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

Delivery Mechanisms Support ETAG Objectives

Southeast Europe Cooperation Initiative (SECI) Transmission Planning Project

Black Sea Regional Transmission Planning Project (BSTP)

Regional DISCO Security of Supply Working Group

Utility Commercialization Privatization & Market Transformation Partnerships with US utilities

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
SECI & BSTP Project Development

1. Needs Assessment
2. MOUs Executed
3. Provision of PSS/E Planning of Software
4. Ongoing Capacity Building for Planning Software
5. National Network Model
6. Regional Network Model Integration
7. Working Group Meetings
8. Network Model Updates and Analysis
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
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 – TERNA (observer)
- Slovenia – Elektro Slovenia (ELES) (observer)
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
Prior to SECI, interconnections between countries and network stability were limited. SECI studies have facilitated transmission reinforcements. Utilities work through SECI to "queue" additional network internal congestion & reliability issues limit integration of clean energy.

USAID-supported studies show feasible benefits of interconnecting portions of Ukraine and Moldova to Romania.

Lack of transmission capacity and internal congestion in Turkey limit the amount of power that can be imported from the Caucasus and transited to Southeast Europe deficit countries.

Continued work with the transmission system operators in the Caucasus is laying a foundation for westward integration.
Prior to SECI, interconnections between countries and network stability were limited. SECI studies have facilitated transmission reinforcements to accelerate electricity trade. Utilities work through SECI to "queue" additional network reinforcements for electricity market backbone infrastructure.

Network congestion limits clean energy integration. Almost all regional system operators & developers use SECI models for project development.

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

- Line 400kV or transformer 400x
- Line 200kV or transformer 200x
- Wind Turbine
- Hydropower Plants
- Thermal Power Plants
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
Planned WPP Installed Capacity by 2020

\[
P_{\text{inst}}(\text{WPPs in 2020}) = 17,068 \text{ MW}
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Source: ENTSO-E PEMD
WPPs in 2010 and 2020

\[ P_{\text{inst}}(\text{WPPs in 2020}) = 17,068 \, \text{MW} \]

Source: ENTSO-E PEMD
Limits for large scale WPP integration

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