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Potential for Large Scale Integration of Wind Power in Southeast Europe

Energy Technology and Governance Program (ETAG)

United State Agency for International Development
United States Energy Association

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ETAG Objectives

Plan for robust, reliable cross border transmission interconnections as the backbone infrastructure for cross border trade and exchange of electricity generated by clean & innovative energy technologies

Develop technical rules, guidelines and network infrastructure assessments to accelerate integration of clean & innovative energy technologies

Improve security of supply in distribution systems by supporting: optimization planning; line loss reduction; asset management programs; smart grid technology; and region wide disaster preparedness and emergency response programs

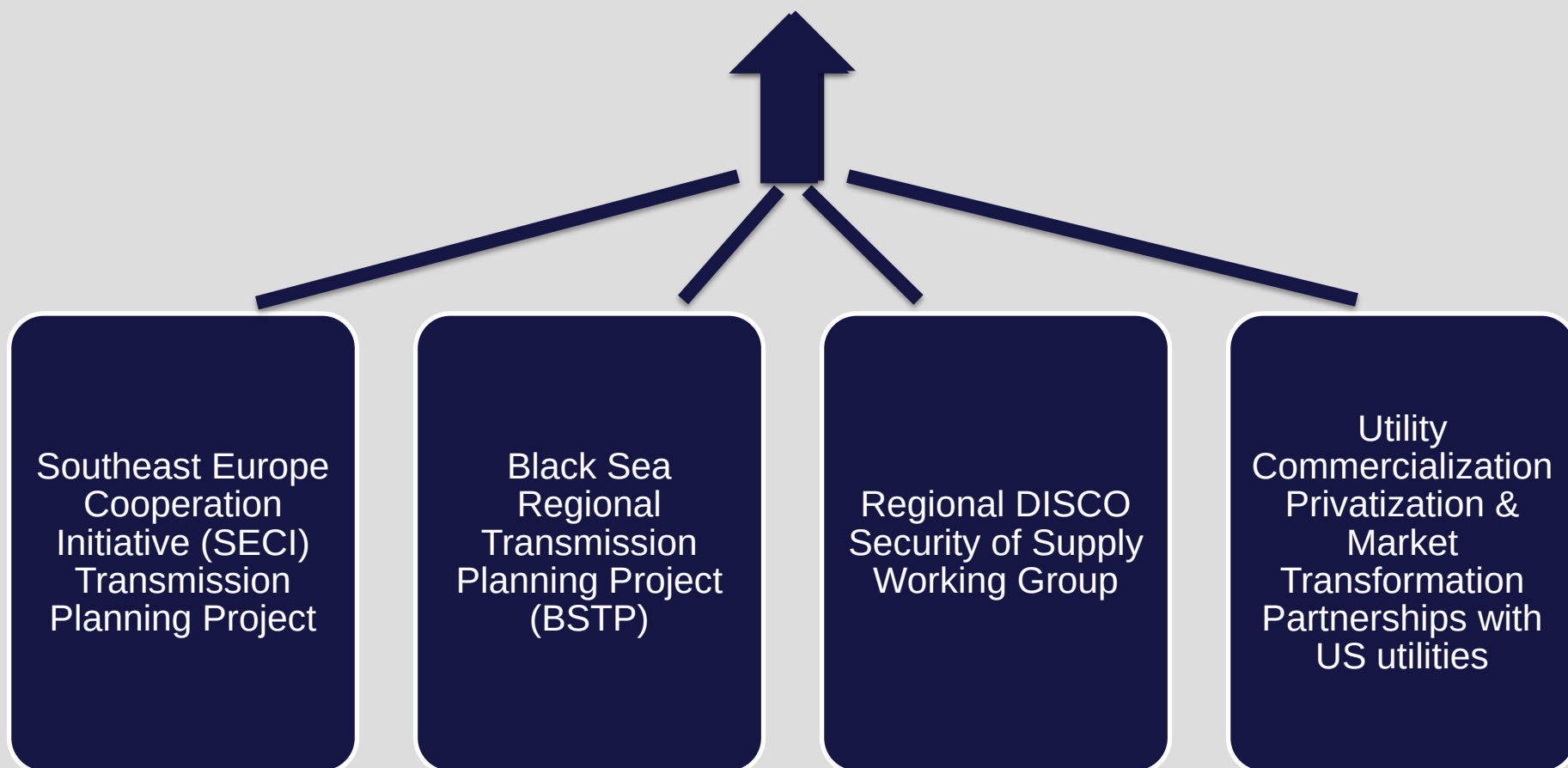
Support utility commercialization, privatization and market transformation to improve overall network efficiency and support clean energy market development



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Delivery Mechanisms Support ETAG Objectives





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Project Goals: SECI & BSTP



Promote National & Regional Transmission Planning
Among TSOs



Harmonize Transmission Planning Principles, Methods
and Methodologies

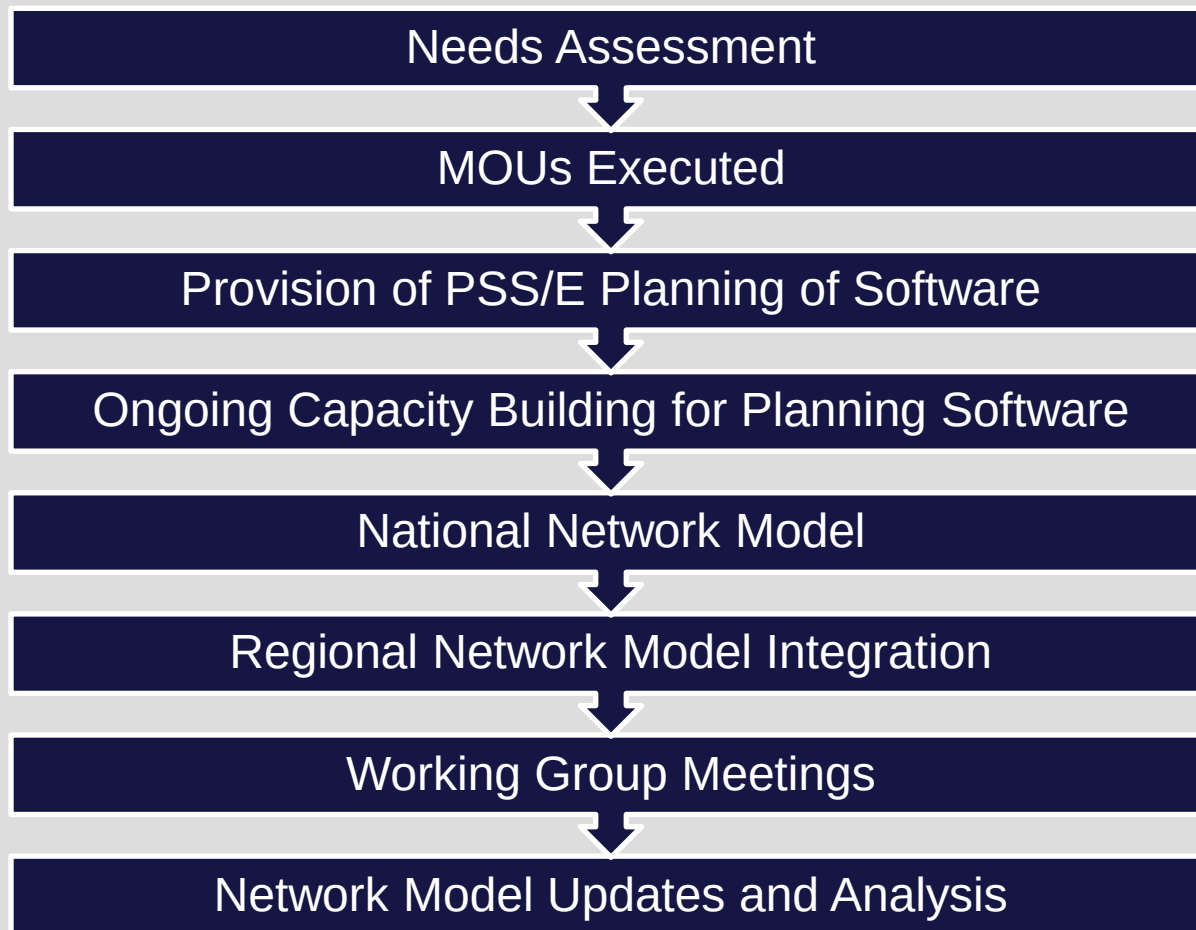
Identify Priority Investments in Transmission Systems &
Interconnections



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SECI & BSTP Project Development





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BSTP Project Participants



- Armenia – Scientific Energy Research Institute
- Armenia – Electric Power System Operator
- Bulgaria – NEK EAD, National Electricity Company
- Georgia – Georgian State Electrosystem (GSE)
- Moldova – Moldelectrica
- Romania – Transelectrica
- Turkey – Turkish Electricity Transmission Company
- Ukraine – Ukrenergo



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SECI Project Participants



- Albania – Transmission System and Market Operator **(OST)**
- Bosnia and Herzegovina – Independent System Operator in BiH **(NOS BiH)**
- Bosnia and Herzegovina – Electricity Transmission Company of BiH
- Bulgaria – NEK EAD, National Electricity Company
- Croatia – **Croatian** Transmission System Operator LLC **(HOPS)**
- Kosovo – Transmission System and Market Operator (KOSTT)
- Macedonia – Macedonia Transmission System Operator **(MEPSO)**
- Montenegro – **Montenegrin Transmission System Operator (CGES)**
- Romania – Transelectrica
- Serbia – JP Elektromreza Srbije (EMS)
- Turkey – Turkish Electricity Transmission Company **(TEIAS)**
- Italy – TERN **(observer)**
- Slovenia – Elektro Slovenia **(ELES)** **(observer)**



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SECI & BSTP Accomplishments



> 200 Participants Trained in the application of PSS/E, financial analysis, electricity market operations
Sustainable Expert Working Groups & Centers of Excellence

> \$1 billion worth of transmission investments leveraged through the use of SECI & BSTP models for new internal & interconnection lines

AGT Power Bridge & Montenegro – Italy Interconnection



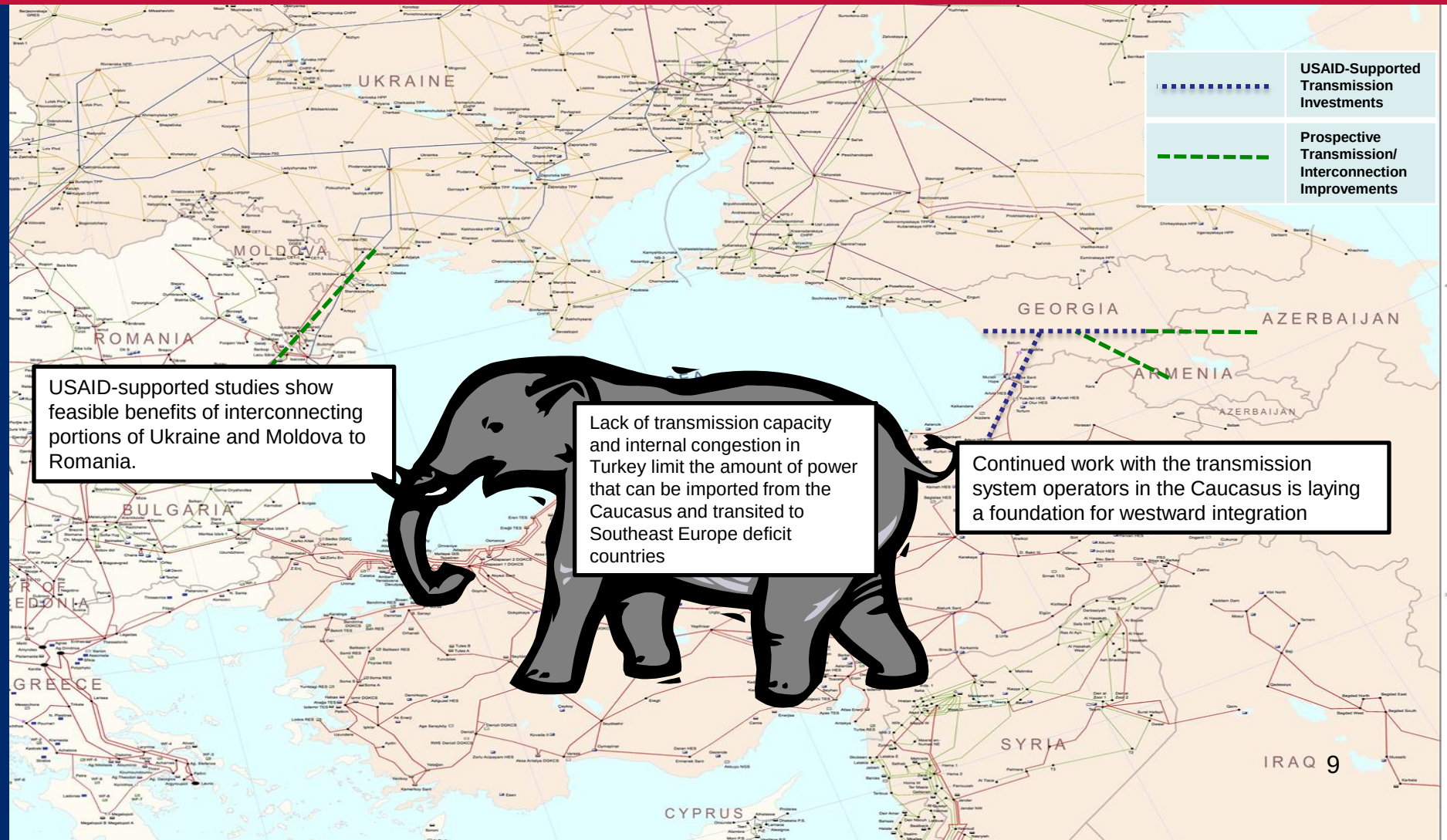
Models & forecasts have proven accuracy & are most detailed available in the E&E



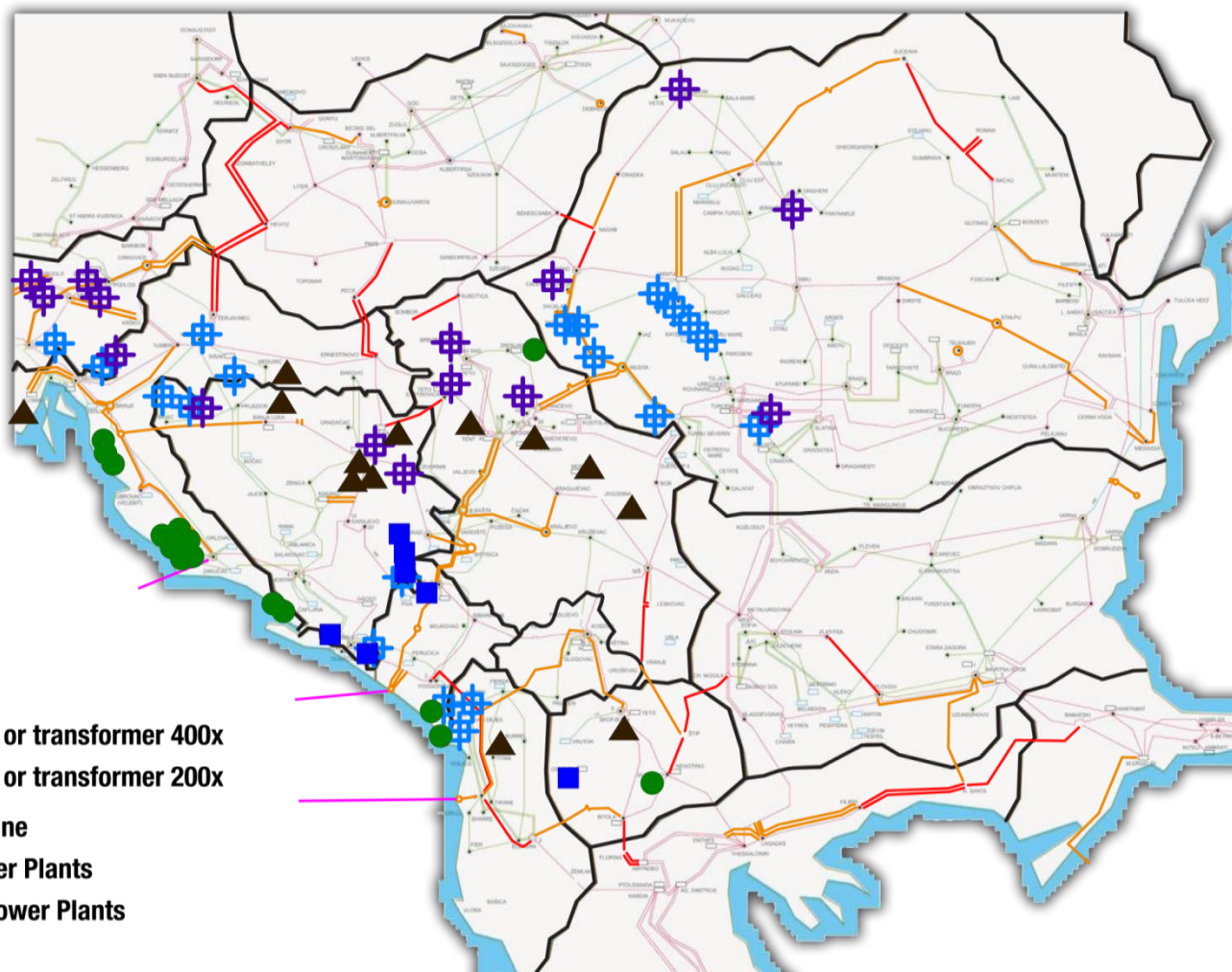
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Internal Congestion & Reliability Issues Limit Integration of Clean Energy



Almost All Regional System Operators & Developers Use SECI Models for Project Development



**Transmission
Reinforcements**

**Queued
Reinforcements**

**Congestion
Limitations**

**Clean Energy
Generation**

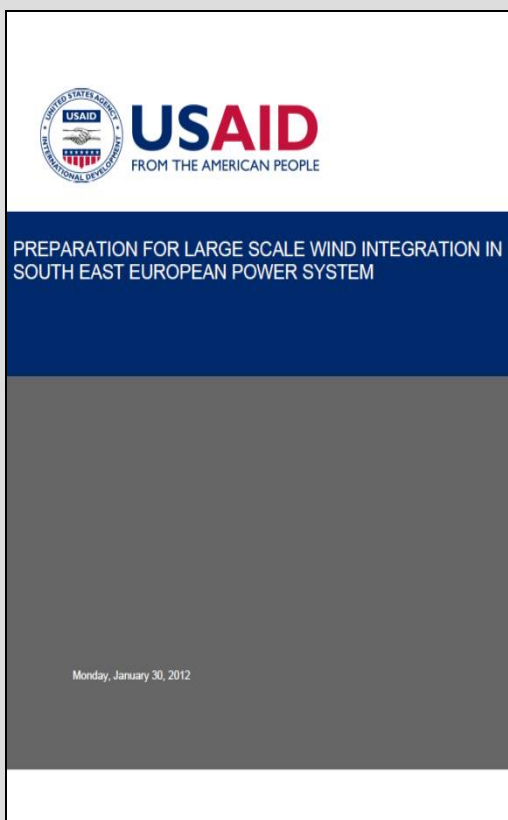
- ✚ Line 400kV or transformer 400x
- ✚ Line 200kV or transformer 200x
- Wind Turbine
- Hydropower Plants
- ▲ Thermal Power Plants



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SECI: Preparation for Large Scale Wind Integration in Southeast European Power System



- Ambitious Renewable Energy Supply (RES) Targets in SEE, especially wind generation
- Study Reviewed RES: Targets, Existing Wind Studies, Legal/Regulatory Framework, Technical Standards for each SECI Country
- Conducted Regional Network Load Flow Analysis Assuming Large Scale Penetration of Wind Generation **and identification of potential network bottlenecks**



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Planned WPP Installed Capacity by 2020

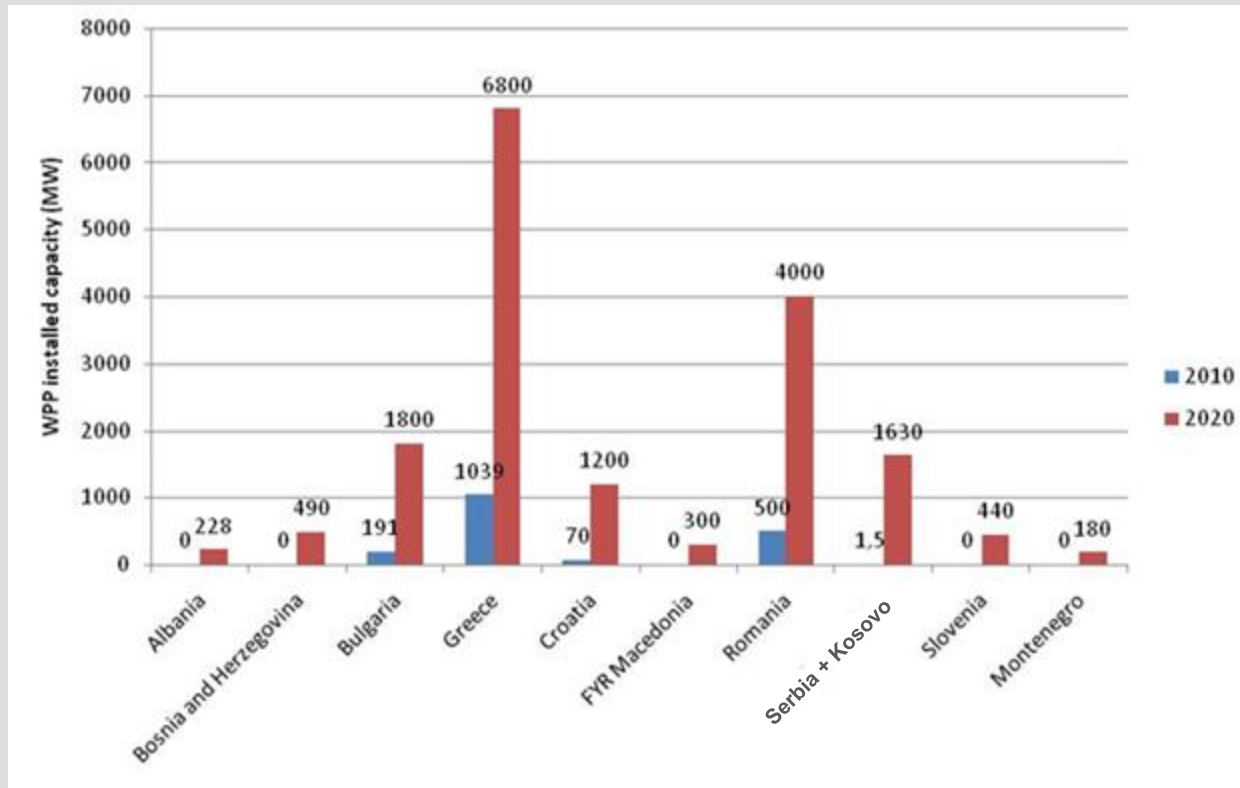




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WPPs in 2010 and 2020



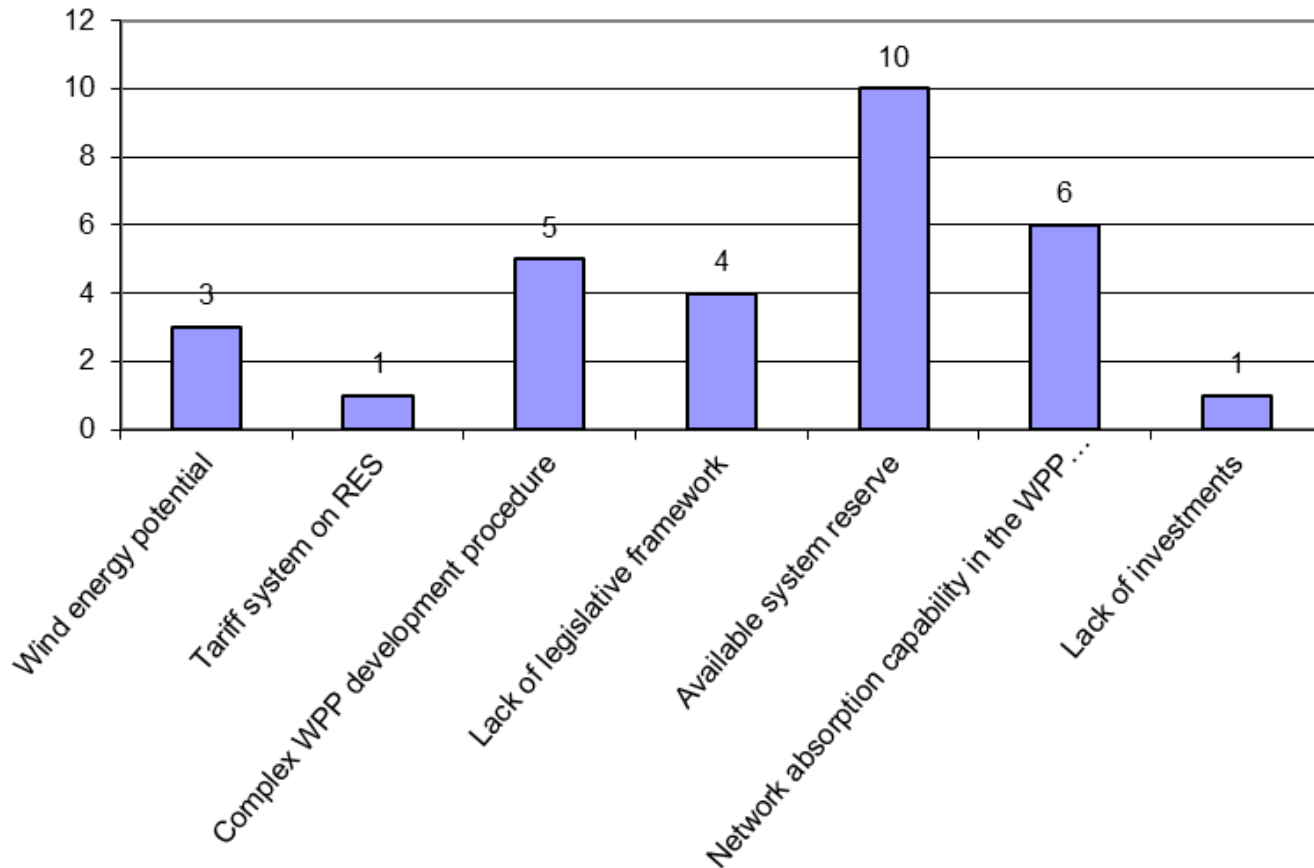


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Limits for large scale WPP integration

Limiting factors for larger WPP intergration

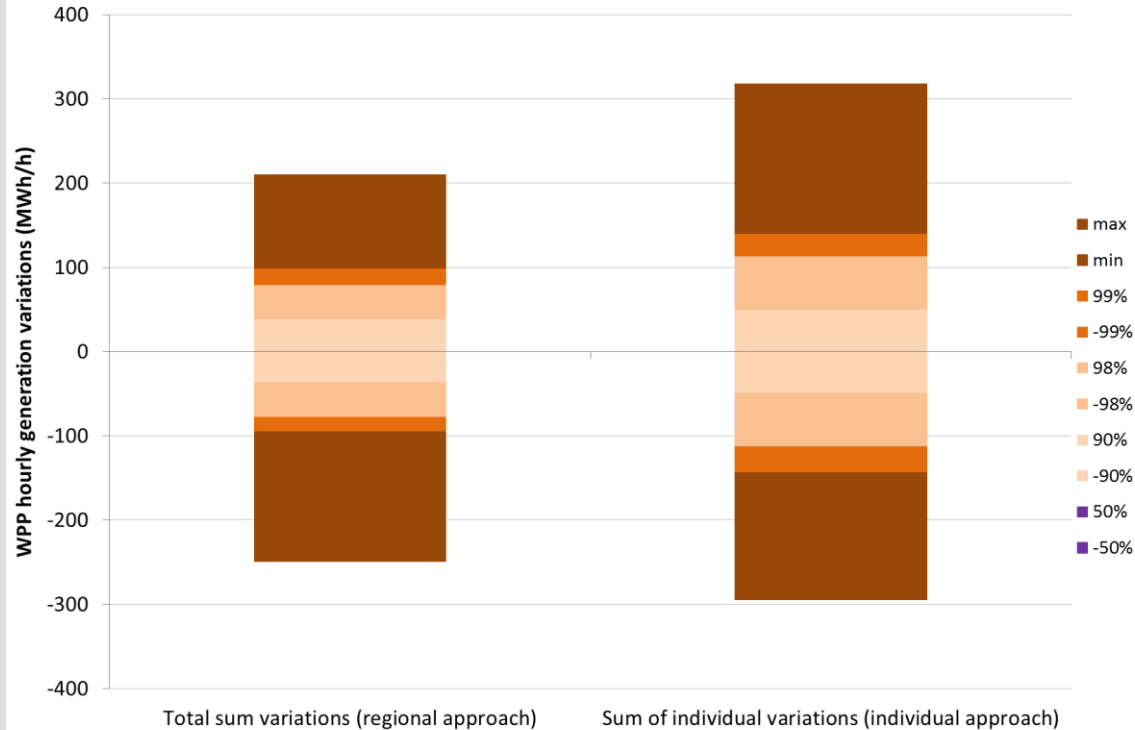




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Experience with WPP Variability in 2011 for CRO, BG, ROM



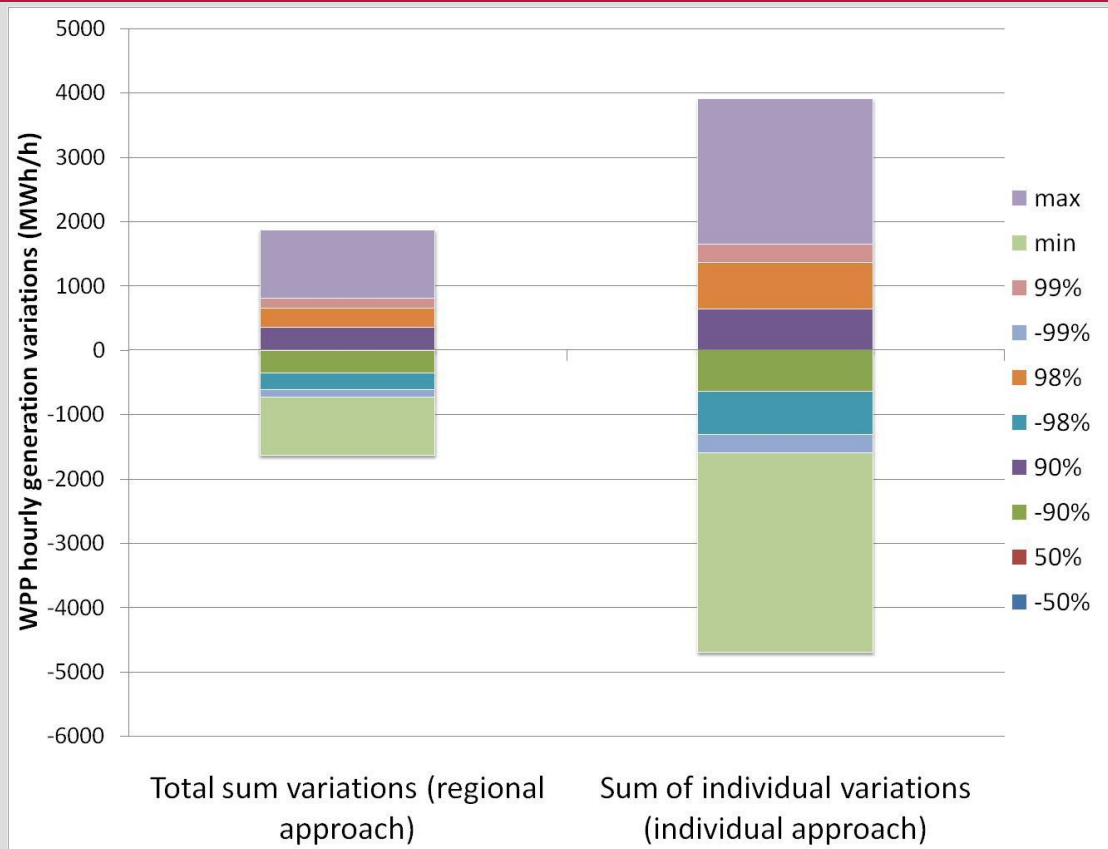
Regional approach for just 3 countries would result with significant decrease (15-35%) of system reserve needed for WPP balancing



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Total SEE WPPs Variations in 2020



Regional approach for all regional countries would result with significant decrease (>50%) of system reserve needed for WPP balancing



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Regional Approach Benefit

Comparing these regional variations to the country variations, we get clear benefit of the regional approach of WPP integration:

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

Regional approach would decrease total reserve needed by -2600 MWh/h and +2000 MWh/h and release it for market activities.



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