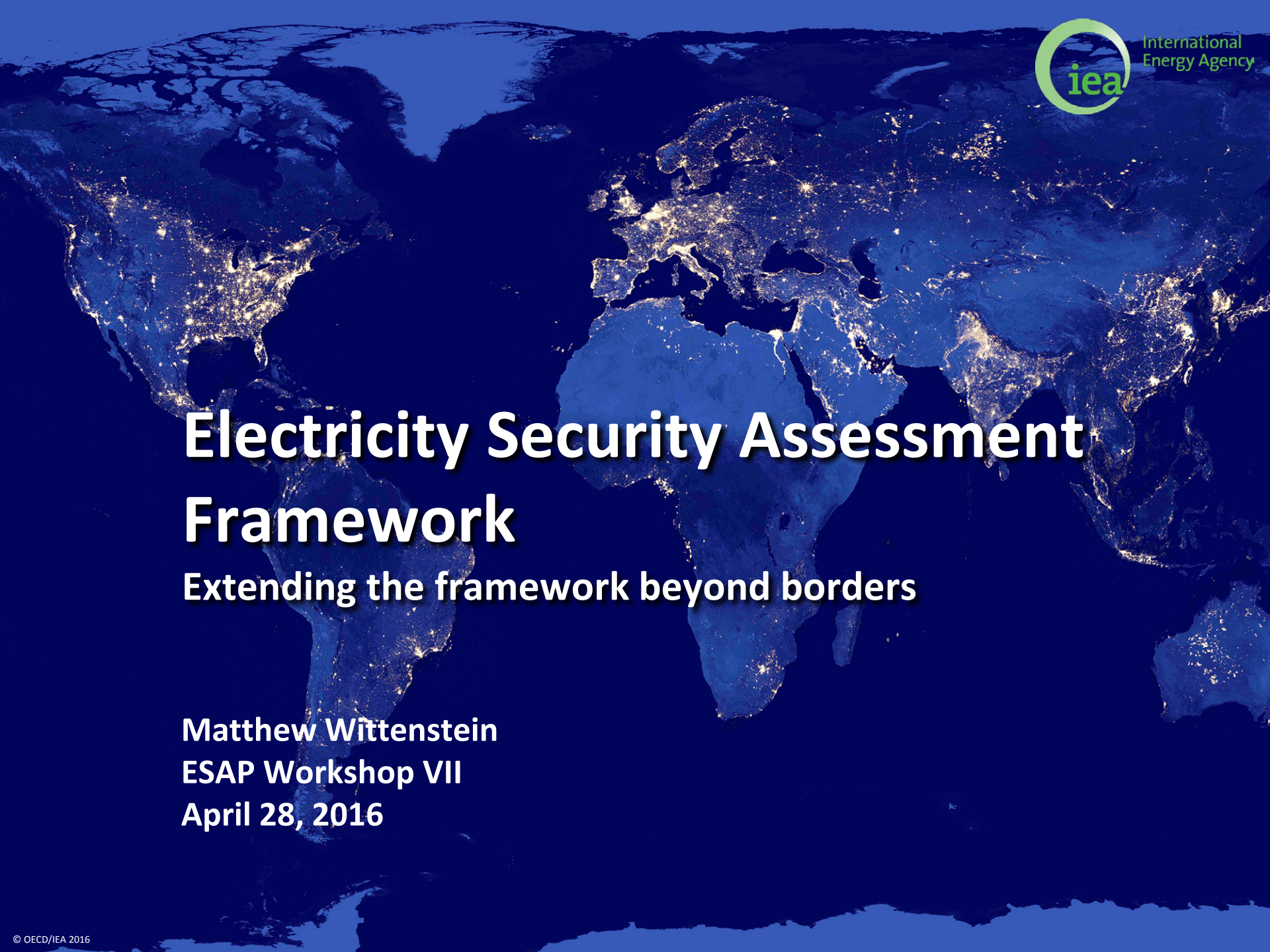

Electricity Security Assessment Framework

Extending the framework beyond borders

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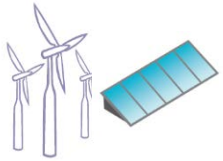
ESAP Workshop VII

April 28, 2016

Keeping the lights on while transforming the power system

- **Electricity security is increasingly urgent:**
  - **Share of electricity is growing fast and delivering it reliably is critical to the global economy.**
- **Maintaining the security of the electricity supply is key for social and political support for decarbonisation.**
- **Increasingly connected power markets means increased exposure to external risks**
- **IEA activities on electricity security:**
  - **IEA Electricity Security Action Plan (ESAP)**
  - **February 2016 publication, "Re-Powering Markets," addresses electricity security issues in-depth.**

Electricity security: a multifaceted challenge

	External threats	*Internal policies and regulations*
Basic principles	 **Fuel Security**	 **Capacity adequacy & system security**
Specific dimensions	 **Resilience**	 **Grid integration of variable renewables**
	 **Cyber Security**	 **Distributed & smart technologies**

Key features of the framework

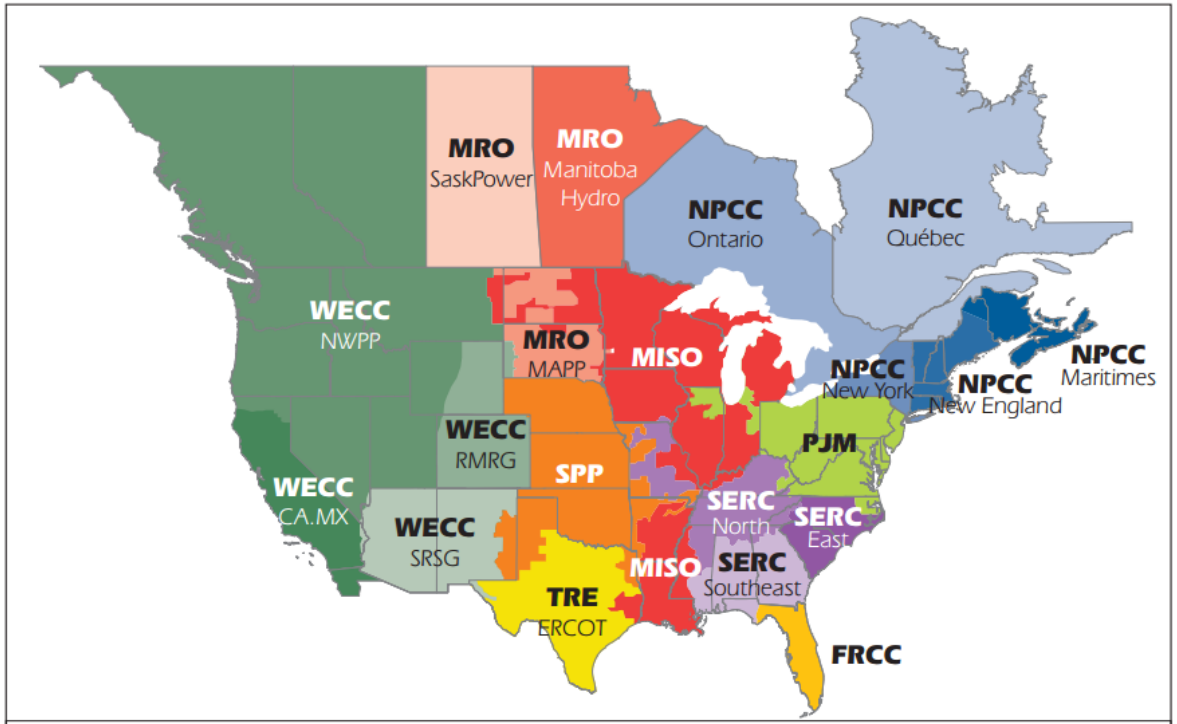
- Integrated framework to facilitate IEA member country peer review processes (ERR, IDR)
  - Developed by Doug Cooke in 2013
- Areas of focus:
  - Governance and market arrangements
  - Power system security
  - Power system adequacy
- Should also consider temporal issues
  - Short-term (system operations, emergency response, etc.)
    - IEA context: Emergency Response Reviews
  - Long-term (system planning, resource adequacy, fuel security)
    - IEA context: In-depth Reviews

Why update the framework?

- Current framework focuses on national or jurisdictional electricity security
- Many recent blackouts extend across borders
  - Italy-Swizterland 2003; US-Canada 2003; Europe 2006; India 2012
- Power flows are less predictable, more dynamic, and moving across longer distances
- Cross-border security issues are currently peripheral to IEA assessment goals
  - Contribution of neighboring jurisdictions to local security
- No comprehensive IEA analysis on regional security

What do we mean by "across borders"?

Map 7.2 • RTOs, ISOs and NERC regional entities



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: IEA, 2014d.

- Primary focus is borders between balancing areas
- Inherent tensions between various jurisdictional boundaries:
  - State vs Federal
  - National vs Supra-national

Framework: Governance across borders

- **Legislation, rules and standards**
  - Proper incentives for cross-border security
  - Clearly defined roles and responsibilities
  - Harmonized security standards
- **Regulatory and institutional frameworks**
  - Transparent and inclusive regulatory practices
  - Policy alignment
  - Regional institutions
- **Market arrangements**
  - Common or harmonized market designs
  - Appropriate investment and operation signals

Framework:
System security across borders

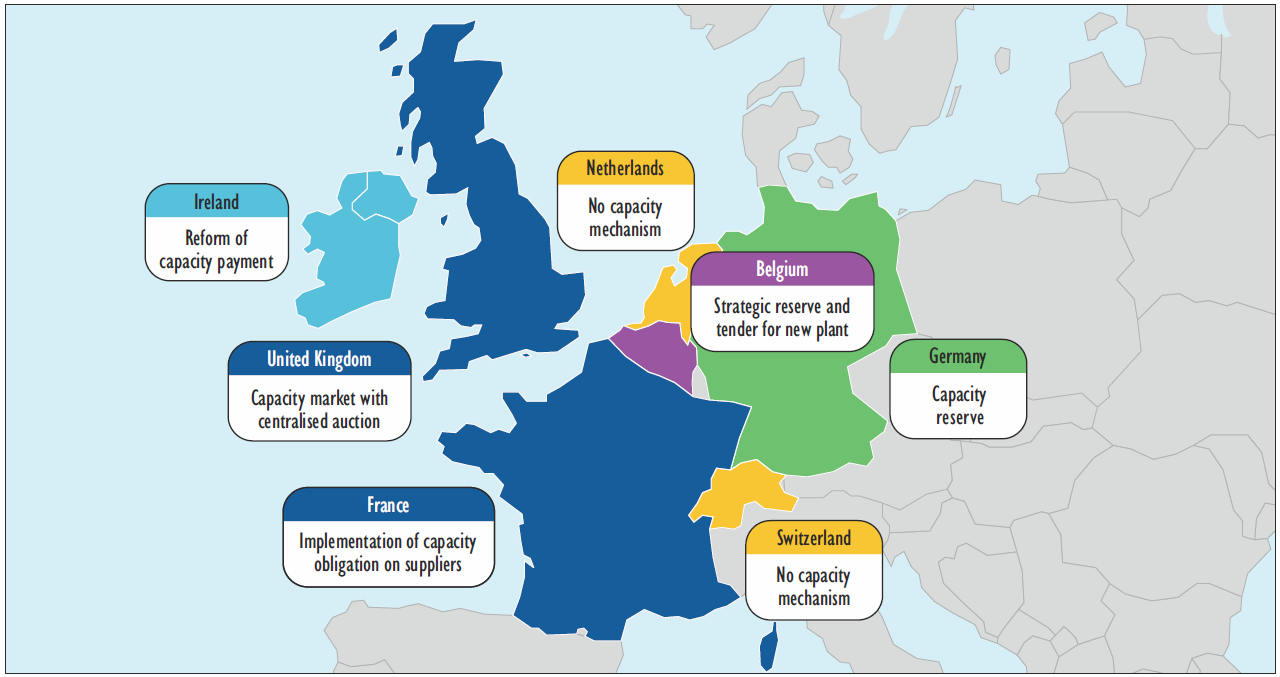
- **Emergency response resources**
  - Cross-border resource assessments
- **Situational awareness**
  - Regular or real-time sharing of information
  - Jointly managed control centers
- **Coordination**
  - Joint emergency response and power restoration activities
- **Communication**
  - Established communication protocols
  - Clear lines of responsibility

Framework: Resource adequacy across borders

- Resource adequacy
  - Sharing of reserves
  - Coordinated or joint system planning
  - Joint development of fuel infrastructure (pipelines, storage)
- Diversity
  - Interconnections to leverage regional resources
- Flexibility
  - Degree of inter-regional trade
  - Stability limits on interconnections

Cross-border trading of capacity

Neighbouring capacity mechanisms in North-West Europe



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Europe is moving toward a common wholesale market design (market coupling) but divergent capacity market designs

Next steps

- Developing a formal framework for evaluating electricity security at a regional level
- Regional case studies (tentative)
  - Focus on regions?
    - Europe
    - North America
    - Southern Africa
    - Southeast Asia
  - Or focus on topics?
    - Market coupling in the EU
    - Establishing regional institutions to support security (e.g. NERC)
    - Developing power pools in Africa
- Electricity Security Across Borders publication (2017)

Some open questions

- Where are the best examples of maintaining cross-border electricity security?
- Which requires more work: short-term (operational) issues or on long-term (adequacy) issues?
- What is the appropriate balance between jurisdictional versus supra-regional authority?
- What is the proper role for the IEA in addressing this question?
- Does the assessment framework capture all relevant focus areas (governance, system security, adequacy)?