

**Proven decarbonisation pathway for
sustainable biofuels and chemicals
production from waste**

GIDARA[®]
ENERGY

Speaker



Dr. Elyas M. Moghaddam

Head of Research & Development

GIDARA Energy

Research associate TUDelft

Q&A Experts



Dr. Ing. Habil. Dobrin Toporov

Gasification Expert

GIDARA Energy

Associate Prof. at RWTH Aachen University



Prof. Dr. Ing. Bernd Eppe

Professor

Institute for Energy Systems and Technology

TU Darmstadt

Who We Are

GIDARA[®]
ENERGY

Investment partner



Ara Partners

Technology Investment

600 Million Euro

Our Technology

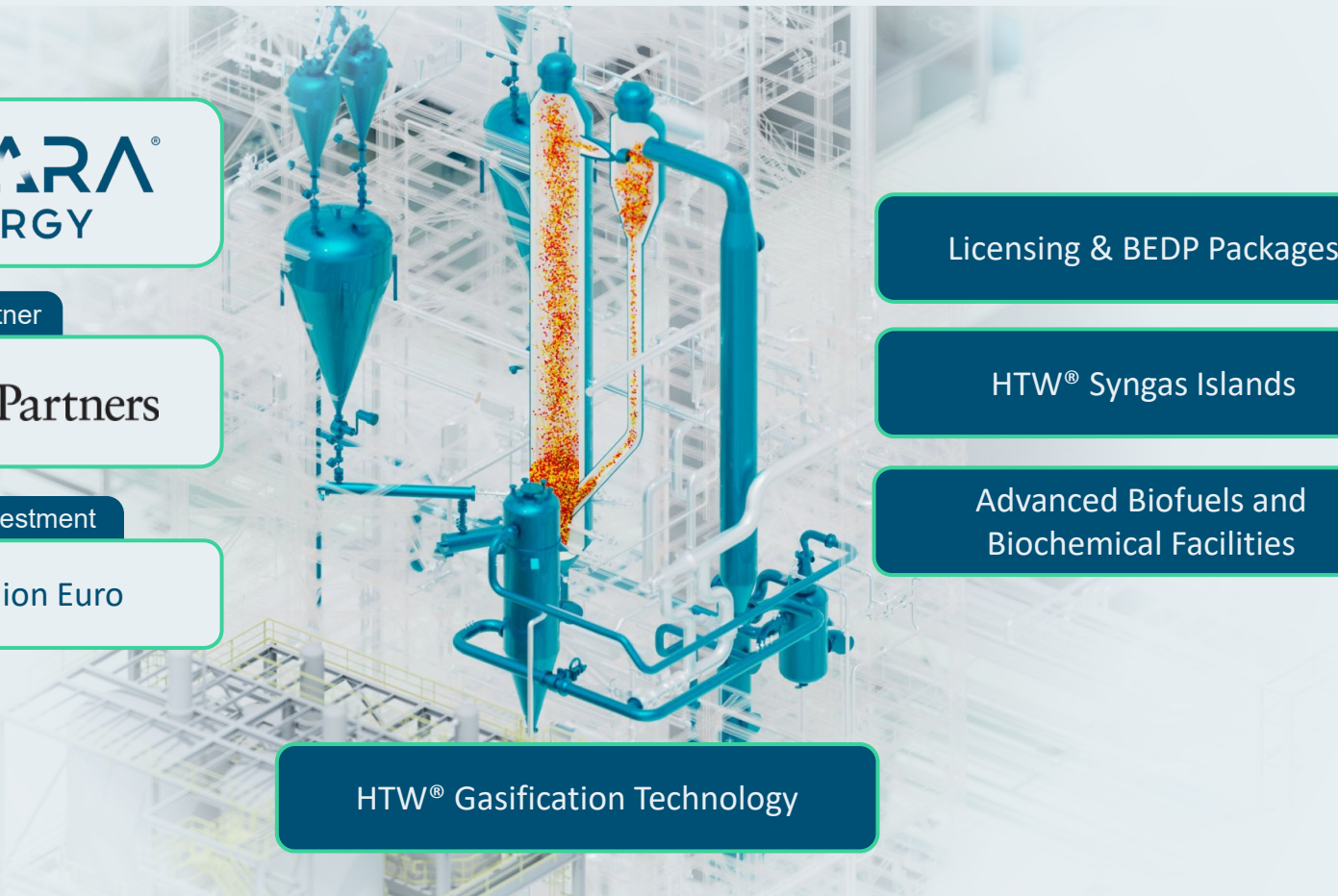
HTW[®] Gasification Technology

What We Do

Licensing & BEDP Packages

HTW[®] Syngas Islands

Advanced Biofuels and
Biochemical Facilities



Global Challenges



Increasing GHG emissions causing climate change, lead to a high demand of sustainable energy sources



Our energy production and irresponsible waste management contribute directly to climate change



Emerging technologies face challenges in converting solid waste to sustainable energy

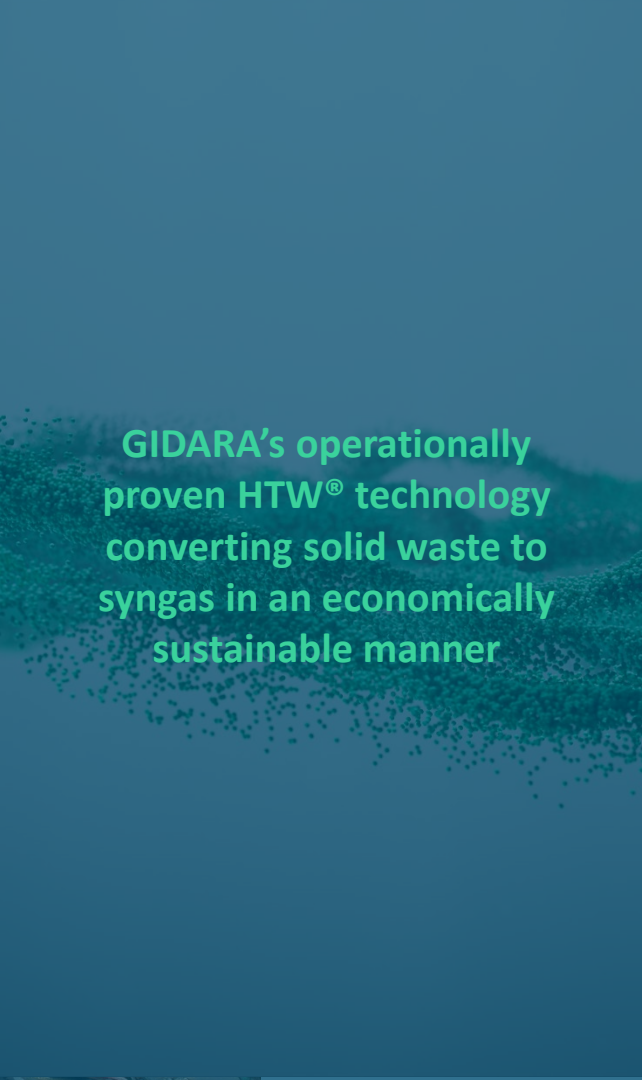
Our Solutions

A photograph of three industrial smokestacks emitting thick white smoke against a clear blue sky. The image is overlaid with a semi-transparent blue filter.

We can utilize waste as a
virtually limitless
feedstock to reduce GHG
emissions

A photograph of a yellow bulldozer operating on a large pile of garbage and plastic waste. The sky is blue with some clouds. The image is overlaid with a semi-transparent blue filter.

We have unlocked the
value of non-recyclable
waste as feedstock

A photograph of a large, dense cloud of green particles or dust, possibly from a construction site or a natural phenomenon. The image is overlaid with a semi-transparent blue filter.

GIDARA's operationally
proven HTW[®] technology
converting solid waste to
syngas in an economically
sustainable manner

Our Purpose and Strategy

Our Purpose

**Help solve humanity's
waste problem, reduce CO₂
emissions and thus
combat climate change**



Our Strategy

**Use our HTW[®]
technology to achieve our
purpose by producing
sustainable clean chemicals
and fuels**



Unlocking Potential: Waste to High Value Products

Feedstock

Wood
Waste



Sewage
Sludge



Municipal
Solid Waste



Non-Recyclable
Plastics



Waste
Paper



Agricultural
Residue



Construction &
Demolition Waste

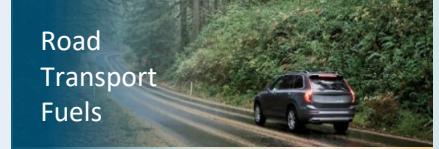


HTW[®] Gasification



Sustainable Fuels and Chemicals

Road
Transport
Fuels



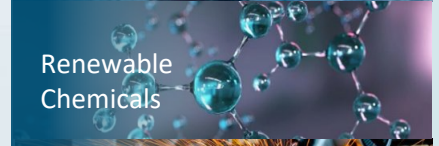
Sustainable
Aviation Fuels



Sustainable
Maritime Fuels



Renewable
Chemicals



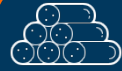
Renewable
Steel
Production



Innovative Solutions: Key Advantages of HTW[®] Technology



High Temperature Winkler (HTW[®]) Technology



Optimized Feedstock Handling: overcoming limitations through advanced feeding systems



Proven Operational Experience: reducing risk with over 10 years HTW[®] operational experience

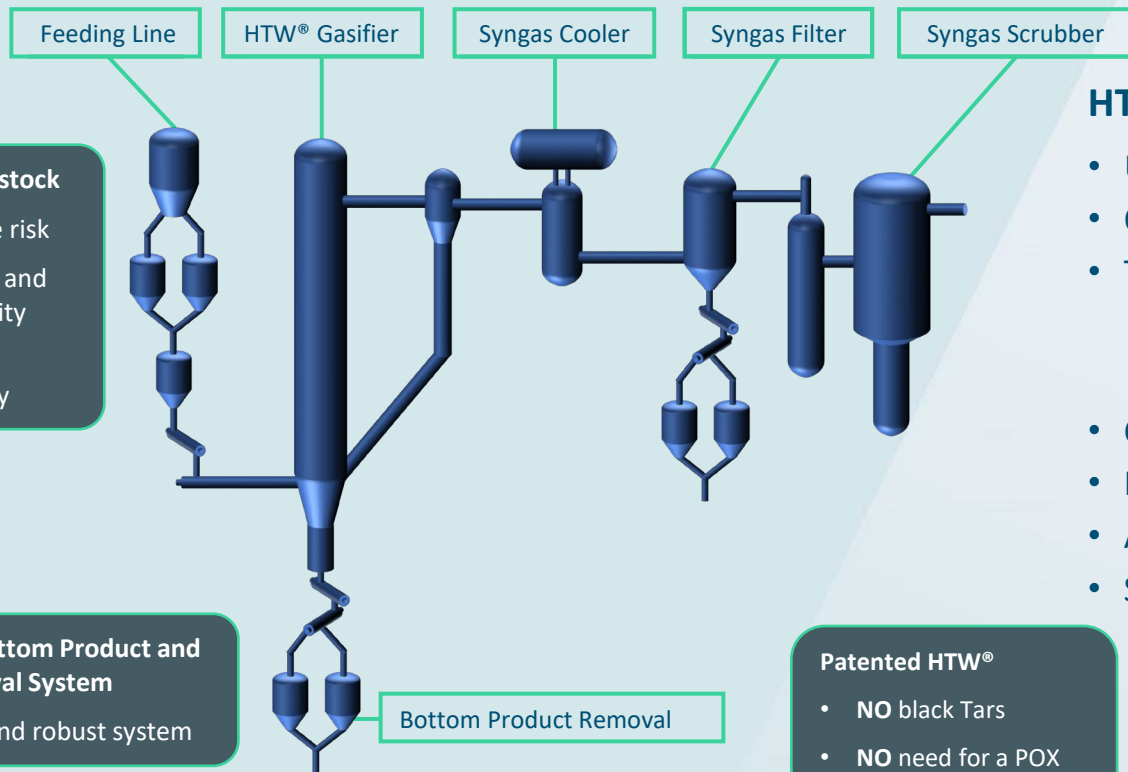


Economic Feasibility: unlocking waste to clean chemicals and fuels by closing the supply and demand gap



Maximizing Sustainability: integrating gasification for significant GHG reductions

HTW® Technology: Solves Classic Gasification Challenges



HTW® Fluidized Bed Gasifier

- Up to 30 bar
- Oxy-blown
- Thermal zones:
 - Fluidized Bed: 750 - 1000°C
 - Freeboard: 900 - 1200°C
- Carbon Conversion: >95%
- High Cold Gas Efficiency: >85%
- Availability: >91%
- Single Train Capacity: up to 1000 TPD

HTW® Technology: 10+ Years Operationally Proven at Commercial Scale



1970s

Rheinbraun & ThyssenKrupp developed the pressurized version of the gasifier known as the High Temperature Winkler (HTW®) process

Key reference plant

1986 - 1997



Commercial plant
at Berrenrath, Germany

Input → **Output**
Methanol

Purpose/learnings of the plant

- ✓ Methanol production from syngas
- ✓ Long-term use of RDF + plastic sources, feedstock flexibility
- ✓ Pressure range 10 bar

1988 - 1994



Commercial plant
at Oulu, Finland

Input → **Output**
Ammonia

Purpose/learnings of the plant

- ✓ Produce ammonia from syngas
- ✓ Utilisation of peat and waste wood as feedstock, feedstock flexibility
- ✓ Pressure range 10 bar

1989 - 1992



High pressure plant
at Wesseling, Germany

Input → **Output**
Syngas

Purpose/learnings of the plant

- ✓ Sustainable HTW® gasification operations under 25 bar

1999 - 2002



Demonstration plant
at Niihama, Japan

Input → **Output**
Syngas

Purpose/learnings of the plant

- ✓ Utilizing direct municipal solid waste as feedstock to produce syngas

Key reference plant

2015 - current



Demonstration plant
at TU Darmstadt, Germany

Input → **Output**
Syngas

Purpose/learnings of the plant

- ✓ Feedstock testing and continuous research and development on HTW® technology
- ✓ Full production including methanol

Today

Improved to current technological and environmental standards

Implemented advanced design for feeding line, BOP, dust removal system & raw gas cooling system

Higher operational efficiency, optimum heat integration and reduced emissions

Adapted with 100% non-recyclables as feedstock



Fossil fuels (coal, lignite)



Biomass (incl. waste wood)



Waste

Demonstration Plant: Feedstock Testing & Validation



Long-Term Operation Feedstocks:

Mono-Gasification:

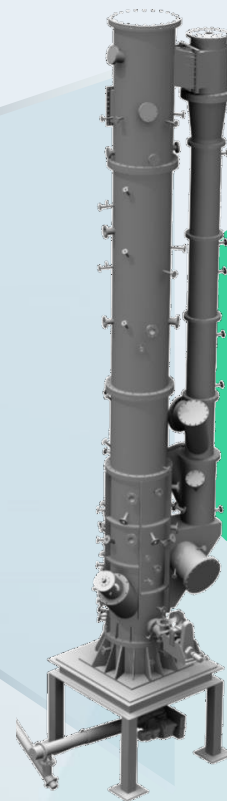
- Waste wood
- RDF
- Sewage sludge

Co-Gasification:

- RDF + waste Wood
- Lignite + RDF



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



Thermal Input:
0.5 MWth

Operation Mode:
Oxy-blown

Operational Hours:
>2000 hrs

Economic Feasibility: Bridging Supply Gaps with Waste As Feedstock



Road Transport — Advanced

Regulatory efforts create a material near-term market opportunity for sustainable road fuels



Maritime — Advanced

Sizeable maritime opportunity supported by new regulations and voluntary commitments



Aviation — Advanced

SAF is expected to displace a significant share of conventional jet fuel in the long-term, with material commitments from airlines already in place



Sustainable Chemicals

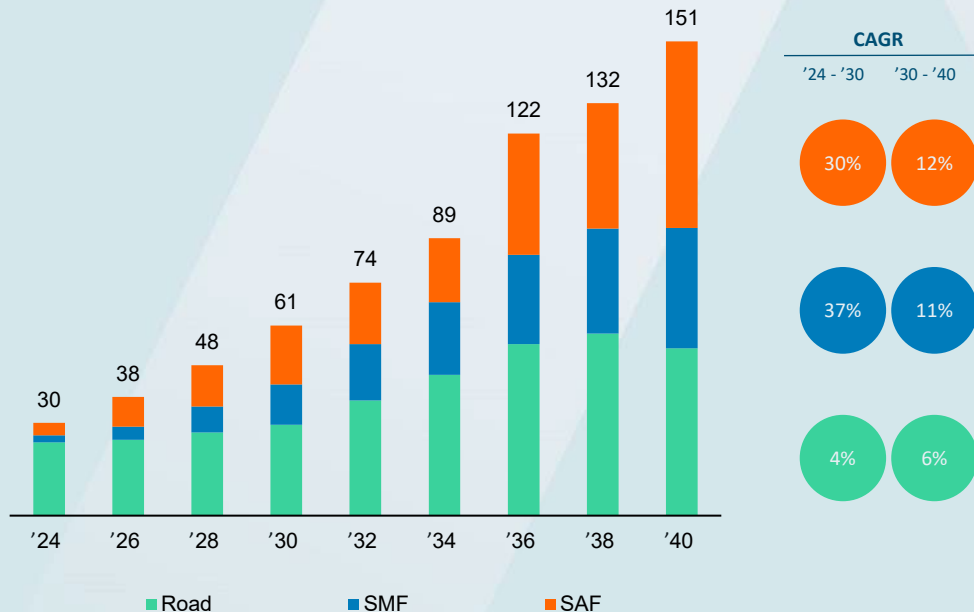
National efforts for bioplastic mandates and industries circular economy commitments offer considerable opportunities for sustainable chemicals



Source: Argus

European Liquid Sustainable Hydrocarbon Transport Demand

MTA methanol equivalent

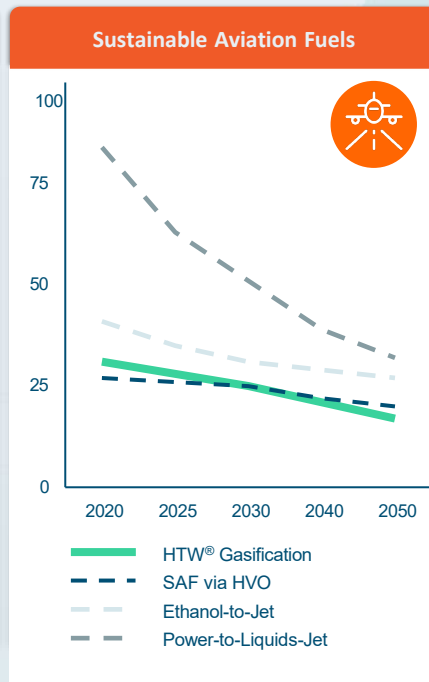
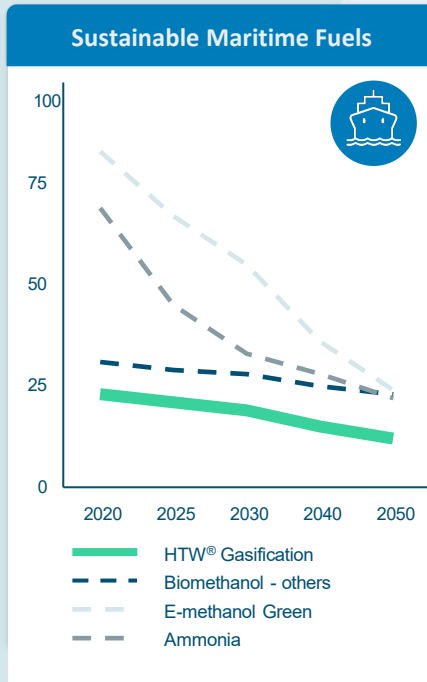
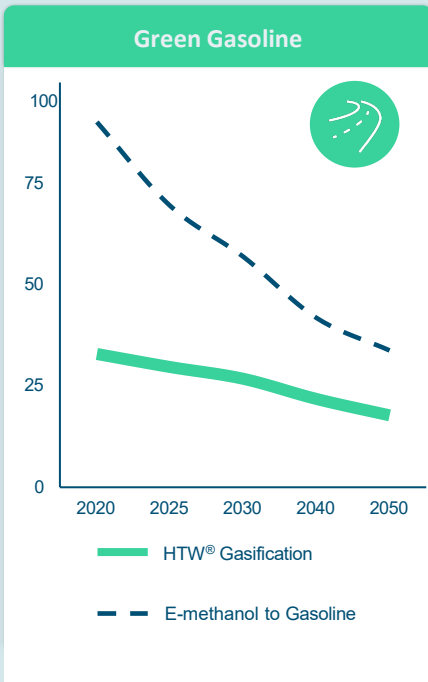
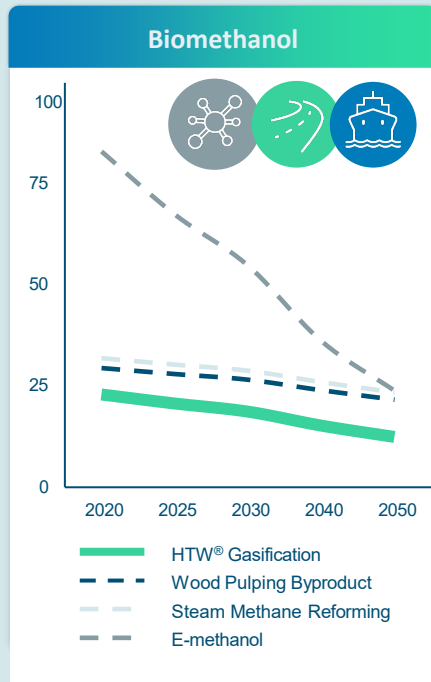


Economic Feasibility: Cost Advantaged Pathway for Decarbonization



Projected Cost by Technology

Real Terms, \$/GJ

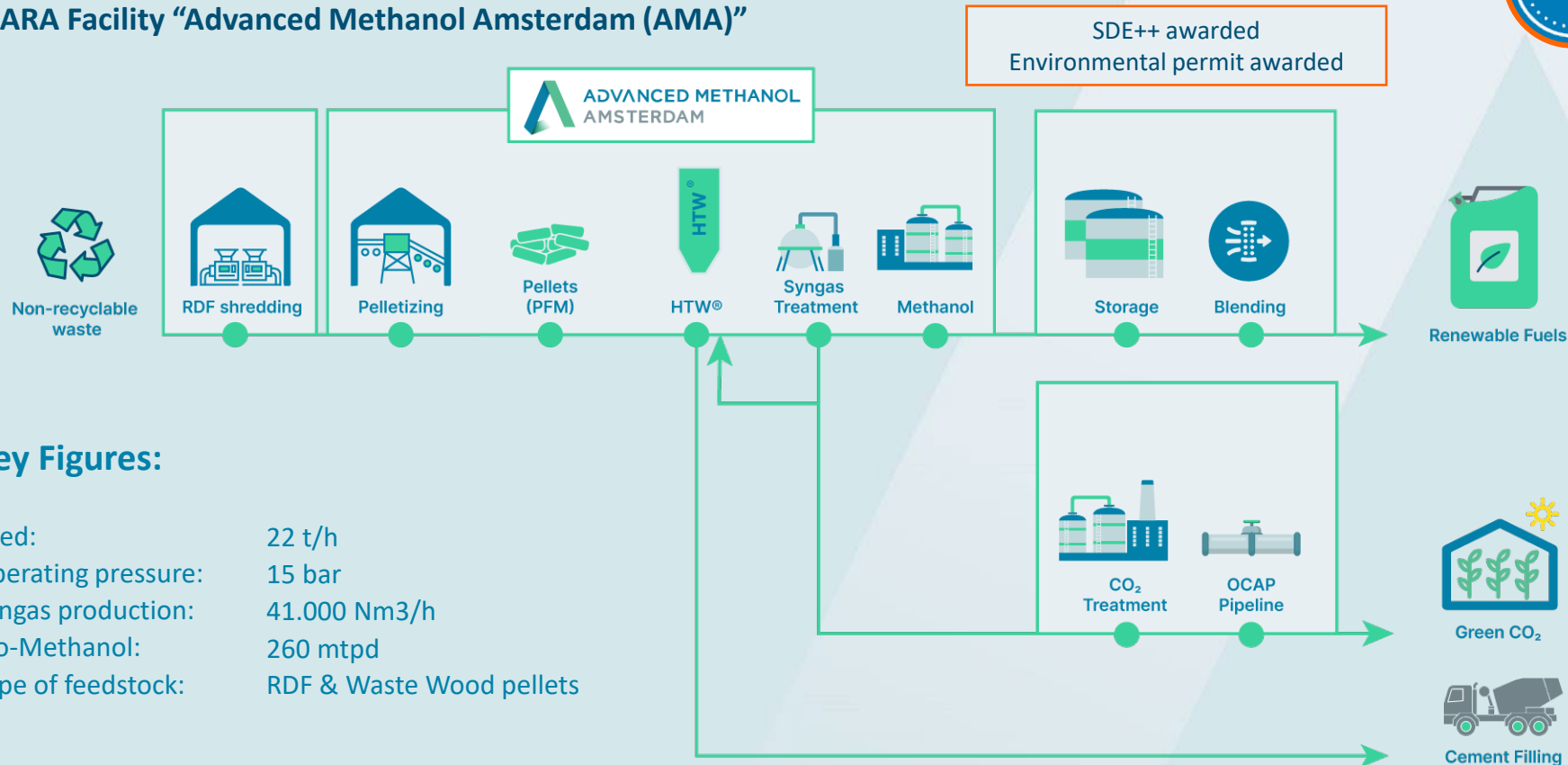


Source: McKinsey

Integrated Value Chain: HTW[®] to Advanced Methanol



GIDARA Facility “Advanced Methanol Amsterdam (AMA)”



Maximizing Sustainability: Emission Reduction Potential with GIDARA's HTW[®]



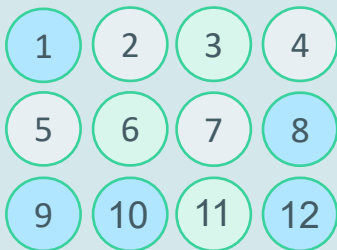
Waste to
Advanced
Methanol



Waste to Green
Gasoline



Waste to
Sustainable
Aviation Fuel



By 2040
12 renewable fuel
plants utilizing HTW[®]
Technology

Today

2040

Renewable Fuel Plants Through
HTW[®] Gasification Have the Potential for:

Emission Reduction

up to **3.13 million**
tonnes CO₂e per
year

771,468
Cars Off the Road

Waste Reduction

up to **1.33 million**
tonnes of waste
per year

210,355 Garbage
Trucks Avoided

Key Take-Aways



✓ **High Feedstock Flexibility
with Waste Streams**

✓ **Over 95% Carbon Conversion
Efficiency**

✓ **Robust Operational System
with No Black Tars Formed**



✓ **Proven 10+ years of
Operation at Commercial
Scale**

✓ **Upgraded Technology to
Today's Standards**

✓ **Reliable HTW® Technology
with Operational Availability >
91%**



✓ **Cost Advantaged Pathway
To Sustainable Chemicals
And Fuels**

✓ **Unlocking a New Pathway
Bridging Supply-Demand Gap**

✓ **Opportunity for Circular
Chemicals Production**



✓ **Decarbonizing Hard to
Abate Industries**

✓ **Up to 3.13 million tones CO₂e
savings per year**

✓ **Waste Reduction up to 1.33
million tones per year**

Join us in solving the waste and energy challenge to combat climate change



Licensing & BEDP Packages



HTW® Syngas Islands



Advanced Biofuels & Biochemicals Facilities

The background of the slide is a blue-tinted aerial view of a large industrial facility, likely a refinery or chemical plant. It features a complex network of white metal scaffolding, walkways, and various industrial vessels. A prominent vertical distillation column is visible in the center, showing a red and orange internal structure. To the left, there are several large, conical storage tanks. The overall scene is industrial and technical.

Interested in doing business?

Contact us:
info@gidara-energy.com
gidara-energy.com

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