



Appendix III: National report for Norway

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International Energy Agency Demand-Side
Management Programme
**Task VIII: Demand-Side Bidding in a Competitive
Electricity Market**

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1 Summary

The Norwegian power market is characterised by 200 suppliers and almost 50 of them offer supply to non-local customers. All customers may change supplier without paying any fee and a survey concludes that 11% of all customers have changed supplier during last year. The market consists of the following five different market roles: Customer, Network Operator, Supplier, System Operator and Market Operator.

In Norway there is registered an interest for Demand Side Bidding (DSB) during this project period. The interest is new and represents a further development of an already liberalised power market. Representatives from all main market roles are positive to new DSB products. The demand side in the market is so far not examined about their opinion to DSB.

The main arguments about advantages with DSB products are that it will increase power reserves, promote a more efficient power market, improve market liquidity, more efficient system operation. It is also mentioned that it will promote energy efficiency and reduce CO₂ emissions not in Norway, but in Denmark in peak periods due to import of thermal power.

Before this project was started, the general knowledge about DSB as a market driven schedule was almost absent in Norway.

Several products that could be traded as DSB products exist, but are not operating. The System Operator and Market Operator both have such products available.

Advanced DSB products recommend technical systems and solutions for monitoring and billing purposes. So far it is not specified how such routines should be managed.

System operators' responsibility for balance and reliability represents a main driving force in the existing products that could be further developed to DSB products.

The spot market is organised in a way that makes it possible to implement new DSB products.

Available DSB products are not organised in separate business units like what is happening in UK. Bilateral contacts and contracts with end use customers is so far the only way to provide DSB products.

System operator, market operator and regulator should have the key role in establishing and promoting new market organisation for DSB products.

This report is a part of an IEA project on Demand Side Management Programmes (Task VIII) with Norway, Sweden, Finland, Netherlands, Spain and United Kingdom as participants.

2 Structure of the Electricity Market

The Norwegian electricity market was deregulated after the Energy Act of 1990, which introduced a third party access to transmission and distribution networks. The industry was unbundled into the following two main parts:

- Generation/supply (competitive)
- Transmission and Distribution networks (regulated natural monopolies)

There are not any limitations for customers who want to change the electricity supplier, it can be done as simple as with a telephone call, and from 1997 it is free of additional charges. The number of customers which have changed their supplier was growing steadily, but it remains relatively low, about 5% of all the customers.

2.1 Regulation of the Norwegian Electricity market

Unlike deregulation in other countries, for instance England and Wales, the similar process in Norway did not include privatisation of the electricity sector and a major part of the industry remains in public ownership. Another particular feature of Norwegian market reforms is that since the beginning of deregulation all consumers have full access to the electricity market. The principle of financial ring-fence (or separated accounting) between generation and distribution in vertically integrated electricity utilities was implemented since 1991, even though it did not require a complete organisational separation. Therefore a number of electricity utilities are undergoing reorganisation from a pure vertically integrated structure type into concern or vertical splitting in different companies.

After a deregulation process suppliers have lost their exclusive rights in providing their franchise areas with electricity and were exposed to price competition. Generators are not obliged anymore to supply their areas on long-term stable electricity prices. Despite the fact that the supply side is deregulated and fully exposed to competition, planning and construction of new facilities is regulated by the state. The industrial concession law regulates construction and ownership of power plants and includes compensation to the involved local authorities, first refusal rights to the local authorities and time limits.

Electricity distributors should have a concession for a given area and additionally is obliged to deliver electricity to the customer in the area if the one wishes so, while the choice of supplier is free.

The main regulating authority regarding the electricity sector in Norway is the Norwegian Water Resource and Energy Directorate (NVE), where the Energy and Efficiency Department is responsible for regulation of the electricity transmission and distribution as natural monopoly and promotion of competition in generation and supply. Additionally the Norwegian Competition Authority controls the competition within the sector. NVE controls that the Third Party Access principle is fulfilled, e.g. the available capacity of the net is available for any market actor without discrimination and under equal conditions.

The new regulation model for the monopoly business of network companies was implemented in 1997. It defines an income cap model. The income cap is defined with regards to financial report data from 1994-95 with a regulating mechanism that includes an annual reduction of

income cap by 1,5%, which should be compensated by company's efficiency improvement. From 1998 it was implemented an additional ratio from 0-3% according to conditions of each company, where companies with worst results get highest (up to 4,5%) ratio.

2.2 Description of major participants at the market

Generation and supply

The main features in the Norwegian electricity generation are determined by natural hydropower resources, which are sufficient to cover about 99% of electricity generation, while the rest is covered by industrial CHP generation. Due to the fact that hydropower resources are relatively even spread around the country, there is a relatively low concentration on the producers' side. The state-owned Statkraft SF controls about 32-35% of generating capacity, while the second-largest producer Oslo Energi controls only 7% and third-largest only 6% of the generating capacity. The 10 largest generators control about 65% of total electricity production. The total annual capacity of generation in typical years is ca. 116 TWh.

However, there are some trends for further enlargement within the production and supply sector, particularly because big vertically integrated companies like Statoil or Norsk Hydro, which were mainly engaged within the petroleum activity, show some intention to participate in the power sector.

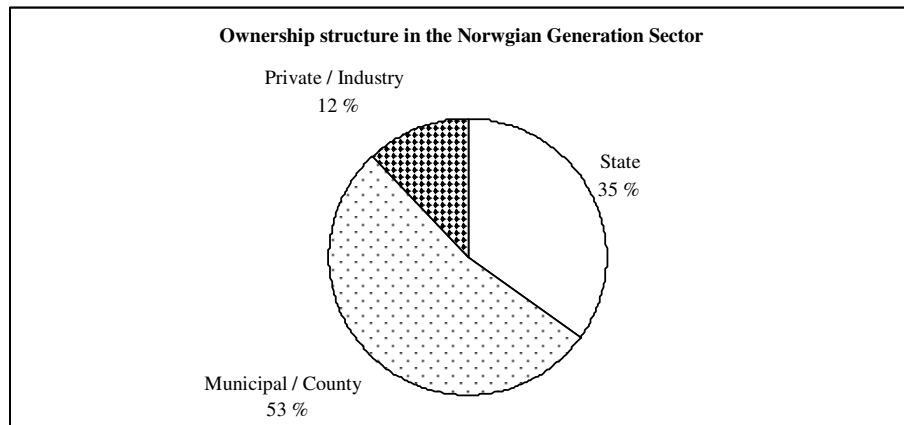


Figure 1 Structure of ownership among Norwegian electricity producers.

In total there are about 200 supply companies in Norway and about 50 of them offer supply to non-local customers. A new market survey concludes that it is more than twice as common to change power supplier than bank. During last year 11% of all households has changed power supplier, while only 6% has changed bank and 7% has changed provider of telecom. The ratio of system maximum demand to capacity is 0.97 excluding imports and 0.94 including imports. In 1998 36 TWh were traded through the electricity pool (spot) (9.8% of total trade). The imbalance market was 6 TWh (1.6%), contracts of differences were 61 TWh (16.7%), bilateral contracts were 233 TWh (63.7%) and options 30 TWh (8.2%) (ref. Nordpool).

Transmission and distribution

The Norwegian transmission and distribution grid consists of three parts: central, regional and distributive.

Table 1 Description of the transmission and distribution network

Level	Voltage, kV	Function
Central net	420 300 (132)	Transmission
Regional net	132 66 47	Primarily distribution
Distribution net	22 11	High voltage distribution Low voltage distribution

Statnett SF owns approximately 80% of the national transmission grid, regarding to its length in kilometres. The rest of the central grid has private, municipal and county ownership, but is leased to Statnett SF. Municipalities and counties own regional and distribution nets, while Statnett SF owns a part of the regional grid.

It is necessary to mention that Statnett SF also controls the 1040 MW offshore cable connection to Denmark and 50% in the planned Eurocable, Viking Cable and the Dutch SEP cable.

There are about 200 local network operators operating the distributing system in Norway. Most of these distribution companies also have a supply business.

Market operation: Nord Pool

The Nord Pool is a Norwegian (Statnett SF) and Swedish (Svenska Kraftnät) owned power exchange that was established in 1996. A large number, approximately 200, of participants from Scandinavia and Finland trade through the market. There are three kinds of participants:

- Direct participant or a trader acting on its own behalf (power producers, suppliers and industrial companies)
- Brokers, trade on behalf of customers or its own.
- Clearing customers

Nord Pool combines two markets;

- Elspot – spot market and
- Eltermin – futures market

System Operation: Statnett SF

The system operator Statnett SF is required to apply market mechanisms at the spot market in order to relieve transmission constraints in the system. In the situation where there might be capacity limitations in the central power grid, the country is subdivided into two or more bidding areas where the clearing price will be settled.

Statnett SF is a system operator with following main responsibilities:

- balancing control and demand
- production co-ordination control
- operating reserves control
- co-ordination of maintenance
- rules for information exchange

The market is regulated (balanced) by Statnett SF, which receives bids from generators to either increase or decrease output for the Regulating Market. All the generators receive the clearing price in the Regulating Market. Any generator that is found with a shortage in the balancing market pays for regulating power at the cleared price.

3 Experiences with Demand Side Bidding

The Norwegian power market is organised and regulated in a way that makes it possible for DSB products to be implemented and operated. Based on information collected from market participants, the conclusion is that the only DSB products so far implemented and in function are “2 hour interruptible power” and “24 hour interruptible power” created and provided by Statnett SF as the system operator and the transmission grid operator. These products are operated for the purpose of system protection and reductions of constraints. They were introduced years before the market was deregulated. The value of these products is set by the DSB provider and not negotiated in market surroundings. However the products are popular specially for customers with oil boilers in parallel to electric boilers.

Table 2 gives a description of relevant DSB products and indicates which of them that are available and operating in Norway.

Table 2: List of relevant DSB products and which of them are available in Norway

DSB product	Available	Operating
Frequency response including spinning reserve	x	-
Fast power reserves (regulating objects in balance market)	x	-
System protection schemes	x	-
Big customers sell back power to spot market	x	-
Big customers sell back power to balance market	x	-
2 hour interruptible power	x	x
24 hour interruptible power	x	x
Big customers sell back power to DSB trader	-	-
Medium and small customers sell back power to DSB trader	-	-
Reactive power	-	-

As described in table 2, several DSB products are available in the Norwegian power market, while only two products are in operation. These operating products are for management of system protection and constraints and were introduced before the market was deregulated. The spot market is organised in a way that permits demand side bids for buying and selling, but so far only bids for buying is operating. The only DSB product in operation is regarding system protection schemes. This is caused by “old” equipment installed at industrial customers’ years ago. Based on frequency disturbances the total amount possible to activate is about 5000 MW. Customers offering this service do not receive any payment or fee from system operator and the product is very seldom activated. There is no communication between system operator and customer for realising the service/product. Monitoring is not developed for start, stop and amount registration.

In Table 3 it is showed which market participants that provide/offer the different available DSB products in Norway. Grid operator for the transmission network is Statnett SF.

Table 3: Providers of available DSB products in Norway

DSB product	Provider
Frequency response including spinning reserve	Sys Op
Fast power reserves (regulating objects in balance market)	Sys Op
System protection schemes	Sys Op
Big customers sell back power to spot market	Mar Op
Big customers sell back power to balance market	Sys Op
2 hour interruptible power	Sys Op / Grid op
24 hour interruptible power	Sys Op / Grid op
Big customers sell back power to DSB trader	-
Medium and small customers sell back power to DSB trader	-
Reactive power	-

In Table 4 a detailed description of each relevant DSB product available (operating and not operating) in Norway is presented. Table 5 gives a detailed description of the only two DSB products that in fact are operating.

Table 4: Description of relevant DSB products available in Norway

DSB product	Description
Frequency response including spinning reserve	Operates continuously in the area 49.5 – 50.5 Hz. Activates momentary.
Fast power reserves (regulating objects in balance market)	Eliminate unbalance within 15 minutes from list of regulating objects/generators. Paid 22% of spot price as an availability fee.
System protection schemes	Trapping of generation units and demand side loads. No fee paid to customers.
Big customers sell back power to spot market	Bids to the spot market (hourly for next day) aggregated for each actor/player. All bids collected before 02 am. Supply and demand side operates at same conditions.
Big customers sell back power to balance market	Bids to the balance market (hourly for next day) specified on each generating and/or demand side unit. All bids collected before 09 am (after spot-price is known). Supply and demand side operates at same conditions.
2 hour interruptible power	See table 5 for description
24 hour interruptible power	See table 5 for description
Big customers sell back power to DSB trader	-
Medium and small customers sell back power to DSB trader	-
Reactive power	-

The Norwegian power market is in general well developed for implementing DSB products. Experiences shows that system services to some extent is organised as DSB products, but still the price/value of the products are one-sided set by system operator. Big industrial customers participate with bids in the spot market. Their bids reflect price elasticity and not back sale of power to the spot market.

Table 5: Description of operating DSB products regarding interruptible power

The name of the product.	2 hour interruptible power	24 hour interruptible power
The purpose of the product.	System protection and reductions of constraints.	System protection and reductions of constraints.
The creator of the product.	System operator, transmission network operator	System operator, transmission network operator
Is a trader or aggregator involved? (acting between the creator and buyer)	Yes	Yes
The buyer of the product.	Industrial and commercial customers with electric boilers	Industrial and commercial customers with electric boilers
Duration of the contract.	Long term (continuous)	Long term (continuous)
Does product require a bid for total demand or for a change in demand?	Reduction of demand	Reduction of demand
Notice given for change in demand.	2 hours	24 hours
Maximum occasions that demand is changed.	No limit	No limit
Limitations on the size of demand.	No limit (the capacity of the boiler)	No limit (the capacity of the boiler)
Duration of the demand reduction.	No limit	No limit
The availability fee.	Reduction in transport tariff to transmission grid owner. Connection fee is 0 (others: 13 NOK/kW) Peak demand fee is 3 NOK/kW (others: 57 NOK/kW)	Reduction in transport tariff to transmission grid owner. Connection fee is 0. (others: 13 NOK/kW) Peak demand fee is 15 NOK/kW (others 57 NOK/kW)
The trigger fee.	None	None
Penalty for non-compliance.	None, but is discussed.	None, but is discussed.
Communications system.	Remote metering system	Remote metering system
Type of control.	Manual and automatic	Manual
Monitoring.	Time series of load	Time series of load
Investment.	Customers	Customers
Demand bid.		
The technology whose demand is reduced.	Direct electric heating or heated processes of customers	Direct electric heating or heated processes of customers
Is the energy reclaimed at a later time?	No	No
The size and shape of the DSB block.	-	-
Success of the product.		
Number of participants.	total 325 MW	total 200 MW
Typical number of occasions that demand is changed.	once or twice a year	once or twice a year
Additional notes.	Mainly customers with oil boilers as a dual system	Mainly customers with oil boilers as a dual system

4 Views towards Demand Side Bidding

All kind of market participants express a positive opinion to DSB products. It is interesting to register that this opinion is independent of market role – except the generator that operates in the wholesale market. The generator is not able to see advantages or disadvantages. Table 6 presents how different market participants in different roles pointed out advantages of having DSB products operating. Due to the fact that Norway has ca. 99% hydro generation, reduced CO2 emissions is not specified as an advantage. However it is important to remember that Norway during a year is net importer of thermal power from Europe and for special situations is looking for new reserve capacity of power.

Table 6: Market opinions about advantages of having DSB products in operation

ADVANTAGES	SYS OP	MO	SUPP	GEN
More business opportunities			X	
Market with stronger influence of demand side	X	X	X	
More efficient market	X			
New market place products	X		X	
More participation from the demand side	X	X	X	
Improved market liquidity		X		
More efficient network and system operation	X		X	
More efficient use of energy and power	X	X	X	
Reduced CO2 emissions				
Other				

SYS OP = System operator

MO = Market operator

SUPP = Supplier

GEN = Generator

In the point of view of different market roles, advantages of DSB in operation are several. The only possible disadvantage that is registered is from system operator regarding possibilities that “necessary long-term development of power and transmission capacity could be postponed”.

The regulator also states that DSB products are possible to operate in the current electricity market, but pricing of products as well as some initial work have to be done before DSB products is operating well. Regulators’ opinion is that Nord Pool as market operator and Statnett SF as system operator should promote new DSB actions. In this process the regulator (NVE) itself should also take an active part.

Monitoring and billing routines for DSB products is necessary to develop and implement. How this should be done in detail is not discussed in questionnaires.

A general impression is that all market actors are not very familiar with DSB and its possible impact on the power market. The replies are given after explanations and discussions and it is registered that there is an overall increasing interest in different DSB products as well as how they could be implemented in the existing market. The special situation in Norway is that the

national capacity of energy as well as power in the generating system has recently changed from being over-capacity to under-capacity. This situation has an influence on the attitude to new thinking regarding DSB as one of several solutions.

5 Barriers to Demand Side Bidding

Market solution and legislative framework do not represent main barriers as DSB is not in real function in the Norwegian power market. Lack of tradition for seeing the demand side as real market participants is however a main barrier. With a generating system dominated by hydro plants, it has been more adequate and cheap to activate generators rather than demand side for ancillary services and reserve purposes.

System services offered by generators have been more or less a part of their contract with system operator regarding connection to the national and/or regional grid. The services themselves have never been stated as a separate "business".

Should DSB products be successful market products in the Norwegian power market, several main barriers should be demolished. Due to information from different market participants and a general evaluation of the existing power market, these barriers are of different character, and the following actions could contribute to their elimination:

- Rethinking in the power industry about demand side participation in all market segments.
- The possibilities for doing business with DSB products have to be cleared up and publicly discussed. New entrants for this kind of business would then be attracted.
- System operator together with market operator and regulator should establish a project with scope to demonstrate some commercial DSB products. Adjustments of regulatory framework and concessions should be discussed as a result of this process.
- Technical challenges regarding monitoring and billing of realised products should be investigated and tested.
- International experiences with DSB must be known.
- Principles, methods for pricing and market operation of DSB products must be developed.
- The demand side must be oriented and educated in possibilities for cost reductions/profit by participating in the DSB market.
- Socio-economical benefits of a well functioning DSB market should be clarified.

A superior barrier that will influence all DSB schedules is the value of the product. If the value is lower than the operating cost including investments in technical infrastructure/monitoring, the demand side will not participate in the market. In a letter to big industrial customers (winter-99), the system operator asked for demand side bids to system services. The reply was accumulated to only 5 MW. The main reason for this low interest is due to lack of knowledge about the value of the product as well as how to organise it (monitoring and billing). To give the right market value of DSB products, it is important that the total socio-economic value is taken into account. This indicates that the role of the regulator in promoting DSB schedules will be important. Figure 2 shows two different models for organising DSB schedules.

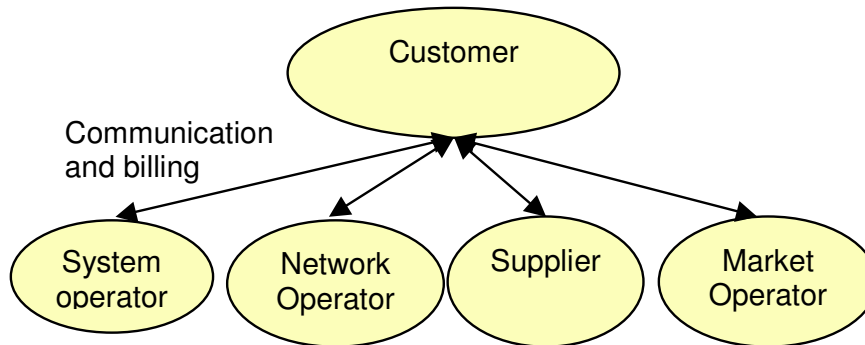
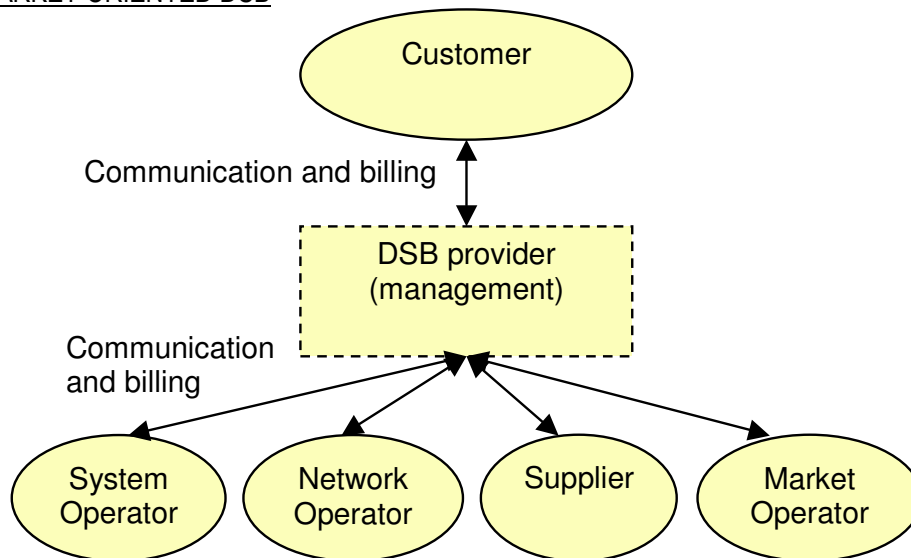
1. TRADITIONAL DSB2. MARKET ORIENTED DSB

Figure 2. Description of two alternatives for organising DSB products

In alternative 1, the different market roles co-operate with end use customers, while in alternative 2, a DSB provider take care of all management, communication, monitoring and billing routines as a core business. Alternative 2 represents a more market oriented model where DSB providers operate independently from other market activities.

6 Discussion

Main findings from this part of the project are based on questionnaires to the regulator, system operator, market operator, supplier and generator. The transmission grid owner was also asked to fill in information, but replied identical to system operator (both in the same company Statnett). Despite the fact that only five replies were received, the information given is adequate and represents common opinions regarding DSB products and mechanisms. Together with internal discussions at SINTEF Energy Research and results from ongoing research projects together with The Federation of Utilities (Enfo) and Statnett, the main findings from this IEA project indeed are representative for Norway.

The main findings are structured and presented in a way that should be suitable for more detailed discussions about DSB and how to develop and implement more products.

It is important to state that the Norwegian power market is organised in a way that will promote new DSB products without major changes. Incentives for promoting DSB are not enough clarified and the value of products seems to be unclear. The national situation for generating capacity of energy and power is rather stressed, and import from other countries is necessary to fill the national demand. Especially this is a situation during wintertime. Reserves and system services are important to secure reliability and quality of supply with this deficit balance. This situation results in an increased value of possible DSB schedules and products.

7 Conclusion

All market participants asked for information about DSB schedules and products give compromised and positive replies. The generator is the participant that is most uncertain about the benefit of new DSB products.

The System Operator already has different DSB products established, but except for one they are not in operation. The only one in operation was implemented years ago and the customer is not paid any fee if interruption is activated.