

IEA Bioenergy Agreement: 2022-2024
Task 33: Gasification of Biomass and Waste
Secon semi-annual Task meeting, 2023
Lyon, France

18.-20. October 2023

Minutes

Prepared by Dr. Jitka Hrbek, BOKU, AT

The list of attendees on 18. April 2023:

Name	Country	Affiliation	email
Berend Vreugdenhil	The Netherlands	TNO	Berend.vreugdenhil@tno.nl
Jitka Hrbek	Austria	BOKU	Jitka.hrbek@boku.ac.at
Donatella Barisano	Italy	Enea	donatella.barisano@enea.it
Joakim Lundgren	Sweden	LTU	Joakim.lundgren@ltu.se
Sabine Fleck	Germany	KIT	Sabine.fleck@kit.edu
Robert Baldwin	USA	NREL	Robert.baldwin@nrel.gov
Rajesh Badhe (online)	India	Indian Oil	badher@indianoil.in
Mohan Rao (online)	India	Indian Oil	mohanrd@indianoil.in
Benjamin Berger	Belgium	ECAM	brg@ecam.be
Chourouk Nait Saidi	France	ATEE	c.naitsaidi@atee.fr
Yannick Ferriere	France	SG Energies	Yannick.ferriere@sg-energies.eco
Travis Robinson	Canada	CanmetENERGY-Ottawa	travis.robinson@NRCan-RNCan.gc.ca
Paula Blanco-Sanchez (online)	UK	Aston University	p.blanco-sanchez@aston.ac.uk
Anna Bazanty (online)	UK		
Bei Bei Yan	China	Tianjin University	yanbeibei@tju.edu.cn
Observervers			
Viren Chunilall (online)	South Africa	CSIR	VChunilall@csir.co.za
Tshiamo Segakweng (online)	South Africa	CSIR	TSegakweng@csir.co.za

The agenda of the Task 33 meeting was as following:

18.10.2023	Site visit Gaya plant
19.10.2023	Workshop “Bioenergy in a net zero future”
20.10.2023	Task 33 meeting

18.10.2023 – Site visit Gaya plant



The ENGIE’s demonstration plant which has a capacity of approximately 600 kWth in incoming biomass and waste converted into 30-40 Nm³/hour of biomethane, has validated the integrated operation of the entire chain of innovative technologies under industrial conditions.

19.10.2023 – Workshop “Bioenergy in a net zero future”

Detailed information could be found here:

https://www.ieabioenergy.com/wp-content/uploads/2023/07/Programme_ExCo92-workshop_final3.pdf

20.10.2023 – Task meeting - agenda

Item	Time	Who
Welcome (Members/Guests)	8:30 – 8:45	All
Country updates India, South Africa, China Canada, USA, Netherlands, UK Belgium, France, Sweden Austria, Germany, Italy	8:45 – 12:30	All (small brake in between)
Lunch	12:30 – 13:30	
- o ITP Synergies - o ITP BECCUS - o TP Hydrogen - o TP Deep Cleaning - o TP Economy - o TP Gasification	13:30 - 15:00	Joakim Lundgren MiriamRoeder/Paula Blanco Joakim Lundgren Jitka Hrbek Berend Vreugdenhil Jitka Hrbek Including a small brake around 15:00
Task activities in next triennium Status of website	15:10 - 15:30	Jitka Hrbek
Feedback from ExCo meeting Financial overview	15:30 – 15:40	Berend Vreugdenhil
Upcoming activities (Next meeting, workshop, webinars) Any other business	15:40 – 16:00	All

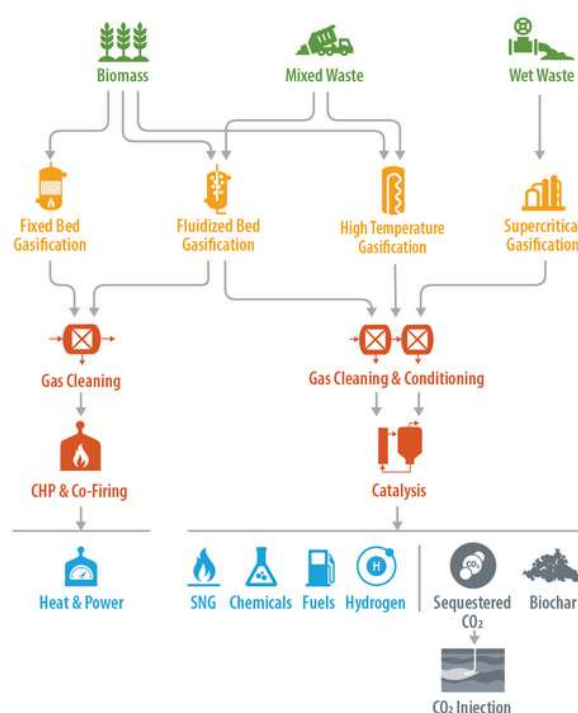
Task 33 Meeting discussions

Task website

The Task 33 website will be re-designed again. The ExCo aim is to have the same website layout for all the Tasks. The works on the new website are now ongoing and should be finished as soon as possible.

There was a short discussion on subpages of the website, which can make Subtasks-results more visible.

Jitka will send the template for the database to make an update again. At the moments there are several new gasification plants, which should be registered in the database.



Access member area:



User: task33_member

Password: %task33_n8wb3r!

Newsletter

The last newsletter was published on the website as well as sent to relevant partners/stakeholders etc.

Joakim offered again to put together a short informative newsletter after the meeting. The NTLs should send him a short teaser text with the highlights in their country.

Agenda toward end of triennium

Next meetings

Spring 2024 – Germany – details regarding date and workshop topic will be known soon

October 2024 Sao Paolo, Brazil

Task and Intertasks projects

In this triennium 2 inter-tasks projects will be realized (Hydrogen, GHG balance)

Next triennium

Participation

In the next triennium following countries expressed their interest to take part.

- | | |
|-----------|---------------|
| • Austria | • Netherlands |
| • Canada | • Sweden |
| • China | • UK |
| • EC | • USA |
| • France | |

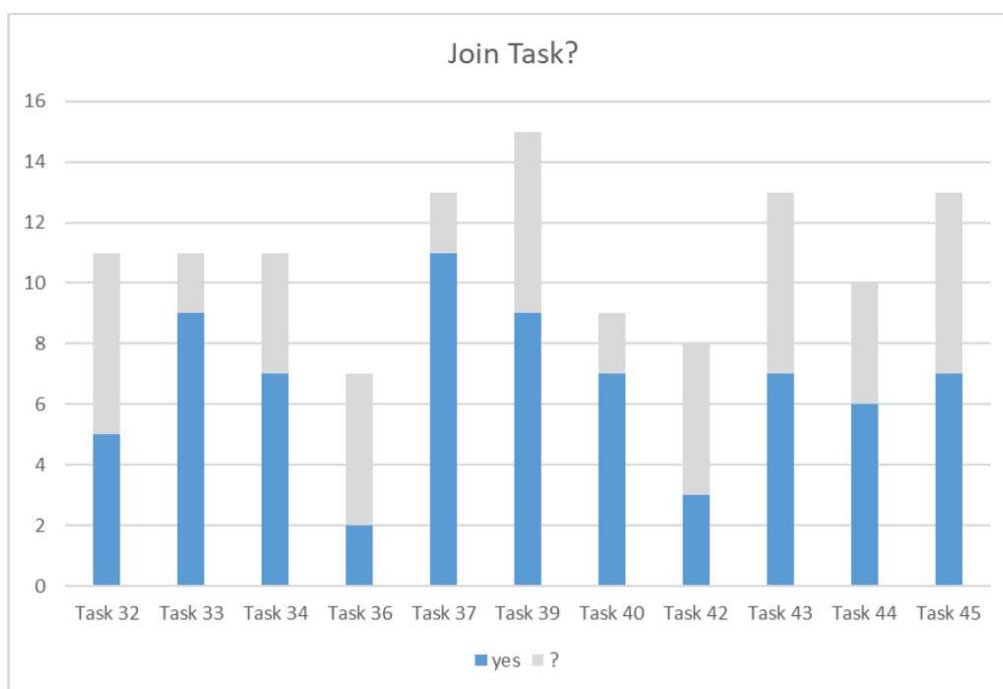


Figure 1: First indication of intentions to join the Tasks (see also table below)

	AUS	AUT	BEL	BRA	CAN	CHI	CRO	DK	EC	FIN	FRA	GER	IND	IRE	ITA	JP	KOR	NL	NZ	NOR	SAF	SWE	SWI	UK	USA
Task 32		Y			Y	?		Y				Y				Y		?	?	?			?		?
Task 33		Y	?		Y	Y			Y		Y	?						Y				Y		Y	Y
Task 34	?	?			Y	?		Y		Y		Y						Y	Y	?					Y
Task 36					?							?		?						?		Y	?		Y
Task 37	?	Y			Y	Y		Y		Y		Y		Y				Y		?		Y	Y	Y	
Task 39	?	Y	?		Y	Y		Y	Y			?		?		Y		Y	Y	?		Y		?	
Task 40		Y						Y				Y					Y	Y						?	Y
Task 42		Y			?	?						Y		?				Y		?		?			
Task 43	?	?			Y	?			Y	Y	?	Y		?					Y			Y		?	Y
Task 44		Y			?	?			Y	Y		Y		?				Y				Y	?		
Task 45	?	?				?		Y	Y	Y	?	Y		?				Y		?		Y		Y	

The title of the Task 33 should cover the activities in the Task. Jitka will send several possible titles and the discussion will be made per email.

After the voting, a title “Gasification of biomass and waste for sustainable future” was chosen.

During the Task meeting two **observers from South Africa** were participating online. Their presentation can be found on the T33 website. South Africa is interested to be a member of the Task, the procedure to join is ongoing.

Task projects

Berend encouraged all Task members to already think about the proposals for the next triennium. Joakim proposed “Potential of biomass gasification in South Africa”.

Country Reports Update

Austria, Jitka Hrbek, BOKU Vienna

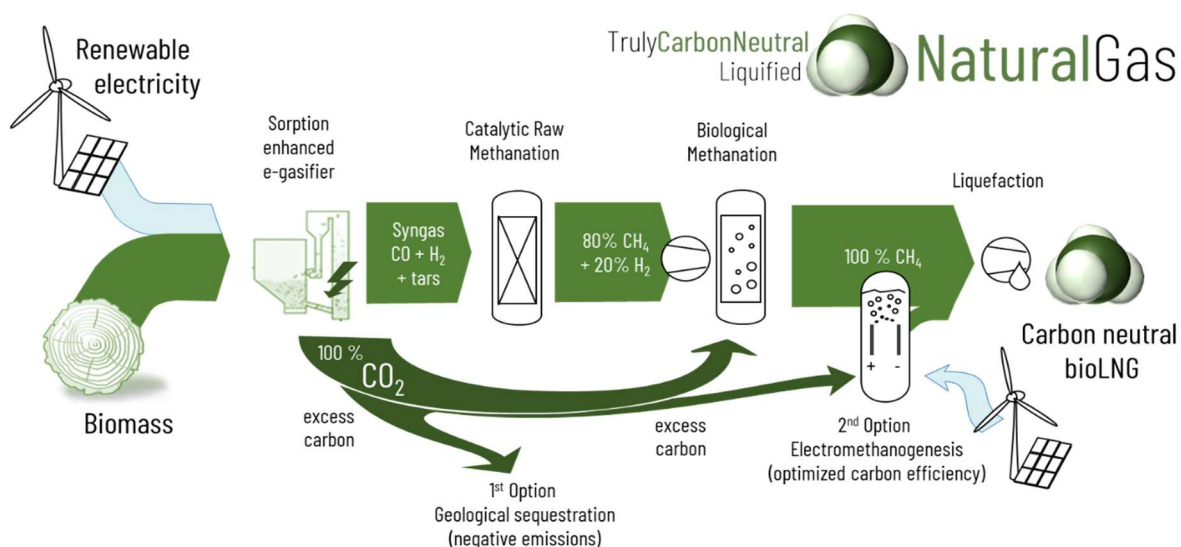
Energy consumption and generation, overview on bioenergy, research on gasification, industrial activities and implementations were presented.

Domestic energy generation is mostly based on bioenergy (45%), hydropower (27%), about 15% is covered by fossils (natural gas, oil). Contrary to imports, renewable sources predominate in domestic energy production with a share of around 82 %.

Research on thermal gasification of biomass and waste takes place in Austria at the following institutions:

- BOKU Wien (University of Natural Resources and Life Sciences Vienna)
- TU Wien (Vienna University of Technology)
- BEST (Bioenergy and Sustainable Technologies)
- TU Graz (Graz University of Technology)
- MCI (Management Centre Innsbruck) – Josef Ressel Zentrum

The research areas as well as actual projects were presented, such as e.g. CarbonNeutralLNG (Trully Carbon Neutral electricity enhanced Synthesis of Liquefied Natural Gas from biomass). The aim of the project is decarbonisation of industrial processes with efficient fluidized bed systems. BOKU is a partner in this project and coordinator is Friedrich-Alexander-Universität Elangen-Nürnberg.



Actual research, goals and outcome of research year 3 at **MCI JRZ** were presented.

Austrian companies, which are active in area of thermal gasification were introduced. Companies such as Aichernig Engineering GmbH, GET, Güssing Renewable Energy, GE Jenbacher, Glock Ökoenergie, Hargassner, Fröling, Syncraft, Gresco Power and Urbas were presented.

New CHP (SynCraft) is in operation in Perg, since the beginning of 2023.

Update concerning the project Waste-2-Value was presented. First results from operation of the gasification facility are promising, the gas quality is in order with the pilot plant at TU Vienna. Anyway, there are still some challenging issues, which should be solved, such as tar content or high amount of nitrogen in the plant.

Belgium, Benjamin Berger, ECAM

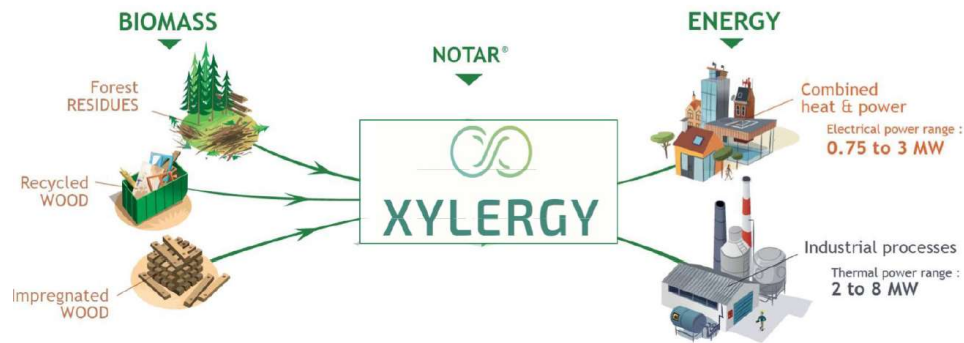
Enerbio

- Project from UCLouvain
- Gasifier from Xylergy with engine and auxiliaries
- Experiments on a 200 kWth-pilot two-stage downdraft gasifier, with secondary air combined with steam and/or replaced by oxygen
 - Syngas LHV increased by +65% using oxygen improving energy density and AFT for CHP or high-temperature burner applications
 - Carbon conversion enhanced by steam injection, and CGE improved by both steam and oxygen
 - Oxygen raises the oxidation zone temperature, but steam compensates that effect
 - Oxy-steam gasification yield more class III and IV tar but the amount remains very low (<120 mg/Nm³ excl. benzene)
- Paper in Biomass and Bioenergy preprint available at:
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4463732
- Interests for full O₂ research (in pyrolysis zone too instead of just oxidation) but no follow-up projects at the moment

Project TTCogen

- HCCI engine using gas at high temperature without cooling and cleaning
- Compression ratio designed to have inlet above tar dew point
- Duration 4 years
- Full experim. Setup: gasifier from CMD + Engine and Auxilliaries (Cogengreen)
- Goal: sutp validated on more than 1000 op.h for 2025
- First experimental campaign expected March 2024

Xylergy – new company that bought Xylowatt



Belgium – Mont-Godine hospital

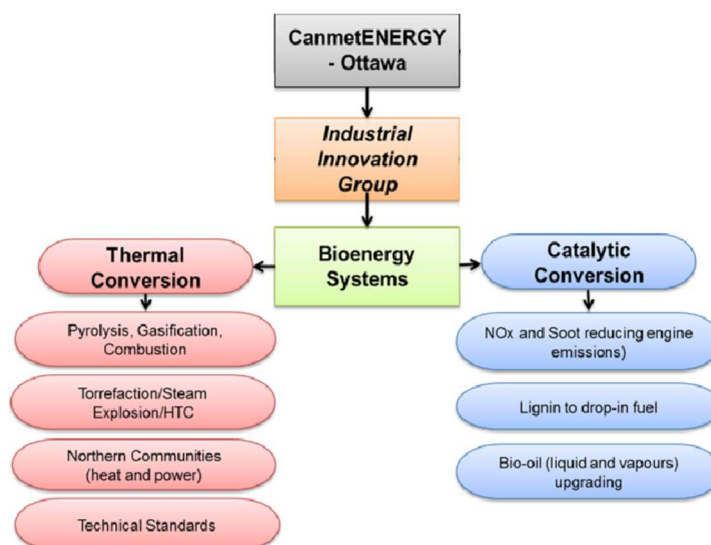
- Engine reached end of lifetime (60 000 hours)
- New engine, same manufacturer (GE Jenbacher)
- Increased electricity efficiency to 37%
- Power increased to approx. 700 kWe
- Commissioning delayed – expected end 2023

Japan – Masumoto (first NOTAR in Asia)

- Commissioning Q3 2023
- Plant aimed at testing different types of biomasses
- Biomass with higher ashes content
- First tests in Nov 2023

Canada, Travis Robinson, CanmetENERGY

CanmetENERGY Ottawa was introduced. CanmetENERGY, Natural Research Council, and the University of Alberta exploring liquefaction as a pretreatment for gasification, FT hydrocarbons for SAF



National Research Council (NRC)

- Recent work included downdraft gasification coupled to a spark ignition engine
- Exploring hydrothermal gasification of bio-liquids HTL and fast pyrolysis oils and slurries

University of British Columbia (UBC)

- The Bioenergy Research Development Facility at UBC has operated a Nexterra gasifier since 2012
- 6 MW thermal for campus district heating
- UBC is commissioning a steam-oxy pilot system for advanced fuels research under the direction of Xiaotao (Tony) Bi

ENERKEM

- Edmonton facility (operating) 38 million L/a methanol
 - first-ever waste-to-biofuel facility to sell its ethanol under the U.S. Renewable Fuel Standard
- VARENNES facility (under construction)
 - Investment greater than 1 billion announced 2020
 - Commissioning 2025
 - 200 K tons waste to 125 million L of renewable fuels annually
 - Slated to include 90 MW electrolyzer
- Tarragona (with Repsol)
 - 220 million L/a Methanol from 400 tons of waste
 - joint venture Ecoplanta Molecular Recycling Solutions
 - Awaiting final investment decision

Hydrogen Naturally

- Venture is driven by a team with experience in gasification of bitumen heavy bottoms at the Sturgeon refinery
- CO₂ from gasification at the Sturgeon refinery has been undergoing sequestration since 2021
- Recreate this success using wood pellets instead of bitumen residue

Char Technologies

- Fired rotary kiln technology
- Produce biocarbon for AD gas clean up (SulfaCHARTM)
- Interest in using biochar for steelmaking
 - C\$6.6M Strategic Investment by ArcelorMittal and Annual Biocarbon Purchase Agreement announced earlier this year
- Thorold, ON facility under construction
 - 11.3 million invested
 - 20000 GJ/a RNG (kiln gas)
 - 2000 tonnes biochar
 - Start-up 2024
- Numerous projects in development US and Canada

China, Beibei Yan, Tianjin University

Policy frame and background information were presented. Large amount of biomass/wastes are currently still not well used and even treated in rural area e.g. MSW, agricultural waste and forest residues and industrial solid waste.

Gasification is a re-growing interest in China because of gas demand.

Actual projects in China

In total, 88 biomass gasification plants are running in China, more than 20 under construction. 5 million tons of biomass/waste are gasified every year.

Representative gasification plants

No.	Location	Company	Description
1	<u>Jingmen</u> , Hubei	<u>Debo Bio-energy technology., Ltd.</u>	• Rice husk gasification coupled with coal combustion for power generation (10.8 MW). • CFB with the feedstock of 8 t/h. • Bio-char is utilized as a fertilizer.
2	<u>Anji</u> , Zhejiang	<u>Debo Bio-energy technology., Ltd.</u>	• Bamboo gasification for poly-generation of steam and bio-char. • CFB (7 t/h) + steam boiler (10 t/h). • Char is sold for production of activated carbon.
3	<u>Heze</u> , Shandong	<u>Baichuan Tongchuang Energy., Ltd.</u>	• Chinese medical residue (as received, 250 t/d) gasification producing heat and steam. • CFB (10 t/h) + combustion of syngas + heat recovery boiler • The steam and heat are recycled to medicine production process.
4	<u>Jingning</u> , Zhejiang	<u>Litian Environmental technology., Ltd</u>	• MSW gasification • Four Fixed bed gasifiers (200 t/d in total) • Gasified gas is combusted and clean treatment of MSW is achieved.

All the projects above are detailed described in the CR presentation. The feedstock is locally available biomass, waste or even medical residues.

Future perspective of gasification in China:

- Carbon tax will significantly promote development of gasification in particular for shipping
- The average carbon price in the national carbon market in 2022 is expected to be 59 RMB/ton, by 2025, it is expected to rise to 87 RMB/ton, and by 2030 will reach 130 RMB/ton.
- Carbon tax should be calculated based on products instead of feedstocks, which can evaluate the carbon reduction benefits accurately.
- Biomass gasification combined with industrial production

Gasification progress at TJU and TJUC were presented.

France, Chourouk Nait-Saidi, ATEE

Terms as pyrolysis, gasification and pyrogasification in France were presented. Funding mechanisms for biomethane, biohydrogen, CHP and Syngas direct use in France were presented.

Planned projects

Production of liquid gaz or DME (Dimethyl ether)

- Commercial-scale gasification plant (20.000ton/year RDF) in operation
- Standardization strategy with no scale-up/down of current configuration
- Commercial development based on industrial skids pre-manufacturing of gasification plant

BiotJet project for production of SAF

- Support from ADEME : 4,9 M€ subsidies + 3 M€ repayable advance
- Forestry residue and alternative feedstocks. Local sourcing.
- Scheme with electrolytic hydrogen injection

Gardanne Production of biomethane from SNG upgrading

Biogaz Gardanne ("BGG") project, involve two gasification lines for production of second-generation biomethane, recovering around 2x50,000 tons of wood waste annually from local deposits.

Salamandre Production of methane SNG

Engie's first commercial project to be installed in Havre

GHAMa production of methane from hydrothermal gasification

- GHAMa, the 1st industrial demonstration project in France currently under development
- HTG Technology developed by Leroux et Lotz Technologies
- Commissioning scheduled for late 2024/early 2025

Research on gasification

University of Lorraine's LERMAB ERBE laboratory

- Development of detailed engineering for O₂/H₂O gasification as part of the European POLYGEN project with CEA Grenoble's LITEN laboratory in 2016.
- Commissioning of an O₂/H₂O gasification unit at the University of Lorraine's LERMAB ERBE laboratory in July 2022.
- Trials for several projects, including Barthe Energie (wood waste for CHP applications).
- Signature of a framework agreement with Wood PLC for the development of gasification projects for biomethane for grid injection.
- Signature of a framework agreement for the potential development of 6 gasification projects for biomethane injection in Italy.

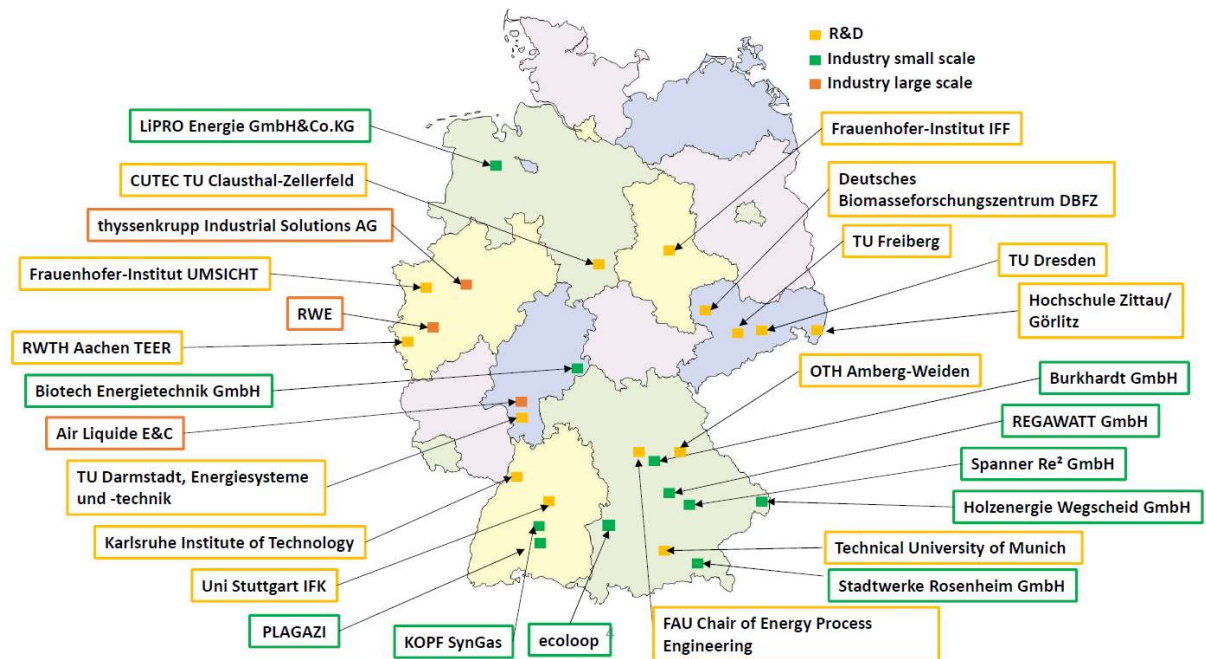
Overview on commercial projects and R&D plants in France



Germany, Sabine Fleck, KIT

News from politics were presented.

Gasification activities in Germany



RWE Phosphorus from sewage sludge

-no news since April 2023

Plagazi

Update October 2023:

- Neue Energie Premnitz: Company foundation for construction of the new plant; after permission of the GmbH, start of approval process
- Plagazi AB and Korn Recycling agreed to conduct a pre-study for construction of a Plagazi waste to hydrogen plant
- CH: several feasibility studies running
- Problems from the point of view of the German representative of Plagazi:
 - long duration of approval processes in Germany
 - politics does not see the possibilities to produce H₂ from waste in Germany (example: declaration of intent between Baden-Württemberg and Andalusia regarding installation of a European H₂-net)

Blue Energy CHP

Plant out of operation due to lack of approval from licensing authority

Wood oil was initially classified by the authorities as waste and wanted to approve the plant only according to waste law

Currently: Submission of new permit application hope for start up again

still no progress

Sülzle Kopf

No new information since April 2023

Research activities at **TU Freiberg, TU Darmstadt, TU Munich** were presented.

Bioliq

Status October 2023

- Repair of cooling screen mouth after blockage in test campaign March 2023

Outlook

- Burner development for waste-based pyrolysis oil
- First tests with tyre pyrolysis oil planned in 2024

→ Characterization of fuel conversion and flame structure

India, Mohana Rao, Indian Oil Corporation Ltd.

India energy share as well as bioenergy deployment were presented.

Biomass co-firing in coal-based power plants in India is an actual topic. It was decided to co-fire 5-10% of biomass in all thermal power plants.

Update in National Bio-energy Programme and National Green Hydrogen Mission were presented.

R&D Roadmap for Green Hydrogen Ecosystem in India was published.

<https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2023/10/202310131572744879.pdf>

Update on biomass gasification-based hydrogen generation was presented.

Indian Institute of Science and Indian Oil Corporation Ltd. jointly working on development and demonstration of biomass gasification-based hydrogen generation technology

- Generate fuel cell-grade hydrogen
- Down draft fixed bed gasification system with oxygen and steam
- Generated syngas subjected rigorous gas cleaning
- Vacuum pressure swing adsorption (VPSA) system

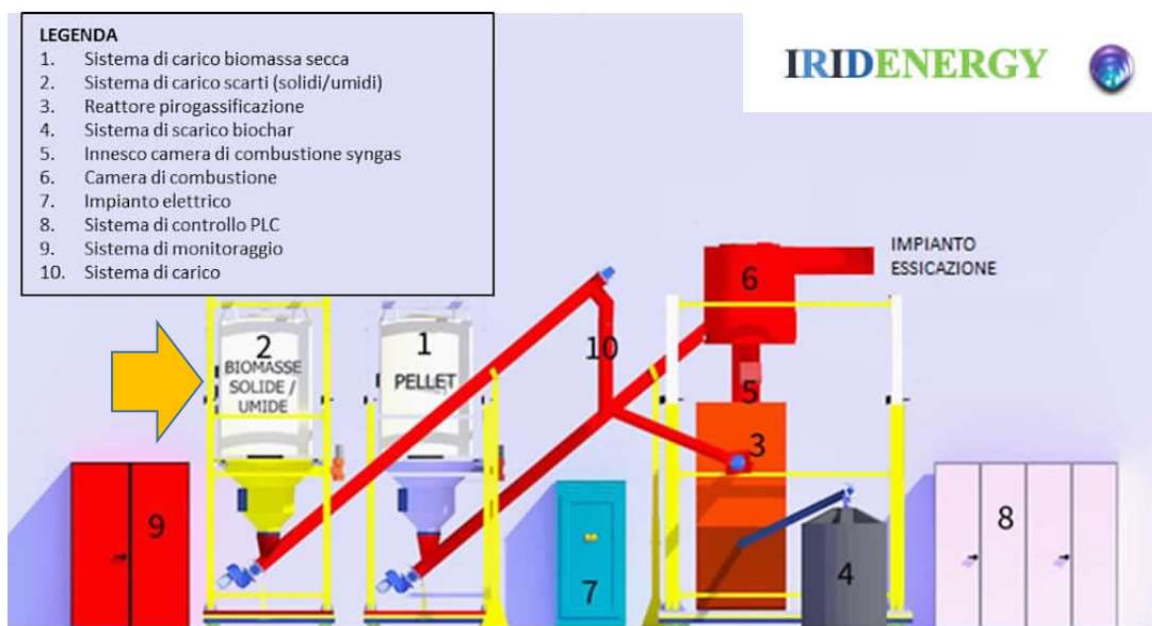
IndianOil unveils hydrogen fuel cell busses:

- Plan to undertake operational trials of 15 fuel cell buses on the identified routes in Delhi, Haryana, and UP
- Hon'ble Minister of Petroleum and Natural Gas launched two hydrogen fuel cell buses on 25th September, 2023 to undertake trial runs in Delhi
- Two hydrogen refueling stations are under advanced stages of installation
- Plan to launch 13 more fuel cell buses are under progress

Italy, Donatella Barisano, ENEA

Update on national programs and network was given. Production and commercialization of biochar from pyrolysis and gasification. Update on EU projects on gasification involving Italy.

PARSIFAL gasification plant by IRIDENERGY S rl.



Ref. <http://smacsforest.it/biochar-e-impianti/>

Netherlands, Berend Vreugdenhil, TNO

Gasification activities in the NL



Stercore

- Manure to green gas & bio-based carbon factory
- Input: 350 000 – 400 000 t/y
- Output:
 - green gas 23 mill. m³
 - biochar 85 000 t/y
 - liquid CO₂ 30 000 t/y
 - Heat 5 MWth

Costs: 55 000 000 Euro

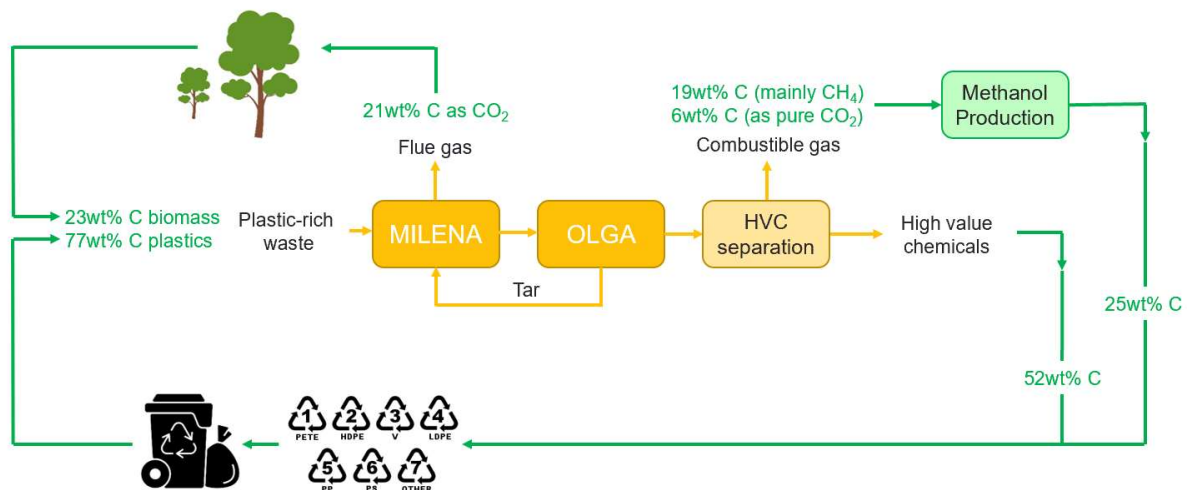
STENCORE can start construction of their plant.

NettEnergy

- Turning side road grass into hydrogen and biochar
- Pilot technology
- Top draft – top fired moving bed reactor followed by a water scrubber
- Next step 500 kg H₂/day

SYNOVA

- Plastic recycling

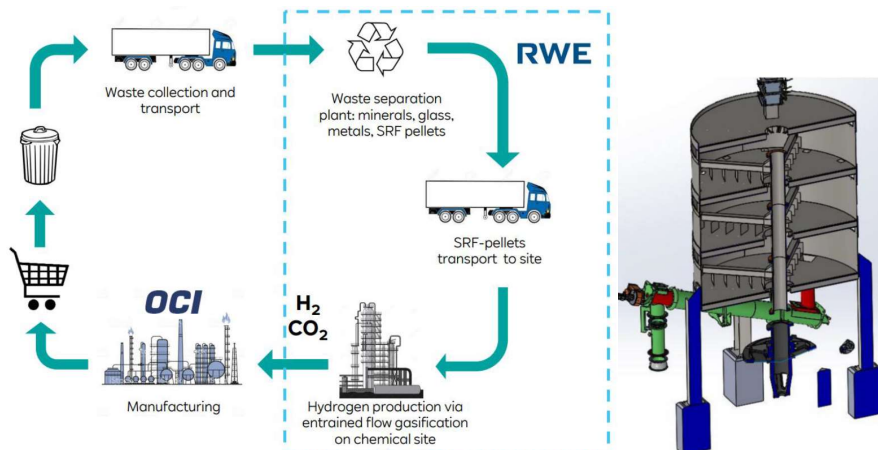


SCW GAS Alkmaar

- Produced SNG based on super critical water gasification
- 20 MW output demo plant
- February 2023 injection of on-spec. high calorific gas into the 70-bar gas grid
- Problematic residual flows for production of renewable gas, up to 100 BCM sustainable gas can be produced from currently non-recyclable waste streams



FUREC RWE



- Waste-2-hydrogen
- "fuse, reuse, recycle"
- Cold commissioning started
- Commercial waste dryer in operation
- Start basic engineering end of 2023, FID end of 2024

South Africa, Tshiamo Segakweng, CSIR

As an invited guest participated South Africa in the meeting and was encouraged to present an overview on gasification status.

- South Africa has been investing in gasification technology to reduce its reliance on coal and increase its use of natural gas.
- However, the country still relies heavily on coal for electricity generation and has a long way to go in terms of transitioning to a more sustainable energy mix.
- Operational gasifiers
 - 2x SASOL coal gasifiers
 - ESKOM Majuba Underground gasification project
 - 1 experimental biomass gasification plant at Melani Village
 - CSIR gasifier pilot plant

Potential for Gasification Technology in South Africa:

- Gasification technology can transform the energy and chemical sectors in South Africa.
- The government aims to generate 18% of the country's energy from renewable sources by 2030.
- It can utilize South Africa's extensive coal reserves for producing electricity, hydrogen, and liquid fuels.
- Gasification can reduce the country's carbon footprint, create jobs, and stimulate economic growth.
- Gasification can assist in reducing waste

Gasification plant at CSIR

- The pilot fluidized bed combustor/gasifier in Building 23.
- It can operate in gasification mode to produce synthesis gas (H_2 , CO) or in combustion mode.
- Technical specifications are detailed in table below
- Currently undergoing refurbishment for gasification of biomass and waste in corporation with an external client

Operating pressure	0 barg
Bed dimensions	0.2m × 0.2m (square)
Freeboard dimensions	0.4m × 0.4m (square)
Furnace height	4m (2 m bed & 2 m)
Fluidised bed height	< 1.3m
Coal feed rate	15–35 kg/h
Thermal rating	140 kW
Coal particle size (d_{50})	1.0–6.0 mm
Coal CV	10–25 MJ/kg
Air flowrate	15–30 Nm ³ /h
Oxygen flowrate	4–10 kg/h
Steam flowrate	10–25 kg/h
Bed temperature	850–1 000 °C
Air, oxygen and steam temperature	200–300 °C
Fluidising velocity	1.2–2.5 m/s

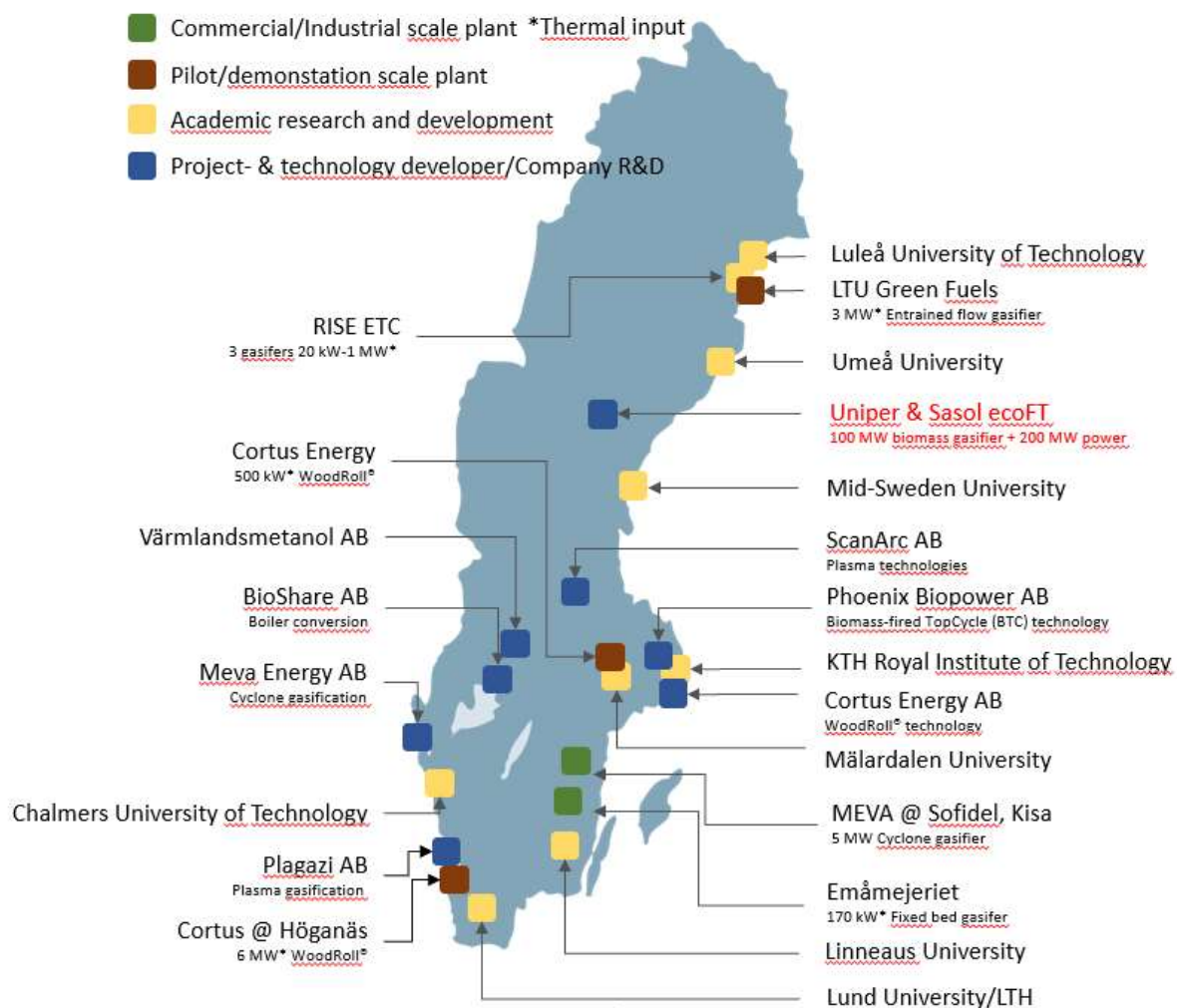


Other countries, such as China and India, have made significant progress in transitioning to natural gas and other renewable energy sources. However, South Africa still has a long way to go in terms of reducing its carbon footprint and transitioning to a more sustainable energy mix.

Sweden, Joakim Lundgren, LTU

Share of energy from renewable sources in 2021 was presented.
Total final energy use in Sweden was presented.

Status on gasification



Commercial gasification projects – update

Cortus 6 MW WoodRoll® gasifier at the Höganäs steel plant

- Syngas deliveries to Höganäs used in their belt conveyor ovens.
- 100 tons of biochar from the pyrolysis unit has been produced. EBC certification is ongoing.
- Installation of a high-pressure syngas storage is underway.

MEVA

- In 2023, Meva Energy completed a commercial plant to produce 4.5 MW of producer gas from wood waste to replace industrial consumption of fossil gas at the Sofidel paper mill in Kisa.
- Approx. 4 MW = 1300 kg/h wood-pellets.
- First gas now delivered used for drying tissue paper.

MEVA Energy

- Low value residues from furniture manufacturing, board, MDF to renewable gas and power (2.4 MW) at IKEA Industry production unit in Zbaszynek, Poland
- 2*1220 kg/h fuel (twin gas trains with shared auxiliary systems)
- 1.2 + 1.2 = 2.4 MW of green electricity, possibly use of residual heat for heating Ikea's nearby buildings
- Planned start-up of the facility Q3-Q4 2024.
- A global investment company, AXA IM Alts, has invested EUR 9 million in Meva Energy
- The investment substantially increases Meva Energy's capacity and capability to help manufacturing industries convert their low value biomass waste residues to fossil-free energy by using their gasification technology.

Uniper and Sasol ecoFT – SkyFuelH2

- Sasol ecoFT and Uniper are planning for an industry-scale production facility for sustainable aviation fuel
- 75 000 tons SAF + 15 000 tons naphtha per year = ca 150 MW = 200 MW power + 100 MW biomass
- Feasibility study supported by the Swedish Energy Agency. Total budget 53 M€ (50 % from SEA)
- The gasification technology is Uhde® entrained-flow gasification process.
- Torrefied biomass as feedstock.
- Ambition to start-up in 2028.

Phoenix Biopower

- Developing a hybrid fluidized bed (HFB) technology
- Associated with high-pressure gasification processes
- The HFB technology combines the advantages of both BFB and CFB by introducing dual-size bed particles. The smaller particles behave like those in a CFB, while the larger particles behave as in a BFB.
- This results in a gasifier with a reasonable reactor diameter and height - ideal for applications with 20 – 200 MW fuel input.

FerroSilva

- FerroSilva is planning a gasification plant at Ovako's steel plant in Hofors for the production of fossil-free sponge iron.
- The next step is to build a demonstration plant of 50 kton DRI with start of operation in 2026

Plagazi AB

- PlagaziAB has a concept for transforming waste into hydrogen through plasma gasification.
- Several new projects are announced:

- Köping Hydrogen Park -Three Plagaziplants to recycle 66.000 tonnes of waste annually for production of 12.000 tonnes(51 MW) of hydrogen.
 - Planned to be operational in 2024
- German project “Havelstoff” located in Brandenburg run together with Neue Energien Premnitz
- LOI with WIRTZ Energie+ Mineralöl GmbH with the intent to form a long-term offtake agreement of 4 000 tons of hydrogen
 - Planned start Q2, 2023

BIOSHARE

- BioShare’s technology enables additional products in addition to heat and power.
- Their fluidized bed solutions can be applied utilizing separate bed material or share bed material with a boiler.

LTU Green Fuels

- >8 M€ granted by EU JTF to build a test bed for a 1 MW electrolysis system at the pilot plant LTU Green Fuels at Luleå University of Technology.
- Opens up for demonstration of bio-electrofuels production

UK, Paula Bianco, Aston University

UK government funding and programmes were presented.

UK industry updates

Altalto Immingham Waste to Sustainable Aviation Fuel Project

- Europe’s first waste-to-SAF plant, enough fuel to power over 1,000 transatlantic flights with net-negative carbon emissions
- Collaboration between Velocys and British Airways
- Technology: Fischer-Tropsch and gasifier (from Velocys)

ABSL, Swindon

- First facility in the world to convert household waste into grid-quality bioSNG.
- FULL chain 4.5 MWth SMALL COMMERCIAL FACILITY
- Plant complete and being brought online currently

ABSL, Biohydrogen project

- Slipstream of hydrogen rich syngas taken after water gas shift reactor.
- Transferred to Xebec PSA which produces high purity hydrogen stream and hydrogen rich tail gas.

KEW Technology, Wednesbury, UK

- BEIS NZIP Industrial fuel switching awarded: Kew & NSG Pilkington’s Modular approach to decarbonisation of energy (MADE) for glass project.

- Developing an industrial co-location solution using modular advanced gasification units to provide syngas as a pressurised natural gas substitute to reduce consumption of carbon-intensive natural gas.
- Aims to decarbonise the glass production process and achieve a 30% reduction of on-site emissions by 2030.

UK ongoing projects

HyNet

- The five projects announced in March 2023, will remove about 3 million tonnes of CO₂/year, supporting the UK's net zero target.
- Kellogg's, Essity and Novelis have been selected to receive funding by the Department for Energy Security & Net Zero to undertake demonstrations in which they will switch their fuel to hydrogen at their Northwest plants.

USA, Robert Baldwin, NREL

Update on commercialization activities

Fulcrum Bioenergy/Sierra Biofuels:

- Status: First gallon of product in December, 2022; status unclear

Other commercialization activities

SunGas Renewables

- July 26, 2023 – announced the formation of Beaver Lake Renewable Energy, LLC
- New green methanol production facility in Central Louisiana (Pineville LA)
- 400,000 MTA carbon-negative methanol for marine fuel from woody biomass
- With 1 MTA CCS
- Offtaker: Maersk

New: Aemetis

- Currently producing bio-gas & 1-G ethanol
- September 13, 2023 - received a Use Permit from the City of Riverbank to build a 90 million gallon per year sustainable aviation fuel and renewable diesel plant (from FOGs) in Riverbank, California
 - Will incorporate 'cellulosic hydrogen' from woody biomass#
 - Extensive use of CCS
- Details of technology providers not clear at this time

DG Fuels

- 12,000 BPD renewable fuels (primarily SAF) project announced
- Gasification/FT – few details provided
- Low CI products with extensive renewable hydrogen (and oxygen) utilization and CO₂ abatement (CCS)
- First project announced in Louisiana

San Joaquin Renewables, San Joaquin, CA

- Gasifier: Frontline BioEnergy RNG (pressurized FB, 10 bar, air or O2 with steam)
- Feedstock: Ag waste
- Product: RNG (15 mill. Gallon-eq.)
- Status: engineering in progress, approvals for injection in existing pipelines received

Mote

- Gasifier: SunGas Renewables (press. FB, 10 bar with CCS)
- Feedstock: Ag residues
- Product: low-carbon hydrogen
- Status: initial stages of project planning

Arbor Renewable Gas, Beaumont TX

- Gasifier: SunGas Renewables, MTG: Haldor Topsøe
- Feedstock: woody biomass
- Product: 1 000 BPD renew. Gasoline (MTG)
- Commercial production in 2024

Madera Gas, Houston TX

- Gasifier: SunGas Renewables, with CCS
- Feedstock: woody biomass 100 000 TPY
- Product: RNG (5B SCFY RNG)
- Status: construction on first train in 2023; operational in 2024

Velocys Natches MS and Immingham UK

- Microchannel FT reactor
- 35M GPY SAF from gasification of woody biomass; no other details available
- Status: Natches, Immingham – start up 2027, BA fuel offtaker
- Natchez Bayou Fuels: engineering unerway – start-up in 2027; SouthWest Airlines fuel offtaker

USA Bioenergy – Texas Renewable Fuels

- Gasif.+ FT
- Feedstock: woody biom.
- Product: SAF, renew. Diesel, naphtha
- Status: planning underway for 1. Biorefinery in Bon Wier, Texas

The political climate

- DOE has issued a roadmap to stand up 4-5 operating biofuels demonstration plants (each at ~1M GPY) by 2030
 - SAF Grand Challenge: 3B GPY SAF is target by 2030; 35B GPY by 2050
 - Gasification + FT is included as a key technology pathway
- Biomass gasification now back in favor (sort of) => low carbon pathways

END