



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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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

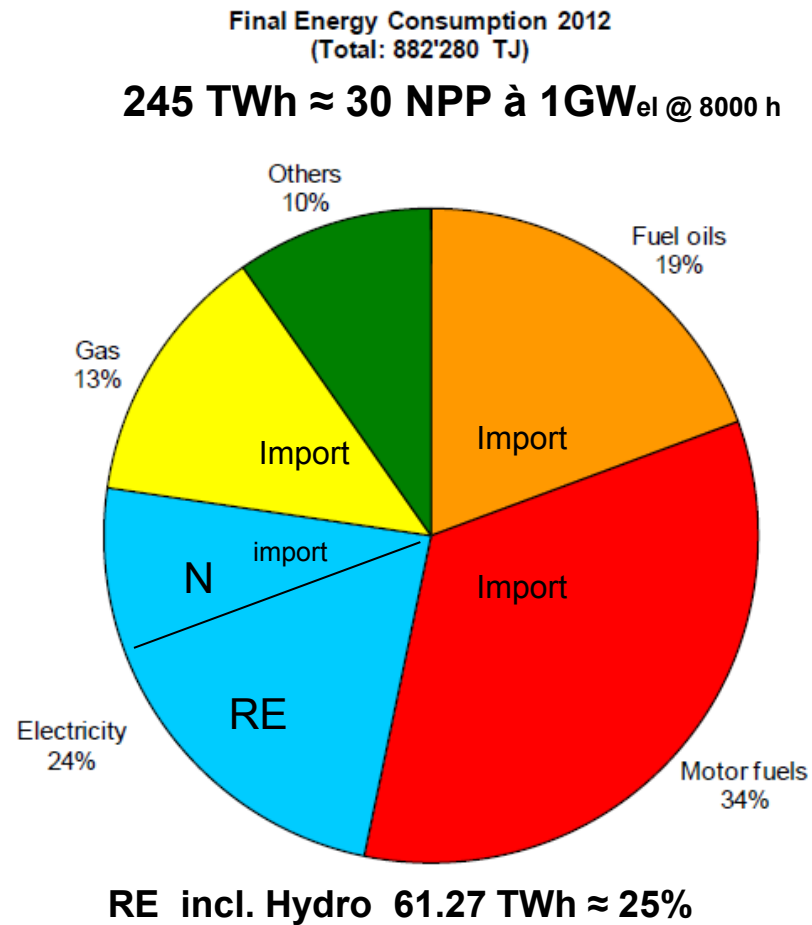
IEA Bioenergy, Task 33, Meeting Mai 2014, Napoli Italy



General Swiss Energy Policy + Programs

Energy Consumption (0,9 EJ \approx 882 280 TJ) \approx 245 TWh

1



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



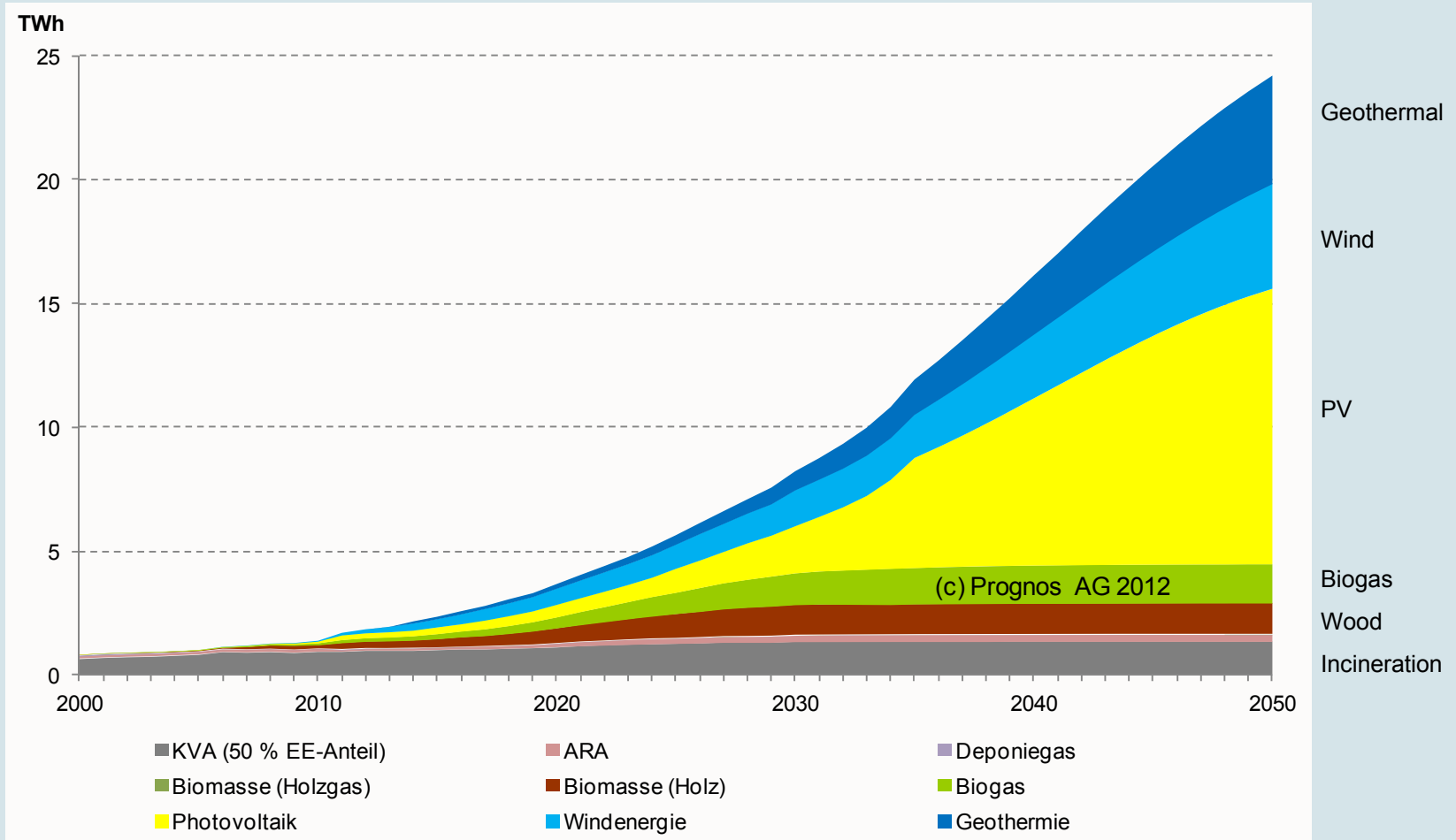
- General policy made by Swiss Federal Office of Energy (SFOE) since 25 year
 - High efficiency
 - Increasing renewable energy
- CO₂ Act (Kyoto) signed
 - emissions reduction of 10% by 2010 (aim not fulfilled)
 - and of 20% by 2020 compared to 1990 levels
- Approved action plans by Swiss Federal Council 2008 // 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
- Vision long-term vision of 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 new **Energy strategy 2050**



General Swiss Energy Policy + Programs

3

Energy Strategy 2050: Substitution with "other renewables + "





General Swiss Energy Policy + Programs Energy Strategy 2050 [ES 2050] must be

4

1. Energy Efficiency improvement

2. Renewable Production Increase 2050

+ 3,2 TWh Hydro

+ 24.2 TWh (11.1 TWh PV; 6.4 TWh Biomass;
4.4 TWh Geotherm; 4.3 TWh Wind)

=> + 6.4 TWh Biomass:

2.0 TWh BM used for CHP

1.6 TWh Biogas from waste BM

1.3 TWh incineration plant waste BM

1.2 TWh wood as solid fuel (Heating)

0.3 TWh BM recovery in waste water

3. Resting Demand to cover by

- Fossil fuel for electricity (CHP and CCPP)
- Imports



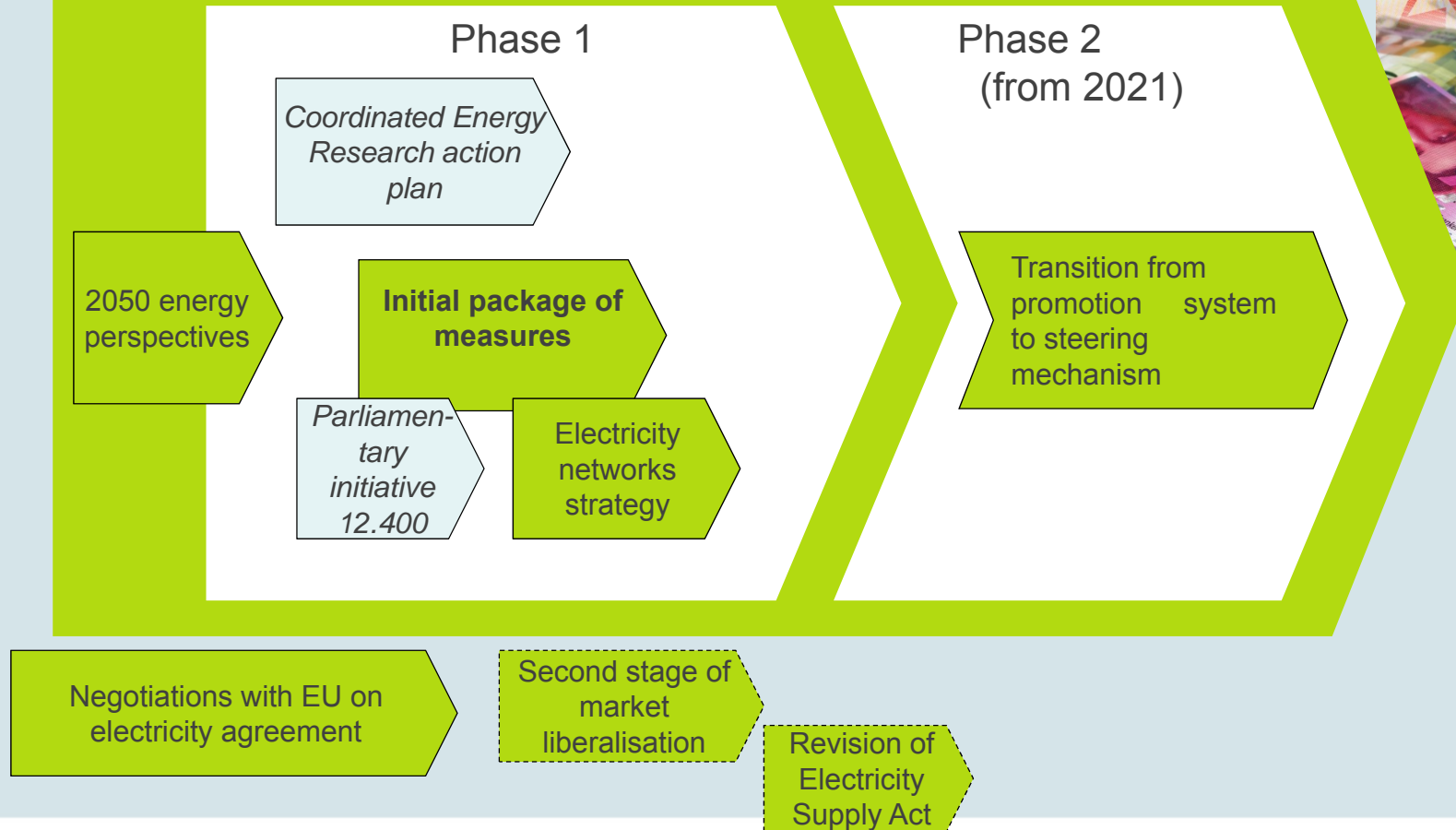


General Swiss Energy Policy + Programs

Energy Strategy 2050: overview action plan

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Energy Strategy 2050





General Swiss Energy Policy + Programs

Energy Strategy 2050: first steps SCCER

6

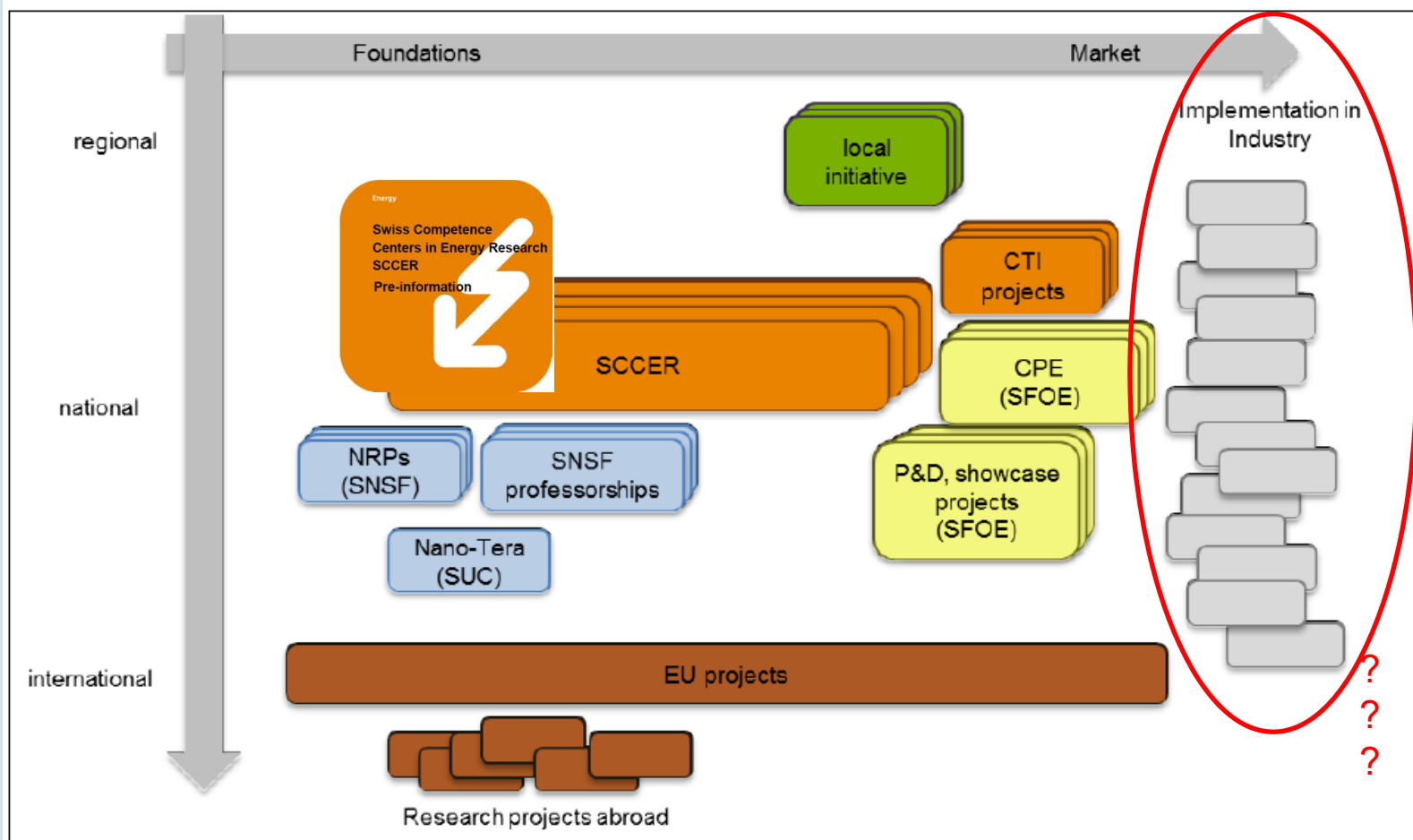


Figure 1: SCCER environment



General Swiss Energy Policy + Programs

Energy Strategy 2050: Costs

7

- + 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





Thermal Gasification of Biomass Research Activities Situation Mai 2014

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 <http://tpe.web.psi.ch/>
 - Dr. Serge Biollaz http://tpe.web.psi.ch/person/per_biollaz.htm
- Gasification of wet biomass (manure, algae)
 - For SNG production
 - Dr. Frédéric Vogel http://cpe.web.psi.ch/CPE/per_Vogel.html
- EU Infrastructure Project, collaboration with: BRISK
(Biofuels Research Infrastructure for Sharing Knowledge)
<http://www.briskeu.com/>



Thermal Gasification of Biomass Research Activities Situation Mai 2014

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/Annual_Activity_Report_2011.pdf

NFP66 (National R Program) 3 Project 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 Mai 2014

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



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





Thermal Gasification of Biomass Swiss Industries Situation Mai 2014

2

- XyloPower AG

www.xylopower.com

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

- CTU

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

- Supplier for turnkey biomass gasifier plants

UMWELT & ENERGIETECHNIK
WASTE TO ENERGY

- Foster Wheeler AG

- Foster Wheeler AG in Baar Switzerland (published March 2010 Infos about BTL-Plant in Finland)
- Foster Wheeler Engineering AG Basel
- Foster Wheeler Management AG in Geneva Switzerland



Thermal Gasification of Biomass News Swiss Projects Mai 2014

- EMPA EAWAG Dübendorf CHP gasifier Plant
Project is in the stage of detail planning; in construction
 - Supplier will be EKZ Woodpergas 500 gasifier
 - 2 x 350 kWel
- PSI: Biomethane Development => 20-80 MW Biom-to-SNG plant in discussion
based on BFB methanation technology
- Gasification CHP unit for forest waste chip =>
1-2 MW fuel input Gasifier Typ in evaluation
Location Köniz/Gasel
- Bucher Josef AG Escholzmatt Sawmill =>
110kW el. /230 kW th Wegscheid Gasifier
7500h warranty Commissioning 2014
- Gasification Riggisberg CHP unit for forest waste chip =>
220kWel/436kWth EAF Austria/Xylogas.com
Location Riggisberg

project cancelled
project cancelled



Thermal Gasification of Biomass SFOE Bioenergy

Collaborations with EU Energy LH Project BESTF pre-commercial

Overview

Bioenergy Sustaining the Future (BESTF) is a European initiative aiming to encourage the commercialisation of bioenergy projects and increase renewable energy production across the EU. This ERANET plus activity will provide funding and support to collaborative bioenergy projects at a pre-commercial stage that demonstrate one or more innovative steps.

The single call for proposals is expected to open in December 2013 and will close in March 2014 with first projects commencing from January 2015. Please note that dates are provisional and will be confirmed later in the year.

Full details will be made available on the BESTF website and at a briefing event on 11th December 2013.

Contact information:
 E-mail: Erin.Looper@decc.gsi.gov.uk

Ewa Bloch (TSB):
ewa.bloch@tsb.gov.uk

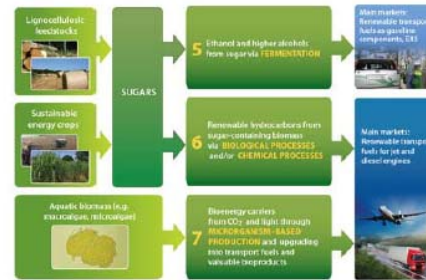


<http://eranetbestf.net/>



Images courtesy of Rothamsted Research

BESTF – Call scope (1)



Bio-chemical value chains

Thermo-chemical value chains



Collaboration with BESTF cancelled

- | | | | |
|--|---------------------|--|--------------------|
| | TSB – UK | | BBSRC – UK |
| | FNR – Germany | | TEKES – Finland |
| | SWEA-STEM – Sweden | | SFOE – Switzerland |
| | EUDP – Denmark | | FCT – Portugal |
| | DECC – UK* | | |
| | Gobierno de Navarra | | |
| | DEHIE – Navarra | | |



New Swiss Technology November 2013/ Mai 2014 Thermal Gasification of Biomass

1



info@br-engineering.ch

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Maihofstrasse 95 B
CH 6006 Luzern
Telefon: +41 44 58 68 78 2
www.br-engineering.ch



Reaktor SIRION

Process: Fixbed two zone downdraft

Leistung: 764 kW Heating power
571 kW Cold gas power
107 kW Heating poer HT >130°C
55 kW low heat power for drying
31 kW loss gas cleaning

Efficacy: 75% cold gas power
89% overall without wood drying
96% overall with wood drying



Thermal Biomass Gasification CHP-Facilities in Switzerland Mai 2014

Summary

1

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



Thermal Biomass Gasification CHP-Facilities in Switzerland Mai 2014

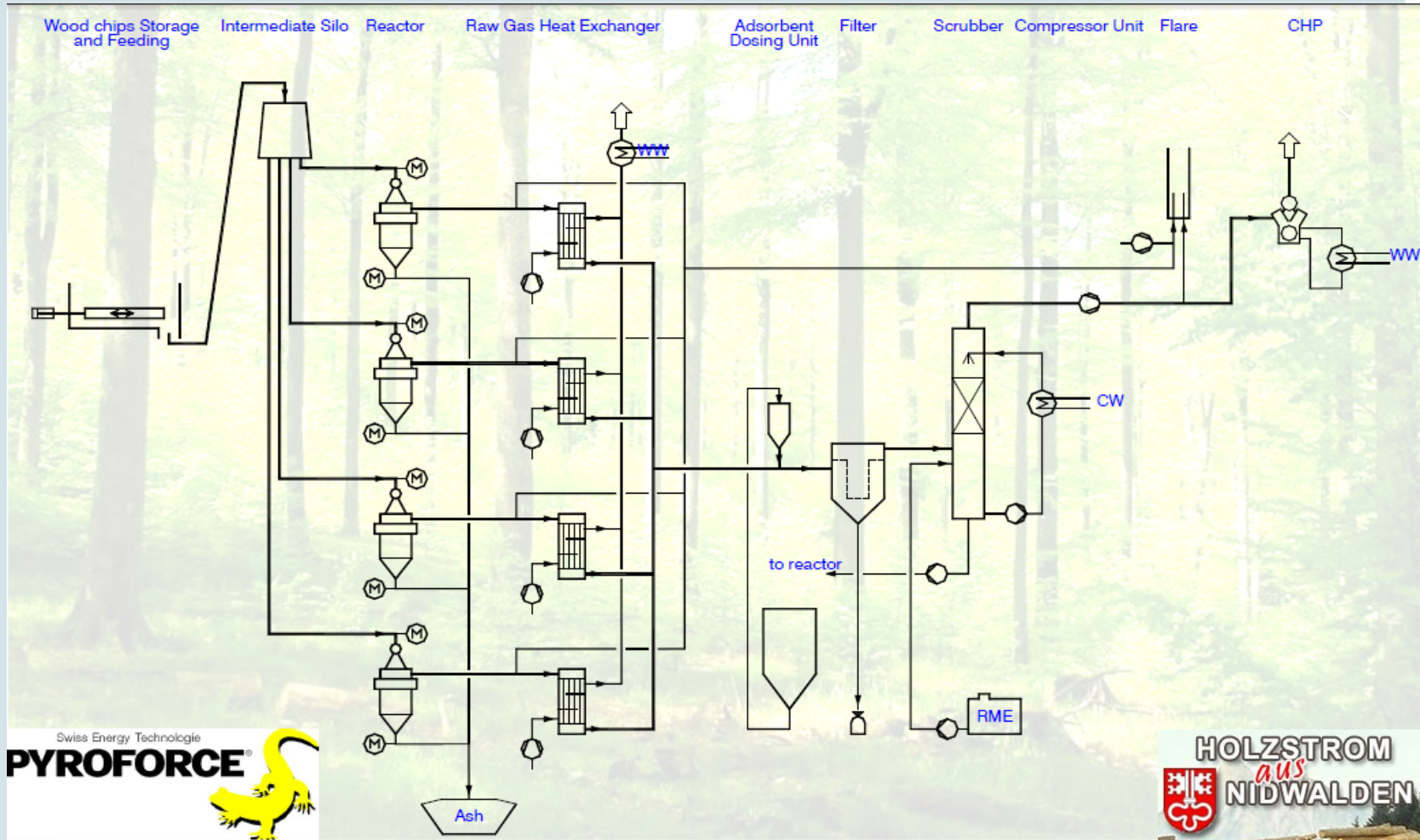
Summary

2

	Aerni in Pratteln	Holzstrom in Stans	A. Steiner + Cie. AG	
Fuel	Dry clean wood chips	Dry demolition wood/scrap wood chips	Dry waste wood chips	
Moisture	8%	10%	Max 15%	
Operating hours last 5 Months	~ 100	Block 1: 3 406 Block 2: 3 612	2000 h	
Declared revision / modification	Gasifier	-	minor adjustments needed by supplier	
Total live time operation h	n.a. due modification	Block 1: 29 956 Block 2: 36 695	5000 h	
Remarks	in testing operation	Plant in normal operation	Plant in operation	



Thermal Biomass Gasification CHP-Plant Stans Switzerland 1



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IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Napoli, Italy
Mai 2014



Thermal Biomass Gasification CHP-Plants Stans Switzerland 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





Thermal Biomass Gasification CHP-Plants Pratteln Switzerland



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Napoli, Italy
Mai 2014



Thermal Biomass Gasification CHP-Plants Ettiswil Luzern Switzerland

 A. STEINER + CIE AG
SÄGEWERK RIEDBRUGG
6218 ETTISWIL



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IEA Bioenergy: Task 33 Thermal Gasification of Biomass

Napoli, Italy
Mai 2014



P+D Projects Thermal Gasification of Biomass Switzerland

Facts today:

- 2 Plant in stable operation (Stans and Ettiswil)
- 1 Plant in testing operation (Aerni)
- 0 Project in construction
- several small in discussion (Spanner, Burkhardt, Agnion)

Facts of the past 5 years:

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

Politics: strong renewable energy promoting but little increase in real projects

Reality:

- Cost-covering remuneration (KEV) for new projects pending till 2015
- 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?

