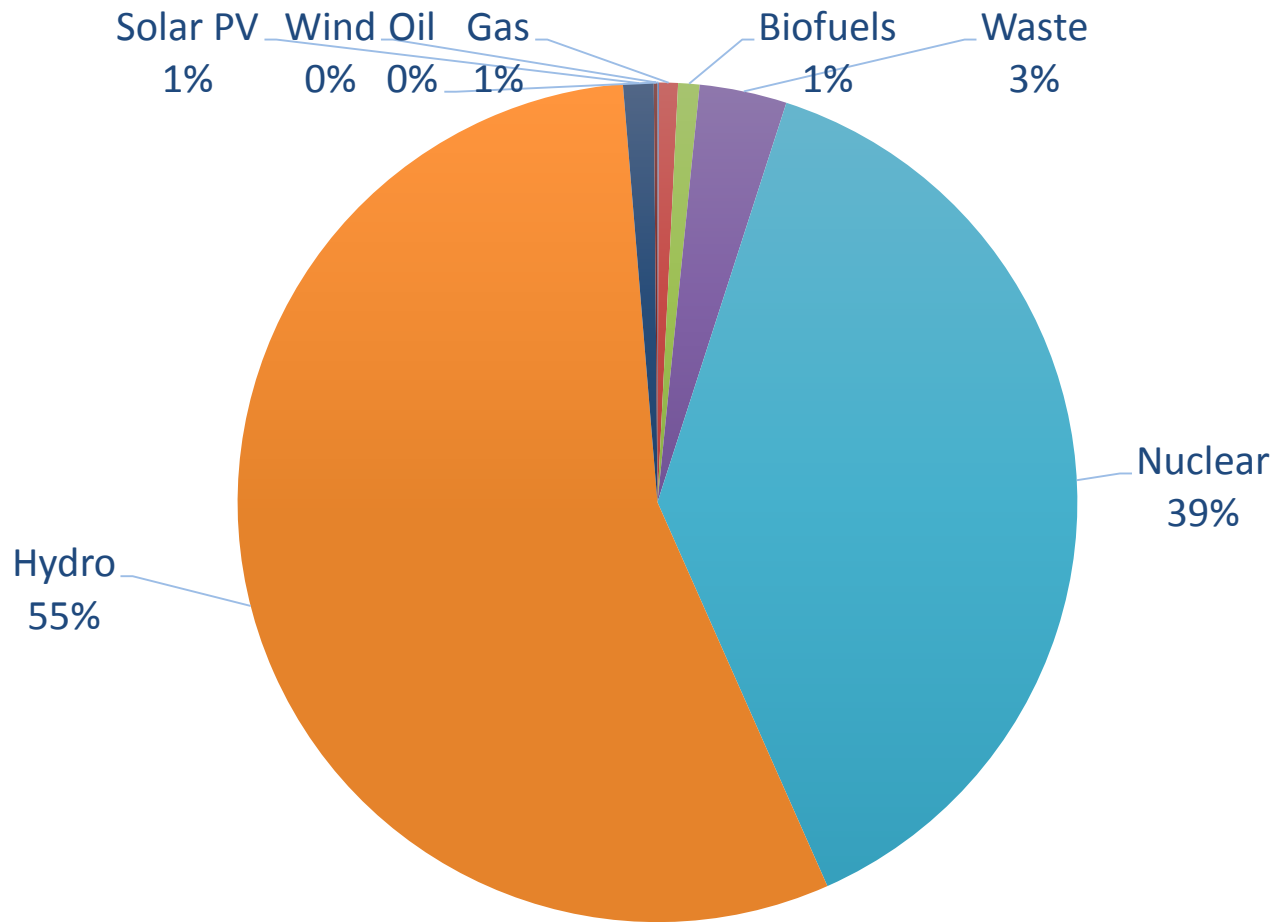


Nuclear power in Switzerland

Presented by Richard Bridle
October 2016



Power mix (IEA)



The swiss nuclear history



Experimental

- 10 MW, SAPHIR, 1957 – 1993
- 30 MW, DIORIT, 1960 – 1977
- 30 MWt, 7 MWe, Lucens 1966-1969

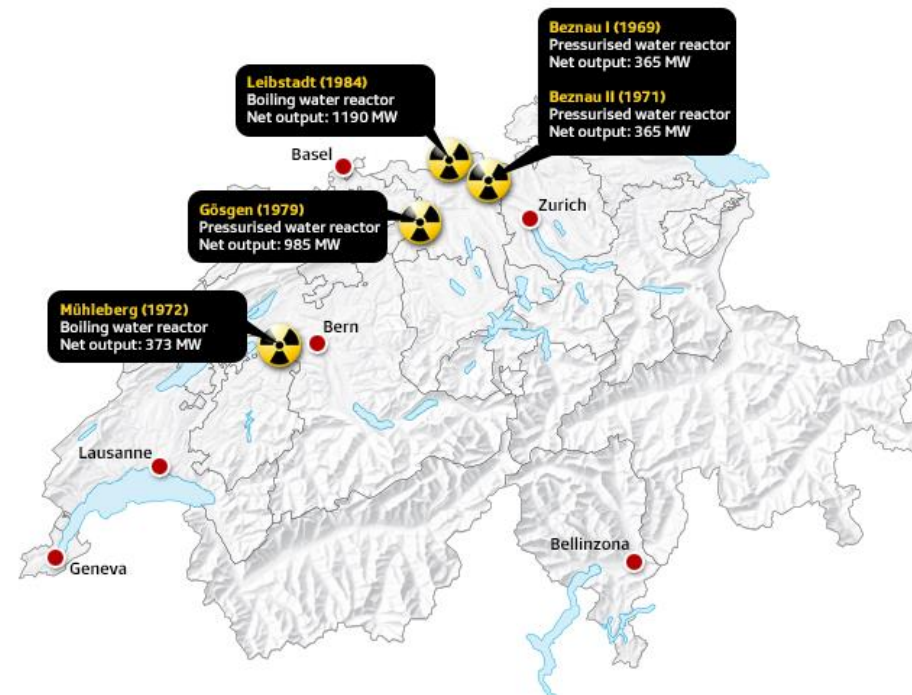
Commercial

- 365 MWe each, Beznau 1 and 2, 1965 and 1971-present
- 373 MWe Mühleberg, 1972-present
- 1,020 MWe Gösgen, 1979-present
- 1,220 MWe Leibstadt, 1984-present

Proposed and cancelled

- 950 MWe, Kaiseraugst, cancelled 1988
- 1140 MWe, Graben, cancelled 1988

THE FIVE NUCLEAR POWER STATIONS IN SWITZERLAND



Sources: IAEA, swissnuclear

What will be closed in 2017?



Beznau

- Beznau 1 is possibly the oldest operating nuclear power plant in the world.
- Currently not running while a review of the pressure vessel safety is carried out.
- Beznau 2 has been cleared for operation
- Both are operated by Axpo, a company wholly owned by the cantons of Northeastern Switzerland and their cantonal utility companies

Mühleberg, 1972-present

- The operator BKW decided in 2013 to close the plant in 2019
- BKW is owned by the canton of Bern (52.54%) and the German utility EON (20.99%)

Gösgen and **Leibstadt** will be closed 45 years after commissioning under the proposal (2024 and 2029 respectively)

Gösgen is owned by Alpiq (private, 40%), Axpo (public, 25%), CKW (91% public, 12.5%), the city of Zurich (15%), and Energie Water Bern (7.5%)

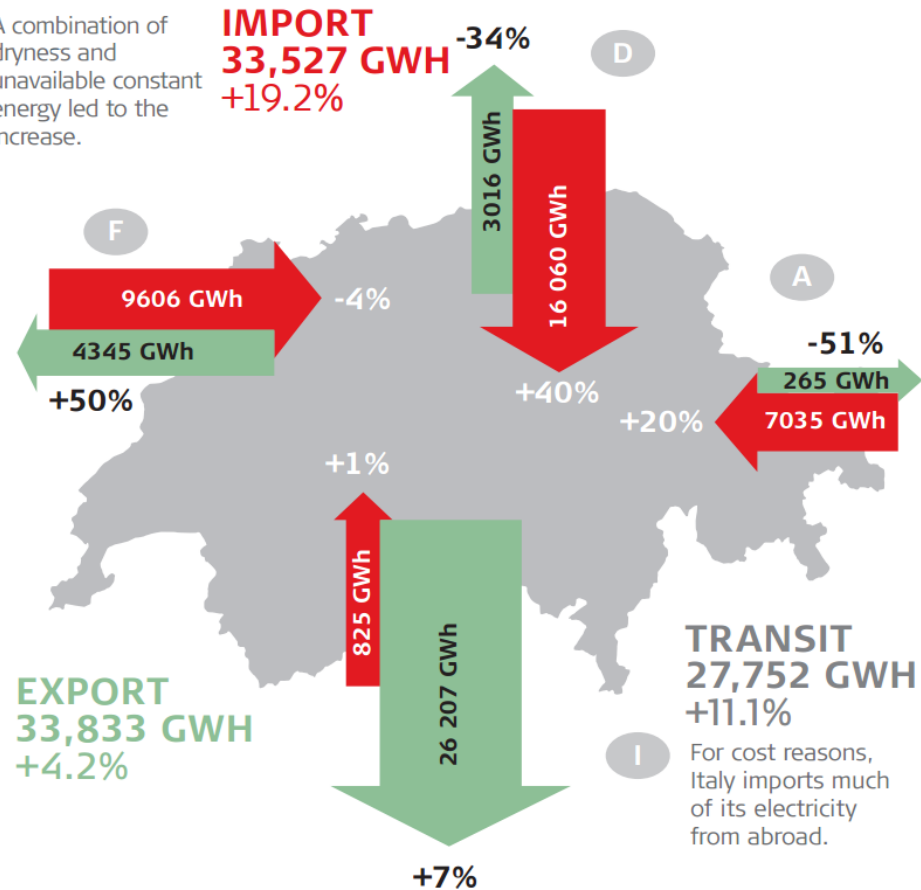
Leibstadt is owned by Atel (27%), NOK (23%), CKW (14%), EGL (16%), BKW (10%), AEW energy AG (5%) – a mix of public and private ownership



A loss of 1000 MW of nuclear is equivalent to most imports from France, half from Germany or 30% of exports to Italy

Import and export of electricity
Comparison to 2014 in per cent

A combination of dryness and unavailable constant energy led to the increase.



The complexity of CH electricity sector



> 800

distributors
(1 per every 10'000
Swiss)

2

Parallel systems:
competition vs
monopoly

56%

Of GVA electricity
coming from EU
(95% certified
renewable)

100%

Electricity suppliers
must publish the
source of their
electricity

87%

Of electricity
generation owned
by Cantons &
Communes

3 of the oldest 7 operational nuclear power stations in the world are in Switzerland

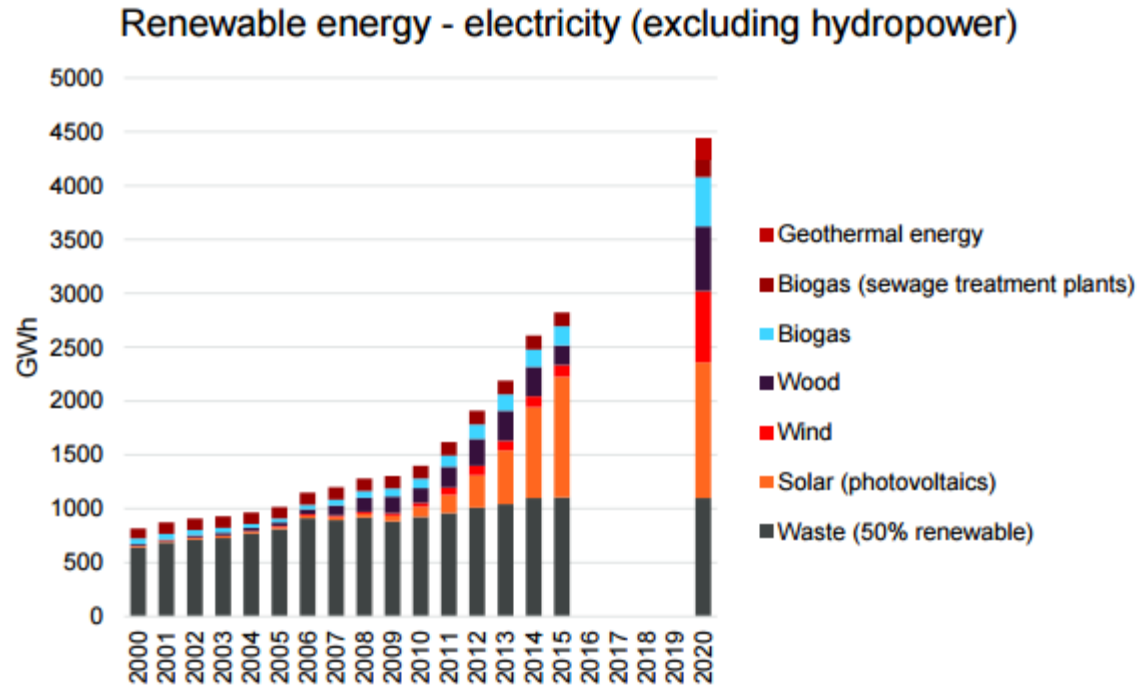


OLDEST REACTORS IN OPERATION (at December 2015)	
Switzerland - Beznau 1	1969
United States - Nine Mile Point 1	1969
United States - Point Beach 1	1970
United States - Dresden 2	1970
United States - Robinson 2	1970
Switzerland - Mühleberg	1971
Switzerland - Beznau 2	1971
Russia - Novovoronezh 3	1971
Sweden - Oskarshamn 1	1971
Canada - Pickering 1	1971
Pakistan - Kanupp	1971
United States - Dresden 3	1971
United States - Monticello	1971
United States - Palisades	1971

Source: IAEA



What are the alternatives?



- Under the 2050 energy strategy wind, wood, biogas and geothermal are due to increase significantly by 2020.
- Support for renewables could be accelerated

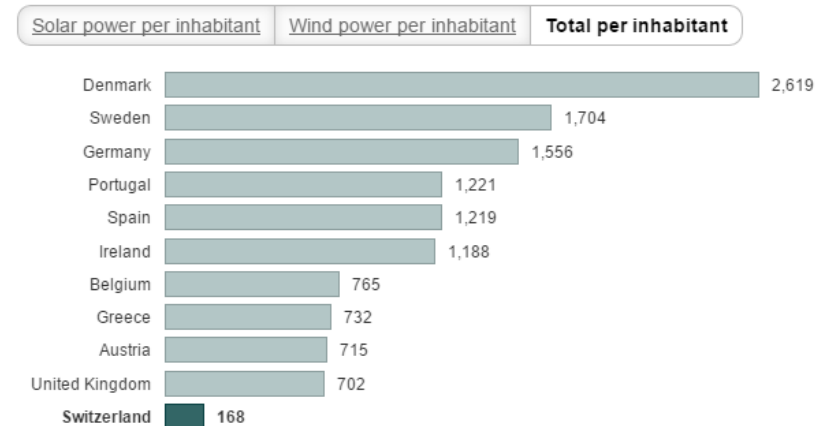


Renewable energy is held up by a struggling system of feed in tariffs

- There are feed in tariffs available for hydro, PV, wind, biomass and energy from waste
- There are currently 37,000 projects waiting for funding from the 'feed-in remuneration', a system of tariffs based on benchmark values (Swiss Energy Foundation)
- Only Slovenia, Slovakia, Hungary and Latvia produce less wind and solar energy per inhabitant than Switzerland
- Grants are available for small (<30kW) projects

Solar and wind energy in Europe

Top ten countries by total output per inhabitant (in kilowatt hours); Switzerland ranked 25th out of 29



Source: [Swiss Energy Foundation](#) [Get the data](#)



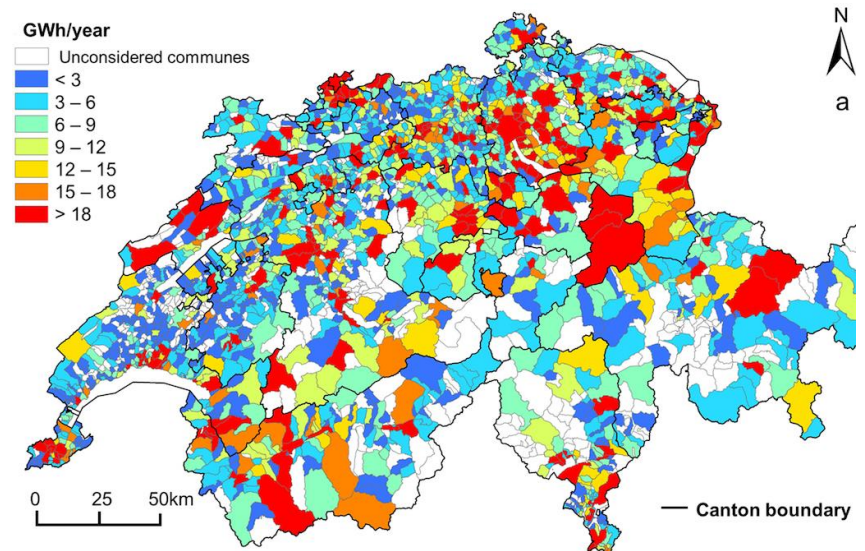
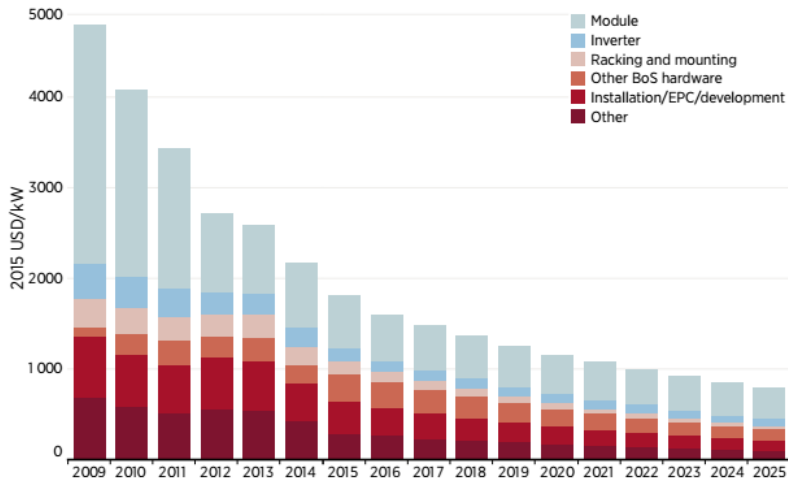
End



Solar: filling the gap?

- The global average cost of solar is projected to fall from 0.13 USD/kWh to 0.06 USD/kWh by 2025 (IRENA)
- EPFL estimate potential of 37% of all electricity from solar roofs by 2050

FIGURE ES 1: GLOBAL WEIGHTED AVERAGE UTILITY-SCALE SOLAR PV TOTAL INSTALLED COSTS, 2009-2025



CH electricity market: the two sides of the coin



Consumers >100 MWh/year
Liberalized market

- Consume around 50% of electricity in CH
- Free choice of electricity supplier, including international (EDF, RWE, Vattenfall,)
- Price defined by contract.
Maximum visibility: 3 years (markets) + spot market (EPEX)
- Focus on price – competitive market

Consumers <100 MWh/year
“monopoly”

- Consume around 50% of electricity in CH
- Local distributor supplies electricity, no possibility to change
- Price defined by regulated tariffs (ElCom)
- Focus on services and “quality” of energy: growing interest for certified electricity