



Air Liquide Advanced Technologies (AL-aT)  
**bioLNG for heavy mobility**



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From  
biogas  
to bio-LNG



For upgrading  
& liquefaction



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

Opening new business frontiers



# From the sources to the market:



Biogas



Landfill gas



Pipeline gas



Flare gas



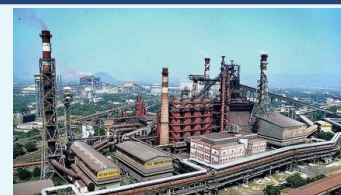
Boil off gas



HDVs
















Maritime



Industry

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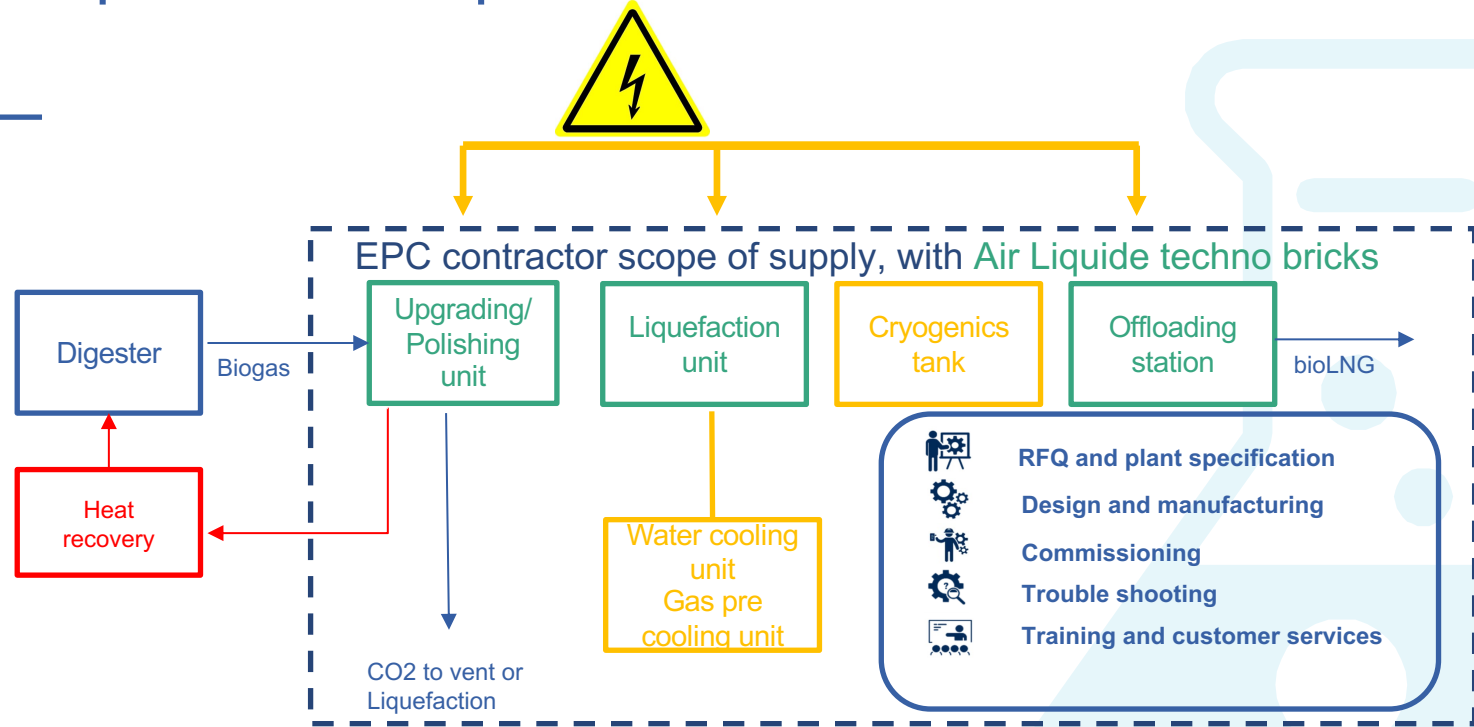
# ssLNG: facts and figures

Status	In operation					In construction		
Location	Lidköping, Sweden	Valle Tanaro, Italy	Turku, Finland	KIMM, Korea	Nymölla, Sweden	GREVE, Norway	Güstrow, Germany	Södertörn, Sweden
								
Delivery date:	Jan-10	Dec-20	Mar-20	Jun-21	Jul-21	May -22	Dec-22	April 23
Production rate	13 TPD	8 TPD	10 TPD	10 TPD	20 TPD	24 TPD	25 TPD	50 TPD
Energy produced	63 GWh/year	40 GWh/year	50 GWh/year		100 GWh/year	121 GWh/year	126 GWh/year	250 GWh/year
Feed gas	biomethane	biogas	biogas	methane	biogas	biomethane	biomethane & Nat gas	biomethane & Nat gas
Technology	Adsorption + BRAYTON	Adsorption + LIN2LNG	Membranes + Adsorption + Turbo Brayton	Turbo Brayton	Membranes + Adsorption + Turbo Brayton	Adsorption + Turbo Brayton	Adsorption + Turbo Brayton	Amine + Turbo Brayton
Scope AL	EP - polishing, liquefaction, commissioning	EP - upgrading, polishing, liquefaction storage commissioning	EPC - upgrading, polishing, liquefaction, storage, offloading	EP - liquefaction, commissioning	EPC - upgrading, polishing, liquefaction, storage, offloading	EPC - compression, polishing, liquefaction	EP - polishing, liquefaction	EPC - compression, polishing, liquefaction
Performance								

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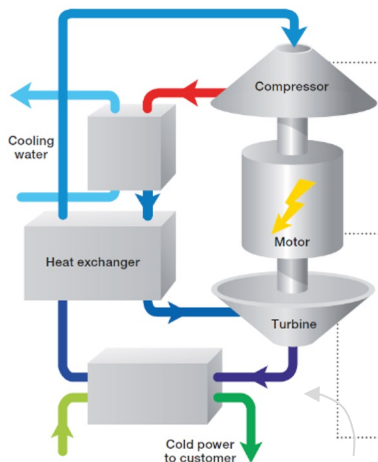
# Air Liquide techno provider





# Turbo-Brayton Overview

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

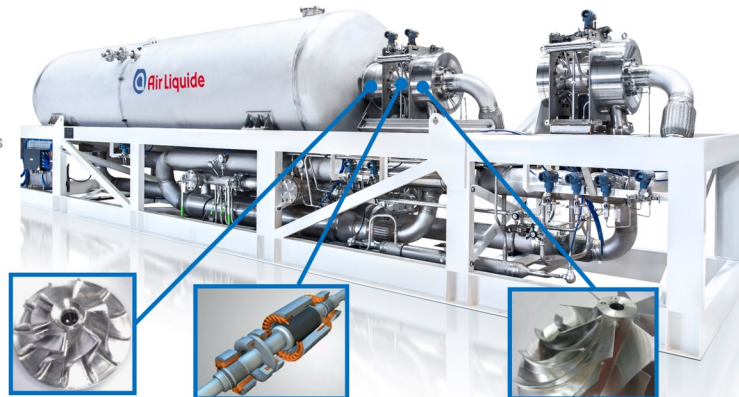
Safe  
Technology  
using inert  
refrigerant

Fully Sealed  
No Refrigerant  
Losses

Easy  
Operation  
Fully  
automatic

Maintenance  
free for  
5 years

Plug and Play,  
Compact



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# Bird view of Topinoja, Turku Finland 10 TPD

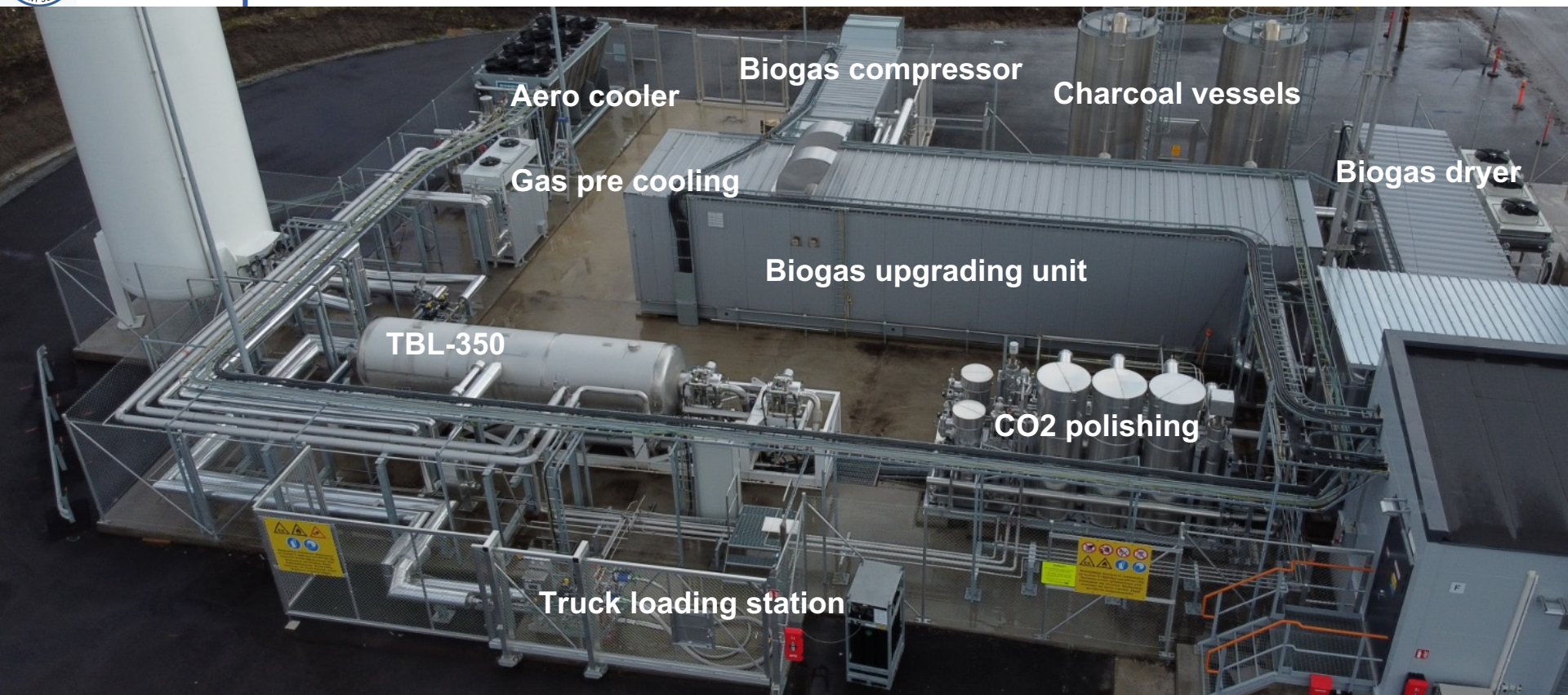


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# Compact and skid mounted solution:



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# Nymölla paper mill plant in Sweden (off design 20 TPD)



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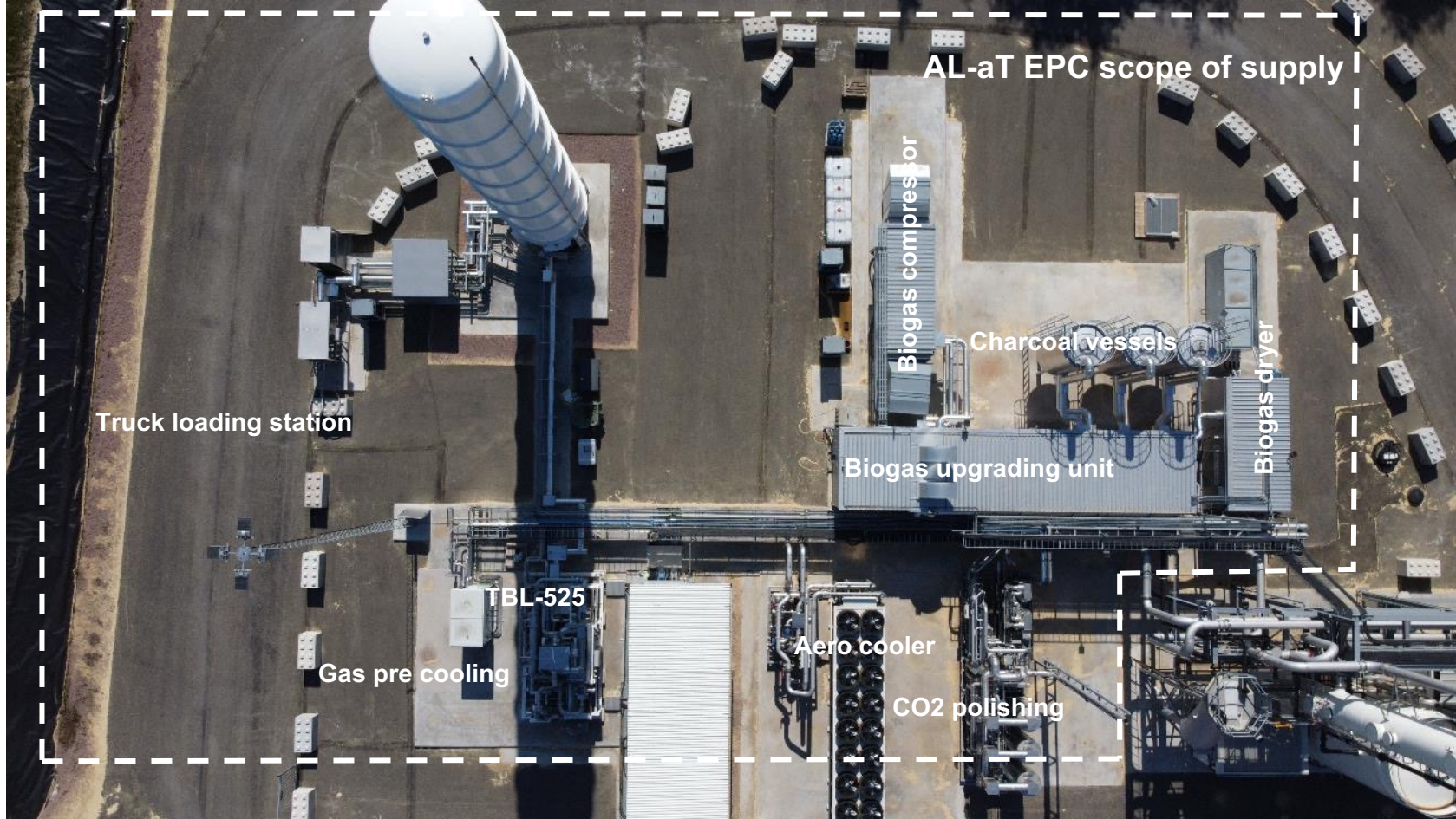
# TBL-525/700 up to 25 TPD liquefaction rate (~130 GWh/y)



Onsite work at Stora Enso's Nymölla paper mill in Sweden.

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AL-aT EPC scope of supply

Truck loading station

Biogas compressor

Charcoal vessels

Biogas dryer

Biogas upgrading unit

TBL-525

Gas pre cooling

Aero cooler

CO2 polishing

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# Easy handling



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# TBF-1800 at test facility prior to shipment



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# The Turbo Brayton, up to 50/100 tpd (~500 GWh/year)



TBL-350,  
10 TPD

TBL-525,  
20 TPD

TBL-700,  
25 TPD

TBL-1800,  
70 TPD

TBL-XXL,  
100 TPD

# Customer services:

**Support to operation  
& trouble shooting**



**Expertise and  
plant fine tuning**



**Maintenance:**

- Preventive
- Curative
- Predictive



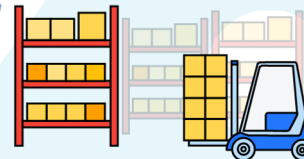
**After sales  
services**



**Mechanical warranty  
management**



**Spare parts  
management**



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# Key benefits of the Turbo-Brayton liquefaction system

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



*Thank you*



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