The Electric Power System

- Sweden-
Basic facts 2014

- Area: 450,295 km²
- Population: 9.6 Million
- Number of electricity consumers: 5.3 Million
- Number of TSOs: 1
- Number of DSOs: 170
- Peak load: 23.4 GW (all time high 27 GW in 2001)
- SAIDI: 139 min (2013)

(SAIDI=System Average Interruption Duration Index)
Interconnectors with:

- Norway
- Finland
- Denmark
- Lithuania (in operation end of 2015/beginning of 2016)
- Poland
- Germany
The Swedish electricity grid is divided as the picture below shows:

<table>
<thead>
<tr>
<th>Voltage level</th>
<th>Kilometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 kV</td>
<td>11 000</td>
</tr>
<tr>
<td>220 kV</td>
<td>4 000</td>
</tr>
<tr>
<td>HVDC</td>
<td>1 000</td>
</tr>
<tr>
<td>Regional network 33-150 kV</td>
<td>30 000</td>
</tr>
<tr>
<td>Local network 10 kV</td>
<td>506 000</td>
</tr>
</tbody>
</table>

Source: Energimyndigheten
Structure of electrical power supply

The diagram illustrates the structure of the Swedish power system, showing the flow of electrical power from the TSO-Grid to the DSO-Grid, down to households and industries. The key voltage levels are highlighted:

- **TSO-Grid**:
  - 400 kV
  - 220 kV
  - 130 kV

- **DSO-Grid**:
  - 10 kV
  - 400 V

The power supply network includes conventional generation, dispersed generation, utilities, and industries. The diagram also indicates the flow to households.
Swedish Power System

Structure of electrical power system
Map of the Transmission Grid
Information on TSO

- Name: Svenska kraftnät
- Network length (km): 15 000
- Annual transmitted energy (TWh): 115 (of 151 generated 2014)
- Website: http://www.svk.se/en
Installed capacity with reference to primary resources

- Total installed capacity 39,563 MW (2014)
  - Hydro power: 16,155
  - Wind power: 5,425
  - Nuclear power: 9,531
  - Solar: 79
  - Other: 8,452
    - CHP: 5,056
Energy production with reference to primary resources

- Electricity generated 151,2 TWh (2014)
  - Hydro power: 64,2
  - Wind power: 11,5
  - Nuclear power: 62,2
  - Solar: 0
  - Other: 13,3
    - CHP: 12,8

![Pie chart showing energy sources: Hydro 42%, Nuclear 41%, Wind 8%, Other 9%, CHP 12.8%]
Development of generated capacity

TWh

Hydro
Nuclear

Heating & CHP
Wind

2007 2008 2009 2010 2011 2012 2013 2014

Swedish Power System
Main Driving Forces behind Swedish transmission grid development

- Integration of new production, mainly increasing share of RES in the system
- Re-investment needs in an aging transmission grid
- Market integration with neighbouring countries through interconnections
Main Driving Forces behind Swedish transmission grid development

Million Euros

- Market integration
- Re-investments
- Connection new production

Production Mix in Sweden

- HYDRO
- WIND
- PV
- BIOFUELS
- NUCLEAR
- OTHER

Sweden 151 TWh
Production Mix in the Nordic and neighbouring countries
Consumption per consumer groups 2013

- Industry: 36%
- Households: 51%
- Transport sector: 2%
- District heating & refinery: 3%
- Distribution losses: 6%
- Transmission losses: 2%
Simulated Energy Balance Scenario 2025

Swedish Power System
Location of renewable energy sources

- **Today:** Primarily Hydro in the north, Wind in the south
- Wind to be located in the north more in the future
- Nuclear and thermal primarily in the south
Price development for industry consumers

Prices include taxes, VAT, tariffs and electricity certificates.
Price development for households

Prices include taxes, VAT, tariffs and electricity certificates.
Electricity export over time and exports share of production

- **2012**: 20 TWh, 12.1%
- **2013**: 10 TWh, 6.7%
- **2014**: 16 TWh, 10.3%

Generation 2014: 152 TWh
Consumption 2014: 136 TWh

Swedish Power System
Interconnectors and its capacity

- The capacity of 16 interconnectors to:
  - Norway (AC)
  - Finland and Denmark (AC & DC)
  - Germany, Poland and soon Lithuania (all DC)
  - Comprises 28% of installed production capacity

- Total: 10 GW.
Peak load 2014

- Dec. 29th 10-11 AM
- 23 400 MW
Market Coupling – General principle

- 08:15: Latest time for market participants to nominate Day-Ahead
  ➔ Use acquired rights or capacity given to Market Coupling - Use-it-or-Sell-it
- 08:15: Nominations are summed up and sum is send to Common System
  ➔ Common System calculates with help of nominations the CZCs
- 10:30: Common System sends the collected CZCs to the exchange system
- 12:00: Order books of power exchange close
- 12:55: Final market results are send to all market participants
- 14:30: Deadline for nomination of schedules

CZC: cross zonal capacity
Price Coupling of Regions (PCR) in Europe

Towards Single European Market: Next Steps

WHAT is PCR?
Price Coupling of Regions (PCR) is the initiative of seven European Power Exchanges to harmonise the European electricity markets.

HOW is this done?
By developing a single price coupling algorithm to be used to calculate electricity prices across Europe.