



# Demand resources as a possibility for a TSO

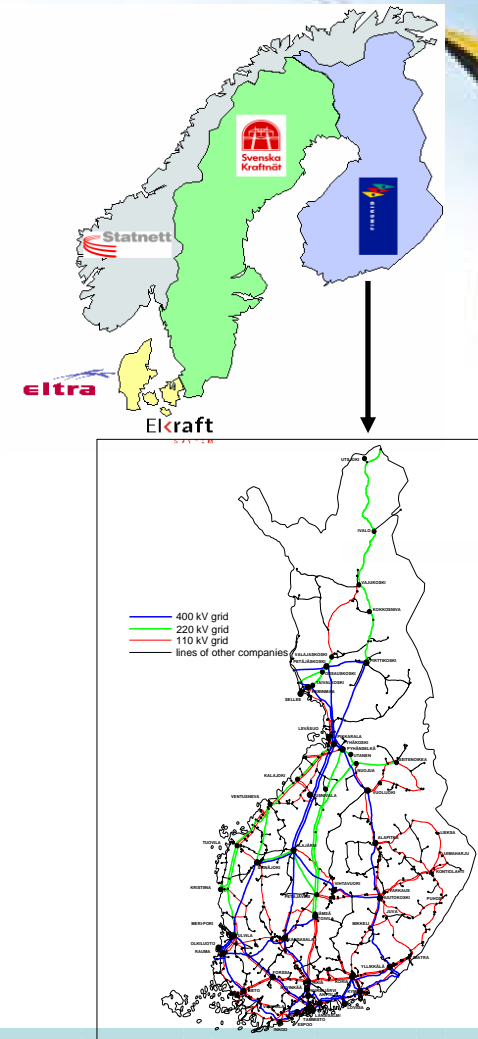
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Operation Planning

Demand Response Workshop in Crown  
Plaza Hotel, Helsinki,  
April 19, 2005

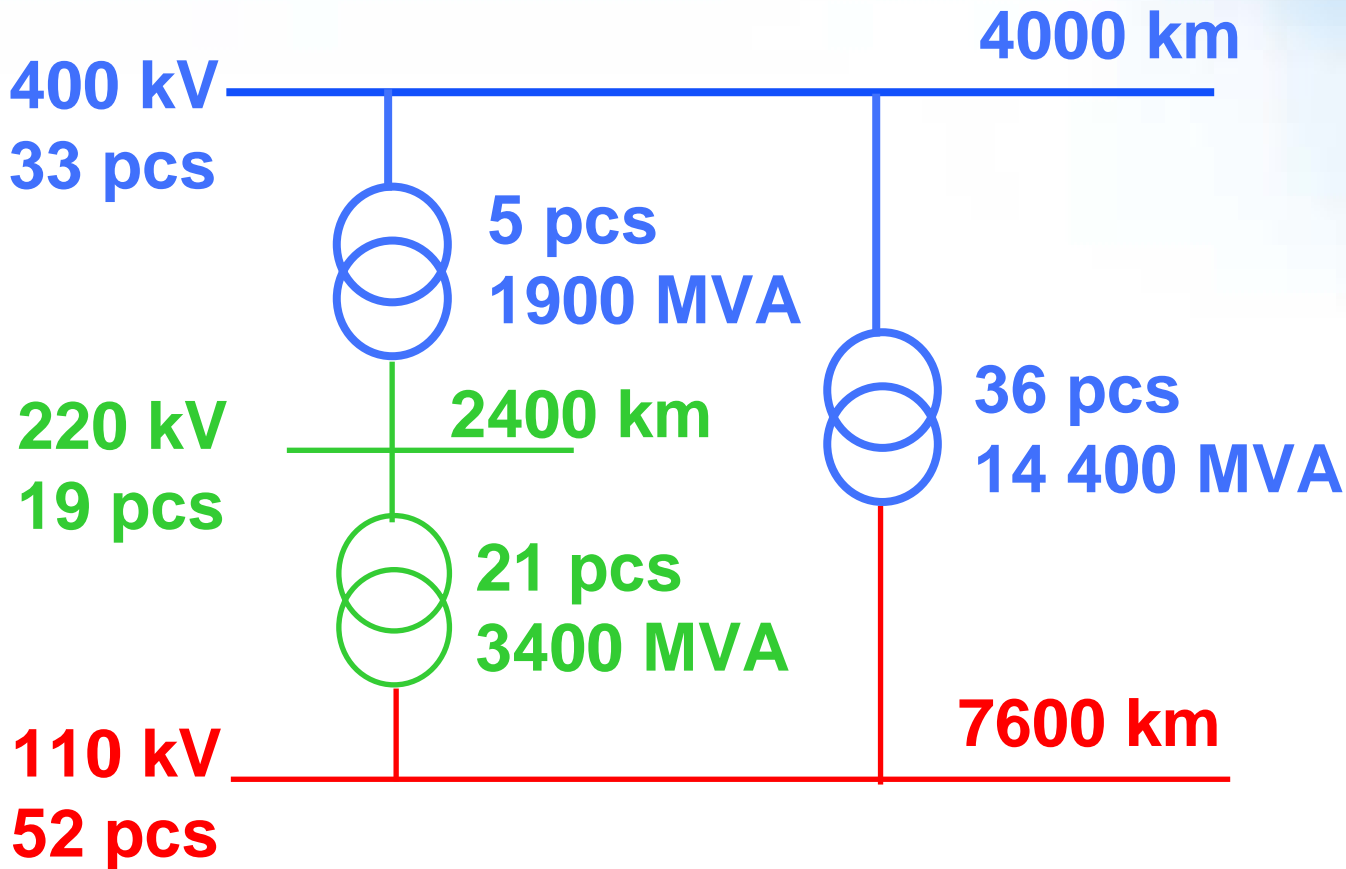
# Fingrid in the Nordic electricity market

## - Finnish Transmission System Operator in brief -

- Started operations on 1 September 1997
- Owns 99.5 per cent of the Finnish main grid and all the major interconnections
- Number of transmission customers: 98
- Number of personnel: 220 (31.12.2004)
- Turnover € 302 million
- Balance sheet € 1,400 million
- Consumption in Finland in 2004 87 TWh
- "All-time high" peak load hour (winter 2002/2003) 13 930 MW



# Fingrid Oyj

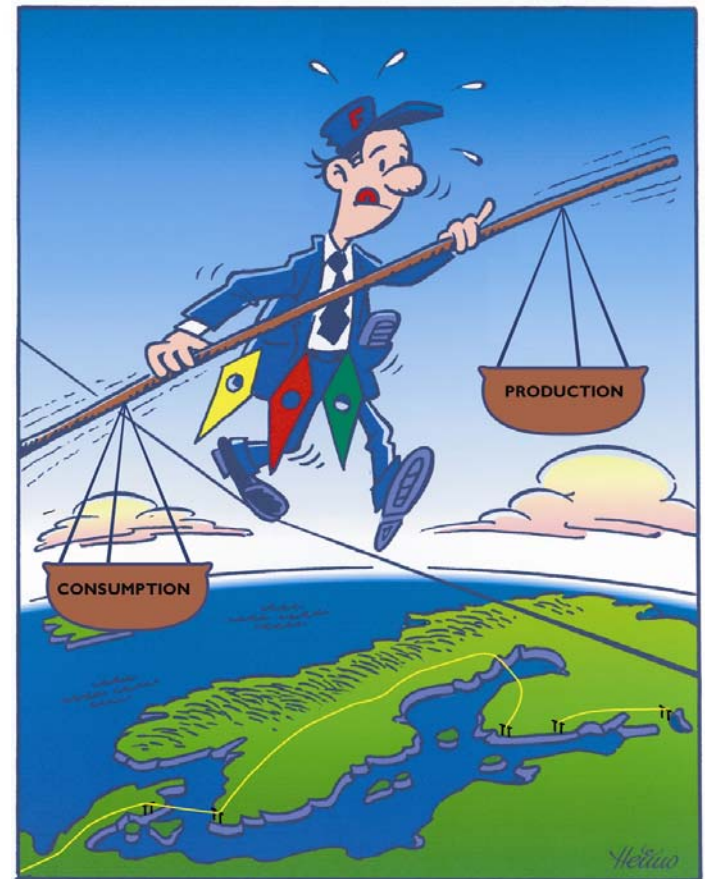


**Substations 104 pcs**  
**Transmission lines 13 900 km**

# Introduction

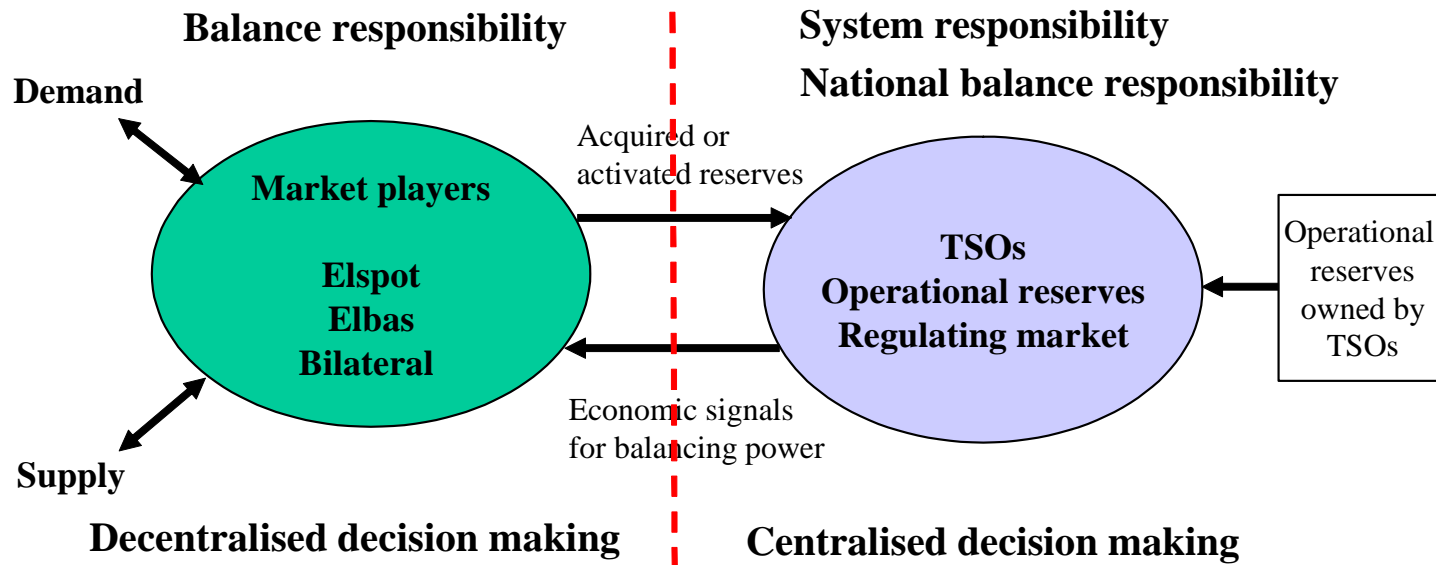
## The Nordic power balance has been tightening in recent years

- more price spikes as a result of increased demand and few investments in new generation capacity
- increases risk of market clearing failure in extreme situations
- increases risk of using reserves in peak load situations for balancing the operation hour



# Balance management

- The market players are responsible for ensuring that their procurement meets their commercial commitments, even in peak-load situations
- TSO's have the national balance responsibility within the operating hour



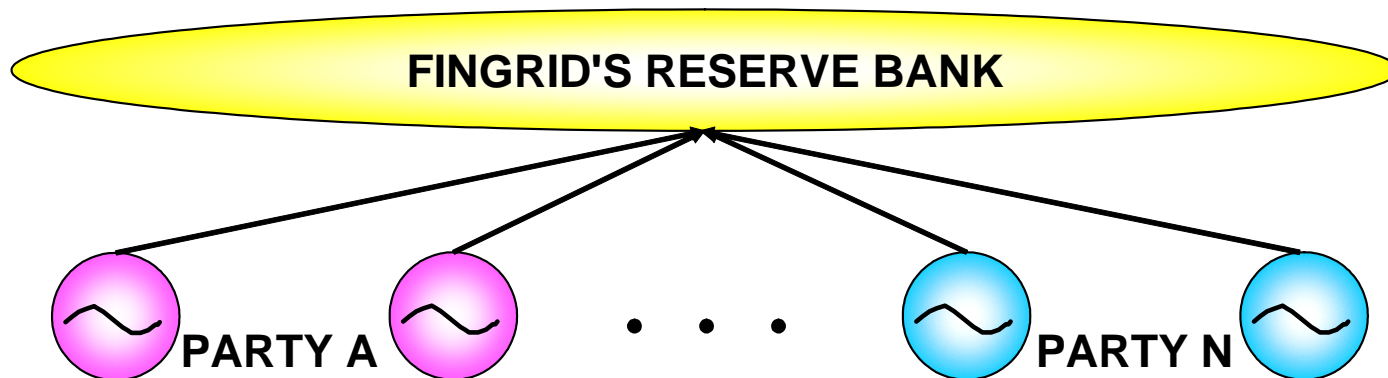
# Balance management

- **TSO's tools for balance management are:**
  - automatic frequency control (primary regulation)
  - manual physical regulations (secondary regulation)
  - disturbance reserves (as a back-up solution)
- **TSO has no regulation capacity of its own in primary and secondary regulation**
  - frequency control is based on contracted resources
  - secondary regulation is based on the regulation power market
- **TSO can only produce part of the disturbance reserves itself**
  - resources are purchased from resource owners



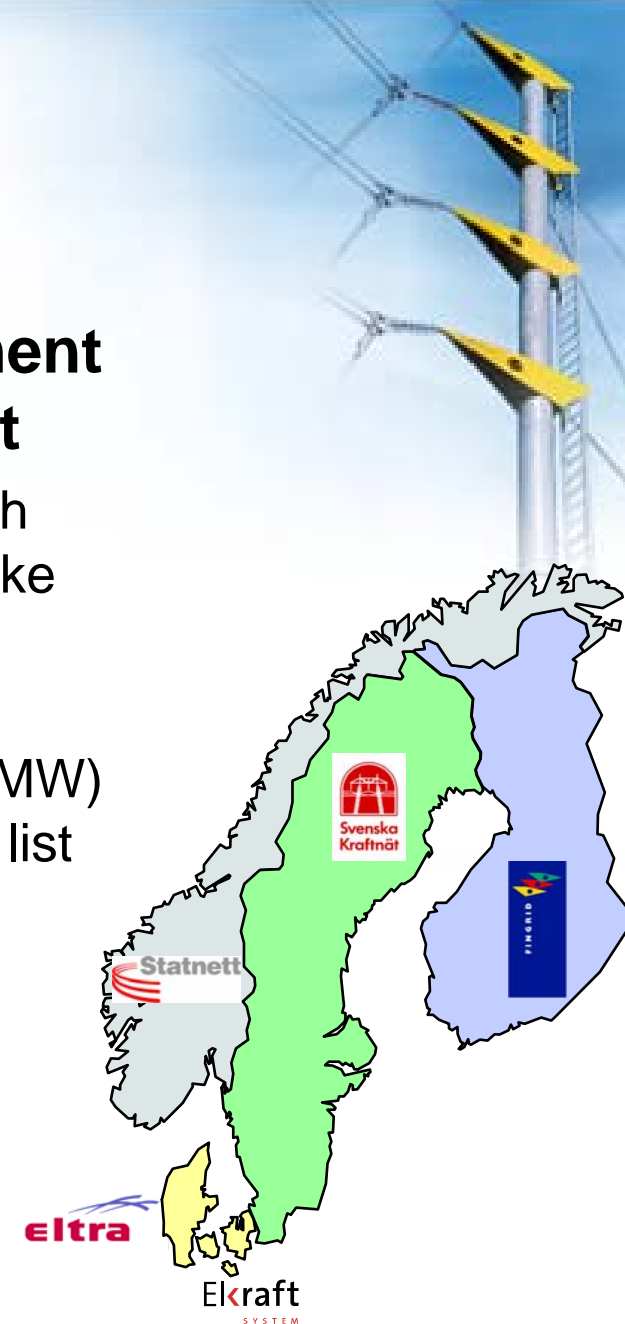
# Primary regulation

- Frequency shall be within the band 49,9...50,1 Hz
- Fingrid has established a so-called reserve bank where companies owning capacity which can be regulated can register their resources
- The resource owners maintain the measured regulation properties at their power plants in the agreed manner and receive a compensation for this from Fingrid



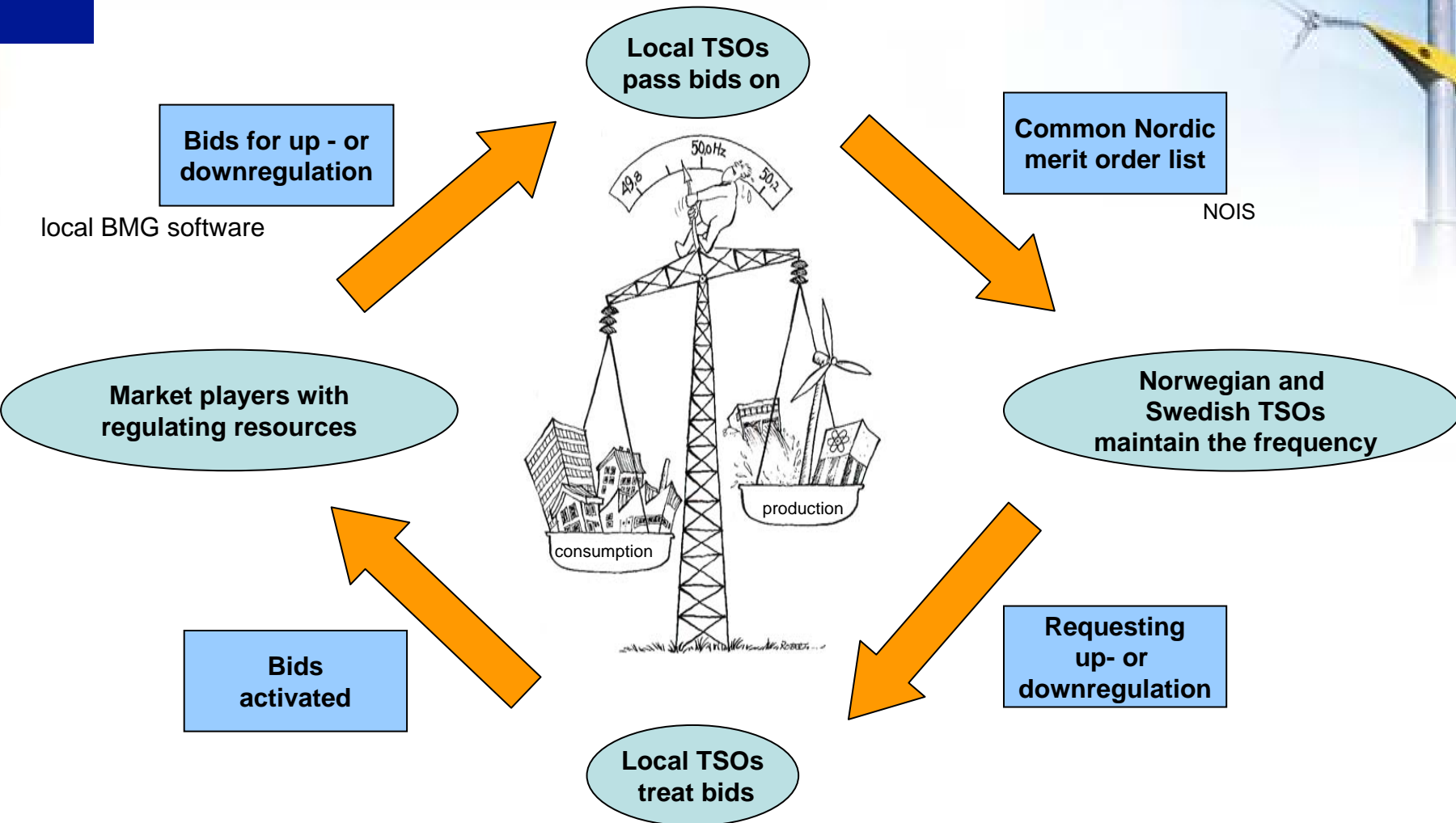
# Secondary regulation

- **Common nordic balance management  
=> Nordic Regulation Power Market**
  - An electricity producer or consumer which has available regulation capacity can make regulation bids to the regulation power market
  - all Nordic regulating power bids (min 10 MW) are collected in one common merit order list
  - The synchronous area is regulated as a one system
  - cheapest available Nordic resources are applied for balancing
  - **there is a potential for increased DR participation in this market!!**





# Nordic Regulation Power Market



# Disconnectable loads

- as disturbance reserves -

- **Demand resources are used in Finland as disturbance reserve in the same way as power plants reserves**
- **Fingrid has signed contracts with large-scale process industry on disconnectable loads:**
  - Metal industry (steel works and furnaces)
  - Forest industry (groundwood plants and mechanical pulping plants)
  - Chemical industry (electrolyses)
  - The minimum unit size is 15 MW with at least 7000 hours availability per year
  - Availability to be disconnected at least 3 hours



# Disconnectable loads

## - agreements -

- **Totally around 1000 megawatts to be available from 2005 to 2015**
  - contracts are divided in two periods:
    - in the first period only half of the agreed power is in use
    - the other half is available on temporary use until the start of new nuclear power plant
- **To assure power system reliability requirements after the new (about 1 600 MW) nuclear power plant comes on-line**
  - new nuclear power plant will be the biggest dimensioning fault (unit size) in Finland
  - separate system protection scheme with disconnectable loads decreases unit size to 1300 MW
- **Contractual terms and payments are equal on voluntary basis to all participants**

# Disconnectable loads

- technical and functional terms -

- **Loads are disconnected from the grid by:**
  - frequency sensitive relays  
(frequency controlled disturbance reserve)
  - manually within 15 minutes, when asked by Fingrid  
(fast disturbance reserve)
  - separate system protection scheme that disconnects 300 - 400 MW load instantly if the new nuclear power plant is tripping
- **Loads can also be used as a part of disturbance reserve in extreme peak load situations, when no other resources are available in regulation power market**
- **Participants have chosen loads so that disconnection does not interrupt significantly normal operation**



# Demand resource benefits for TSO

- **It promotes competition and further capacity in regulating power market**
- **Market based resources are a better way of maintaining the balance during extreme peak load situations than using**
  - disturbance reserves
  - or as a last resort forced load shedding
- **It creates additionally resources for disturbance reserves**



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## State of power system

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  -  Cross-border transmission
  -  Balance settlement
  -  State of power system
-  **ENVIRONMENT AND TRANSMISSION LINES**
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-  **COMPANY**



### Consumption and production in Finland

Consumption	10784 MW
Production	8740 MW
- hydro power	1736 MW
- nuclear power	2683 MW
- condensing power	357 MW
- district heat back pressure	1993 MW
- industry back pressure	1909 MW
- other production (estimate)	62 MW
Net import/export	2044 MW

### Electricity price in Finland

Elspot price area Finland	30.0 e/MWh
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### Power balance

Production deficit/surplus in Finland	-161 MW
Surplus/deficit, cumulative	-28 MWh
Instantaneous freq. measurement	50.02 Hz
Time deviation	-6.48 s

Temperatures in Finland: Helsinki +7°C, Jyväskylä +7°C, Oulu +4°C, Rovaniemi +1°C

<http://www.fingrid.fi>

