



## CRYOSTAR SAS

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## ★ About CRYOSTAR

### **The leading company in cryogenic machinery and related products**

- More than 40 years experience
- Close co-ordination and joint project development with customers
- On-going product development and innovative designing for new applications

**Turnover of around €150 million of which 90% are exported**

### **Multi-national team for a close service**

- 8 Business Centers including Headquarter (*Europe, USA and Asia*)
- 15 Representative Agents over the world  
(*Australia, Czech Republic, India, Italy, Japan, Korea, Malaysia, Poland, Qatar, South Africa, South Korea, Spain, Turkey, Vietnam*)

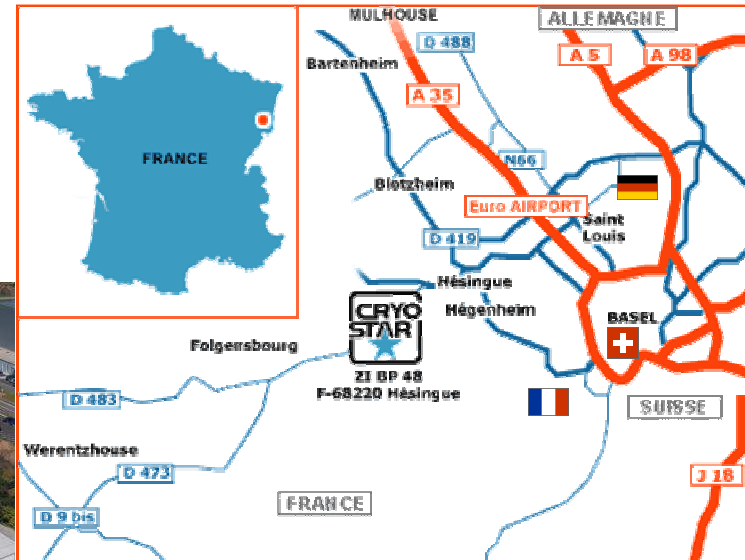
**Global ISO 9001:2000 and 14001 certified organisation**

**Part of THE LINDE GROUP**



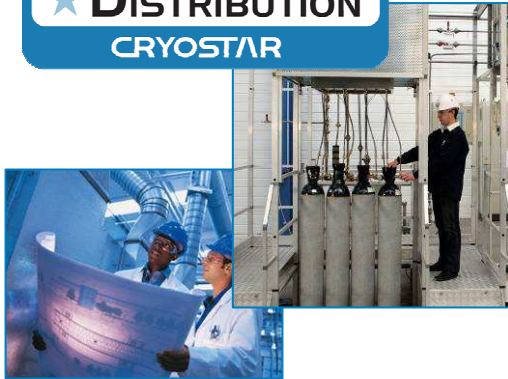


## ★ Headquarter in France





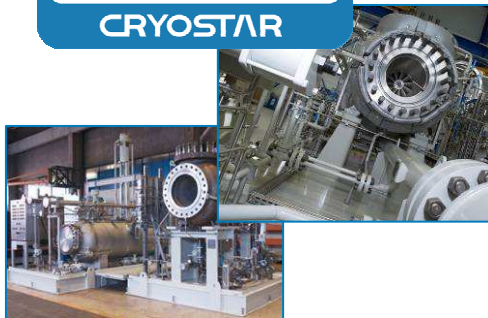
★ **DISTRIBUTION**  
CRYOSTAR



★ **LNG / SHIPBOARD**  
CRYOSTAR



★ **PROCESS**  
CRYOSTAR

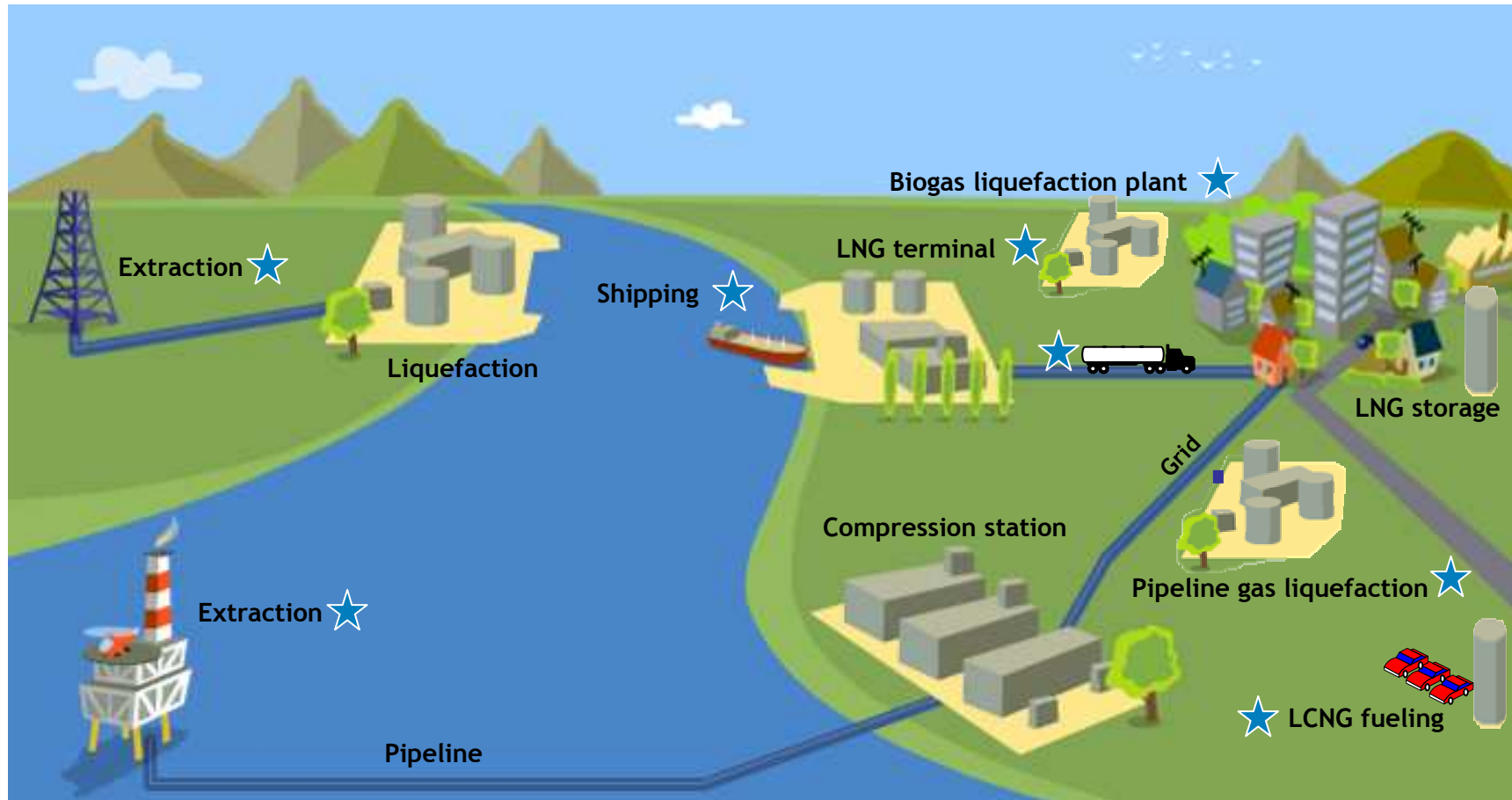


★ **Lo-C**  
CRYOSTAR



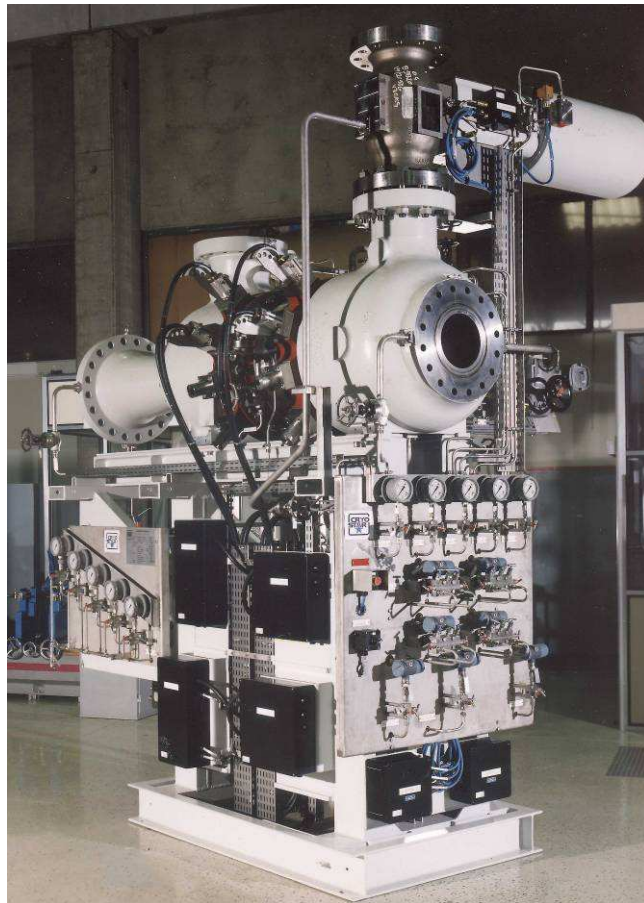


## ★ LNG Supply Chain Overview





## ★ PROCESS CRYOSTAR



Different models :

- Oil brake Turboexpanders
- Electrical Generator driven Turboexpanders
- Compressor driven Turboexpanders
- Magnetic bearing Turboexpanders

Performances :

From 150kW to 12MW





★ **LNG SHIP**  
CRYOSTAR

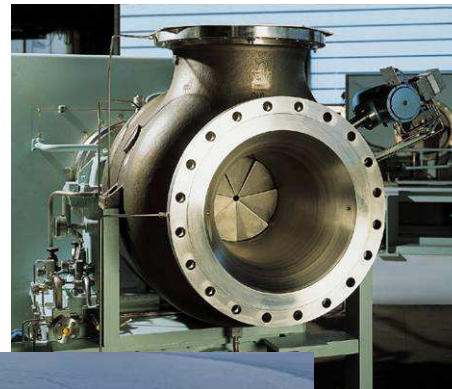
**Boil Off Gas compressors driven by :**

- steam turbine
- electric motor

**Liquid Natural Gas Vaporizers**

**Natural Gas Heat exchangers**

**On board liquefaction units**



**HD Compressors :**  
15'000 to 35'000 m<sup>3</sup>/h  
700 to 1'000 kW

**LD Compressors :**  
2'500 to 8'500 m<sup>3</sup>h  
150 to 350 kW



**Vaporizers / Heat Exchangers**  
For shipboard capacity up to 250'000 m<sup>3</sup>



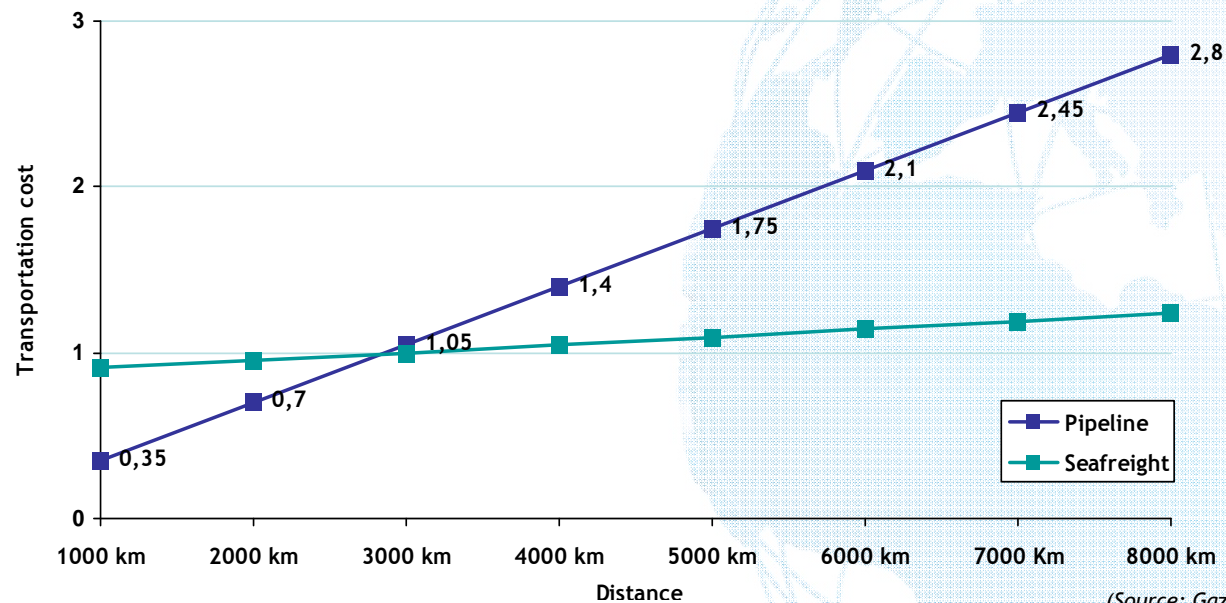
## ★ Natural gas - Large scale transportation

### Pipeline

- When?
  - Strength?
  - Weakness?
- > Short distances (<3000 km)
  - > Cost of transportation depending on gas amount
  - > Investment cost depending a lot on pipeline distance

### LNG carrier

- When?
  - Strength?
  - Weakness?
- > Long distances (>3000 km)
  - > Constant transportation cost, supply flexibility
  - > Cost of liquefaction plant



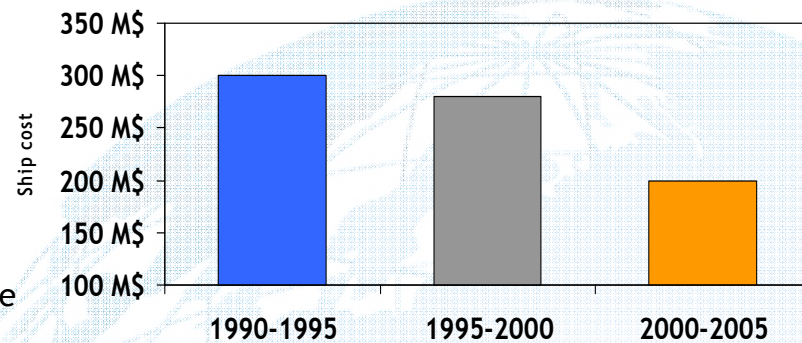
(Source: Gaz de France "LNG valorization report")



## ★ LNG Shipboard trends

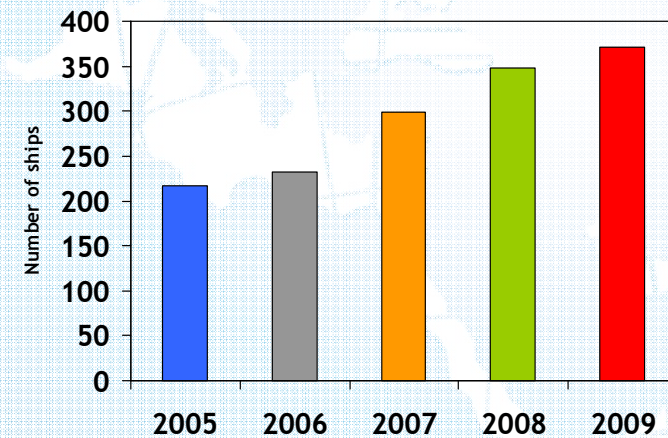
### Shipboard cost evolution

- New ships with on-board reliquefaction will help by reducing transportation costs
- Building of bigger ships is reducing transportation costs as well
- Cost reduction will allow to have more and more profitable short distance shippings



### Existing fleet (Ships over 100'000 m3)

- These figures are based on the ordered ships
- Considering that a shipboard needs 3 years to be constructed, the orders placed in 2004 will be delivered in 2007
- Today, **230** tankers are in operation



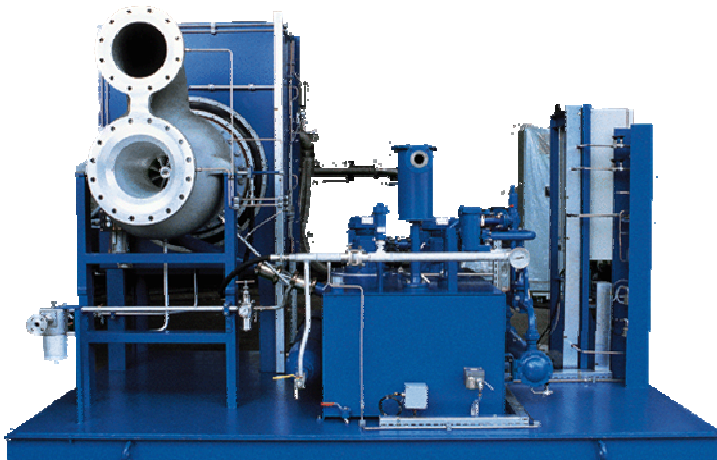
(Source: Cryostar Shipboard compressors sales dept.)



## ★ PROCESS CRYOSTAR

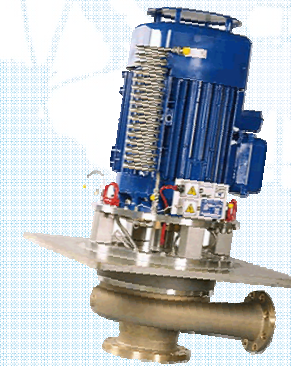
### Turboexpander systems loaded by :

- Generator
- Compressor
- Oilbrake
- Combination



### Cryogenic process pumps

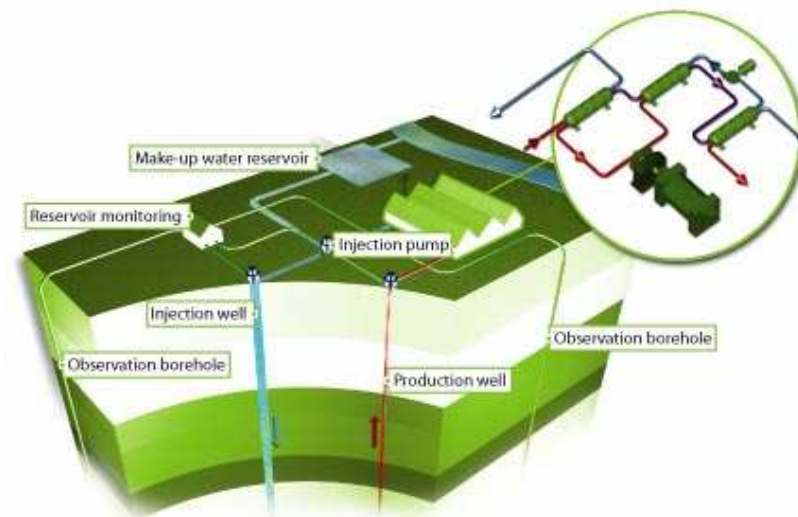
- Variable speed pumps
- High pressure process pumps
- Injection pumps
- Circulation pumps
- Sealless pumps
- Reflux pumps
- Internal compression pumps





Energy recovery expansion turbine driving an electric generator for:

- Natural gas pressure let down station
- Geothermal heat
- Wasted heat
- Natural gas liquefaction unit





Energy Recovery by expansion of natural gas pressure losses

Energy production from 150kW to 12 MW



Geothermal energy  
Turbo-generator  
Energy production up to 12 MW



## ★ Small Scale Liquefaction Plants

★ SSL = small scale liquefier

★ Capacity = from 5 to 200 tons / day

★ Source =

Biogas from landfill, digester or waste water treatment plant

Pipeline gas

Coal related sources (CBM & CMM)

Stranded gas

Flared gas

★ Final Application =

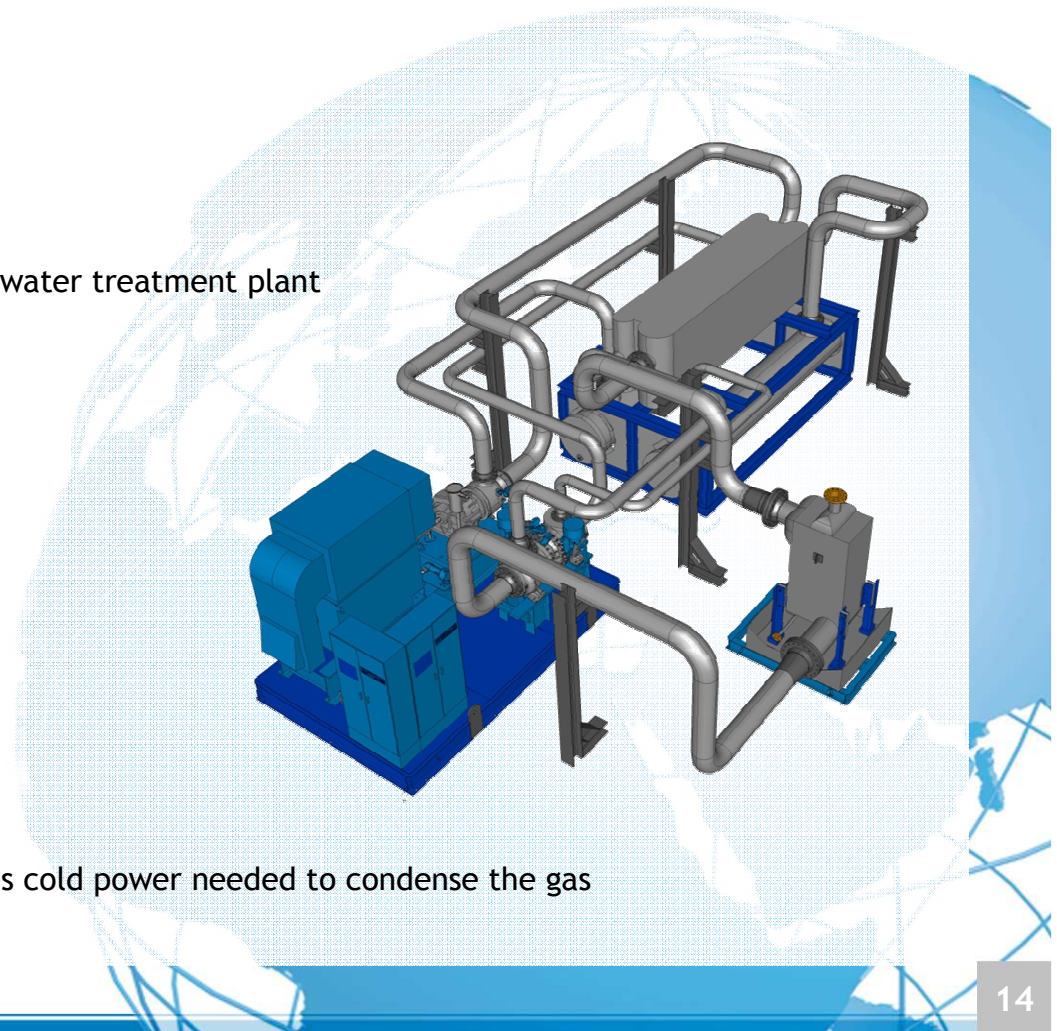
Vehicle fuel, as alternative to diesel

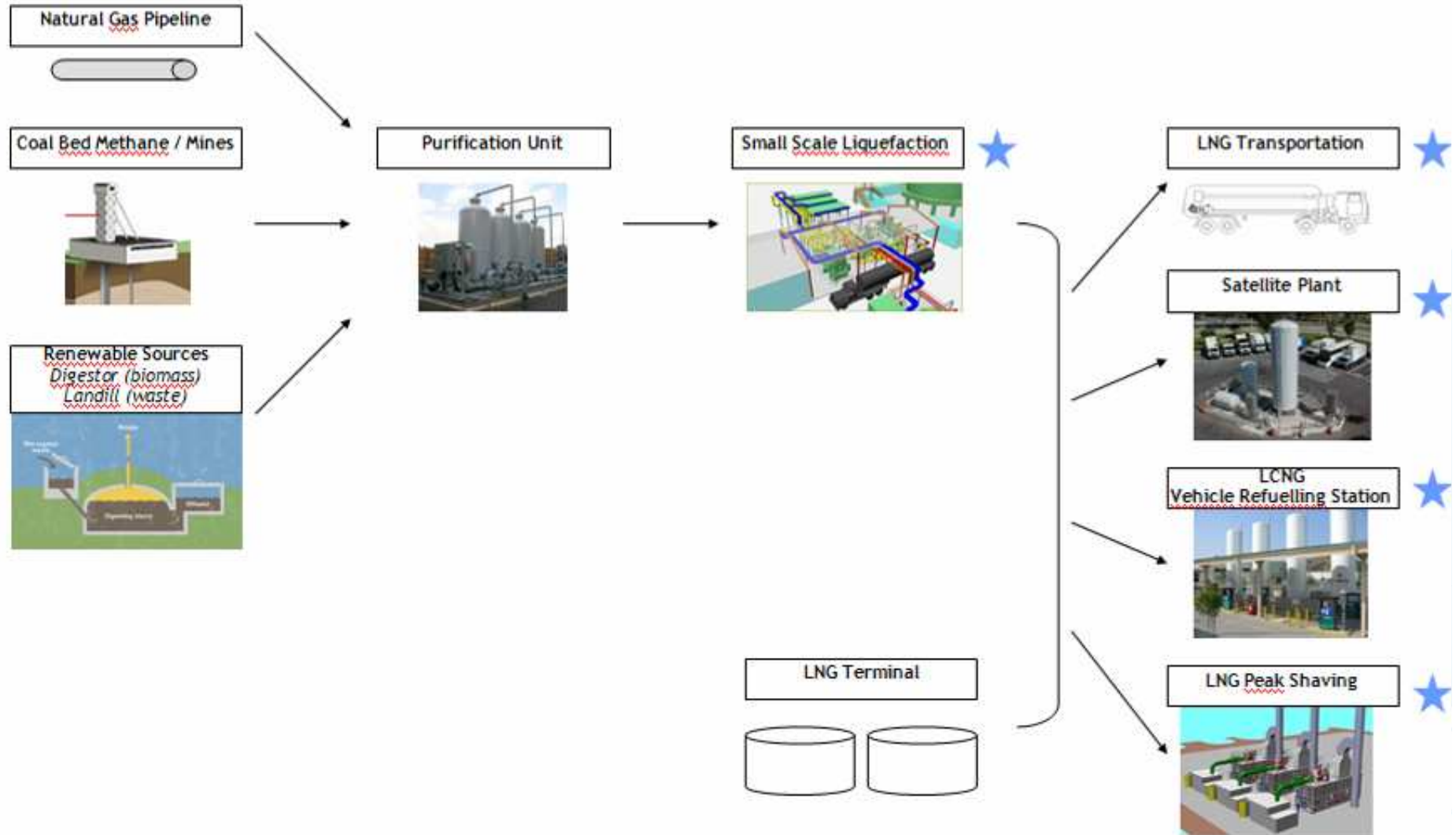
Industrial applications


Peak shaving

★ Technology for liquefaction =

closed refrigerant cycle which produces cold power needed to condense the gas





 : With CRYOSTAR Technology

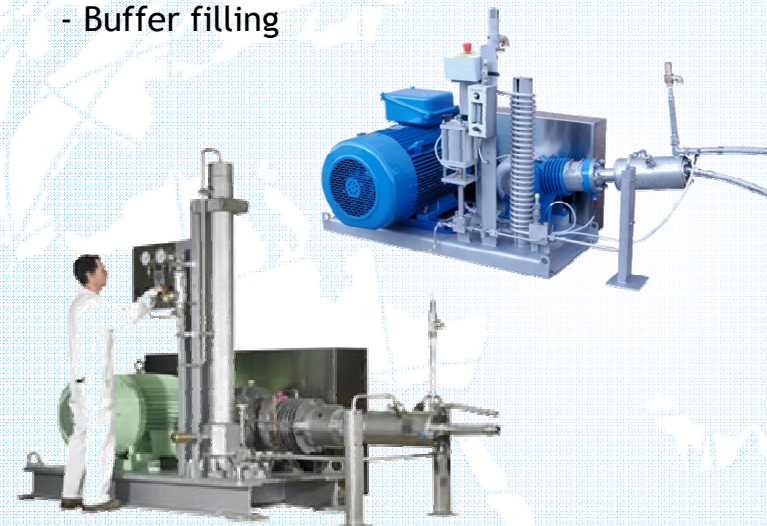


## ★ DISTRIBUTION CRYOSTAR

**Cryogenic centrifugal pumps**  
- Pumping systems  
for mobile or stationary applications  
- Vertical sealess pumps  
- Filling/transfer pumps



**Cryogenic reciprocating pumps**  
- High pressure pump for cylinder filling (up to 400bar)  
- Buffer filling





## ★ DISTRIBUTION CRYOSTAR

### High Pressure Cylinder Filling stations

- Turn key project
- Manual or PLC drive systems



### LCNG/LNG/LH2 Vehicle Refuelling Stations

- Turn key project





## ★ SERVICES CRYOSTAR



### **Installation and commissioning services**

42 Highly qualified Service technicians and engineers

On-Site maintenance highly qualified team

### **Spares parts supplies**

OEM guaranteed high quality parts

Availability of wear parts

### **Customer support**

24 h service and emergency phone

Short response time

### **In house repairs capabilities**

Dedicated shop and team

Also in the UK, US, Singapore, China, Brazil, soon Russia and India

### **Technology up dates**

Efficiency and / or life time improvements

Maintenance and retrofit up grade

### **Full Service Agreements**

Innovative service concepts including preventive maintenance, consulting support and stock management

### **Training Center for Customers on products operating and maintenance**



*Thank you for your attention*

