



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

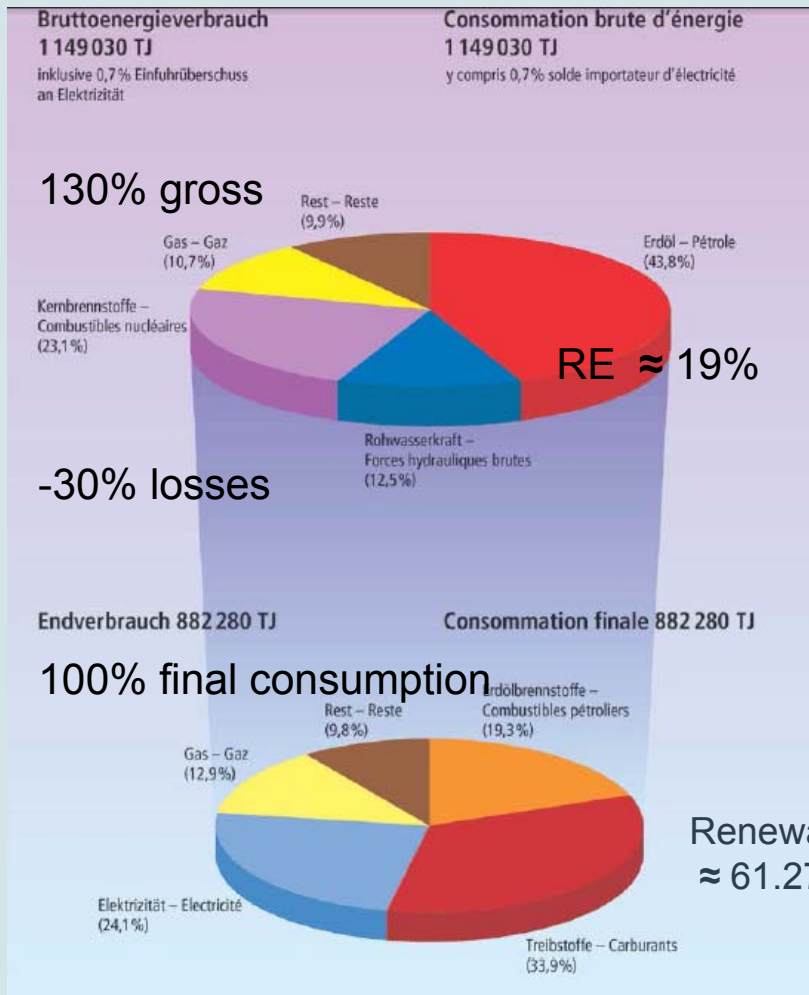


Martin Rügsegger, *ETECA GmbH*, CH-3617 Fahrni

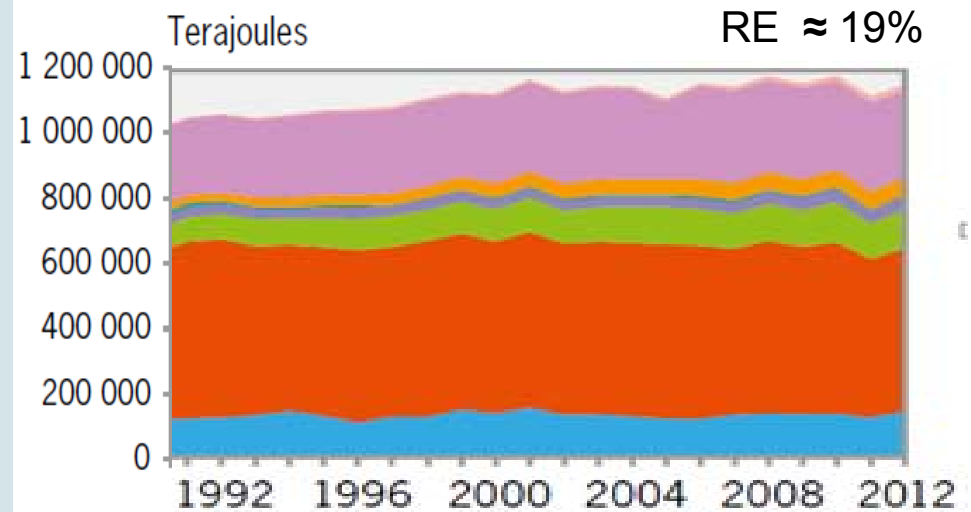
IEA Bioenergy, Task 33, May 2015, Ponferrada Spain



Switzerland 2012 Energy gross Consumption ≈ 320 TWh Energy final Consumption (0,9 EJ $\approx 882\,280$ TJ) ≈ 245 TWh



Energy use¹ gross



- Other renewable energies
- Nuclear combustibles
- Household and industrial waste
- Coal
- Wood and charcoal
- Gas
- Crude oil and petroleum products
- Hydropower

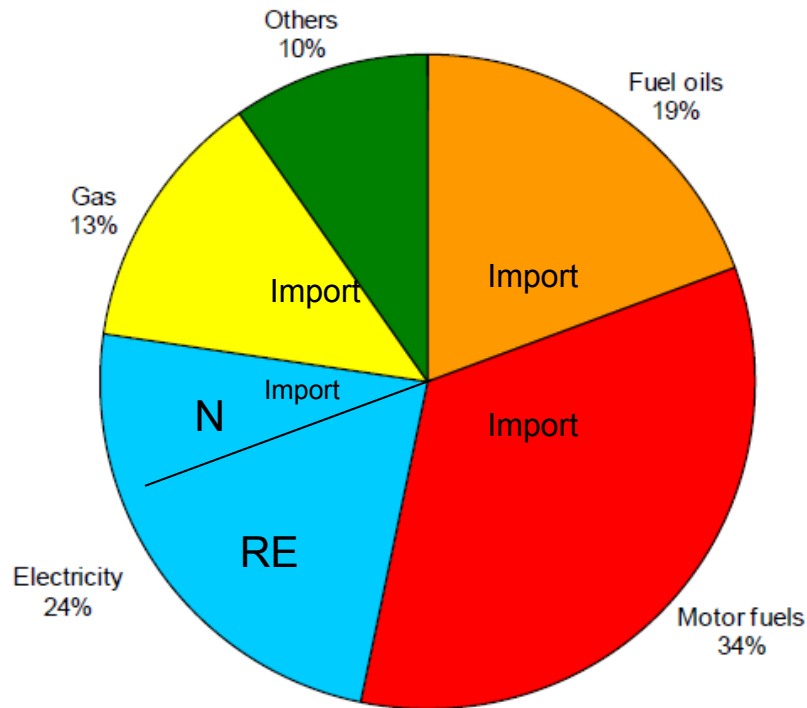


Switzerland 2012

2

Energy final Consumption net (0,9 EJ ≈ 882 280 TJ) ≈ 245 TWh

Final Energy Consumption 2012
(Total: 882'280 TJ)
245 TWh ≈ 30 NPP à 1GW_{el} @ 8000 h



RE incl. Hydro 61.27 TWh ≈ 25%

Energy source	%
	2012
Petroleum products	53,3
Electricity	24,1
Gas *	12,9
Coal	0,6
Wood	4,2
District heating	1,9
Waste	1,2
Other renewable Energy	1,8
thereof Biofuels	0,06
Biogas **	0,20
Solar thermal	0,21
Ambient heat from soil, groundwater, air, etc.	1,38
Total final consumption	100

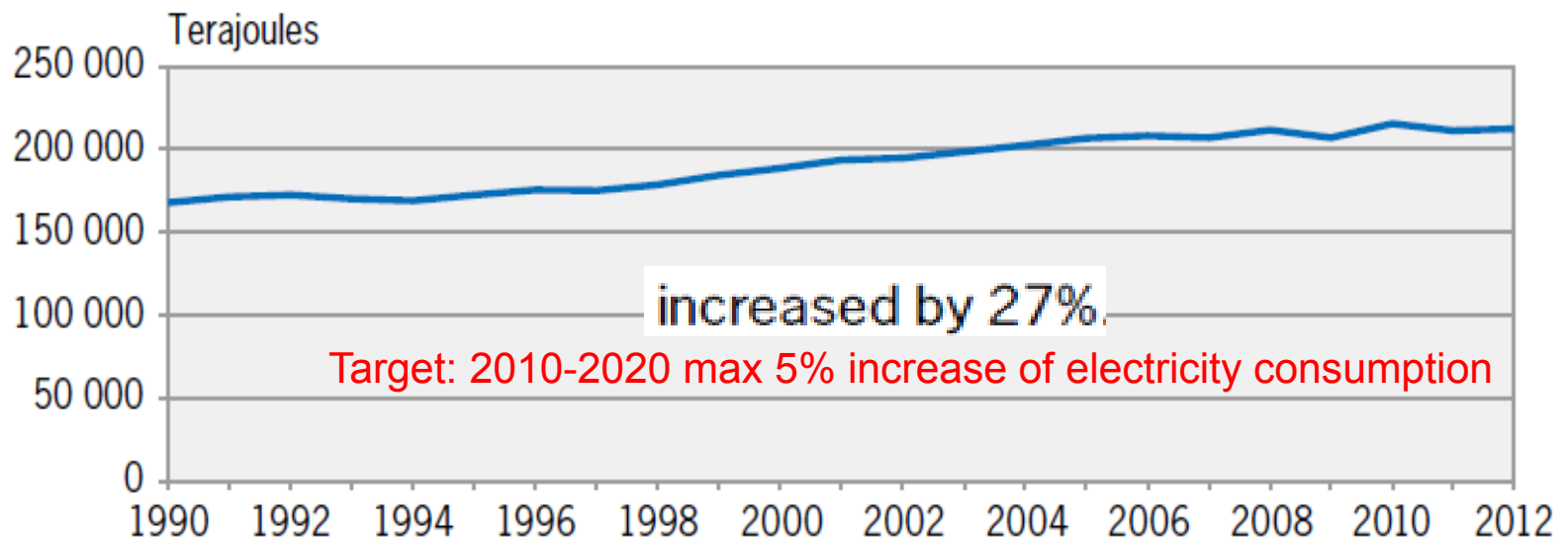


Switzerland

3

Electricity Consumption (210 PJ) \approx 58 TWh

Electricity consumption



Source: Federal Office of Energy

© FSO 2014

Between 1990 and 2012, electricity consumption in Switzerland increased by 27%. In 2012, 59% of electricity was produced by hydropower and 36% by nuclear energy. The remainder came from conventional thermal power plants (4%) and various renewable sources (1.4%).

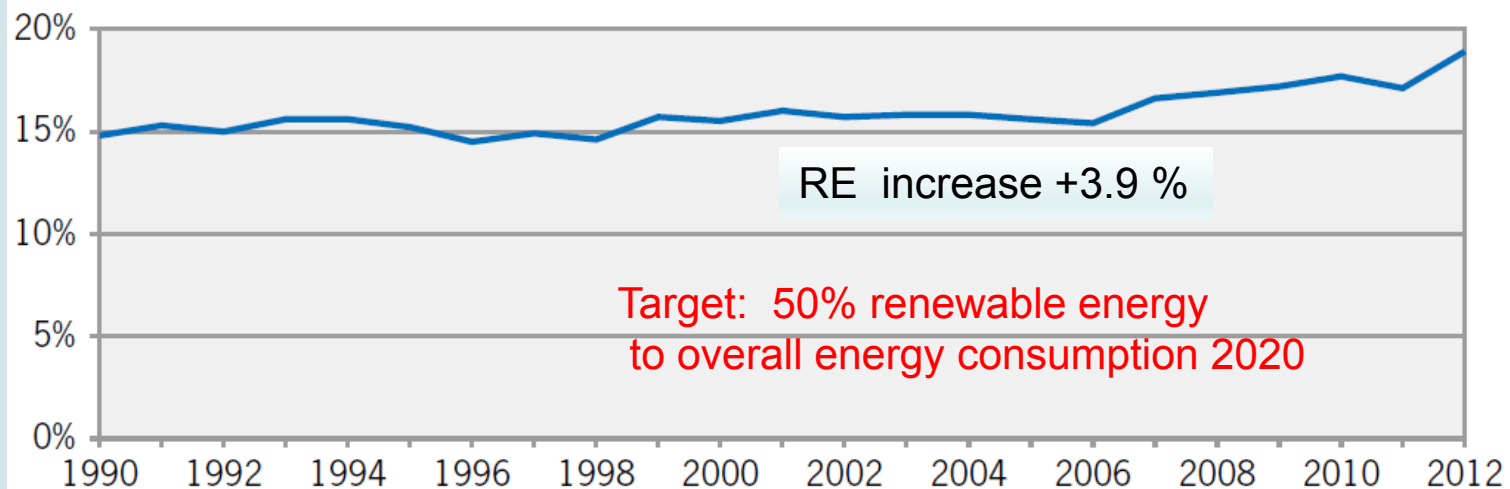


Switzerland RENEWABLE ENERGIES

4

Renewable energies

Share of renewable energies in gross energy consumption



Source: Federal Office of Energy

© FSO 2014

In 2012, 18.9% of gross energy consumption came from renewable sources. 66% of renewable energies were obtained from hydropower, followed by wood with 18.4% and energy generation from renewable waste with 11.8%. Ambient heat (5.6%), biogas (1.7%), solar energy (1.4%), biofuel (0.2%) and wind energy (0.1%) were involved to a lesser extent in the production of energy.



General Swiss Energy Policy + Programs

1

- General policy made by Swiss Federal Office of Energy (SFOE) since 25 years
 - High efficiency
 - Increasing renewable energy
- CO₂ Act (Kyoto) signed
 - emissions reduction of 10% by 2010 (aim not fulfilled)
 - and of 20% by 2020 compared to 1990 levels
- Approved action plans by Swiss Federal Council 2008 and 2011
 - 50% renewable energy to overall energy consumption 2020
 - reduce the consumption of fossil fuels by 20 per cent by 2020
 - 2010-2020 max 5% increase of electricity consumption
 - After 2020 stabilise electricity consumption
- Long-term vision for sustainability
 - The 2000 Watt society (per capita energy consumption)
- Federal council decision 25.5.2011 **to go out of nuclear power production**
 - Federal office of Energy presents new **Energy strategy 2050**



General Swiss Energy Policy + Programs

Energy Strategy 2050: Costs

3

- + Investment in efficiency
- Savings in energy costs / imports
- + Investments Costs of production
- + Grid enforcement

= **Total CHF 39 000 000 000.-**

Angebotsvariante C&E | Quellen: Prognos 2012, Consentec 2012





SCCER

Swiss Competence Center for Energy Research

Swiss Energy Research

- Energy Strategy 2050
 - Solutions to problems arising from the “energy revolution”
 - Research plays a strategic role
- Coordinated Energy Research in Switzerland Action Plan
 - Swiss Competence Centers for Energy Research (CHF 72 million)
 - R&D projects in the energy field (CHF 46 million)
 - Funding schemes for young scientist (CHF 24 million)
- Swiss Competence Centers for Energy Research (SCCER)
 - Inter-university research networks
 - Seven predefined action areas
 - Supervised by the Commission for Technology and Innovation (CTI) and the Swiss National Science Foundation (SNF)

2013-2016
Total
142 Mio CHF



SCCR

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





Thermal Gasification of Biomass Know How, Competence Building and Education



biosweet

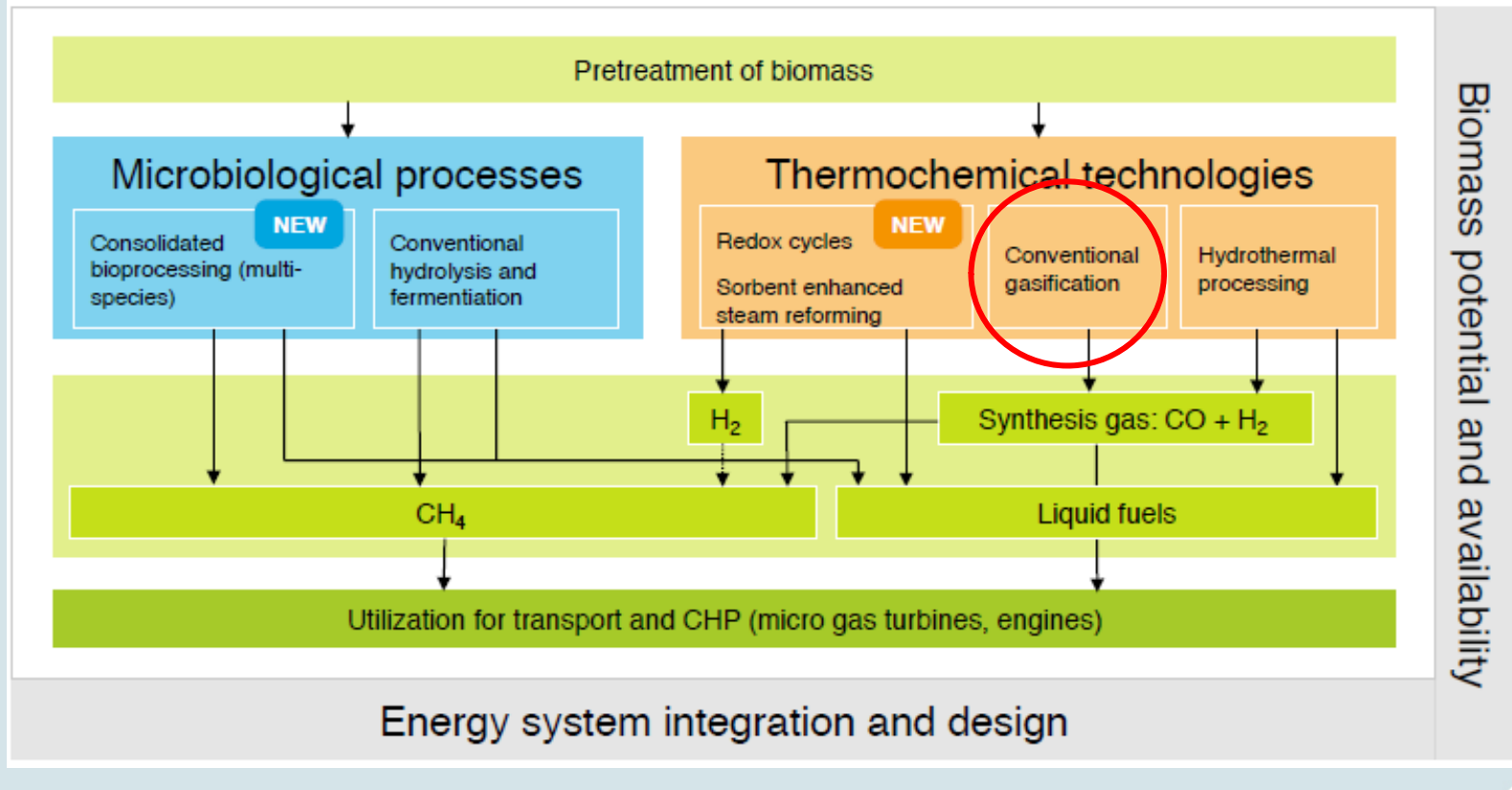
Biomass for Swiss Energy Future
Swiss Competence Center for Energy Research



Biomass for Swiss Energy Future



R&D field





Thermal Gasification of Biomass Research Activities Situation May 2015

1

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 Activities Situation May 2015

2

CCEM Competence Center Energy and Mobility (PSI)

3 Projects related to "Thermal Gasification of Biomass".

- ARRMAT (Attrition Resistant Reactive Bed Materials in Fluidised Beds)
- WOODGAS-SOFC II
- SYNGAS Diagnosis

http://www.ccem.ch/MediaBoard/CCEM_Annual_Activity_Report_2013.pdf

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)

<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)

<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)

<http://www.nfp66.ch/E/projects/wood-source-energy/production-ultra-pure-hydrogen-wood/Pages/default.aspx>



Thermal Gasification of Biomass

Swiss Industries Situation May 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 Swiss Industries Situation May 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



Thermal Biomass Gasification CHP-Facilities in Switzerland May 2015

Summary

1

	Aerni in Pratteln	Holzstrom in Stans	A. Steiner + Cie. AG	J. Bucher AG Escholzmatt
Gasifier	Wegscheid	8 Pyroforce	Spanner	Wegscheid
Type	downdraft	2-zone downdraft	downdraft	downdraft
Gas engine	1 x 130 kW Adapt MAN	2 x 690 kW Jennbacher	45 kW el	140 kW
Waste heat therm	230 kW for district heating	1,2 MW for district heating	district heating	district heating drying wood chips
extra Boiler	2MW wood chip district heating	1,6 MW W'chips + 1,7 MW oil for district heating	yes	Yes
Commissioning	2009 first 2013 second	2007	2012/2013	1.4.2015 completed
Remarks	in testing operation	24h_7d p week operation	24h_7d p week operation	24h_7d p week operation



Thermal Biomass Gasification CHP-Facilities in Switzerland May 2015

Summary

2

	Aerni in Pratteln	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
Moisture	8%	10%	Max 15%	
Operating hours last 5 months	Not declared	Block 1: 2747 Block 2: 3810	3819 h	600 h
Declared revision / modification	Classifier	-	-	-
Total live time operation h	Since April 2013 1000h	BHKW 1: 35 197 BHKW 2: 43 348	11 342 h	600
Remarks	New wood dust remover	Plant in normal operation	Plant in normal operation	Plant in normal operation



Stans Switzerland Thermal Biomass Gasification CHP-Plant

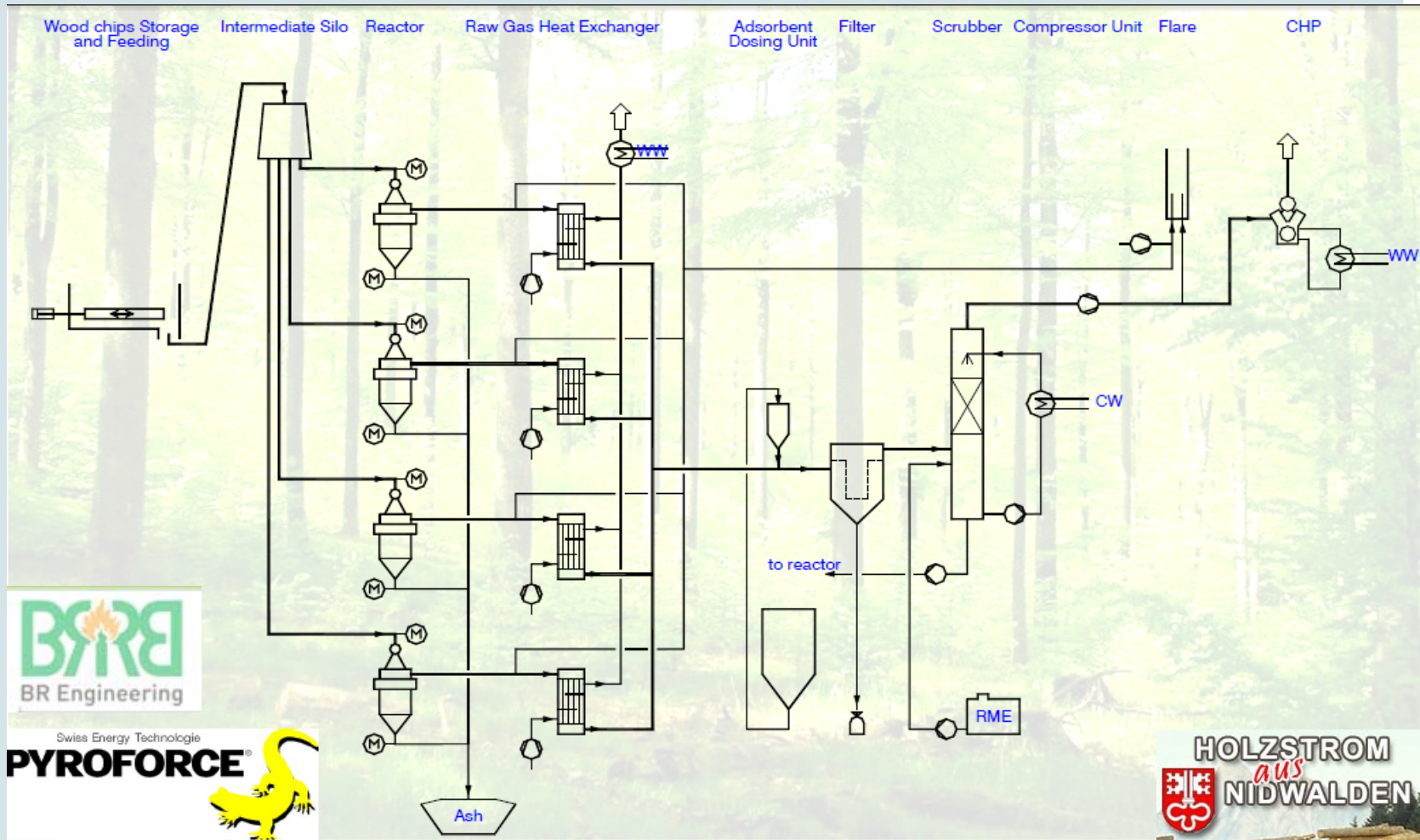
2





Stans Switzerland Thermal Biomass Gasification CHP-Plant

1



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

May 2015

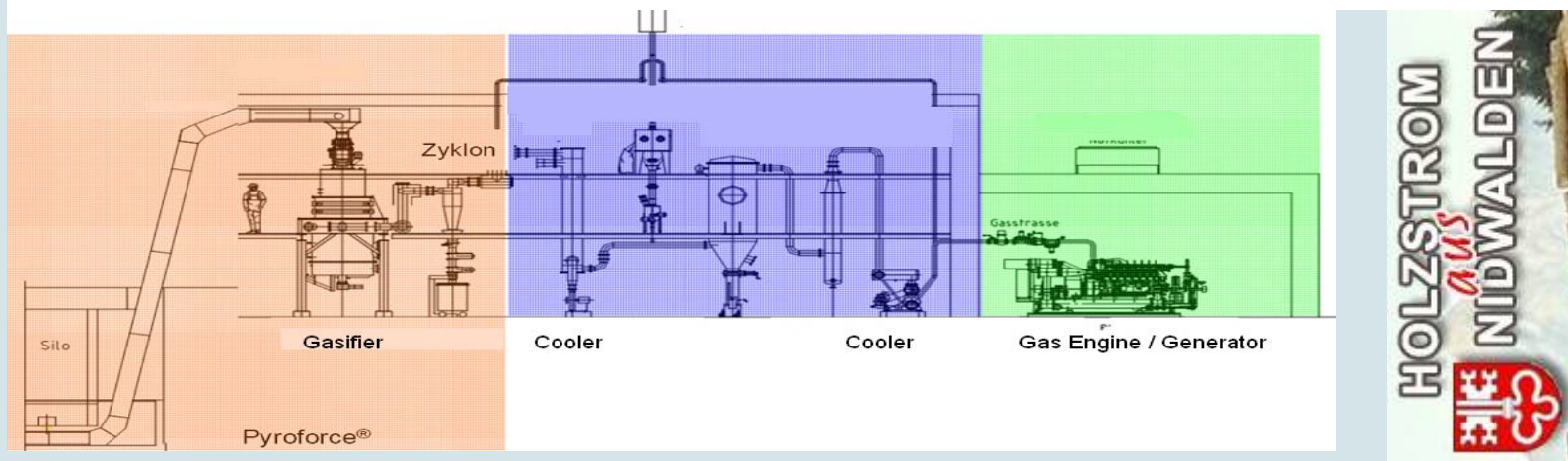
19



Stans Switzerland Thermal Biomass Gasification CHP-Plant

2

Jahr	Bh BHKW1	Bh BHKW 2	operating hours CHP 1	operating hours CHP 2	operating hours CHP 1+2
2008	2800	3800	2800	3800	6600
2009	5300	9050	2500	5250	7750
2010	7900	13800	2600	4750	7350
2011	14200	21537	6300	7737	14037
2012	21384	27808	7184	6271	13455
2013	27551	34127	6167	6319	12486





Pratteln Switzerland Thermal Biomass Gasification CHP-Plants



Closed down 2015



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

May 2015



Ettiswil Luzern Switzerland Thermal Biomass Gasification CHP-Plants



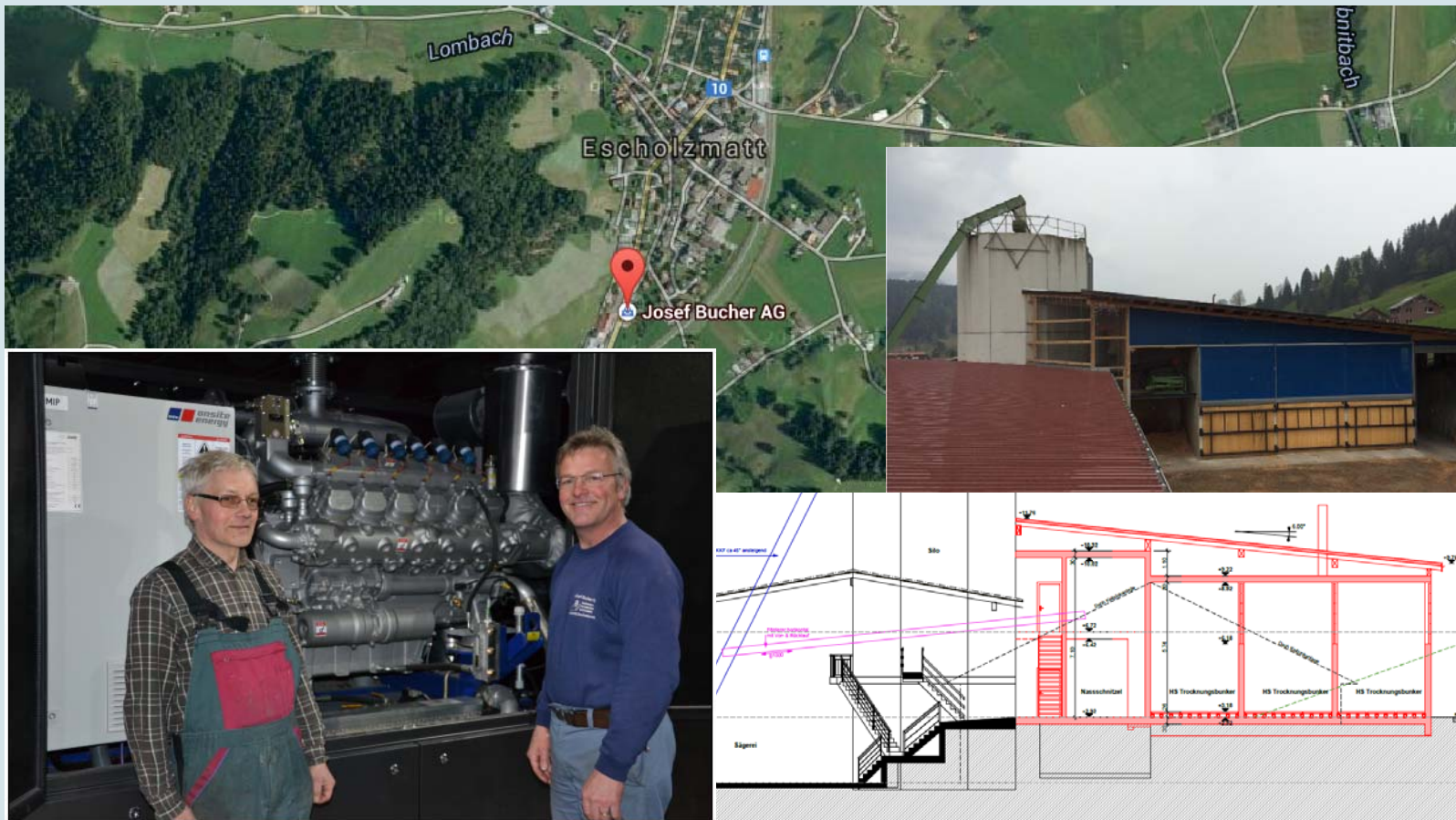
A. STEINER + CIE AG
SÄGEWERK RIEDBRUGG
6218 ETTISWIL





Escholzmatt Luzern Switzerland 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



Thermal Gasification of Biomass Swiss Projects May 2015

- Gasification Riggisberg CHP unit for forest waste chip => building permission requested
220kWe/436kWth EAF Austria/Xylogas.com
Location Riggisberg
- Gasification CHP unit for forest waste chip => ready for final decision
1-2 MW fuel input Gasifier typ in evaluation
Location Köniz/Gansel
- Several small scale gasifier CHP offered, decisions pending



Thermal Gasification of Biomass Switzerland May 2015 Summery

- 3 Plant in stable operation (Escholzmatt, Stans and Ettiswil)
- 1 Plant closed down January 2015, equipment for sale (Aerni, Pratteln)
- 1 Plant under construction (Köniz),
- 1 Plant building permission requested (Riggisberg Balsiger (Xylogas))

several small in discussion (Spanner, Burkhardt.....)

Facts of the past 6 years:

- 2 Plant closed down (Wila, Spiez, Pratteln)
- 4 Projects abandoned (Empa, E Hup Baden, Brickfactory, PSI)
- 2 Main Gasifier supplier out of business (EKZ, Pyroforce)

Politics: strong renewable energy promoting, but weak increase of projects

- Frame:
- Cost-covering remuneration (KEV) existing
 - Thermal gasification is technically complex (higher costs)
 - Risk investments for biomass-energy projects not existing
 - CO₂ -certificates, -contributions and -compensations unsecure in the future
 - Public and private frames not in line with political visions
 - Volatile biomass-fuel-price



Thanks for your attention, any questions?

Log transport with wood gasifier tractor
Gasterntal to Kandersteg Switzerland 1940

