# Smart regulation for smart grids?

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# Overview

**Introduction**

1. What is expected from energy grids?
2. What are the grid company and user's incentives?
3. How to align the incentives with the expectations?
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 |
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| **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. How to align the incentives with the expectations: *Grid services*

| **Expectations** | | |
|---|---|---|
| Operational cost increases as costs of maintaining quality of supply | | |
| Less energy distributed with DG and demand response integration | | |
| Lack of incentives to do the best | | |

# 3. How to align the incentives with the expectations: *Grid services*

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# 3. How to align the incentives with the expectations: *Grid services*

| **Expectations** | **Incentives** | **Smart regulation** |
|---|---|---|
| Operational cost increases as costs of maintaining quality of supply | Cut costs and improve quality of supply | Correcting the distortion of incentives in the existing regulatory frameworks<br><br>e.g. define, measure, reward new services |
| Less energy distributed with DG and demand response integration | Revenue depends on distributed energy | |
| Lack of incentives to do the best | Do what is minimally required | Potential for output regulation:<br><br>e.g. rewards for DG capacity connecte |

# 3. How to align the incentives with the expectations: *Grid technology innovation*

| **Expectations** | | |
|---|---|---|
| Long term benefits with shorter term costs | | |
| Distributed benefits (leakage) | | |
| Interoperability (enlarging leakage) | | |

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# 3. How to align the incentives with the expectations: *Grid technology innovation*

| Expectations | Incentives | Smart regulation |
|---|---|---|
| Long term benefits with shorter term costs | Cut costs, including innovation costs | Output regulation grid services can be a "market pull" for mature technologies<br><br>Design specific regulatory measures for grid technology innovation |
| Distributed benefits (leakage) | | |
| Interoperability (enlarging leakage) | | Standards |

# 3. How to align the incentives with the expectations: *Grid user participation*

| **Expectations** | | |
|---|---|---|
| Cost efficient consumption of grid services | | |
| Participate in the ongoing grid innovation, definition of new services, coordination with grid companies, etc | | |

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| **Expectations** | **Incentives** | **Smart regulation** |
|---|---|---|
| Cost efficient consumption of grid services | Grid regulation, e.g. charging for grid services | Potential for output regulation on grid companies |
| Participate in the ongoing grid innovation, definition of new services, coordination with grid companies, etc | Regulations external to grid regulation, e.g. support schemes | Revisiting regulations affecting grid users' participation and being external to grid regulation? |

# 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 |
| | | | |
| | | | |

# 4. Case studies: introduction

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| **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 |

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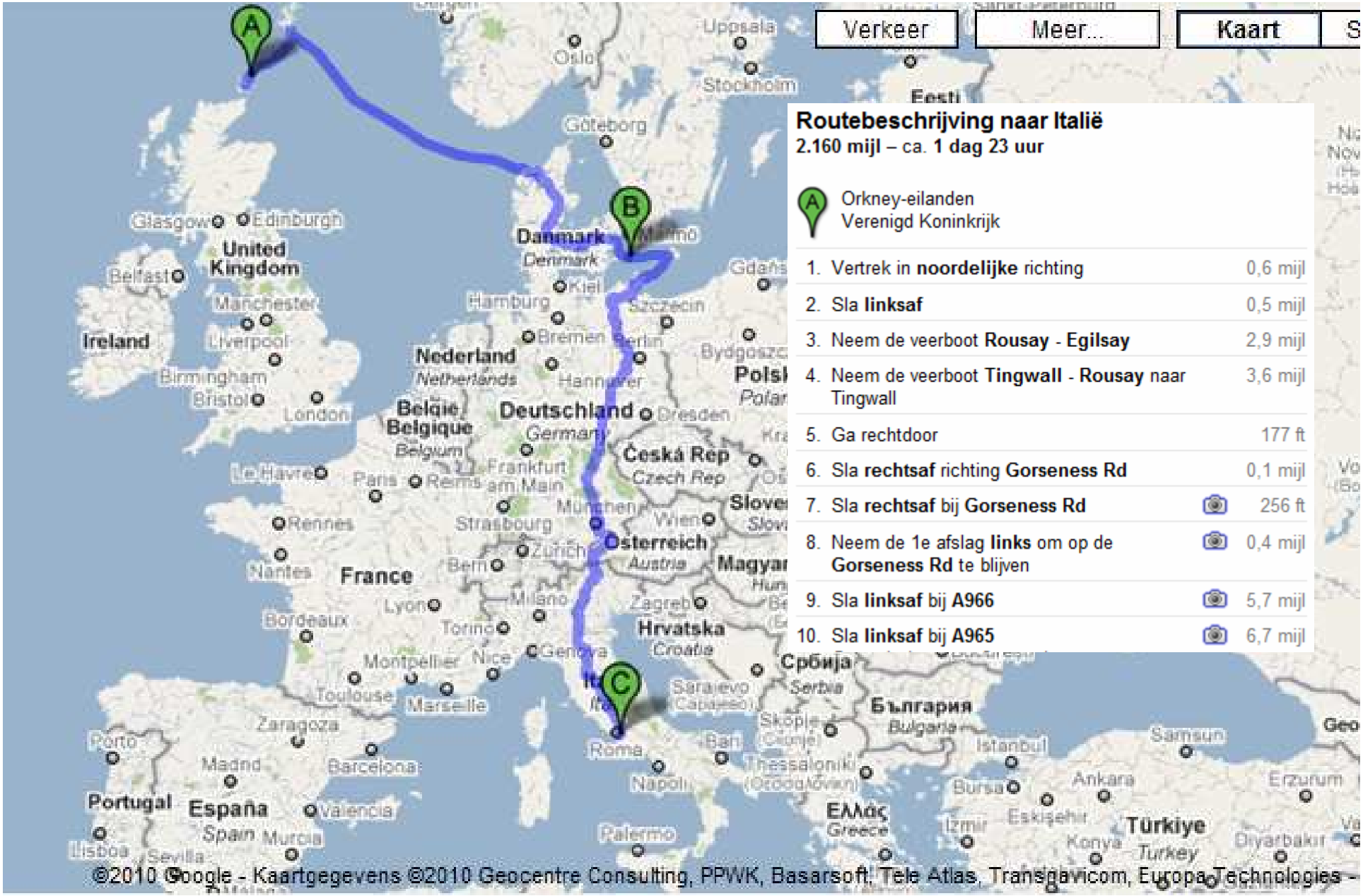

# 4. Case studies: main findings

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

# 4. Case studies: main findings

| | Regulatory tools applied | Room for improvement |
|---|---|---|
| **Italy** | Specific mechanisms for innovation:<br>WACC +2% for demonstration<br>Tariff component for R&D<br><br>Output regulation for user participation:<br>visual display obligation for customer feedback, and energy savings incentive with white certificates and mandatory Time of Use prices<br><br>*contributing to the use of smart meters* | Grid services:<br>access to the smart meters for customers and third parties, which is ongoing |

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| | **Regulatory tools applied** | **Room for improvement** |
|---|---|---|
| **Kriegers Flak** | Specific mechanism for innovation: European Economic Recovery Programme<br><br>*contributing to a multi-terminal HVDC VSC by cooperating TSOs* | Grid services: incentives for TSOs to coordinate<br><br>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 also needs to be conceived, while separately
  - Notably: public money too should contribute to ensure the electrical and GHG system transformation process
  - Strong governance (as investment planning process) to ensure the transition from R&D to value for money grid services

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