Daily generation profiles 2013
Spring, Summer, Fall, Winter

Source: Swiss Electricity Statistics 2013, SFOE
# Domestic Nuclear and Long Term Contracts

## Supplying Switzerland with 42 TWh Electricity

<table>
<thead>
<tr>
<th>Swiss units</th>
<th>COD Foundation</th>
<th>Plant/LTC Capacity</th>
<th>Generation/Import 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beznau 1&amp;2</td>
<td>1969/1971</td>
<td>730 MW</td>
<td>5.9 TWh</td>
</tr>
<tr>
<td>Mühleberg</td>
<td>1971</td>
<td>373 MW</td>
<td>2.9 TWh</td>
</tr>
<tr>
<td>Gösgen</td>
<td>1979</td>
<td>1010 MW</td>
<td>6.4 TWh</td>
</tr>
<tr>
<td>Leibstadt</td>
<td>1984</td>
<td>1220 MW</td>
<td>9.7 TWh</td>
</tr>
</tbody>
</table>

## Nuclear imports (LTC from France)

- **CNP (FES, CAT)**: 1972/1985, 830 MW, 5.1 TWh
- **AKeB (BUG, CAT)**: 1972/1984, 521 MW, 2.9 TWh
- **ENAG (-)**: 1990, 400 MW, 3.5 TWh
- **Others**: ~1000 MW, ~5.5 TWh

### Total supply for Switzerland 2013: 42 TWh

(Total domestic consumption: 64 TWh)
Backfitting of Swiss NPPs for severe accidents and accident management

Since the 1980s

- Backfitting of systems to prevent hydrogen explosions (passive autocatalytic recombiners, H2 mixing systems, H2 ignition systems in the primary containment, and N2 systems to inert the primary containment)

Since the 1990s

- Backfitting of independent special emergency systems in separate, bunkered buildings in Beznau and Mühleberg NPPs (part of design for the for Gösgen and Leibstadt).
- Backfitting of filtered containment venting system to mitigate the consequences of severe accidents
- Gradual backfitting of alternative feed lines to the reactor pressure vessel and the primary containment

Since the 2000s

- Written decision-making aids to mitigate the effects of severe accidents (SAMG) have been developed both for power and nonpower operation
Post-Fukushima action plan

Since 2011

- Further strengthening of preventive and mitigative measures against consequences of accidents (onsite and offsite):
- Establishment of a Central Offsite External Storage Facility Reitnau in a former Swiss military bunker
- Further safety improvement measures ongoing in all Swiss NPPs
Retrofitting of Gösgen NPP over the last 35 years

Examples

- 1979 Start of commercial operation
- 1993 Retrofit of filtered venting system
- 1993 Gross power increased from 970 MW to 990 MW
- 1995 Gross power increased from 990 MW to 1020 MW
- 1999 Third independent cooling line for the spent fuel pool
- 2001 Process computer replaced by data information system
- 2005 Retrofit pressure release system reactor coolant system
- 2008 New external wet spent fuel pool storage building
- 2010 Cooling tower internals optimization completed
- 2010 Gross power increased from 1020 MW to 1035 MW
- 2013 Low pressure turbine, condenser, main generator
- 2013 Gross power increased from 1035 MW to 1060 MW
## Historical operating results Gösgen NPP

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating hours</th>
<th>Load factor</th>
<th>Electricity Generation</th>
<th>Annual costs</th>
<th>Generation costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>8220.4</td>
<td>93.6</td>
<td>7,928</td>
<td>399.5</td>
<td>5.04</td>
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<tr>
<td>1997</td>
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<td>93.6</td>
<td>7,908</td>
<td>401.0</td>
<td>5.07</td>
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<td>1998</td>
<td>8129.5</td>
<td>92.8</td>
<td>7,840</td>
<td>398.0</td>
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<td>1999</td>
<td>7825.5</td>
<td>89.3</td>
<td>7,534</td>
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<td>5.02</td>
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<td>2000</td>
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<td>4.10</td>
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<td>2005</td>
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<td>89.5</td>
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<td>2006</td>
<td>8370.5</td>
<td>95.5</td>
<td>8,099</td>
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<tr>
<td>2007</td>
<td>8434.2</td>
<td>96.2</td>
<td>8,159</td>
<td>297.3</td>
<td>3.64</td>
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<tr>
<td>2008</td>
<td>8235.7</td>
<td>93.8</td>
<td>7,964</td>
<td>316.6</td>
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<tr>
<td>2009</td>
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<td>95.3</td>
<td>8,072</td>
<td>374.8</td>
<td>4.64</td>
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<tr>
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<tr>
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<td>93.7</td>
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<td>2013</td>
<td>6643.9</td>
<td>74.7</td>
<td>6,410</td>
<td>319.20</td>
<td>4.98</td>
</tr>
</tbody>
</table>
Long-term operation management
Example: Leibstadt NPP

**Equipment/Investments**
- Mechanical
- Electrical
- Civil Engineering

**Post Operation Phase**
- Decommissioning
- Disposal of Radwaste
- Fund development / Finances

**Other Factors of Influence**
- Staff development
- Techn.power uprate(s)
- Spare Parts Storage

**External Factors of Influence**
- Electricity Market Development
- Political Environment
- Nuclear Law: Backfitting Imperative
- Vendors/ Market Environment

**Fuel**
- Long Term Contracts Purchase

**Business Economical Analysis**
- Needs/ Plans for Investments
- Consumption of Fixed Capital
- Net electricity generation
- Annual and Generation costs

Modernization of existing NPPs
- New long-term energy policy
- Decision to withdraw from the use of nuclear energy
- Intention: decommission Switzerland's NPPs when they reach the end of their service life
- NPPs not to be replaced with new ones
- Focus on energy efficiency, hydropower and new renewable energy sources
Outside forces

- Massively reduced electricity market prices in Western Europe triggered to a large part by German subsidy policy
- Strong Swiss currency but surrounding electricity markets all priced in EUR/MWh
Conclusion

- Large component replacements and modernizations ongoing (plant improvement and plant ageing management)
- Further safety improvements ongoing (continuous improvement & Fukushima lessons learned)
- Modified/additional legal requirements for the nuclear industry (for example: emergency measures/iodine tablets, fuel transport insurance, decommissioning cost studies & funds)
- Swiss electricity utilities under financial pressure (also run of river and storage hydro power plants not as profitable as in the past)

→ Very challenging environment for NPP long-term operation management
Thank you very much!

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