

Gasification Survey Country:

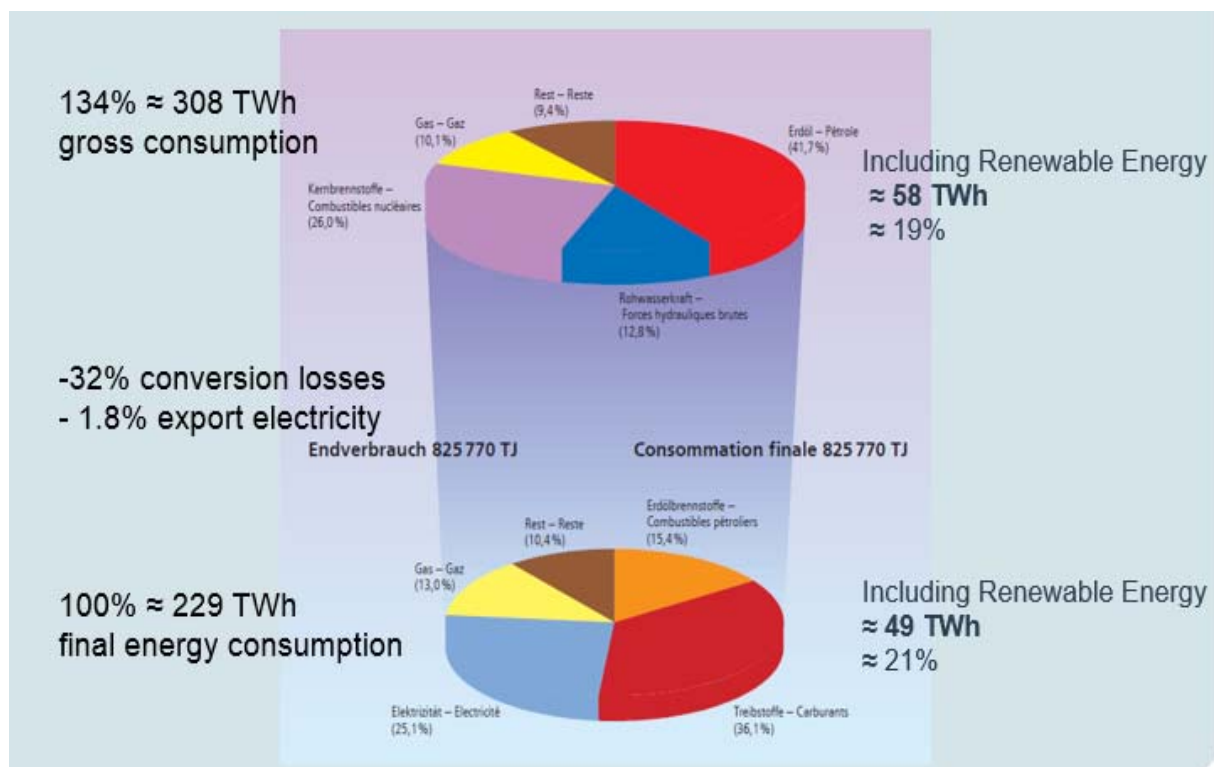
**Switzerland**

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Delegated for Switzerland for IEA Bioenergy Task 33  
On behalf of Swiss Federal Office of Energy (SFOE)

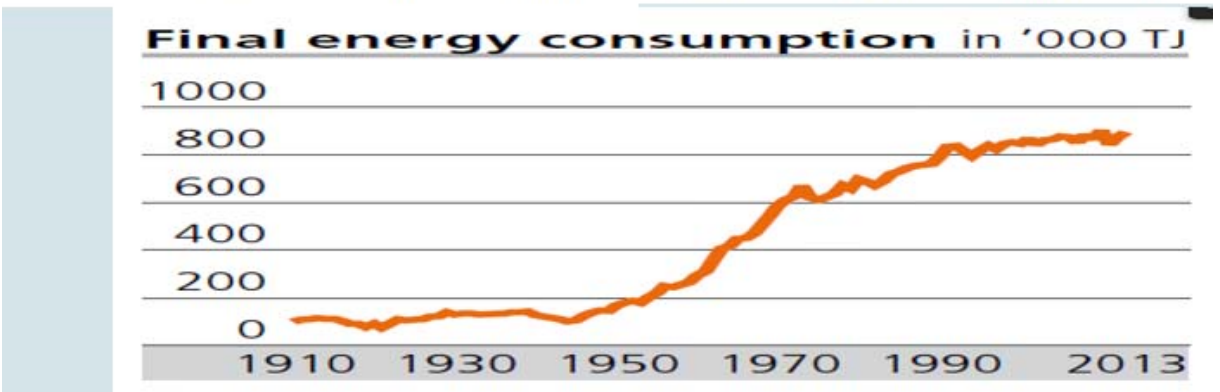
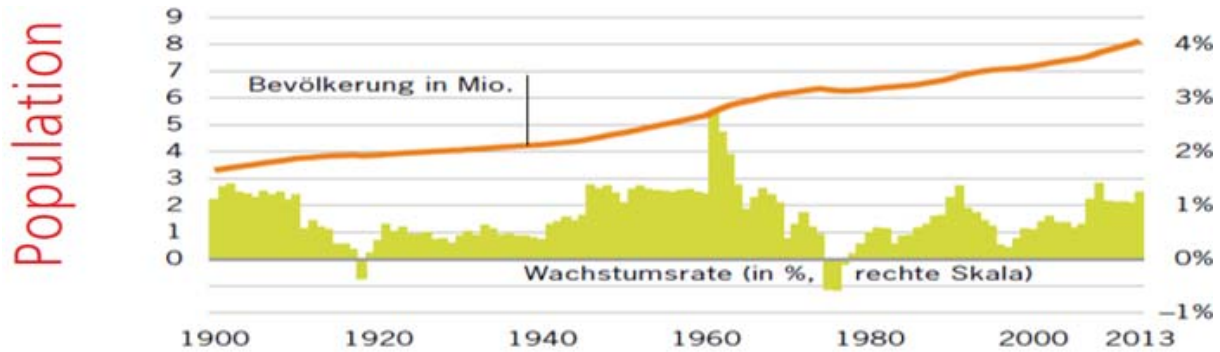
Date: 2<sup>th</sup> December 2015

## 1. Facts

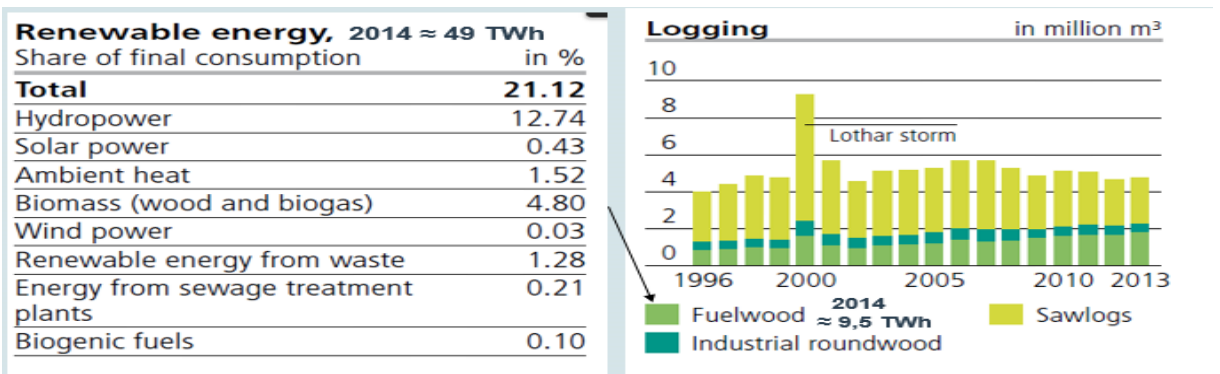
The total energy gross consumption in Switzerland 2014 was 308 TWh. 229 TWh was the final energy consumption. Two thirds (61.7%) were covered by imported fossil energy (heating oil, fuels, coal and natural gas). 56% of this fossil energy was used for traffic fuel only. Renewable energy sources (Hydro, biomass, waste, wind and solar) contributed 21% of total final energy consumption.



Switzerland a very dens populated country with about 200 habitant/km<sup>2</sup> could reduce the specific energy consumption during the last four decades. This is the good news, but still the overall total consumption is still increasing due a continuing remarkable population growth. (See next two graphs population and final energy consumption together)



Biomass contributed 2014 roughly 6.39% of the energy demand. (Wood and biogas 4.8%, biomass energy from waste treatment 1.28%, biomass energy from sewage treatment 0.21%, bio fuels 0.10%). In 2014 was 9.5 TWh fuelwood used, the amount is still increasing.



This energy from biomass conversion is used approximate to, 50% for direct domestic heating in very small furnaces applications, 20% is used for process heat, 15% for combined heat and power (CHP) and 15% for district heating. The largest biomass boiler in Switzerland has the size of 100 MW.

Historically, Switzerland's longest-serving and most important source of renewable energy has been hydropower. But the "new" renewables including solar, wood, biomass, wind, geothermal and ambient heat also play an increasingly important role in today's Swiss energy mix. The long-term potentials of domestic renewable energy indicate that, for all forms, the prospects for electricity and heat are very important. However, it is also clear that, primarily for economic reasons, it will only be possible to fully utilise the major potentials of photovoltaics or geothermal energy in medium term future. Other renewables such as wood and biomass, ambient heat, electricity from small-scale hydropower plants and, to a modest extent, wind, are available now and in some cases are also already economically attractive.

## 2. Policy

In February 2007, the Federal Council decided to focus its energy policy on four main areas: energy efficiency, renewable energy, replacement of existing large-scale power plants and construction of new ones, and foreign energy policy. In order to implement this strategy, the Federal Department of the Environment, Transport, Energy and Communications (DETEC) prepared draft action plans for energy efficiency and the use of renewable energy, which were approved by the Federal Council on 20 February 2008.

These action plans set out to reduce the consumption of fossil fuels by 20 percent by 2020 in line with the declared climate objectives, to increase the proportion of renewable energy to overall energy consumption by 50 percent, and to limit the increase in electricity consumption to a maximum of 5 percent between 2010 and 2020. From 2020 onwards, the objective is to stabilise electricity consumption.

With regard to the signed Kyoto Protocol Switzerland is obliged to reduce its GHG emissions. The CO<sub>2</sub> Act asks for an emissions reduction of 10% by 2010 and of 20% by 2020 compared to 1990 levels. Under the CO<sub>2</sub> and Energy Acts, the principles of subsidiarity and cooperation apply, i.e. priority is given to voluntary measures based on performance mandates with agencies and agreements on targets. SFOE vision is the 2000 Watt society. The 2000 Watt society is a long-term vision of sustainable per capita energy consumption. For Switzerland this means reducing energy use to a third of its current level and largely replacing fossil fuels with renewables.

2011 the Fukushima effect also influenced Swiss energy policy. A new paper was produced so called “2050 Energy strategy” in an emergency decision 700 Mio CHF where spoken for the “Energiewende” (faces out from nuclear and fossil energy towards renewables). Meanwhile the paper was largely and hardly discussed and the strategy softens up to less ambitious aims. The government will decide earliest 2018 and the new strategy will be in place, but if there is a referendum taken, than Switzerland has to wait till 2020 for a new legal energy frame.

## 3. Programs

Since about three decades Switzerland supported strongly energy related R&D programs for different biomass conversion technologies. **Thermal gasification was** also for a long period a major topic for research activities. There are still open questions and the potential for technology optimizations exist. Lately the expectation takes place that the collected research results and experiences with the several pilot and demonstration plants in past should be consolidated and implemented into commercial **thermal gasification** plant.

Direct available finances for research related to biomass as a versatile energy source are decreased down to a minimum which therefore affects also **thermal gasification**.

Co-financing possibilities for demonstration plant for energy conversion shifted from the federal government (SFOE) down to the government’s level of the cantons (provincial) and down to private initiatives.

With the introduction of remuneration at cost for input into the grid, one of the goals of Switzerland's energy policy is to increase the proportion of electricity produced from renewable energy by 5,400 GWh by 2030 compared to the electricity consumption of the year 2000. In the year 2009, 57.7% of Switzerland's overall electricity production came from renewable sources; with hydropower was by far the biggest contributor (96.7%). In the year 2014, 60.3% of Switzerland's overall electricity production came from renewable sources; hydropower contributed 93.6%. The remuneration program showed for Biomass CHP installations in general lately acceleration. The number of all installations increased. Total thereof are three commercial **thermal gasification plants** 2015 in operation. In addition to the units in operation are two in construction and two more units in planning.

For biofuels and natural gas no mineral oil tax has to be paid in Switzerland. For the consumer the cost for biofuels are similar or lower as the cost for fossil liquid fuels. Even due to these advantageous conditions, there is no major increase of purchased biofuels noted. BTL over the thermal gasification value chain is in Switzerland not existing.

#### 4. R&D Institutes with activities in Thermal Gasification

- PSI (Paul Scherrer Institute) [www.psi.ch](http://www.psi.ch)
  - Gasification of dry biomass (wood, grass)
  - Usage of the product gas in fuel cells
  - Co-firing in NGCC for power generation
  - High temperature fuel cells for CHP
  - Gas processing for SNG production <http://tpe.web.psi.ch/>
  - Process simulation of Fischer Tropsch fuels
    - Dr. Serge Biollaz [www.psi.ch](http://www.psi.ch)
  - Gasification of moist biomass (manure, algae) for SNG production
  - Dr. Frédéric Vogel [www.psi.ch](http://www.psi.ch)
  - Energetic use of biomass (gasification, gas cleaning, fuel synthesis)
    - Dr Tilman Schildhauer
  
- EMPA [http://www.empa.ch/](http://www.empa.ch)
  - Life Cycle Assessments
    - Dr. Rainer Zah [http://www.empa.ch.](http://www.empa.ch)

3 Projects related to "Thermal Gasification of Biomass" are under the CCEM (Competence Centre Energy and Mobility PSI) to find:

- ARRMAT+ (Attrition Resistant Reactive Bed Materials in Fluidised Beds)  
[http://www.ccem.ch/MediaBoard/CCEM\\_Annual\\_Activity\\_Report\\_2014.pdf](http://www.ccem.ch/MediaBoard/CCEM_Annual_Activity_Report_2014.pdf)  
page 74 - 77
- WOODGAS-SOFC II  
[http://www.ccem.ch/MediaBoard/CCEM\\_Annual\\_Activity\\_Report\\_2014.pdf](http://www.ccem.ch/MediaBoard/CCEM_Annual_Activity_Report_2014.pdf)  
page 90 - 92
- SYNGAS Diagnosis  
[http://www.ccem.ch/MediaBoard/CCEM\\_Annual\\_Activity\\_Report\\_2014.pdf](http://www.ccem.ch/MediaBoard/CCEM_Annual_Activity_Report_2014.pdf),  
page 71-73

## 5. Industries and Supplier for Thermal Biomass Gasifier

- BR Engineering GmbH CH-6006 Luzern [www.br-engineering.ch](http://www.br-engineering.ch)
  - Engineering and commissioning of thermal Gasification plants and gasification components (Holzstrom Stans)  
Development of new Gasifier
- Schmid Energy Solution CH-8360 Eschlikon <http://www.holzfeuerung.ch/>
  - Represent Aktion for Switzerland and south Germany  
Burkhardt turnkey biomass gasifier plants  
(Taken over from Ölmühle Möriken)

### No thermal biomass gasifier activities reported since 2013

- CTU <http://www.ctu.ch/de/home.html>  
Supplier for turnkey biomass gasifier plants, gas cleaning, filter etc.
- XyloPower AG [www.xylopower.com](http://www.xylopower.com)
  - Supplier for turnkey biomass gasifier plants  
(BMG Technique similar to WILA)
- Foster Wheeler AG (published March 2010 Info's about BTL-Plant in Finland)
  - Foster Wheeler AG in Baar Switzerland (April 2010 Zug)
  - Foster Wheeler Management AG in Geneva Switzerland

### Out of thermal biomass gasifier business

- EKZ [www.ekz.ch](http://www.ekz.ch)
  - Supplier for turnkey biomass gasifier plants  
(BMG technique similar to WILA Woodpower)
  - Energy contracting for biomass cogenerating plants
- Pyroforce Energietechnologie AG
  - Supplier for turnkey biomass gasifier plants  
(BMG technique according to Stans Nidwalden)
  - Other projects: Güssing: 300 kWel 2 gasifiers; 2009  
Spiez: 200 kWel 1 gasifier; 2000-2007

## 6. Projects

### Pending Projects end of the year 2015

- Gasifier 160 kW AEW Rheinfelden CHP, unit for pellets  
1 Burkhardt unit is ordered
- Gasifier 130 kW Bucher Eschholzmat, second unit Wegscheidt  
=> Decision 2015/16
- Gasifier 220 kW Riggisberg 1 Xylogas CHP - unit for forest waste chip  
=> building permission requested
- Several small scale gasifier CHP offered from supplier, decisions pending

Reason of increased activity is: Since 2015 KEV (Feed in tariff) is legal approved by the government for renewables and paid out. Renumeration approx. 28 Eurocent per kWh

**Project 2015 not any more in discussion, never invested for hardware**

- 3 MW Gasifier Project for brick production in rotating furnace; fuel gas shall replace fossil fuel.  
The fuel gas shall be produced by 3 gasifier units each 1 MW  
Test with 1 MW unit gasifier estimated in the beginning of 2012 (never realized either)
- Similar CO<sub>2</sub> - reduction projects where in discussion for several brick plants
- PSI: Bio methane Development => Pilot plant
- Swiss SNG
- CHP/SNG **Thermal Gasification** Project “Energie Hub Baden” was postponed due to economic reasons.

**7. Contacts and Links Thermal Gasification**

- Swiss Federal Office of Energy (SFOE)  
[Biomass and Wood Energy Research Program](#) Dr. Sandra Hermle  
[Wood energy](#) Daniel Binggeli  
[Energy from Sewage and Waste](#) Matthieu Buchs
- IEA Bioenergy ExCo Member for Switzerland:  
Dr. Sandra Hermle SFOE
- IEA Bioenergy ExCo Alternate Member for Switzerland:  
Mr. Matthieu Buchs SFOE
- IEA Bioenergy **Thermal Gasification** Task 33,  
Official Representation for Switzerland and National Expert:  
Martin Rügsegger ETECA GmbH mandated by SFOE
- **Exco IEA Bioenergy Agreement** <http://www.ieabioenergy.com/>
- **IEA Bioenergy Task 33** <http://www.ieatask33.org/>

## 8. Implementations Status December 2015 “In Operation”

COMPANY LOCATION	HOLZSTROM IN STANS / NIDWALDEN	STEINER ETTISWIL	BUCHER ESCHOLZMATT	KAESER KÖENIZ/GASEL
<b>GASIFIER</b>	8 PYROFORCE	1 SPANNER	1 WEGSCHEIDT	1 LIGENTO
<b>TYPE</b>	2-ZONE DOWNDRAFT	DOWNDRAFT	DOWNDRAFT	DOWNDRAFT
<b>GAS ENGINE</b>	2 X 690 KW JENNBACHER	1X 45 KW	1 X 125 KW	1X140 KW
<b>WASTE HEAT THERM</b>	1.2 MW FOR DISTRICT HEATING	DISTRICT HEATING	BASE LOAD YEAR AROUND FOR DISTRICT HEATING W'CHIP DRYING	WOOD CHIP DRYING UNIT FOR FUEL MARKET
<b>EXTRA BOILER</b>	1,6 MW W'CHIPS + 1,7 MW OIL FOR DISTRICT HEATING	YES	YES	NO
<b>COMMISSIONING</b>	2007	2012	APRIL 2015	END 2015
<b>REMARKS</b>	24H_7D P WEEK OPERATION	24H_7D P WEEK OPERATION	24H_7D P WEEK OPERATION	
<b>STATUS</b>	IN OPERATION	IN OPERATION	IN OPERATION	IN CONSTRUCTION
<b>TOTAL OPERATING HOURS</b>	CHP unit 1: 38 764 CHP unit 2: 44 789 Total 83 553	11 342	3 500	
<b>LINK</b>	WWW.HOLZSTROM.CH			

**History Summary of Implementations Status:**  
**“stopped operation”, “has been dismantled” or “project was given up”**

COMPANY LOCATION	AERNI PRATTELN	PROJECT EMPA WOODPOWER	WOODPOWER IN WILA	PYROFORCE AMC SPIEZ
<b>GASIFIER</b>	1 KUNTSCHAR MODIFED	1 WOODPOWER	1 MODIFIED DASAGREN	1 PYROFORCE
<b>TYPE</b>	DOWNDRAFT	DOWNDRAFT	DOWNDRAFT	DOWNDRAFT
<b>GAS ENGINE</b>	1 X 130 KW ADAPT. MAN	2X350 KW EL	1 X 350 KW EL JENNBACHER	200 KW JENNBACHER
<b>WASTE HEAT THERM</b>	230 KW FOR DISTRICT HEATING	DISTRICT HEATING	425 KW FOR WOOD CHIPS DRYING	DISTRICT HEATING
<b>EXTRA BOILER</b>	2MW WOOD CHIP DISTRICT HEATING	YES	200KW WASTE COAL FOR DISTRICT HEATING	NON
<b>COMMISSIONING STOP OPERATION</b>	2009 2014	NOT COMPLETED 2013	2007 TO 1. APRIL 2011	2000 2007
<b>REMARKS</b>	ALWAYS IN TESTING OPERATION	PROJEKT BY EKZ STOOPPED JULY 2013 ABANDONED OKT 2013	24H_7D P WEEK OPERATION	PILOT PLANT
<b>STATUS</b>	OUT OF OPERATION DUE FINANCAL REASONS	PROJEKT ABANDONAD AFTER 2MIO CHF OF INVEST	DESMANTELED AFTER DEMONSTRATION AND DUE FINANCAL REASONS	DESMANTELED AFTER DEMONSTRATION