European University Institute
Robert Schuman Centre for Advanced Studies
Florence School of Regulation

Smart regulation for smart grids?

Jean-Michel Glachant
Director Florence School of Regulation
(with Leonardo Meeus)

Presentation based on study associating:
Marcelo Saguan and Ronnie Belmans

Overview

Introduction

1. What is expected from energy grids?
2. What are the grid company and user's incentives?
3. Regulatory challenges & regulatory tools
4. Smart Grid case studies

Conclusions

Introduction

- *Context*: 1-Climate change & security of supply driving to decarbonization of electricity system

  2-Smart grids main challenges are system integration of DG, demand response and large-scale RES
- *Motivation for the report*: 1- Growing awareness that smarter grids need more than innovating grid technology

  2- Need to revisit regulation of grid services and regulations affecting grid users
- *Main contribution of the report*: 1-Investigate smart regulation for grids

  2- Looking at its three components: *grid technology innovation, **grid services, and ***grid user participation

1. What's expected from grids:
sample of European funded research projects

Project acronyms	Integration of DG	Integration of demand and storage	Integration of large scale RES
DISPOWER, DG Grid, ELEP, Sustelnet, SA-WSN, OPENNODE, INTEGRIS, IRED, CRISTAL HIPERDNO	√		
Fenix, EU DEEP, ADDRESS, G4V	√	√	
SMARTHOUSE/SMARTGRID, SMARTCODE, ALISTORE, ESMA, SMART-A, OPEN METER		√	
TradeWind, EWIS, RELIANCE, DOWNWIND, Greennet, IRENE-40S			√

1. What's expected from grids:
main expectations for grids in this sample

Integration of	Grid technology innovation	Grid services	Grid user participation
Distributed Generation	Active distribution grid operation	Flexibility in connection and access, proactive planning	Participate in pro-active planning and grid operation
Demand and storage	Metering and communication infrastructure	Information services	Save energy and peak energy
Large-scale RES	Off-shore grids	Cooperation among TSOs, flexibility in connection and access, proactive planning	Participate in pro-active planning and grid operation

2. Grid companies and users' incentives

- Grid companies

  1- They use inputs (resources) to produce outputs (grid services)

  2- Preferred approach to give incentives

  - Agreeing ex-ante on allowed revenue for defined tasks, length of period limited because costs uncertain and information asymmetry
  - Measured outputs, but outputs can be difficult to define, measure, etc

- Grid users

  1-They use a bundle of grid services when consuming or producing

  2- Preferred approach to give incentives

  - Cost reflective charges for grid services, but difficult to design, and information asymmetry

  3- Their incentives can be external to grid regulation (typical: support schemes; other one: white certificates and enhanced energy efficiency)

3. Regulation challenges & tools: *Grid services*

Regulatory challenges	**Regulatory tools**
Operational cost increases as costs of maintaining quality of supply	Correcting the distortion of incentives in the existing regulatory frameworks
Less energy distributed with DG and demand response integration	
Lack of incentives: no incentive to do the best or to do better than the minimum required	Potential for output regulation: e.g. rewards for DG capacity connected

3. Regulation challenges & tools:
Grid technology innovation

Regulatory challenge	**Regulatory tool**
Long term benefits with shorter term costs	Specific regulatory measures for grid technology innovation
Distributed benefits (leakage)	
Interoperability (enlarging leakage)	Standards

3. Regulation challenges & tools: *Grid user participation*

Regulatory challenge	**Possible regulatory tool**
Delivery of new grid services	Potential for output regulation on grid companies
Charging for new grid services	
Barriers blocking market signals (as regulated end-consumer prices)	Revisiting regulations affecting grid users' participation and being external to grid regulation?
Support schemes	

4. Case studies: introduction

	Challenge	Grid technology innovation	Importance of innovation
Orkney Islands	Integration of DG	Active management system of distribution grid	Among first implementations of its kind
Italy	Integration of demand and storage	Access to smart meters and customer feedback	Largest base of smart meters in the world
Kriegers Flak	Integration of large-scale RES	Multi-terminal HVDC connecting off-shore wind	First step towards a super grid

4. Case studies: main findings

	Regulatory tools applied	**Room for improvement**
Orkney Isles	Output regulation for innovation: Registered Power Zone Specific mechanisms for innovation: Innovation Funding Incentive *contributing to active grid management development*	User participation: only for newly connected DG, and unpredictable curtailing without compensation

	Regulatory tools applied	Room for improvement
Italy	Output regulation for user participation: visual display obligation for customer feedback, and energy savings incentive with white certificates and mandatory Time of Use prices *contributing to the use of smart meters*	Grid services: access to the smart meters for customers and third parties, which is ongoing
Kriegers Flak	Specific mechanism for innovation: European Economic Recovery Programme *contributing to a multi-terminal HVDC VSC by cooperating TSOs*	Grid services: incentives for TSOs to coordinate User participation: incentives for wind developers to coordinate with TSOs

Conclusions

1- New services have to be defined and measured (even using proxies, etc)
  - Innovation is not the target in itself
  - Grid users should participate to this definition as they are not willing to pay for services they do not value or did not ask for

2- Support of (risky) technology innovation needs to be conceived too while separately
  - Notably: public money too should contribute to ensure the electrical and GHG system transformation process

3- Regulatory frame has to open “experimental areas”
  - Test and pilots necessary to accumulate experience and to manage a typical “trial and error” learning process

Future research and today's debate

- This study: main challenges in smart grids context, while discussing each challenge alone
- In practice challenges often appear mixed like:

  1- Massive integration of plug-in electric vehicles includes elements of DG and demand & storage

  2- What regulated activities or infrastructures to be rolled-out by grid companies, and what left to competition (e.g. recharging installations for electric vehicles)?