



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

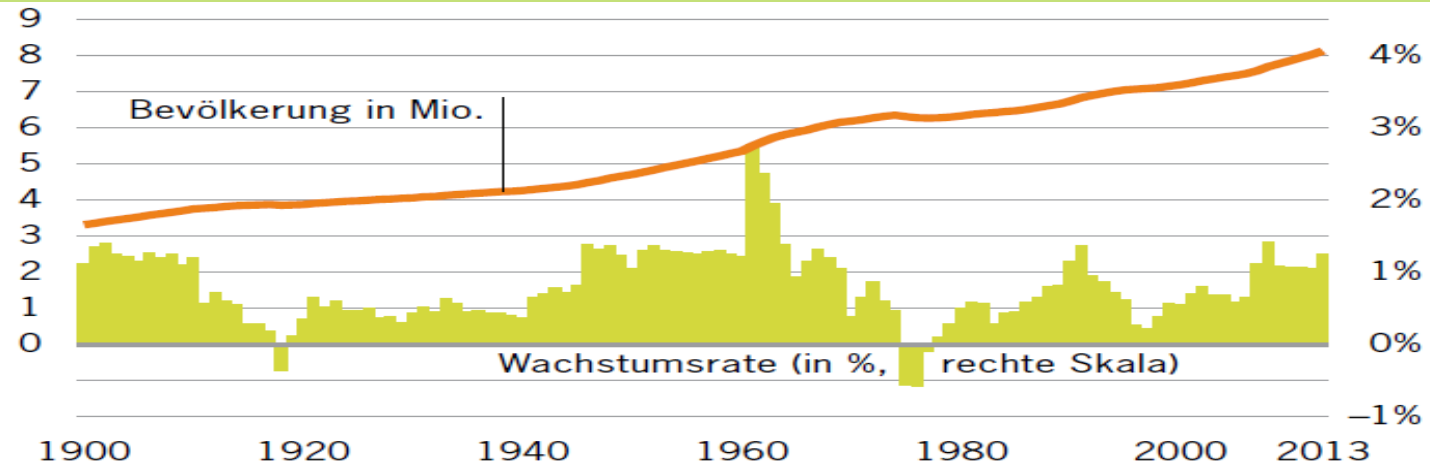


Martin Rügsegger, *ETECA GmbH*, CH-3617 Fahrni

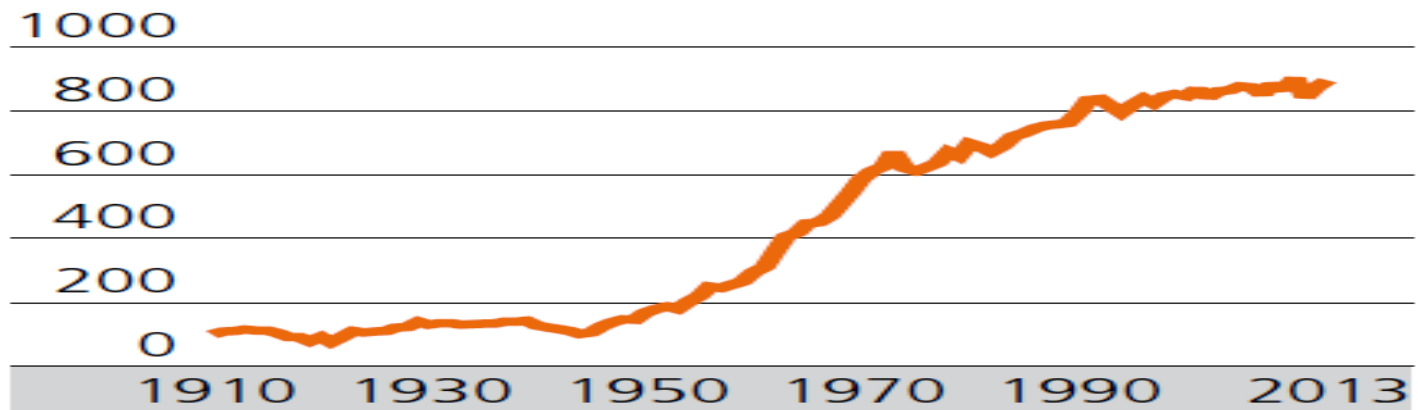
IEA Bioenergy, Task 33, October 2015, Berlin Germany



Population



Final energy consumption in '000 TJ

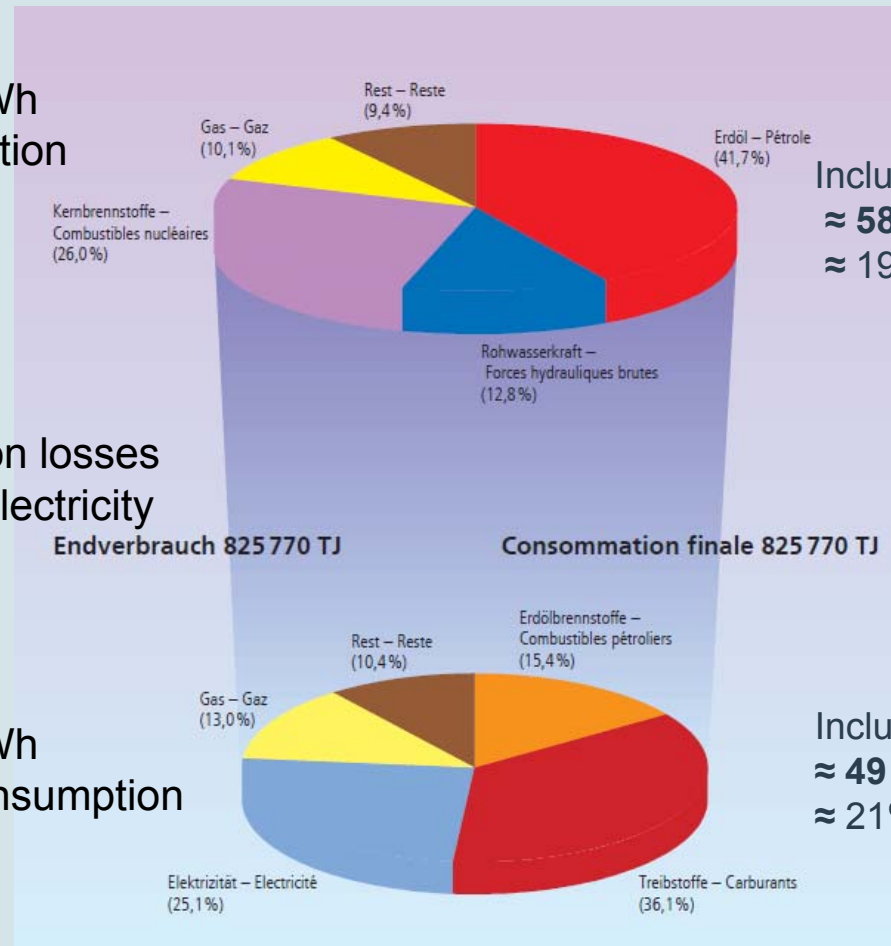




134% \approx 308 TWh
gross consumption

-32% conversion losses
- 1.8% export electricity

100% \approx 229 TWh
final energy consumption



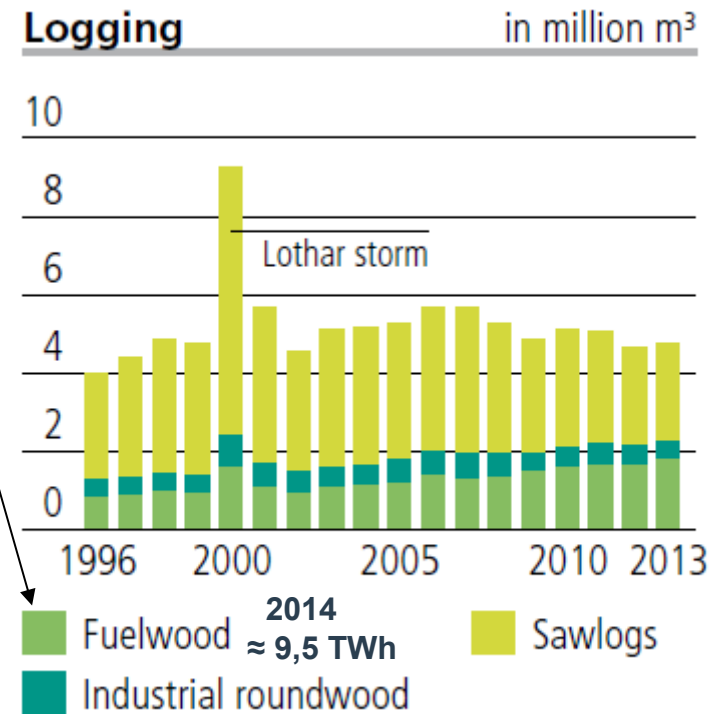
Including Renewable Energy
 \approx 58 TWh
 \approx 19%

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





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

1970 Oil crises

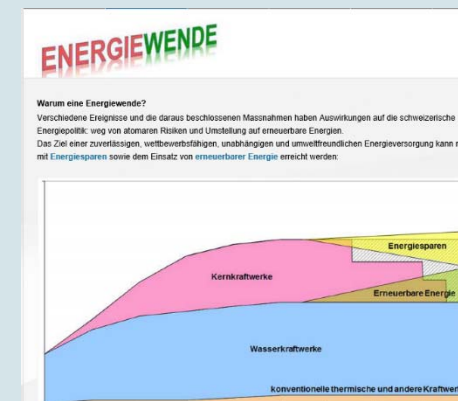
- 1980 **first ENERGIEWENDE**
- Program: “energieschweiz”
- Strategie: Save, Efficiency, RE, Research

40 years later

2011 Fukushima



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





Future Energy Strategy 2050, RE Support Today

- “Change of Energy” = Energiewende (out of fossil and nuclear) →
- “Energierstrategie 2050” Political decisions 2018 expected
- “Energierstrategie 2050” without referendum in place 2018
- “Energierstrategie 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 (Feed in tariff) for electric RE production since 2015
- To many RE-Projects, for KEF (Feed in) Budget
=> Projects line up in a cue
- P+D contribution for “Lighthouse Projects”



Swiss Competence Centre for Energy Research SCCER under Energy Strategies 2050

SCCER Action Areas

Efficiency

SCCER FEED&D
Future Energy Efficient Buildings & Districts

Efficiency

SCCER EIP
Efficiency of Industrial Processes

Grids and their components, energy systems

SCCER FURIES
Future Swiss Electrical Infrastructure



Storage

SCCER HaE
Heat & Electricity Storage



Power supply (supply of electrical energy)

SCCER SoE
Supply of electricity



Economy, environment, law, behavior

SCCER CREST
Competence Center for Research in Energy, Society and Transition



Efficient concepts, processes, components in mobility

SCCER Mobility
Efficient Technologies and Systems for Mobility



Biomass

SCCER BIOSWEET
Biomass for Swiss Energy Future



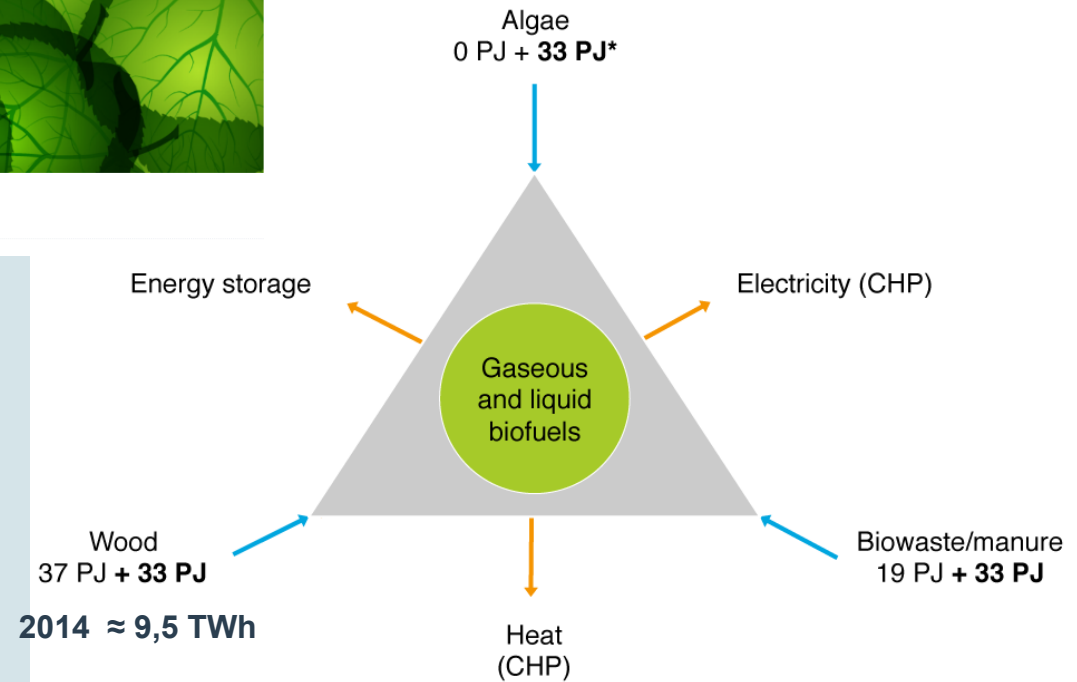


Know How, Competence Building and Education VISION more Biomass for Energy



Biomass for Swiss Energy Future

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



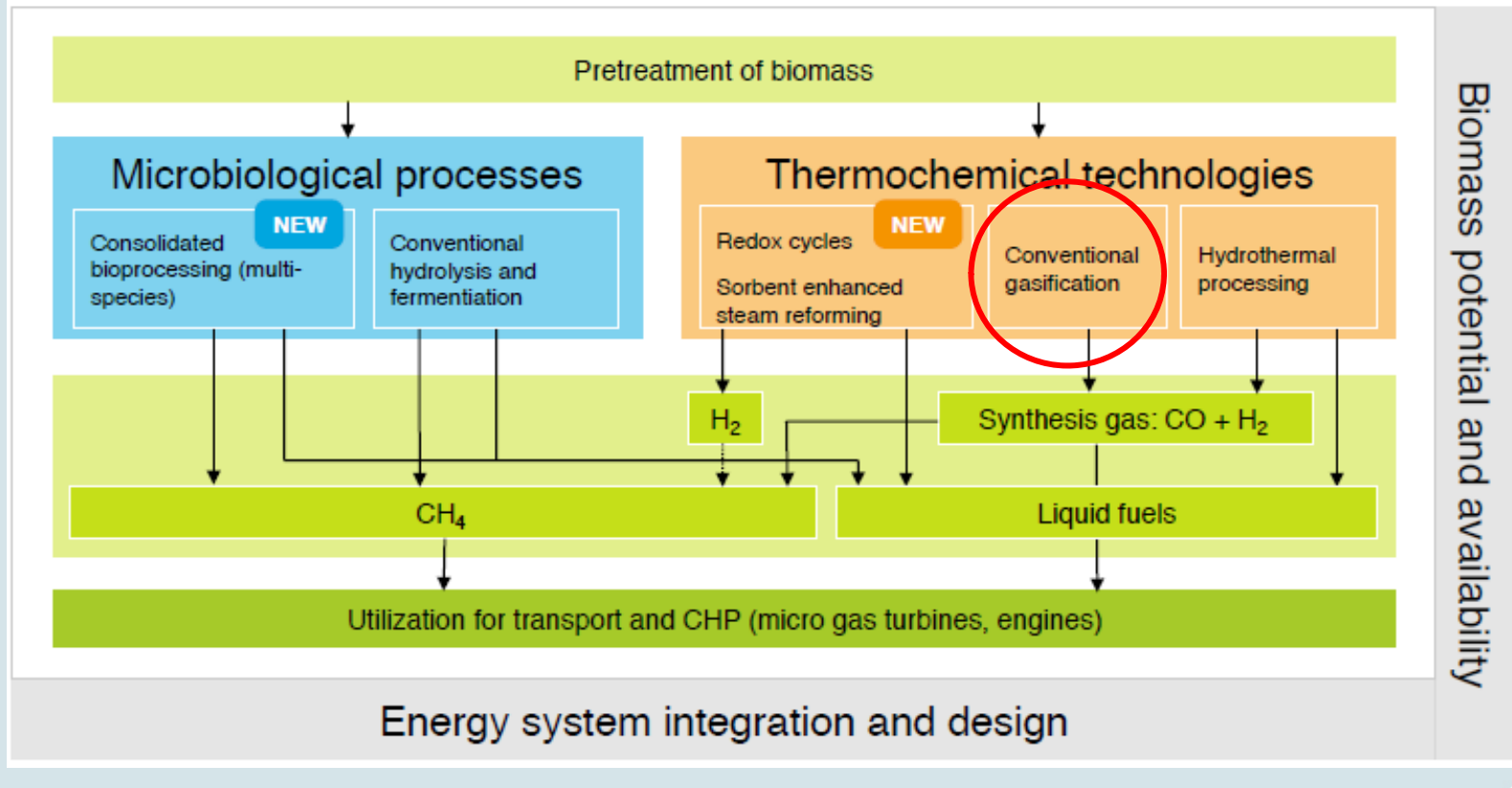
*production mainly outside Switzerland



SCCER Biosweet includes Research for Thermal Gasification of Biomass

R&D field

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





Thermal Gasification of Biomass Research Activities 2015

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 2015

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 2015

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 2015

1

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



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



- Schmid Energy Solution CH-8360 Eschlikon <http://www.holzfeuerung.ch/>
 - Representation for Switzerland and south Germany Burkhardt turnkey biomass gasifier plants (taken over from Ölmühle Möriken)





Thermal Gasification of Biomass Supplier Swiss Industries Situation 2015

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



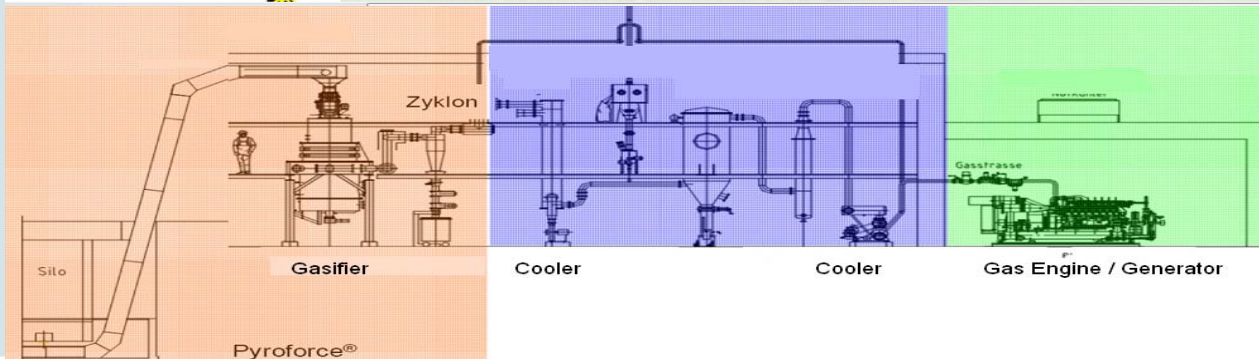
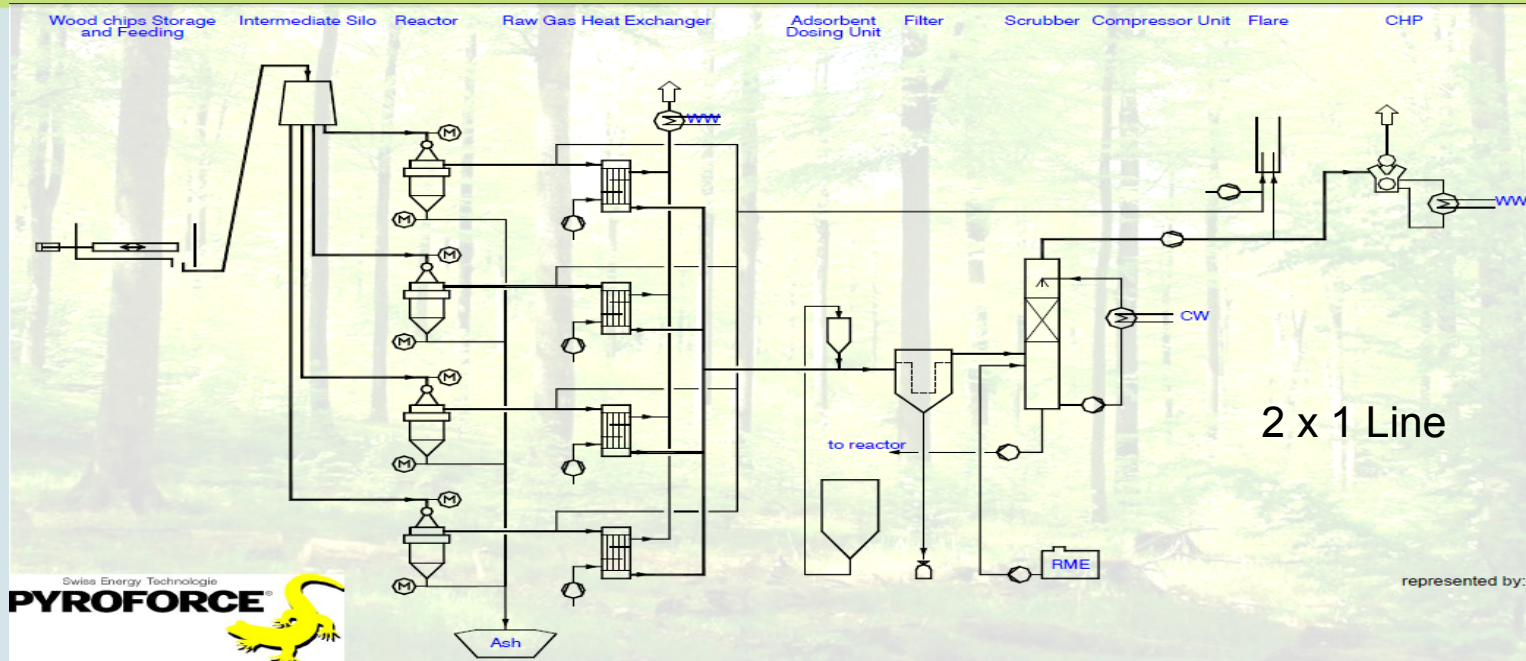
http://en.wikipedia.org/wiki/Foster_Wheeler

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 1 400 kW el. Thermal Biomass Gasification CHP-Plant

1



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

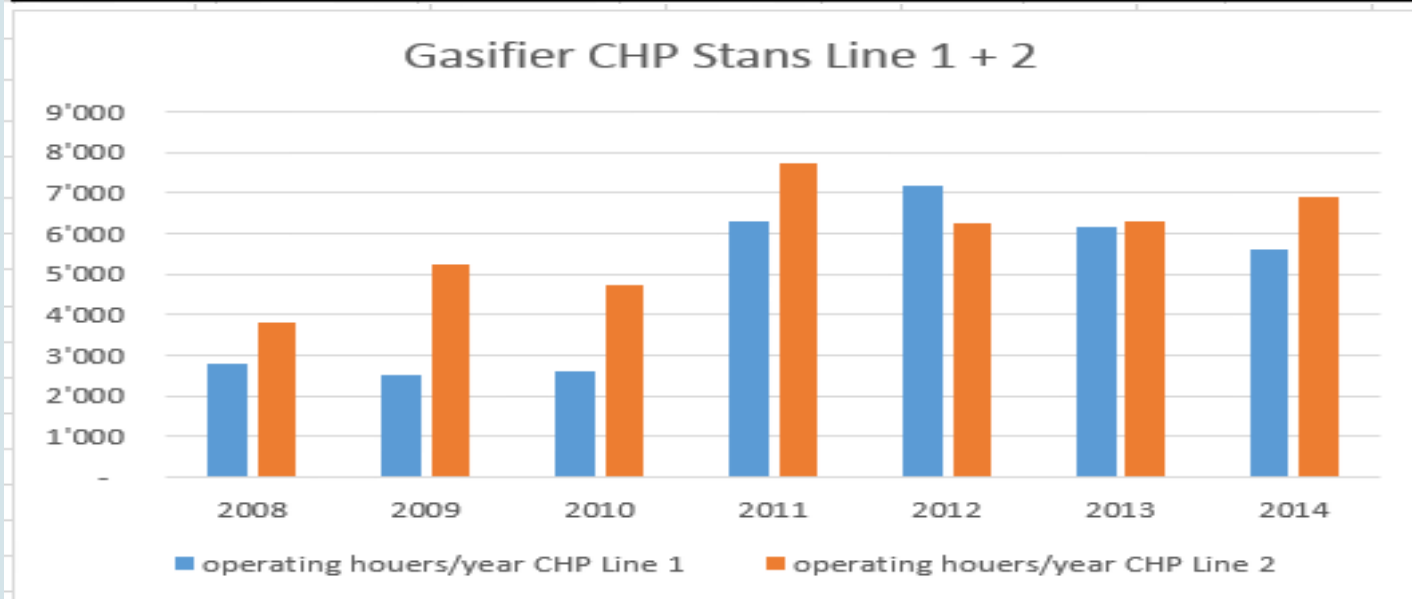
Berlin, Germany 2015



Stans Nidwalden 1 400 kW el. Thermal Biomass Gasification CHP-Plant

2

	operating houers/year			cumulatet operting houers		
	CHP Line 1	CHP Line 2	LINE 1+2	CHP Line 1	CHP Line 2	LINE 1+2
2008	2'800	3'800	6'600	2'800	3'800	6'600
2009	2'500	5'250	7'750	5'300	9'050	14'350
2010	2'600	4'750	7'350	7'900	13'800	21'700
2011	6'300	7'737	14'037	14'200	21'537	35'737
2012	7'184	6'271	13'455	21'384	27'808	49'192
2013	6'167	6'319	12'486	27'551	34'127	61'678
2014	5'610	6'911	12'521	33'161	41'038	74'199





Stans Nidwalden 1 400 kW el. Thermal Biomass Gasification CHP-Plant

3



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

Berlin, Germany 2015

17



Ettiswil Luzern Switzerland 45 kW el. Thermal Biomass Gasification CHP-unit«Spanner»

 A. STEINER + CIE AG
SÄGEWERK RIEDBRUGG
6218 ETTISWIL

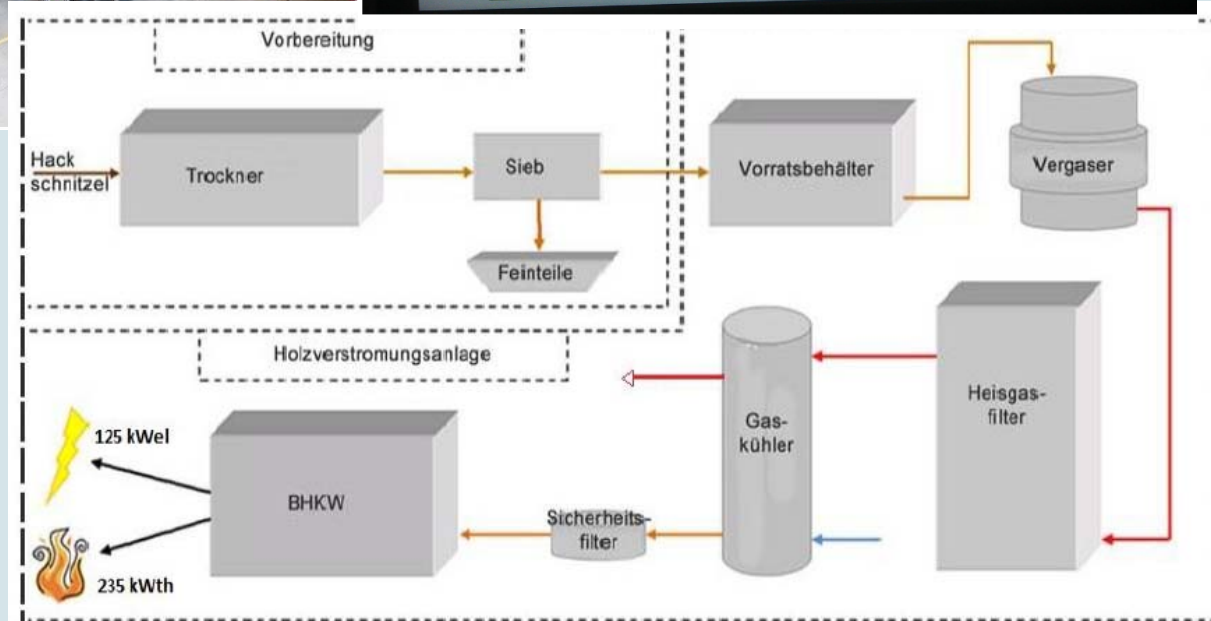
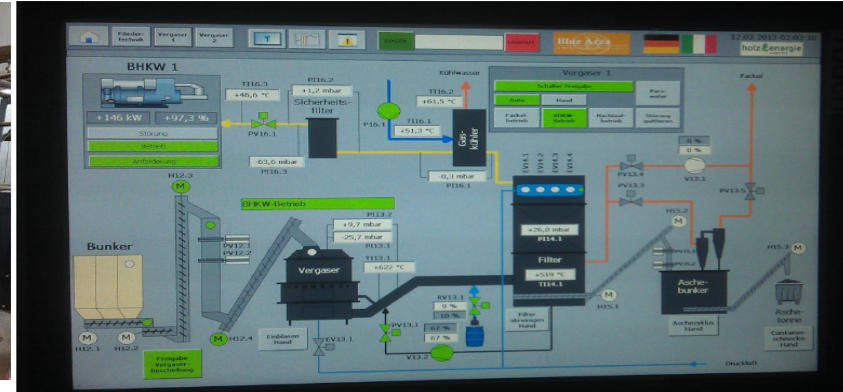


M. Rügsegger *ETECA GmbH*; CH-3617 Fahrni
IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Berlin, Germany 2015



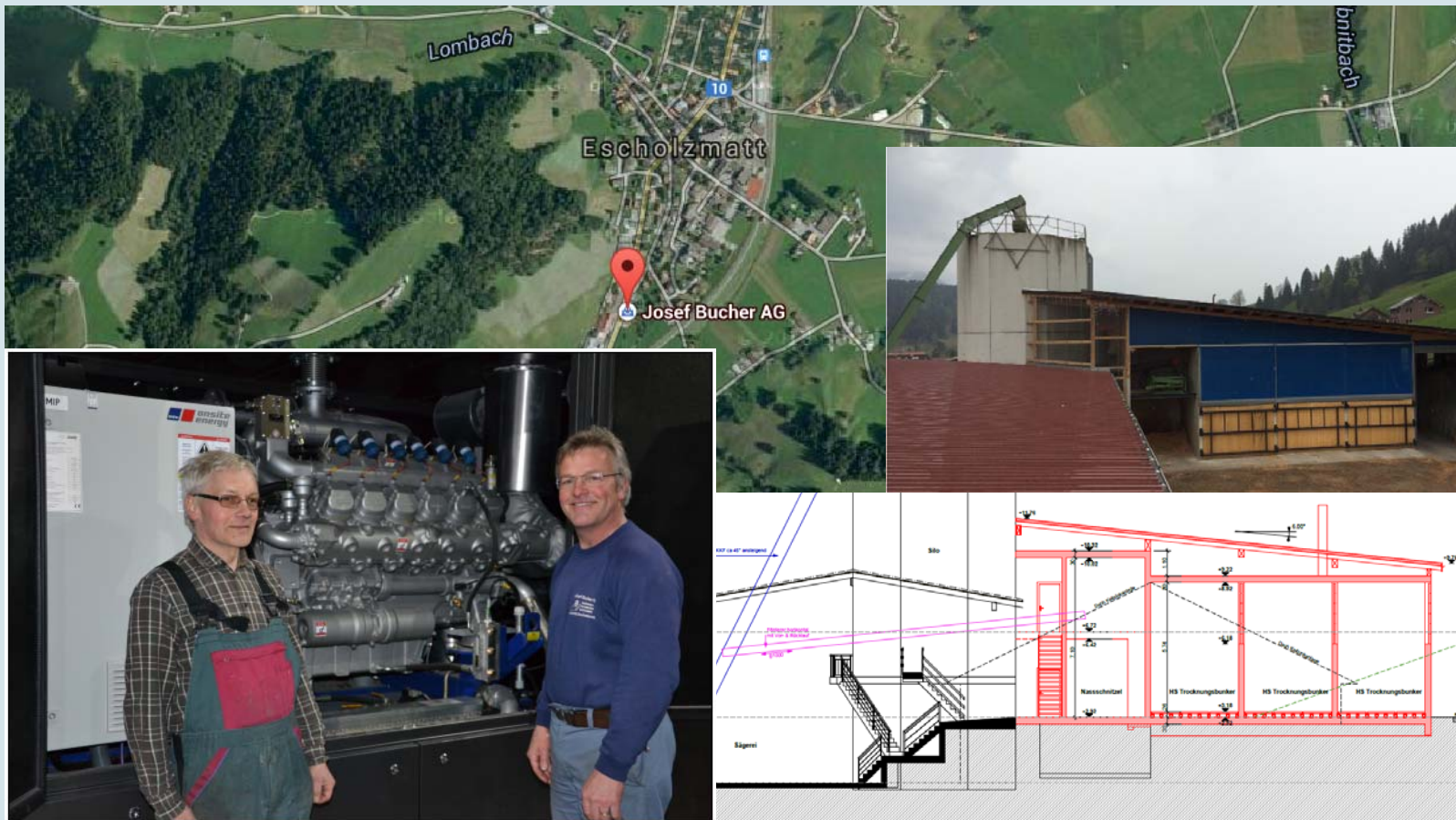
Escholzmatt Luzern Switzerland 125 kW el. Thermal Biomass Gasification CHP-Plant (Start Operation 1. April 2015)





Escholzmatt 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



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

Chip Wood Supplier for biomass district heating
around Bern.

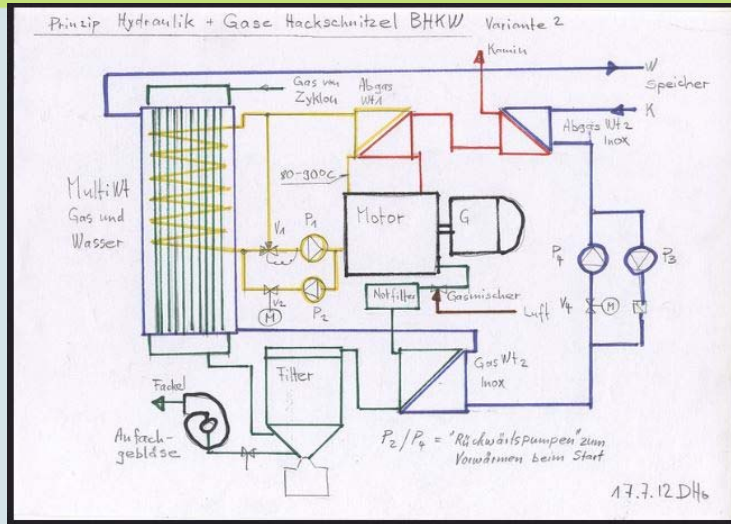
Gasifier Unit Ligento serves for electric Power
and Heat for chip wood drying.

www.hhkaeser.ch





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 October 2015

Summary

1

	Käser Gasel	Holzstrom in Stans	A. Steiner + Cie. AG	J. Bucher AG Escholzmatt
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	140 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	2015 November	2007	2012/2013	1.4.2015
Remarks	under construction	24h_7d p week operation	24h_7d p week operation	24h_7d p week operation



Thermal Biomass Gasification CHP-Facilities in Switzerland October 2015

Summary

2

	Käser Gasel	Holzstrom in Stans	A. Steiner + Cie. AG	J. Bucher AG Escholzmatt
Fuel	Dry clean wood chips	Dry demolition wood/scrap wood chips	Dry waste wood chips	Dry waste wood chips G 30-100
Moisture		10%	Max 15%	<10%
Operating hours last 6 months		Block 1: 3567 Block 2: 1441	3819	2 900 h
Total live time operation h		BHKW 1: 38 764 BHKW 2: 44 789	11 342	3 500
Remarks	under construction	Plant in normal operation	Plant in normal operation	Plant in normal operation

3 CHP gasifier in stable operation
1 CHP gasifier under commission



Thermal Gasification of Biomass Commercial Swiss Projects October 2015

- Gasifier 160 kW AEW Rheinfelden CHP, unit for pellets => Ordered
1 Burkhardt unit
- Gasifier 130 kW Bucher Eschholzmat, second unit => Decision 2015
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



Thanks for your attention, any questions?

