Global experiences in cross-border power system integration

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Power systems planners must balance competing goals.

Effective transmission planning and regional integration can help resolve the energy trilemma, especially when other technology options are limited.
Regional integration: a matter of degree

“If you want to go fast, go alone; if you want to go far, go together.”

Consolidated systems are best able to meet the technical requirements of decarbonisation, but require strong jurisdictional alignment. Coordinated systems require significant harmonisation, ideally supported by regional institutions.
What role for institutions in an interconnected world?

**National responsibilities**
- National development plans
- Establishing tariffs
- System/market monitoring
- Reliability/security standards and grid codes

**Regional responsibilities**
- Coordinated planning
- Transmission cost allocation; wheeling charges
- Participation of external resources in power system
- Harmonising reliability standards and grid codes
### Different models for regional institutions

| Loose cooperation | • ASEAN Energy Regulators Network  
|                   | • MedReg (Mediterranean region)  
|                   | • NordReg (Nordic Region) |
| Limited regional authority | • ACER (EU)  
|                           | • CRIE (Central America) |
| Strong regional authority | • FERC (US)  
|                           | • NERC (North America)  
|                           | • CERC (India) |
EU power system integration: an ever closer union

Interconnection level assuming all Projects of Common Interest (PCIs) are completed

The EU goal of a single, Internal Energy Market (IEM) is driven by a “market first” approach: free movement of goods, people, capital... and electrons.
Benefits of power system integration: increased reliability

Loss of Load Expectation in 2020 for isolated systems and integrated regions (EU)

Historically, cross-border power sector integration often starts with the sharing of primary reserves.

Source: ENTSO-E
North America has many (at times overlapping) jurisdictional boundaries. Reliability standards have evolved from voluntary to mandatory.
Western Energy Imbalance Market (WEIM)

- Markets are already well interconnected, but rising VRE is driving deeper integration
- WEIM is a voluntary market, with CAISO as market operator
  - CAISO organizes market and, therefore, takes on regional responsibilities
- Economic and environmental benefits are real and significant
  - USD 143 million saved (2014-16)
  - 10 000 tonnes of avoided CO₂
  - Reduced reserves requirements (btw 400 and 500 MW)

Source: CAISO
Central America: developing the SIEPAC line

SIEPAC development and trade is supported by a number of regional institutions: CRIE (regulator); EOR (system operator); EPR (transmission owner); CDMER (economic development). Imports are a small % of domestic consumption.
Latin America: an electricity superhighway?

Regional initiatives in South America

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Source: ISA ETESA, IEA research
Regional integration can help resolve the “energy trilemma”
- Economics, security and environment

Integration is a matter of degree
- No one path, but clear direction helps

Need to consider relevant jurisdictional boundaries
- Political, geographic, technical

Of crucial relevance: the boundaries of decision making
- Are roles and responsibilities clearly defined?
- Is decision making free of outside influence?
- Are decisions enforceable?