Advances in the thermochemical pathway in Europe

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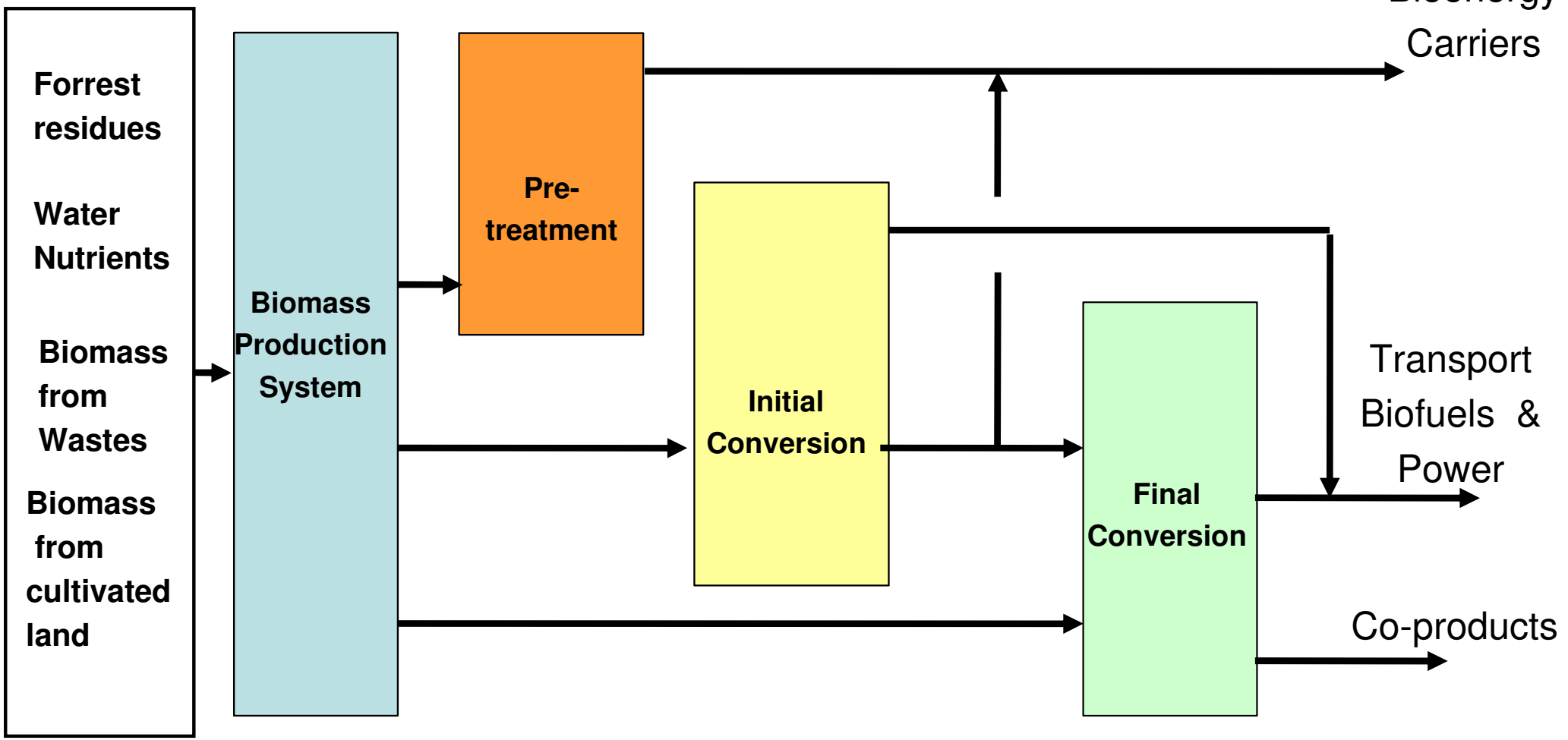
DISCLAIMER

The presenters have gathered the informaton from contacts, EBTP secretariat and through the Internet. Some deviations from factual situation may therefore be presented.

”Original from EIBI 2009”

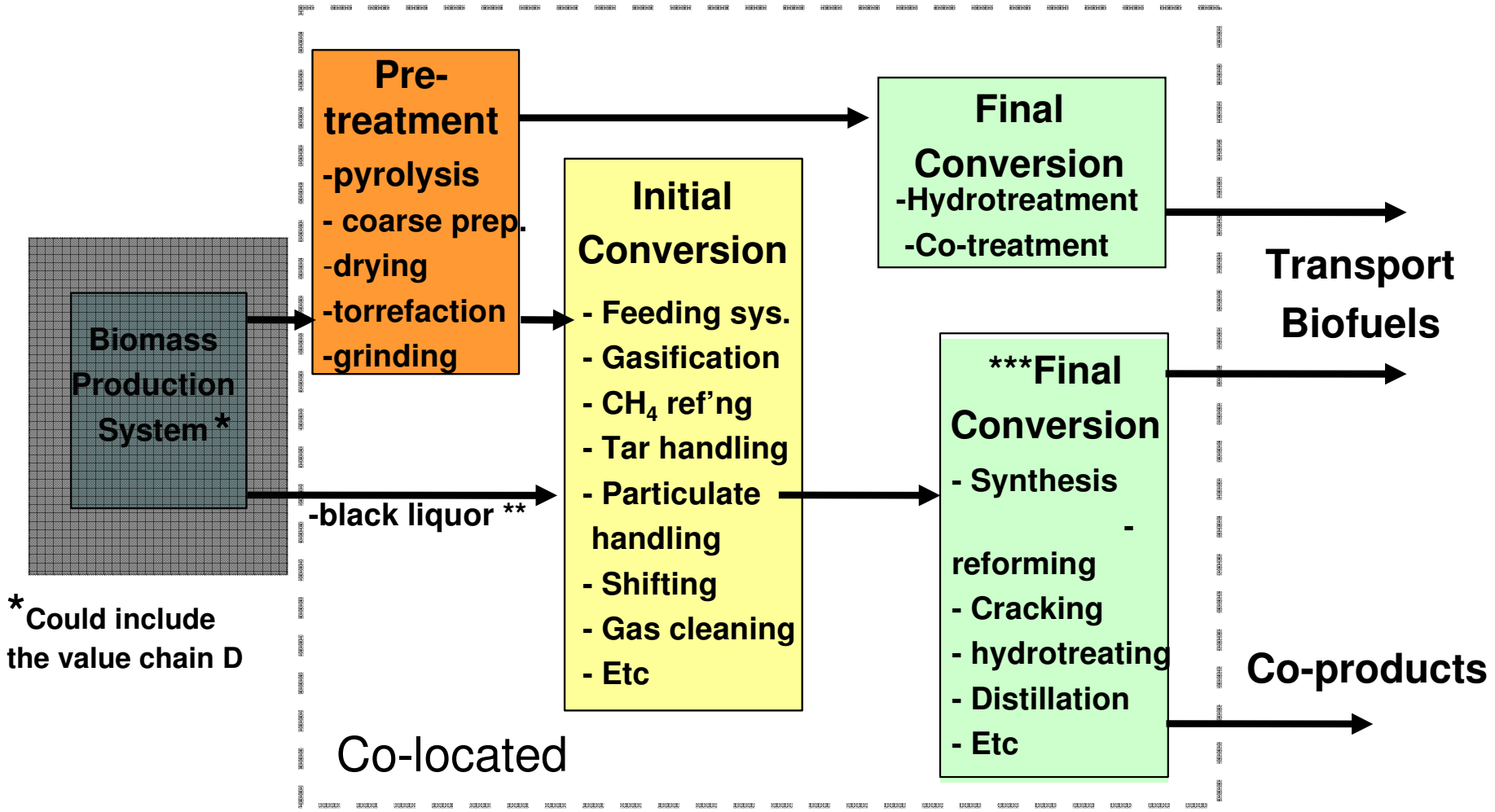


Four identified value chains

A. Synthetic fuels* (oxygenates or hydrocarbons) through gasification.
B. Bio-methane through gasification
C. High efficiency heat & power generation through gasification
D. Intermediate bio-energy carriers through techniques such as pyrolysis and torrefaction

* Includes all fuels produced via synthesis of H_2 + CO

A. Synthetic fuels (oxygenates or Hydro-carbons) through gasification



*Could include the value chain D

** Black Liquor is an internal, energy-rich stream within pulp mill. No pre-treatment necessary before gasification.

***certain steps of final conversion may be located elsewhere

A. Synthetic fuels (oxygenates or Hydro-carbons) through gasification

Biofuels Technology Platform

Choren Projects

a. Beta plant,

~45 MW_t / FT products / Under Start-up

b. Sigma Plan

~640 MW_t / FT products / Start-up 14-15(?)

Choren Beta Plant

BioLiq Project

2 MW_t / via DME to HC:s / 2012

Bioliq pyrolysis plant

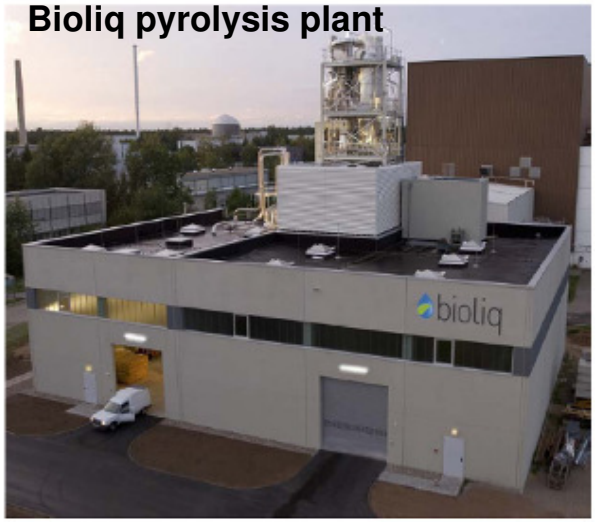


Figure 23. A photograph of the FZK's Bioliq demonstration facility (www.fzk.de).

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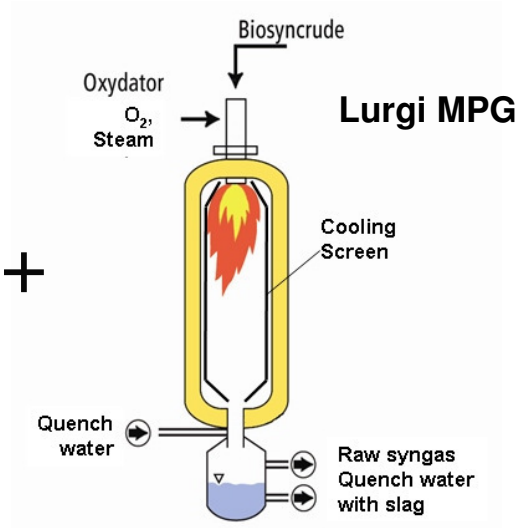


A. Synthetic fuels (oxygenates or Hydro-carbons) through gasification

Biofuels Technology Platform

Chemrec development plant

Amine Wash in BioDME project

Chemrec Projects

a. BioDME

~3 MW_t / DME / Start-Up Sept 2010

b. Domsjö Biofuels

~200 MW_t / DME and Methanol / Start-Up 2013

UPM Project

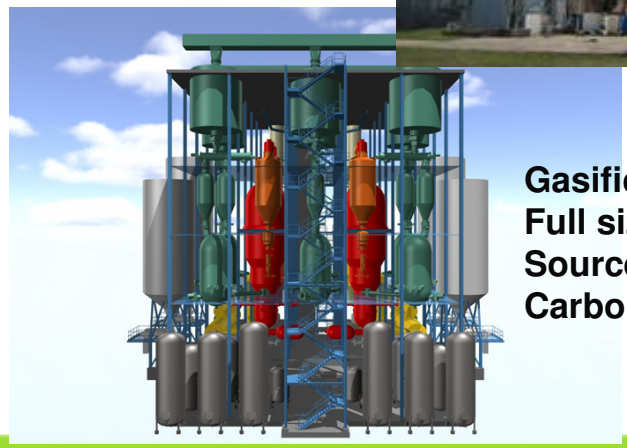
a. Pilot testing at IGT, Chicago

~5 MW_t / syngas production / Ongoing

b. Commercial Demonstration

~300$_t$ / FT products / Start-Up 2014/15

Pilot tests in Chicago at IGT



Gasification Module
Full sized plant
Source: UPM, Andritz, Carbona

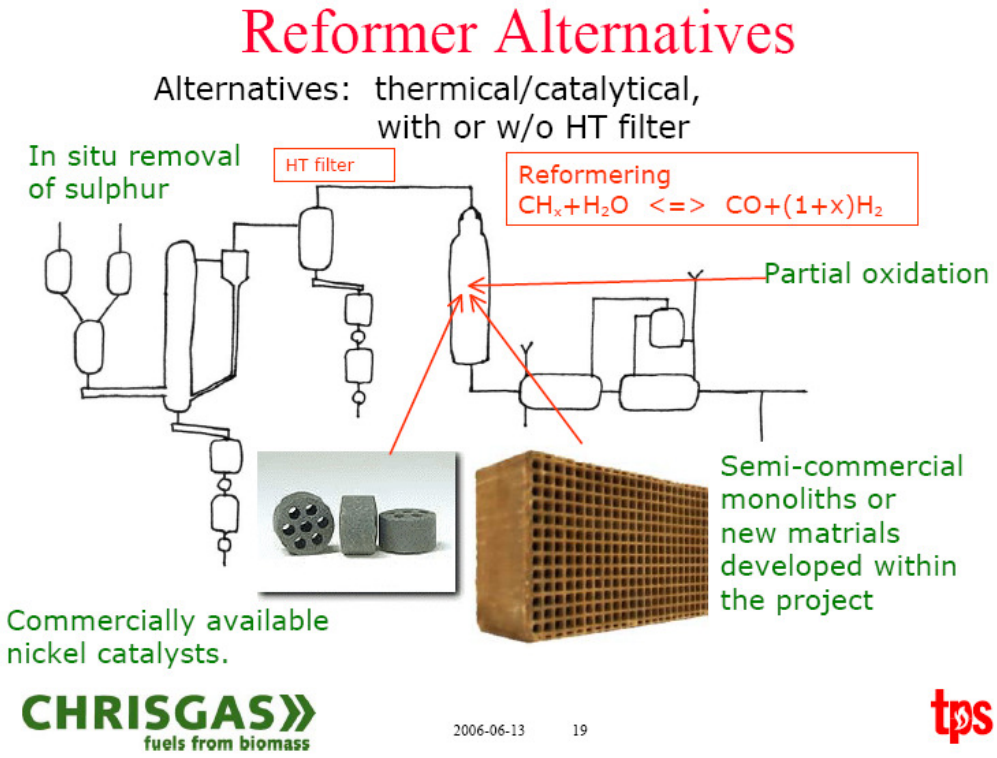
A. Synthetic fuels (oxygenates or Hydro-carbons) through gasification

Biofuels Technology Platform

VVBGC Project

(under re-financing & re-organisation)

~15 MW_t / clean syngas / 2012-13



Neste-Stora Enso project

~ 12 MW_t /part stream to FT / Gasification in operation

StoraEnso Pilot Plant

BioTfueL Project

~ 12 MW_t / FT products / 2012

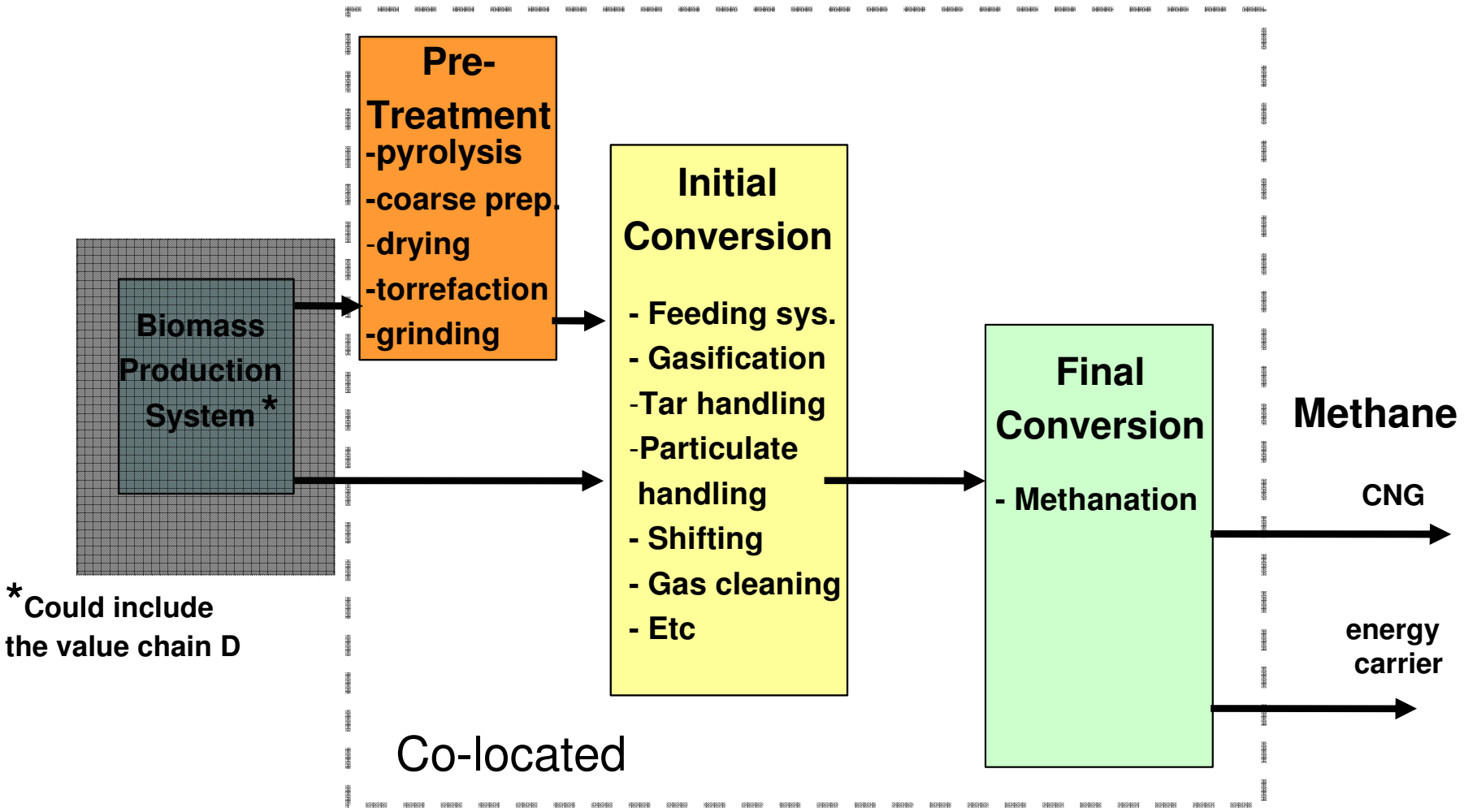
A. Synthetic fuels (oxygenates or Hydro-carbons) through gasification

Biofuels Technology Platform

Key R&D Areas

- Pre-treatment scale-up and cost
- Where is the system pressurized? (Biomass feeding system: Syngas compression; ...)
- Syngas purification technology and cost
- Overall integration

B. Bio-methane through gasification



B. Bio-methane through gasification

ECN/HVC (18kt/y feed- 2012)

BioSNG demo

Güssing

8 MWt / Heat & Power / 2002

Side stream converted to SNG

and tested in vehicle

SNG pilot at Güssing

GAYA (GdF – Suez)

Decentralzed SNG for transportaion application

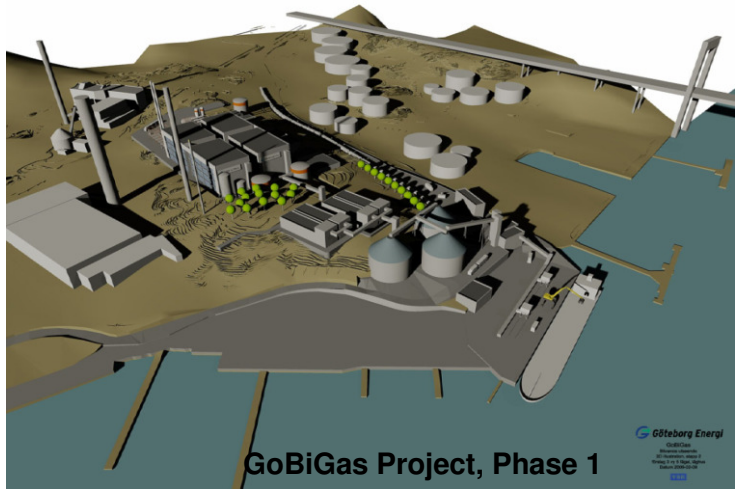
GobiGas – Gothenburg Energy

a. Phase 1,

20 MW_t / SNG / 2012

b. Phase 2

80 MW_t / SNG / 2015-16



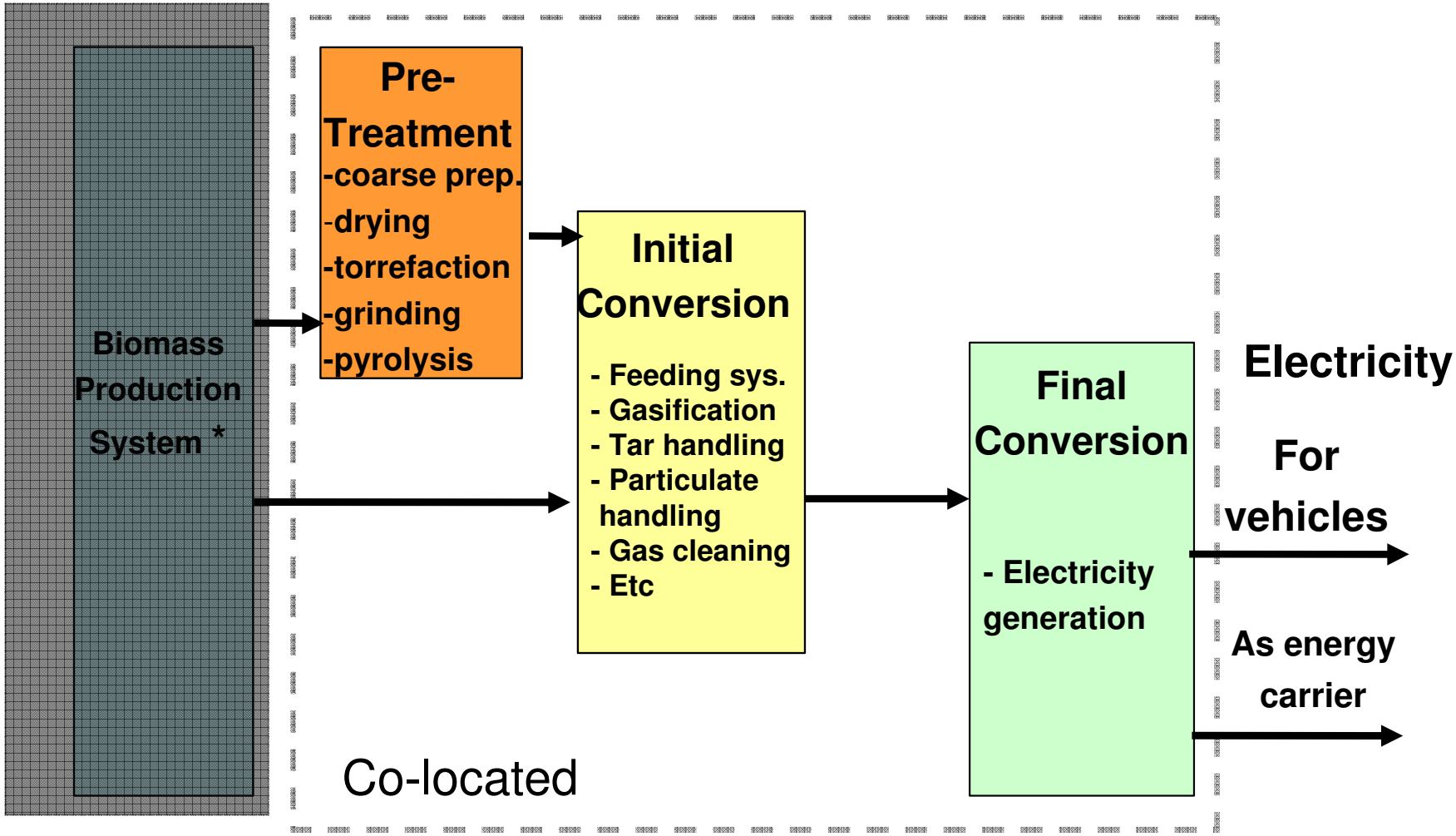
B. Bio-methane through gasification

Biofuels Technology Platform

Key R&D areas

- Pressurization. Where is the process pressurized?
- Gas conditioning and purification technology and cost
- Efficint distribution

C. High efficiency heat & power generation through gasification



*Could include the value chain D

C. High efficiency heat & power generation through gasification

Biofuels Technology Platform

Güssing Plant

8 MWt / Heat & Power / 2002

(1 more plant in operation and

4 in EPC phase, 10-25 MWt)

VVBGC Project

18 MWt / Heat & Power / 1996 - 1999

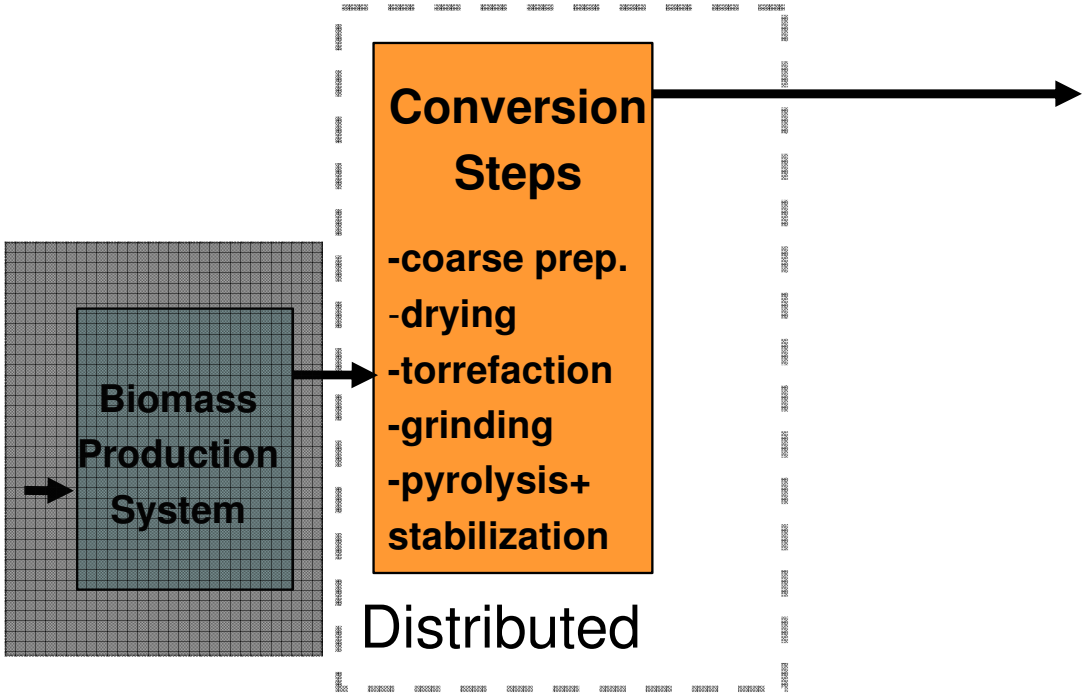
C. High efficiency heat & power generation through gasification

Biofuels Technology Platform

Key R&D areas

- Pre-treatment scale-up and cost
- Fuel gas purification technology (hot gas filtration and tar removal at HT)
- Overall energy integration

D. Intermediate bio-energy carriers



1. Bioenergy carrier <u>for further processing to fuels</u>

(2. As energy carrier)

D. Intermediate bio-energy carriers

Biofuels Technology Platform

PYROLYSIS

VTT, UPM, Metso, Fortum

Bio-oils to fuel oils (80kt/y feed)

KIT (former FZK)

Bioliq project stage 1 for gasification

(see Value Chain A)

Metso Pilot Plant

TORREFACTION

ECN labscale

BioTfueL 3 t/h / energy carrier / 2012

Key R&D areas

- Scale-up
- Cost reduction
- Pyro-oil stability