



# Introducing CFL

Defossilising the hard-to-abate LPG and off-grid energy sector.

# The Off-Grid Energy Challenge

The off-grid heating market is significantly larger than the aviation fuels market, and more importantly, addresses areas regarding air quality and displacement of primary fossil sources – oil, coal and wood (which causes deforestation). The project is therefore critical infrastructure – that will ultimately save lives. The ESG credentials of the project and ability to impact cost-of-living are second to none.



Across the world, over 200m tonnes of Liquefied Petroleum Gas (LPG) is used for energy per year, providing portable, clean burning fuels to billions of people living and working off the mains gas grid. For many of these applications, mainstream solutions such as hydrogen or electrification will not be suitable due to geography, practicality or affordability.



There is a clear need for alternative renewable energy solutions in off-grid areas, whether for homes and businesses in rural areas, hard to electrify HGVs or industrial processes.



To address this, the LPG Industry across the globe are transitioning to 'drop-in' renewable liquid gases. Dimeta is supporting this transition by producing rDME and accelerating its adoption, which alongside other renewable liquid gases can reduce carbon emissions, improve air quality in an affordable way.

# What is rDME?

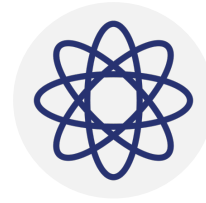
Renewable and recycled carbon DME is a safe, clean-burning, sustainable fuel that can support decarbonisation of the off-grid energy sector including domestic and commercial heating and cooking, industry and transport.



**Chemically similar**  
to propane and butane



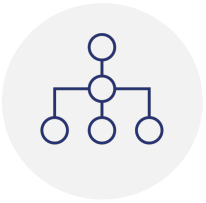
**Easily transported**  
as a liquid in pressurised  
cylinders and tanks



**Can be blended with LPG**  
and used in existing applications



**Can reduce GHG emissions significantly**  
compared to LPG & heating oil



**Easily distributed**  
using existing LPG infrastructure at the  
same pressure



**Can be produced today**  
from a wide range of sustainable, locally  
sourced, feedstocks



**DME has been used safely**  
in industrial applications for  
decades



**Similar to LPG, substantially reduces  
pollutants such as NOx, SOx, and PM**  
compared to solid and liquid fuels

# LPG: Energy for the Off-grid Areas

LPG (propane) is a **liquid gas** that allows the off-grid areas to have access to a **clean** and **affordable** form of **energy**.

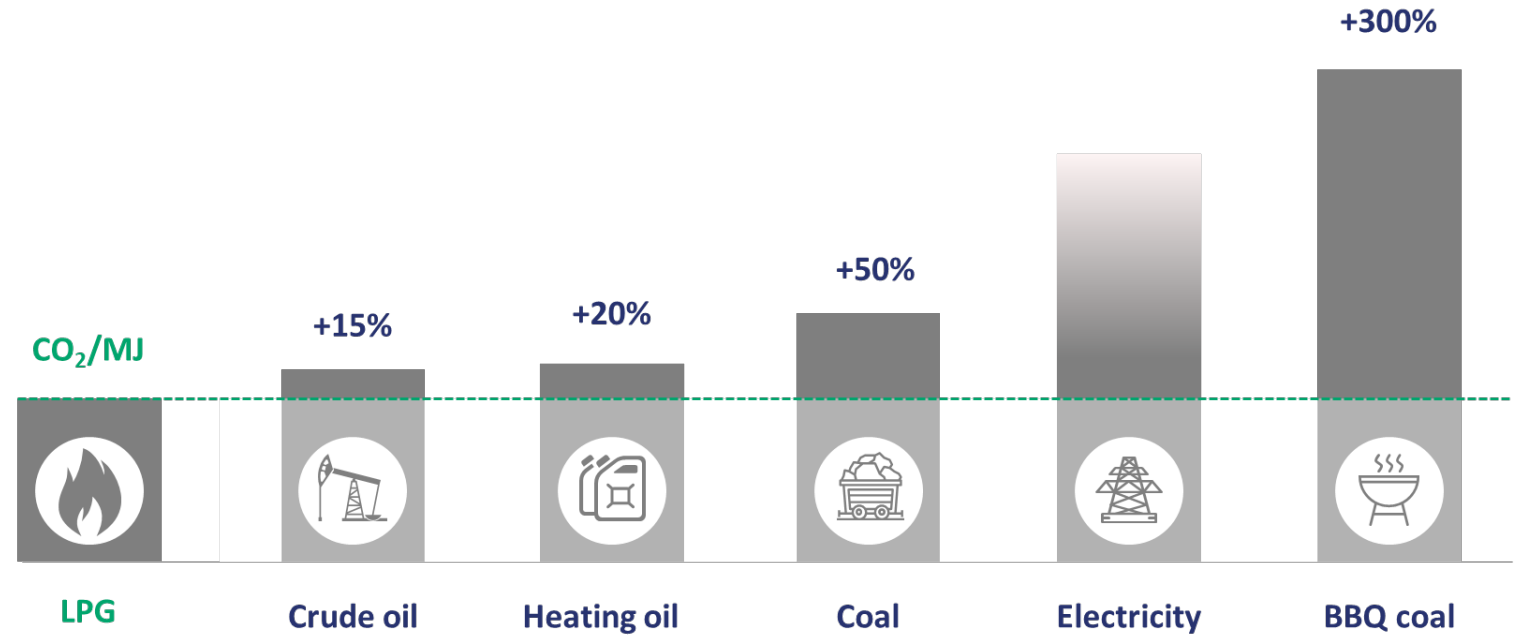
It is used in different applications, from transportation to heating and cooking all-over the world.

**Renewable LPG** is already available, but in limited quantities.

LPG energy usage:

 **>200M** tons/year

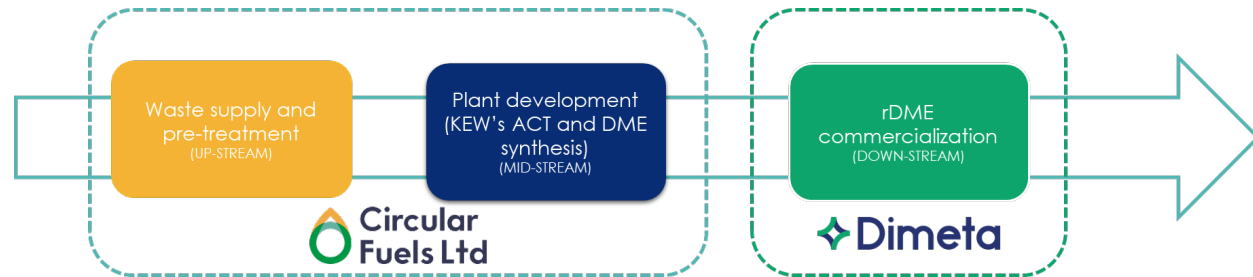
 **+25%** over 10 years



# Defossilising Off-Grid Energy



Circular Fuels Ltd (CFL) is a partnership between Dimeta [www.dimeta.nl](http://www.dimeta.nl) and KEW Technology [www.kew-tech.com](http://www.kew-tech.com). We are a specialized **project development company**, developing construction-ready renewable and recycled carbon DME from waste production plants.



# Dimeta

**Dimeta** is a joint-venture between **SHV Energy** and **UGI International** advancing the production and use of renewable and recycled carbon Dimethyl Ether, a low-carbon sustainable liquid gas, to accelerate renewable solutions for the LPG and off-grid energy industry.



**SHV ENERGY**

**Family owned**

**25** countries

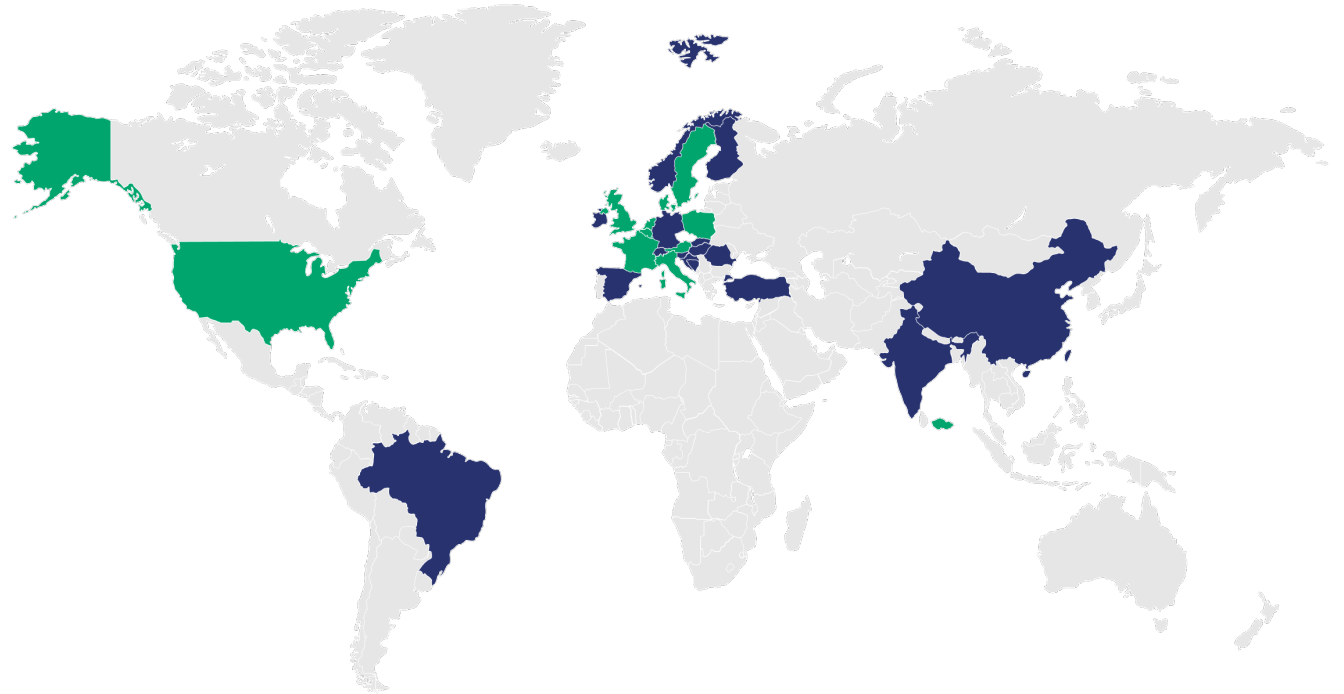
**17k +** employees



**US main market listed**

**18** countries

**11k +** employees



# KEW Technology:

## Delivering a world beyond fossil fuels

Sustainable energy solutions company **using proprietary technology** and development capability **to convert waste and biomass-based feedstocks** into **advanced energy vectors** efficiently and cost-effectively.

Proprietary and **proven pressurised advanced gasification technology** provides leading levelized cost of production and energy efficiency.

**Over 10-year from development to deployment** with a full commercial product demonstrator (**>£50m invested in flagship** facility in the UK).

Over £28m of **public programme funding** secured for technology demonstration and for projects across the energy transition landscape.

Clearly defined **commercial roll-out strategy** and **maturing sales pipeline** supported by blue-chip multi-national energy corporates.

Clearly defined **waste feedstock strategy** aligned to waste majors' future requirements.





# CFL's Arboretum Project Pipeline Underlying Technology

## Commentary

Renewable and recycled carbon DME can be produced from a wide range of sustainable feedstocks

Arboretum projects will utilize KEW Technology's advanced gasification process, in combination with RenFud's proven proprietary DME synthesis technology, to produce its target of >50,000 tonnes of renewable and recycled carbon DME annually.

The combination of these two technologies makes Arboretum a first of a kind (FOAK) project.

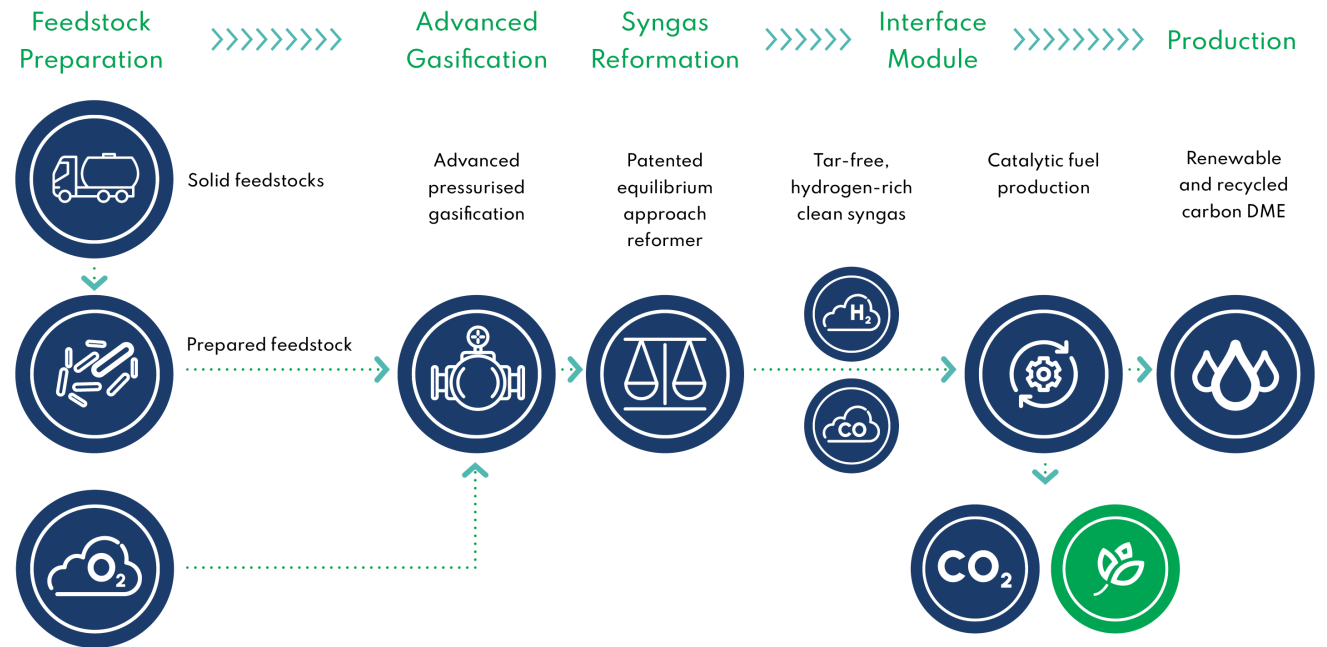
Renewable and recycled carbon DME is chemically similar to propane and butane and has a variety of end uses. It can be blended with LPG and used in existing applications.

The end product is easily transported as a liquid in pressurized cylinders and tanks and can also be used as a hydrogen carrier.

## Key Advantages

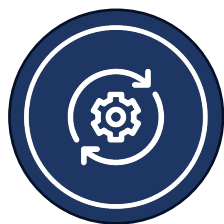
- **Simple product:** Single molecule that can be produced from a wide range of feedstocks and inputs.
- **Easily transportable:** Renewable and recycled carbon DME is chemically similar to propane and butane. Similarly to LPG, it can be transported in liquid form.
- **Sustainable:** Renewable and recycled carbon DME produced at Arboretum is estimated to reduce GHG emissions by c.70% and has the potential to be negative carbon<sup>1</sup>.
- **Multiple end uses:** It is used in different applications, from heating to transportation and as a clean cooking fuel all-over the world

1. If connected to the planned Teeside carbon sequestration facility





# First of its kind waste to energy project advancing the production of renewable and recycled carbon dimethyl ether (rDME)



## Benefits of renewable and recycled carbon DME

UK transition to net zero by 2050 requires decarbonisation of off-grid energy

Renewable and recycled carbon DME offers an attractive opportunity to decarbonise off-grid energy by utilising existing infrastructure and supply chains as a 'drop-in' fuel

Substitute for diesel and LPG



## Attractive ESG profile

c.70% GHG reduction at plant start-up compared to fossil counterfactuals that will decrease further as the UK electricity grid continues to decarbonise in line with the UK government targets.

Carbon negative potential with implementation of CCUS



## Advantages compared to other treatments<sup>1</sup>

Flexible feedstock requirements – uses residual waste stocks that would otherwise fall lower down the waste hierarchy e.g. landfill or incineration

Converts >55% of the energy in feedstock to fuel vs conventional Energy from Waste (EfW) facilities, which operate at an efficiency of up to 27%<sup>2</sup>



## FOAK technology

Arboretum will use KEW's proprietary advanced gasification, in combination with DME synthesis technology to convert residual waste to renewable and recycled carbon DME, thus creating a FOAK plant.

Testing of end-to-end waste-to-renewable and recycled carbon DME technology in the SEC+ demo plant, de-risking Arboretum #1



## Waste saving

Converts up to 300kton/year of residual waste to renewable and recycled carbon DME, avoiding landfill, RDF export or incineration.

Targeting a growing niche of i) high calorific value and biogenic sorting rejects and ii) biogenic and plastic rich residual waste from EfW pre treatment.

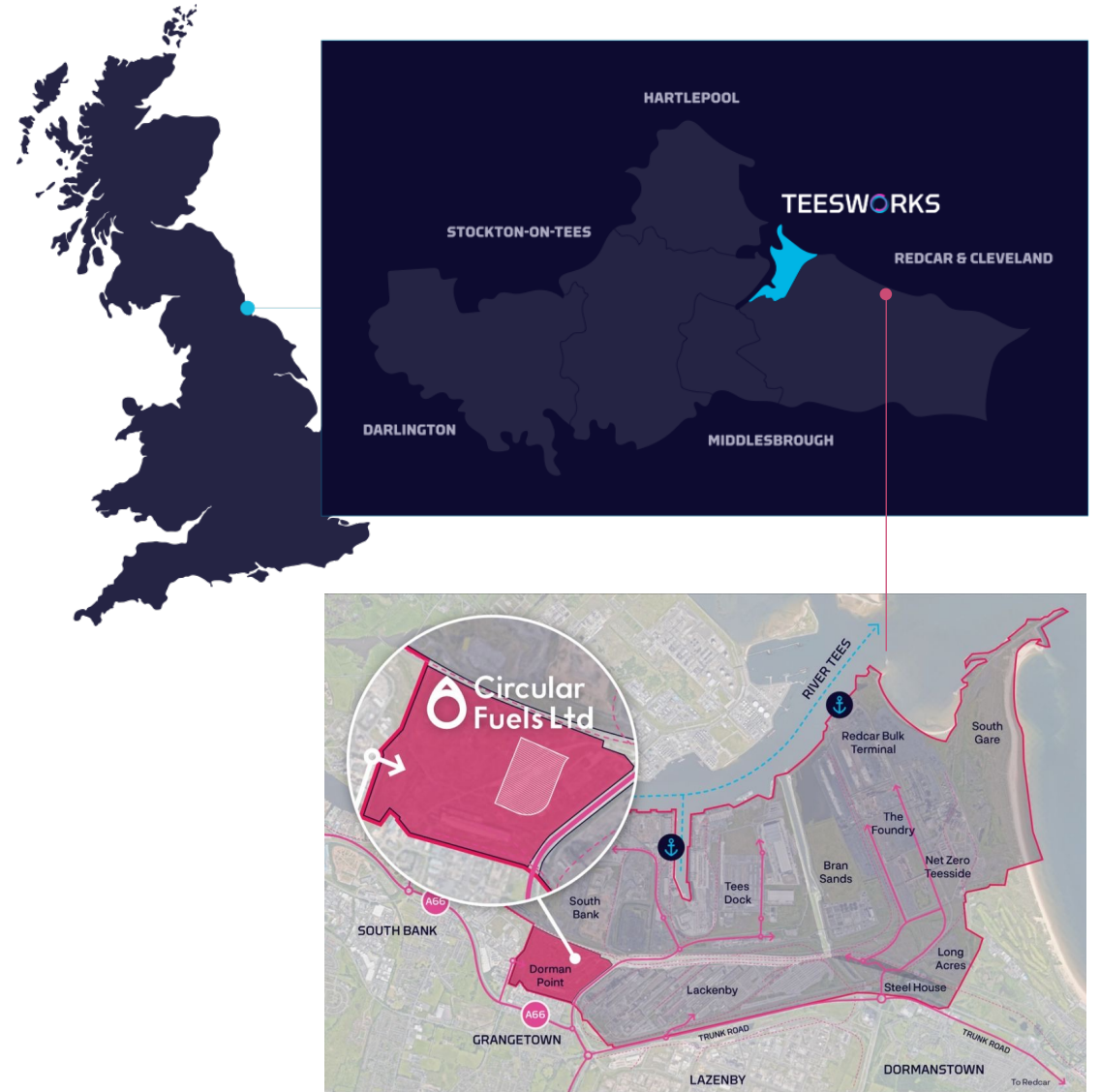
# 5tpd waste to renewable and recycled DME demonstration facility production ahead of our first large-scale project

Currently under construction as an add-on to KEW's existing operational advanced gasification plant currently producing syngas for power with plans to divert c.50% of the syngas to producing renewable and recycled carbon DME in 2024.



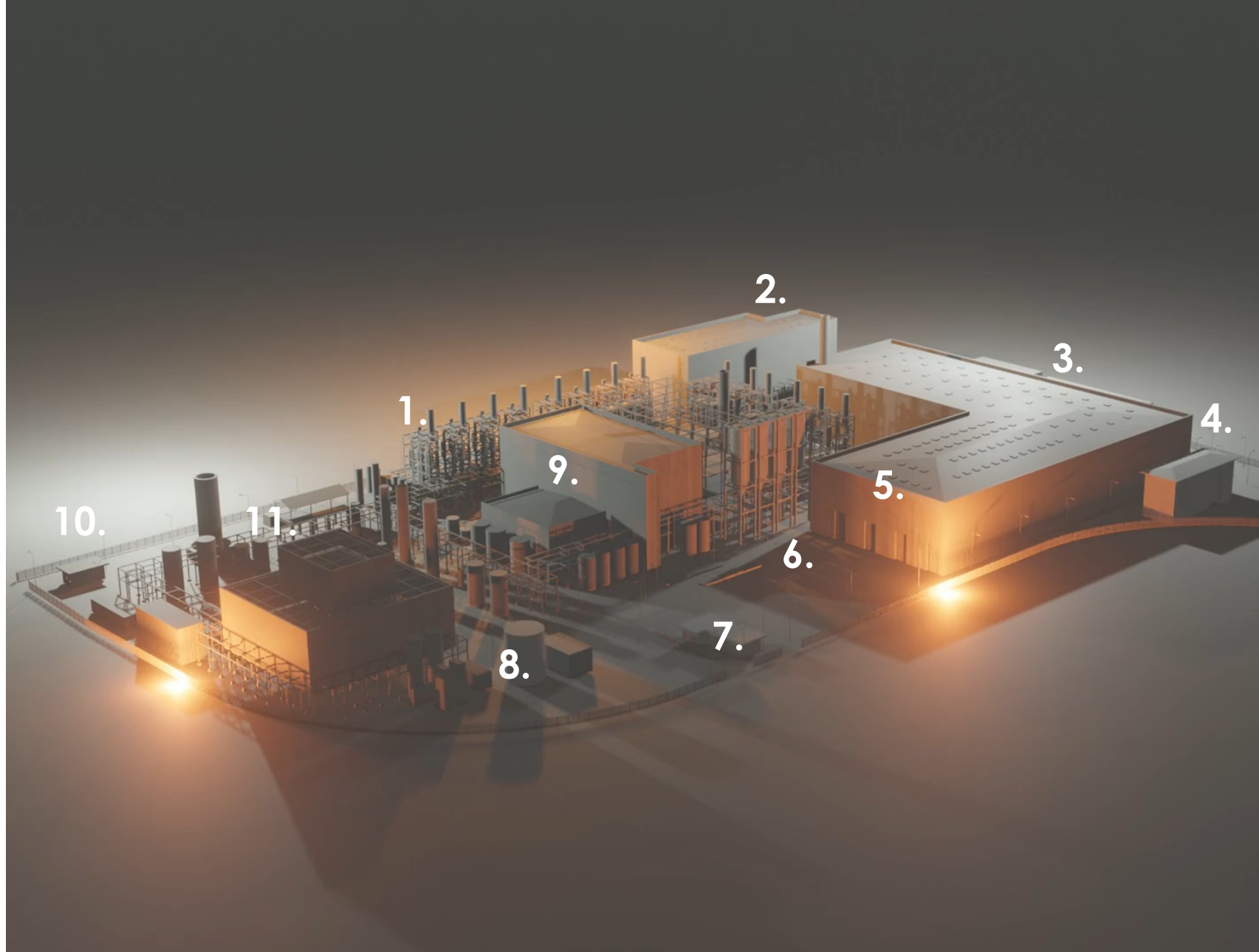
# Our FOAK >50KTPA Large-Scale Plant: Arboretum #1

- A project in advanced development stage:
  - ✓ Contract negotiation maturing
  - ✓ Entering late-stage FEED
  - ✓ Defossilising over 5% of the UK LPG demand





1. Modular Advanced Gasification Islands
2. Feedstock Storage
3. Future Expansion
4. Offices & Parking
5. Feedstock Pre-treatment & Preparation
6. Truck Turning & Queing
7. Gatehouse Entrance
8. Fire Water & Ancillary Plant
9. Utility Buildings & Control Room
10. Flare & Ancillary Plant
11. rDME Synthesis Unit & Storage



# An ESG Investment

We have worked together with ERM to develop ESG action plans for our projects roll-out to meet monitoring, reporting and verification requirements of:



## SUSTAINABLE DEVELOPMENT GOALS



Our rDME (renewable and recycled carbon fuel dimethyl ether) product will be **(ISCC)** accredited

We will achieve the RED II and RTFO GHG savings thresholds and exceed them versus the relevant fossil counterfactual

Our project has the potential to achieve **a net negative rDME product via CCUS** - our technology enables pre-combustion carbon capture directly from the syngas stream resulting in compelling carbon capture economics.

**Lower carbon waste management & energy production even without CCUS:**

**For the same amount of waste, our rDME emits c.70% less CO<sub>2</sub> per MJ of energy output versus incineration**

Independently assessed and verified by:



# Our Strategic Ambition

Contributing to the **300 kton / year rDME production by 2027 Dimeta target**



**UK**

Late stage  
development



**EU**

France – Site  
selection stage



**USA**

State selection  
Stage

