Energy Technology and Governance Program

Electricity Market Initiative (EMI) Working Group

THE MARKET, EMISSIONS AND NETWORK IMPACTS OF SIGNIFICANT INCREASES IN RENEWABLES IN SOUTHEAST EUROPE

Approach, Findings and Recommendations

IAEE Online Conference, Concurrent Session 12, June 9, 2021

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PRESENTATION CONTENTS

The EMI's Broad Geographic Coverage and Interconnections

15 Companies (TSOs, MOs)
From 11 Countries in
Southeast Europe (SEE)

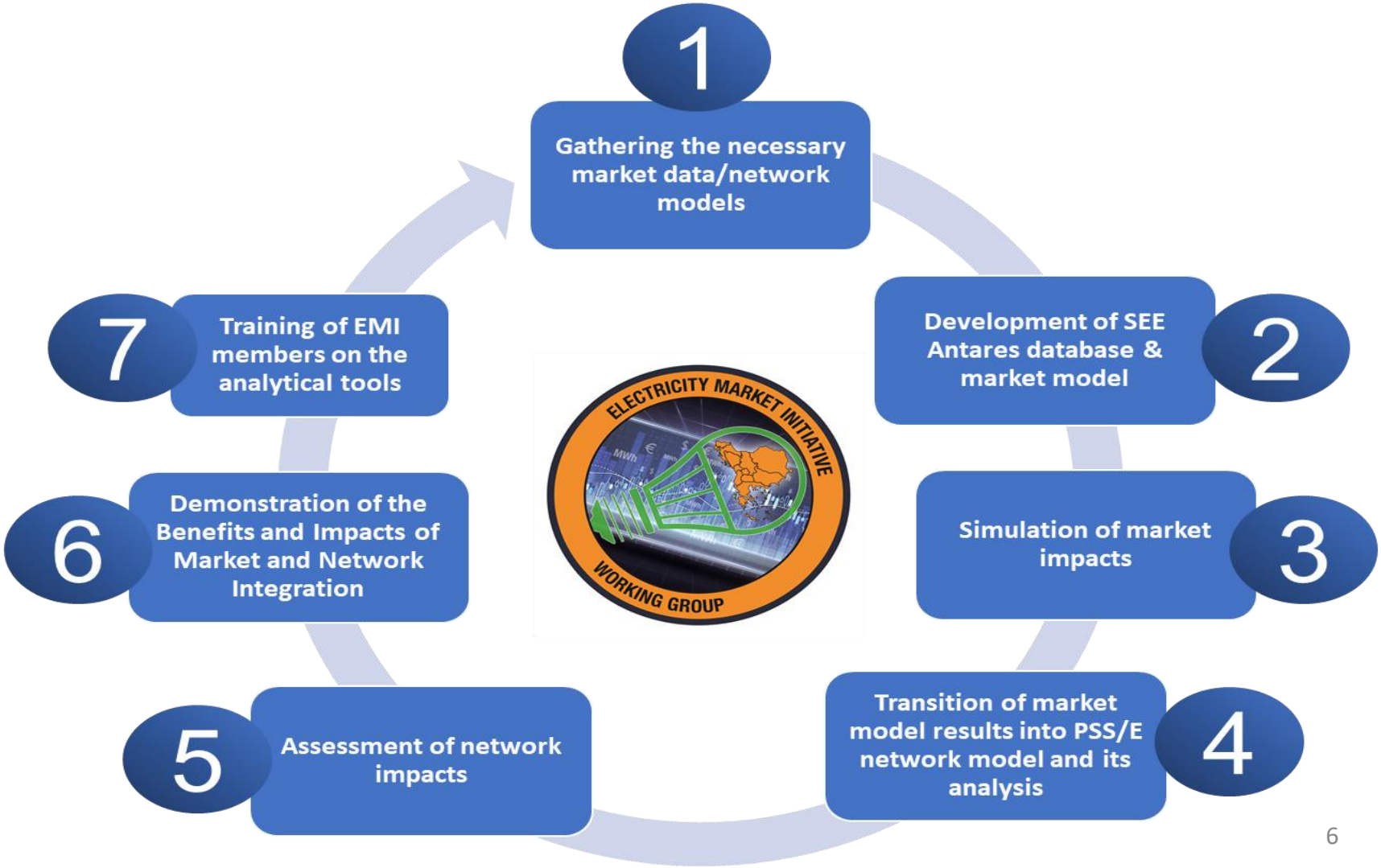
1. Study Objectives
2. Study Methodology
3. Key Findings

OVERALL OBJECTIVES OF THE ELECTRICITY MARKET INITIATIVE (EMI)

FORMED IN JULY 2018 FOR MULTIPLE PURPOSES:

- Lower Seams and Eliminate Barriers Between Markets
- Provide Practical Studies, Tools and Training to Accelerate Electricity Market Integration in SEE
- Advance the Social Welfare and Well Being of All Residents of SEE
- Expand Opportunities for Private Sector Investment and Innovation
- Stimulate Significant Growth of Renewables and a Substantial Reduction of GHG Emissions
- Respond to the EMI Members' Interests
- Coordinate with European Organizations
- Support US Government Policy in the Region

OUR MULTI-FACETED STUDY METHODOLOGY



CREATING A SOPHISTICATED ELECTRICITY NETWORK MODEL and MARKET TOOL FOR SEE

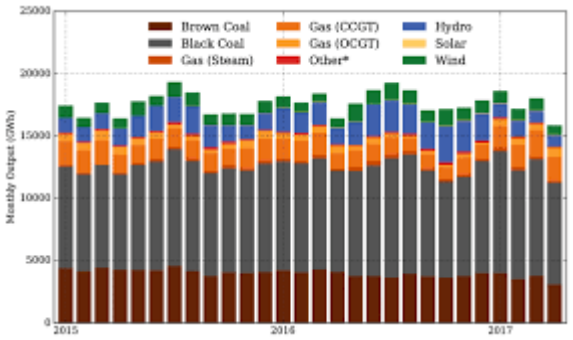
We have created a robust and verified a regional power system model consisting of:

- 8,578 buses
- 10,050 branches
- 3,360 loads
- 1,521 power plants
- 3,745 transformers
- 149 switched shunts
- 4 DC lines

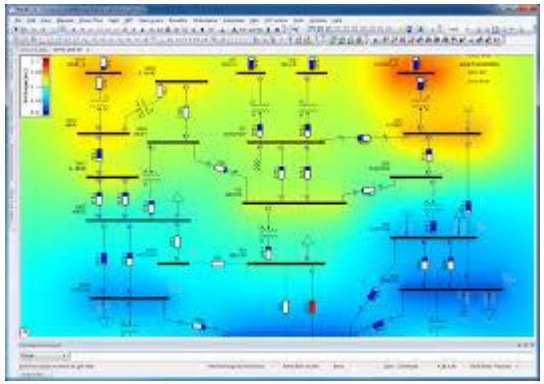
This work requires an extensive, current set of data on the network and markets of Southeast Europe.

MARKET STUDY PROVIDES INPUTS TO THE NETWORK ANALYSIS

- **Market study results** → the most critical patterns (as defined in the scenarios) → **run selected cases for the network studies.**



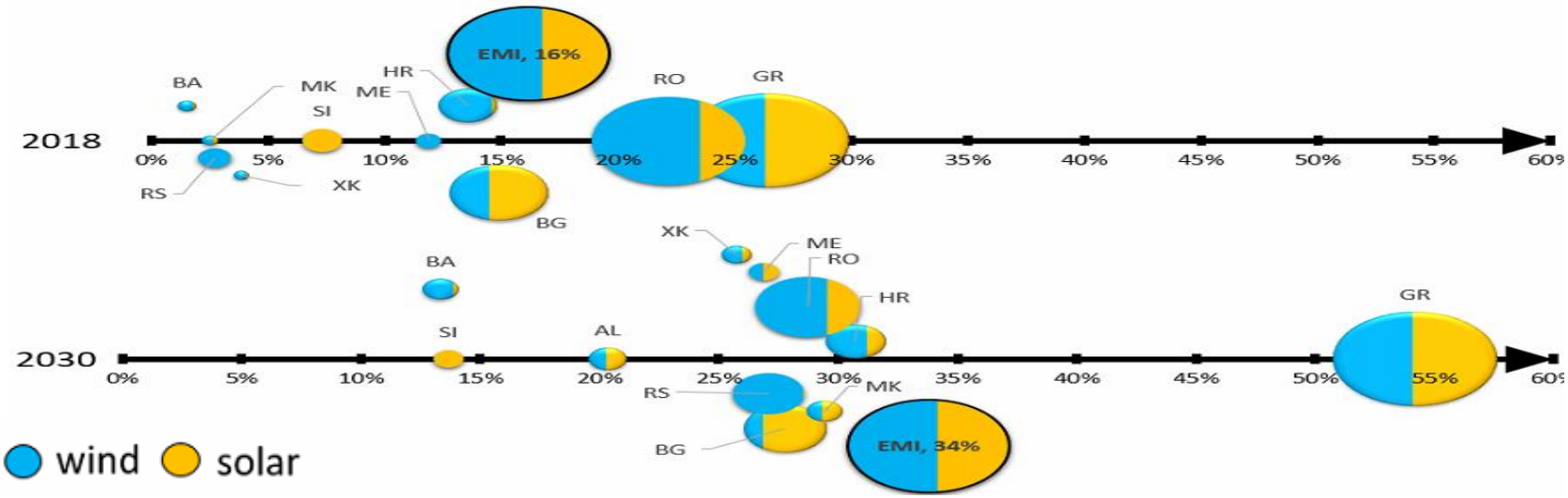
Market analyses (ANTARES)



Network analyses (PSS/E)

KEY INPUT - RES CAPACITIES COULD GROW 4X BY 2030

EMI Member	SPP installed capacity (MW)	Installed WPP capacity (MW)	Total SPP installed capacity (MW) in 2030		Total WPP installed capacity (MW) in 2030	
	Current (2018)		Referent RES	High RES	Referent RES	High RES
AL	0	0	445	557	384	480
BA	10	51	100	200	580	650
BG	1059	712	2929	3661	887	1109
HR	60	582	600	800	1300	1500
GR	2445	2302	7700	9600	7000	8800
XK	7	34	150	250	336	500
MK	17	37	403	550	306	366
ME	0	118	250	313	243	304
RO	1262	2977	2000	3700	4200	5100
RS	6	201	32	40	2892	3615
SI	281	3	492	1650	10	150
TOTAL	5147	7017	15101	21321	18138	22574



KEY STUDY FINDINGS

1. THE OUTLOOK FOR LIGNITE GENERATION

2. THE EMISSIONS IMPACTS OF RES, GAS AND CO2 TAXES

3. BALANCE OF THE REGION AND INDIVIDUAL ZONES

4. WHOLESALE PRICE IMPACTS

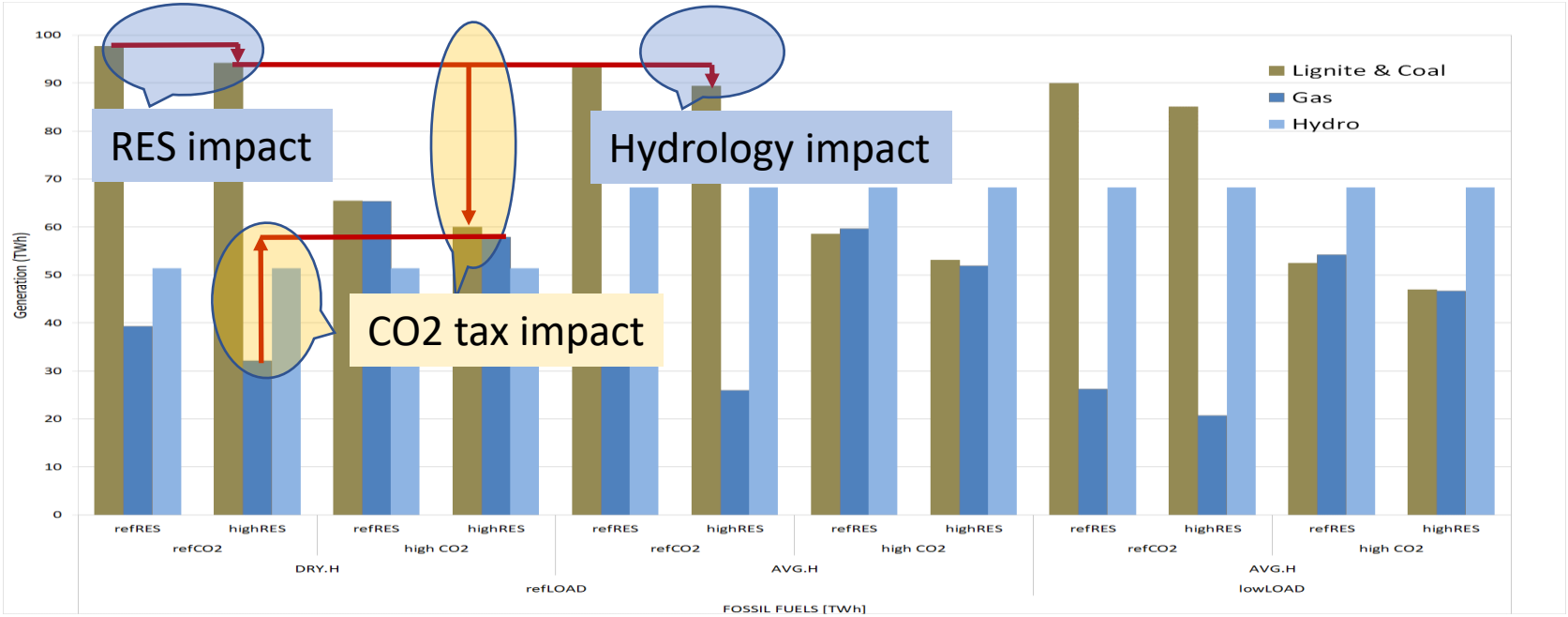
5. ADDITIONAL GAS GENERATION IMPACTS

6. NETWORK RESILIENCY

7. POTENTIAL NEXT EMI STEPS

8. RECOMMENDATIONS AND IMPLICATIONS

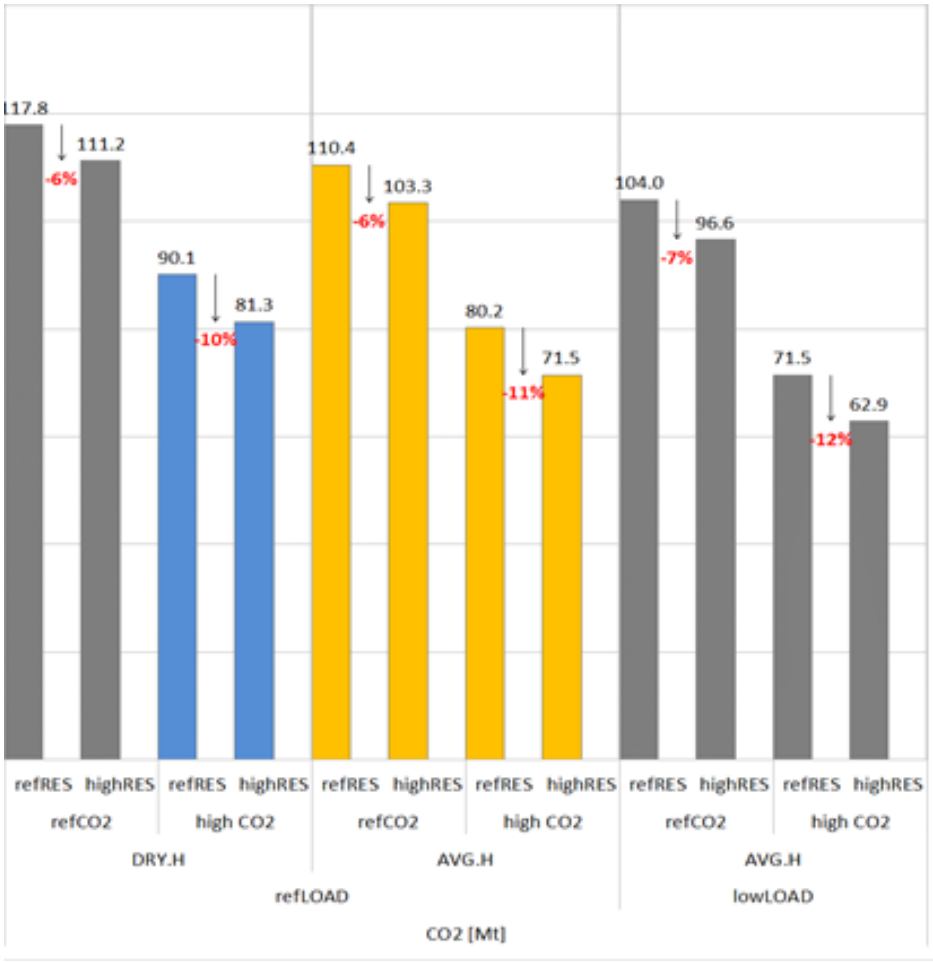
LIGNITE TPPs ARE SERIOUSLY ENDANGERED WITH A HIGHER CO2 EMISSION TAX IN 2030



RES capacities increase and hydrological circumstances have small impact on lignite and gas fired plants operation

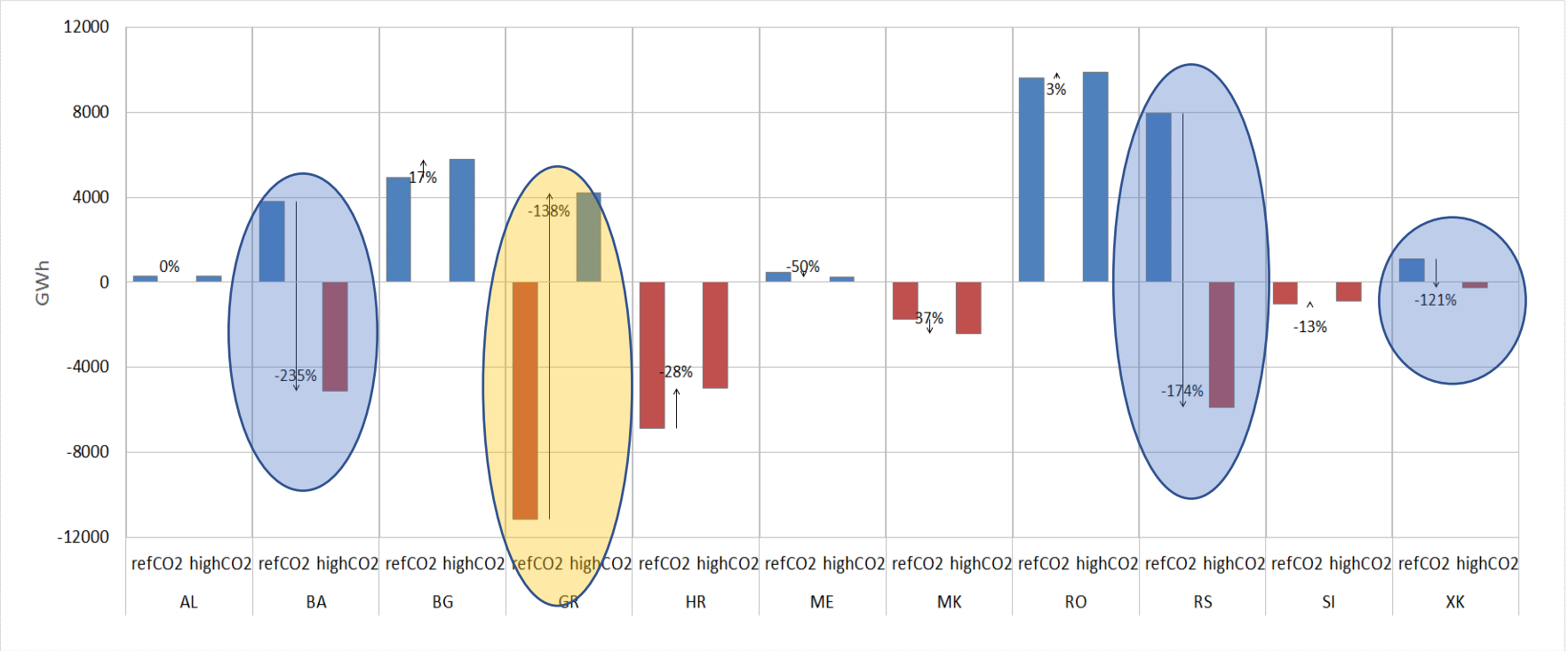
But with increase in CO2 emission tax ➔ lignite fired plants economy is **seriously endangered**

HIGH RES ➔ A MODEST EMISSIONS IMPACT



- The emissions impact of analyzed scenarios is **modest** (**6-12%**)
- This is largely because the **model does not retire lignite plants**
- To even come close to reaching the **EU's emissions targets**, **much more needs to be done** than adding a lot of RES, given RES' low capacity factors

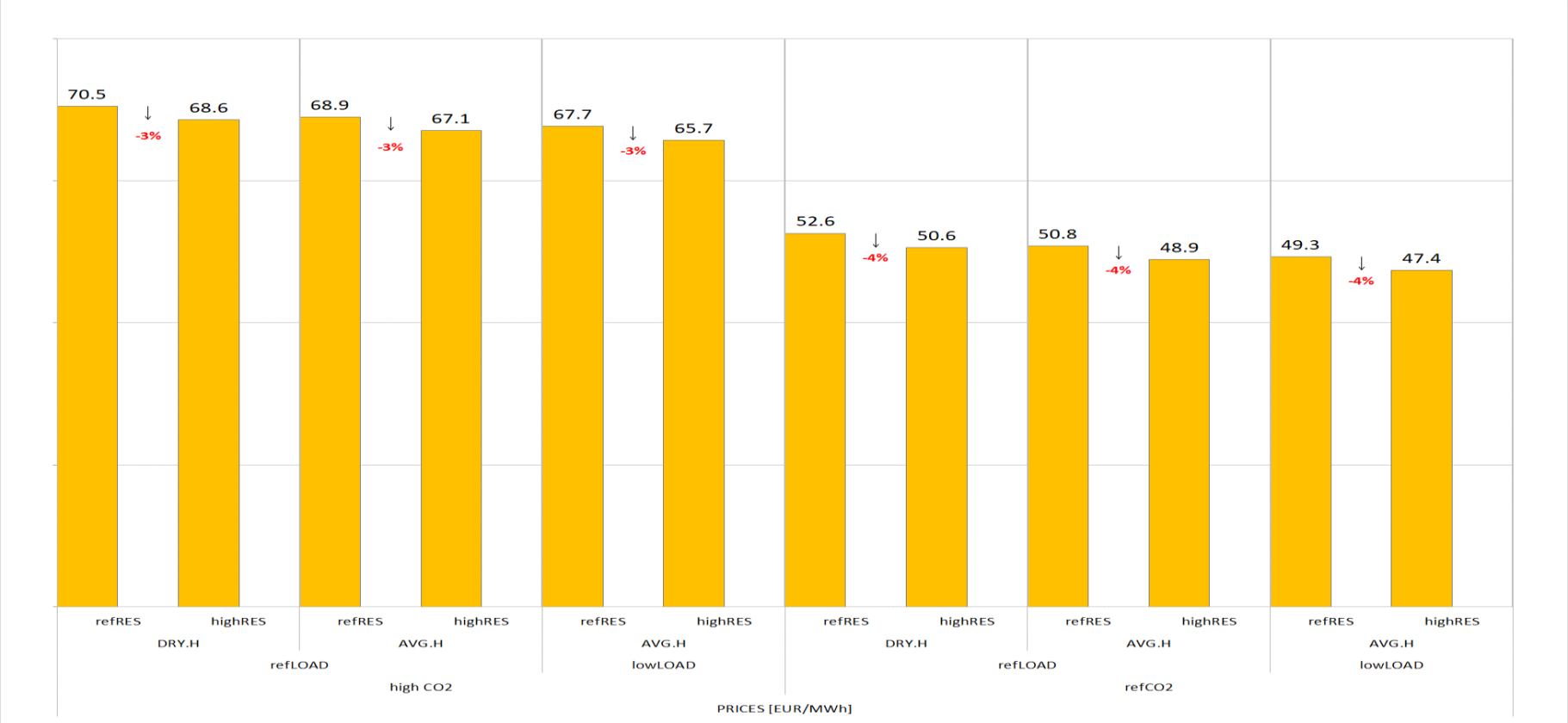
HIGH RES AND CO2 TAX BRINGS SIGNIFICANT CHANGE IN SEE POWER SYSTEMS BALANCE IN 2030



Lignite based zones becomes importers and gas-based zones become exporters ➔

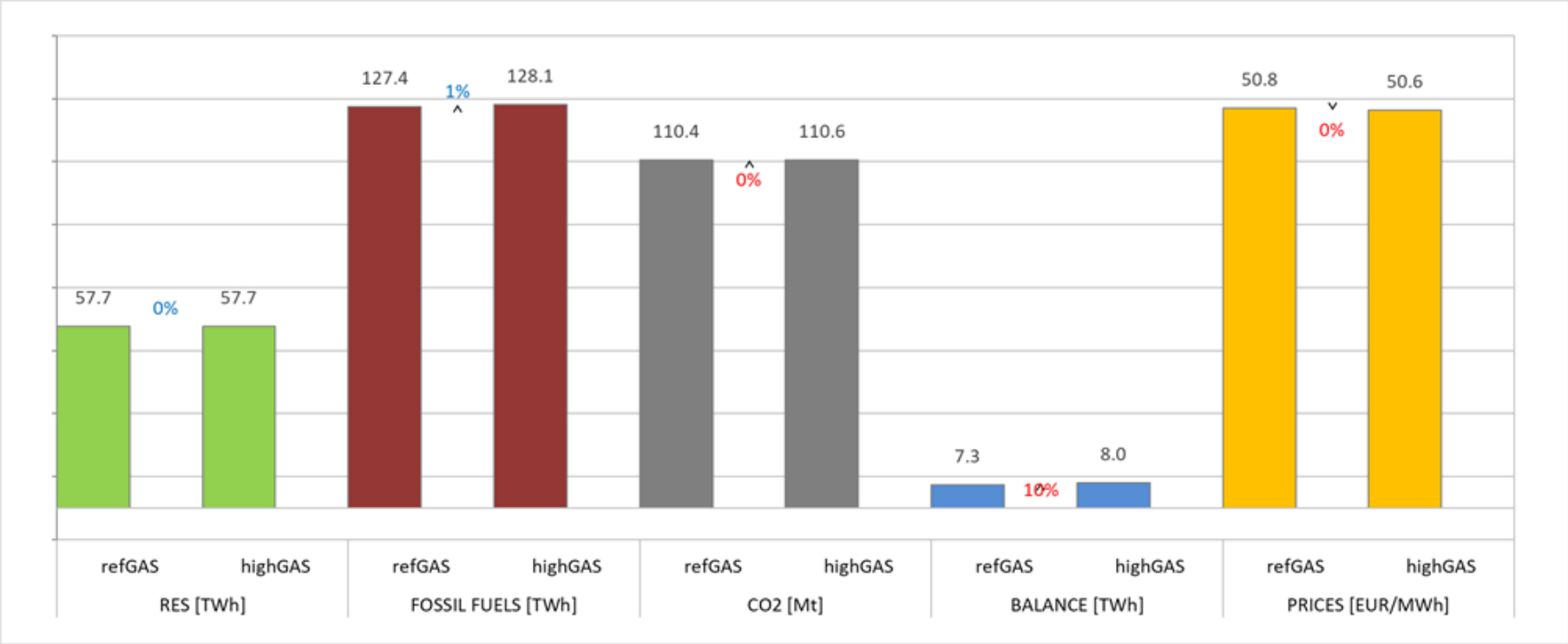
significant change……to be considered by the authorities

HIGHER RES ➔ MODEST PRICE DECLINES, WHILE CO2 TAXES ➔ LARGE PRICE INCREASES



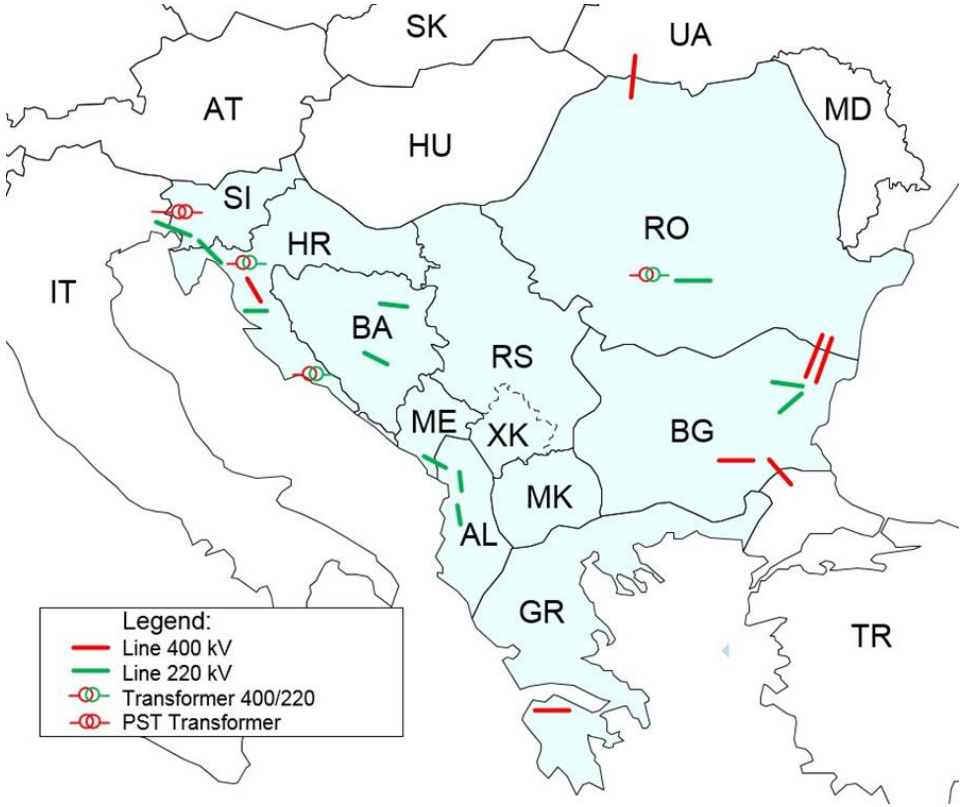
- More RES and more hydro ➔ lower prices: -2 EUR/MWh or -4%
- Higher CO2 tax ➔ higher prices: +18 EUR/MWh or +26%

THE IMPACTS OF ADDITIONAL GAS GENERATION ARE MODEST



New gas-fired TPPs **replace existing gas-fired** TPPs, **substitute lignite**, **decrease pump storage** activations, **leads to additional export** for approx. 10%, **provide flexibility** to the power system and support RES intermittency

HIGH RES ➔ NEW NETWORK BOTTLENECKS IN 2030, BUT NO MAJOR CONCERNS



Just 22 detected critical network elements in all large RES scenarios ➔ clear evidence of robust and well-planned network

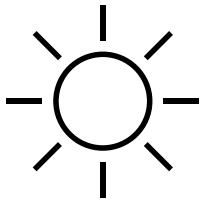
POTENTIAL FUTURE EMI WORK

- **Support the substantial capital needs** to be mobilized to realize the changes expected by 2030

Further study would be beneficial to assess:

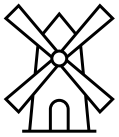
1. The impacts of meeting high emissions targets, and **lignite plant retirements;**
2. The balancing and interconnection impacts of higher RES;
3. The impacts of **new technologies**, (e.g., battery storage and grid-enhancing devices);
4. The implementation of the **MACZT** (70%) rule; and
5. The implications of **demand-side resources**

Recommendations of the EMI RES Study for TSOs, NRAs and Policy Makers - 1



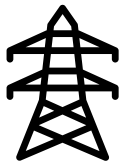
- **Prioritize the expansion of cross-border trade and coupling to foster regional clean energy projects and balancing markets**

- **Assure adequate grid investment with enhanced tariffs and codes, and with regional planning**



- **Provide the proper incentives, interconnection and queueing policies, and sites for private sector renewables (with some common regional policies)**

Recommendations of the EMI RES Study for TSOs, NRAs and Policy Makers - 2



- **Consider gas to support the transition to a clean energy future and ensure resource adequacy**
- **Strongly encourage bilateral and regional power exchanges and competitive markets for real-time, day-ahead, and longer-term markets**
- **Anticipate and incorporate distributed energy resources into these markets, on an equal basis with wholesale power generation**

OTHER IMPLICATIONS

- **Policymakers and utilities** can use these models and analytic frameworks for further country- and project-specific analyses to inform their decisions;

- **Regulators** may leverage these tools to assess the impact of new rates and incentives; and

- **Economic leaders** can deploy these tools to better understand the impact of retiring older power generation facilities.

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THANK YOU FOR YOUR ATTENTION

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