Kliment Naumoski

Preparation for Large Scale Wind Integration in SEE

Investment and Trade
in Renewable Energy in the Black Sea
3-4 April, 2012, Kyiv

content

- Study for Preparation for Large Scale Wind Integration in SEE Power System
- Methodology & results
- Possibilities for creation regional balancing mechanism (RBM) in SEE

scope of SECI TSP Project

SECI TSP

- Regional approach in grid planning
- Common database regularly updated
- Harmonize planning principles, methods and procedures
- Identify priority investments

SECI TSP members & organization

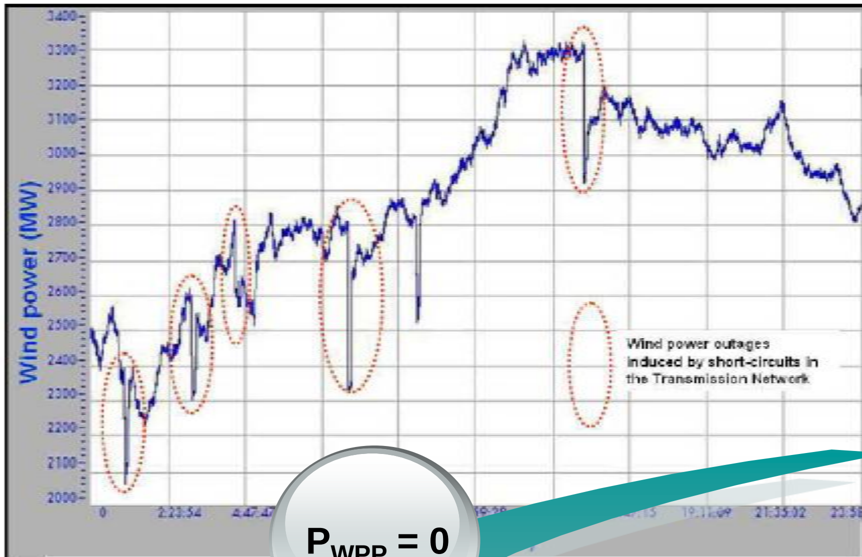
SEE
TSO-s

Finance & Support
- USAID
- USEA

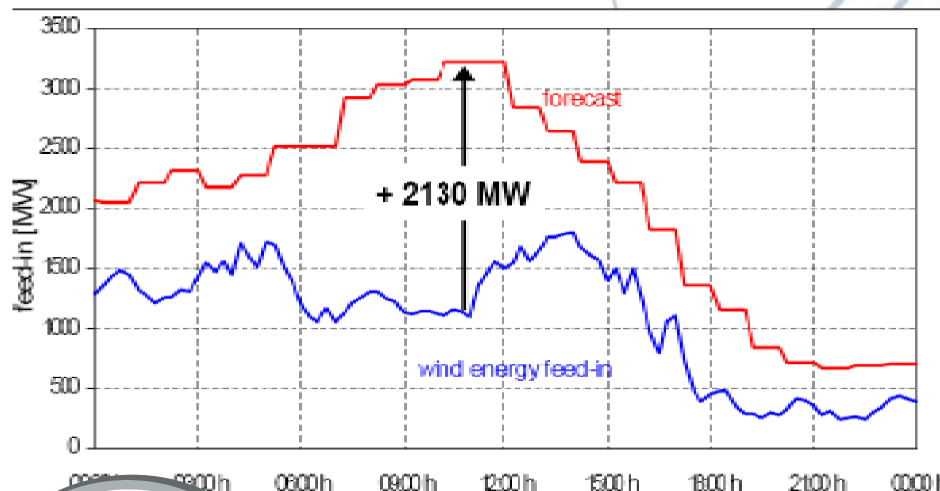
Analytics
- EKC - Belgrade
- EIHP - Zagreb

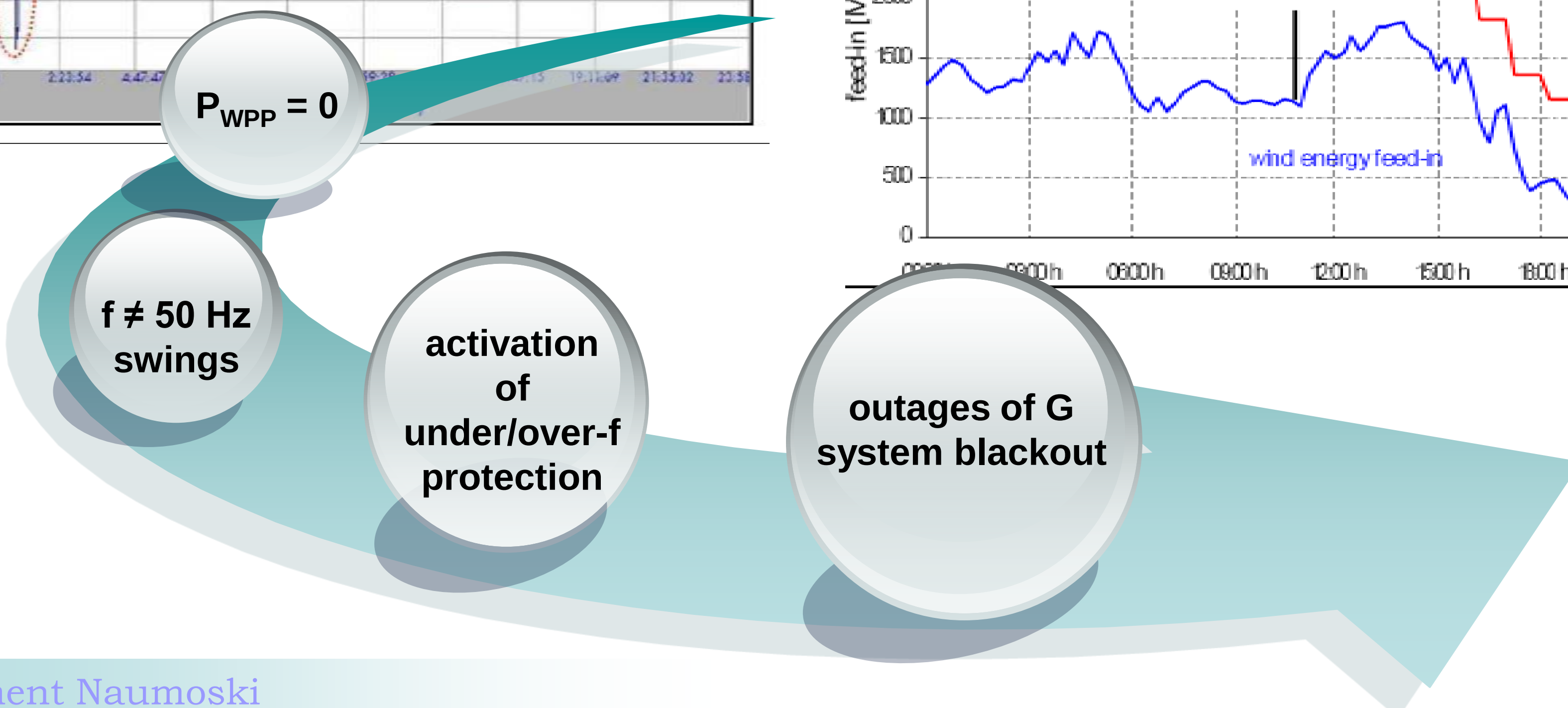
Coordination
- MEPSO

large scale WPP integration put more risk in grid operation

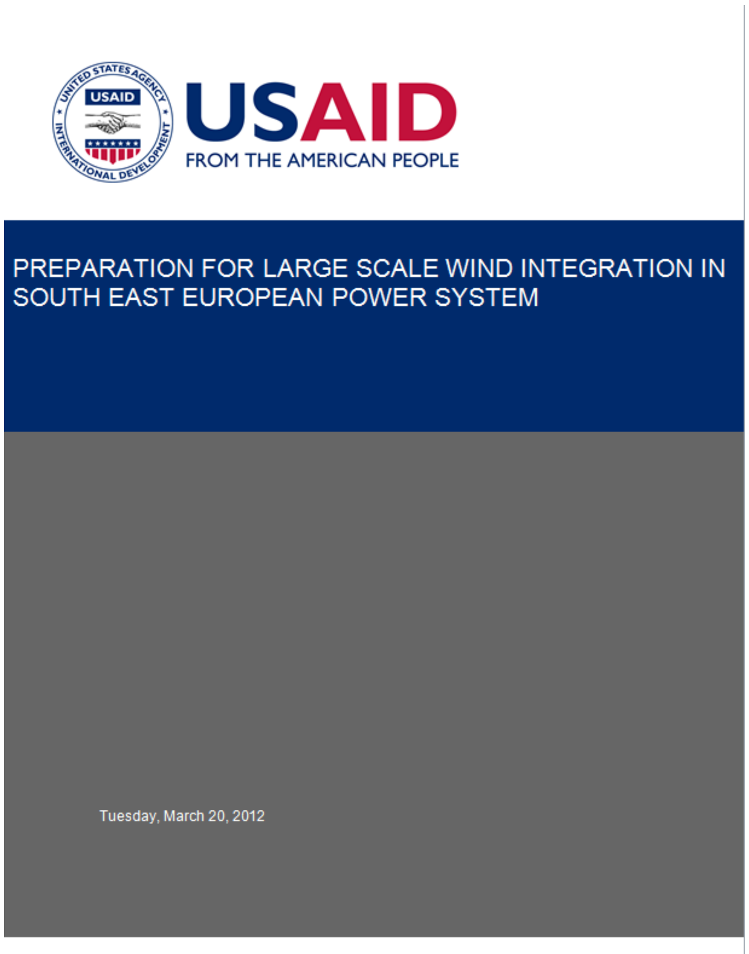


forecast errors / P variation
high wind speed
rapid wind gust changes
short circuits





preparation for large scale wind integration in SEE


USAID
FROM THE AMERICAN PEOPLE

PREPARATION FOR LARGE SCALE WIND INTEGRATION IN SOUTH EAST EUROPEAN POWER SYSTEM

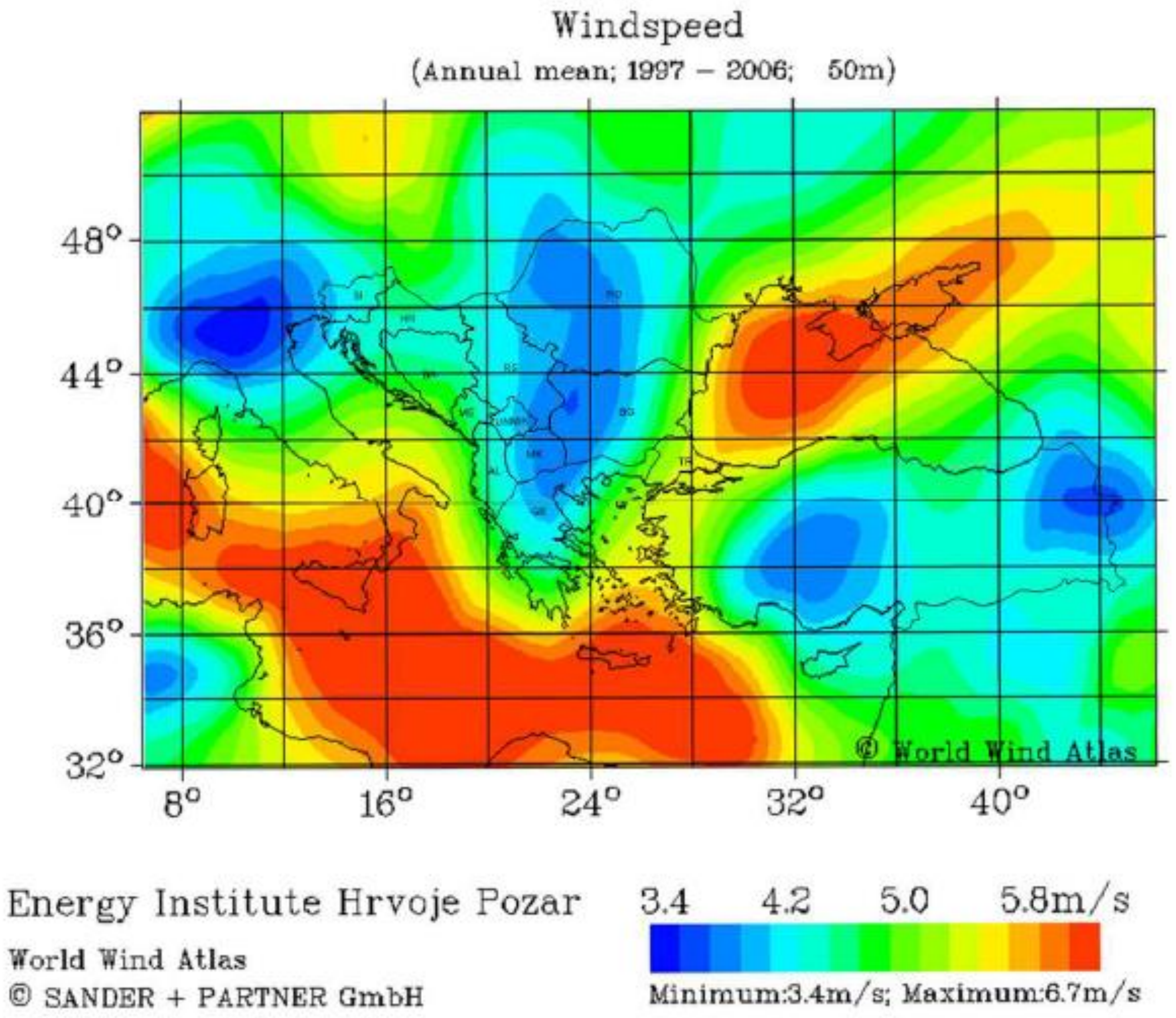
Tuesday, March 20, 2012

coordination:
USAID, USEA

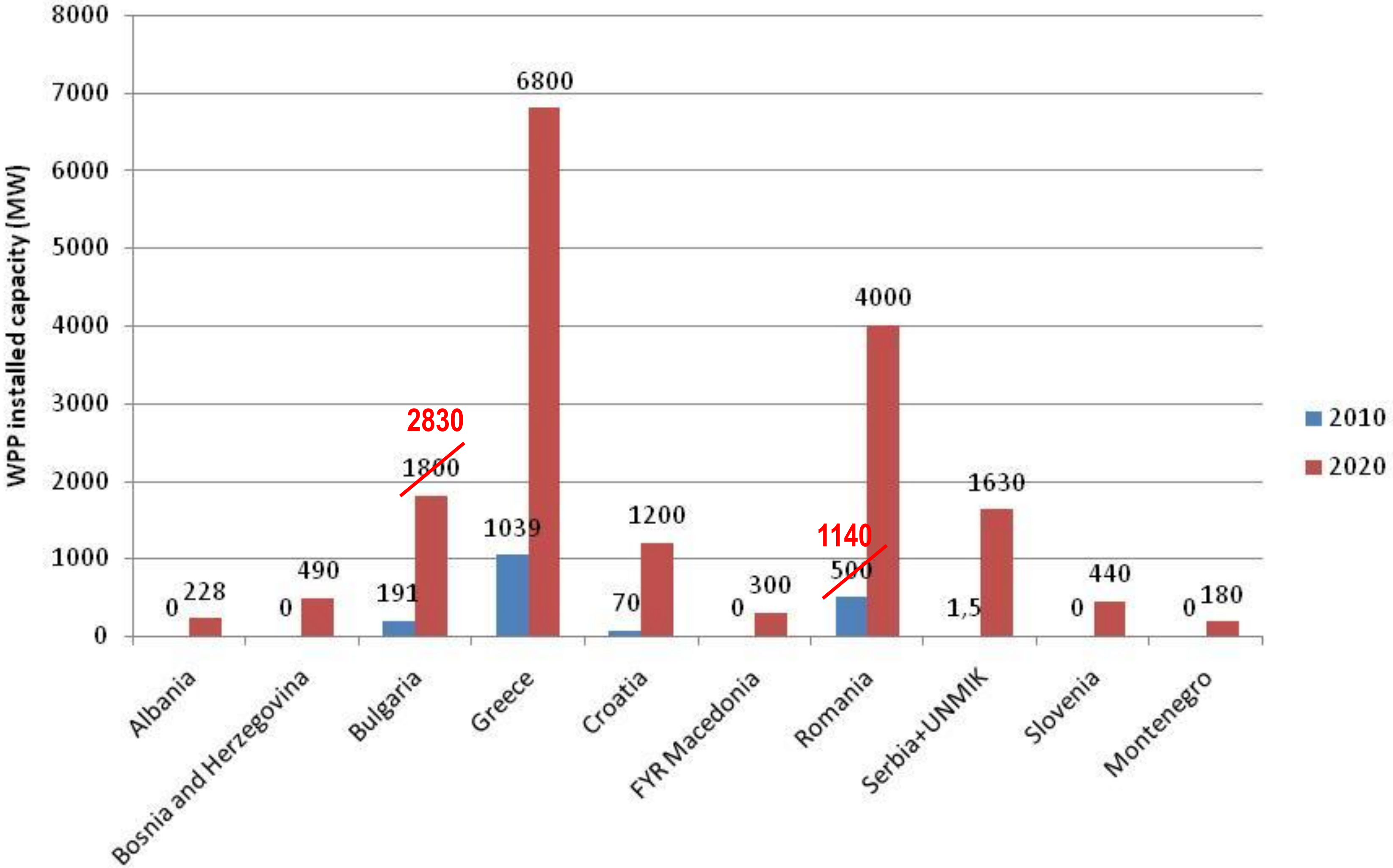
authors:
EIHP, Zagreb
EKC, Belgrade

topics:
- WPP identification
- WPP variations
- requirements harmonization
- regional load flows

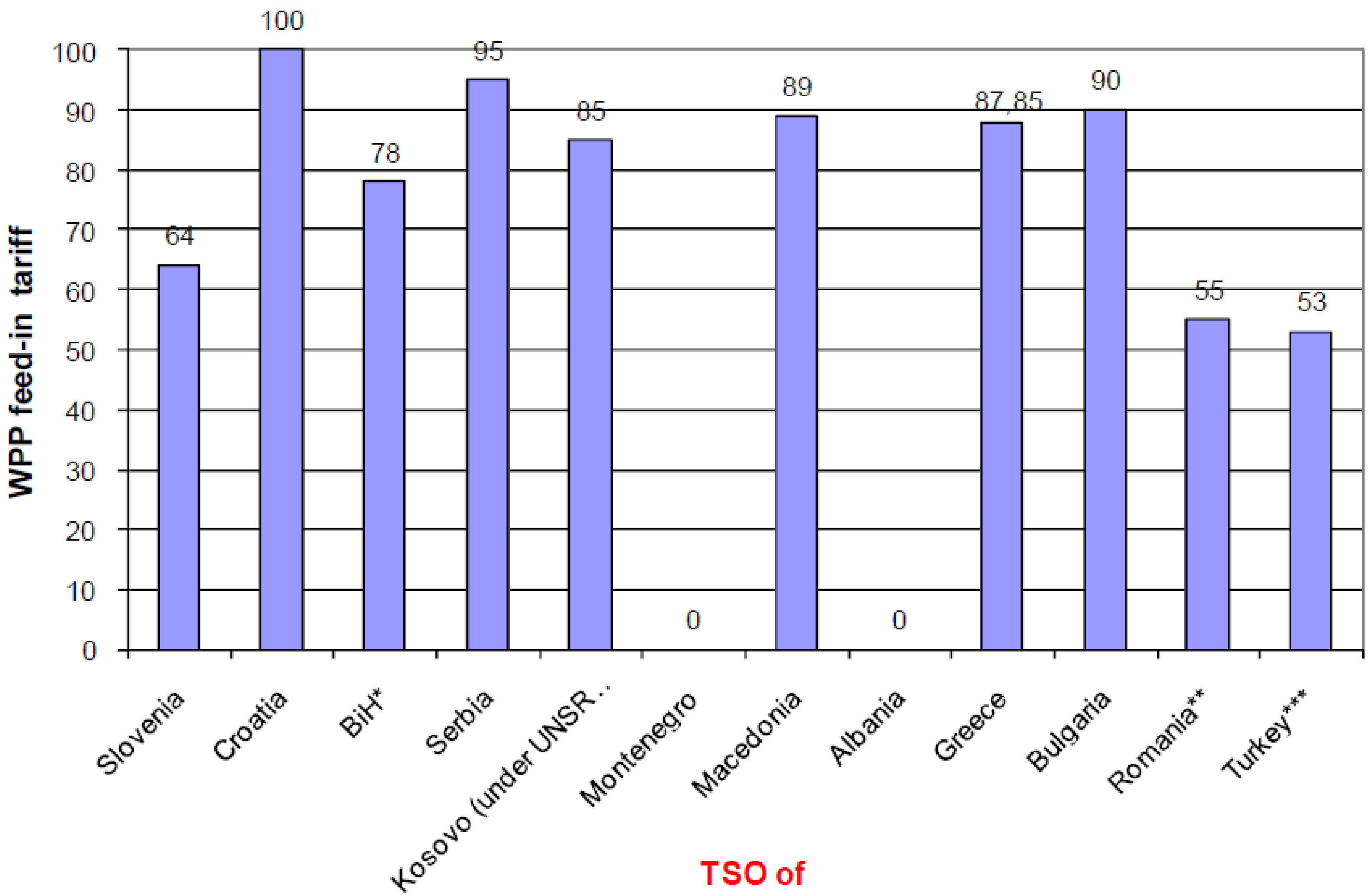
SEE wind potential



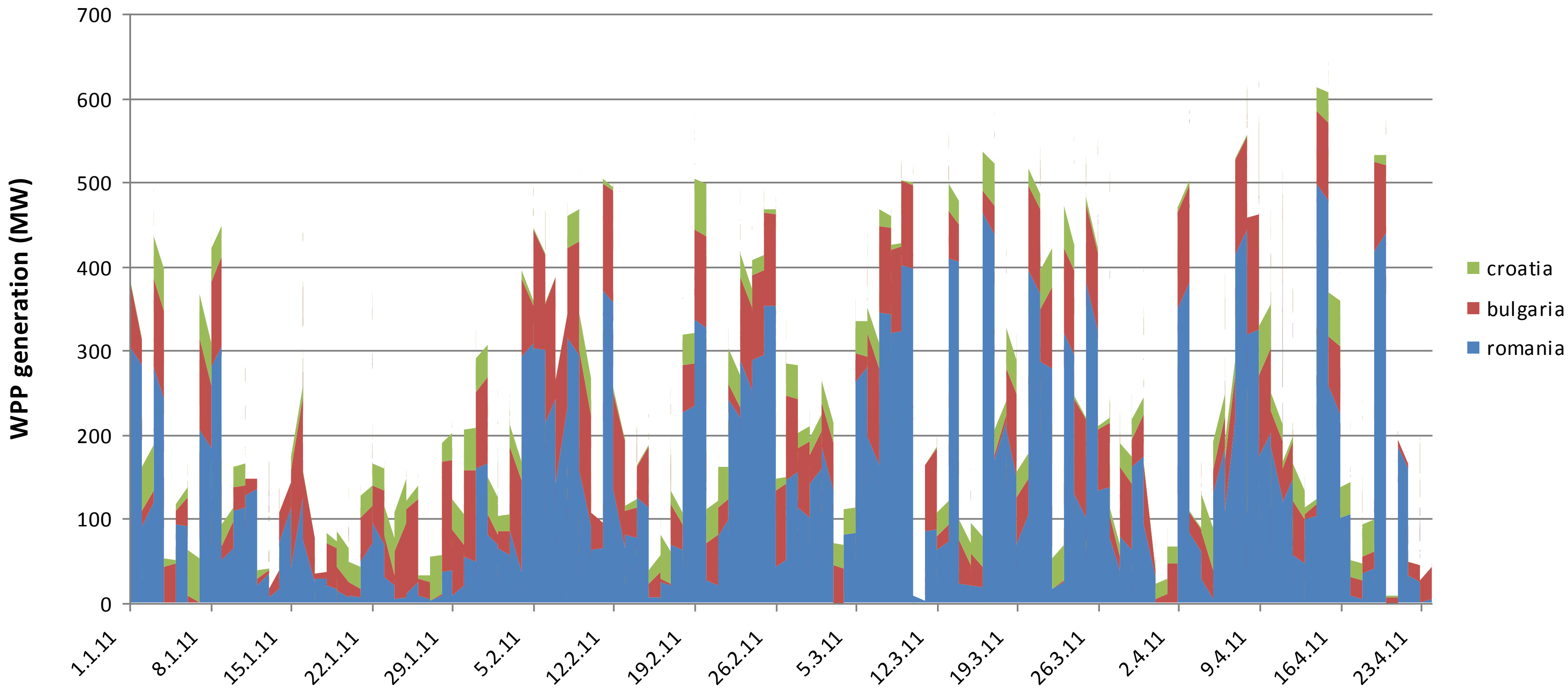
installed WPP 2010/2020



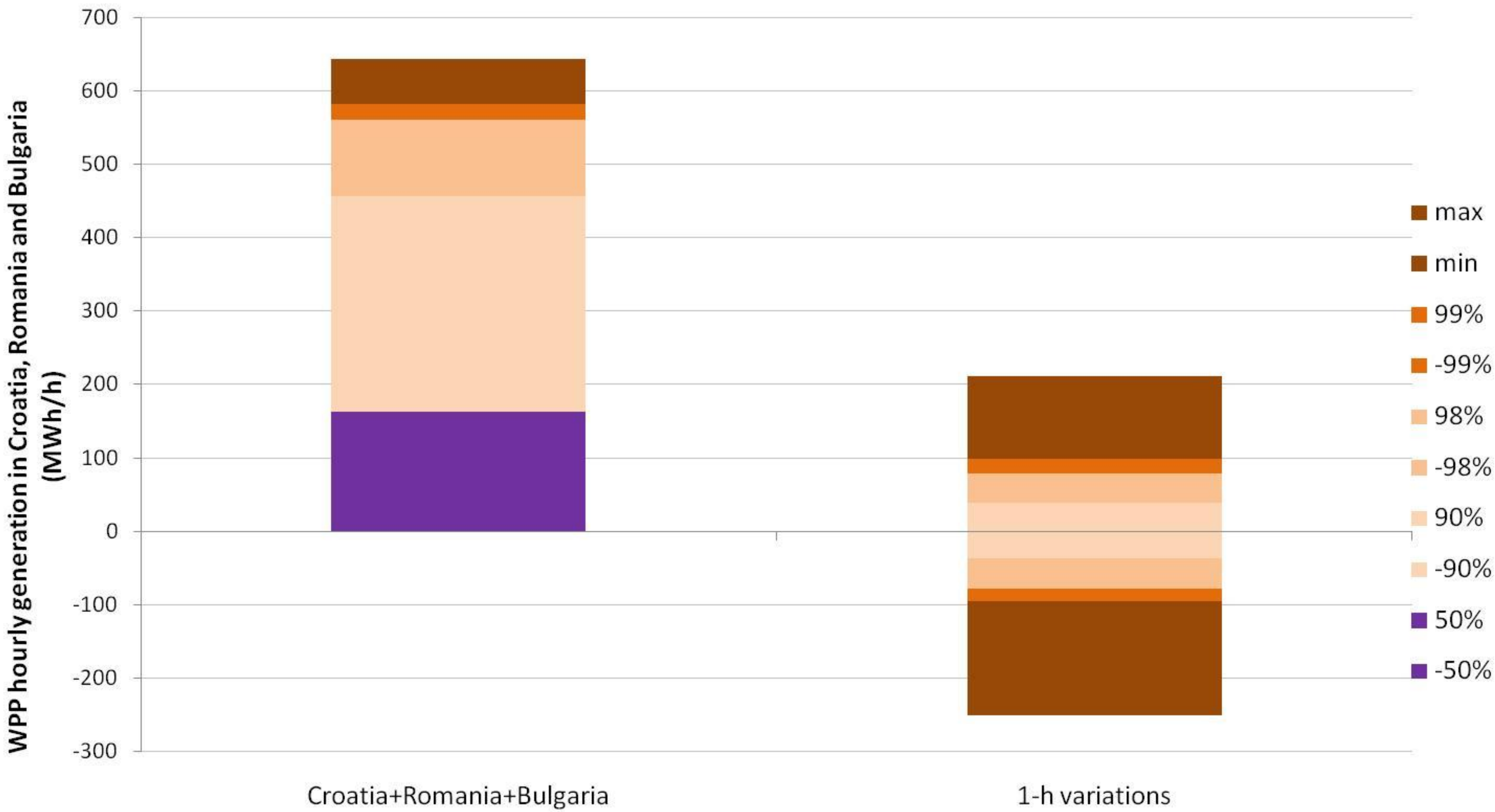
WPP feed-in tariffs (2010)



WPP production (2011)

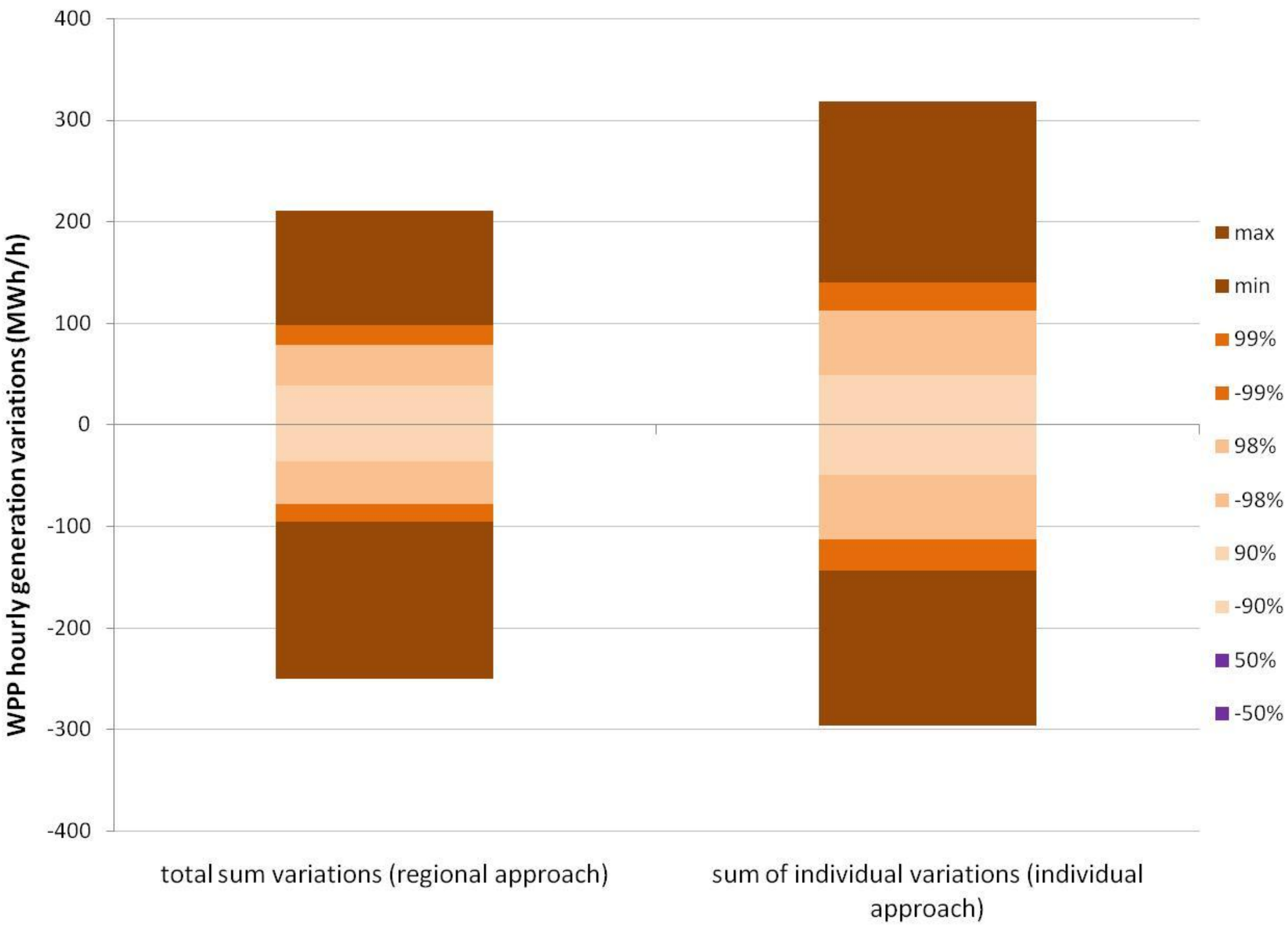


WPP production/variations (2011)

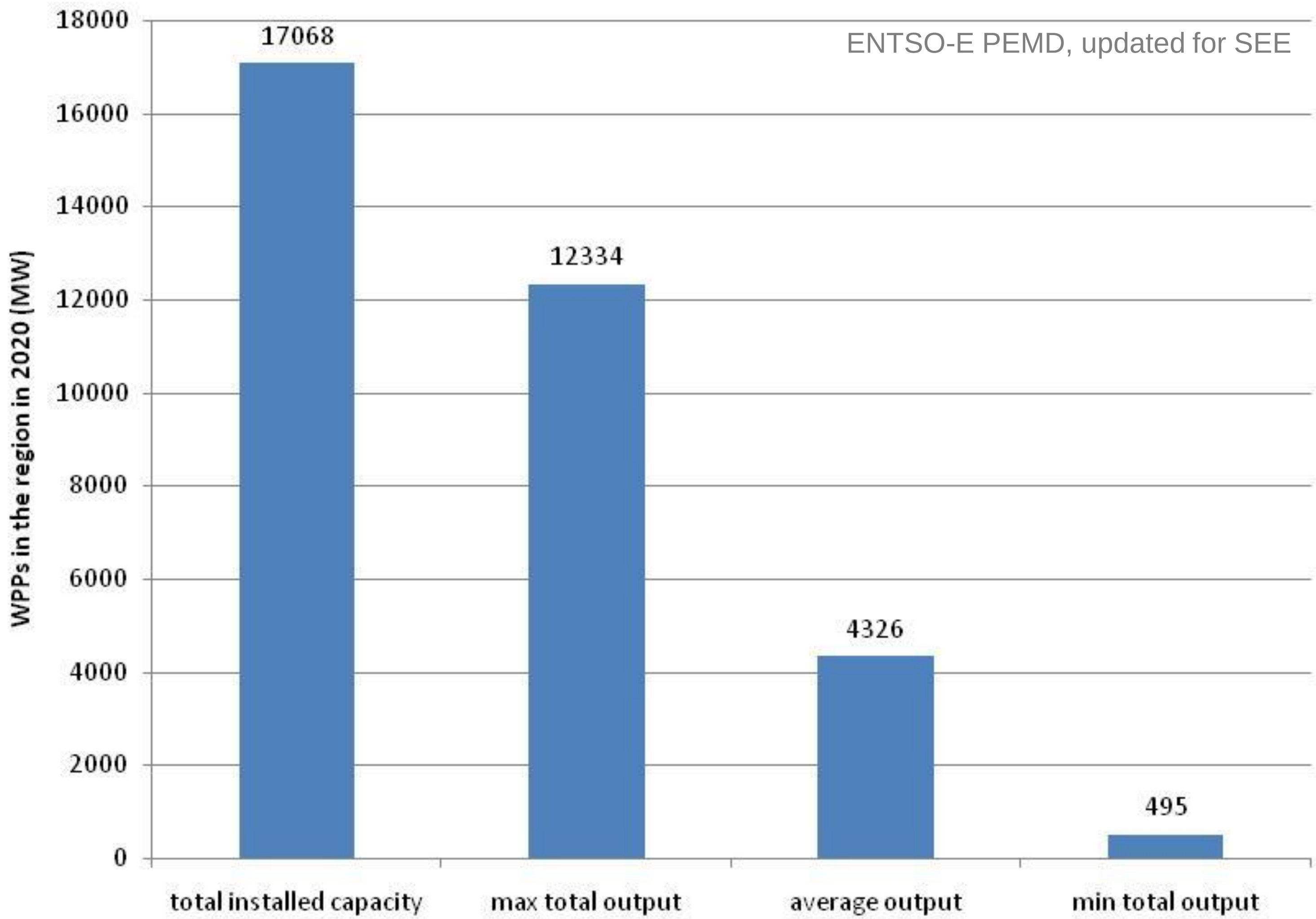


Pinst (WPP total) = 883 MW (2011)

WPP variations (2011)

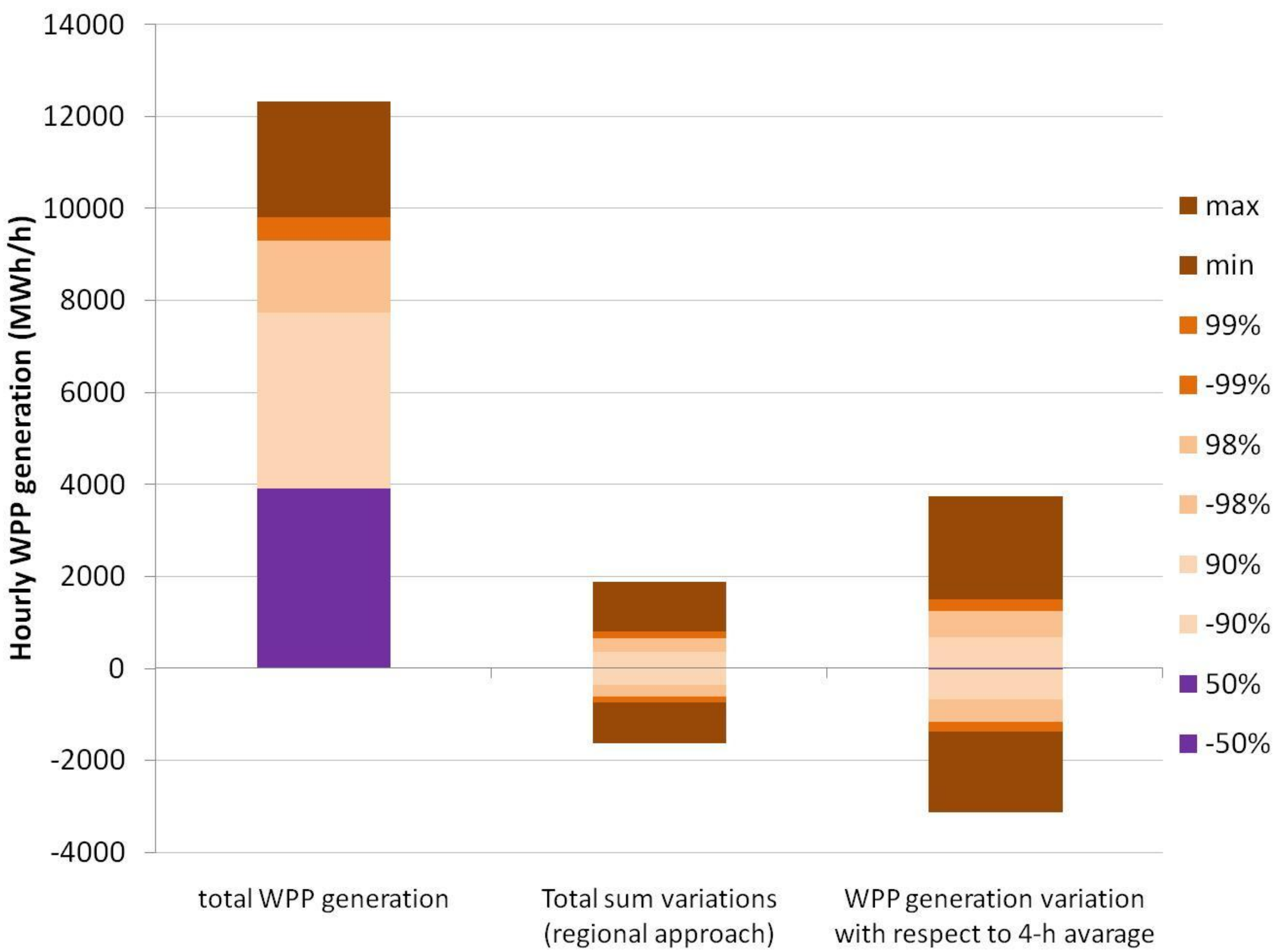


WPP in 2020

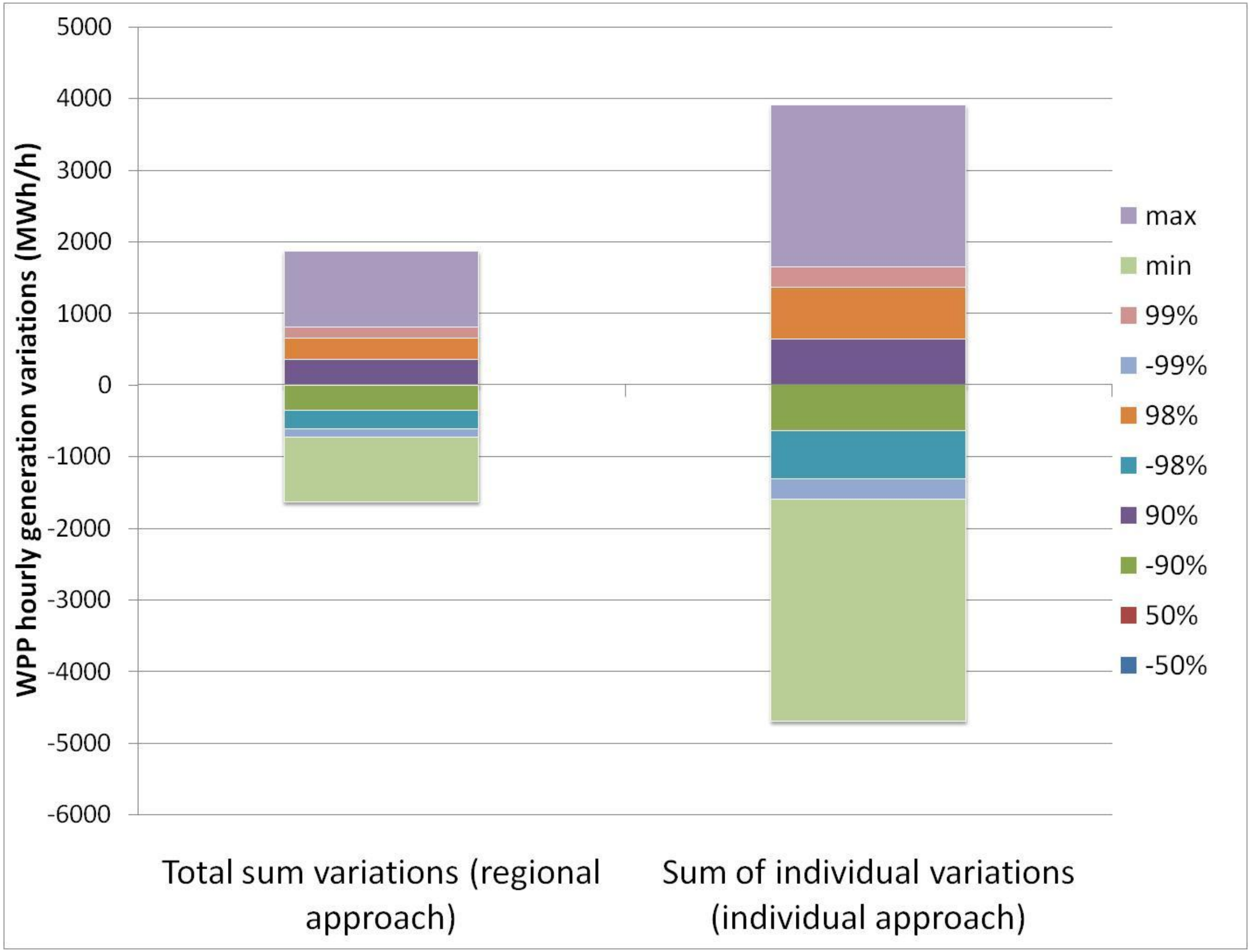


ENTSO-E PEMD, updated for SEE
WPPs in the region in 2020 (MW)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
17068
12334
4326
495
total installed capacity
max total output
average output
min total output

WPP production/variations in 2020



WPP variations in 2020



regional approach in balancing

Recognize clear benefit of the regional approach of WPP integration:

- regional approach would decrease total reserve needs for -2600 MWh/h and +2000 MWh/h

- regional approach would decrease system reserve needs for balancing WPPs to less than half of the existing individual country approach

legislative framework overview

	Albania	BiH	Bulgaria	Croatia	Greece	Macedonia	Montenegro	Romania	Serbia EMS	Serbia KOSTT	Slovenia	Turkey
Connection procedure	N/A	✓	✓	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
Connection study	N/A	✓	✓	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
Optimal connection point analysis	N/A	✗	✗	✗	✗	N/A	✓	✓	✓	N/A	N/A	✗
Load flow analysis	N/A	✓	✓	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
Voltage profile analysis	N/A	✓	✓	✓	✓	N/A	✓	✗	✗	N/A	N/A	✓
Short-circuit analyses	N/A	✓	✓	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
Power quality	N/A	✗	✗	✓	✓	N/A	✓	✓	✗	N/A	N/A	✗
Stability analysis	N/A	✗	✗	✗	✓	N/A	✗	✓	✓	N/A	N/A	✗
Dynamic simulation	N/A	✓	✓	✗	✓	N/A	✓	✓	✗	N/A	N/A	✗
Cost-benefit analysis	N/A	✓	✓	✓	✓	N/A	✗	✓	✗	N/A	N/A	✗
Realiability indicators	N/A	✗	✗	✗	✓	N/A	✗	✓	✗	N/A	N/A	✗
Spatial details of grid connection	N/A	✗	✗	✓	✗	N/A	✗	✗	✗	N/A	N/A	✗
Cost sharing principle	N/A	shallowish	shallow	deep	shallowish	N/A	shallowish	shallowish	shallowish	N/A	N/A	shallow
Ancillary service	N/A	✓	✓ [1]	✓ [2]	✓	N/A	✓	✓	✓	N/A	N/A	✓ [4]
Available secondary reserve [MW]	N/A	50	-300:+500	±200	±600	N/A	±20	±150/±300	±170	N/A	N/A	±1252.5
Specific technical requirements in Grid Code	N/A	✓	✗	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
P/f regulation	N/A	✓	✗	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
Voltage/reactive power control	N/A	✓	✗	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
FRT	N/A	✓	✗	✓	✓	N/A	✓	✓	✓	N/A	N/A	✓
WPP specific data requirements	N/A	✗	✗	✓	✓	N/A	✗	✓	✓	N/A	N/A	✓
Wind measurment data	N/A	✗	✗	✗	✓	N/A	✗	✗	✓	N/A	N/A	N/A
Wind forecasting tools	N/A	✗	✗	✓ [3]	✓	N/A	✗	✗	✗	N/A	N/A	✓

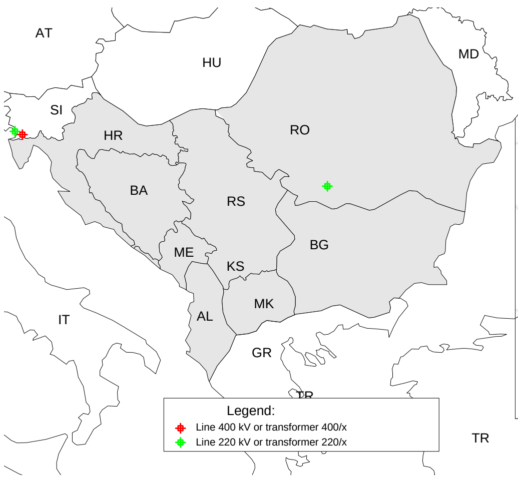
1 - Not appropriate for larger WPP integration
2 - Need to be upgraded
3 - Wind forecaster in testing phase
4 - WPPs not included in ancillary service mechanism

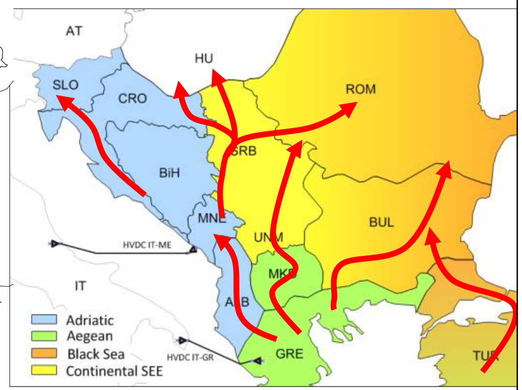
load flow analyses

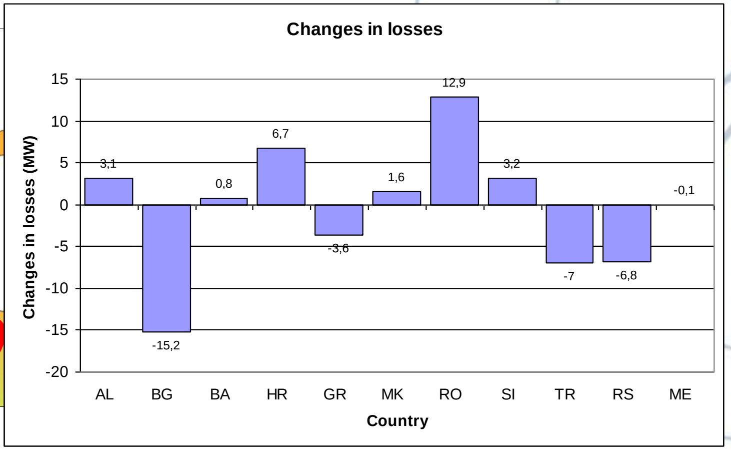
load flow scenario 1

MAX Adriatic & Aegean; MIN Black Sea

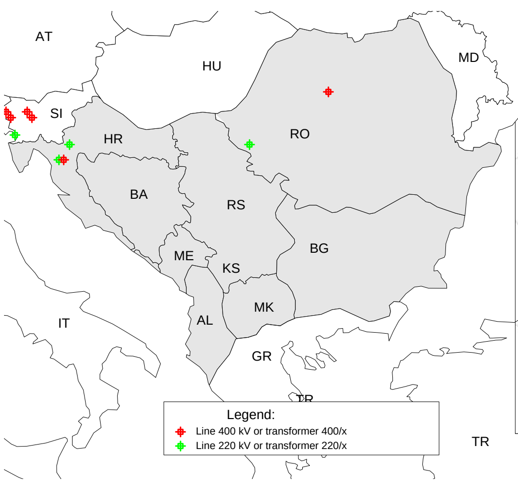
2015

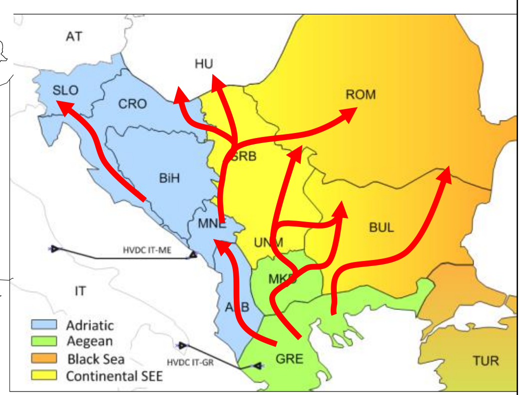


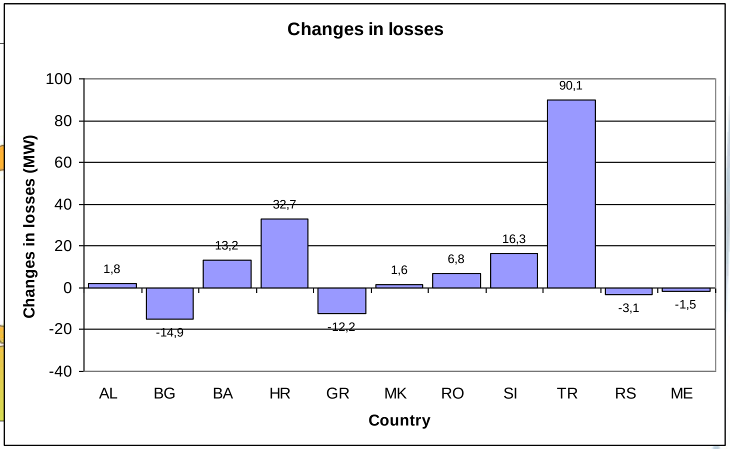




2020

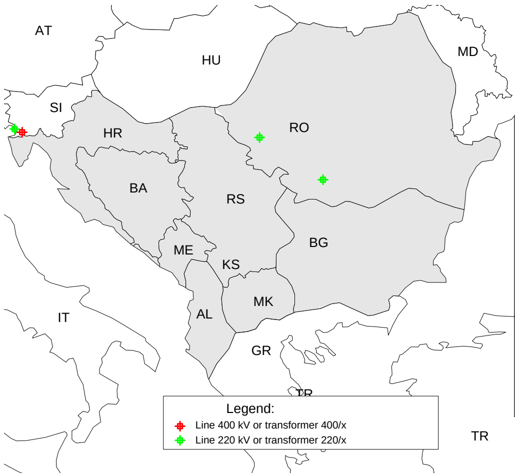


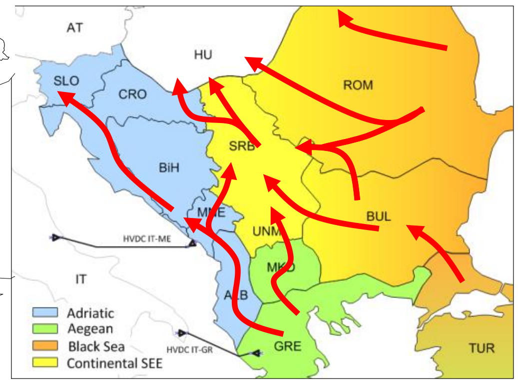


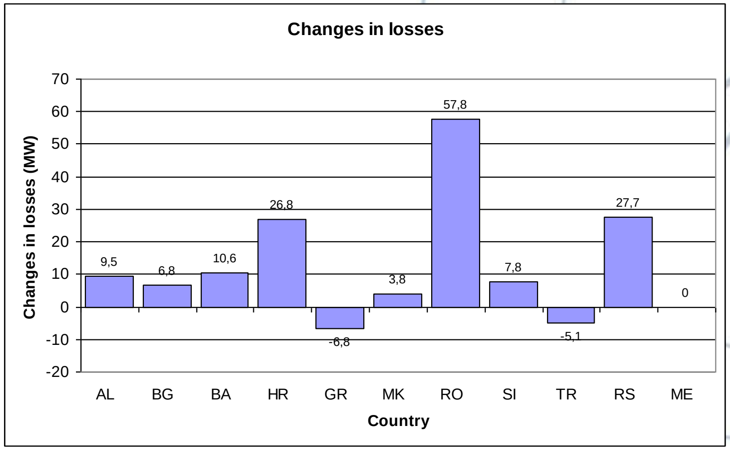


load flow scenario 2
MAX Aegean & Black Sea; MIN Adriatic

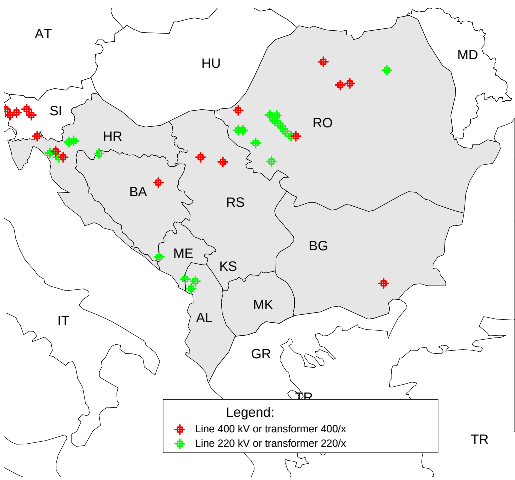
2015

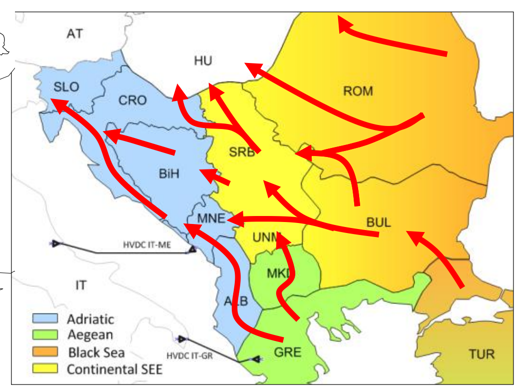


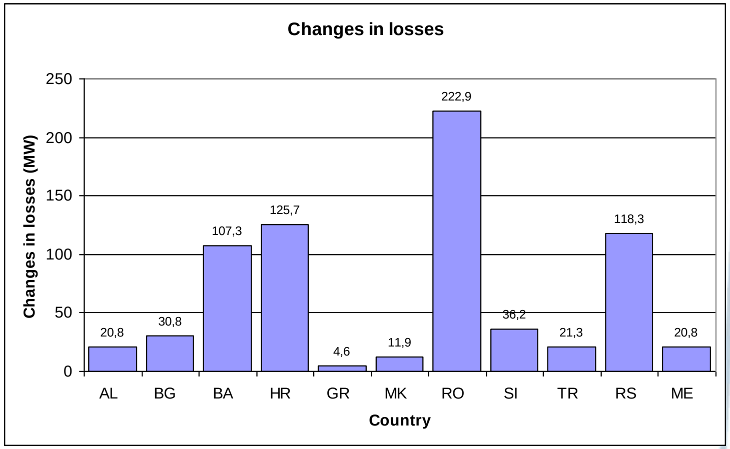




2020



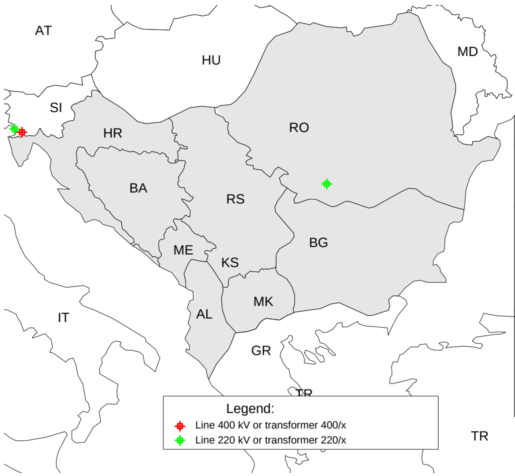


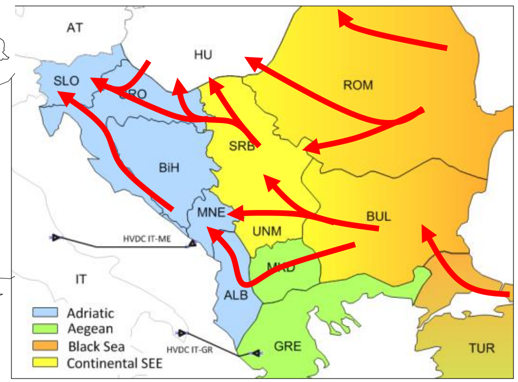


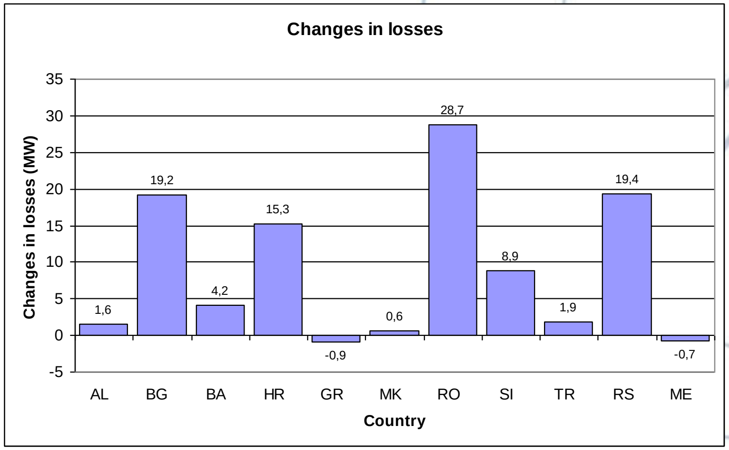
load flow scenario 3

MAX Black Sea & Continental; MIN Adriatic

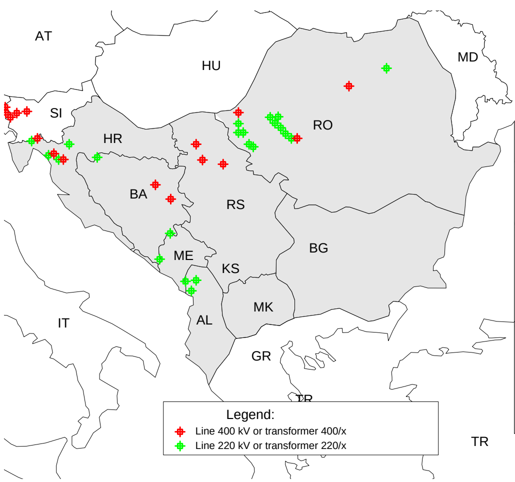
2015

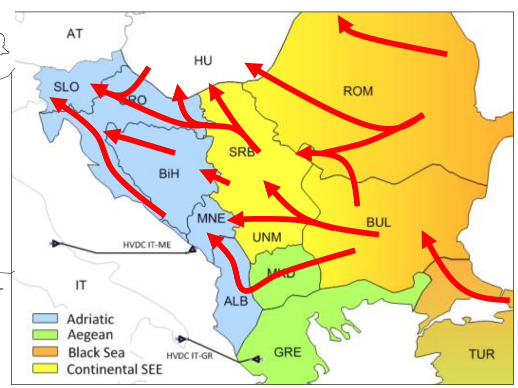


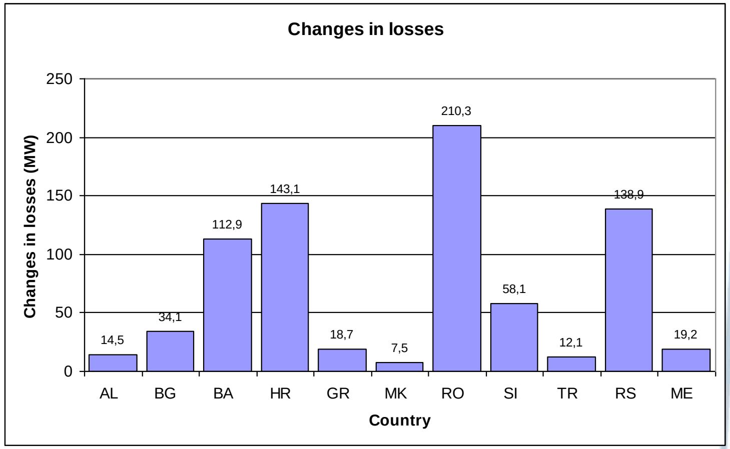




2020



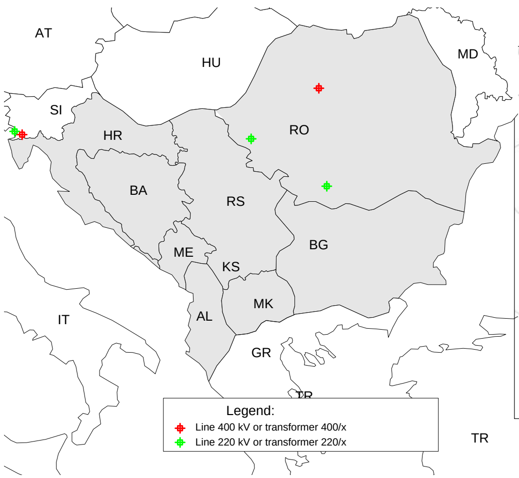


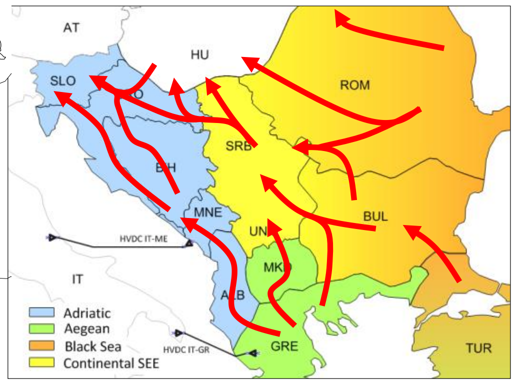


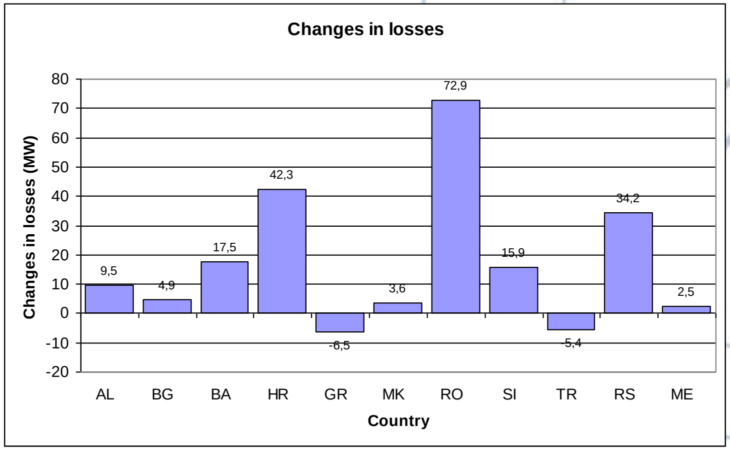
load flow scenario 4

MAX All SEE Regions

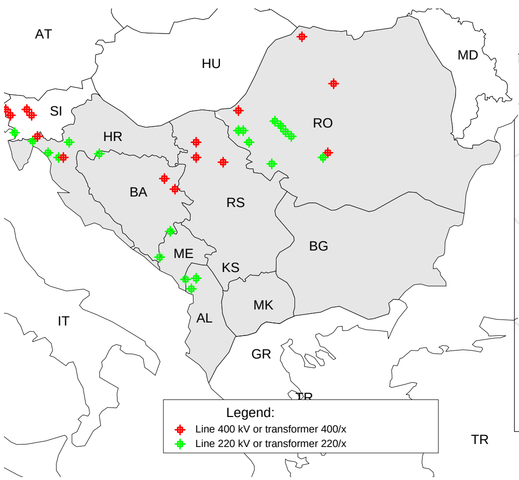
2015

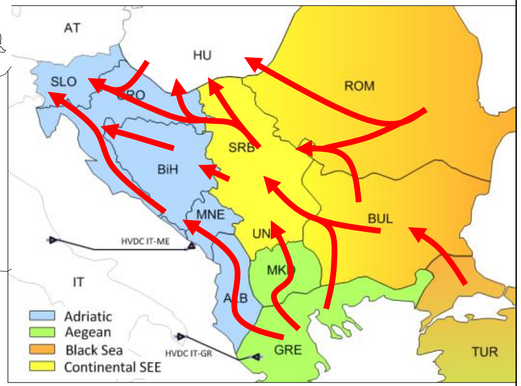


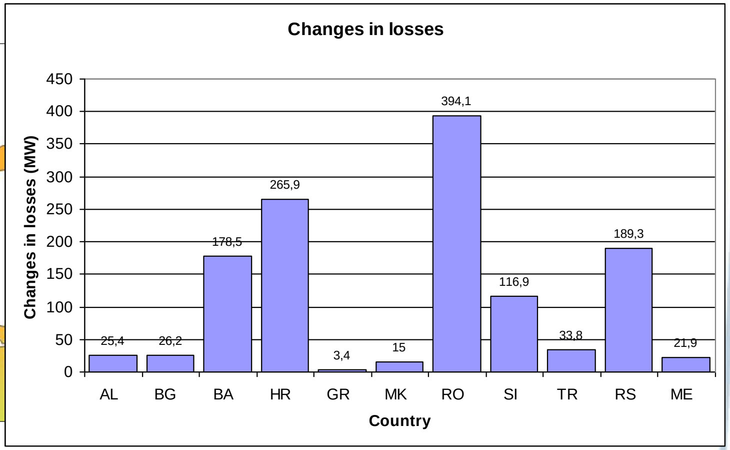




2020



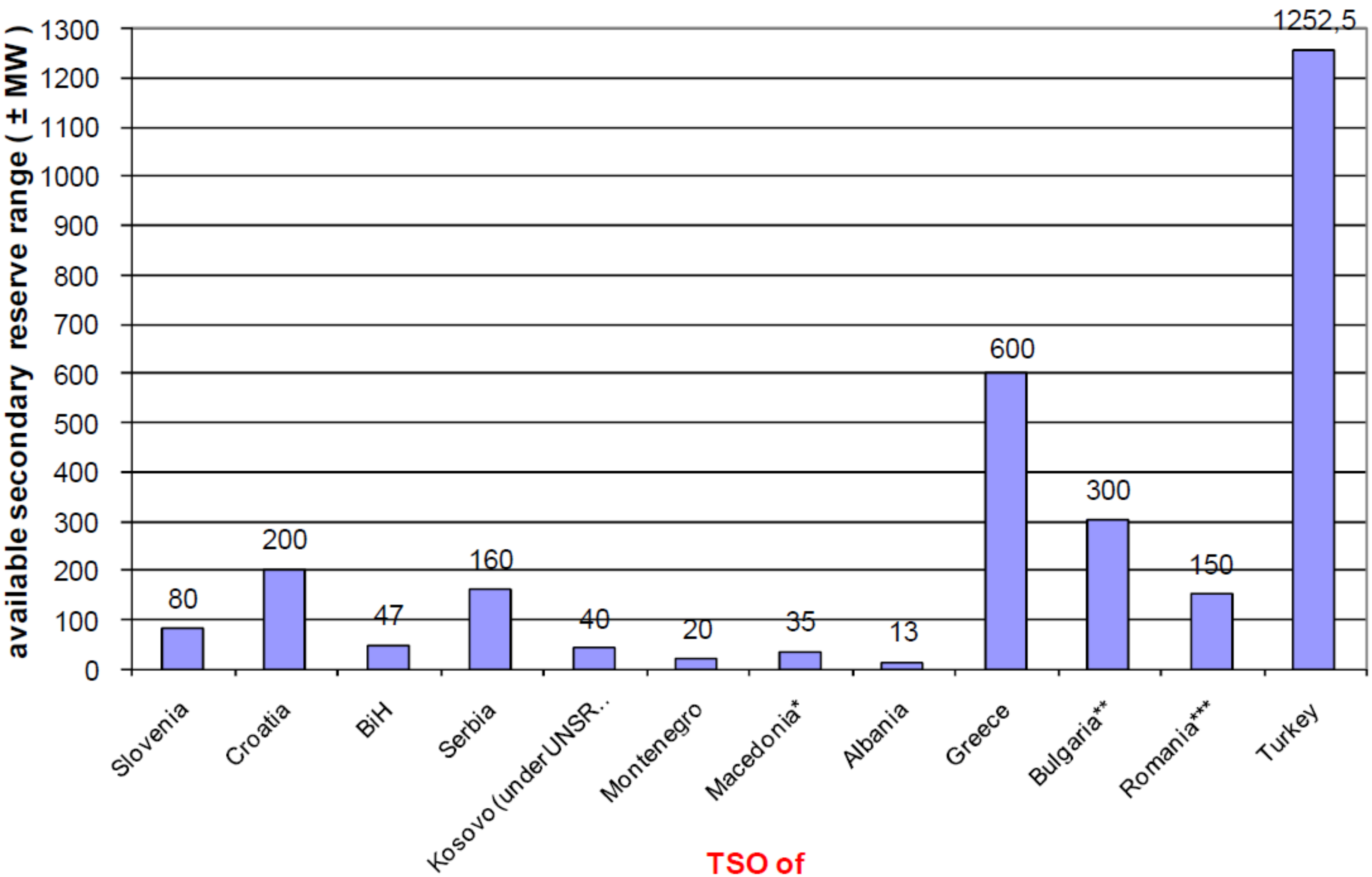




RBM in SEE
- drivers -

- Large scale WPPs integration in the region
  - Reserve capacity needs are the largest limitation for WPPs integration in SEE
  - Regional approach would decrease system reserve needs for balancing WPPs to less than half in comparison to the current practice of providing it at the national level (-2600 MWh/h and +2000 MWh/h)
- Scarce reserve capacities on national level
  - Each TSO is responsible for its own system reserve needs
  - Practically there are no reserve cross-border exchanges
  - For the time being, TSO-s are facing problems to provide system reserves requirements from national production capacities

available reserve capacities



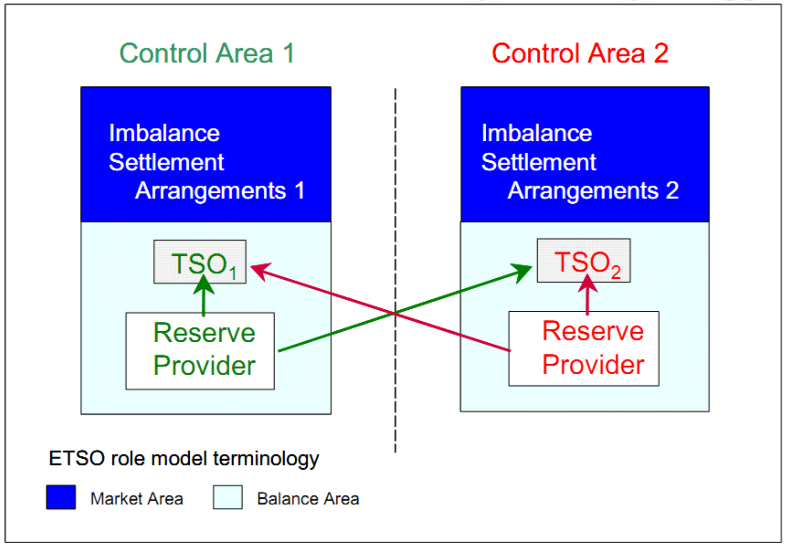
RBM in SEE
- challenges -

- Important building block on the road of creating a common electricity market in SEE
- TSOs to procure balancing services in efficient manner by using the power reserve resources across the whole region of SEE
- To design efficient RBM
  - TSO with deficit of power reserves (negative energy balance) to acquire power/energy deviation from others TSOs with surpluses for respective period
  - Supposed to operate on intraday time-frame
  - Should be flexible enough to take into account characteristics of national market models in SEE

current practice on RBM in EU

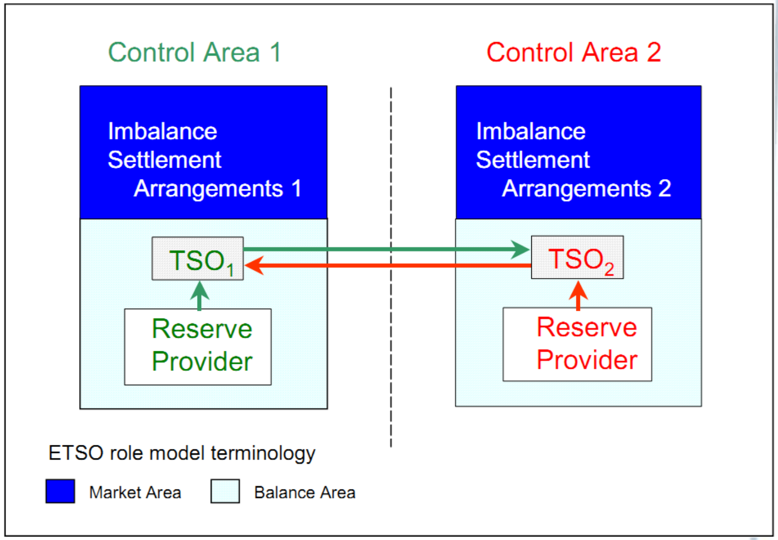
Model 1

- TSO is trading directly with reserve providers in different control areas
- Used inside the German control block (including the part of Austria)



Model 2

- TSO is trading with one or more TSOs
- One TSO can only buy balancing services from external providers only through connecting TSO
- A variant of this model is used in Nordel



current works on RBM framework

- ACER
  - Framework Guideline on Balancing (definition of content)
- ENTSO-E WG Ancillary Services
  - Proposals for a balancing target model in the short and medium term
  - Position paper on the mid-term model for cross-border exchanges of balancing energy
  - Position paper on the allocation of transmission capacity to reserve markets
- ENTSO-E WG RES
- BETSEE platform

SECI TSP focus

- Regular TSO reporting
  on WPP integration issues, plans and experience
- Identification of real needs & problems
- Follow up with common RBM issues
- (Re-)establishment of TSOs' expert association
- Harmonization with
  - concept of regional AO for transmission capacity
  - National market models and BM
  - WPP technical requirements

http://www.ekc-ltd.com/seci

Спасибо!
Thank you!