

GIDARA[®] Fluidized Bed Gasification for Producing Sustainable Fuels and Chemicals from Biomass and Waste

Intensified (Bio)methanol Production | Webinar | 30th October 2026

Dr. Avishek Goel

Head of Technology Development



Funded by
the European Union



Funded by the European Union under project number 101147737. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor CINEA can be held responsible for them.

Need

Demand

Long Term Structural Drivers

~500 Mt/yr

Global SAF requirement by 2050 (IATA)

~2.4 Mt/yr

Current global SAF production (IATA, Dec 2025)

~385 Mt/yr

Renewable methanol demand by 2050 (IRENA)

<0.2 Mt/yr

Renewable (green) methanol today (IRENA)

Energy & Food security

~25%

of world seaborne oil trade transits Hormuz (2025)

~20%

of world LNG supply transits the strait (2025)

~80%

of oil and products went to Asia (2025), **44%** went to China and India

Global Energy Dependence to Regional Energy Systems

Supply

Feedstock Availability

~2.24 bn t/yr

Municipal solid waste generated globally

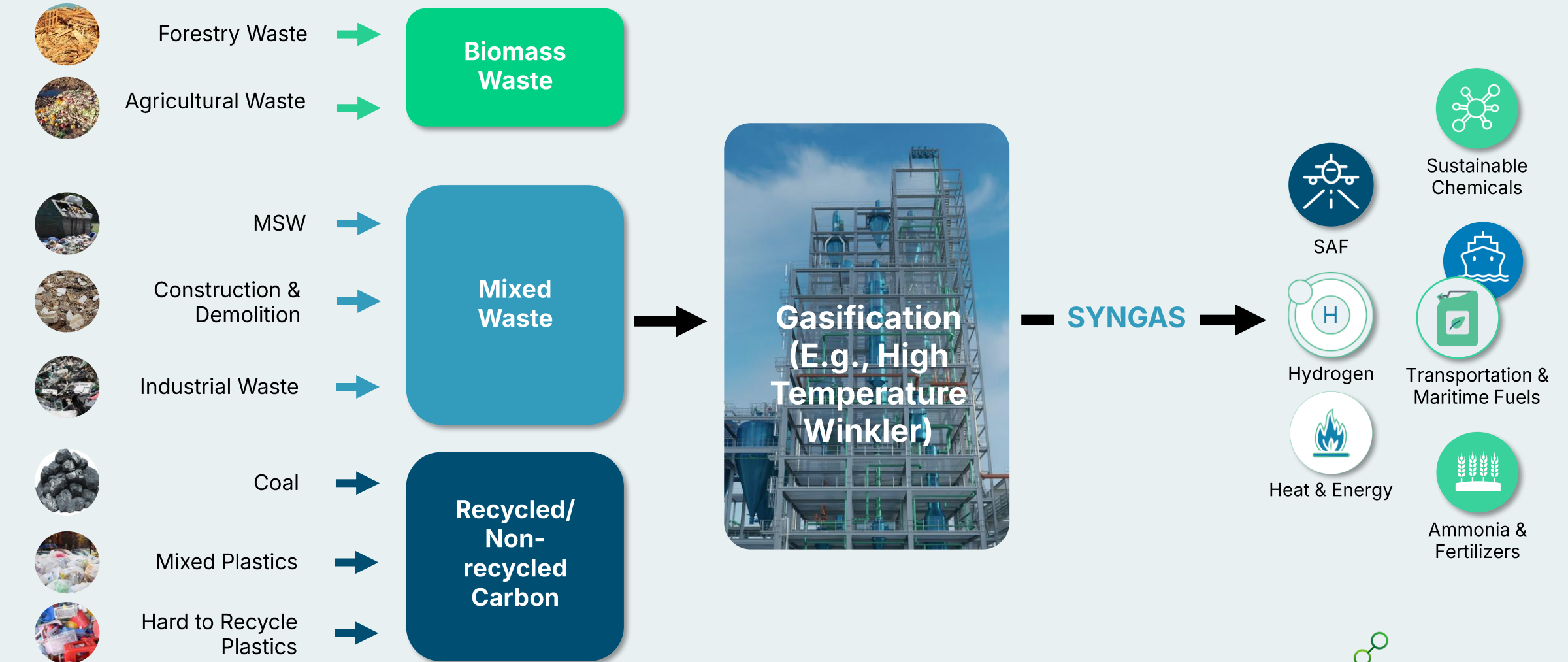
~1.3 bn t/yr

Crop residue waste

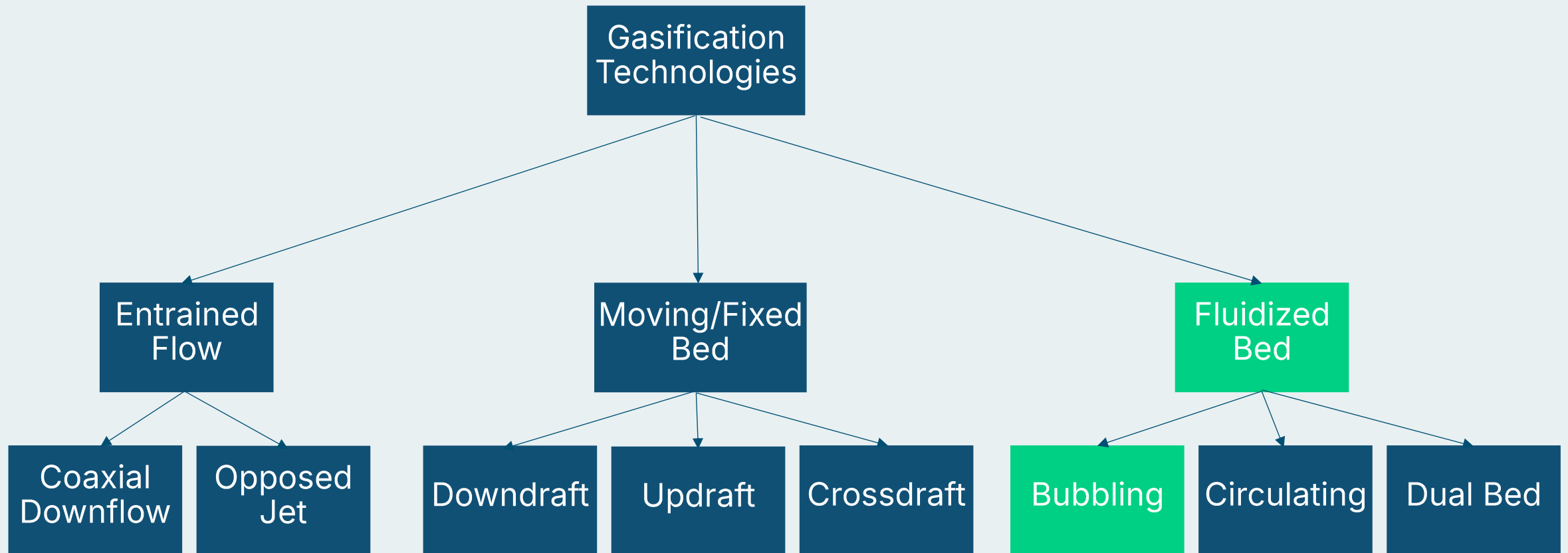
0.5–1.0 bn t/yr

Sustainable forestry residues

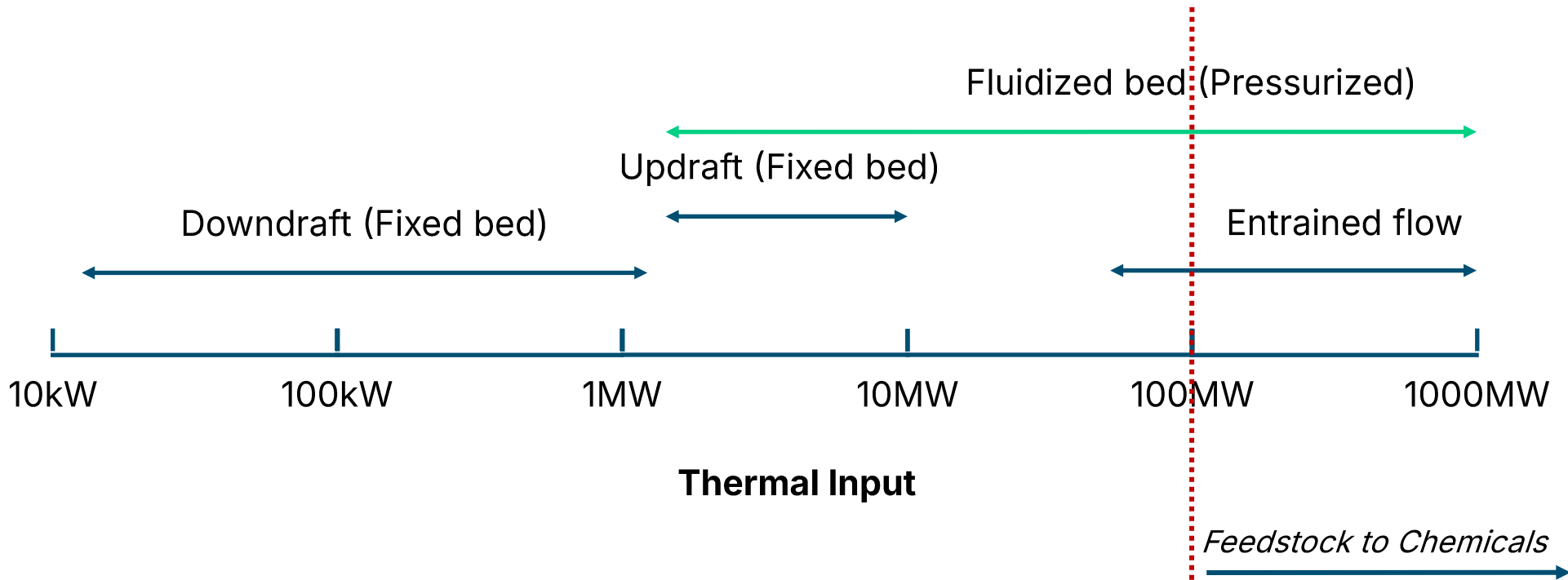
Gasification



Gasification Types



Gasification Operational Scales



High Temperature Winkler Gasification (HTW®)

How it Started?



1920s Industrial Gasifier - use of cheap brown coal (instead of coke) → synthesis gas production



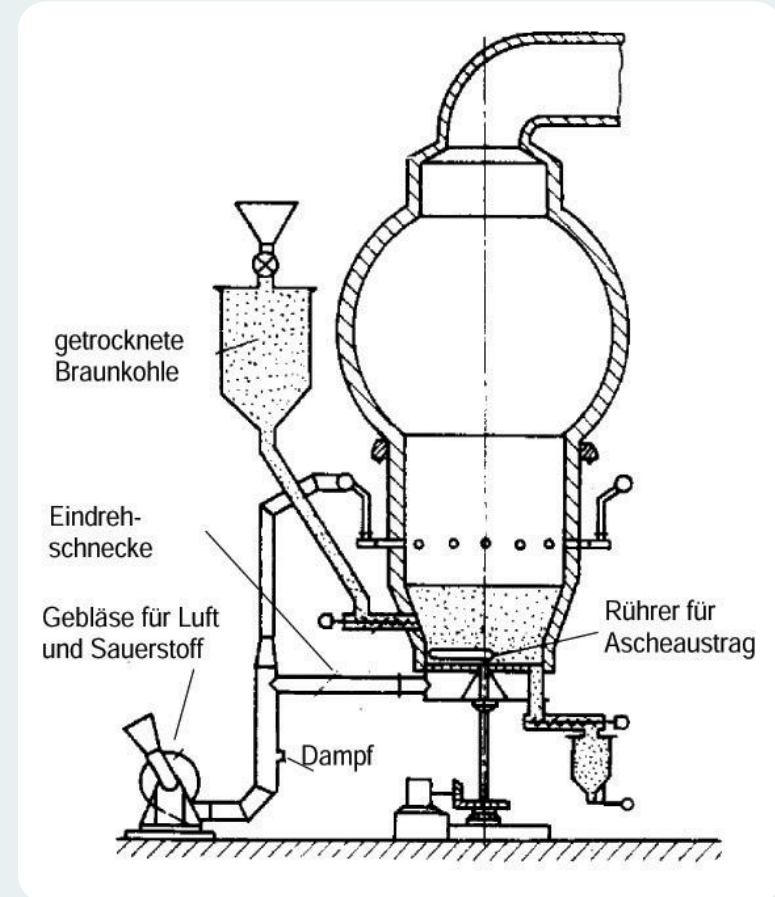
1921 Dr. Franz Winkler, Germany, idea of using boiling bed
1922 first Patent, DRP 437,970



1926 – first large-scale Winkler Gasifier (60,000 Nm³/h)



>60 units built worldwide mainly for fuel gas, H₂ and ammonia plants



Original Winkler Gasifier schematic
1926, Leuna, Germany

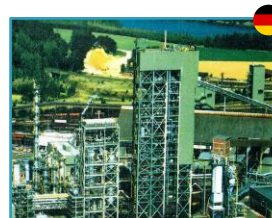
HTW® Operational History



Successful
increase of
pressure

Key reference plant

1986 - 1997



Commercial plant
at Berrenrath,
Germany

- ▶ 720 TPD dry lignite + waste
- ▶ 10 bar
- ▶ 300 TPD MeOH
- ▶ 12 years (76000h) of successful commercial operation

Successful
Scale Up Of
Factor 18

1988 - 1994



Commercial plant
at Oulu, Finland

- ▶ 650 TPD peat + sawdust
- ▶ 10 bar
- ▶ 270 tpd NH₃

Successful
Commercial
Application
On Biomass

1989 - 1992



High pressure plant
at Wesseling, Germany

- ▶ 185 TPD lignite and bitt. coal
- ▶ 25 bar

Successful
Pressure
Increase Of
10 To 25 Bar

1999 - 2002



Demonstration plant
at Niihama, Japan

- ▶ 24 TPD MSW
- ▶ 1.5 bar

Successful
Commercial
Application
On Waste

Key reference plant

2015 - current



Demonstration plant
at TU Darmstadt,
Germany

- ▶ 2.4 TPD MSW
- ▶ 1.5 bar
- ▶ Coal, Biomass, MSW, sewage sludge, plastic, etc.

Successful
Tests On
Variety Of
Feedstock

1960's - 1970's



Atmospheric Winkler Gasifier
Operated by RWE

- ▶ 260 TPD dry lignite with inner diameter up to 8 m

1974 - current



HTW® PDU Plant
Aachen, Germany

- ▶ 1 TPD lignite, peat, grasses, biomass, RDF, dry sludge etc
- ▶ 1 bar

1978 - 1985



Pilot Plant
at Wachtberg,
Germany

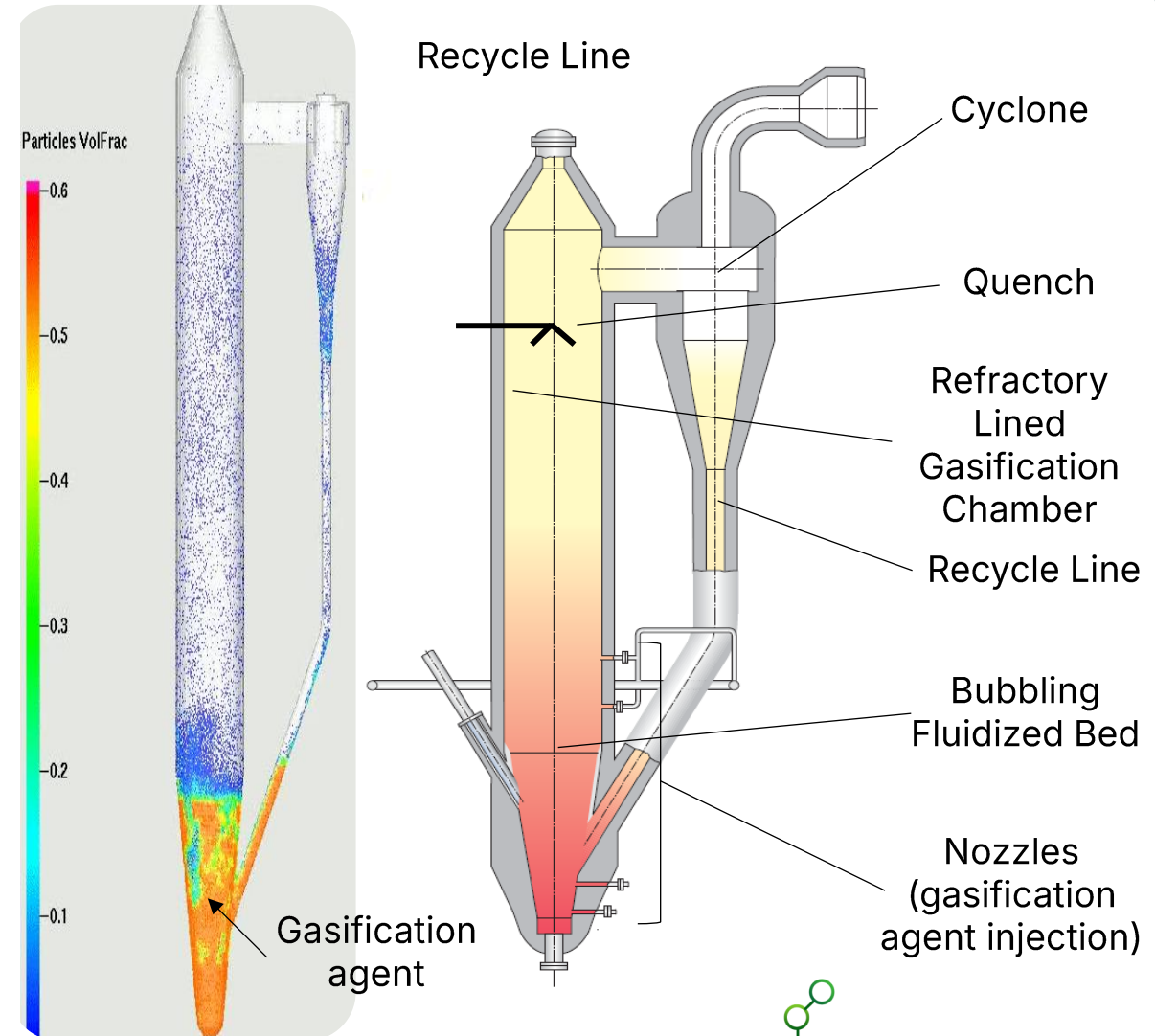
- ▶ 40 TPD dry lignite, peat
- ▶ 10 bar

50+ years of experience

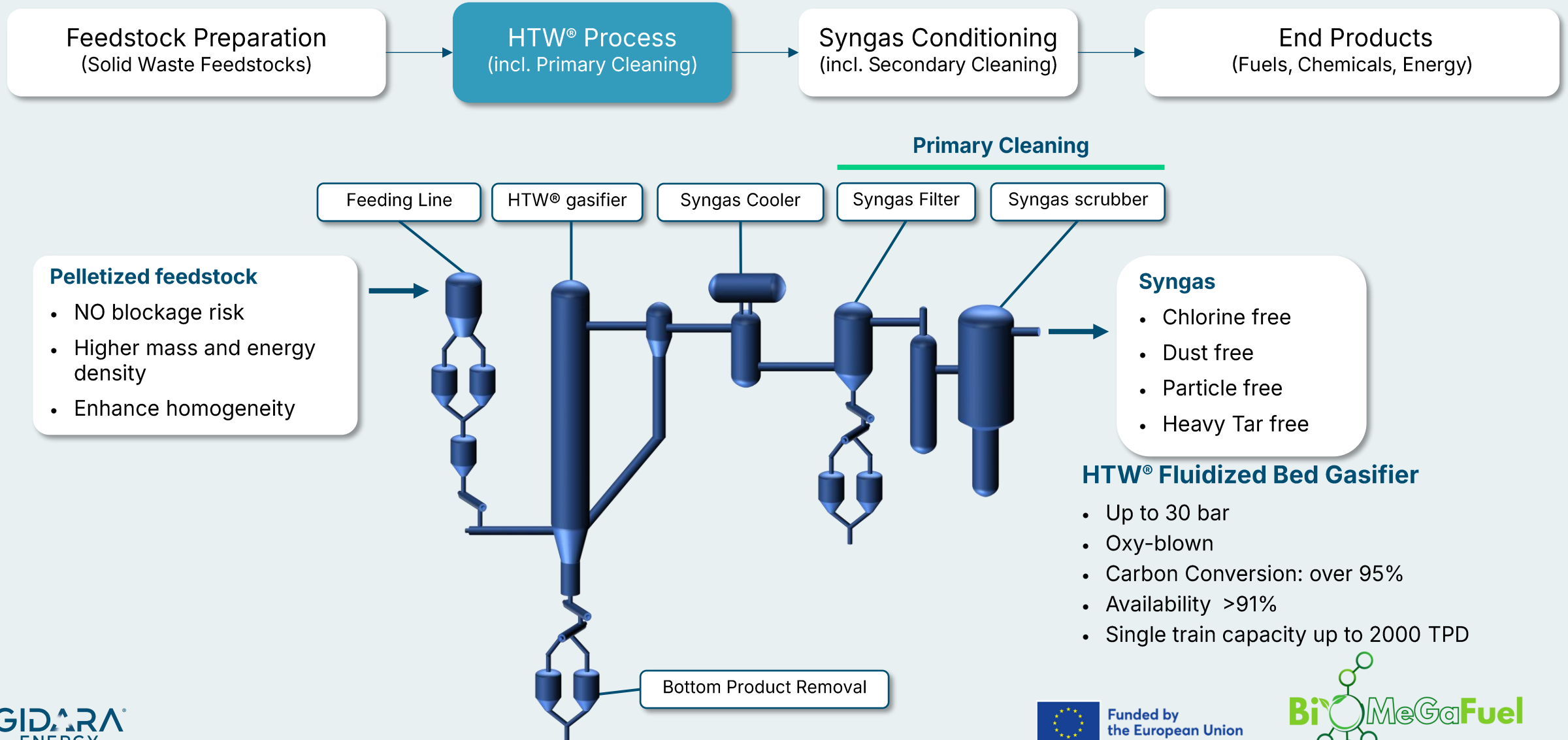
100,000+ Operating Hours (cumulative)

HTW® Gasifier Today

- Industrial Scale Gasifier
 - Pressurized, fluidized bubbling bed
 - Agents: Air or O₂/Steam/CO₂
 - Injected via nozzles at several levels
- Reactor Temperatures (avg.):
 - Fluidized bed: 850 – 1000 °C
 - Freeboard: 950 – 1200 °C
- Pressure: 10 – 30 bar
- Feed: up to 60 t/h (20 and 40 t/h standard, at 15bar pressure)
- C- Gasification degree: over 95 %
- Ideal for multiple feedstocks, including, biomass, waste, coal, etc.
- Designed availability: 8000 h/y (approx. 91 %)



HTW[®] Gasification Island



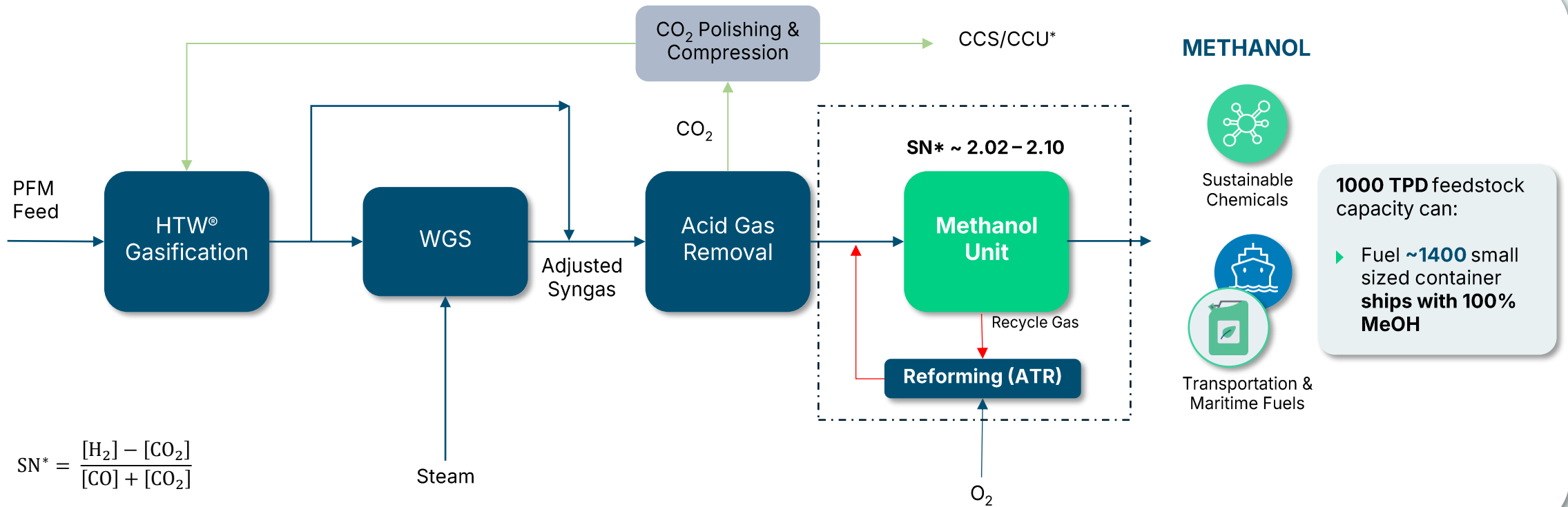
Methanol Production

Feedstock Preparation
(Solid Waste Feedstocks)

HTW® Process
(incl. Primary Cleaning)

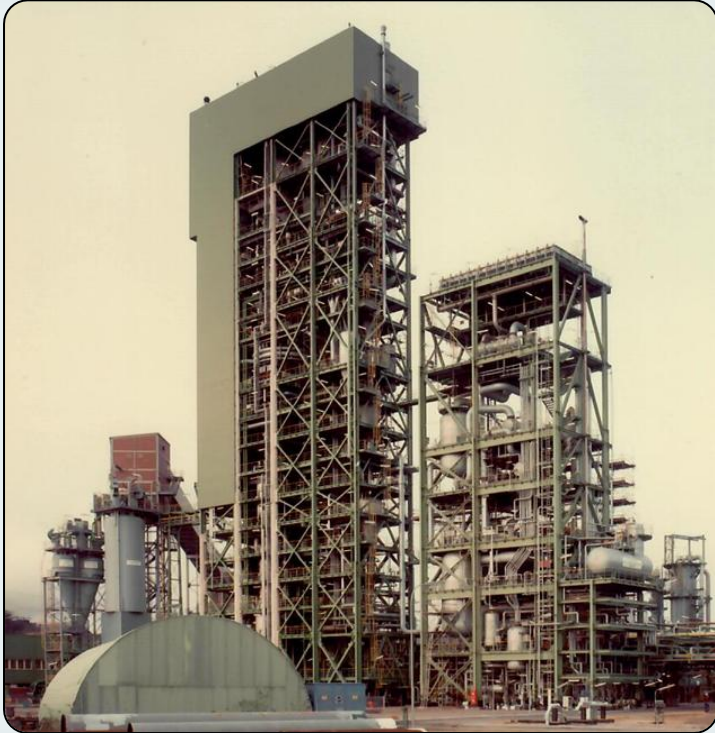
Syngas Conditioning
(incl. Secondary Cleaning)

End Products
(Fuels, Chemicals, Energy)



Commercial Facility – Berrenrath, Germany

Background of the Plant



**Commercial plant at Berrenrath,
Germany**

Operational Highlights

- Feedstock: Coal, plastic waste, RDF, Sewage sludge, waste wood, auto shredder residues, dioxin polluted active carbon
- Total operating hours: 76,000 hours
- Historical availability: 91%, well exceeding the 8,000-hour industry standard
- Total methanol produced: 800,000 tons
- Feedstock: 30 tons/h (720TPD)
- Operating pressure: 10 bar
- Thermal input: 175 MW_{th}
- Gasification agents: O₂ / Steam / CO₂

Note: Berrenrath was closed in 1997 as pricing and customer demand were lower at this time. Following the introduction of RED-II and the accelerating regulatory environment globally, economics of the HTW® process are highly attractive

Commercial Facility - Oulu, Finland

Background of the Plant

HTW Syngas Plant, Oulu/Finland



Commercial plant at Oulu,
Finland

Operational Highlights

Feed: Peat, pre-dried:	640 TPD
Ash content:	6%-wt
Operating pressure:	10 bar
Syngas production:	25,000 Nm3/h
Oxygen use:	7,500 Nm3/h
Cold gas efficiency:	80 %
Ammonia Production:	230-270 tpd

Note: Commercially Proven Efficient Conversion of Peat/Biomass into Hydrogen/Ammonia

Testing Facility – Darmstadt, Germany

Selected test campaigns

April 2020	100% FW 100% RDF
May 2021	75% RDF 25% WW
November 2022	75% WW 25% RDF
July 2023	75% WW 25% RDF
July - August 2024	100% FW 100% RDF
September 2025	100% WW

FW: Forestry wood
RDF: Refused Derived Fuel
WW: Waste Wood

Operational since 2015

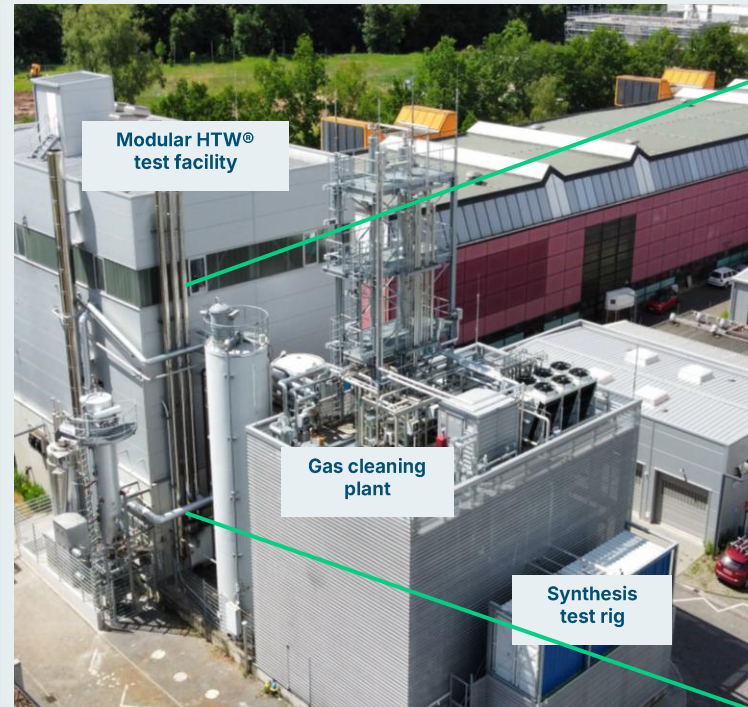
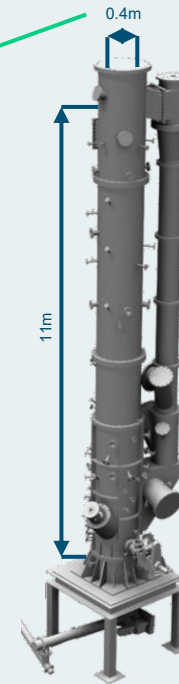
Long term operation feedstocks:

Mono gasification:

- Waste wood
- RDF
- Sewage sludge

Co gasification:

- RDF + waste Wood
- Lignite + RDF



Thermal Input
0.5 MWth

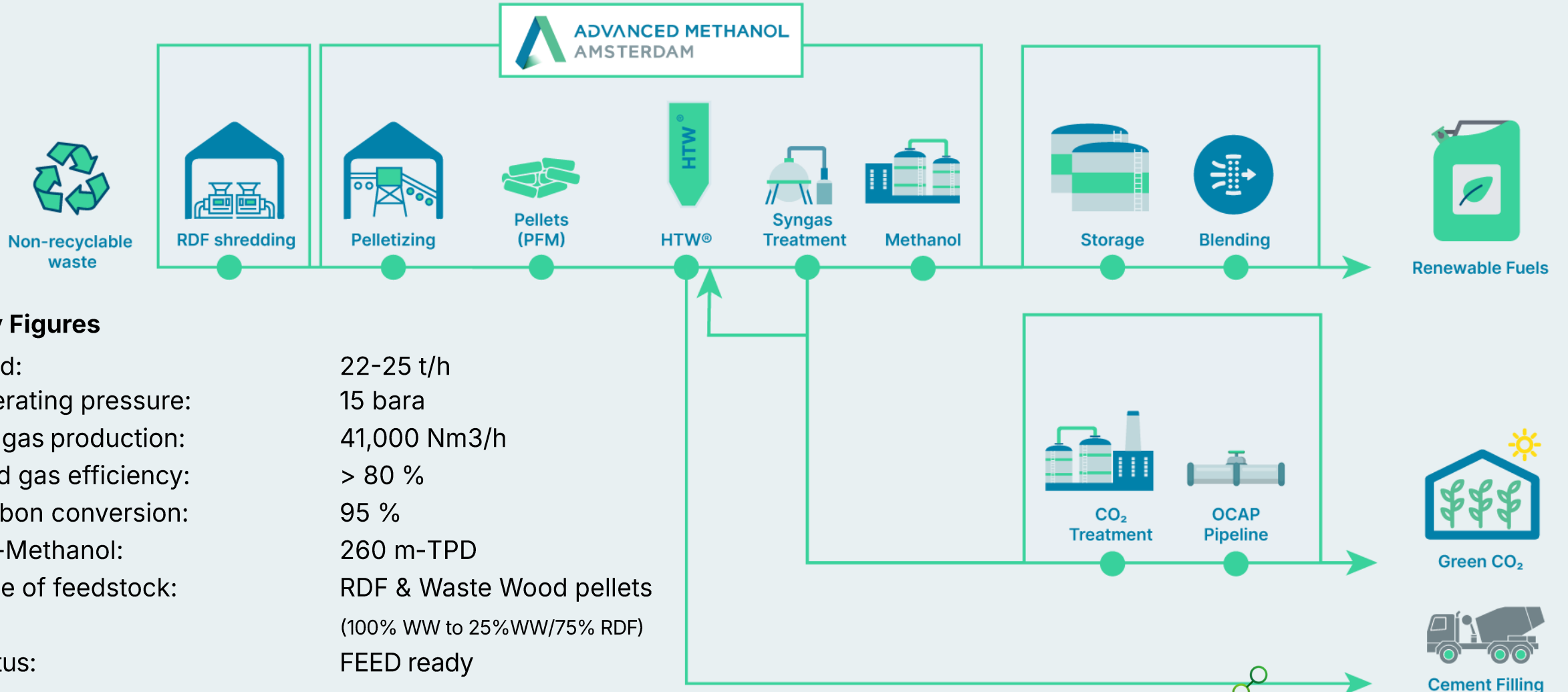
Operation mood
Oxy-blown

Operational hours
>2000 hrs

HTW® facility at TU Darmstadt (Germany)
(Energy Systems and Technology)

 **Funded by
the European Union**

Advanced Methanol Amsterdam



Key Figures

Feed:	22-25 t/h
Operating pressure:	15 bara
Syngas production:	41,000 Nm ³ /h
Cold gas efficiency:	> 80 %
Carbon conversion:	95 %
Bio-Methanol:	260 m-TPD
Type of feedstock:	RDF & Waste Wood pellets (100% WW to 25%WW/75% RDF)
Status:	FEED ready

Thank you!

Dr. Avishek Goel
Head of Technology Development
GIDARA Energy

