Integration of Distributed Generation in Electricity Supply Systems in Europe in the Medium and Long Term

Regulatory and business strategies

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USAEE/IAEE, Washington, July 10, 2004
Introduction & Topics

Introduction

- Drivers for Change:
  - Sustainability policy
    - Greenhouse gas emission reduction
    - Renewable energy
    - Energy saving
  - Electricity Market Liberalisation
    - Full market opening in 2007
    - Electricity distribution and supply unbundled (→ Distribution System Operator; DSO)
- Distributed Generation (DG)
  - Electricity from renewable energy sources (RES)
  - Combined heat and power (CHP)
  - Medium and small scale, connected to the distribution grid

Topics

Results from two EU Research Projects:

1. Regulatory Roadmaps
   - SUSTELNET
     www.sustelnet.net

2. Business strategies for DSOs
   - DISPOWER
     www.dispower.org
Drivers for Change: Sustainability

The Policy Targets:
- GHG-emission reduction
  - Post-Kyoto target?
- RES-target
  - 2010: 22% relative to electricity consumption
  - 2020: 20% of total energy supply; 40-50% of electricity supply?
- Energy end-use saving: 1% per annum
Distributed Generation
Indicative DG-shares in Selected EU Member States

DG-production relative to national power consumption

DG: medium and small CHP (<50MW); medium and small hydro (<10 MW); on-shore-wind, tidal energy, biomass and waste, solar energy
Today

Cost price
Regulated feed-in tariff
Market based pricing

Future (2010-2020)

Cost price
Regulated feed-in tariff
Market based pricing

Compensation for electricity system benefits
Support (e.g. green certificates)
• environmental benefits
• sustainability goals
• technology support

Commodity price

Electricity system benefits increases due to network innovates
Lower support only for remaining externalities
Higher commodity price because of internalisation of CO₂-emission costs through emission trading system
**DG Economics**

**SUSTELNET:** Creating a level playing field
- correct transfer of values between DG and network operators
- guaranteed market access for DG

**Potential benefits to the system***
- Distribution capacity cost deferral
- Ancillary services
- Congestion relief
- Reliability improvement

**Potential benefits or costs to the system***
- Line losses
- Balancing

**Costs to the system**
- Connection and reinforcement costs

* Requires ‘Active network management’

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(2010-2020)

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Market based pricing

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Regulatory framework

Characteristics of a typical current regulatory framework

**Connection charges:** → long term
- Shallow (covering costs for connection to nearest line): **problem for DSO**
- Deep (covering costs also for reinforcements): **problem for DG-operator**

**Use of System charges:** → short term
- System costs (e.g. in case of auto producer), no compensations for system benefits

**Market access**
- DG only participates in energy market

**Innovation**
- Incentives for DSO are discouraging innovations

SUSTELNET proposed criteria and guidelines

- Shallow costs & positive/negative entry charge (locational signal)
- System costs and benefits allocated to individual DG or DG as a group
- DG offers local ancillary services to DSO and facilitate access to balancing market
- Allow DSOs to experiment with new technologies without direct consequences for their profits
Policy and Regulation

- **European Commission**
  - Directive 2001/77/EC (Renewables)
  - Directive 2003/54/EC (Electricity Market)
  - Directive 2004/8/EC (CHP)

- **National Government**
  - Directive 2001/77/EC (Renewables)
  - Directive 2003/54/EC (Electricity Market)
  - Directive 2004/8/EC (CHP)

- **Regulator**
  - National Electricity Law

- **Distribution system operators (DSOs)**
  - Give correct incentives to DSOs:
    - Multiple revenue drivers
    - Performance based incentives
    - Network optimization in the long run
    - DG as an option in managing the network
    - Innovations

- **DG/RES supplier**
  - Give incentives to generators and consumers to act economically efficient in short- and long term

- **Consumer**
  - Support schemes only for:
    - Environmental benefits (not internalized)
    - To achieve sustainability goals (e.g., to meeting renewable targets)
    - To support technologies in their infant stage

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Regulatory Roadmaps
An instrument for regulatory strategies

- backcasts the regulatory steps necessary to reach a desired future state (i.e. reaching the level playing field in power generation)
- guide to development of regulation
- timing of regulatory actions
- addresses all main stakeholders
- responds to market developments
- detailed in short-term actions
- general in long-term actions

Regulatory roadmap for The Netherlands

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## Regulatory Roadmaps

### Developing regulatory road maps

#### Market Access

<table>
<thead>
<tr>
<th>Network Regulation</th>
<th>protected niche market</th>
<th>DG/RES in wholesale markets</th>
<th>level playing field</th>
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<td>no regulation/self regulation</td>
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Regulatory roadmap for The Netherlands
Business Model for DSOs
Existing Business Model

DSO (Distribution System Operator)

Revenues
- Connection charges
- UoS charges

Money flow

Capital expenditures
- Extensions/reinforcements

Operational expenditures
- Energy losses
- O&M Costs
- Ancillary services
- UoS charges (cascade)

Consumer/DG Operator
- Connection charges
- UoS charges

Equipment supplier
- TSO
- TSO/DG Operator
- DG Operator/Large power producer

Money flow

Equipment supplier

TSO

TSO/DG Operator

DG Operator/Large power producer

UoS (cascade)
Network Economics

Today

DG electricity system benefits

Future (2010-2020)

Lower revenues/expenditures due to regulatory economic efficiency incentives

'Level playing field' regulation

Business as usual

Use of System charges

Connection charges

Revenues Expenditures

CAPEX (capital expenditures)

OPEX (operational expenditures)
DSOs attitudes to DG development

Detractors
Focus on:
- Minimising regulatory exposure
- Limiting the development of DG

Advocates
Focus on:
- Establishing alliances with DG operators
- Technological advancement
- Market development
- Creating a conducive regulatory regime

Neutral

Characteristics of the advocates:
- Possess key capabilities required to become an ‘active’ DSO
- Innovative, entrepreneurial culture
- Able to play and win the regulatory ‘game’. A ‘first mover’
New Business Model for ‘Active’ DSOs

Extensions/reinforcements

Ancillary services

Energy losses

O&M Costs

New business

DSO (Distribution System Operator)

Capital expenditures

Extensions/reinforcements

Equipment supplier

Money flow

Local balancing

UoS charges

TSO charges (cascade)

Operational expenditures

TSO

TSO/DG Operator

Energy supplier

DG Operator/Energy supplier

Consumer/DG Operator

Connection charges

Revenues

Extra reliability

Information (ICT)

Consumer/DG Operator

Consumer/DG Operator

New Business Model for ‘Active’ DSOs
In Summary

• Distributed Generation will play a key role in future sustainable electricity supply systems

• Transition to future sustainable electricity system requires an ‘active’ distribution network management providing generators and consumers with signals to behave efficient in the short and long term

• Regulators:
  - should develop a regulatory strategy for the medium and long term
  - can use a regulatory road map as an instrument to map out the regulatory strategy
  - remove regulation that is harmful for DG deployment
  - give correct incentives to DSOs for economic efficient network development
  - create possibilities for DSO to innovate

• Distribution System Operators (DSOs):
  - should becoming pro-active
  - should be innovative
  - should develop new business

Thank You
Questions?
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Future EU events on promoting DER/RES

• First International Conference on the Integration of Renewable Energy Sources and DER, 1\textsuperscript{st}-3\textsuperscript{rd} December 2004, Brussels

• Organisers: IRED cluster DG projects

• Objectives: Sharing knowledge of EU projects with USA, Japan and OECD

• Info: www.conference-on-integration.com