# How manufacturers can decarbonise heat

**Technology mini guide one of three:**

## Low carbon fuels

verco
a bip. company

# Understand your options for decarbonisation technology

verco
a kpl company

“For industrial organisations, implementing decarbonisation technology is almost always the largest step to decarbonisation. It typically accounts for 50-70% of site emissions.

For most industries, there are an overwhelming number of solutions, possibilities and combinations to choose from on the path to decarbonisation.

Knowing what the options are is the first step and so we have created these mini guides to help you become more familiar with the potential solutions.”

**Thanos Patsos, Associate Director, Head of Deliver for Zero, Corporates**

# Options overview

verco
a kiwa company

In this guide we compare several key low carbon fuels and outline the key considerations, benefits and risks.
Browse the other guides in this series to find out more about electrification of heat and renewable thermal.

## Electrification of heat

- Heat pumps
- Electric boilers

## Low carbon fuels

- Hydrogen
- Biogas
- Biomass

## Renewable thermal

- Deep geothermal
- Solar thermal

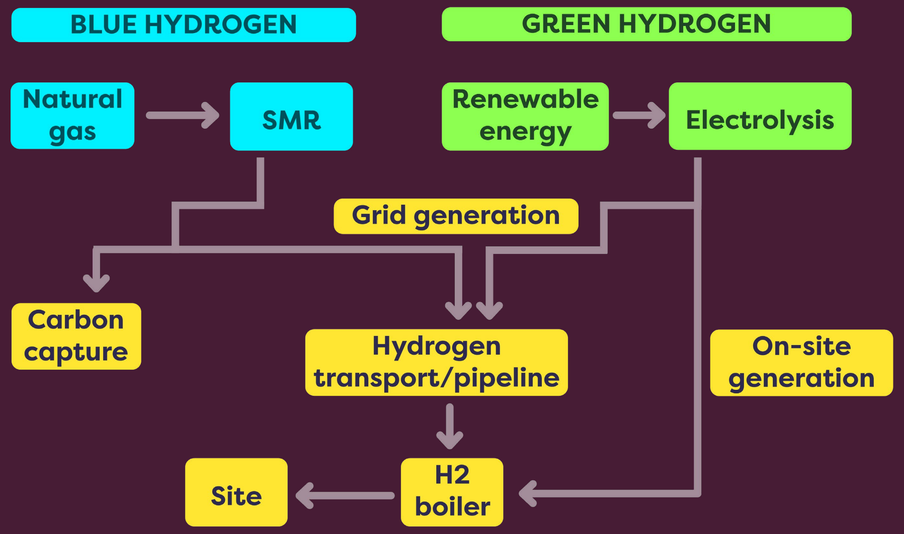
# Hydrogen

verco
a kpl. company

Hydrogen fuel can be derived from multiple sources. You can see some of them in the table below. Blue and green are planned routes for most future low-carbon hydrogen.

Hydrogen is a potential solution for the hardest to abate sections of industry with specific very high temperature requirements (e.g. chemicals, glass & minerals, iron & steel manufacturing).

For industrial processes with temperatures < 200°C, electrification is likely to provide a more attractive alternative due to its energy efficiency and availability.




| | |
|---|---|
| **Technology maturity** | Green hydrogen (electrolyser) technology is becoming available, CCUS for blue hydrogen not currently available. |
| **Potential net zero carbon impact** | A good option for very high temperature manufacturing but depends on source of $H_2$. |
| **Fuel availability** | Very location-specific. |
| **Capex** | High capital for local generation via electrolysers, uncertain costs for grid hydrogen. Onsite costs low, may need to change boiler burner. |
| **Opex** | Green $H_2$ – very high.<br>Blue $H_2$ – likely to be more competitive vs. fossil fuels. |

## Hydrogen colours

Green - electrolysis from renewable electricity

Blue - fossil fuels with $CO_2$ capture

Grey - natural gas no $CO_2$ capture

Brown/black - coal no $CO_2$ capture

Pink - electrolysis from nuclear generated electricity

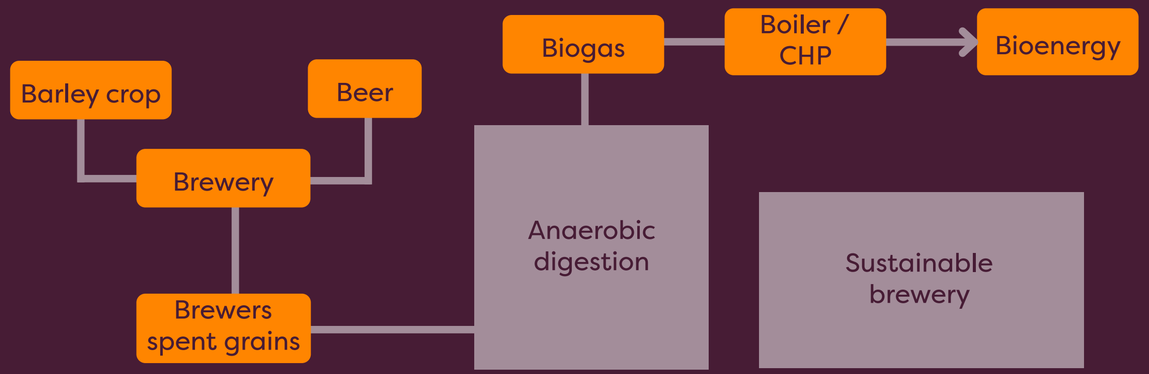
# Biogas

Biogas can be produced via anaerobic digestion utilising waste feedstocks. It can also be biologically treated and converted into highly calorific biomethane.

Biomethane can be used in boiler systems or CHPs, substituting natural gas. It can also be used in bio-LNG converted heavy goods vehicles.

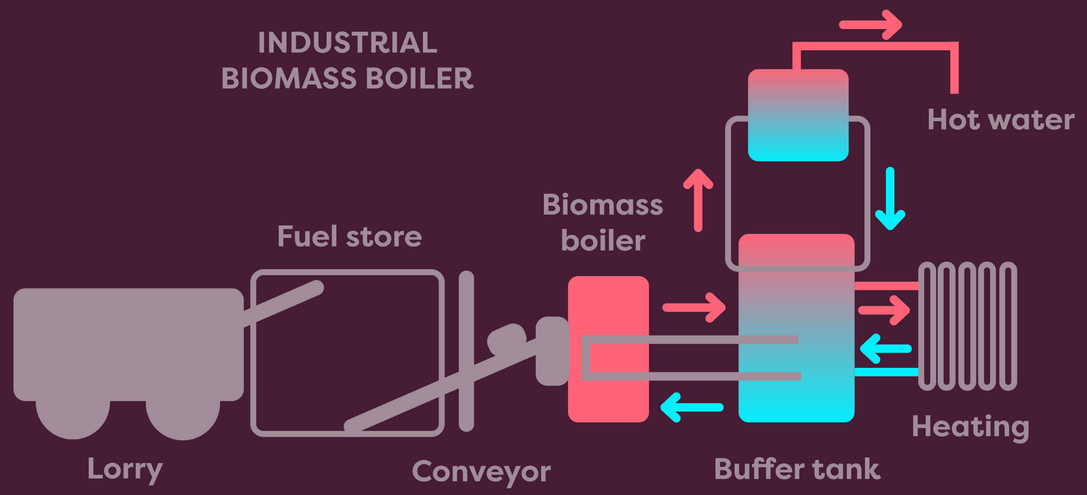
Biogas technology is most likely to be useful for large processing plants with significant waste or residue streams.

| | |
|---|---|
| **Technology maturity** | Established technology for the processing industry (dairy, meat, pulp & paper, wastewater), less potential for the heavy industry. |
| **Potential net zero carbon impact** | Biogas is unlikely to meet all needs for low carbon heat. |
| **Fuel availability** | Reliable feedstock supply is fundamental to profitable AD. |
| **Capex** | AD plants are capital intensive, alongside high footprint requirements. |
| **Opex** | Higher maintenance and running costs for the AD plant, but fuel is free once treated, offsetting the cost of fossil fuels. |



# Biomass

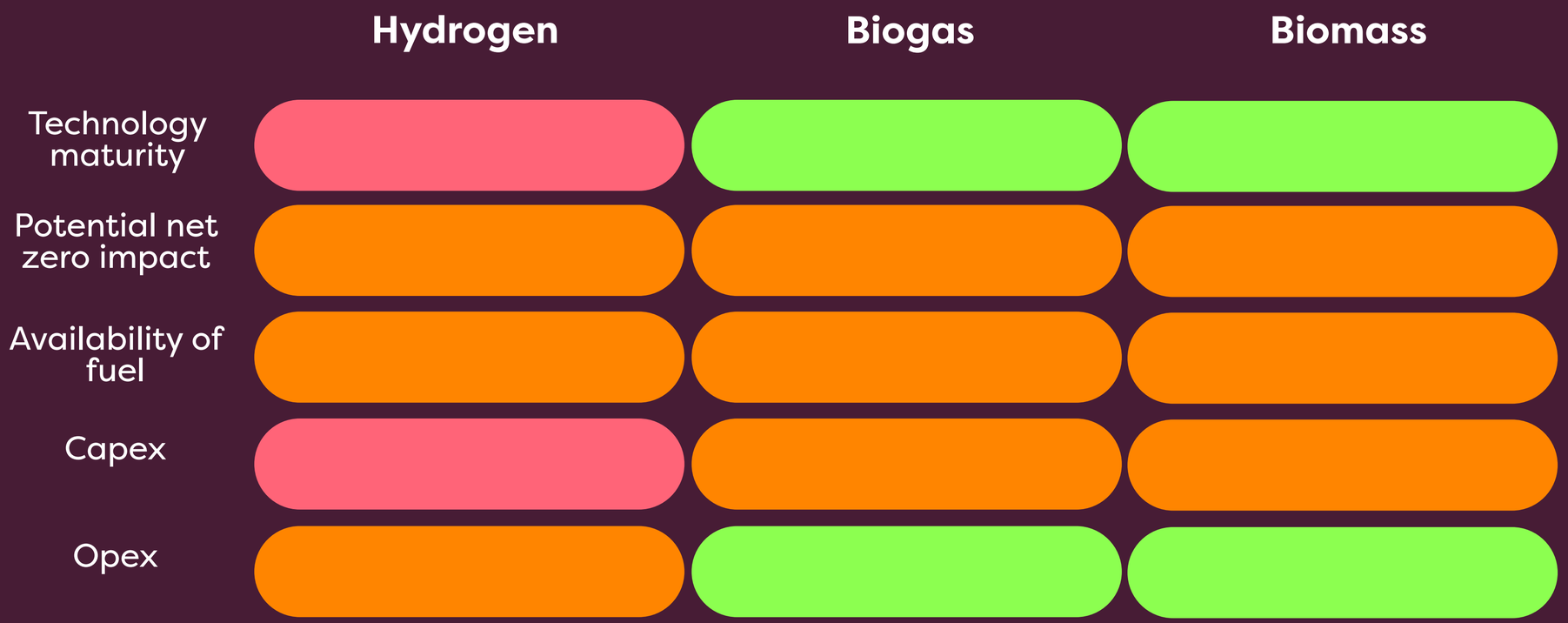
Similar to hydrogen, biomass is expected to play a small but targeted part in the decarbonisation of industrial heat. Biomass is usually used for electricity generation, with carbon capture added in the future.  Biomass can provide all the same heating functions as conventional fossil fuel systems, for example steam production, so it can be used to replace a conventional boilerhouse or CHP.




| | |
|---|---|
| **Technology maturity** | Very mature technology. Practicality of running large industrial biomass plants can be challenging. |
| **Potential net zero carbon impact** | Need to consider air quality and noise impacts. Scrutiny over sustainable biomass sources is likely to increase, e.g. import of banned first generation forest. |
| **Fuel availability** | Securing a long term, local & sustainable biomass supply is a challenge. High frequency of deliveries required – traffic on site. |
| **Capex** | Up to 50% more than typical fossil fuel boiler, alongside additional capital cost relating to fuel storage. |
| **Opex** | Highly dependent on supply, but can be close to parity with traditional fossil fuel boilers. |

# Fuel comparison

verco
a kol. company



# Other low carbon fuels

verco
a kol. company

| | Renewable methane | Bio-LPG | Biodiesel | Hydrogenated vegetable oil (HVO) |
|---|---|---|---|---|
| Overview | A second way to replace natural gas directly from renewable sources. Renewable methane is derived from green hydrogen with an additional reaction step with $CO_2$ to produce methane. | A low carbon alternative to LPG. It is derived as a by-product of the biodiesel production process and is chemically identical to LPG so would require no costs to change infrastructure. | Biodiesel, an alternative to fossil fuel derived diesel, is produced by converting fatty acids (e.g. waste cooking oil or food waste) into biodiesel and other co-products. | HVO is made via hydrotreatment of waste vegetable oils and fats, with the resulting fuel functionally identical to fossil fuel derived diesel. |
| Technology maturity | Green hydrogen additional process step | Very limited technology penetration worldwide | Mature large & continuous refineries that produce biodiesel do exist | Hydrocracking facilities are present in multiple countries globally |
| Potential net zero impact | High impact potential | High impact potential (ca. 90% reduction) | To meet common diesel standards blends of up to 20% have been reported | High impact potential (ca. 90% reduction) |
| Availability of fuel | Highly dependent on location | Limited production worldwide | Already used in road transport diesel and home heating to reduce emissions | Availability is increasing |
| Capex | Additional capital on top of green hydrogen | Drop-in-and-go alternative to LPG, no on-site changes needed | Small modifications may be required | Drop-in alternative to diesel |
| Opex | High compared to fossil fuel derived methane | Price premium on standard LPG | Price premium on standard diesel | Can add an additional ~50% to Opex vs. standard diesel |

# Consider low carbon fuels

“Low carbon fuels can provide a sustainable solution for heat decarbonisation, but are being increasingly selected for hard-to-abate sectors or specific location/process reasons. For a more standardised production process with heat demands less than 200°C, electrification of heat might provide a more attractive alternative.”

**Jonny Pigott, Senior Consultant, Deliver for Zero Corporates**

See our guide to these technologies here:

**Link to electrification of heat guide**

# How we can help

## Take a look at the other mini guides in this series:

**Renewable thermal mini guide**

**Electrification of heat mini guide**

## Low-Carbon Heat Investment Blueprint

This cost-effective service will provide you with:

- A tailored and evidence-backed assessment of viable heat decarbonisation solutions.
- Investment cost range, carbon and cost savings from each solution.
- A clear direction on progressing to a concept solution design or business case.

**Browse the service document to find out more**