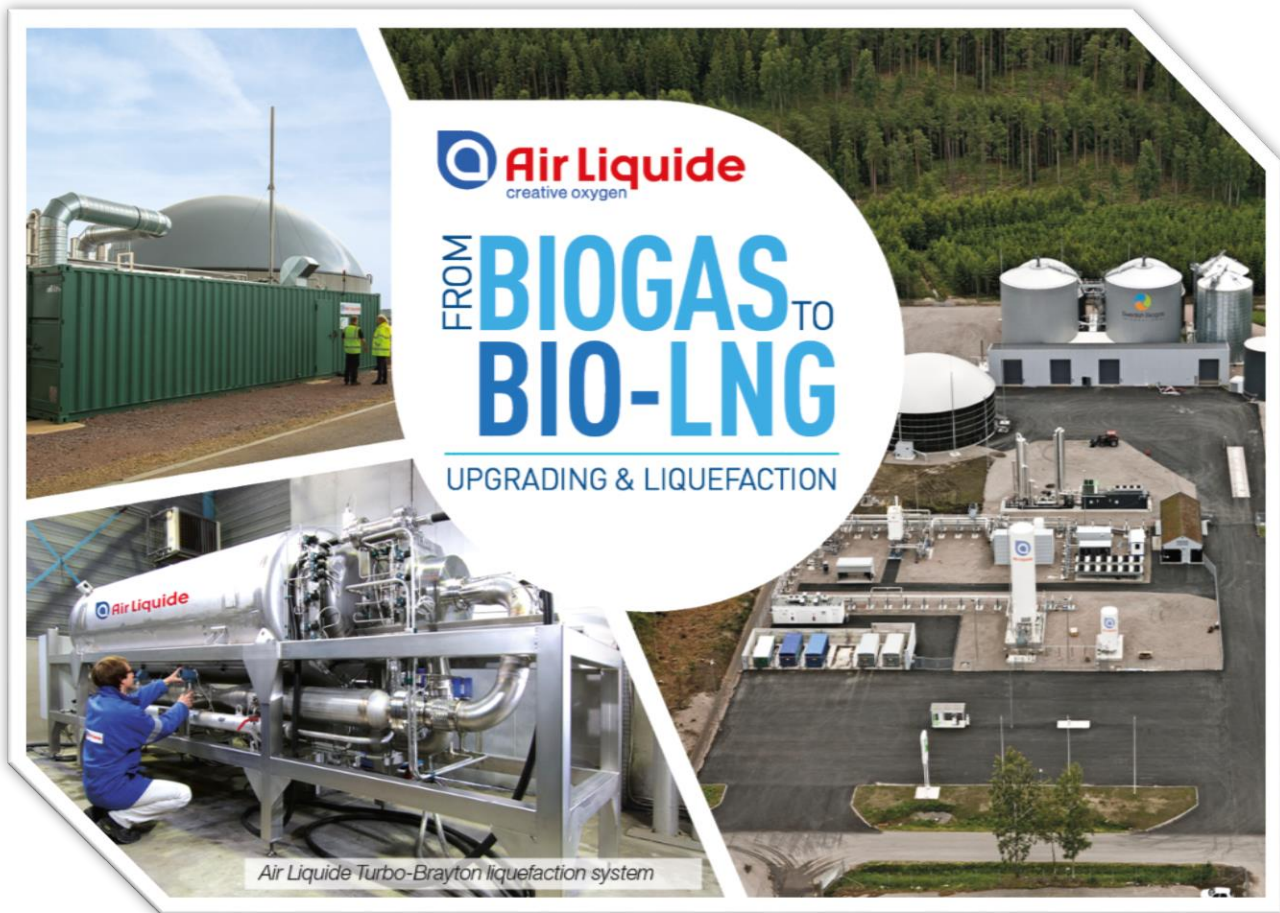


Advanced Business  
& Technologies

*Turbo Brayton, a  
disruptive technology  
for LBG production.*



FROM **BIOGAS** TO  
**BIO-LNG**

UPGRADING & LIQUEFACTION

Air Liquide Turbo-Brayton liquefaction system

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April 2019

Air Liquide Advanced Technologies

AIR LIQUIDE, THE WORLD LEADER IN GASES, TECHNOLOGIES AND SERVICES FOR INDUSTRY AND HEALTH

Opening new business frontiers

# The Turbo Brayton, up to 50 tpd methane liquefaction



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 **Air Liquide**  
creative oxygen

# Air Liquide, methane liquefiers product range



LIN-8 TPD

TB-10 TPD

20  
TPD

30  
TPD

TB-50  
TPD

Turbofin-200 to  
1000 TPD

Smartfin +  
800 TPD

Liquefin +2200  
TPD

4 800 GPD

6 000 GPD

12 000  
GPD

20 000  
GPD

30 000  
GPD

0.12 - 0.66  
MGPD

0.48 MGPD

1.32 MGPD

∞ Turbofin™

∞ Smartfin™

∞ Liquefin™

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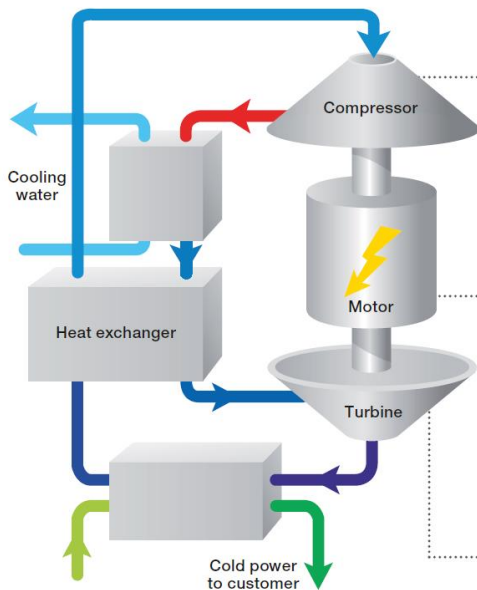
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# Reverse Turbo-Brayton principle:

Air Liquide's innovative reverse Turbo-Brayton process essential innovation concerns the assembly of all active elements on a single shaft.



## 1 Centrifugal compressor



- High efficiency
- Oil-free

## 2 High-speed synchronous motor and active magnetic bearings



- Direct drive
- No gear box
- High compacity
- Contact free
- Unsurpassed lifetime

## 3 Centripetal expander



- More than 50 years experience in the design and manufacture of expanders
- High efficiency

# Key benefits of the Turbo-Brayton liquefaction system

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1. **Maintenance-free** for 5 years
2. **Low** electrical consumption and **high efficiency** on all operate range **from 0 to 100%** turn down
3. **Safe technology**: inert process gas, no refill of process gas required (no hydrocarbon mixture)
4. **Easy to operate** - Unmanned operation, fully automatic
5. Low installation cost and time: **plug and play**, compact (low footprint and weight)
6. Flash and boil off are avoided thanks to **methane sub cooling**,
7. **Utility-free**: no compressed air, no oil, no nitrogen
8. Cold power available instantaneously (**less than 5 min**) from stand-by mode

# Factory pre tested for quick start up.



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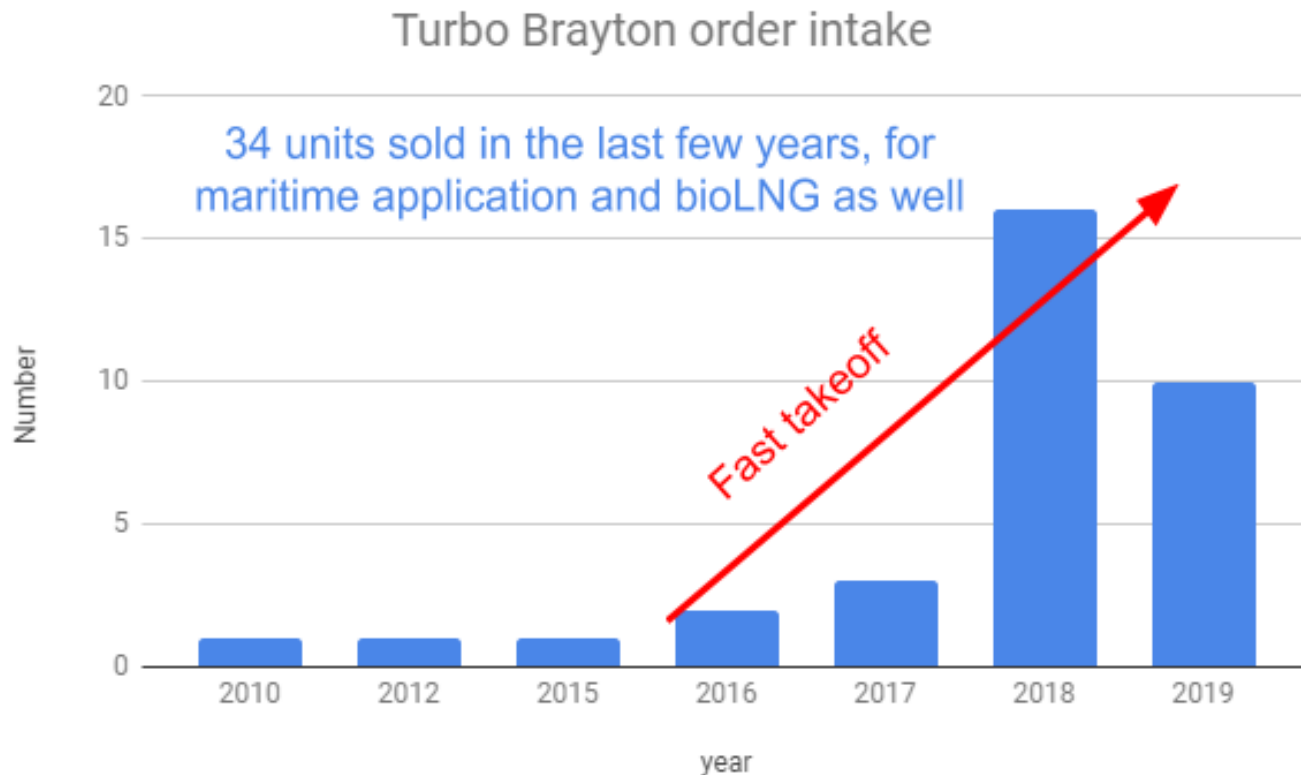
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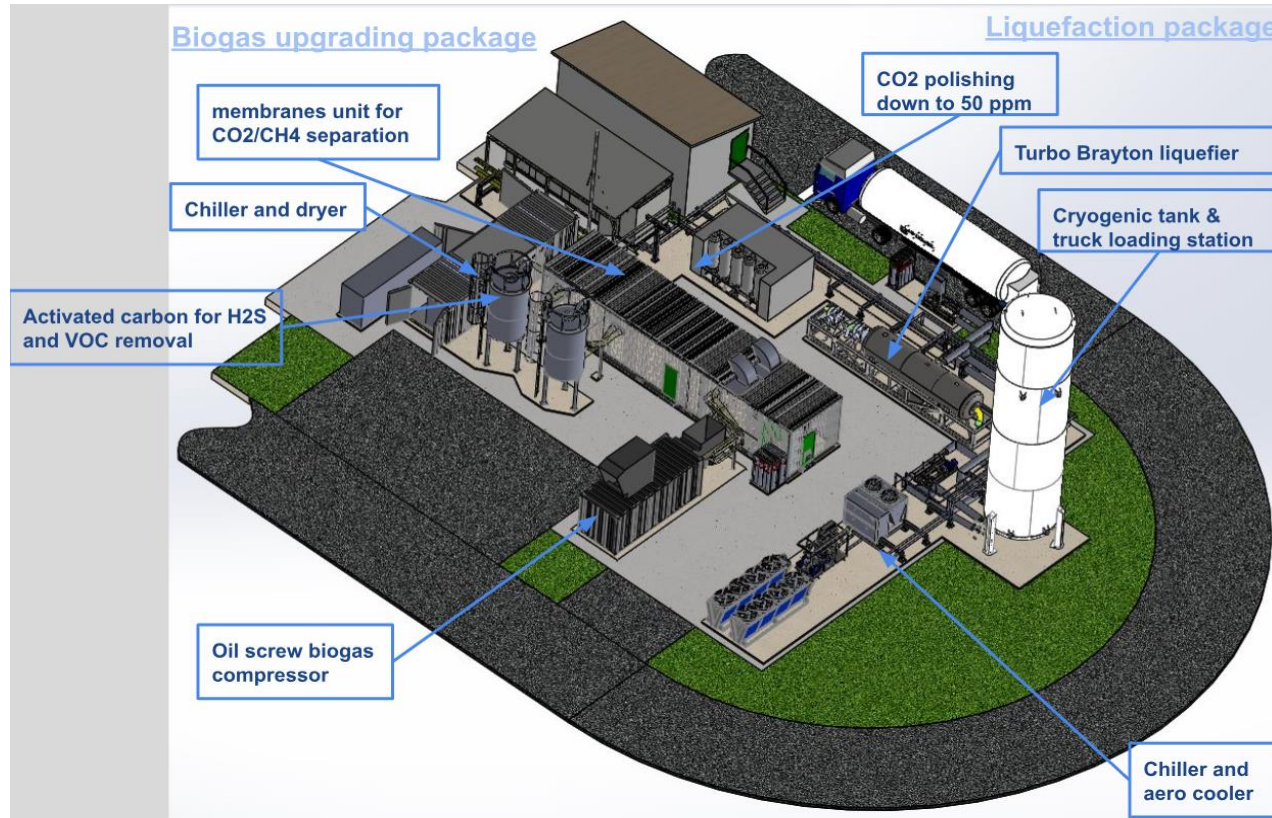
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# Turbo Brayton a success story



# Turku, Biogas to Bio-LNG plant to be started up in mid 2019







*Thank you*



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