Regulatory road maps for the integration of an increasing amount of variable DG/RES-E

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Outline

1. **Goal**

2. **Regulatory road map methodology**

3. **Country-specific road maps**
   - Denmark, Germany, Netherlands, Spain, United Kingdom
   - Illustration and main action points

4. **Concluding remarks**

1. Goal

- **Translate analysis on response options into regulatory actions**
  → Priority setting
  → Put regulatory actions in time perspective
- **Systematic approach to variable DG/RES-E impact, market and network integration issues and implementation of response options**
- **Road map methodology**
- **Country applications**

2. Regulatory road map methodology

- **Regulatory road map:**
  - Identifies the required regulatory developments for an optimal integration of variable DG/RES-E in electricity systems
  - Identifies required regulatory actions
  - Identifies responsible actors

- **Methodology needed to**
  - Derive specific regulatory actions required when striving for optimal integration of variable DG/RES-E in time,
  - based on variable DG/RES-E developments
  - while taking into account country specific characteristics

2. Regulatory road map methodology

- **Variable DG/RES-E integration has two dimensions:**
  - Network integration
  - Market integration

- **Increasing amount of variable DG/RES-E**
  - System impact (among other factors) dependent on penetration level
  - Different market and network integration issues emerging at different levels

- **Three tables:**
  - Different stages of network integration of DG/RES-E
  - Different stages of market integration of DG/RES-E
  - Response options for different levels of DG/RES-E integration

2. Regulatory road map methodology

*Stages of **market** integration*

	Stage	Description	Criteria (market integration issues)	Recommendations
A	Protected niche market	• Low penetration level of DG/RES-E • DG/RES-E outside the markets	• Wholesale market access • Variable DG/RES-E negligible impact on markets	• Focus on economic viability DG/RES-E, priority dispatch, feed-in tariff regime
B	DG/RES-E in the market	• Moderate penetration level of DG/RES-E • DG/RES-E participates partly in supply side of ancillary services market. • DG/RES-E has little to moderate effect on market prices.	• Wholesale market access, limited access to other markets • Moderate impact in system balancing costs • Need for differentiated market prices to reflect system conditions	• Move to feed-in premium • Introduce basic interval metering • Regime of balancing responsible parties • Facilitate interuptible contracts
C	Active DG/RES-E	• High penetration level of DG/RES-E • DG/RES-E provides all kind of ancillary services when profitable • DG/RES-E has moderate to high effects on market prices	• DG/RES-E enters other markets (ancillary services, balancing) • Substantial increase in system balancing cost • Demand-side involvement in balancing and ancillary services market	• Implementation of smart metering • (Regional) market-based congestion management • DG/RES-E involvement in all markets

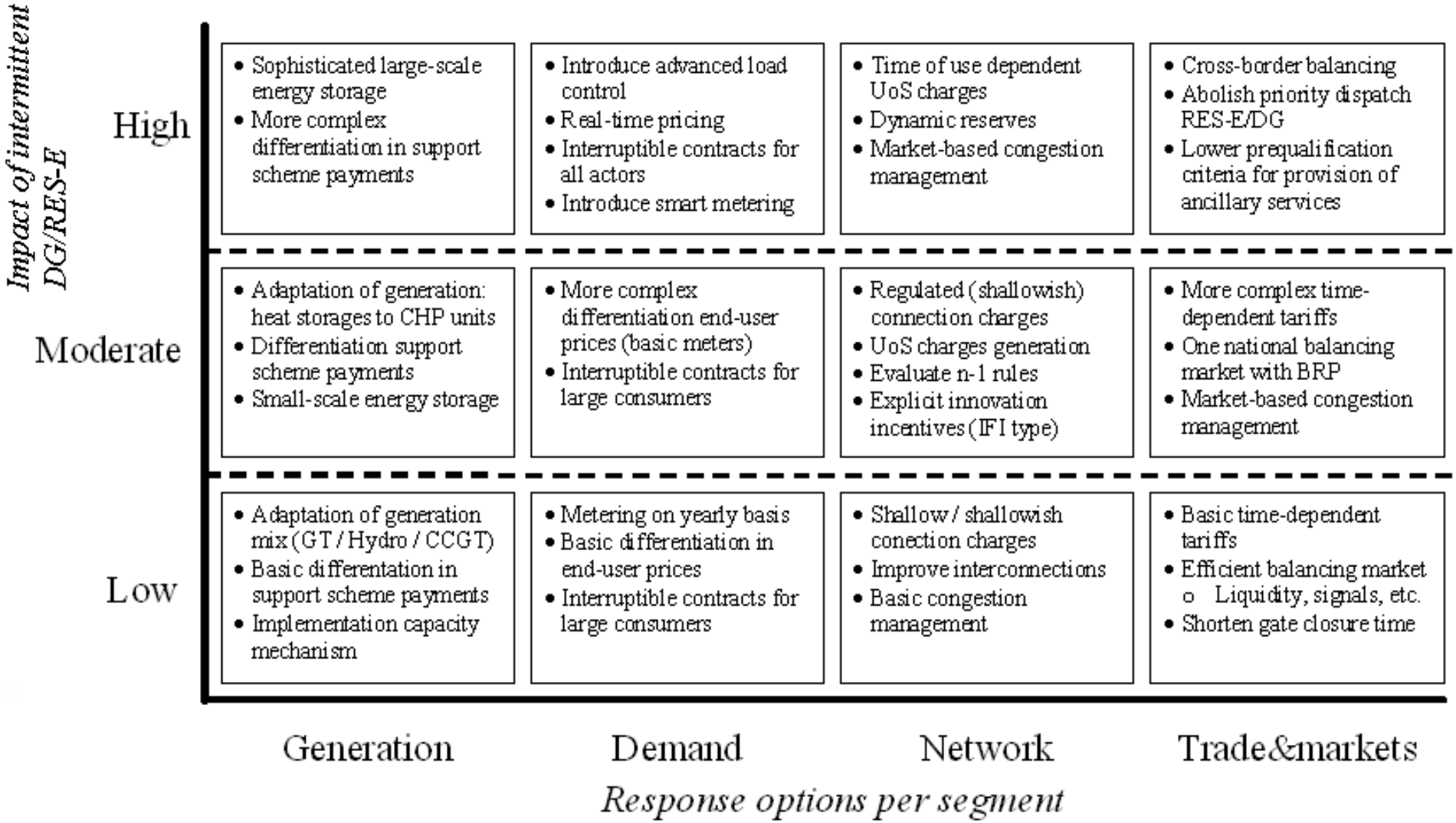
2. Regulatory road map methodology

*Stages of **network** integration*

	Stage	Description	Criteria (network integration issues)	Recommendations
II	Performance-based networks	Regulated network access, cost-driven, incentives for efficiency improvements	• Negotiation on connection costs • Limited network reinforcements • Limited congestion due to variable DG/RES-E	• Shallow regulated connection charges (mandatory access) • Basic congestion management
III	Enhanced performance-based networks	Regulated network access, incentives for efficiency, incl. quality incentives & basic innovation aspects.	• Increasing network integration costs (especially distribution) • Differential impact across distribution networks • Increasing congestion	• Shallow regulated connection charges plus basic use of system chages • Account for differential DG/RES-E impact across networks
IV	Innovative passive networks	Innovative distribution network (monitoring and limited control possibilities), incentives for innovation, active transmission network	• Increasing network integration costs (upward flows) • Proper incentives for network operators and generation / load • Increasing congestion	• Basic time/location differentiated connection & use of system charges •DG/RES-E in network planning • Market-based congestion management
V	Innovative active networks	Holistic approach, fully active networks, regulation incl. active role generators & load	• Increasing network integration costs • Proper incentives network operators & generation and load • Increasing congestion	• Time and location differentiated connection & use of system charges • Smart-meters • Active network management

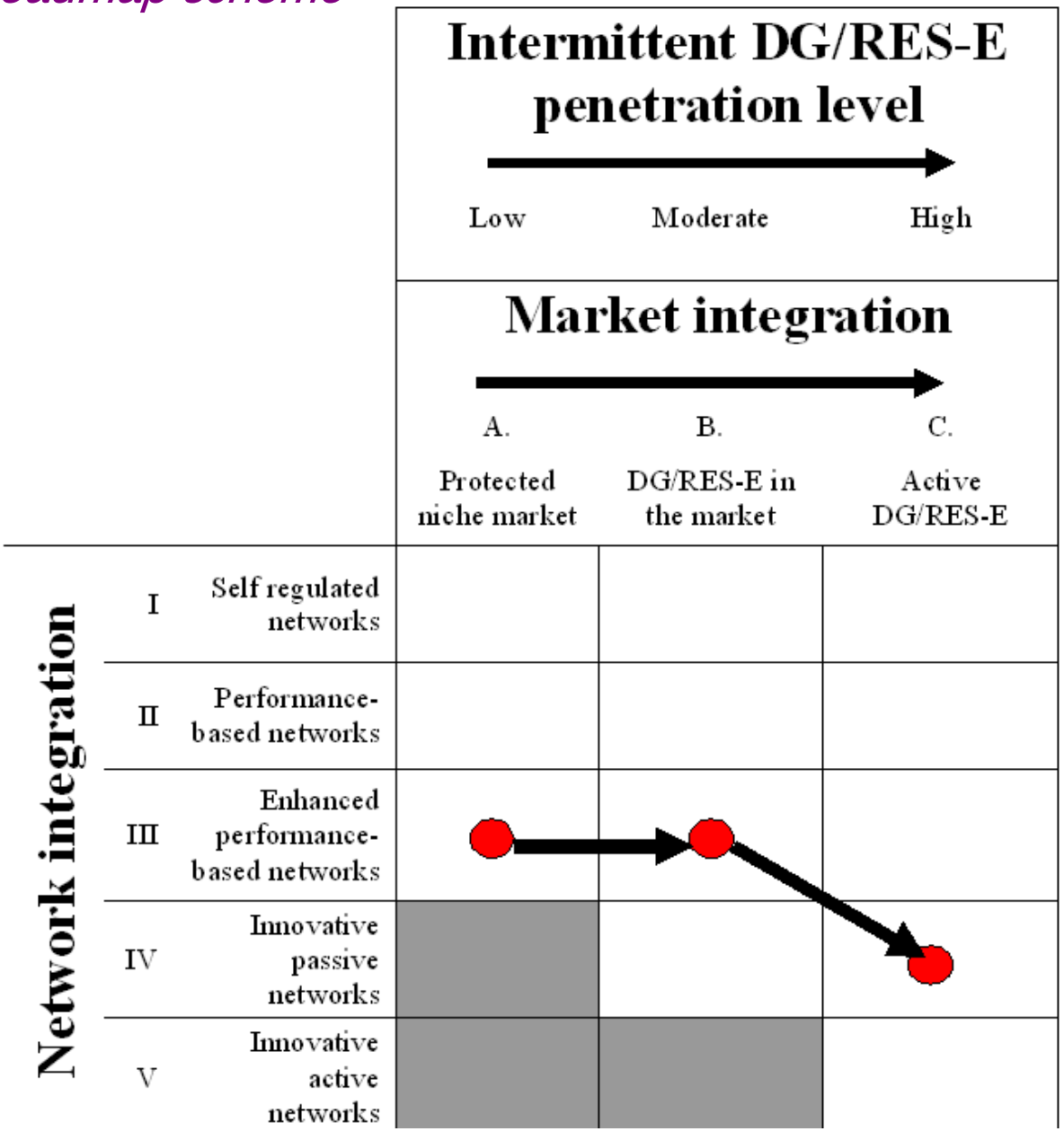
2. Regulatory road map methodology

Response options



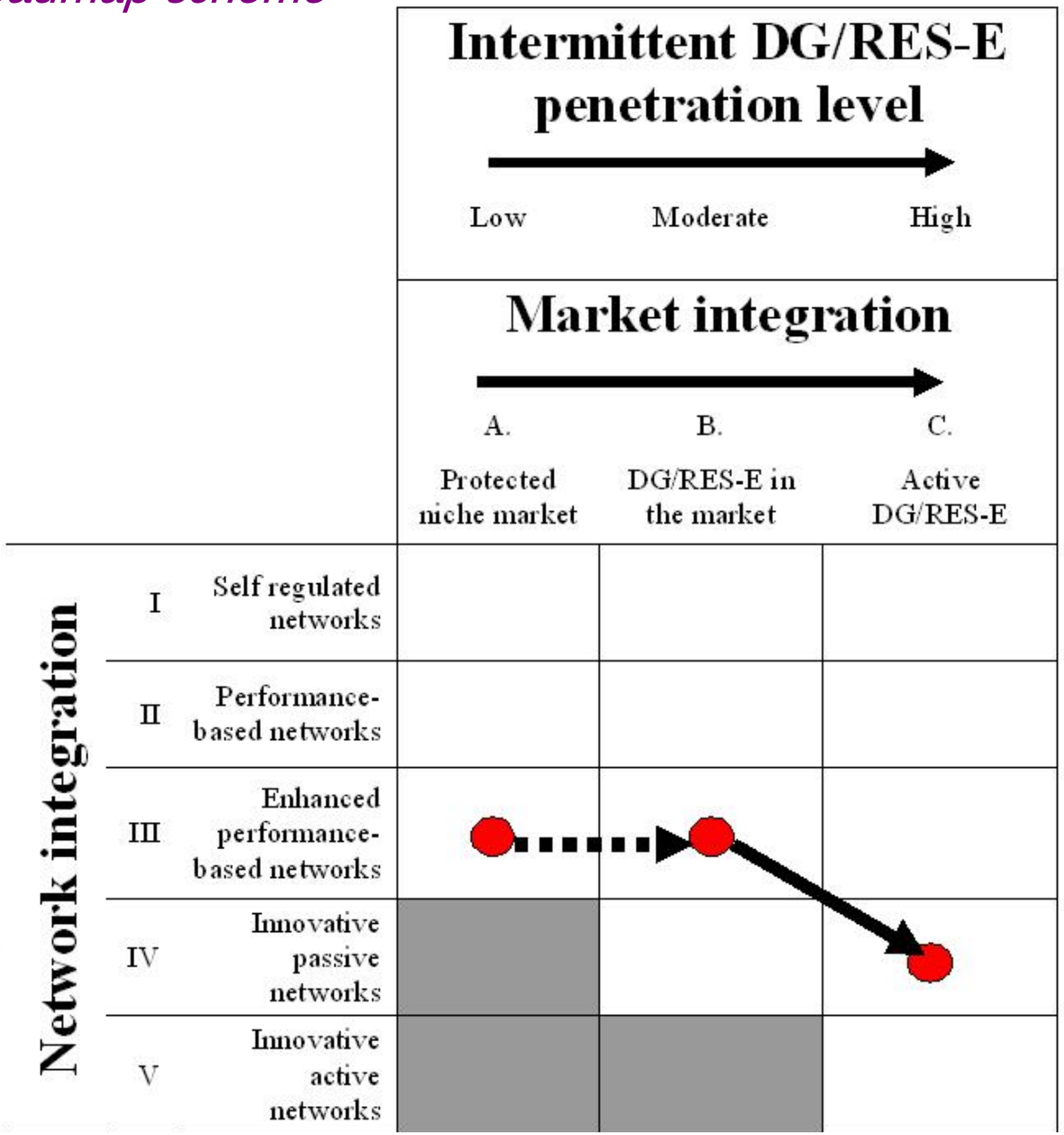
2. Regulatory road map methodology

Generic roadmap scheme



2. Regulatory road map methodology

Generic roadmap scheme



3. Country-specific road maps

- **Countries, and hence, road maps differ with respect to:**
  - Electricity market transition (technological potential / choices)
  - (variable) DG/RES potential
    - Level and technology
  - Network structure
    - Density, type of network, match in generation & load
  - Market design
    - Market rules, institutions

3. Country-specific roadmaps

Illustration: Regulatory road map for Spain

Step 1:

- Assess DG/RES-E development and electricity system transition

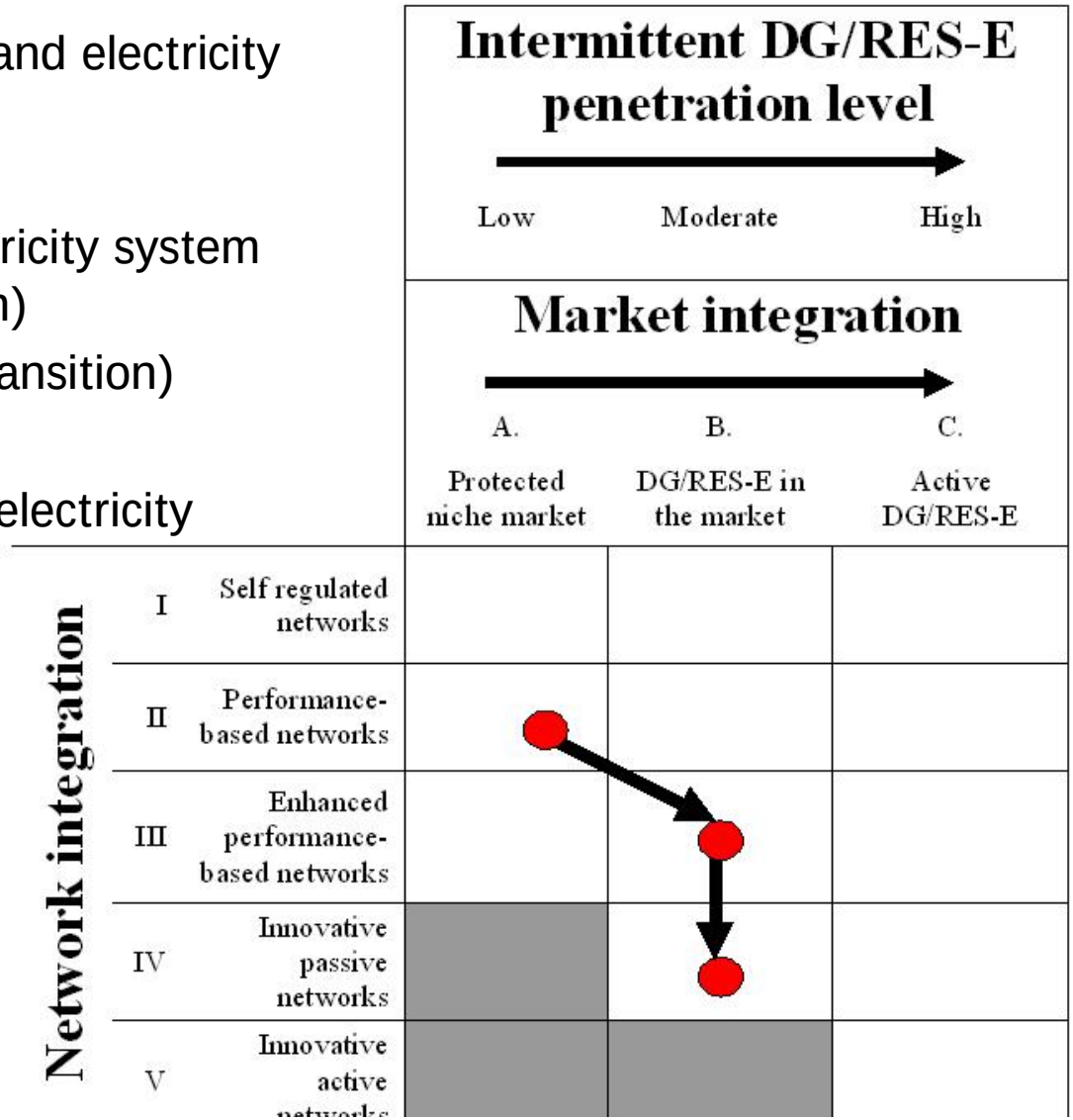
Step 2:

- Characterization of current electricity system (network and market integration)
- Given country characteristics (transition)

Step 3:

- Identify likely 'end-state' of the electricity system

→ Identify regulatory road map



3. Country-specific roadmaps

Illustration: Regulatory road map for Spain

- Step 4: Identify action points
- Main action points:
  - Implement use of system charges for generation (location incentives)
  - Improve network connections (national and international)
  - Implement system of balancing responsible parties

Category	Action	Responsibility		Term
		Prepare	Approve	
Network integration	Implement additional measures for increased interconnections. E.g. allow merchant investment, improve coordination with respect to regulatory processes, et cetera.	Regulator/Government	Government	Short
	Encourage further international coordination in regulation and network operations.	Regulator/ TSO	-	Short
	Implementing innovation incentives in network regulation.	Regulator/Government	Government	2012
	Implement use of system (UoS) charges for generation.	Regulator	Government	Medium
	Implement shallow connection charges.	Regulator	Government	Medium
	Implement market-based congestion management methods on (inter)national network connections	Regulator	Government	Medium
Market integration	Liberalize the last part of the retail market	-	-	Short
	Implement system of programme responsible parties	Regulator/Government	Government	Short
	Implement different balancing zones (tariffs), possibly with final end-consumer compensation.	TSO	Government	Medium
	Implement supporting measures for flexible electricity generation units (gas) and (large) hydro-storage units (for example via capacity mechanism) when investments are lacking / not materialising (for example via capacity mechanism).	Government	Government	Continuous

3. Country-specific roadmaps
Main action points

Germany

- Increase efficiency of balancing market
- Implement market-based congestion management
- Introduce explicit innovation incentives in network regulation
- Implement dynamic reserve requirements

Denmark

- More price reflective use of system charges for generators
- Establish common standard for functionality of smart meters
- Implement basic time-differentiated prices for all consumers
- Implement dynamic reserve requirements

3. Country-specific roadmaps
Main action points

Netherlands

- Introduce use of system charges for generators
- Introduce explicit innovation incentives in network regulation
- Implement dynamic reserve requirements
- Allow for negative prices at power exchange

United Kingdom

- Implement market-based congestion management
- Implement more cost-reflective network charging methodology

4. Concluding remarks

- **Systematic approach to variable DG/RES-E impact, market and network integration issues and implementation of response options**

- **Five EU countries assessed with moderate to high level of DG/RES-E**
  - **Some common, some country-specific recommendations**

- **Road map derived action points are indicative**
  - **No quantification of response options**
    →Future research

- **General road map methodology applicable to other countries**

Thank you for your attention!

Questions?

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Additional slides

2. Regulatory road map methodology

Roadmap structure

1. Projections on development of DG/RES-E
   - Within fixed time horizon
   - Likely impact in combination with electricity system transition
2. Characterization of current electricity system
   - Current level of DG/RES-E
   - Current stage of network integration
   - Current stage of market integration
3. Identify likely end-state of electricity system
   - Expected impact of variable DG/RES-E level and accompanying market and network integration stage
4. Identification of regulatory roadmap and back-casting of regulatory actions
   - Short and long-term actions
   - Responsible actors