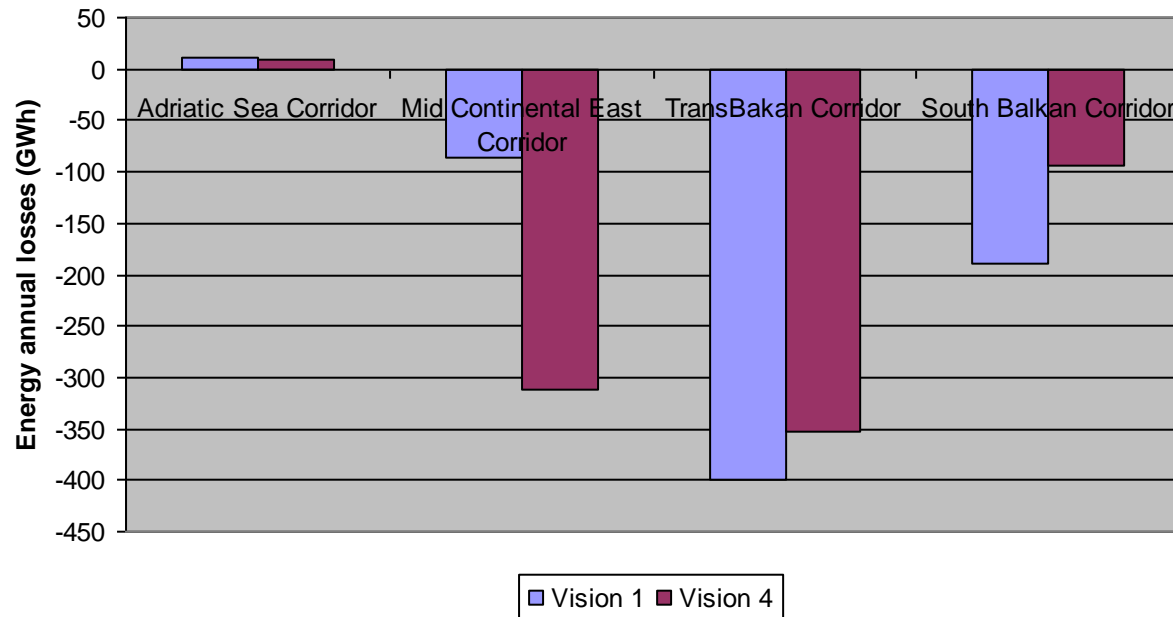
Variation in CO2 emissions



Variation in Losses (energy efficiency)



Variation in Losses



- Most of the projects contribute to a reduction of losses in the Regional network
- Adriatic Sea Corridor should be considered to have a rather neutral impact

Conclusions (1/2)

- Market studies results concerning two scenarios/visions for the CSE Region in 2030 have been presented. Vision 1 is a bottom-up scenario based on Regional TSOs estimation. Vision 4 is a top-down scenario established at a centralized European level.
- Vision 4 is differentiated from Vision 1, since the hypothesis of this scenario include a higher PV penetration, an increase of demand and a higher CO2 price resulting in a change of the generation merit order.
- In both scenarios the Region is exporting. Exported energy over the year is less in Vision 4 compared to Vision 1. This must be attributed to the different assumptions in the two scenarios.
- In Vision 1, prevailing power flow directions are N-S and E-W similarly to what we know today. In Vision 4 this pattern does not appear in some cases.
- Yearly market studies coupled with DC load flows are used in order to assess bulk power flows and examine transmission adequacy of the Regional network. In this respect power flows in 4 characteristic boundaries have been presented.

Conclusions (2/2)

- These boundaries are primarily motivated by market integration. In addition they are highly related to RES integration in the area, which is one of the most important drivers for network development in the examined horizon.
- The assessment results of the 4 projects aiming to increase transfer capacity in the mentioned boundaries have been presented. Market related benefits are higher in Vision 4 compared to Vision 1 due to the different adopted assumptions.
- In general projects studied in the CSE Region have a positive influence on the total losses of the transmission system.
- Concerning Security of Supply, the indicator has a zero value. In general Security of Supply is not at stake for our area and the proposed projects do not aim to resolve such issues. However in certain cases, at least part of the projects have a positive contribution in the Security of Supply.
- An important uncertainty exists regarding the market development in the CESA-TR borders. Sensitivity network studies are performed in order to examine deeper this issue.



Thank you very much for your attention !!