



EXECUTIVE SUMMARY
of a
TCG-UC EL500 W2GE Project
Based on
„Thermo-Chemical Gasification Technology”
– that utilizes **Municipal Solid Waste and/or**
„sewage sludge”, its residuals, and other carboniferous wastes and materials
- in an environmental-friendly way -, in a closed, zero-emission Thermo-
Degradation system,
for generating clean energy.



Technical background

The Thermo-Chemical Gasification Technology – TCG - allows high temperature thermo chemical gasification without oxygen and air.

It incorporates several new technological developments and design features such as:

- modular construction and shop fabrication;
- no requirement for refractory brick;
- no requirement for separation and injection of oxygen;
- no sensitivity to moisture content in the feedstock;
- no requirement for pulverization or slurry injection of feed;
- flexibility in feedstock alternatives including varying proportions of coal, pet coke, biomass, sewer sludge or other organic waste in different proportions;
- utilization of a unique ionized water treatment system;
- capability of recycling un-reacted carbons back into the reactor chamber, and a near-zero air emissions and liquid discharge.

In addition, some of the carbon dioxide generated in the gasification process can be captured and recycled as feedstock. Further the potential exists to readily integrate this system into a portable, flexible gas-to-liquids bio-refinery. There is substantial commercial potential in the TCG unit.

During the last years, many novel design aspects have been further developed that culminated in a US patent filed on April 11, 2006, application No: 60 / 791,401.

The „TCG-UC System” covers the whole problem area, offering the total solution from the grinding machine, via the TCG Unit, to the „SECU” - SynGas-Electricity energy Conversion Unit (Gas motors or Turbines,) - to the „LFU” - Liquid Fuel Unit (Fischer-Tropsch or other Liquefaction technology) with a specific readily available additional equipment.

A solid carbonaceous material synthesis gas generation plant (gasifier) was built on a test site. This commercial scale reference plant was completed in mid-August 2007. Currently conducting operational start-up activities at the University of Toledo, Ohio. The plant is designed to utilize carbonaceous feedstock from coal to biomass including wood chips, rice straw, ethanol plant DDGS, and municipal and industry waste products (i.e. organic sludge, industry waste, petroleum coke) for synthesis gas production. The plant feed system is designed to handle blended feedstock, including coal mixed in any proportion, with the above mentioned materials.

From the middle of 2007, on the Denver, Colorado site, with a daily processing load of 75-200 tons of input material, the TCG installation met and in many cases exceeded the expectations suggested by our modeling and calculations.

The verification of these and other results was done by independent organizations. “*TSS Consultants*” (<http://www.tssconsultants.com>) examined the potential and performance parameters of this thermo-chemical technology from a number of different angles. Five categories (E1-E5) were created and examined:

1. Economic viability (E1)

2. Energy Efficiency (E2)
3. Environmental Compatibility (E3)
4. Research, Development, Demonstration and Deployment (RDD&D) Evaluation Stages (E4)
5. Potential Socio-Political Effectiveness (E5)

These categories were selected and rated using data from several hundred installations worldwide either currently operational or in the planning stages.

After lengthy investigation, the analysts deemed the TCG installation to be the most highly rated, and further recommended it to the United States Senate as one of the foremost methods available today for reducing the importance of fossil fuels in energy generation in a most environmentally-friendly and safe manner.

TSS Consultants concluded that the

„TC thermo-chemical pyrolysis/steam refining process when conducted in absence of oxygen or air is superior to all other existing technologies examined.”

The US House of Representatives, Science and Technology Committee, Subcommittee on Energy and Environment had requested testimony on research and development issues for producing liquid fuels from coal on September 5, 2007. Nationally and internationally recognized environmental scientists and researchers such as Mr. Bartis from RAND Corporation and Dr. Boardman from Idaho National Laboratory testified on the importance of this very issue.

The committee unanimously recommended to the federal government for support research on coal gasification and associated synthesis gas cleaning and treatment processes. These programs are near-term, relatively low risk concepts related mostly for power generation and hydrogen production. That said, many of the programs are also applicable to Fischer-Tropsch (F-T) technology to liquid fuels.

Specific Technology Innovations that are incorporated in the TCG-UC system

- Water Vapor (steam) is added into the system after the water has been super-saturated with negatively charged oxygen using patented water treatment technology (ionized steam reformation)
- Syngas is cooled by quenching with water which is then treated using patented technology to remove all tars and phenols, which are then recycled back into the gasifier. (gas clean-up)
- Partially decomposed particles are recycled through the system to achieve higher reaction efficiency. (carbon re-cycle)

- System operates at lower temperatures, (below vitrification levels) which requires less parasitic load and thus creates higher efficiency (non-slugging gasifier)
- Combustion flu gas can be captured and recycled, with minimal emissions.
- Final ash from system is generally not leachable, or can be contained in cementaciousbyproducts. (non-hazardous)
- Elimination of reactor refractory brick.

The feedstock

Although any carbon-based or carbonaceous material is suitable for use as an input material, the System achieves optimal efficiency when operated with mixed-source input materials. The System is capable of operating normally using single-source input material, however in this case its efficiency is dependent upon several factors.

ANY CARBONIFEROUS MATERIALS CAN BE USED IN THE TCG UNIT

In the projects, listed below we have modeled, - and is based on - a basic operation, using Municipal Solid Waste (MSW) and Sewage Sludge (SeSl), considering the existing incentive systems related to the MSW handling and sewage water cleaning.

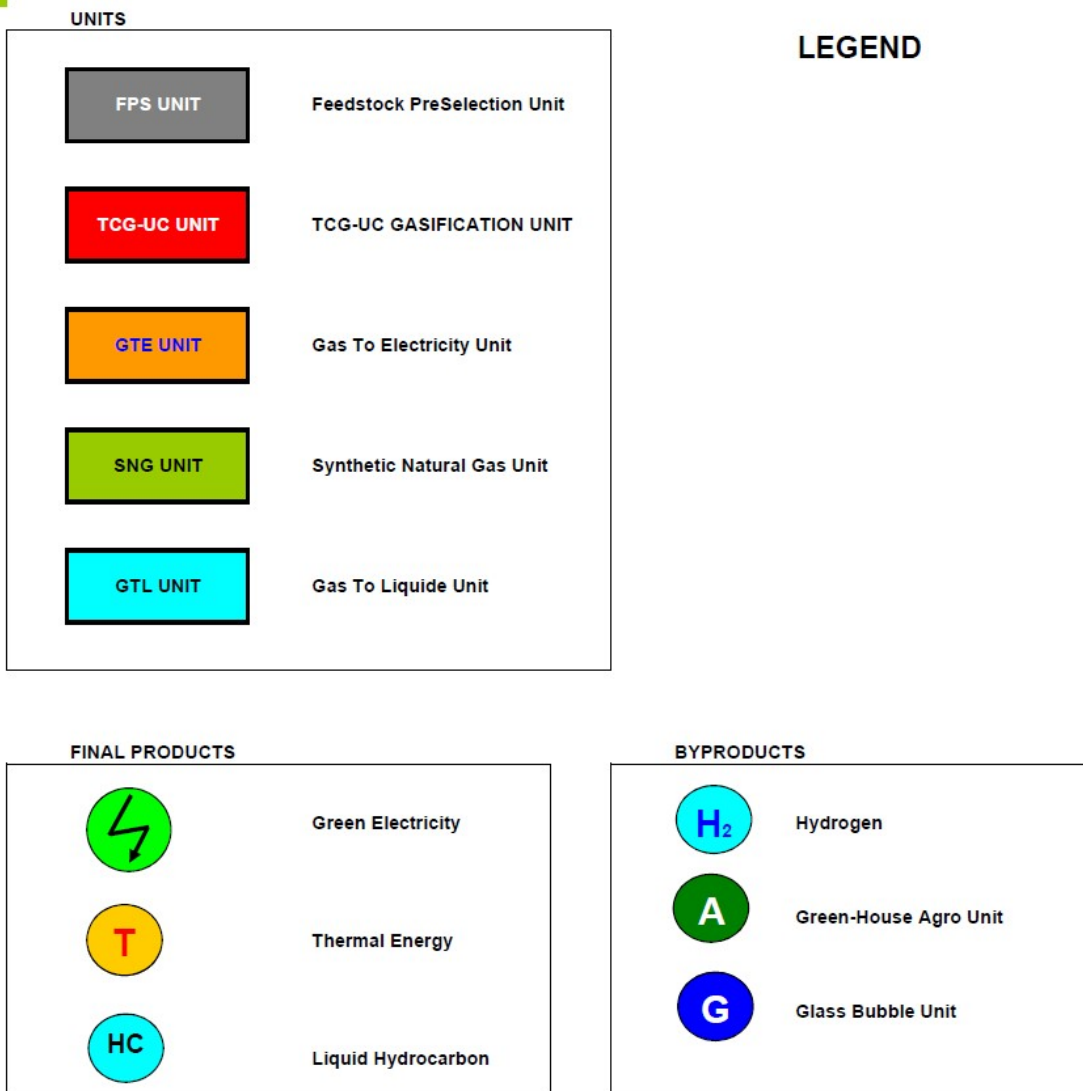
The European Union produces altogether cca 2 billion tons of MSW yearly. This mass of MSW contains about $2,4 \times 10^{10}$ GJ ($6,6666 \times 10^9$ MWh) energy.

This can be transformed to synthesys gas with $4,662 \times 10^9$ MWh energy content.

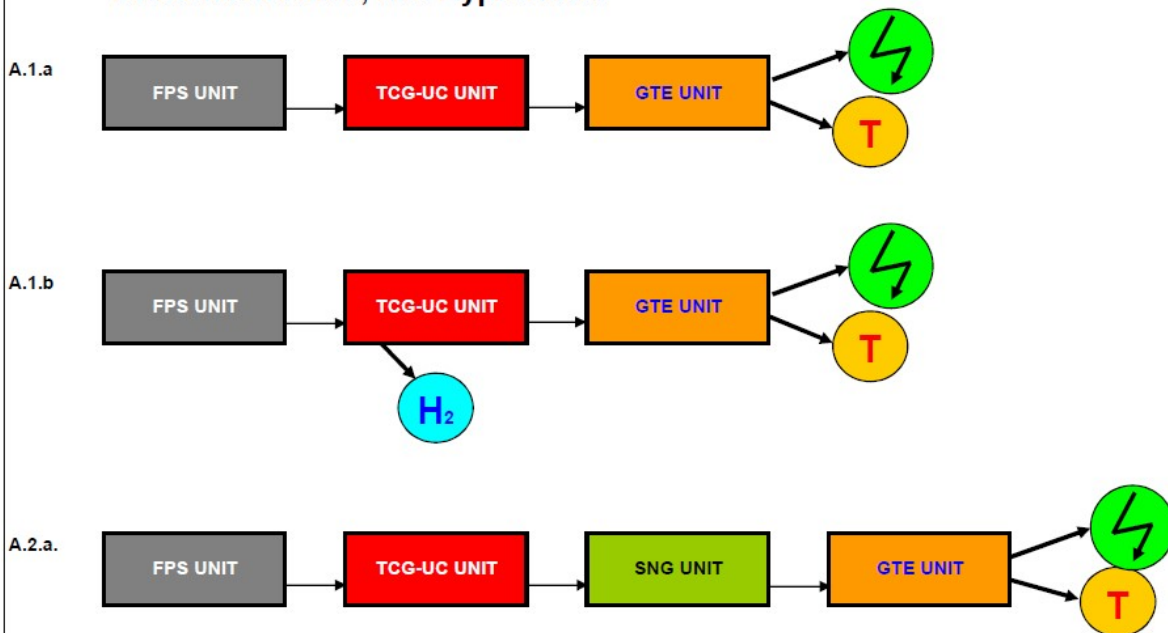
The Output and Environmental protecting

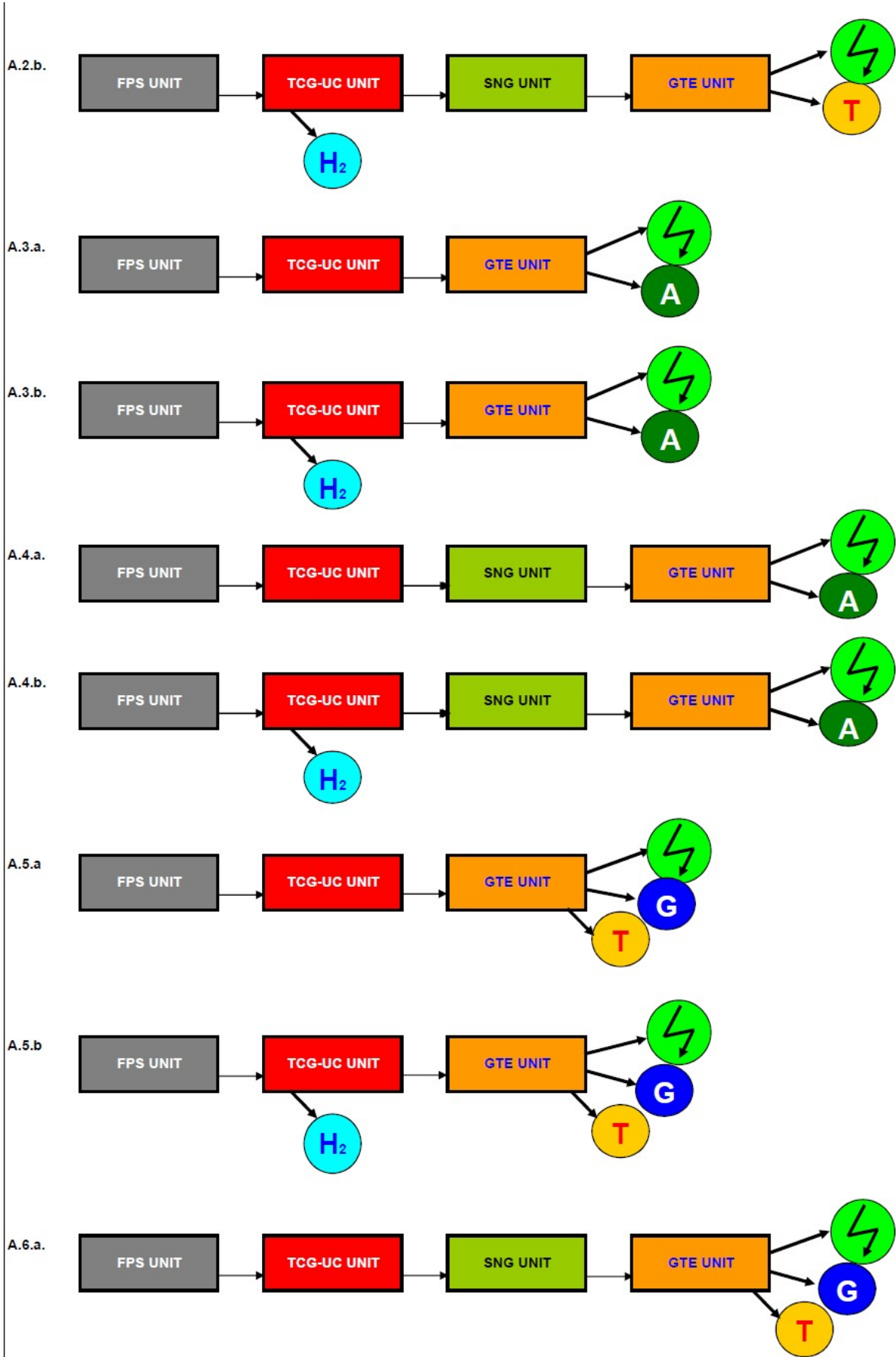
- Syngas (which is itself a feedstock for any further processes and/or energy generation)
- slag/ash, dependent upon the ash content of the input materials, which is generated at an approximate rate of 2-25 tons per day. It is powdery and gray in color, environmentally-inactive, bound and water-insoluble, and is non-polluting. It is easily and beneficially integrated into construction, cement-making, or road construction applications, among many others depending upon the feedstock material.

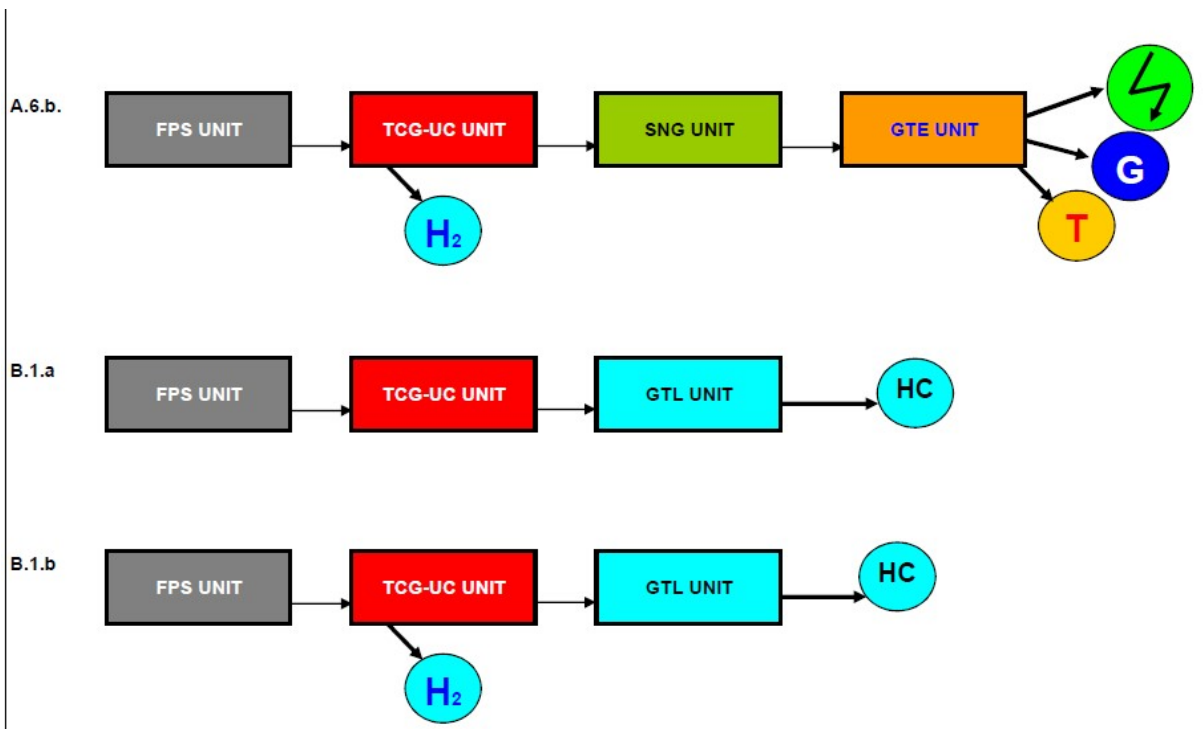
There are no other liquid or gaseous emissions or environmental pollutants whatsoever formed by the TCG Unit and its processes



Versions of Final-, and Byproducts

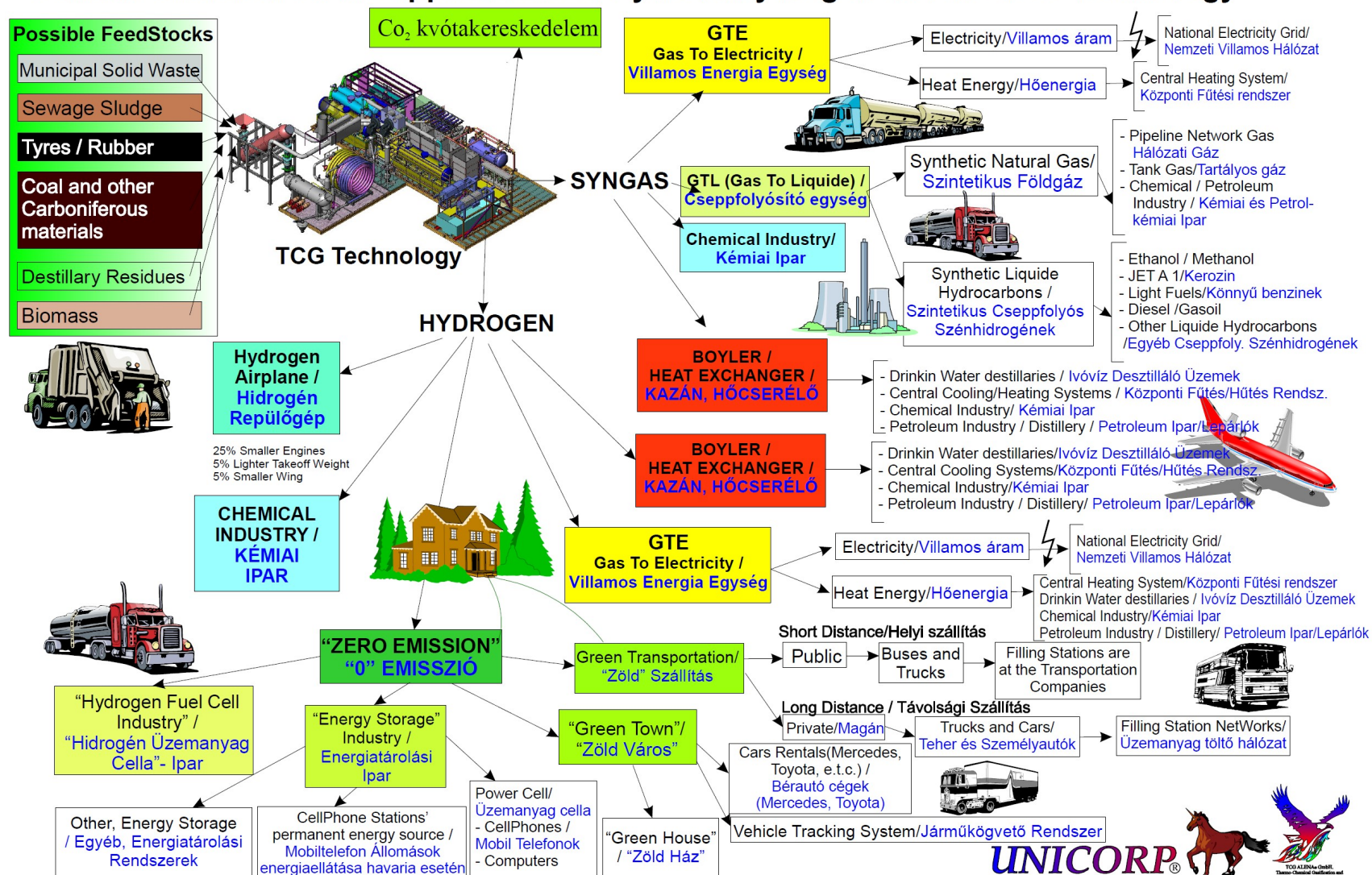


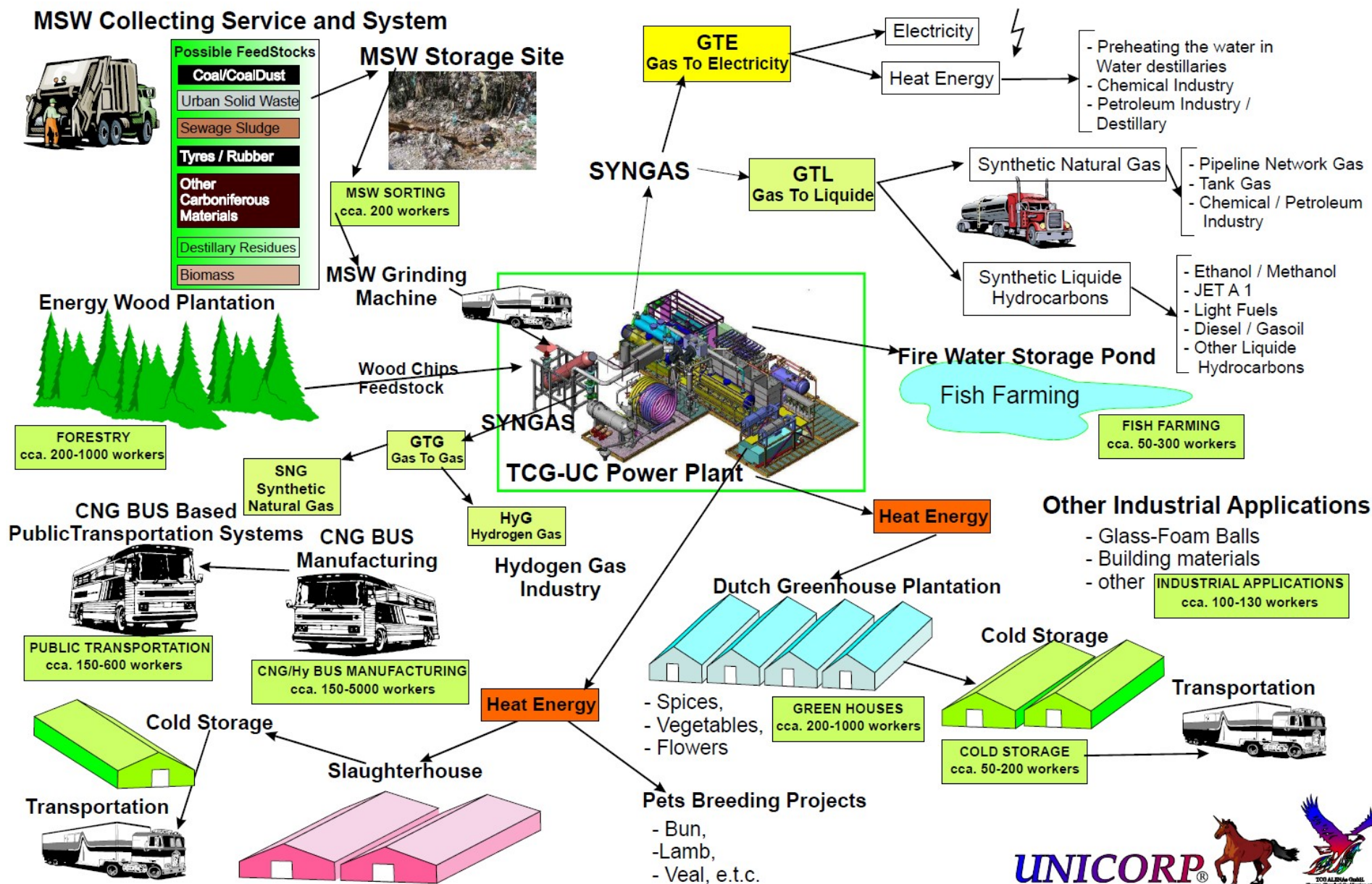




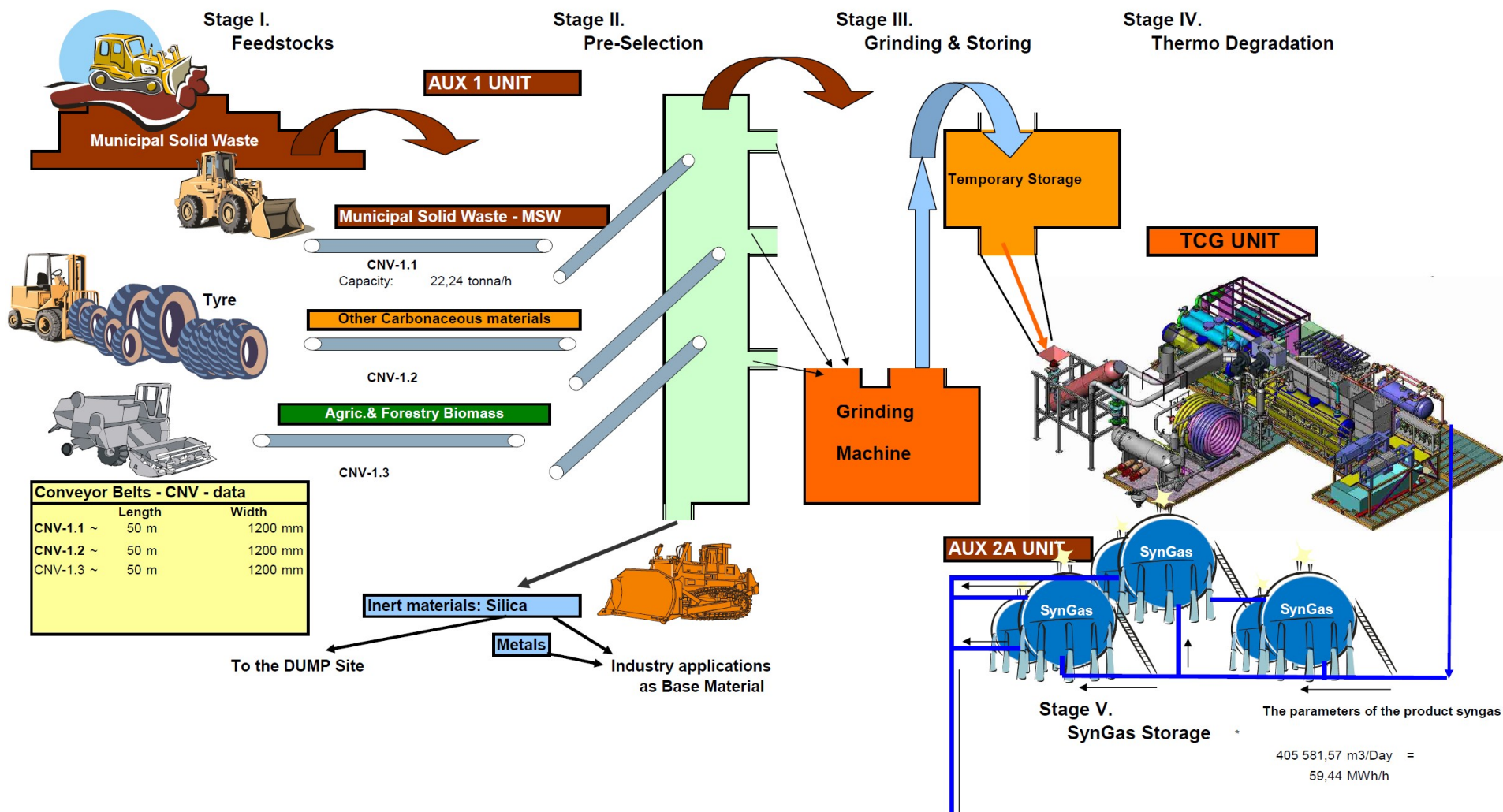
http://www.synergvtri.eu/en/tcg_technology-id23.html

General Overview on the applications of SynGas/Hydrogen and the TCG Technology



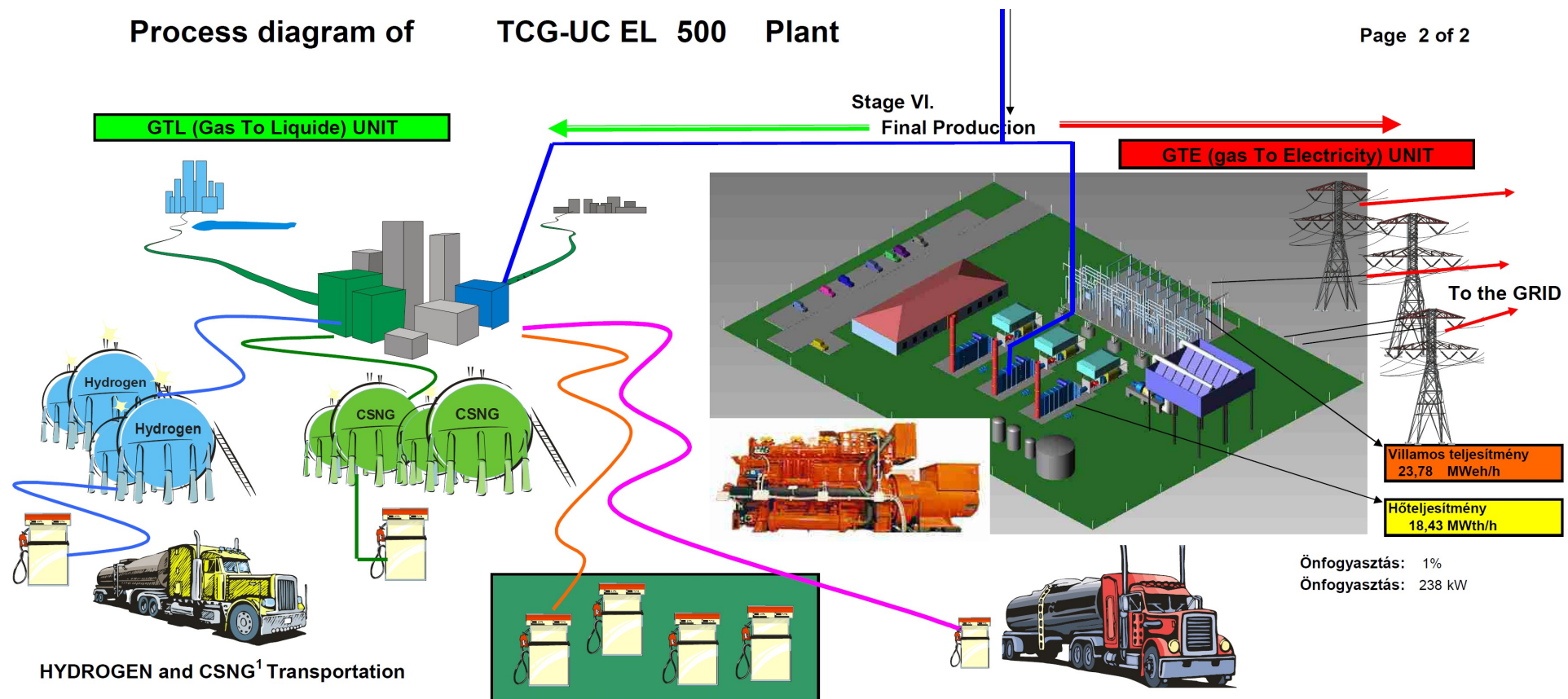


Process diagram of TCG-UC EL 500 Plant



http://www.synergytri.eu/en/tcg_technology-id22.html

Process diagram of TCG-UC EL 500 Plant



HYDROGEN and CSNG¹ Transportation

The parameters of the product syngas

405 581,57 m3/Day → 59,44 MWh/h

The Total Quantity of Hydrogen produced

214 958,23 m3/Day

1 CSNG - Compressed Synthetic Natural Gas

BIO-FUEL Production

Bio-Diesel, Ethanol, Methanol, JET A1, other BIO-FUELS

113 549 Liter/d Ethanol/Etanol
 38 155 Liter/d Methanol/Metanol
 or
 90 275 liter/day Diesel
 or
 95 810 liter/day JET A Fuel

BIO-FUEL Transportation

Bio-Diesel, Ethanol, Methanol, JET A1, other BIO-FUELS

http://www.synergytri.eu/en/tcg_technology-id22.html

Preliminary ProForma

588 Short ton per Day

SAMPLE

Gasification Project

!! NOT FINAL MODEL !!

using the TCG gasification plant and the TCG-UC System

Feeding material: Municipal Solid Waste
Final Product: ELECTRICITY+HEAT

UNICORP USA International Consulting and Servicing Corp.
TCG ALENA Alternative Energy Applications GmbH.
GLOBAL PROJECT INVEST

Type of TCG Unit 500

Date: 2016.06.15

Feedstock Material: Municipal Solid Waste
Final Product: ELECTRICITY+HEAT

* The modeling is based on the Basic Data provided by the Prospective Purchaser
(NOT FINAL MODEL)

INPUT MATERIALS			
500	Dry s.ton/Day	5.915	Btu/Lb = 13 749 kJ/kg
365	Scheduled Days/Year	(27,22)	US \$/short ton = (27) EUR/ton
85,5%	Overall Availability	-	US \$/short ton transportation/handling cost = EUR/ton
7 400	Operating hours/year	(27,22)	netto cost of feed stock material US \$/short ton = (27) EUR/ton
156 038	Dry Short Ton/Year	11,83	MM Btu per short ton INPUT MATERIAL = 14,75 GJ/ton
103 574	As Received short ton/Year	(2,30)	Cost US \$/MMBtu of input material = (1,9) EUR/GJ
(4 996 086)	Yearly revenue from Solid Waste US \$/Year		(4 453 279) EUR
106 536	Feedstock quantity tonna/year as received		

Capital Expenditures		Cost (USD)		Payment schedule			
Item				Instalment(%)	Sum (USD)	Sum (EUR)	Proposed period of payment
Total Costs and Fees of Financing		10 113 810					
Financial Support (Subsidy)		0					
Own resources	500 dry tons per day Gasifier	70 000 000		40%	61 630 724	55 120 165	In 3 weeks after contracting
	Ancillary Equipments for Feedstock*	15 046 000		30%	46 379 043	41 340 124	120 days
	Ancillary Equipment of the technology altogether	11 136 000		20%	33 919 362	27 550 063	180 days
	The price of ELECTRICITY UNIT	40 639 000		10%	15 459 691	13 780 041	180 days
Contingencies @	5,60%	7 662 000					
Total Project (Entire Project)		154 596 810	USD =		137 800 414	EUR	
	Daily cost	510 912,9	USD =		14 719	EUR	
					14 718,7	EUR	

Syngas Production for Sale			
1 820 174	Syngas MM btu per year =	1 602 795	GJ
9,13	net MM btu/ton of as received input material	9,6243	GJ/ton
			Energy Content of the produced SynGas Yearly
			The Heat content of the feed stock/ton
126 571 868	produced syngas cubic meter per year		
30 453 107	revenue US \$ per year from all the products =		27 144 485 EUR
24 041 927	revenue US \$ per year from SynGas =		21 429 857 EUR
19 233 542	revenue US \$ per year from SNG =		17 143 885 EUR
24 932 369	revenue US \$ per year from Electricity =		22 223 555 EUR
33 664 021	revenue US \$ per year from ETHANOL =		30 005 544 EUR
3 771 283	revenue US \$ per year from METHANOL =		3 361 546 EUR
25 115 818	revenue US \$ per year from JET A-1 =		22 387 073 EUR
27 834 482	revenue US \$ per year from DIESEL =		24 810 364 EUR
	revenue US \$ per year from Hydrogen =		- EUR
5 520 739	revenue US \$ per year from STEAM =		4 920 930 EUR

Annual Operating Costs							
	O&M cost of the Gasifiers \$	532 061	0,35 US \$/MM Btu	474 254	EUR		
	O&M cost of the Electric unit \$	456 052	0,300 US \$/MM Btu	406 504	EUR		
	Production cost of Hydrogen \$	-	0,002 US\$/scf	0,06	EUR/m3		
	Cost of Ash Disposal \$	498 609	20,00 US \$/t	445 328	EUR		
	Electricity @	1,44	Megawatt \$	1 509 944	0,14 US \$/KWH	1 345 894	EUR
	Spare Parts (@ 1% of Cap. Exp.) \$	1 278 333				1 139 447	EUR
	G&A (@ 1% of Cap. Exp.) \$	1 278 333				1 139 447	EUR
	Insurance (@0,6% of Cap. Exp.) \$	639 166				569 723	EUR
	Contingency on above at: 10,00%	619 350				552 060	EUR
	Cost of preselection	1 332 290				1 187 541	EUR
	Total Operation Costs	\$ 8 146 137				7 269 195	EUR
	Daily cost of "Operation Cost Total" in continuous operation	\$4 329 955				113 875	EUR
	Part of "Operation Cost Total" in case of emergency	\$3 815 182				112 225	EUR

Note:
609 062 148 = 20 Year Gross Revenues from Syngas
488 102 765 = 20 Year Net Revenues from project

Annual EBITDA			
30 453 107	US \$ Gross Revenue		27 144 485 EUR
(4 996 086)	US \$ Feed stock Cost		(4 453 279) EUR
-	US \$ Income from Drying Fee		0 EUR
35 449 194	US \$ Net Revenue		31 597 764 EUR
2 898 919	US \$ Labor Cost		2 583 961 EUR
8 145 137	US \$ Operation Cost		7 269 196 EUR
24 405 138			21 753 606 EUR

Capital				Salary and Labor costs of TCG and Electricity Unit				Daily Cost	
154 596 810	US \$ Investment			1 858	Labor cost of TCG US \$ per day	1	Engineer(s) + 18	Worker(s)	
0,02730392	US \$/Wh cost of unit of electricity			6	Operators per day at OTE (incl suvpy)	1	Engineer(s) + 5	Worker(s)	Daily Cost of Feedstock \$16.009
2,2067	US \$/GJ cost of heat			12,68	Average US \$ per hour (loaded)	11,30	EUR/h	271	EUR/day
				8	daily working hours				Daily Total Capital Expenditures \$16.513 For 30 years of life
				0,34	Ratio of bonuses compared to the 100%				Daily Operating Cost \$35.389
				619,08	Total allowances/benefits per day				Total Daily Cost \$51 902 For 30 years of life
				2 463	Labor cost US \$ per day			552	EUR/day
				5 476	Labor cost of preselection unit US \$ per day			2 199	EUR/day
				7 942	Project Labor cost US \$ per day			4 880	EUR/day
								7 079	EUR/day
									Daily Income from Production \$07.583
									Daily Income from Feedstock \$16.009
									Total Daily Income \$113 592
									Daily Saldo \$61 690

Yearly Pro Forma (\$000)	Year (-1:0) Constr.+Operat.	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Earnings before interest tax, depreciation & amortization		24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	488 103
Capital Investment	154 597																					
Pre-Tax Cash Flow	(154 597)	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	24 405	488 103
Cum Pre-Tax Cash Flow	(154 597)	(130 192)	(105 787)	(81 381)	(56 976)	(32 571)	(8 166)	16 239	40 644	65 049	89 455	113 860	138 265	162 670	187 075	211 480	235 885	260 291	284 696	309 101	333 506	
Time Length of return of investment	6,33	year																				
Project Rate of Return	15%	Before tax																				



**Brief Summary
of
TCG-UC EL500 SAMPLE
Project**

!! NOT FINAL MODEL !!

Project Name (Place & Final Product): **SAMPLE**
Name of Input (feed) Material: **Municipal Solid Waste**
Contractor/Supplier: **TCG ALENA Alternative Energy Applications GmbH.**
Date: **2016.06.15**

1. Brief Description of the Technology

The objective of this project is to design and establish a TCG-UC Waste To Green Energy Power Plant capable of producing electricity from the specific feedstock material as determined by the purchaser according to the site specific data and information, and the availability of feedstock material. The plant will produce an extremely clean synthetic gas (mostly H₂ and CO) intended to be utilized in a gas motor or turbine and generator set to produce electricity that either independently or in connected to the national grid would service the required energy needs of a larger community. The TCG-UC W2GE project will serve the energy needs of a town, industrial firms, or recreational complex incorporating sports, wellness, hotel and other facilities. The undisputable advantages of the TCG technology against other existing, superficially-similar systems is that the TCG is uniquely designed and is capable of utilizing a very broad range of materials (containing acceptable carbonaceous content) either as a single feed stock or in any combination. This list of potential feed stocks includes: biomass from agriculture, solid waste from communities, used tyres and many other carbonaceous materials

2. Basic Parameters of the Project

Quantity of total input material (dry basis)	500	Dry s.ton/Day	=	588	sTPD moist.
	156 038	Dry Short Ton/Year	=	183 574	As Received short ton/Year
Scheduled Days/Year	365		=	8 760	Hours
Overall Availability	85,50%	that means		7 490	Operating hours/year
Energy Content	16 175	kJ/kg	=	7 337 042	MJ/d
Selling price of Electricity	0,14	\$/kWh =		0,1248	EUR/kWh
Cost of Electricity	0,14	\$/kWh =		0,1248	EUR/kWh
Acceptance fee of MSW (Income)	-30,00	US\$/ton			
Transportation fee	0,00	USD/tonna			
Selling price of Heat	0,04	\$/kWh =		11,111	US\$/GJ
Engineers' salary	12,00	US\$/hour			
Workers' salary	9,00	US\$/hour			

3. Capital Expenditures

Total Project (Entire Project)	\$154 596 810	=	137 800 414 €	=
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4. Final Products

Electric Power	23,78	MWe	=	178 088	MWh/year
Heat energy	18,43	MWth	=	138 018	MWh/year = 496 866 GJ/year

5. Yearly Income

MSW	166 536	TPD moist.	X	30,00	US\$/ton	=	\$4 996 086
Electricity	178 088	MWh/year	X	0,14	\$/kWh =		\$24 932 369
Heat energy	138 018	MWh/year	X	0,04	\$/kWh =		\$5 520 739
Total							\$35 449 194

6. Annual Operating Costs

Total Operation Costs	\$8 145 137
Salary and Labor costs of TCG and Electricity Unit	\$2 898 919

7. Annual EBITDA

US \$ EBITDA	\$24 405 138
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8. Financial results

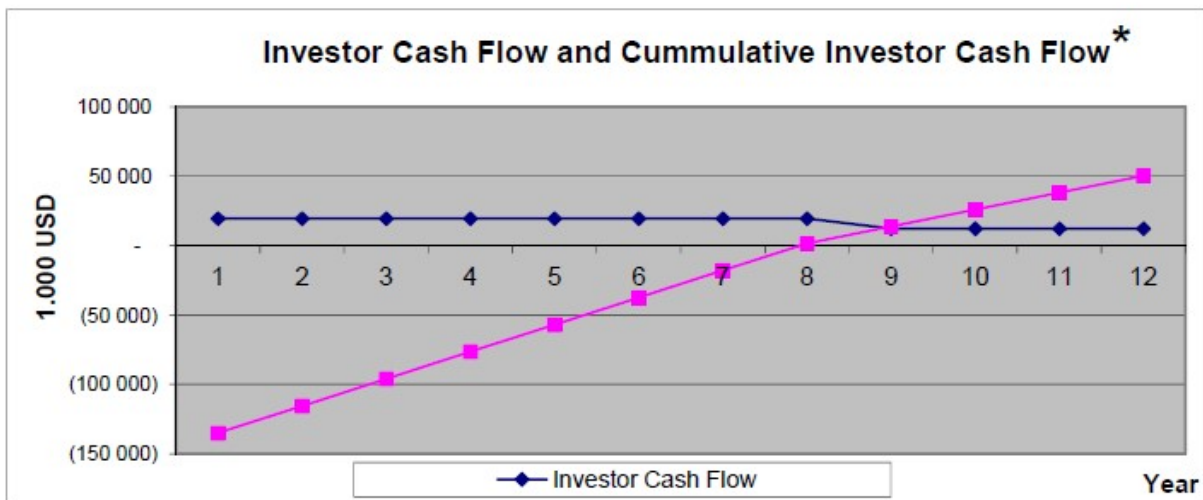
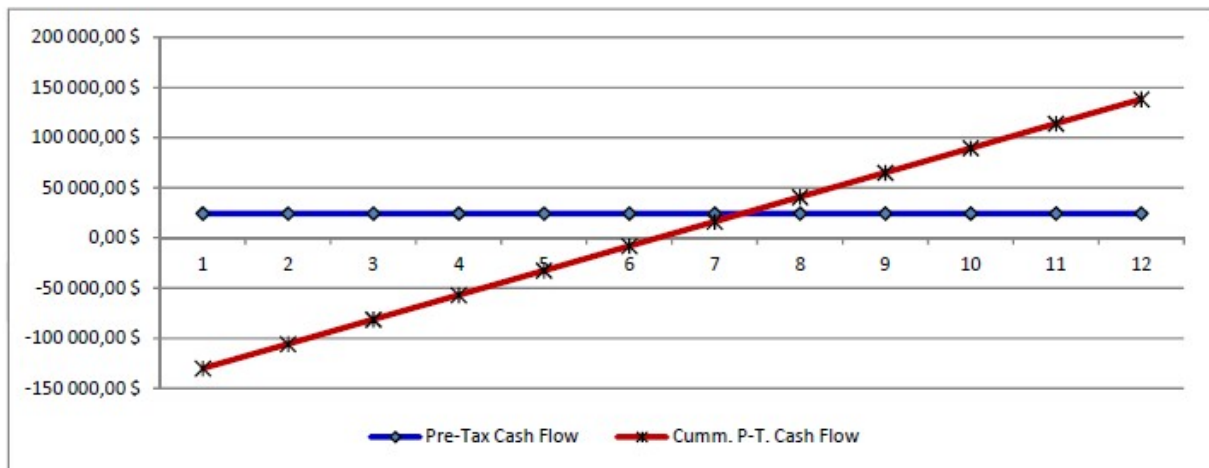
Project Rate of Return	15%
Time Length of return of investment	6,33 year * + PIP
*PIP =	Plant Installation Period

CASH-FLOW OF TCG-UC EL500 SAMPLE

!! NOT FINAL MODEL !!

Pro Forma (\$000)	Year (-1;0) Constr.+Operat.	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Earnings before interest, tax, depreciation & amortization		24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14
Capital Investment	154 596,81						
Pre-Tax Cash Flow	-154 596,81	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14
Cum Pre-Tax Cash Flow	-154 596,81	-130 191,67	-105 786,53	-81 381,40	-56 976,26	-32 571,12	-8 165,98
Time Length of return of investment	6,33	year					
Project Rate of Return	14,78%	Before tax					

Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17
24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14
24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14	24 405,14
16 239,16	40 644,30	65 049,43	89 454,57	113 859,71	138 264,85	162 669,99	187 075,13	211 480,26	235 885,40	260 290,54



**The salability of the produced electricity – manufactured by TCG-UC W2E Power Plants - is guaranteed in Europe.
The Green Energy production is highly supported by the Green Energy Sections of the Law of Energy that set priority and the obligatory purchasing of the Green Electricity Energy.**

Visit the video in our site: http://www.synergytri.eu/en/tcg_technology-id39.html

In case of any inquiries.

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