DSM in competitive market

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Business from technology

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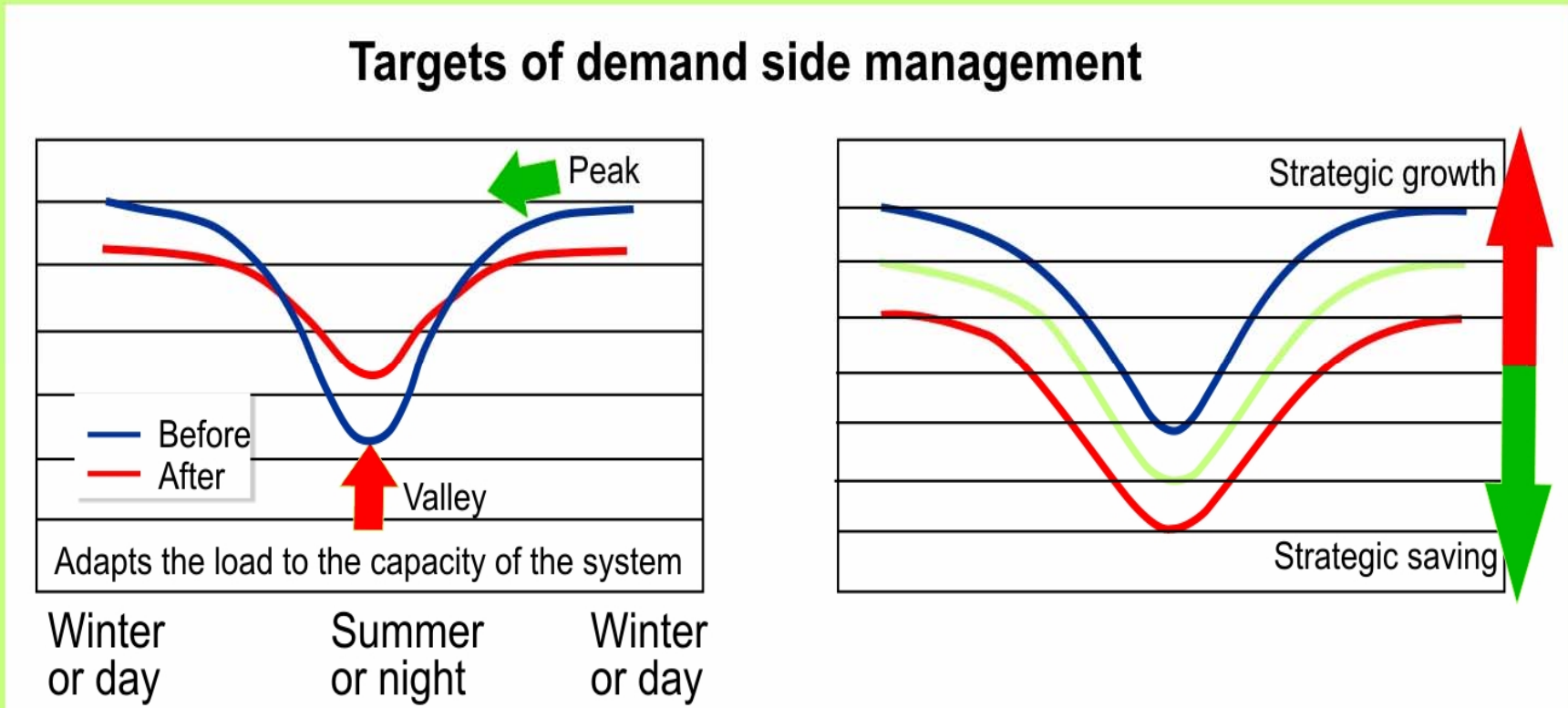
Definitions: DSM/DR/LM/…

- The term Demand Side Management, DSM, originates from late 70ies, early 80ies, from US where demand side resources were tried to take into account as parallel resource of supply side (generation). This resulted also as an Integrated Resource Planning (IRP) procedure.
- Load Management (LM)/Load Control has been applied even before the definition of DSM, and it is seen as an one part of DSM
- Demand Response, DR, is a newer term describing the market based approach to DSM.
- Demand-side-bidding (DSB)/Demand Bidding (DB) is a way to sell (unused) loads back to the market

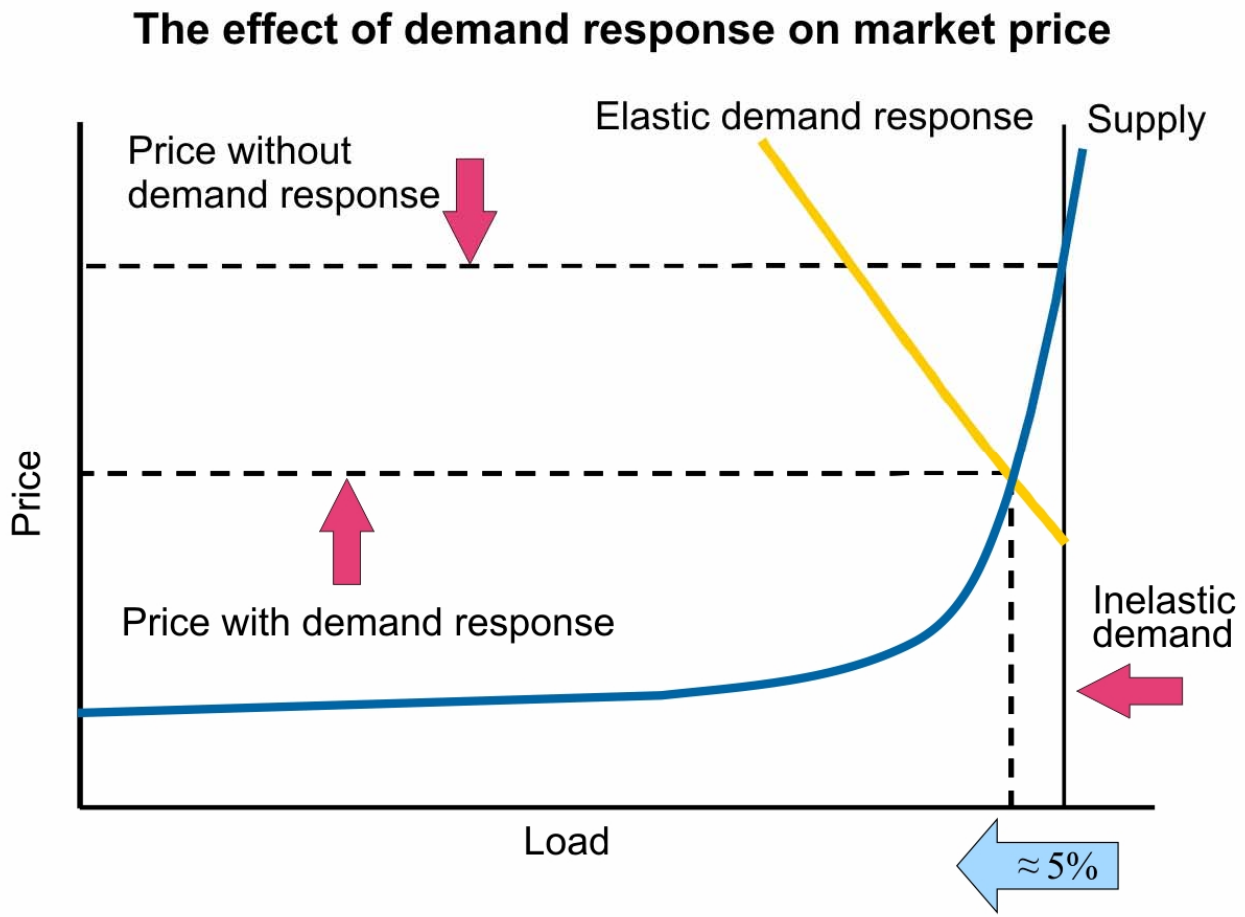
What is the problem in competitive market?

- **Load level** (emissions and waste from too much supply to a too high demand)
- **Load shape** (Too high peaks, too little reserve capacity and bottlenecks in transmission)
- **Market responsibilities and market design** (who is the owner of the problem?)

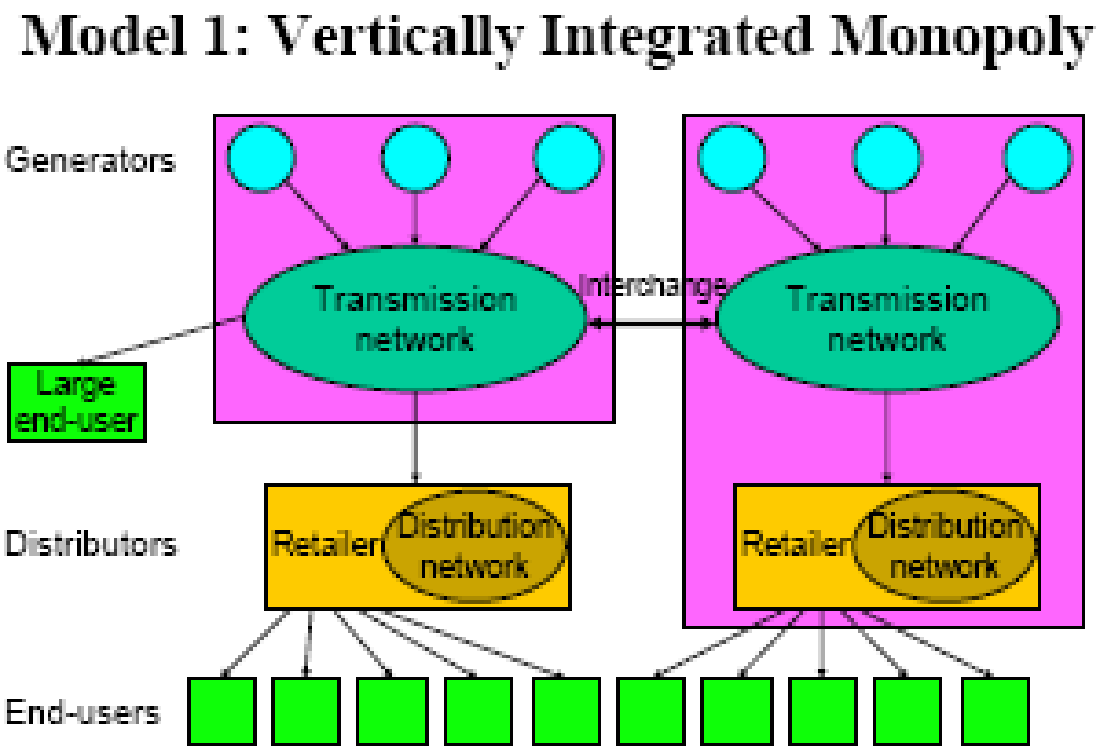
DSM can change the load shape and load level



Demand response can effect on market prices



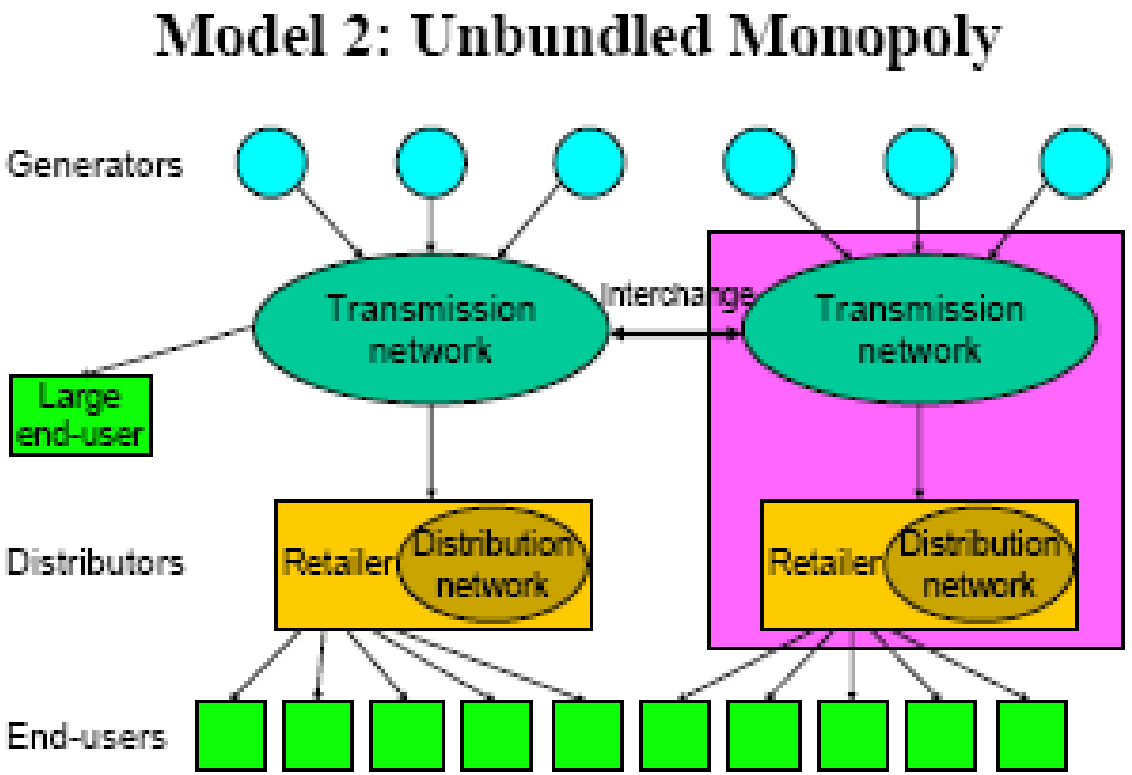
Basic Market Models (1): Most favourable to traditional DSM, LM and IRP



The electricity utility controls and undertakes all business functions: generation, transmission, distribution, wholesale and retail energy supply and services.

- There is no competition at any level.
- Utilities have the obligation to serve customers within their own region.
- Government regulates the utility to prevent monopoly abuse.
- All customers in the region must buy energy from the utility

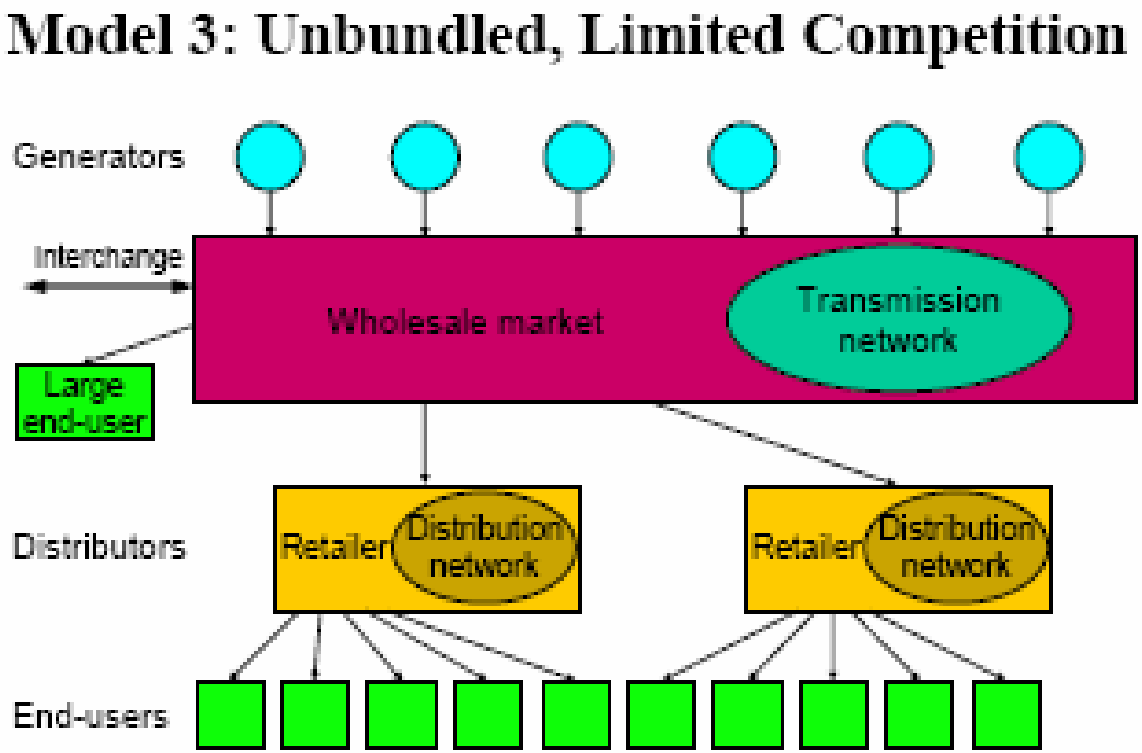
Basic Market Models (2): Still favourable to traditional DSM and LM, IRP less favourable



Generation is separated from all other functions: several generation companies serve distribution companies and, possibly, major industries. Generators and distributors maintain monopoly status:

- The generation company has the exclusive right to supply customers within its franchise area, and the distribution companies have a monopoly to serve customers in their respective areas.
- Transmission is provided by generators, distributors, or a separate entity or entities.
- Government regulates the monopolies to prevent monopoly abuse.
- Competition may occur at the generation level, but there is no competition at the retail level. All customers in a region must buy energy from the retail utility which holds the franchise to their geographical area

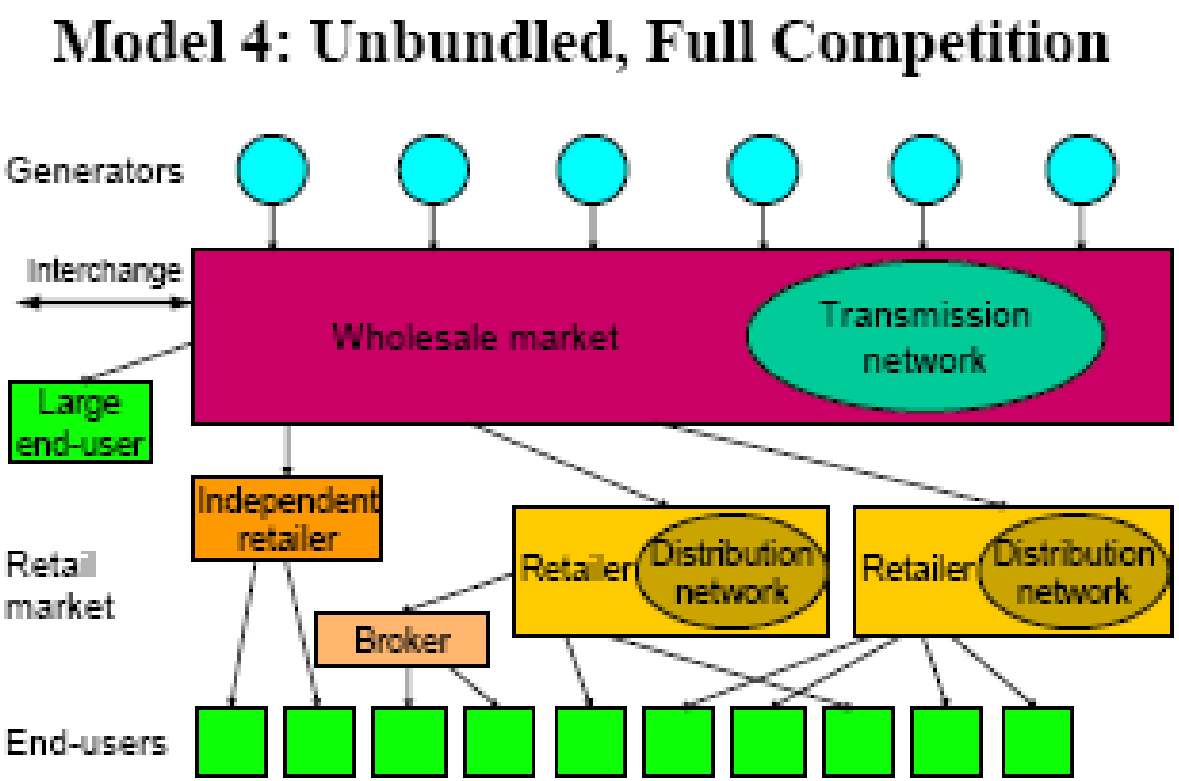
Basic Market Models (3): Market based DSM at wholesale level Traditional DSM at distribution level



Generation is separated from natural monopoly functions: many generation companies serve distribution companies and, possibly, major industries through a competitive wholesale market.

- Generators have open access to the transmission and distribution grid.
- Transmission is provided by generators, distribution companies, or a separate entity or entities.
- Government regulates the transmission and distribution system to prevent monopoly abuse.
- There is competition at the wholesale level: primarily among generation companies and there may be some competition through the use of self-generation by large customers.
- But with this one exception, there is no competition at the retail level.

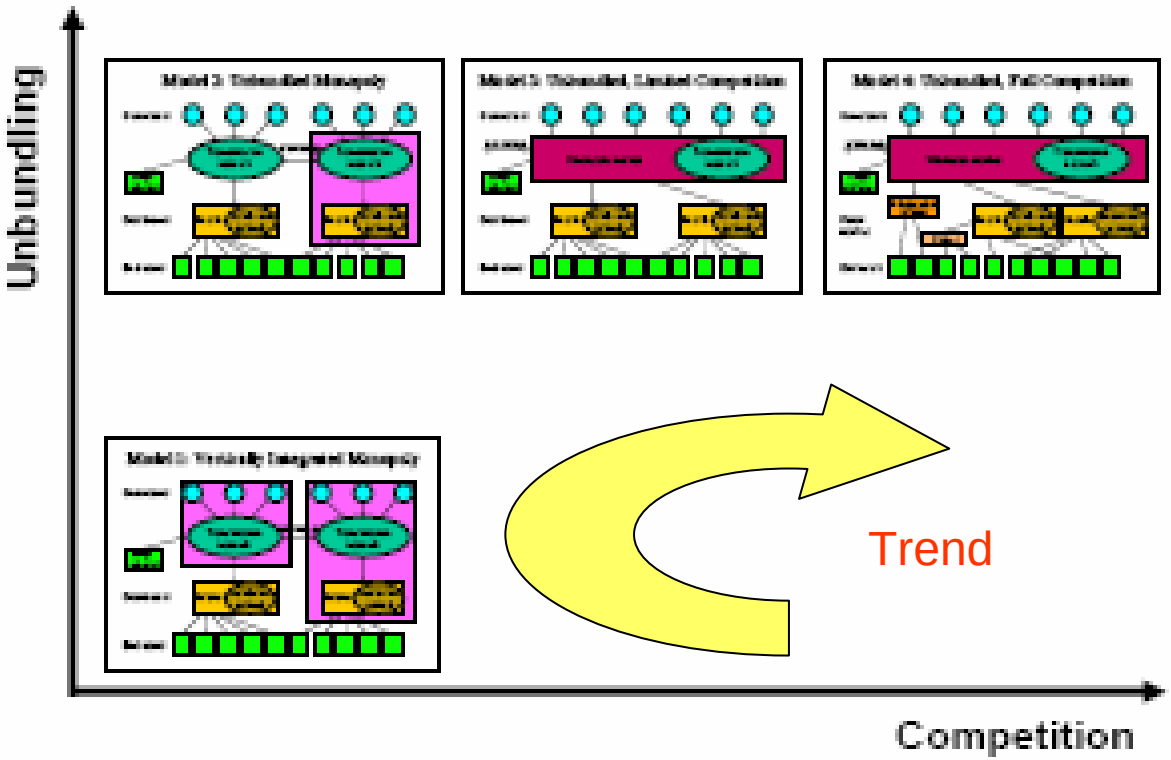
Basic Market Models (4): Market based DSM at all levels



Generation, transmission and distribution functions are separated.

- There is competition among generators (generators have open access to the transmission and distribution grids).
- There is complete competition at the wholesale and retail level. At the retail level, two new organisations supply electricity to end-use customers: Independent retailers (who have no interest in the distribution 'wires' business) purchase electricity in bulk from the wholesale market and on sell to end-users. Brokers provide a similar service without ever owning the electricity.
- There is some oversight (regulation) of the wholesale and retail markets to ensure a more efficiently operating market and to prevent abuse of market power. In addition,government regulates (or maintains ownership of) the monopoly transmission and distribution

Basic Market Models (5)



The generic models are based on only two structural dimensions of an electricity industry:
the degree of unbundling and the extent of competition. The models do not attempt to describe other aspects of an electricity industry, such as the type of ownership of electricity businesses, form of industry regulation, and customer access to electricity markets. These can take different forms within each type of industry structure. Such aspects would have to be included in any full description of an actual electricity industry.

from traditional DSM to market-base DSM

Example:Deregulation Process in the Nordic countries

1991, ->

Norway

- Unbundling of Statnett and Statkraft
- All customers in competitive market without extra costs
- Unbundling of network businerss and sales on bookkeeping base
- Nordpool in Oslo
- Tight governmental control power plant licensing

1995, ->

Finland

- Unbundling of IVO / IVS, Fingrid in 1997
- In 1995 market opened for 500 kW+ customers, for all customers in 1997 (without extra costs in 1998)
- Unbundling of network businerss and sales on bookkeeping base
- National power exchange EL-EX, integration into NordPool in 1997
- Liberal licensing policy

1996, ->

Sweden

- Unbundling of Vattenfall / Svenska Kraftnät
- Market open for all customers (hourly meters required in the beginning)
- Unbudling of network and sales businesses into separate companies
- NordPool

1998, ->

Denmark

- Unbundling of two system operators ELSAM / ELTRA merged into one stateowned company in 2005, Energinet.dk
- Full competition in 2003
- Special support for renewables (wind), CHP, energy savings
- NordPool (1999, 2000)

The Nordic countries are leaders in the deregulation and transcountry trading of electricity

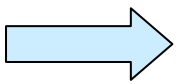
Regulation/DSM

Basic types of regulation

- Price/tariff regulation
  - Can include some incentives for DSM (DSM costs can be the allowed reason to increase prices), as in several states of US before competition
  - Does not suit very well with competitive market
- Price cap regulation, costs plus margin accepted. Some efficiency improvement of network company can be required, but usually incentives are weak
- Revenue regulation plus possible some incentives for network companies to improve the efficiency of the company
  - This type of regulation is increasing in Europe
  - At the moment DSM is not usually mentioned in regulation

Market rules and regulation/DSM

- The possibilities for the DSO (distribution system operator) to make business is rejected in most unbundled market, which may decrease possibilities for DSM
- Arrangement for metering business vary between different countries
- Metering and settlement procedures between suppliers vary in different countries, the size of hourly or half-hourly metered customers vary



- More accurate metering requirements are beneficial for DSM !
- Restrictions in the business possibilities of DSOs give room for new actors/service provides in the market

Who needs load shaping? Why? (1)

➢Policy makers/regulators

- to increase system security
- to improve economic efficiency
- due to environmental reasons?

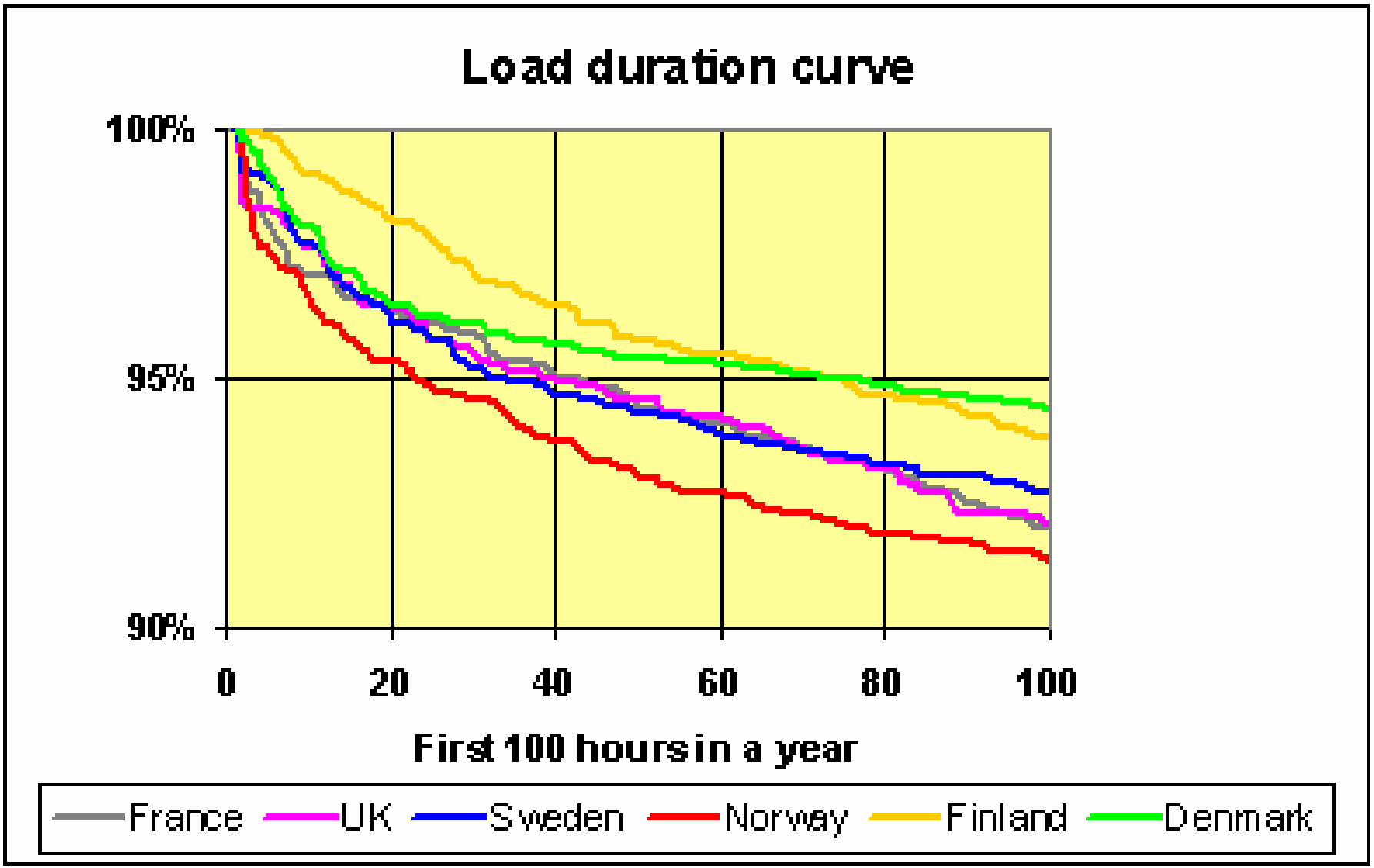
➢Market operators

- effect on the market price (customer benefit)
- decrease the market power of big players
- to increase the credibility of the market
- to develop new products into the market

Who needs load shaping? Why? (2)

- System Operator (SO)/Transmission System Operator (TSO)
  - for system balancing (regulating power market in many cases)
  - for handling disturbances in generation and in transmission system (ancillary services)
  - preventing blackouts and restoration from blackouts
  - for handling bottlenecks in transmission
  - for better use of existing generation and transmission capacity

System operator perspective: Need for peak load reduction some 20 to 80 hours per year



Who needs load shaping? Why? (3)

- Distribution network operator
  - Handling of network bottlenecks during peak load period
  - Better utilization of network capacity
  - Prevent and restoration from blackouts
  - decrease the problems caused by distributed generation (especially intermittent generation: wind, solar, chp)
  - increase the quality of supply (voltage etc)
  - due to requirements of regulators/energy policy

Who needs load shaping? Why? (4)

- Traders/suppliers/retailers
  - for risk management/hedging
  - for new businesses (acting as aggregators)

- Customers
  - to get economic benefits (react to tariffs, prices or to other incentives, economic benefits from trading loads)
  - to improve system reliability and environment

- New actors for new businesses: still basically missing
  - Aggregators
  - Metering service providers
  - Brokers

Classification of Demand Response activities

- System led: the system operator, or a service aggregator or agent, signals the demand-side customers that there is a requirement for load reduction or shifting. These are often reliability-based programs where the prices are set by market or system operator (wholesale markets)

- Market led: the customer responds directly to market pricing signal, causing behavioural or consumption changes. Prices are set by market mechanisms (interaction between wholesale and retail markets).

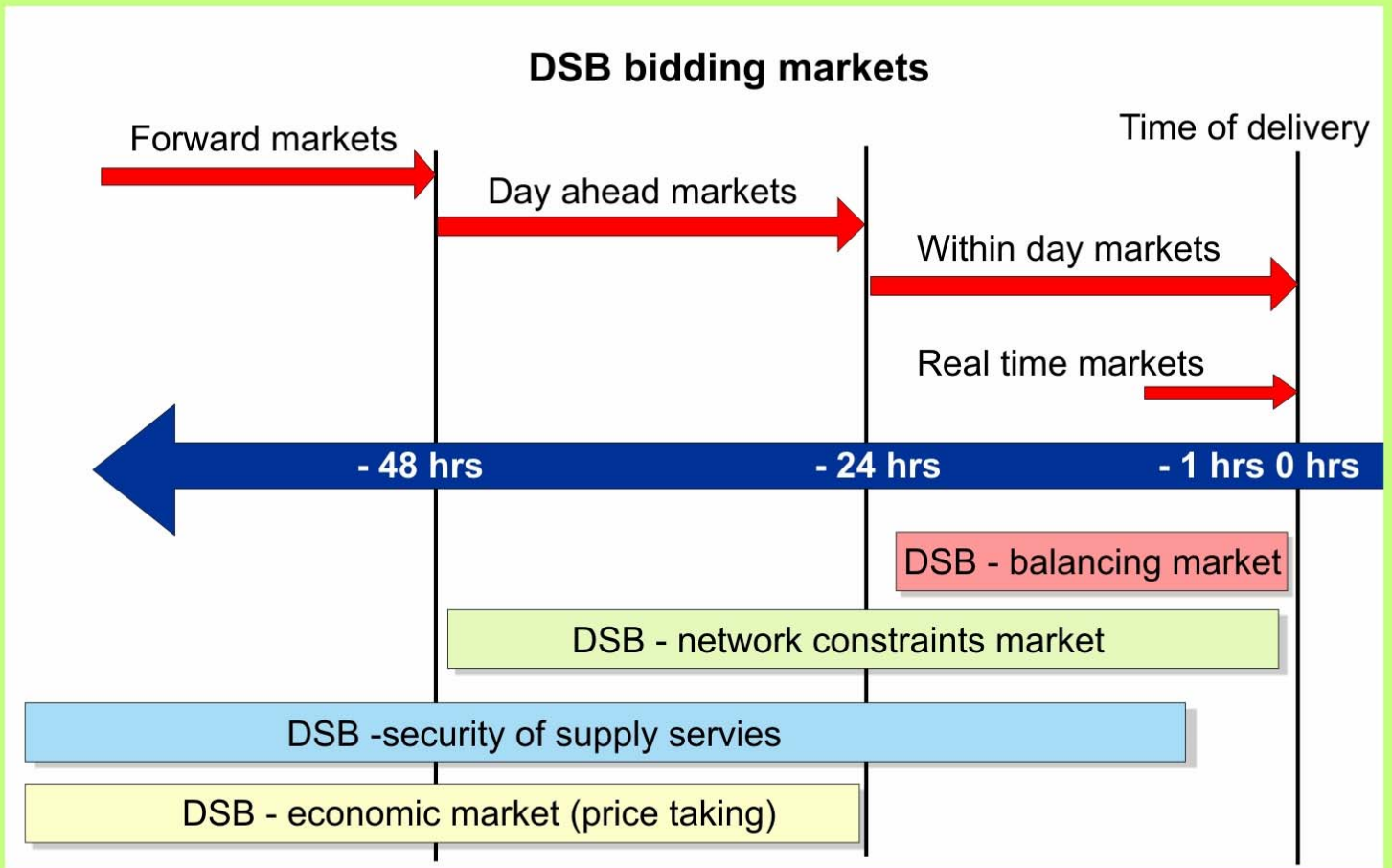
How to effect on customers? (1):

- Tariffs and pricing
  - network tariffs
    - time-of-use (ToU)-tariffs
    - demand charges
    - special contracts like ancillary service contracts (load control)
  - retail pricing
    - transparent pricing reflecting the costs
    - real-time pricing (RTP)
    - Critical-peak pricing (CPP)
    - risk-sharing type contracts
    - dynamic pricing (for.ex. Tempo-tariffs in France)
    - interruptible tariffs
    - ToU-tariffs
  - innovative pricing requires new metering and often 2-way communication
  - automatic response to prices requires building/process automation and loads to be controlled and/or distributed generation

How to effect on customers? (2)

- Direct load control by utilities
  - special contracts needed
  - can be applied to special type of loads (air conditioning, heating)
  - in unbundled situation: who (DSO?) is doing load control and to whom (DSO, TSO, supplier, …) and how to share costs and benefits?
- Getting loads to market
  - DSB
- Information to customers
  - Feedback to customers based on measured consumption and special analysis/comparison to other similar customers + hints, important especially to small customers

Demand Side Bidding in competitive market



IEA Demand Side Management Agreement (1)
Tasks related to the load shape cluster

More information: **http://dsm.iea.org/, http://ieadsm.org/**

- Task II: Communications Technologies for Demand Side Management (finished)
- Task VIII: Demand-Side-Bidding in a competitive electricity market (finished)
- Task XI: Time of use pricing and energy use for demand management delivery (finished)
- Task XIII: Demand Response Resources (finished)
- Task XIV: Network-Driven DSM (ongoing)
- Task XVII: Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages (ongoing)

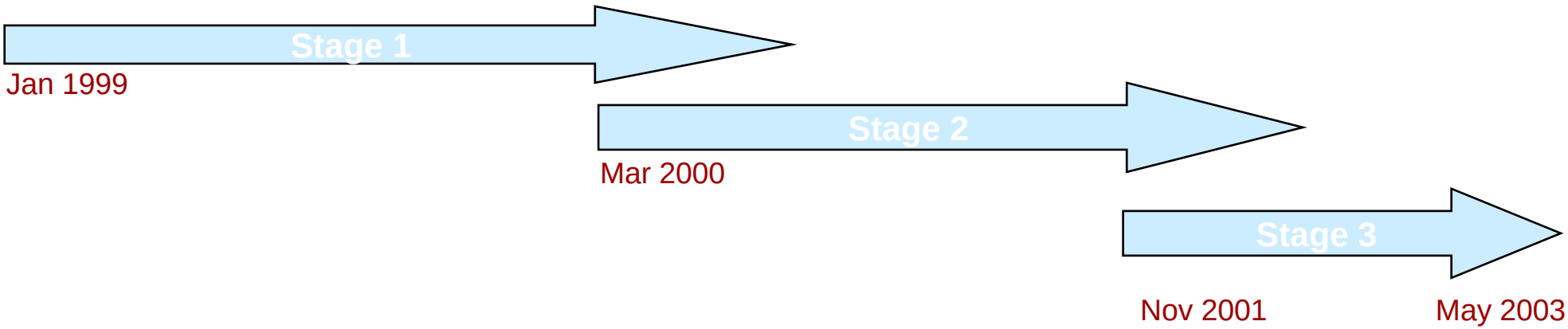
IEA Demand Side Management Agreement (2)
Task II: Communications Technologies for Demand Side Management (finished in 2002)

- Concentrated mainly on small (residential) customers
- Defining and prototyping flexible communication gateway (Flexgate) at customer site for bundled customer services (price estimate < 100 USD)
- Business Case assessment of the provision of customer services
- Definition of Services and Field Trials
- AMR data collection, load control etc. part of services

IEA Demand Side Management Agreement (3)
Task VIII: Demand-Side-Bidding in a competitive electricity market (finished 2003)

➢see next slide

IEA Demand Side Management Agreement (4)
Work programme of IEA DSB project - overview



Sub-Tasks
1. Definition of DSB
2. Market Survey
   - •market operators
   - •system operators
   - •regulators
   - •suppliers / traders

Sub-Tasks
3. Consumer Survey
4. Technologies for DSB
5. Analysis / evaluation

Sub-Tasks
6. Workshop
7. Technical issues
8. Practical guide

IEA Demand Side Management Agreement (5)
Task XI: Time of use pricing and energy use for demand management delivery (just finished)

- Focus in small customers, customer perspective
- Includes 3 subtasks, reports available:
  - Smaller Customer Energy Saving by End Use Monitoring and Feedback
  - Smaller Customer Time of Use Pricing for Demand Management Delivery
  - Demand Side Bidding for Smaller Customers

The overall conclusions from the Subtask 1, 2 and 3 studies can be linked together and indicate that many smaller customers would be motivated to make energy savings, as long as the inconvenience is not too great and there are some, even small, financial rewards. These customers can also be motivated to change behaviour by TOU energy pricing with the automatic management of many end uses a possibility, providing notice is given. These energy end use changes can be aggregated into formal processes of demand bidding and bid into markets provided that cost effective mechanisms to attribute reward can be developed.

- New subtasks 4-5 also just finished (reports not yet public)
  - The Impact of Dynamic Demand Changes on Profile Settlement Systems
  - Demand “available” and “turndown” Mechanisms for Market Bidding of Smaller Customer Demand

IEA Demand Side Management Agreement (6)
Task XIII: Demand Response Resources (2004 -2006)

http://www.demandresponseresources.com

- Deals with all types of actors and delivery mechanisms of demand response, umbrella task
- 8 subtasks
  - finalize global and country-specific objectives
  - define the DR resource base and market characterization
  - market potential of DRR
  - demand response valuation
  - role and value of enabling technologies
  - characterize priorities and barriers, and develop solutions and recommendations
  - develop DRR network of methods, tools and applications
  - deliver products and IP to IEA DSM programme and project participants
- Links to all other projects of the cluster, especially DSB

IEA Demand Side Management Agreement (7)
Task XV: Network Driven DSM (started 2004)

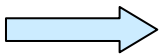
- Concentrates on network operators (transmission & distribution) and network capacity constraints
- 5 subtasks finished
  - worldwide survey of network-driven DSM projects
  - assessment and development of network-driven DSM measures
  - Review of DSM measures integrated into network planning
  - the evaluation and acquisition of network-driven DSM resources.
  - Communication of information about network-driven DSM (newsletter)
- New subtask going on
  - Load Control and Smart Metering Technologies
  - Load Control and Smart Metering Projects
  - Best Practices in the Use of Load Control and Smart Metering

IEA Demand Side Management Agreement (8)
Task XVII: Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages

- First stage going on (until September 2008) with objectives: The first step in the Task is to carry out a scope study collecting information from the existing IEA Agreements, participating countries and other sources (research programmes, field experience, information collected through Cigre working groups, etc), analyse the information on the basis of the above mentioned objectives and synthesize the information to define the more detailed needs for the further work.
- Subtasks:
  - Information collection on the characteristics of different types of DER in the integrated solutions
  - Analysis of the information collected and preliminary conclusions (state of the art)
  - Feedback from the stakeholders: Workshop
  - Final conclusions and the detailed definition of the further work

Future views/Conclusions

Liberalisation of electricity market and unbundling of activities inside utility industry continues



- market based DSM/DR/LM products are needed although at the moment there are lot of barriers
- two way communication with AMR often needed in these cases
- new innovative business opportunities are possible (bundled services, aggregators,..)

On the other hand, there are still market where competition is only in generation and the roles of DSO and supplier are integrated, especially in developing and rapidly increasing electricity systems: these also have often capacity restrictions in generation and networks

- traditional one-way load control (ripple control) as a cheap and simple system has still market potential

Also DSB of small customers needs new innovations: aggregators with direct load control without individual accurate metering is one probable solution

Thank You