

Global Markets & Technologies

Biogas to Biomethane to transport

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GLOBAL MARKETS
& TECHNOLOGIES



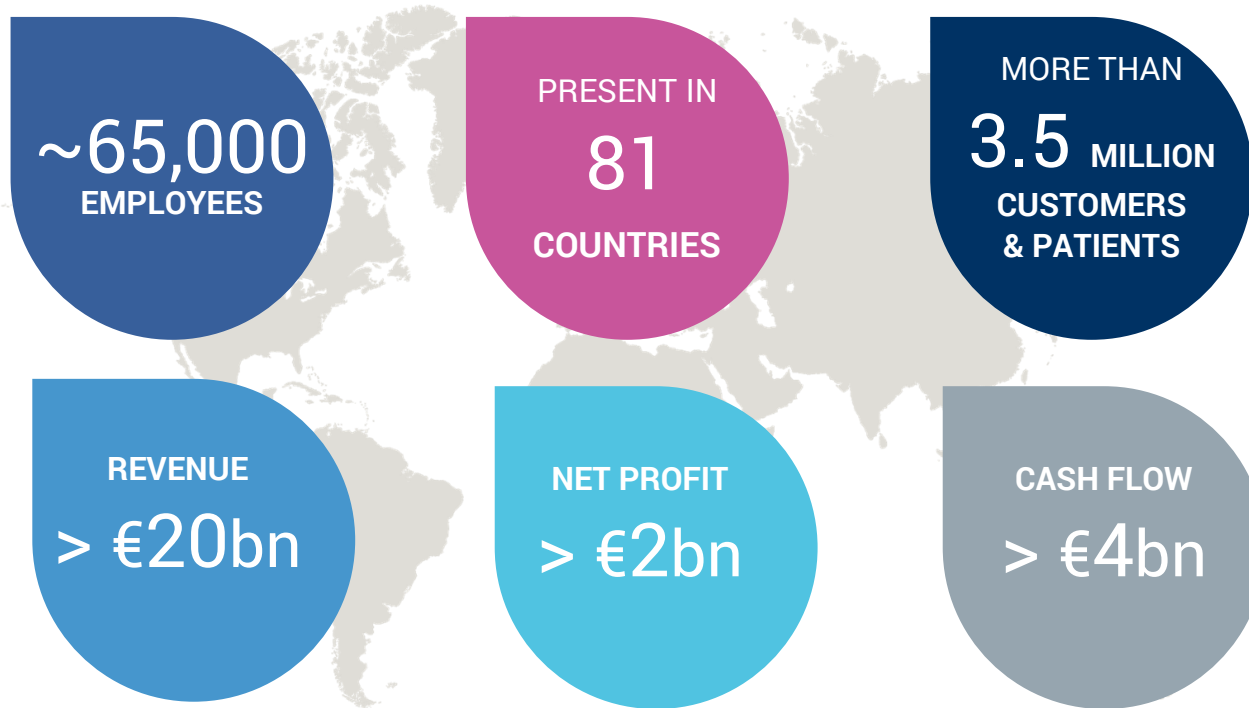
1

Air Liquide

AIR LIQUIDE, LE LEADER MONDIAL DES GAZ, TECHNOLOGIES ET SERVICES POUR L'INDUSTRIE ET LA SANTE

2

2017 key figures



2017 Figures

AIR LIQUIDE, LE LEADER MONDIAL DES GAZ, TECHNOLOGIES ET SERVICES POUR L'INDUSTRIE ET LA SANTE

Our scientific territory: essential small molecules

Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.

Separating the **air** components
to take advantage of their properties



OXYGEN



NITROGEN



ARGON
AND RARE GASES

Producing molecules from
natural resources of the planet



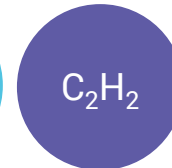
HYDROGEN



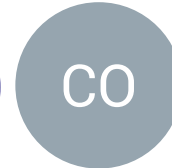
HELIUM



SILANE



ACETYLENE



CARBON
MONOXIDE



Bio CH₄

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2

Climate objectives

CLIMATE OBJECTIVES



ASSETS

Reduce our carbon intensity in 2025 vs. 2015 by **-30%**



CUSTOMERS

Act for clean industry by developing low-carbon solutions



ECOSYSTEMS

Contribute to a new low-carbon society

A global approach

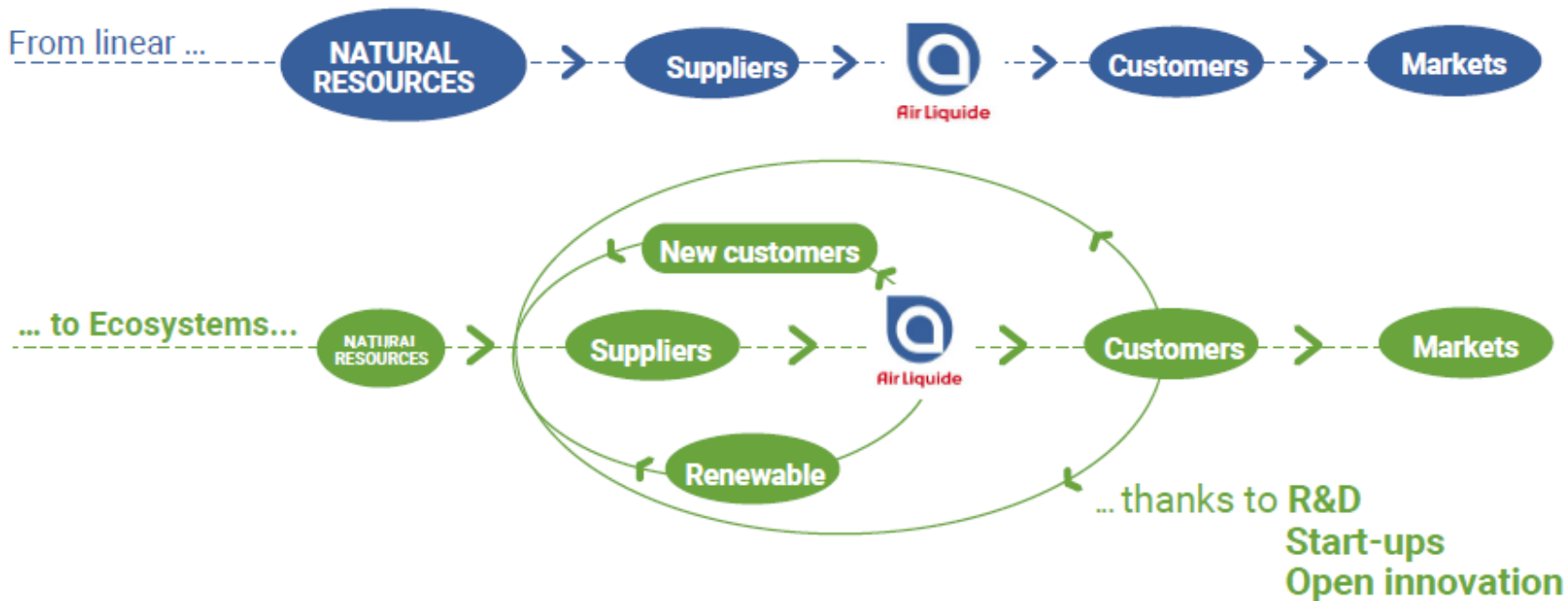


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Air Liquide in Biogas value chain

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Lever 1: Develop circular economy



OBJECTIVE : Reduce the use of Natural Resources

➔ Upstream/downstream integration leveraging technologies and new business models

Lever 1: Develop circular economy through biomethane production and usages



Build new biomethane plants

- Air Liquide value in the **biogas purification** with proprietary membrane technology
- 2 main regions:
 - Europe
 - USA
- Capacity: **0.8 TWh/year** today to **5 TWh/year** in 2025

x6



Extended usages

- **End-users:** Industry and Transport
- **Injection into existing natural gas network**

> 60
Retail
stations

> 10
Production
units

4 Our operations in Europe

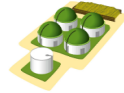
Our solutions supporting clean mobility & clean energy

CH4 SOLUTIONS

BIOCH4 productions

Multi-energy stations

Industrials



N2 SOLUTION

Bluezeze equipments & stations



H2 SOLUTION

H2 for Forklifts

H2 for Cars

H2 Production



EU territories and operations

Integrated in full value chain

Porsgrunn, Norway
Air Liquide Skagerak



Gothenburg, Sweden
FordonsGas
an Air Liquide company



Benelux



Birmingham, UK
Air Liquide UK



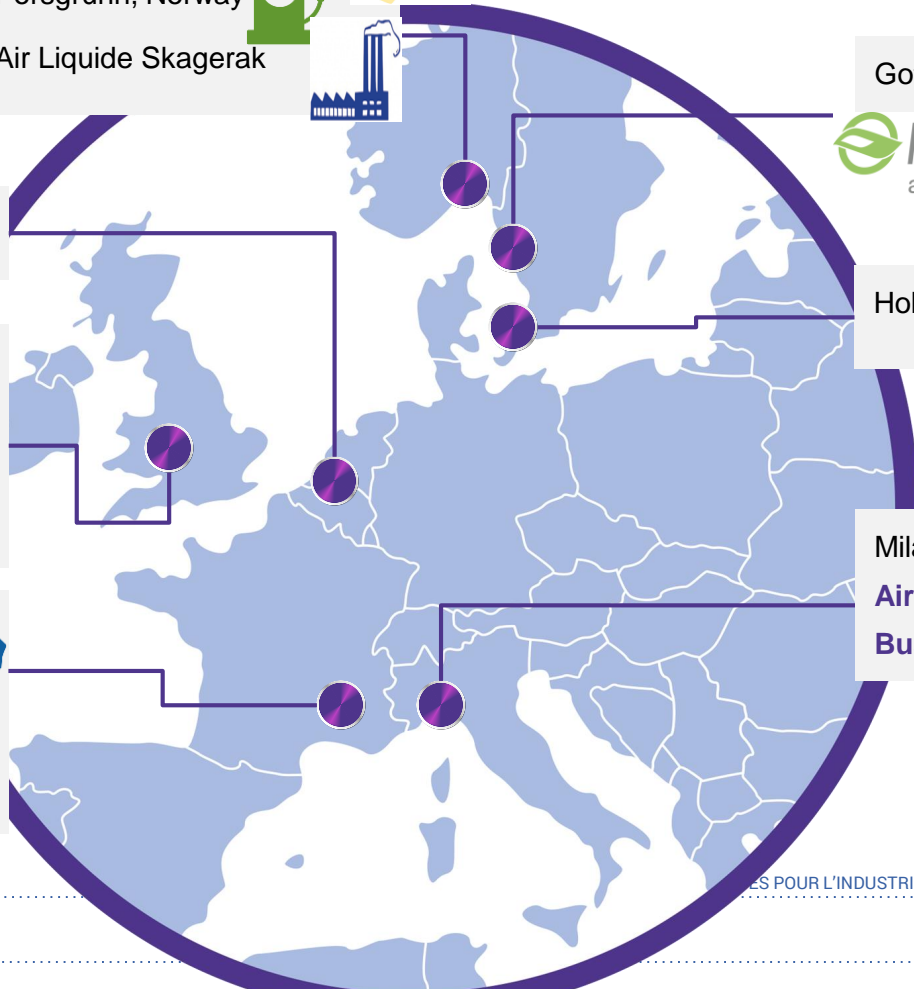
Hobro, Denmark



Grenoble, France
Air Liquide advanced
Business

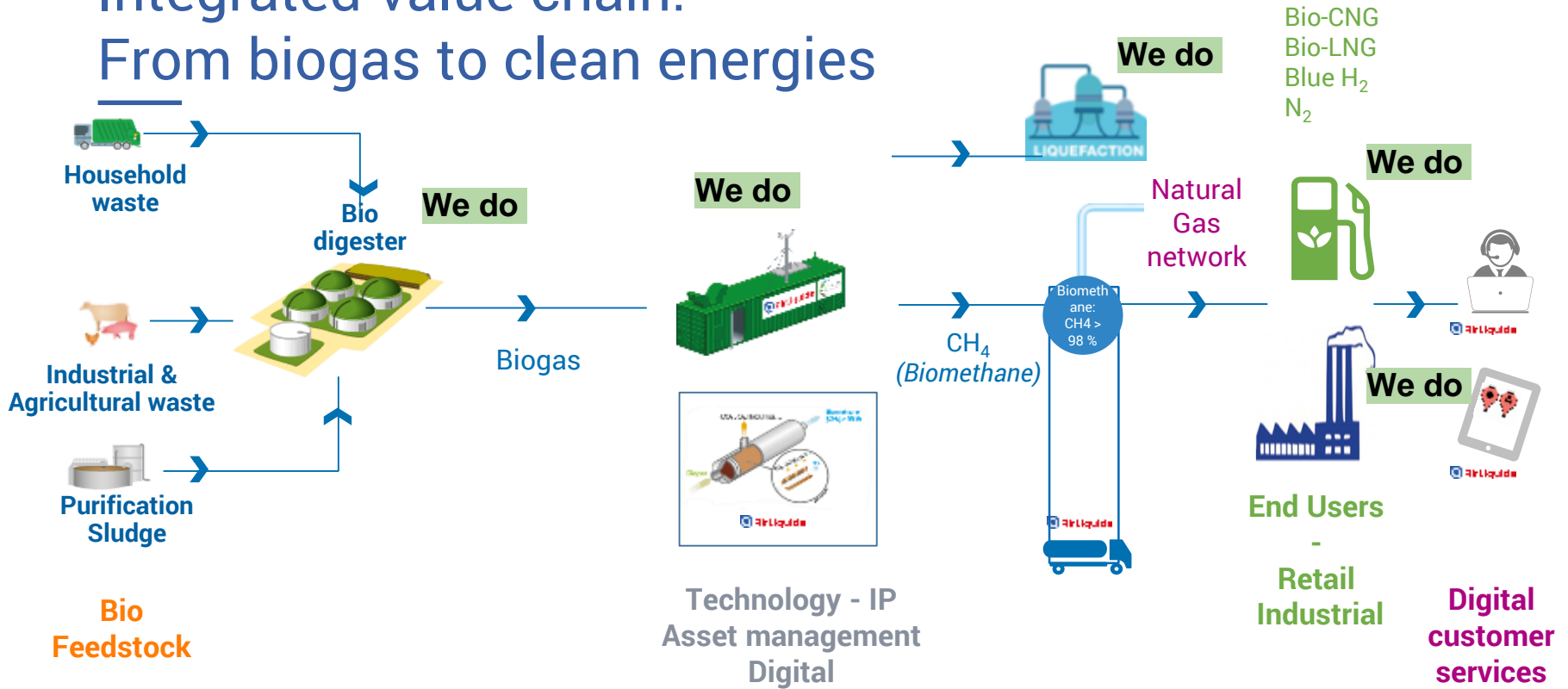


Milano, Italy
Air Liquide advanced
Business Italy



ES POUR L'INDUSTRIE ET LA SANTE

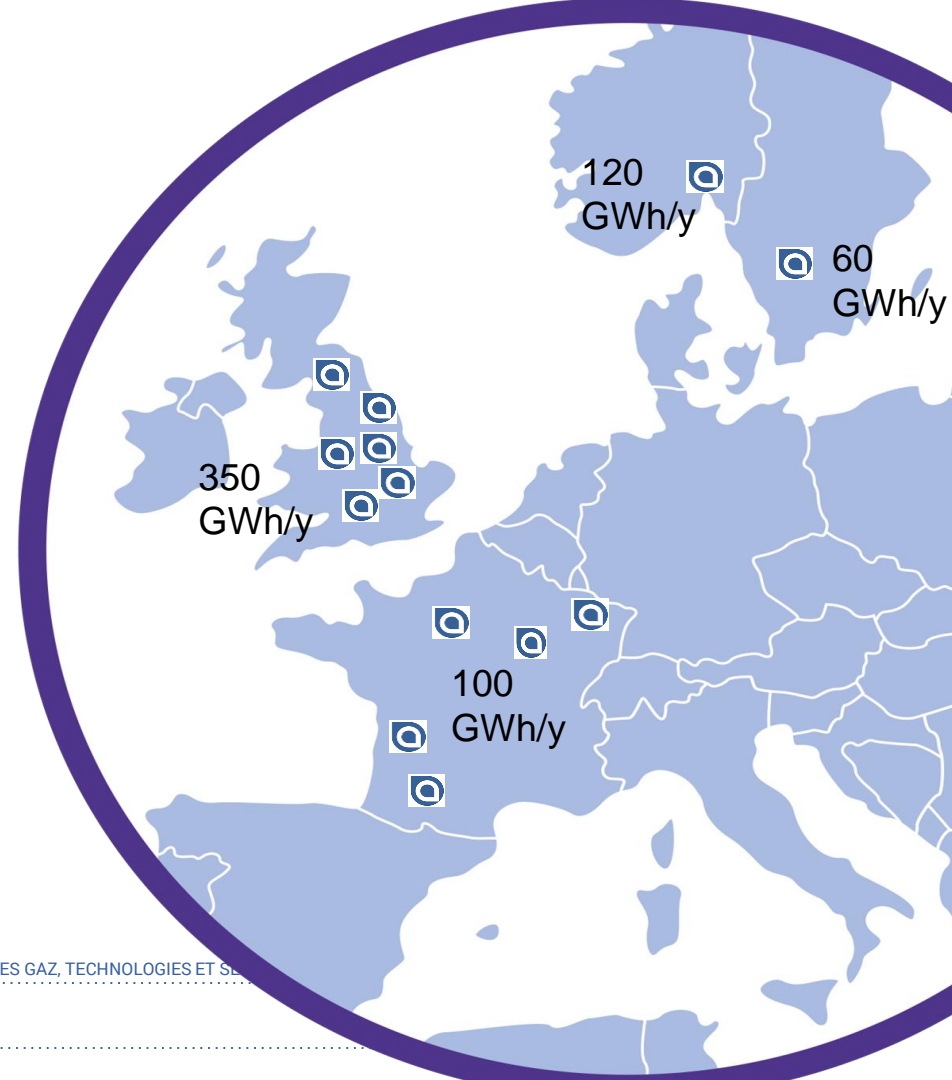
Integrated value chain: From biogas to clean energies



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AL Biogas sourcing sites

~650 GWh/y capacity



AL European Network of ~70 stations (22 Trucks stations)

- > 50% bio (avg Europe)
- > 80% in Nordics



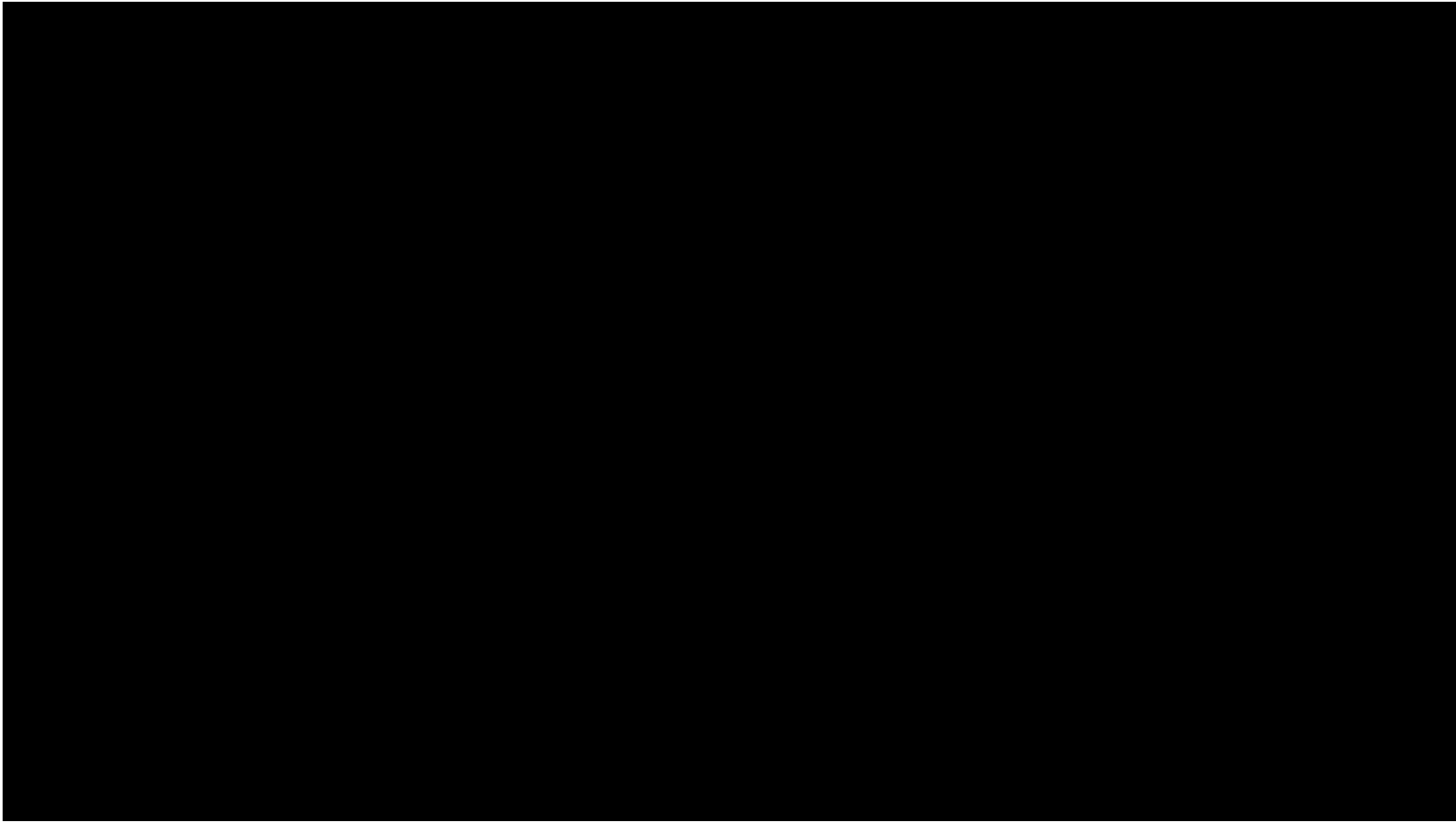
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A typical Project


















Ex. Pot Au Pin



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Circular Economy Matrix

Stakeholders	Supply to / what	Buy from / what
	 <ul style="list-style-type: none"> - Waste coming from supermarkets and from Carrefour suppliers 	  <ul style="list-style-type: none"> - PV : Deliver high quality sustainable Food - AL : Clean Transportation (see below) - AL : Green certificate fully traceable - AL & PV : CO2 savings / Green Image
	  <ul style="list-style-type: none"> - AL : Agriculture wastes - AL : Land - AL : Digestate offtake - C : high quality sustainable Food 	 <ul style="list-style-type: none"> - Service : Technology / Risk Management - Service : Project execution - Service : Biogas purification - Service : Operations of the site - Service : Financing
	  <ul style="list-style-type: none"> - PV : Services for methanisation site - C : Clean transportation Invest. Station Gas supply Green certificates 	 <ul style="list-style-type: none"> - Feedstock - Land - Digestate offtake
	 <ul style="list-style-type: none"> - Domestic wastes 	   <ul style="list-style-type: none"> - Good & sustainable food - Cleaner Air - Climate benefit - Domestic waste management

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Conclusions

Summary : AL supply to Circular economy stakeholders

Technologies

- Biogas purifications & liquefaction
- Clean mobility solutions (BioCH₄, N₂, H₂)
- Gas transportation



Services

- Project executions / Risk management / Engineering capabilities / Technical expertise
- Operations
 - Operational excellence
 - Optimisation
 - Debottlenecking
- Financing → equity in SPV – Purification & Liquefaction invested by AL
- Green certificates produced by AL (full traceability)
- Energy sourcing

Pot Au Pin as a typical projects

- Leverage AL offer to develop circular economy projects

Thank you

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