



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE
Swiss Federal Office of Energy SFOE

Thermal Gasification of Biomass Country Report Switzerland

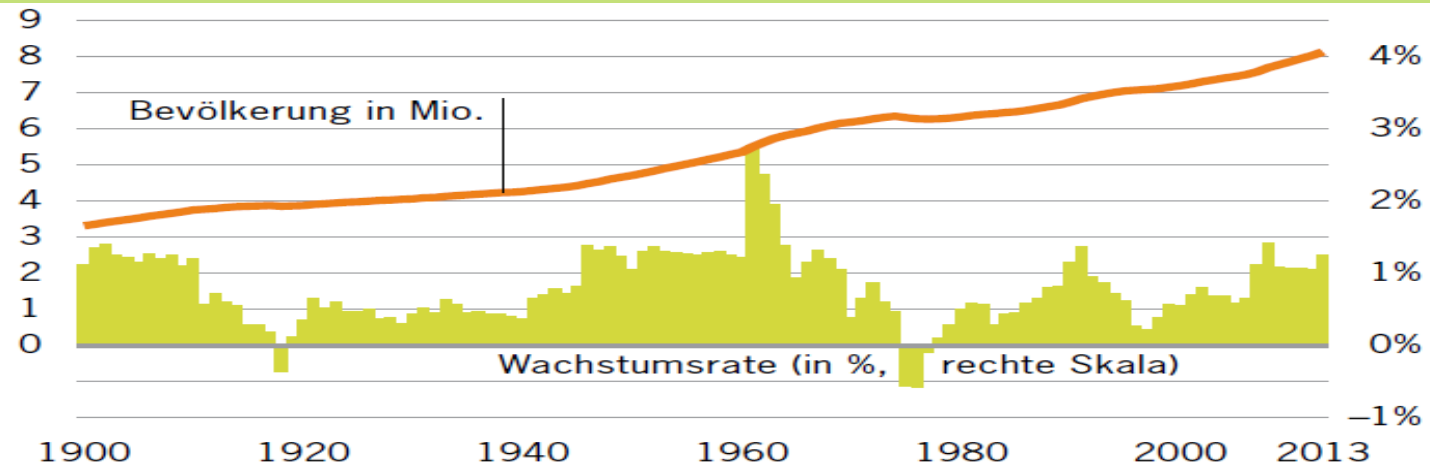


Martin Rügsegger, **ETECA GmbH**, CH-3617 Fahrni

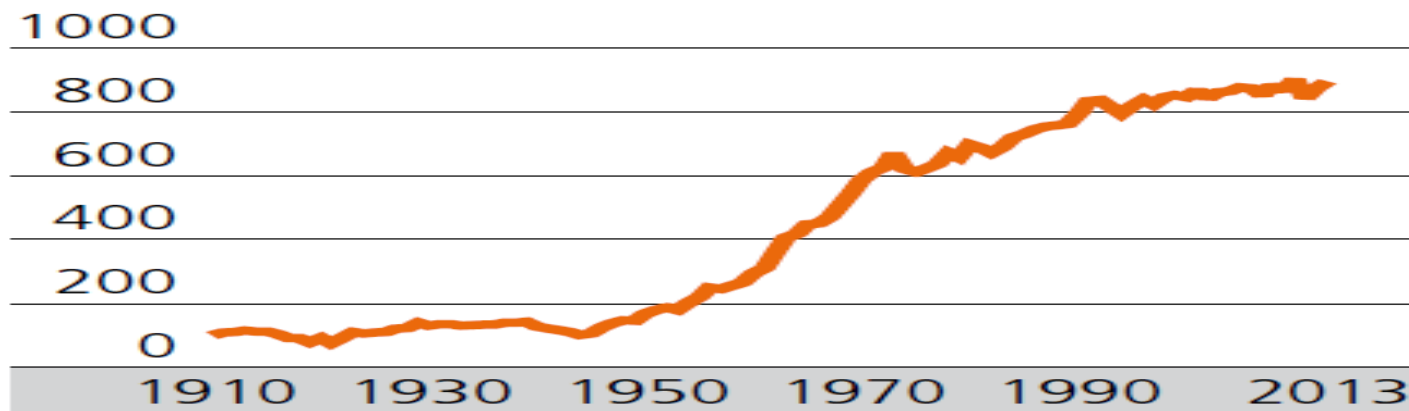
IEA Bioenergy, Task 33, Mai 2016, Trondheim Norway



Population



Final energy consumption in '000 TJ

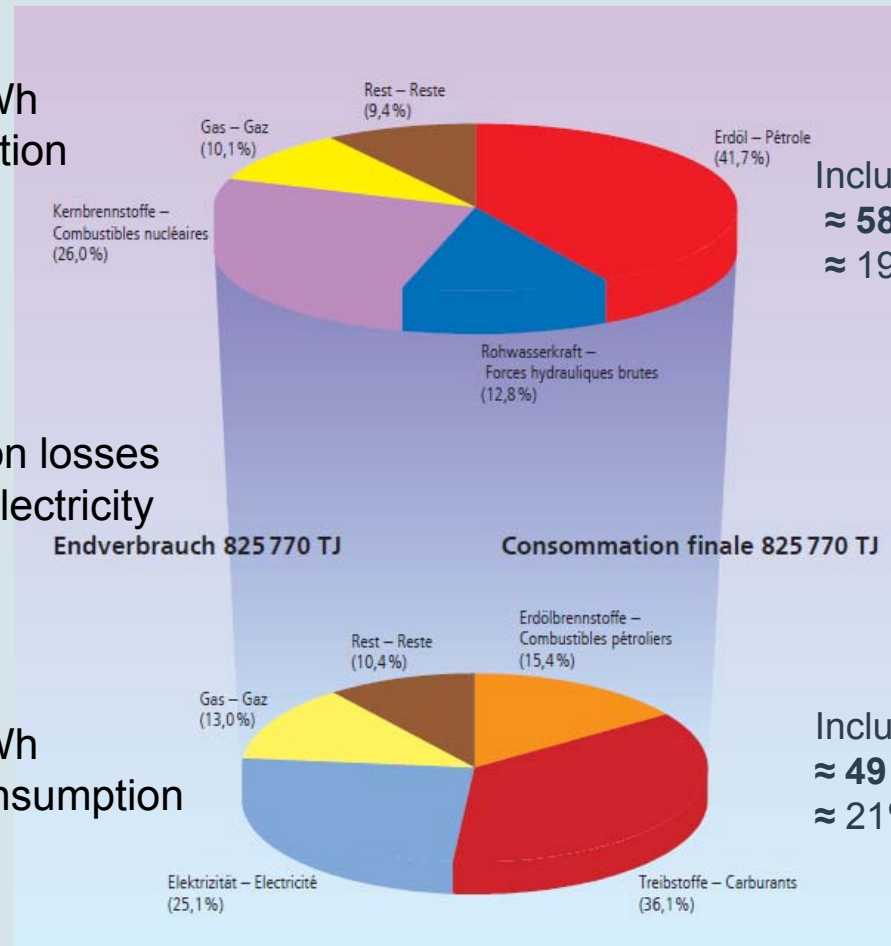




134% \approx 308 TWh
gross consumption

-32% conversion losses
- 1.8% export electricity

100% \approx 229 TWh
final energy consumption



Including Renewable Energy
 \approx 58 TWh
 \approx 19%

Including Renewable Energy
 \approx 49 TWh
 \approx 21%



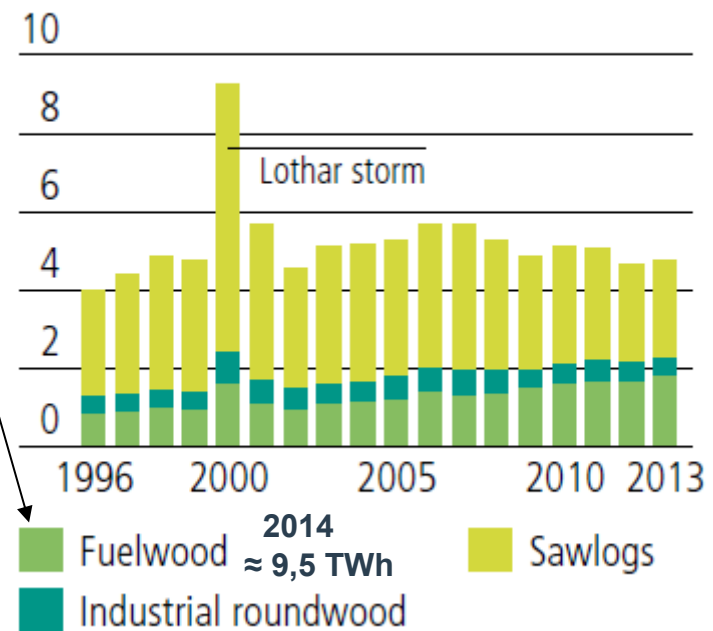
Renewable energy, 2014 \approx 49 TWh

Share of final consumption in %

Total	21.12
Hydropower	12.74
Solar power	0.43
Ambient heat	1.52
Biomass (wood and biogas)	4.80
Wind power	0.03
Renewable energy from waste	1.28
Energy from sewage treatment plants	0.21
Biogenic fuels	0.10

Logging

in million m³





Energy-Impact-Problem, Politics, Program, Strategies,

1970 Oil crises

- 1980 **first ENERGIEWENDE** in Switzerland
- Program: “energieschweiz”
- Strategie: Save, Efficiency, RE, Research

40 years later

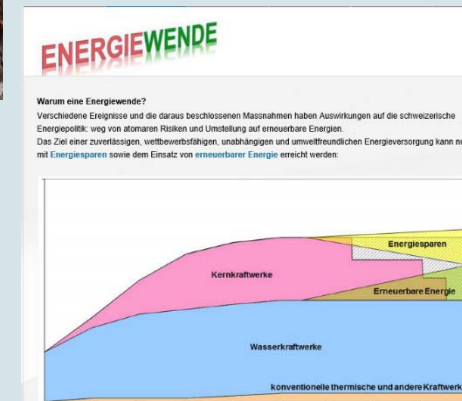
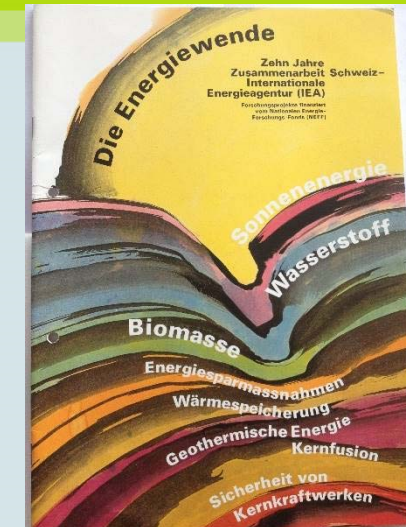


2011 Fukushima

- 2012 **second ENERGIEWENDE**
- Program: “Energiesstrategie 2050”
- Strategie: Save, Efficiency, RE, Research

2016 today

- **Swiss Energy Strategy 2050 still not approved by the government**





Future Energy Strategy 2050, today's facts and RE Support

- “Change of Energy” = Energiewende (out of fossil and nuclear) →
- “Energiesstrategie 2050” Political decisions 2018 expected in place with no referendum
- “Energiesstrategie 2050” with referendum in place earliest 2020

Today

- In October 2015 after elections National Government shifted towards “right”
- 85% of Swiss people don't believe in “Change of Energy”
- In Switzerland KEV exists (Feed in tariff) for electric RE production since 2015
- But to many RE-Projects, for KEF Budget. Increase of Budget is missing
=> Projects line up in a cue => disappointed RE investors
- CO2 Tax on fossil transport fuel 0.015 CHF/Litre = > 0.15 CHF cents/kWh
- CO2 Tax on fossil heating fuel 84.- CHF/ton CO2 = > 2.23 CHF cents/kWh
- P+D contribution for “Lighthouse Projects”



SCCCR Know How, Competence Building and Education VISION more Biomass for Energy



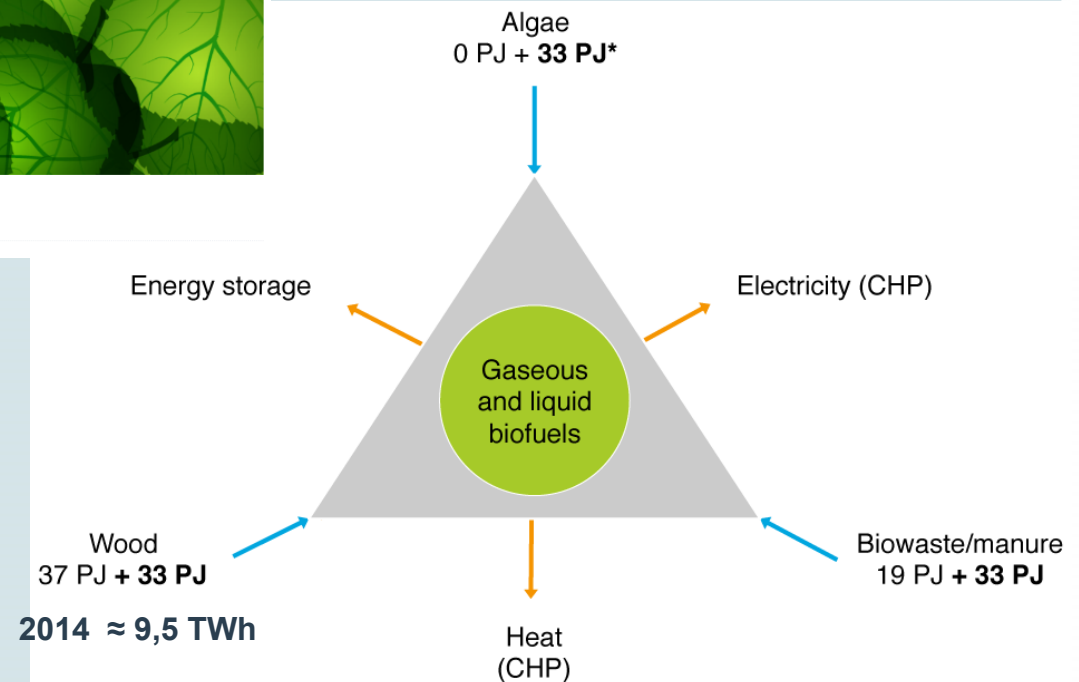
biosweet

Biomass for Swiss Energy Future
Swiss Competence Center for Energy Research



Biomass for Swiss Energy Future

+ 100 Petajoule Vision
(+ 27 TWh = 8000h x 3,3 GW)



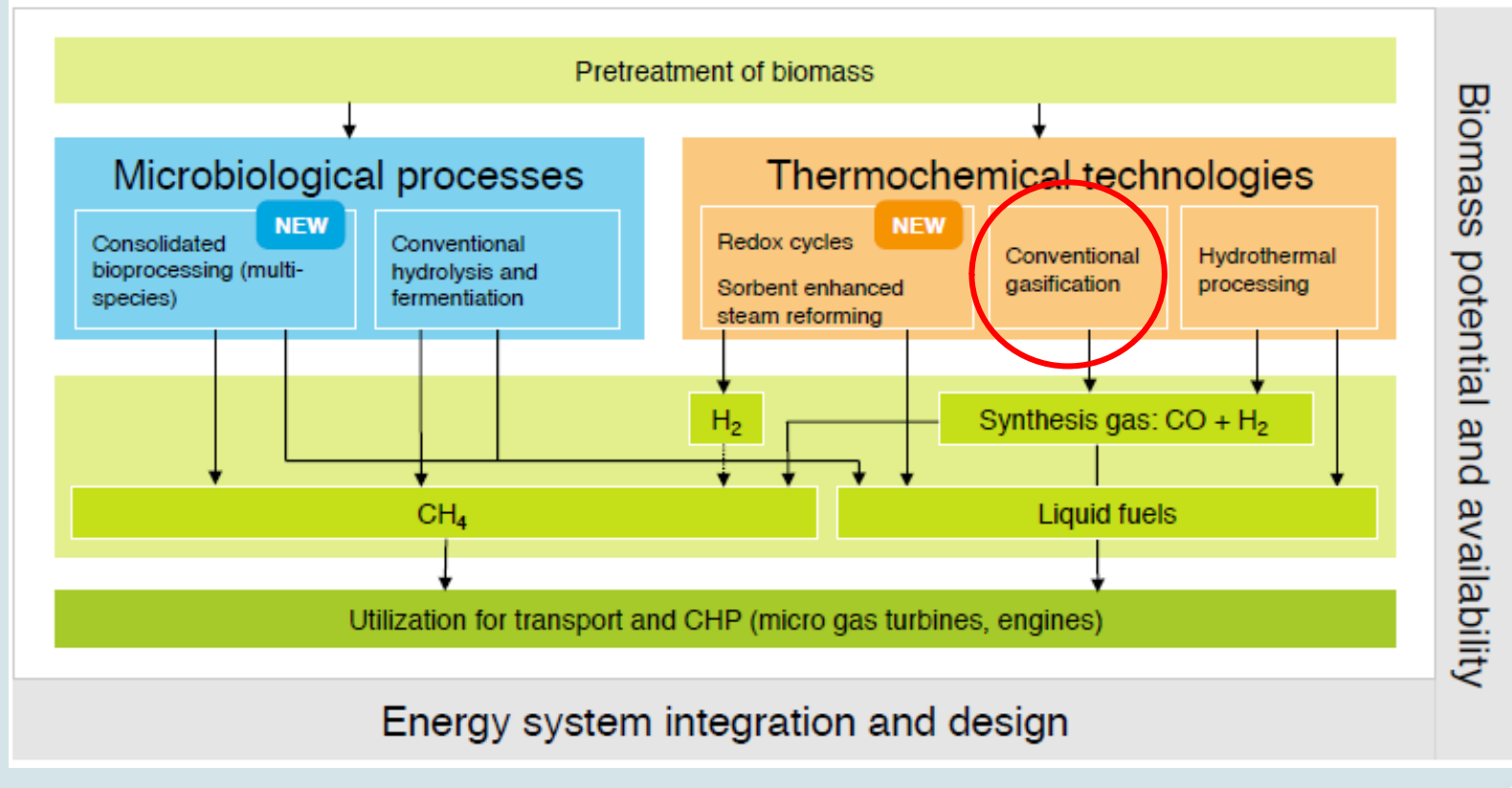
*production mainly outside Switzerland



SCCER Biosweet includes Research for Thermal Gasification of Biomass

R&D field

<http://www.sccer-biosweet.ch/>





Thermal Gasification of Biomass Research Activities 2016

PSI

www.psi.ch

- Gasification of dry biomass (wood, grass)
 - Co-firing in NGCC for power generation
 - High & low temperature fuel cells for CHP
 - Gas processing for SNG production
 - Dr. Serge Biollaz
- Gasification of wet biomass (manure, algae)
 - For SNG production
 - Dr. Frédéric Vogel
- EU Infrastructure Project, collaboration with: BRISK
(Biofuels Research Infrastructure for Sharing Knowledge)

<http://www.briskeu.com/>



Thermal Gasification of Biomass Research Projects 2016

CCEM Competence Center Energy and Mobility (PSI)
3 Projects related to "Thermal Gasification of Biomass":

- ARRMAT+ (Attrition Resistant Reactive Bed Materials in Fluidised Beds)
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 , page 90 - 92
- SYNGAS Diagnosis
http://www.ccem.ch/MediaBoard/CCEM_Annual_Activity_Report_2014.pdf , page 71-73



Thermal Gasification of Biomass Research Projects

2

NFP66 (National R Program) 3 Projects related to
"Thermal Gasification of Biomass"

1. Hot gas cleaning of producer gas from wood gasification for production of bioSNG and electricity from wood (Hot gas cleaning wood gasification) (PSI) 2012-September 2015
<http://www.nfp66.ch/E/projects/wood-source-energy/gas-cleaning-economical-energy-wood/Pages/default.aspx>
2. Predicting the complex coupling of chemistry and hydrodynamics in fluidised bed methanation reactors for SNG production from wood (PSI) (bio-SNG - fundamentals of methanation)
Synthetic natural gas from wood — How can the synthesis be optimised?
2012-January 2016
<http://www.nfp66.ch/E/projects/wood-source-energy/synthetic-natural-gas-wood/Pages/default.aspx>
3. Distributed production of ultra-pure hydrogen from woody biomass (ETHZ) 2012- December 2016
<http://www.nfp66.ch/E/projects/wood-source-energy/production-ultra-pure-hydrogen-wood/Pages/default.aspx>



Thermal Gasification of Biomass Supplier Swiss Industries 2016

1

- BR Engineering GmbH CH-6006 Luzern
 - Engineering and commissioning of thermal Gasification plants and gasification components (Holzstrom Stans)
 - Development of new Gasifier

www.br-engineering.ch



- XyloPower AG
 - Supplier for turnkey biomass gasifier plants (BMG Technique similar to WILA)

www.xylopower.com



- Schmid Energy Solution CH-8360 Eschlikon
 - Representation for Switzerland and south Germany Burkhardt turnkey biomass gasifier plants (taken over from Ölmühle Möriken)

<http://www.holzfeuerung.ch/>





Thermal Gasification of Biomass Supplier Swiss Industries Situation 2016

2

- CTU

<http://www.ctu.ch/de/home.html>

- Supplier for turnkey biomass gasifier plants, gas cleaning....

UMWELT & ENERGIETECHNIK
WASTE TO ENERGY



- Foster Wheeler AG

- Foster Wheeler AG in Baar Switzerland
- Foster Wheeler Engineering AG Basel



http://en.wikipedia.org/wiki/Foster_Wheeler

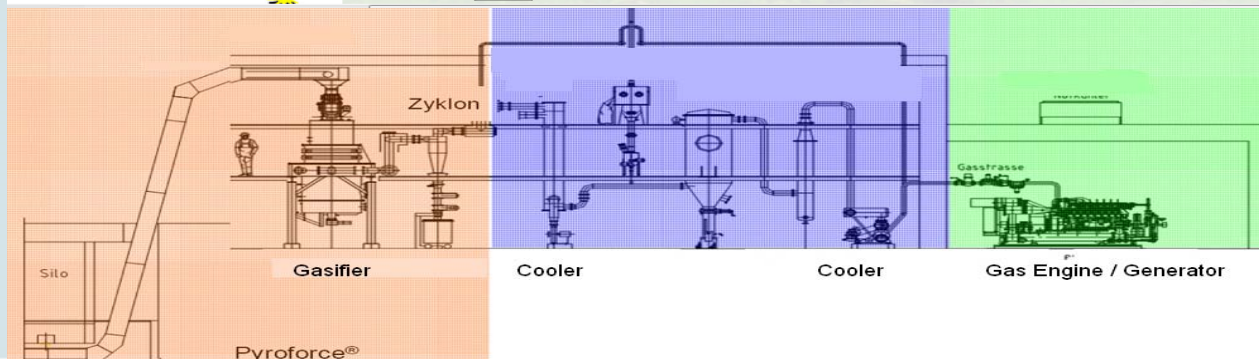
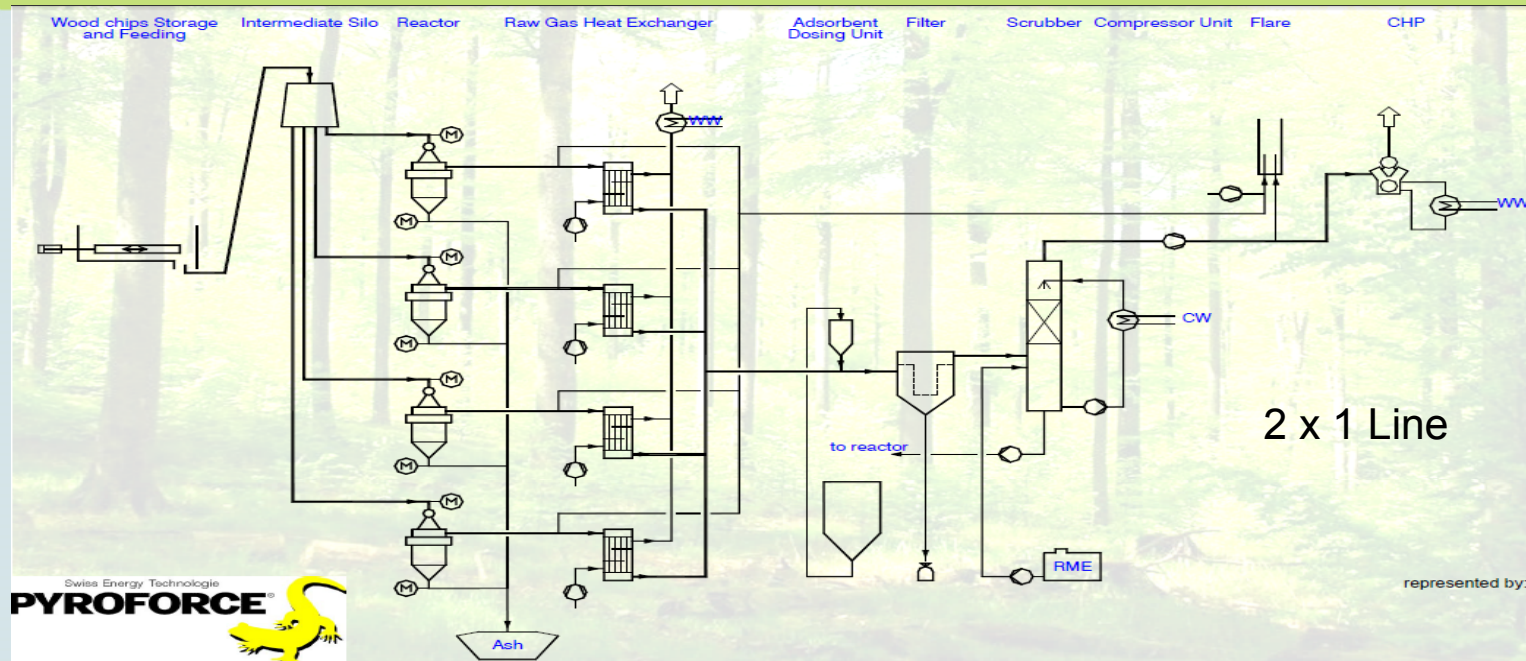
Type	Subsidiary of Amec Foster Wheeler
Traded as	NASDAQ: FWLT
Industry	Engineering
Founded	1927
Headquarters	registered office: Baar, Switzerland principal executive offices: Reading, UK
Key people	Kent Masters, CEO
Number of employees	14000+
Website	www.fwc.com



Stans Nidwalden Thermal Biomass Gasification CHP-Plant

1 400 kW el.

1



M. Rügsegger **ETECA GmbH**; CH-3617 Fahrni
IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Trondheim, Norway 2016

14



Stans Nidwalden Thermal Biomass Gasification CHP-Plant

1 400 kW el.

3



M. Rügsegger **ETECA GmbH**; CH-3617 Fahrni
IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Trondheim, Norway 2016

15



Ettiswil Luzern Switzerland

45 kW el.

Thermal Biomass Gasification CHP-unit«Spanner»



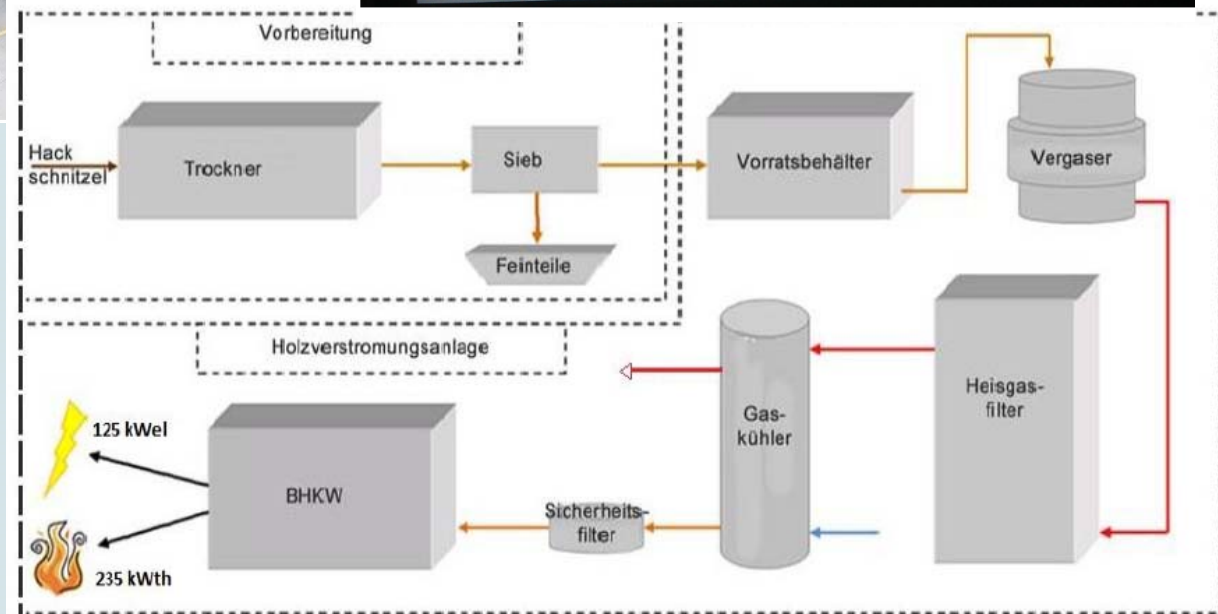
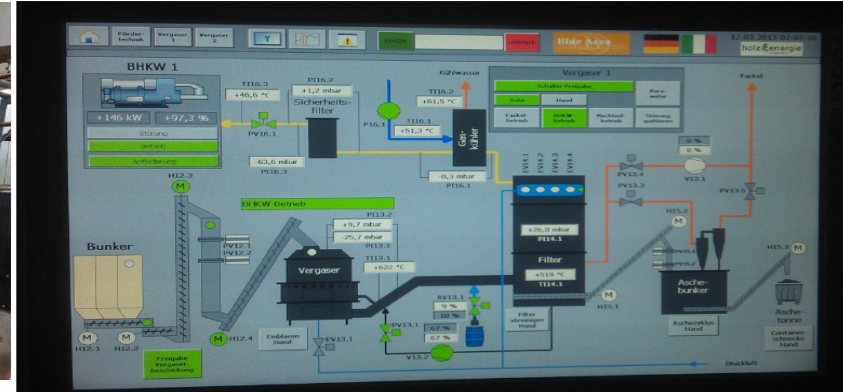
A. STEINER + CIE AG
SÄGEWERK RIEDBRUGG
6218 ETTISWIL





Escholz matt Luzern Switzerland 125 kW el. Thermal Biomass Gasification CHP-Plant (Start Operation 1. April 2015)

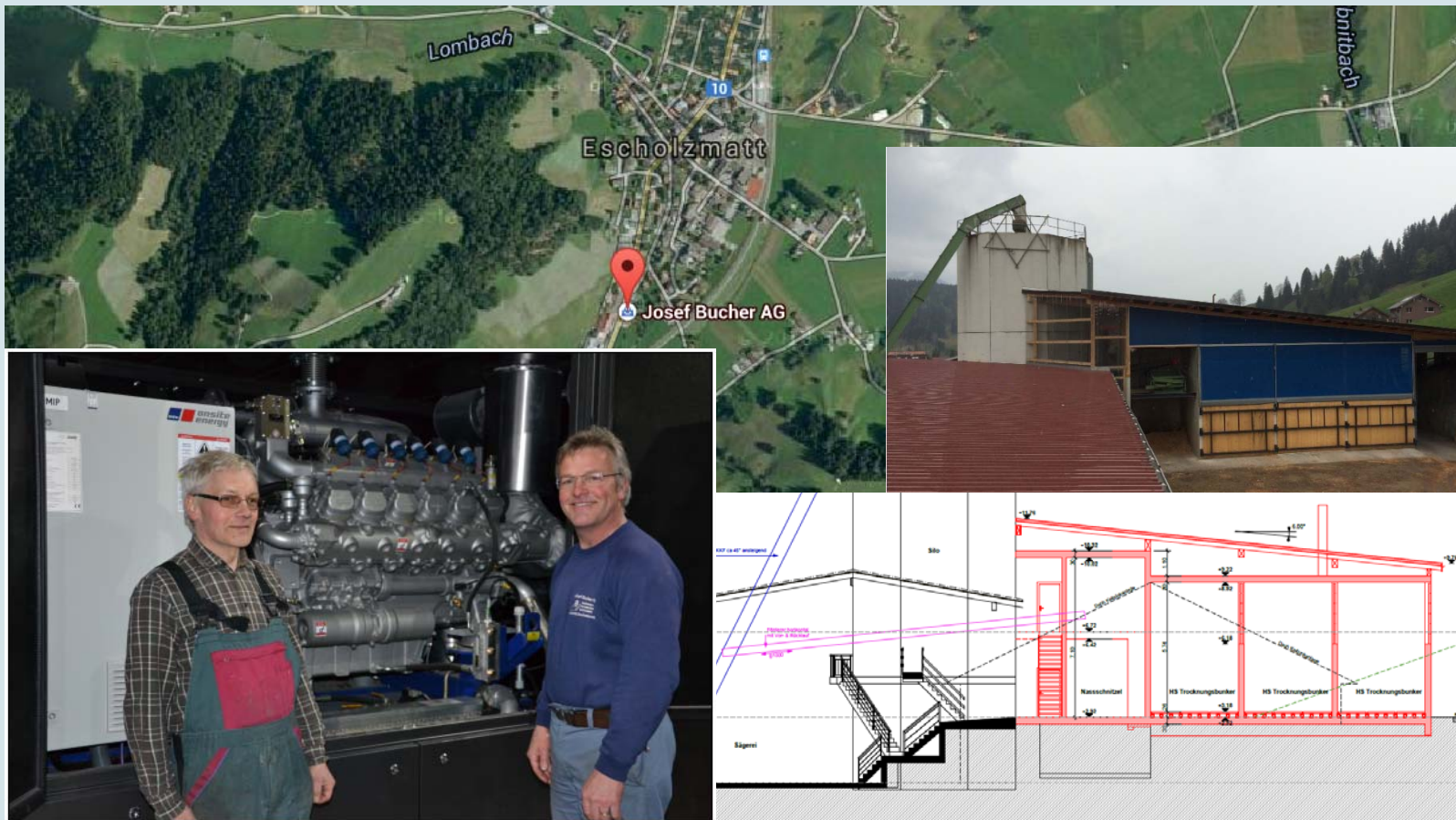
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Escholz matt Luzern Switzerland 125 kW el. Thermal Biomass Gasification CHP-Plant (Start Operation 1. April 2015)

Wegscheid Gasifier CHP 125 kW will be added to a 2.1 MW district heating System



M. Rügsegger **ETECA GmbH**; CH-3617 Fahrni
IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Trondheim, Norway 2016

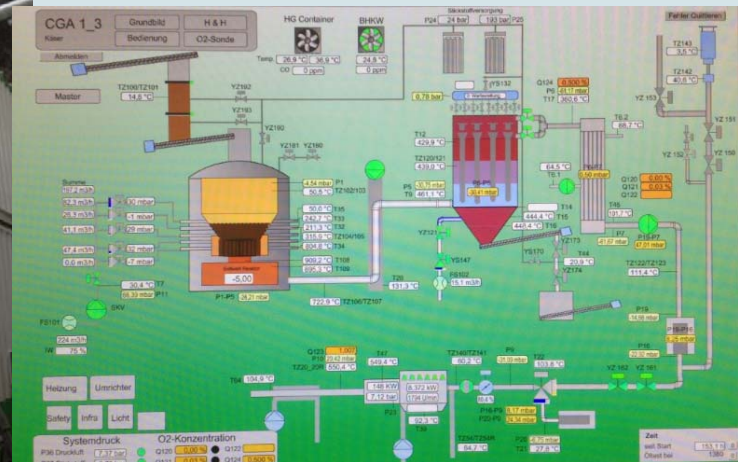


H.H. Käser GmbH, Gasel Köniz, 140 kW el. Thermal Biomass Gasification CHP

Chip Wood Supplier for biomass district heating
around Bern.

2 Gasifier CHP Unit “Ligento” serves for
electric Power and Heat for chip wood drying

www.hhkaeser.ch

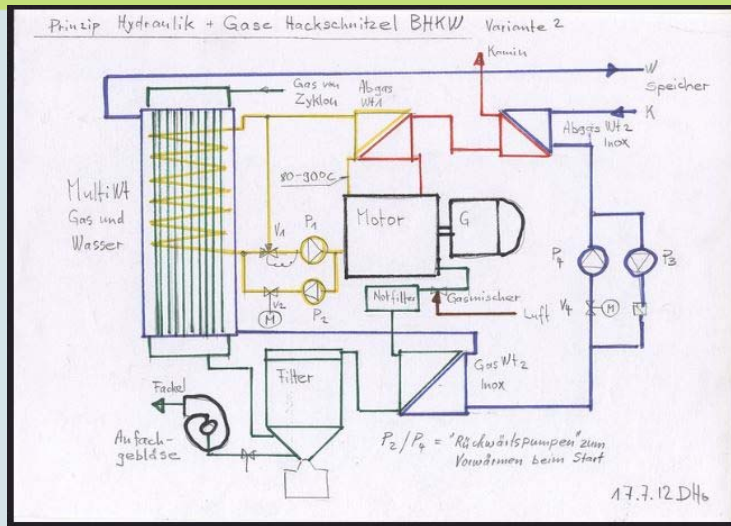


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IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Trondheim, Norway 2016



Hofstetter Self Made-Unit 9 kW el. Thermal Biomass Gasification CHP



2009 start with experimental gasifier

2013/14 start with CHP 9kW 500h

2014/15 only operated during
heating season 1000h

Investment 25 000.- Euro + 2,5 man-year
Legal approved unit by all authorities
receiving KEV (feed in tariff)





Thermal Biomass Gasification CHP-Facilities in Switzerland Mai 2016

Summary 1

	Käser Gasel I + II	Holzstrom in Stans	A. Steiner + Cie. AG	J. Bucher AG Escholz matt
Gasifier	Ligento	8 Pyroforce	Spanner	Wegscheid
Type	downdraft	2-zone downdraft	downdraft	downdraft
Gas engine	1 x 140 kW	2 x 690 kW Jennbacher	45 kW el	125 kW
Waste heat therm	for drying	1,2 MW for district heating	district heating	district heating drying wood chips
extra Boiler		1,6 MW W'chips + 1,7 MW oil for district heating	yes	Yes
Commissioning	End 2015	2007	2012/2013	1.4.2015
Remarks	24h_7d p week operation	24h_7d p week operation	24h_7d p week operation	24h_7d p week operation



Thermal Biomass Gasification CHP-Facilities in Switzerland Mai 2016

Summary

2

	Käser Gasel I+II	Holzstrom in Stans	A. Steiner + Cie. AG	J. Bucher AG Escholz matt
Fuel	Dry clean wood chips	Dry demolition wood/scrap wood chips	Dry waste wood chips	Dry waste wood chips G 30-100
Moisture	<10%	10%	Max 15%	<10%
Operating hours last 6 months	Block 1: 1'350 Block 2: 950	Block 1: 4974 Block 2: 45	3819	4 400
Total live time operation h	Block 1: 1'350 Block 2: 950	BHKW 1: 43 738 BHKW 2: 44 834	17 450	8 200
Remarks	2 Units in normal operation	1 unit in normal operation 1 unit under maintenance	Plant in normal operation	Plant in normal operation

4 CHP gasifier in stable operation
1 CHP in construction



Thermal Gasification of Biomass Commercial Swiss Projects Mai 2016

- Gasifier 160 kW AEW Rheinfelden CHP, unit for pellets => Ordered
1 Burkhardt unit
- Gasifier 130 kW Bucher Eschholzmat, second unit => Decision 2016
1 Wegscheidt
- Gasifier 220 kW Riggisberg CHP, unit for forest waste chip => building permission
requested
1 Xylogas
- Several small scale gasifier CHP offered from supplier, decisions pending

Reason of activity: KEV (Feed in tariff) approx. 28 Eurocent per kWh



Blooming Biomass is Blooming Gasification? YES!
Thanks for your attention, any questions?

