



The post-2020 EU Policies on decarbonising transport and their impact on biofuels via gasification

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Energy

9th International Seminar of Gasification



VERNAME

**An 6 MWe state of the art
wood fuelled Integrated
Gasification Combined Cycle
(BIGCC) plant by SYDKRAFT**



ARBRE

An 8 MWe state of the
art wood fuelled
Integrated Gasification
Combined Cycle
(BIGCC) plant in
Eggborough, North
Yorkshire, UK
1999-2004



tps®

ALSTOM

KeldaGroup



Energy



CHOREN

**OPTFUEL FP7 Contract,
Consortium led by VW
Fisher-Tropsch from wood**



European

CHEMREC

BIO DME FP7 Contract,
Consortium led by VOLVO
Bio DME from Black Liquor

SmurfitKappa kraft mill

Chemrec's DP-1
Development Plant

DME Synthesis Plant





INEOS

The Indian River facility in the US to manufacture cellulosic ethanol via gasification and fermentation technology; (8 million gallons of bioethanol per annum and 6 megawatts of power from local yard, vegetative and household wastes); 2013-2015.



Andritz/Carbona - Skive plant

Europe's largest for CHP

- ❖ – 6 MWe
- ❖ – Wood pellet fuelled
- ❖ – Pressurized CFB - Carbona
- ❖ • Co-financed by FP4 & US DOE
- ❖ – 2013: 26 GWhe and 52 GWh heat





LAHTI

**160 MW co-firing
SRF plant,**



A large industrial facility, the Enerkem Alberta Biofuels plant, featuring complex piping, scaffolding, and storage tanks under a clear blue sky. The Enerkem logo is visible on a sign within the structure.

ENERKEM

ALBERTA BIOFUELS

Capacity:	38 million litres per year
Feedstock:	25-year agreement with City of Edmonton for 100,000 dry tonnes of MSW per year
Products:	Biomethanol, cellulosic ethanol



GoBiGas



Güssing

2008/12/23



**A four times scale
up from the original
plant in Güssing**

Past & Present

Closed

Vernamo
ARBRE
Choren
Chemrec
INEOS

Commercial

Skive
Lahti

Operational

ENERKEM
GoBiGas

(There are more on all cases)

We need to understand better the above

Gasification projects under H2020

2014 641229-FlexiFuel-SOFC

...innovative highly efficient and fuel flexible micro-scale biomass CHP technology consisting of **a small-scale fixed-bed updraft gasifier**, a compact gas cleaning system and **a solid oxide fuel cell (SOFC)**. The technology shall be developed for a capacity range of **25 to 150 kW** (fuel power) and shall be characterised by a wide fuel spectrum applicable (wood pellets and wood chips of various sizes and moisture contents, SCR, selected agricultural fuels), high gross electric (40%) and overall (85-90%) efficiencies as well as almost zero gaseous and PM emissions.

Gasification projects under H2020

2017 727330-HiEff-BioPower

...Within the project a new highly efficient biomass CHP technology consisting of a **fuel-flexible fixed-bed updraft gasifier, a novel compact gas cleaning system and a solid oxide fuel cell (SOFC) shall be developed for a capacity range of 1 to 10 MW (total energy output)**. The technology shall distinguish itself by a wide fuel spectrum applicable (wood pellets, wood chips, SRC, selected agricultural fuels like agro-pellets, fruit stones/shells), high gross electric (40%) and overall (90%) efficiencies as well as equal-zero gaseous and PM emissions. The system shall consist of a fuel-flexible updraft gasification technology with ultra-low particulate matter and alkali metal concentrations in the product gas, an integrated high temperature gas cleaning approach for dust, HCl and S removal and tar cracking within one process step as well as a SOFC system which tolerates certain amounts of tars as fuel. It is expected to achieve at the end of the project a TRL of 5 and a MRL of at least 5.

Gasification projects under H2020

2017 727600-FLEDGED

.... The FLEDGED project will deliver a process for Bio-based dimethyl Ether (DME) production from biomass. The FLEDGED project will combine a **flexible sorption enhanced gasification (SEG) process and a novel sorption enhanced DME synthesis (SEDMES) process** to produce DME from biomass with an efficient and low cost process.

The primary aim of FLEDGED project is to develop a highly intensified and flexible process for DME production from biomass and validate it in industrially relevant environments. This objective will be accomplished by:

- Experimental validation of the flexible SEG process at TRL5;
- Experimental validation of the flexible SEDMES process at TRL5;
- Evaluation of the full biofuel production chain from energy, environmental, economic, socio-economic and risk point of view;

Climate and energy: where do we stand?

2008/2009

2011

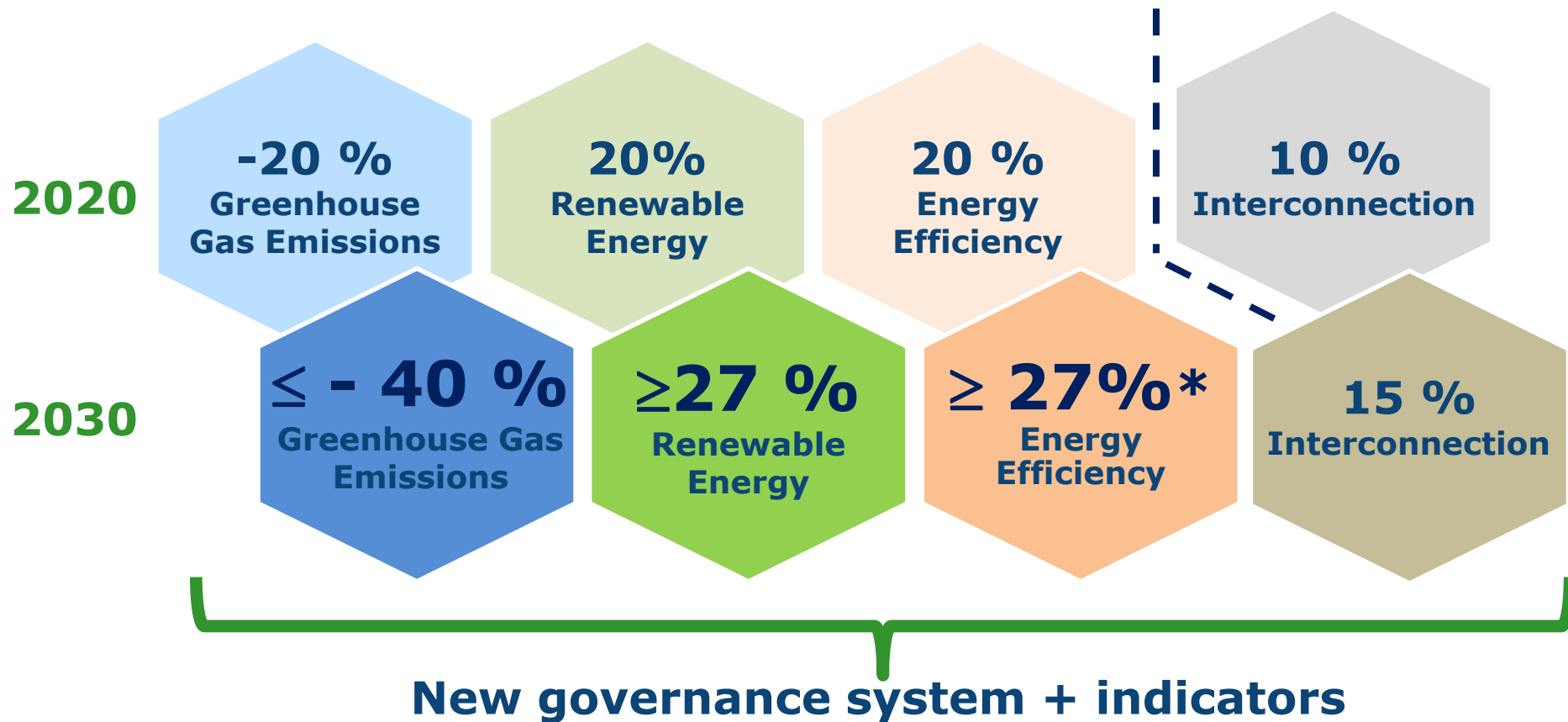
2014

The EU climate and
energy package



Energy
roadmap 2050

Agreed headline targets 2030 Framework for Climate and Energy



* To be reviewed by 2020, having in mind an EU level of 30%

[illegible]

7% CAP on first generation

- Contribution of **conventional biofuels** towards RES target and is limited to 7% of energy consumption in transport sector.
For the Member States to decide: application of cap towards FQD target and to allow aviation to contribute to FQD target.
- Biofuels from **energy crops** are in principle but maybe not in practise included in the cap.
- Biofuels included in future **Annex IX** (both A and B) count double towards RES-Transport target but not necessarily towards supply obligations.
- **Renewable electricity** used by electric cars counts 5x (doubled) and rail 2.5x (new).

GHG savings

- **Minimum GHG emission threshold** increased to **60%** for new installations starting physical production of biofuels after 5 October 2015.
- **The estimated ILUC emissions** are included in the fuel suppliers' and Commission reports in both Directives but no ILUC factors in the sustainability criteria or for FQD 7a accounting.
- **New: "Low ILUC-risk biofuels and bioliquids"** – definition + EC reporting by end of 2016 on possibility for identification and certification
- Change in procedure for the **GHG emission calculation methodology for both - fossil fuels and biofuels** (FQD – Art 7a, Annex IV, RED - Annex V): Delegated act only to add new GHG emission values, legislative proposal for update of values

Advanced biofuels

- MS shall set a ***national target*** for biofuels produced from the Annex IX A feedstock
- Reference value is **0.5%** of the energy consumed in road transport
- Target is ***not legally binding*** ("*shall endeavour to achieve*")
- ***Grandfathering clause***: Former Article 21 (2) feedstock (eligible for double counting) may also be counted towards this target if it was officially recognised by competent national authorities and was used in existing installations before 9 October 2015.
- Commission can ***add to - but not remove*** elements from the list of feedstock in Annex IX

European Council Conclusions:

2030 Framework for Climate and Energy (October 2015):

.....it is important to ***reduce greenhouse gas emissions*** and ***risks related to fossil fuel dependency*** in the transport sector.

...The European Council therefore invites the Commission to further examine instruments and measures for a ***comprehensive and technology neutral approach*** for the promotion of emissions reduction and energy efficiency in transport, for electric transportation and for ***renewable energy sources*** in transport also after 2020.

Energy Union Communication

...15 Action points

Most of the action points relevant for renewable energy and biomass, particularly:

- Point 12: Implementation of climate and energy framework for 2030 at the October European Council.
 - **The Commission will propose legislation to achieve the greenhouse gas reduction target.**
- Point 13: The Commission will propose a new Renewable Energy Package in 2016-2017.
 - **This will include a new policy for sustainable biomass and biofuels as well as legislation to ensure that the 2030 EU target is met cost-effectively.**

Recent & next steps:

Post the Paris UNFCCC conference

Summer 2016:

- ❖ **Communication on decarbonisation of transport**

End of 2016

- ❖ **Propose for a new Renewable Energy Package including a new policy for sustainable biomass and biofuels**
- ❖ **Communication on Waste to Energy**

Strategy on low emission mobility

Strategy on low emission mobility identifies three main pathways to decarbonise transport

- *higher efficiency of the transport system,*
- **low-emission alternative energy for transport,** and
- *low- and zero emission vehicles*

*Options to promote low-emission alternative energy would be for example an **obligation for fuel suppliers***

*Food-based biofuels have a limited role in decarbonising the transport sector. Commission is focusing on **their gradual phase out and replacement by more advanced biofuels***

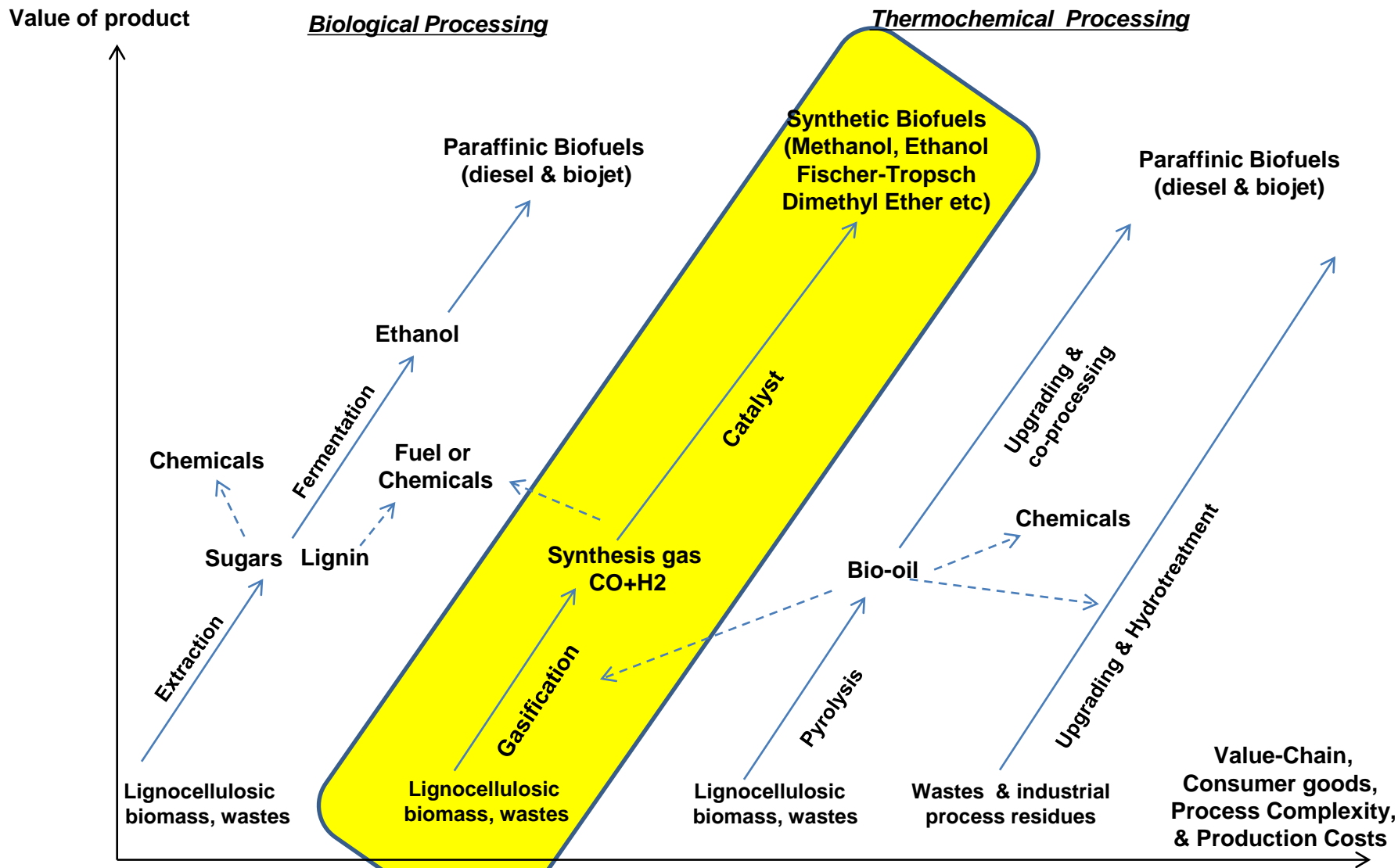
Legal proposal for post 2020

Legal proposal for RED

- *Assessing options in line with the 2030 Climate and Energy Framework and Strategy on low emission mobility*
- *COM aims to table proposal by end of 2016*

GHG emission methodology

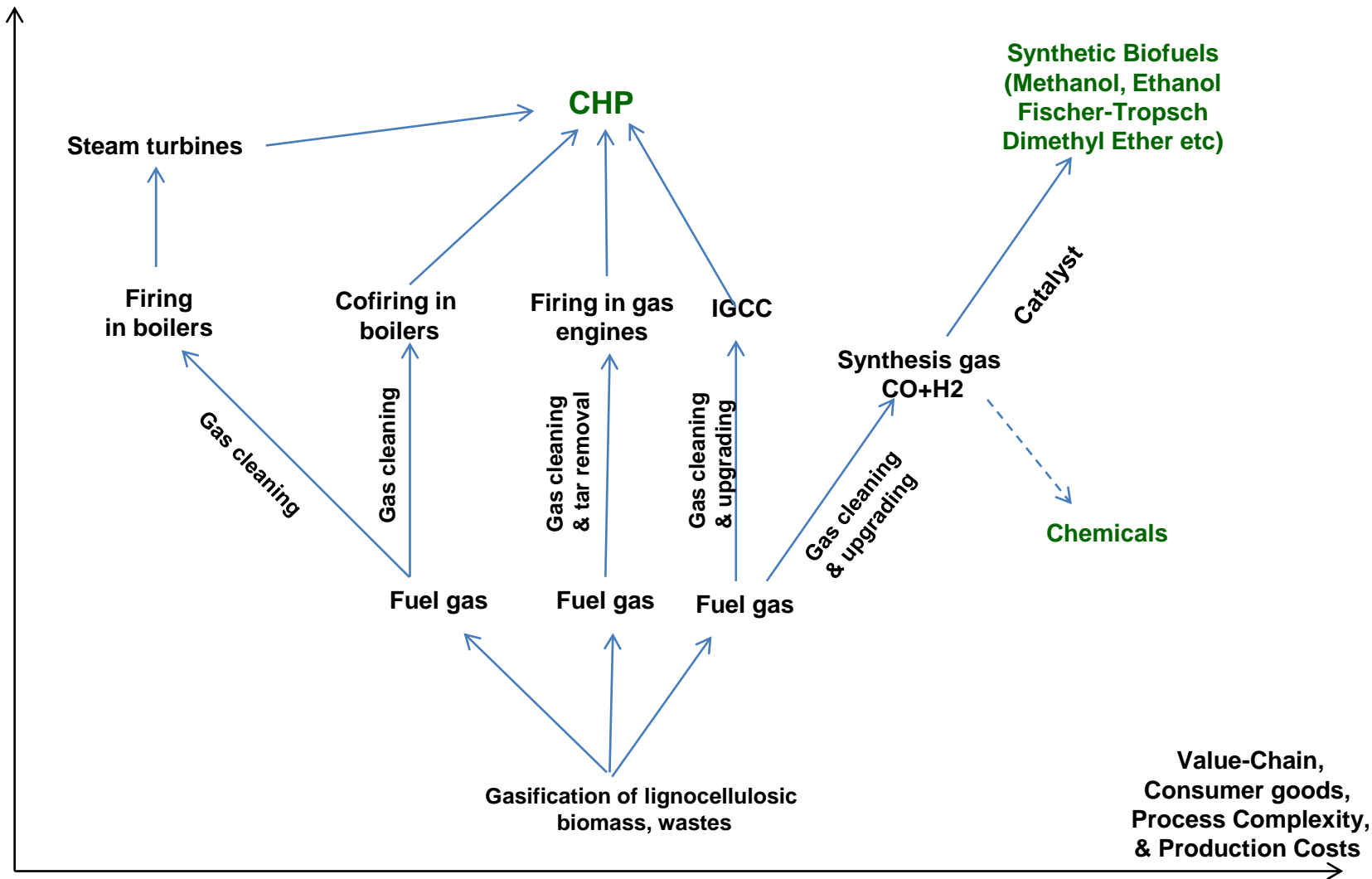
- *Commission cannot change methodology or default values on implementing acts – changes are only possible via a legislative proposal*
- *Can address all issues including fossil fuel comparator and default values*



**Adding value to biomass by processing to advanced biofuels
and to biochemicals**

Value of product

Gasification



Adding value to biomass by processing to power, advanced biofuels and to biochemicals via gasification

Technology Valley of death: Positioning of technologies

First of a kind

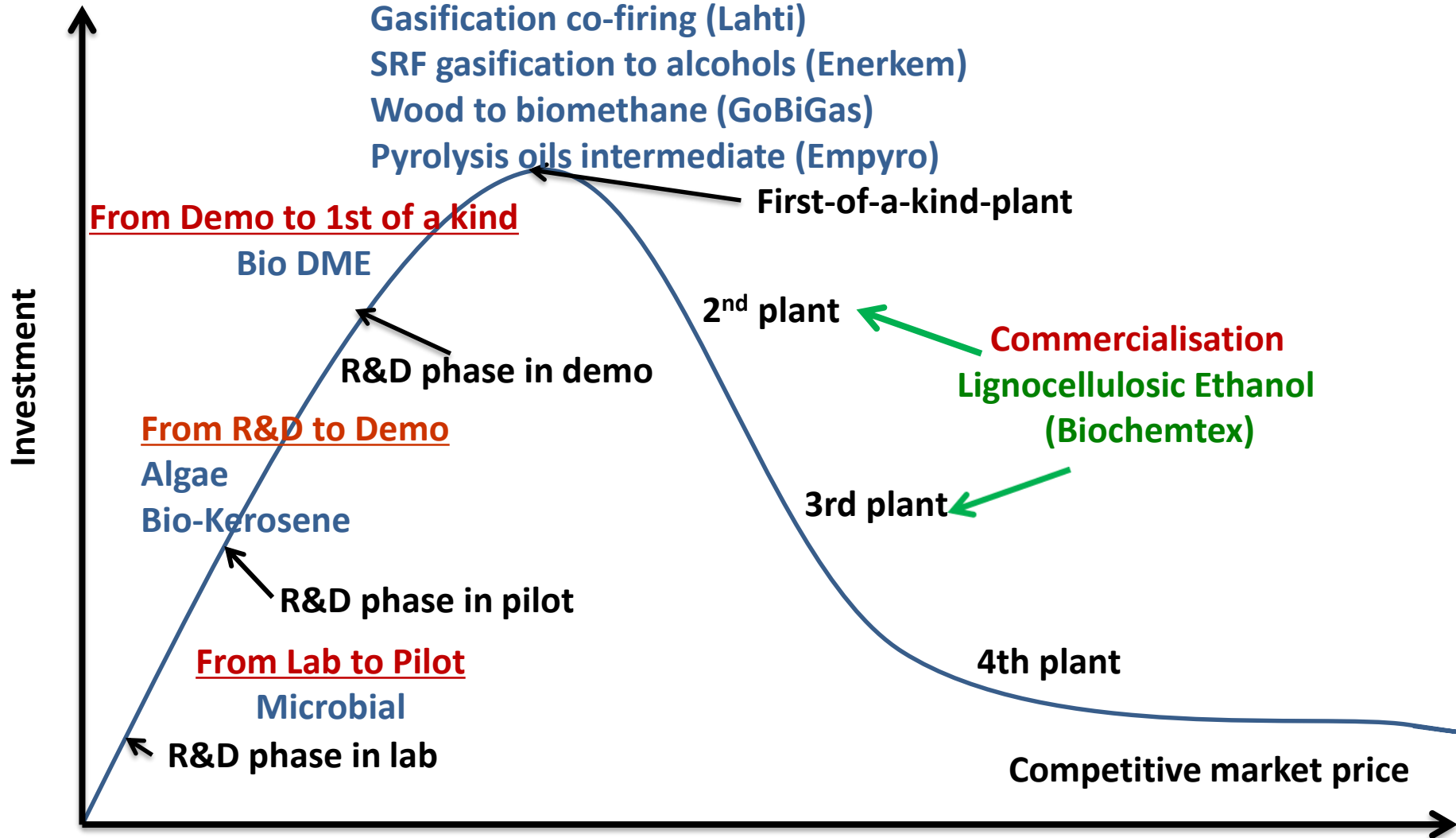
Gasification CHP (Skive)

Gasification co-firing (Lahti)

SRF gasification to alcohols (Enerkem)

Wood to biomethane (GoBiGas)

Pyrolysis oils intermediate (Empyro)

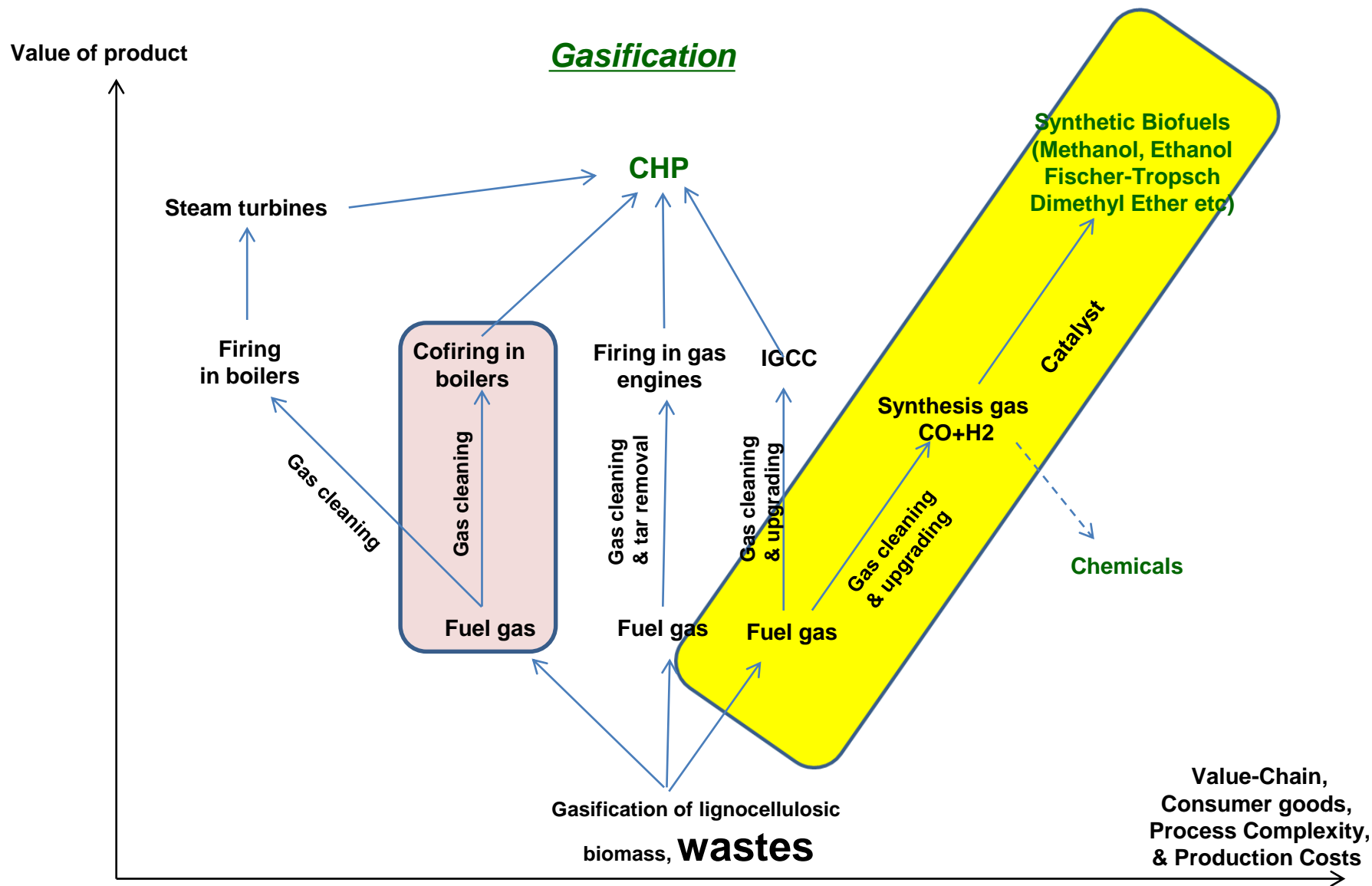


Key successes

- Biochemtex of Italy built the first commercial plant on **ethanol from lignocellulosics** at Crescentino, Italy. This was the first such plant on global scale.
- EU **enzyme** companies such as Novozymes, DSM and Abengoa are world leaders. The US cellulosic ethanol plants are all based on EU knowhow.
- Three **large scale algae production facilities** are under development in the EU. These will be the largest facilities built in the EU; 10 hectares each with a productivity of 90 dry matter ton algal biomass per hectare per year.
- The EMPYRO pyrolysis oil plant of BTG in the Netherlands is the first plant to **sign a long term supply contract** of the bio-oil to replace fuel oil.
- The CHEMREC Bio-DME project has been the first project to demonstrate the conversion of **black liquor to bio-dimethyl-ether**.

Technology & Market Opportunities for Advanced Biofuels

		Existing Technology	New Technology
Existing Markets		Market Penetration	Product Development
		Hydrotreated Veg. Oils Lignocellulosic EtOH Pyrolysis oils	Synthetic Biofuels Pyrolysis oils co-processing Algal oil based biofuels Direct conversion of sugars Bacterial conversion
New Markets		Market Development	Diversification
		HVO + SC & Certification Bio DME Biomethane	Aviation Heavy Duty transport Maritime transport BioChemicals



Adding value to biomass by processing to power, advanced biofuels and to biochemicals via gasification

***Thank you for your
attention!***

More information:

<http://ec.europa.eu/energy/renewables/>