










Advantages and disadvantages of the different sources of energy in Switzerland

		Assessment Criteria							
Use in Switzerland	Source of energy for the production of electricity	Contribution to the power supply (2015)	Costs	Potential contribution to power supply	Contribution to the stabilization of the grid	Dependence on external factors (weather conditions)	Foreign dependency	CO ₂ emissions	Other negative externalities in Switzerland
Existing sources	Water	59,8 % or 39 486 GWh	Large hydro-electric plants 4–9 cts/kWh Small hydro-electric plants 8–35 cts/kWh	+	+++	+	++	+++	+
				Small increase though the optimization of existing plants, but limited by environmental protection measures.	Very high contribution, supplies peak and base load energy, can be opened/closed without losing too much time; turbing-pumping plants can act as large batteries.	Rather low, depends on rainfall ; less rainfall and electricity production during the winter.	Low, in part dependent of the technology necessary for the construction.	Low for construction, almost non-existent for exploitation (staff travel for operation and maintenance).	Impact on the landscape, natural balance of water and aquatic species, especially fish; residual risk of a low dam failure.
	Nuclear Energy	33,5 % or 22 095 GWh	4–7 cts/kWh	---	++	+++	---	++	++
				Decreased consent on behalf of the political spheres and public opinion;low economic profitability (renovations); in the upcoming decades, dismantling will take over development.	High contribution, supplies peak and base load energy and covers part of the base load; balanced vibrations are possible to a certain extent; cold start can take from 12 to 25 hours.	Very low; except for possible technical interruptions, constant output power is possible.	High, for uranium fuel and technology.	Weak for uranium mining and construction, almost inexistant for the operation (staff travel for operation and maintenance).	Impact on landscape, very low residual risk of radioactive leakage (nevertheless, high theoretical potential damage).
	Biomass	2,4 % or 1608 GWh	11–48 cts/kWh	–	+	+++	+++	++	++
				Weak, in principle renewable, but limited available raw material (wood, waste and biogas).	Positive contribution, (connection/disconnection is generally available immediately), but a weak total contribution because of its limited potential.	Very low; except for possible technical interruptions, constant output power is possible.	Low, raw material is generally renewable but their availability is limited on a national level.	CO ₂ emissions during biomass transport and exploitation; partially neutral CO ₂ performance; when biomass is in any case burnt (e.g.waste) there are no additional CO ₂ emissions related to energy.	Increased air pollutants; when biomass must be burnt anyway, there are no additional pollutants linked to energy.
	Cogeneration	2,4 % or 1604 GWh	14–22 cts/kWh	--	--	+++	---	++	++
				Extensible, but high costs ; problems related to CO ₂ , petrol or gas are generally used.	Low, electricity production depends on needs for heat and are thus impossible to control.	Very low; except for possible technical interruptions, constant output power is possible.	High dependence to gas and oil.	CO ₂ emission during fuel transport and its exploitation considering that until now it is heated with fossil fuels, there is no additional, CO ₂ emission related to energy.	Increase in air pollutants; but since we heat anyway, there are no additional CO ₂ emissions linked to energy.
	Photovoltaic	1,7 % or 1119 GWh	17–21 cts/kWh	+	---	--	+	++	+
				Extensible, but not ideal for Switzerland, increasing conflicts with the landscape and the local features, mass development but no enough storage options, therefore not relevant.	Difficult to control and predict the production, tends to destabilize the grid.	High ; depends on the level of the clouds and the angle of incidence of the sun's rays (depend on the time of the day or the year.	Relatively low, importation of solar panels.	Low in the extraction of raw material, fabrication and installation; almost inexistant in the exploitation (except for maintenance).	Impacts the landscape and the local features; no additional land is used only in the cases where existing roofs are used; negative effect on grid stability, network management costs are high.
Possibilités supplémentaires	Wind energy	0,2 % or 110 GWh	13–21 cts/kWh	+	---	---	+	++	+
				Extensible, but not ideal for Switzerland, increasing conflicts with the landscape and the local features, mass development but no enough storage options, therefore not relevant.	Production can neither be controlled nor predicted, and tends to destabilize the grid.	Very high ; depends on the wind's strength and steadiness.	Relatively low, dependent on the technologynecessary for construction.	Low in the extraction of raw material, fabrication and installation; almost inexistant in the exploitation (except for maintenance).	Impacts the landscape and local features, noise; risk of avian collision; negative effect on grid stability, network management costs are high.
	Geothermal	0 % or 0 GWh	ca. 20–40 cts/kWh	–	+	+++	+	+++	–
				Great available potential, practical implementation, but still very new and expensive.	Postive, but there is still very little practical experience.	Very low; except for possible technical interruptions, constant output power is possible.	Relatively low, dependent on the technologynecessary for construction.	Low for the construction, almost inexistant for the exploitation.	Possible impact on groundwater, can cause micro earthquakes.
	Combined-cycle gas	0 % or 0 GWh	5–15 cts/kWh	+	++	+++	---	--	--
				Possible in principle, but doubtful approval because of CO ₂ emissions.	Potentially high contribution, provides load energy and covers the base load, cold start takes between 2 to 5 hours.	Very low; except for possible technical interruptions, constant output power is possible.	High dependence to gas and oil.	High CO ₂ emissions from gas combustion (but aprox. 50 % less than with coal combustion.	Increase in the air pollution such as methane.
	Coal	0 % or 0 GWh	4–9 cts/kWh	--	++	+++	---	---	---
				Possible in principle, but doubtful approval because of CO ₂ emissions.	Potentially high contribution to the medium and base load; cold start takes between 4 to 15 hours.	Very low; except for possible technical interruptions, constant output power is possible.	High dependence to coal and technology.	Very high CO ₂ emissions from coal combustion.	Increase in air pollutants.