Wind power

Minimising the costs of integrating wind power into the grid

Office for Energy Regulation (DTe)

Lars Groenhuijse

IEA/OECD, May 25th 2004

Outline

- Introduction
- Incentives for WPI
- Incentives for DSO/TSO
- The Dutch case
- Questions

Introduction

Efficient integration of wind power by creating the right incentives for all actors:

- Wind Power Investors (WPI)
- Distribution System Operators (DSO)
- Transmission System Operator (TSO)

- Introduction
- Incentives for WPI
- Incentives for DSO/TSO
- The Dutch case
- Questions

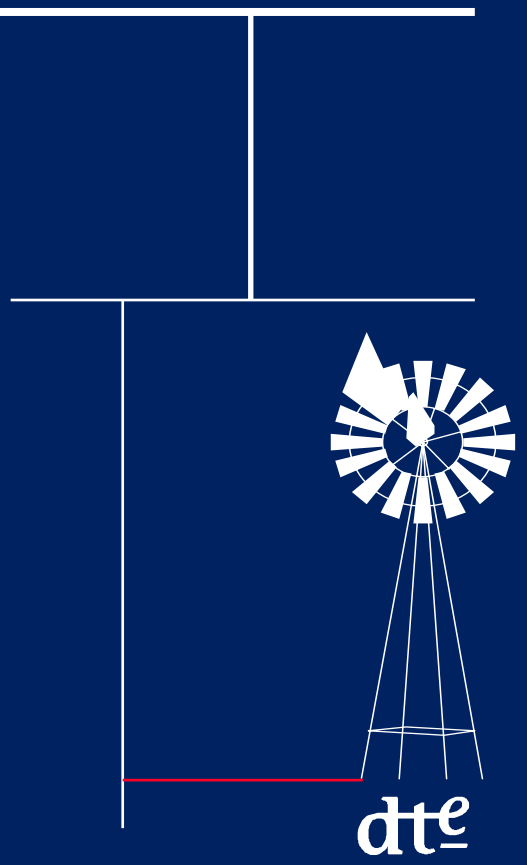
Incentives for WPI

- Shallow cost method
- Shallow cost method with incentive
- Deep cost method

Shallow cost method

WPI pay for connection to grid only

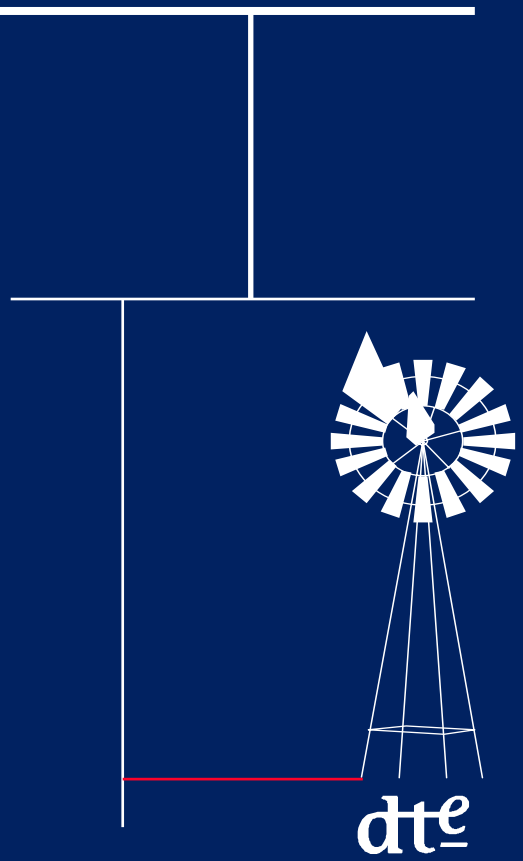
Advantages	Disadvantages
Objective with regard to determine costs	No locational signals
	Not cost reflective



Shallow cost method with incentive

WPI pay for connection to grid plus extra fee depending on location

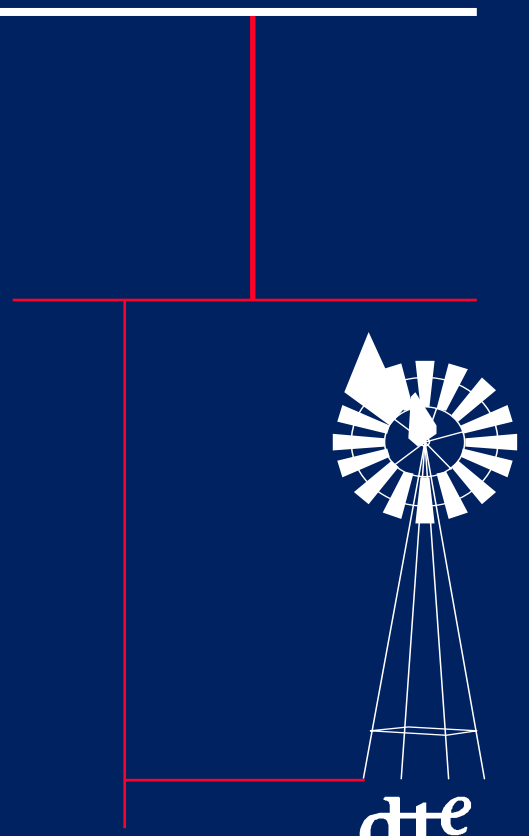
Advantages	Disadvantages
Locational signal	Difficult to determine extra fee
More or less cost reflective	



Deep cost method

WPI pay for connection to grid and necessary investment in the grid

Advantages	Disadvantages
Locational signals	Difficult to allocate grid investment costs
Cost reflective	



- Introduction
- Incentives for WPI
- Incentives for DSO/TSO
- The Dutch case
- Questions

Incentives for DSO

- Auction
- Yardstick
- Revenue cap
- Cost-plus

Auction

Highest bidder (best quality/lowest tariff) wins concession

Advantages	Disadvantages
No informational asymmetry between regulator & company	Informational advantage to incumbent
Prices based on efficient costs	Difficulty to transfer assets
	Danger of collusion

Yardstick

Simulating market, tariffs based on efficiency of sector in past projected to future

Advantages	Disadvantages
Incentive to outperform 'competitors'	Companies have to be comparable
Exogenous factors incorporated	Danger of collusion
Prices based on efficient costs	

Revenue cap

Tariffs fixed for period (5 years), corrected by CPI-X

Advantages	Disadvantages
Incentive to minimise costs: within regulatory period companies keep extra profit	Long period: difficult to incorporate exogenous factors
	Short period: less incentive to perform
	Strategic behaviour: anticipating on end of period

Two ways to determine revenue

- Network modelling tool

Tariffs based on simplified model of grid

- No exogenous factors included
- De facto investment decisions by regulator

- Benchmark

Using data of other companies in sector

Cost plus

Tariffs based on reported costs plus fee for invested capital

Advantages	Disadvantages
Relatively easy to implement	No incentive for regulated company to minimise costs
	Perverse incentive for management: more costs = more revenue
	Lots of information needed by regulator

- Introduction
- Incentives for WPI
- Incentives for DSO/TSO
- The Dutch case
- Questions

The Dutch case

- Total generating capacity: 26,000 MW
- Wind generating capacity: 900 MW
- Expected wind generating capacity in 2020: 7,500 MW

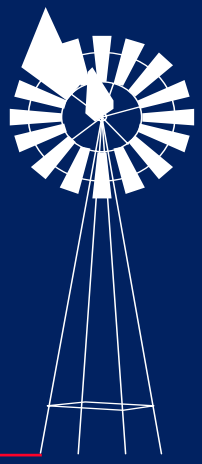
Regulatory scheme

WPI	Shallow
DSO	Yardstick
TSO	Revenue cap

WPI

- Above 10 MVA connected to grid where capacity is available
- Below 10 MVA connected to nearest grid

Advantages	Disadvantages
Locational signal for large connections	Splitting up of wind parks
Balance in informational needs and allocation of costs	



DSO

Yardstick competition with quality parameter

$$\pi_i = p.q_i - C_i - \varphi.(s_i - s)$$

- π_i profit
- C_i cost
- P price
- q quantity
- s_i ‘inverse’ quality (e.g. number of interruptions)
- s norm for quality
- φ societal costs of quality unit

Effects

- DSO is obliged to connect wind generator to grid
- DSO has incentive to minimise costs of integrating wind generator
- DSO has incentive to minimise interruptions in grid

TSO

Revenue cap

- Revenue cap based on international benchmark
- Size of grid not benchmarked
- Large investments approved by regulator

Effects

- TSO is obliged to connect wind generator to grid
- Only necessary expansion investments approved

Conclusions on Dutch situation

- WPI: some incentive to choose efficient location
- DSO: incentive to operate network efficient, including integrating wind power
- TSO: incentive to operate network efficient, including integrating wind power

- Introduction
- Incentives for WPI
- Incentives for DSO/TSO
- The Dutch case
- Questions