

MIK **INERATEC**

Next Era Mobility.

Started 2016, with over 130 people fueling the future today.

PROBLEM

Decarbonizing Hard-to-abate sectors



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Slide 3

SOLUTION



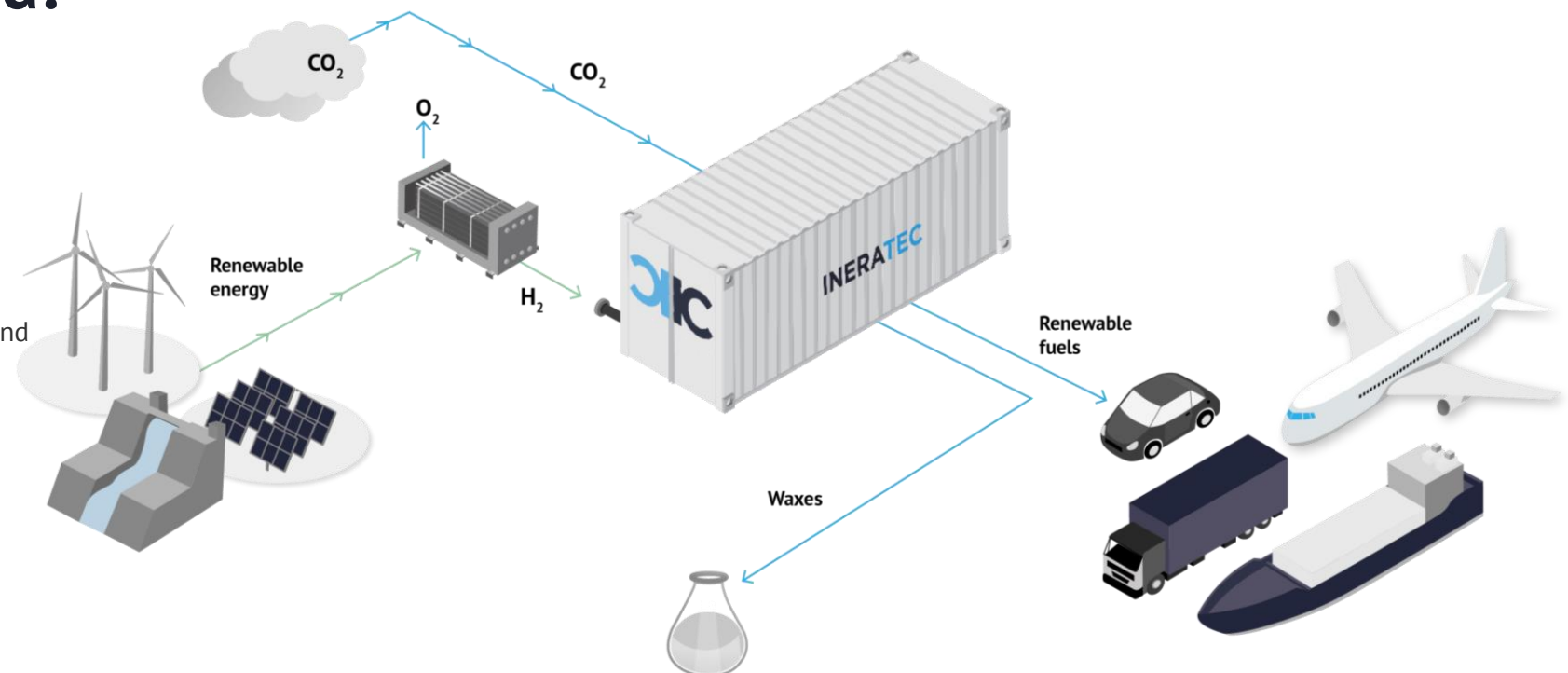
POWER-to-Liquid: CO₂-recycling



THE POWER-TO-LIQUID SOLUTION:

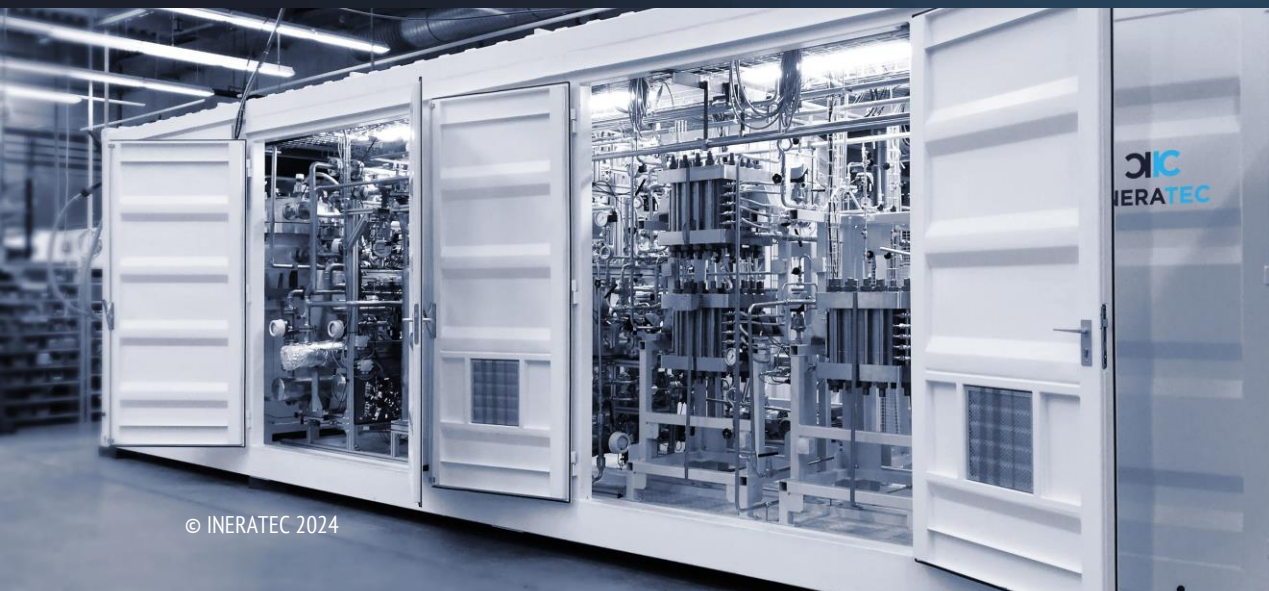
We recycle the greenhouse gas CO₂ and use green hydrogen in our chemical plants to produce climate neutral e-fuels and e-chemicals.

INERATEC focuses on **high TRL, high product yield, and robust thermochemical process pathways** to produce drop-in and ASTM compliant fuels.



Power-to-X-Plants

As a technology provider, we offer modular chemical plants for Power-to-X applications.



E-Fuels and E-Chemicals

As a solution provider, we deliver drop-in ready SAF (Sustainable Aviation Fuel), AvGas (Aviation Gasoline), and e-Diesel, as well as e-waxes and e-methanol for sustainable chemical products.



Scalability & modular approach

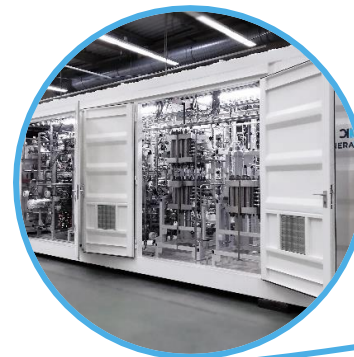
SCALE-UP ROADMAP:

We supply chemical plant units along the availability of green hydrogen and carbon dioxide.

✓
RESEARCH AND DEMONSTRATION PLANTS



✓
INDUSTRIAL PLANT
1 MW



✓
COMMERCIAL PLANT
10 MW



COMMERCIAL ROLL-OUT
100 MW



>0.1 M US gal/a

>1.0 M US gal/a

>10.0 M US gal/a

BUILD OWN OPERATE



H2Uppp / Power-to-X in Chile

Analysis of local requirements for establishing an e-Fuel production

Samantha Michaux,
INERATEC, Business Development

The International Hydrogen Ramp-up Programme (H2Uppp) of the German Federal Ministry for Economic Affairs and Climate Action (BMWK) promotes projects and market development for green hydrogen in selected developing and emerging countries as part of the National Hydrogen Strategy.

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

INERATEC

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OVERVIEW

THE PROJECT
SITE PROFILING
CHILEAN ELECTRICITY MARKET
PERMITTING PROCESS
TECHNICAL INFORMATION
ECONOMIC ANALYSIS
MARKET ANALYSIS

Feasibility study Chile (2023-2024)

| **FACTS:**

- Project start in 2023
- Over 400,000 EUR invest
- Target: Production of up to 50,000 t/a e-Fuels
- Feasibility study is finalised

| **OBJECTIVES:**

- Potential sites profiling
- Facility plot plan (3D)
- Block Flow Diagram
- Mapping of local stakeholders
- Techno-economic analysis

| **About H2Uppp:**

- Supports efforts to boost green H₂ and PtX market
- In selected developing and emerging economies
- In cooperation with the private sector

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Identify local Resources

to produce e-Fuels

1

- Identification of feedstock sources
- Analysis of connection to electrical grid

Selection of potential Sites

to install a PtL-plant
in Chile

2

- Identification of potential zones
- Qualification of potential sites

Permits

to install a PtL-plant
in Chile

3

- Necessary permits identified
- App. Timeline for permit submission
- Identification of local awarding authorities

Identify local Partners

for assembly and
certification of e-Fuels

4

- Identification of local companies for assembling & manufacturing
- Analysis of certification process and auditing bodies

Identify potential Off-takers

5

- Market of liquid fuels in Chile
- Identification of potential Off-takers

SITE PROFILING

Identification of

Identification of

Identification of industrial scaled

Identification of

Identification of connection to the

Identification of potential

Distances to the

Industrial Lands*

- Feasible permitting for chemical plant
- Near to H₂ (max. 2 km) & to electricity substation
- Buildable land

CO₂ sources*

- At least 170,000 t/a
- Biogenic
- Industrial
- At proximity to site (max. 50 km)

H₂ Sources*

- At least 23,000 t/a
- At proximity of CO₂ source (max. 150 km)
- Mature development (FEL1-3)

Water Sources*

- Nearby desalination plant
- Connection to potable water network
- Feasibility of waterhole

Electrical System*

- Substation at proximity with min. capacity of 220 kV
- Grid total capacity of 200 MW by 8,000 h/a

Syngas*

- At least 300.000 NM₃/a (without inert gases)
- Type of biomass

Transport Network*

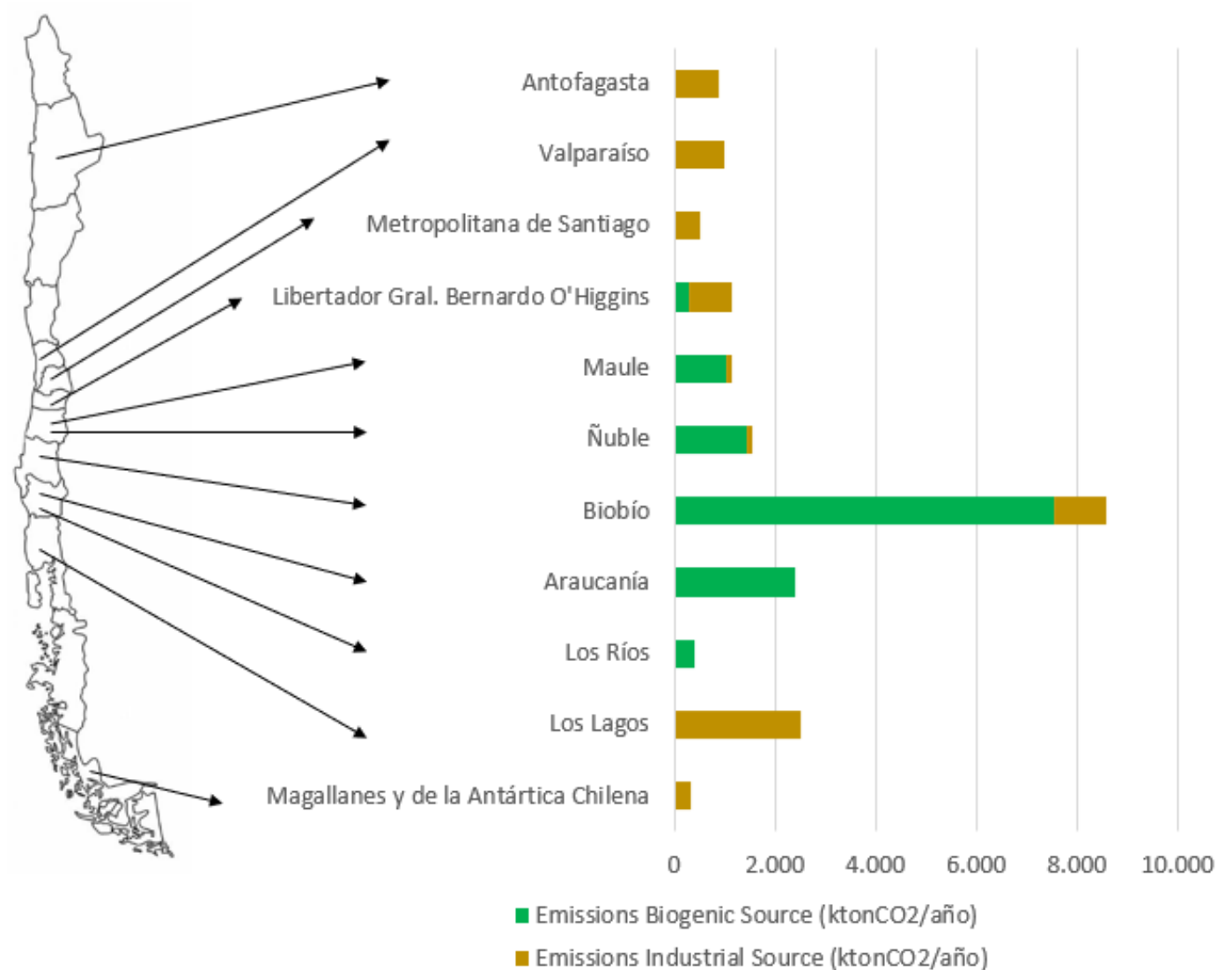
- Highway & railroad
- Pipeline at proximity

SITE PROFILING

Local Resources CO₂ sources

CRITERIA:

- Select sources of **CO₂ > 100,000 t/a**
→ 55 million tons in 67 point sources.
- Excludes coal-fired and natural gas power plants (plan to cease operations by 2024 and limited operation time)
→ 20.5 million tons in 44 point sources.



Local resources

CO₂ sources

1 CMPC (Pulp & Paper)

- **Biogenic source (biomass)**
- > 7000 kton CO₂/a
- 3 big plants in Potential Zone N°7

2 Comasa Energía (Thermoelectric Power Plant)

- **Biogenic source (biomass)**
- 380 kton CO₂/a
- 1 plant in Potential Zone N°12

3 Celulosa Arauco (Pulp & Paper)

- **Biogenic source (biomass)**
- > 2000 kton CO₂/a
- 5 plants in Potential Zone N°5, 6, 7 and 12

Local resources

CO₂ sources

4 Cementos Biobío (Cement)

- **Industrial source (Petcoke)**
- 272 kton CO₂/year
- 2 plant in Potential Zone N°1 and 5

5 Cementos Polpaico (Cement)

- **Industrial source (Petcoke)**
- 500 kton CO₂/year
- 1 plant in Potential Zone N°3

6 Energías Industriales (Thermoelectric Power Plant)

- **Biogenic source (biomass)**
- 388 kton CO₂/year
- 1 big plant in Potential Zone N°5

Local resources H₂ sources

1 GENESIS- ANTUKO

(La Negra):

- 100 MW // 15 kton/a
- Potential Zone N° 1
- Status: FEL 2

2 ATACAMA HYDROGEN

(Paracelsus):

- 2 GW // 120 kton/a
- Potential Zone N° 1
- Status: FEL 1

3 VOLTA MAE Energy

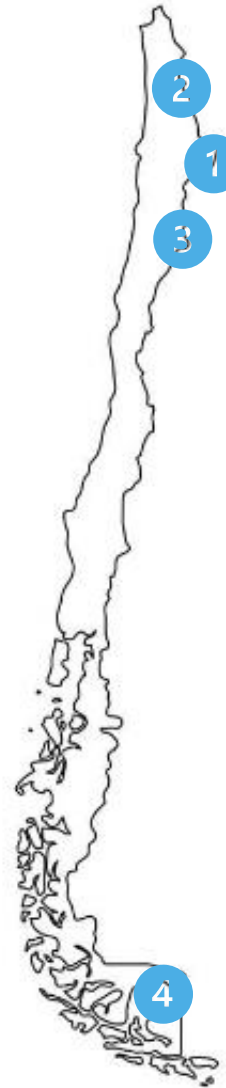
(Mejillones):

- 350 MW // 61 kton/a
- Potential Zone N° 1
- Status: FEL 3

4 CABEZA DEL MAR GH Energy

(Cabo Negro):

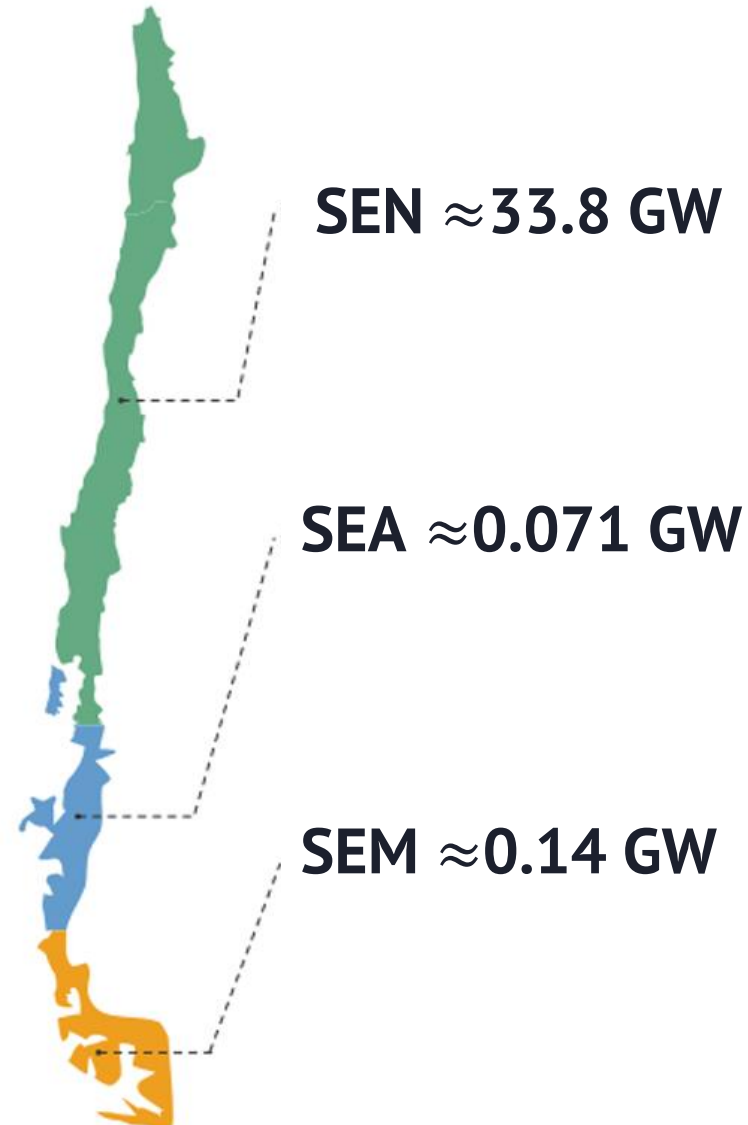
- 1 GW // 119 kton/a
- Potential Zone N° 16
- Status: FEL 1



Local resources

Renewable energy

- In Chile, 33.8 GW of electrical capacity is installed
- \approx 20.5 GW are renewable energy
- 50% of this is controlled by 5 big providers
- There is one big interconnected System:
SEN (National Electric System)
- And two medium systems:
SEA (Aysen Electric System)
SEM (Magallanes Electric System)

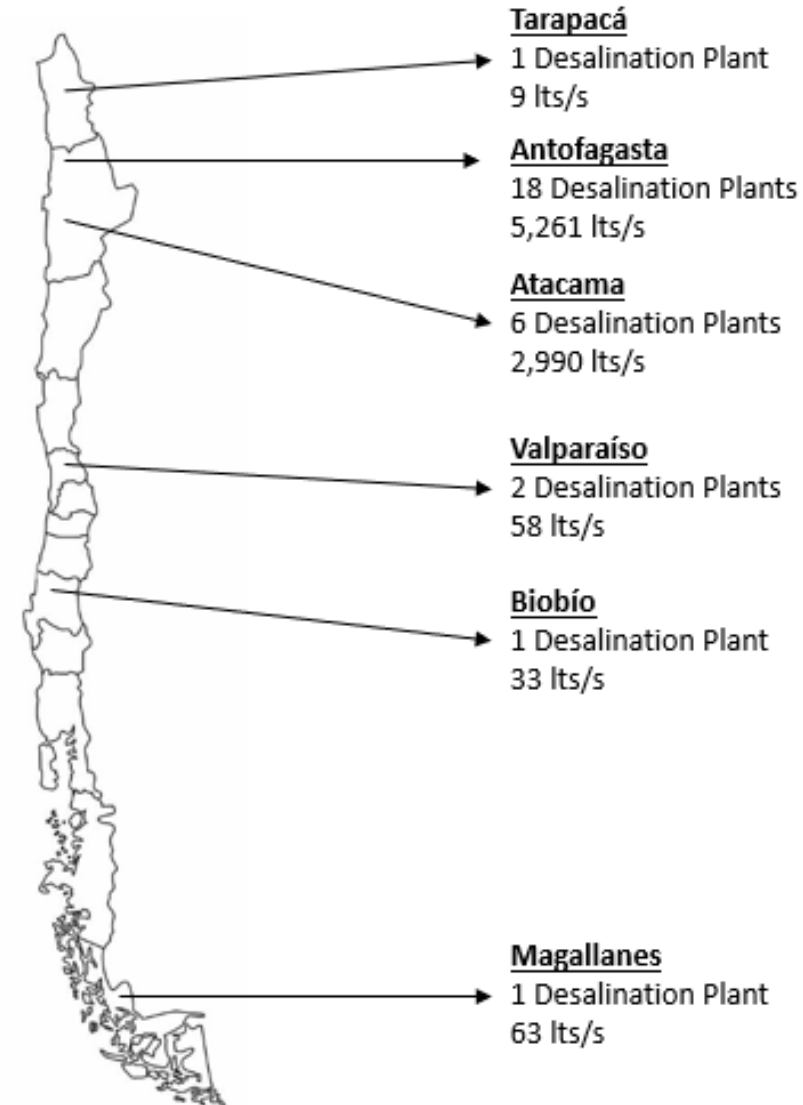


Local resources

Water sources

WATER ACCESS:

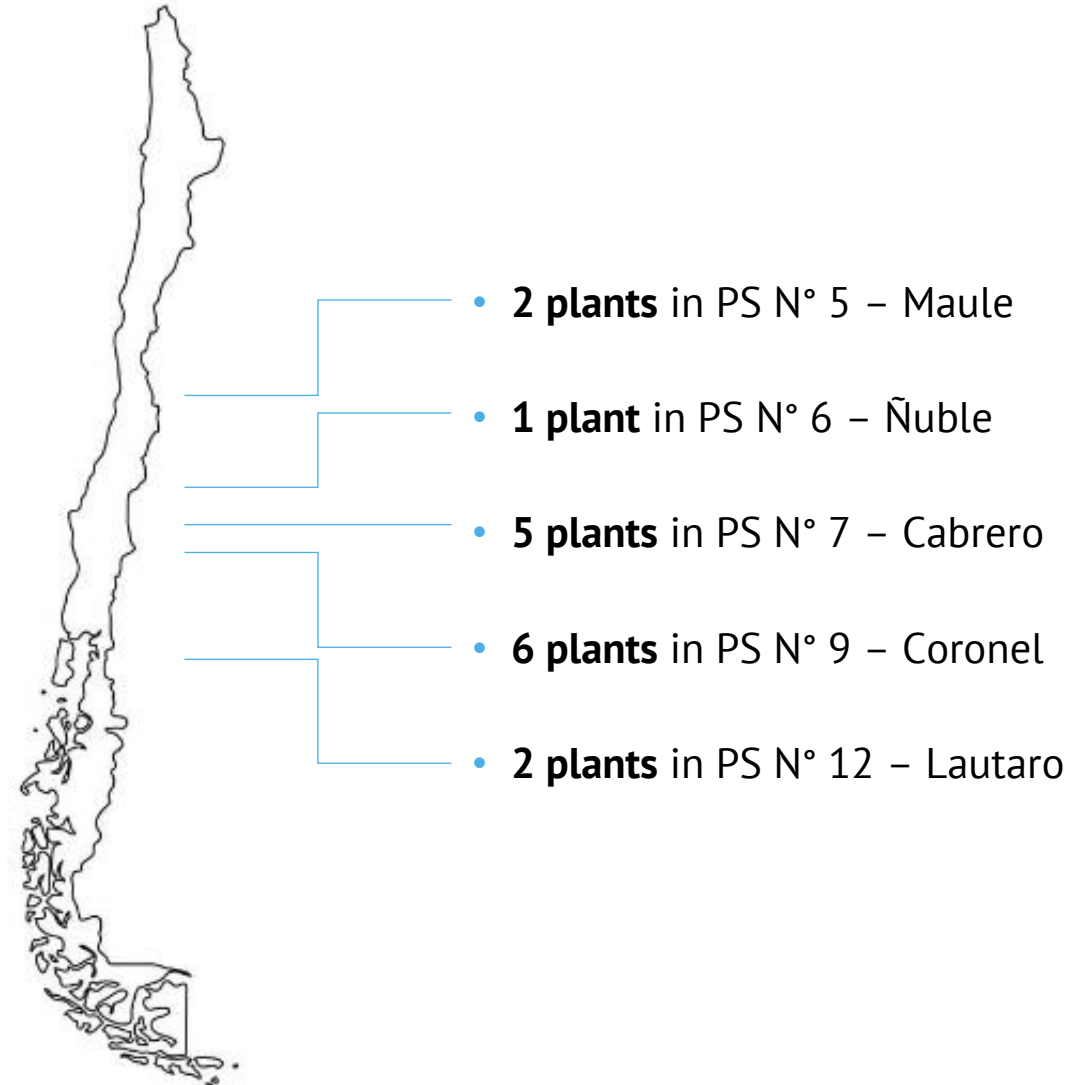
- Three options available:
 - Connect to the distribution sanitary water network
 - Access to on site waterhole
 - Supply through pipeline from third-party water treatment plants
- There are **29 desalination plants** in Chile; 24 of these plants have a major capacity.



Local resources

Syngas sources

- There is no **production or supply of syngas** or any similar gas in Chile.
- There are some **16 plants** producing more than **100,000 tons of wood waste** per year that could be used to produce syngas.
- INERATEC's optimal ratio:
H₂ : CO = 2:1 + max. 50 % inert gases



Potential Sites Zones and Sites

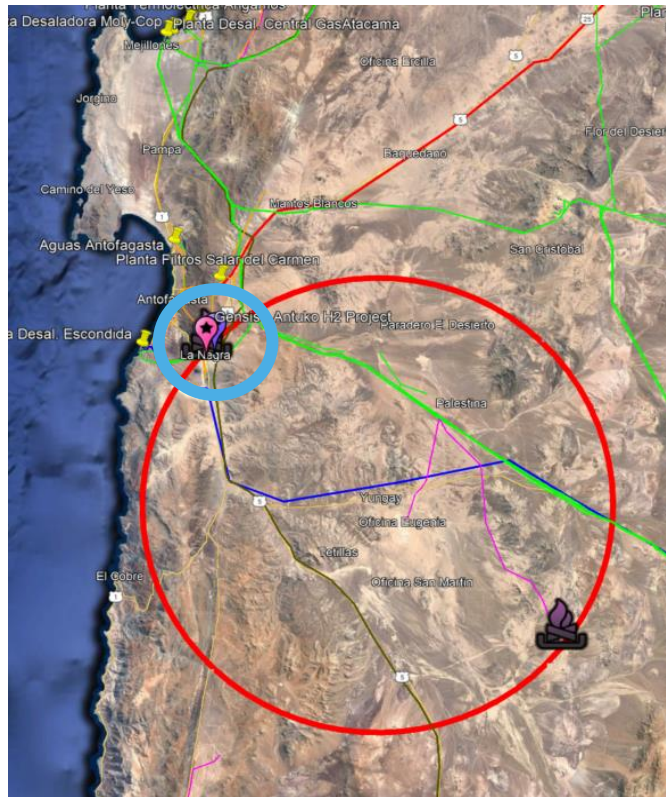
- Preliminary **16 potential zones** were identified, based on an analysis of the mandatory resources for a PtL-plant.
- **Neighbouring zones have been combined** to a single zone, when the distances of the different sources were at proximity.
- This reduces the list of 16 potential zones to **10 potential sites**.



- **Potential Site N° 1 – La Nofoya (Atafagasta)**
- Potential Zone N° 2 – El Loa
- **Potential Site N° 3 – Tiltil (RM)**
- Potential Zone N° 3 – Valparaíso & Tiltil (RM)
- Potential Zone N° 4 – Rancagua
- Potential Site N° 4 – Graneros (Rancagua)
- Potential Zone N° 5 – Maule
- **Potential Site N° 5 – Maule**
- Potential Zone N° 7 – Laja, Cabrero & Diguillín
- Potential Site N° 6 – Ñuble
- Potential Zone N° 8 – Talcahuano & Hualpén
- Potential Zone N° 9 – Coronel & SPDLP
- **Potential Site N° 7 – Cabrero (Zones N° 7 & 11)**
- Potential Zone N° 10 – Arauco
- Potential Site N° 9 – Coronel (Zones N° 8, 9 & 10)
- Potential Zone N° 11 – Nacimiento, Minico & Mulchen
- Potential Zone N° 12 – Lautaro
- Potential Site N° 12 – Lautaro
- Potential Zone N° 13 – Valdivia
- Potential Zone N° 14 – Puerto Montt
- Potential Site N° 14 – Puerto Montt
- Potential Zone N° 15 – Castro Chiloé
- **Potential Site N° 16 – Cabo Negro (Magallanes)**
- Potential Zone N° 16 – Cabo Negro (MAG)

SITE PROFILING

Potential Sites



Site N° 1 – LA NEGRA

Industrial Land	38,000 m²
Distance by railroad	0.8 km
Distance by Highway	0 km (Ruta 5)

Electrical connection to substation

Tension	220 kV
Distance	0.8 km
Estimated year	2025

H₂ sources

Name	Antuko-Genesis (La Negra)
Capacity	100 MW
Production	15 kton/year
Distance by highway	1.8 km

Principal water source

Type	Feasibility of waterhole
	Desalination plant Coloso

CO₂ sources

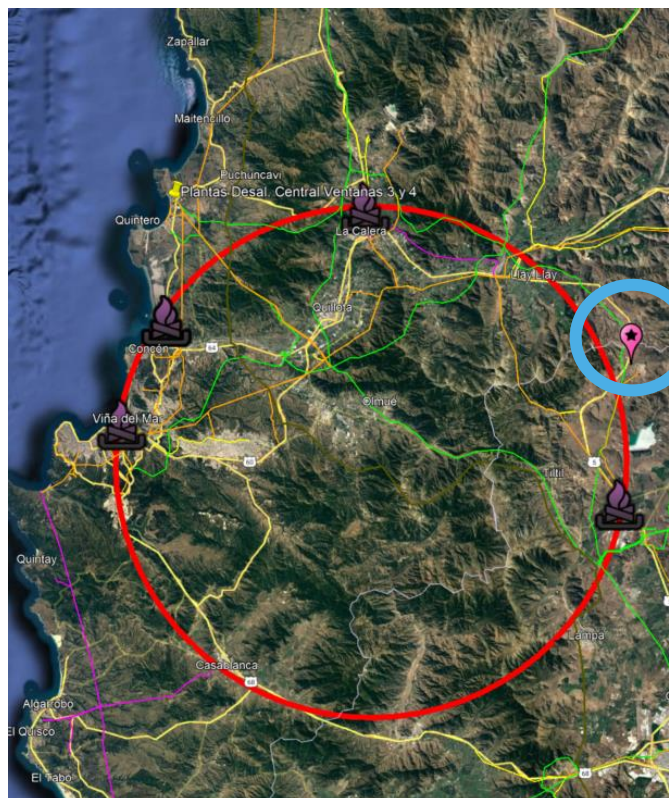
Planta Cemento Antofagasta	
Emissions	167,295 t/a
Distance to highway	0.3 km
Faena el penon	
Emissions	600,139 t/a
Distance by highway	136 km

SITE PROFILING

Potential Sites



Santiago



Site N° 3 – Tiltit (RM)

Industrial Land **75,000 m²**
 Distance to railroad **0.5 km**
 Distance to Highway **0.4 km**

Electrical connection to substation

Tension **220 kV**
 Distance **1.6 km**
 Estimated year **2026-2027**

H₂ sources

None

Principal water source

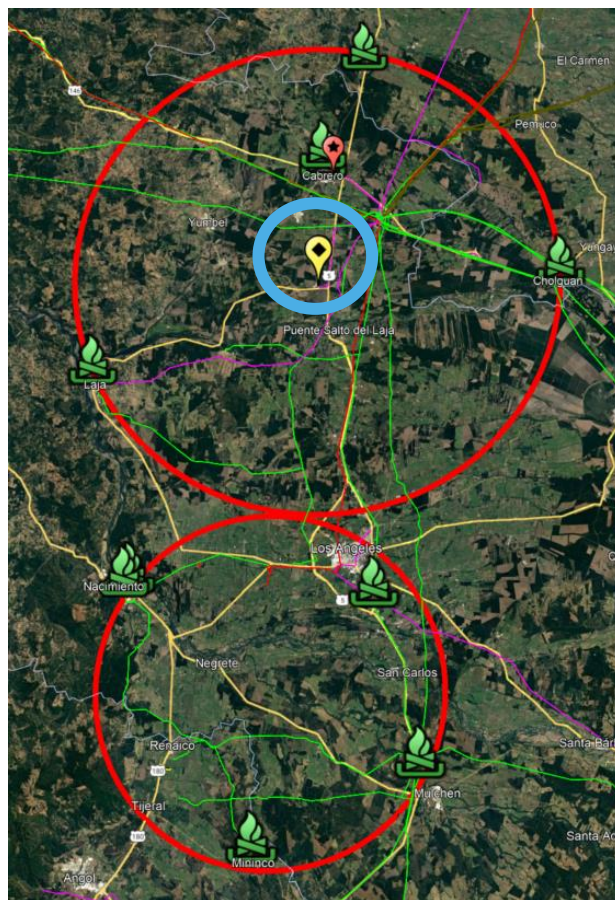
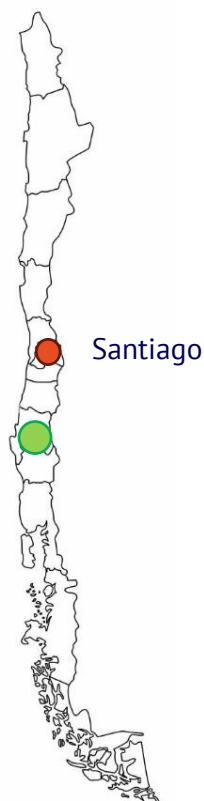
Type **Feasibility of waterhole**

CO₂ sources

Planta Cerro Blanco	500,000 t/a, 28.8 km
Cemento Melòn Planta	144,221 t/a, 48.8 km
Planta Co Generadora	178,669 t/a, 85.4 km
Refineria ENAP	294,729 t/a, 85.4 km
Elaboradora de Cobre	259,516 t/a, 105.5 km

SITE PROFILING

Potential Sites



Site N° 6 – CABRERO

Industrial Land **83,550 m²**
 Distance by railroad **0 km**
 Distance by Highway **1.3 km**

Electrical connection to substation

Tension **66 kV**
 Distance **1.0 km**
 Estimated year **2026-2027**

H₂ sources

None

Biomass producer

CMPC Maderas S.P.A.
 Distance by highway **19 km**

Principal water source

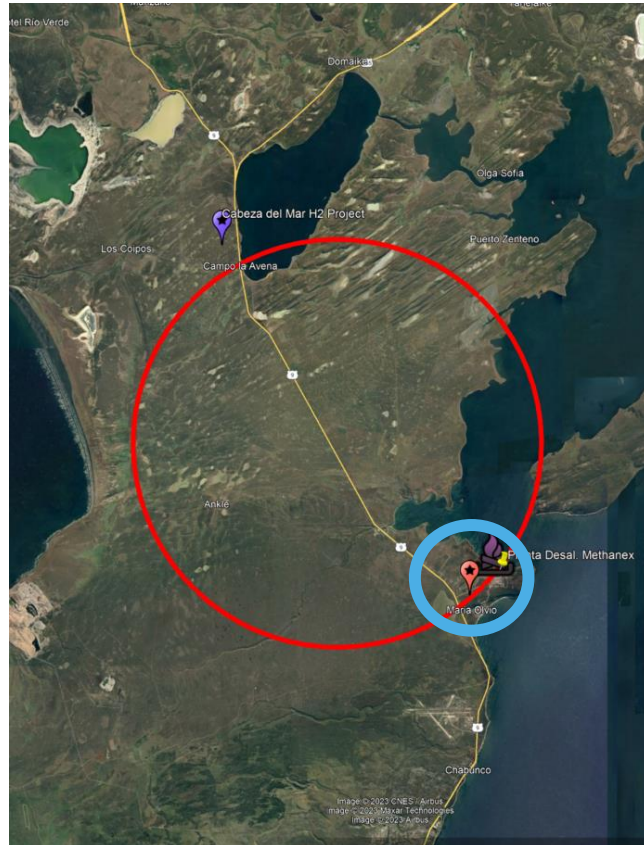
Type **Sanitary distribution network**

CO₂ sources

Neomas S.P.A.	255,512 t/a, 1.5 km
Central Termoelectrica	115,801 t/a, 2.2 km
Orafti Chile S.A.	338,340 t/a, 15.5 km
Planta Trupán/Cholquan	403,049 t/a, 32.3 km
CMPC Celulosa Planta	1,562,965 t/a, 54.2 km
Planta Remanofactura	107,940 t/a, 57.2 km
Aserradero Mulchen	148,753 t/a, 53.9 km

SITE PROFILING

Potential Sites



Site N° 10 – CABO NEGRO (MAG)

Industrial Land **> 170 ha available**
 Distance by highway **0.7 km**

Electrical connection to substation

None

Principal water source

Type **Feasibility of waterhole**

H₂ sources

Name **Cabeza del Mar**
 Capacity **1,000 MW**
 Production **> 100 kton/a**
 Distance by highway **20 km**

CO₂ sources

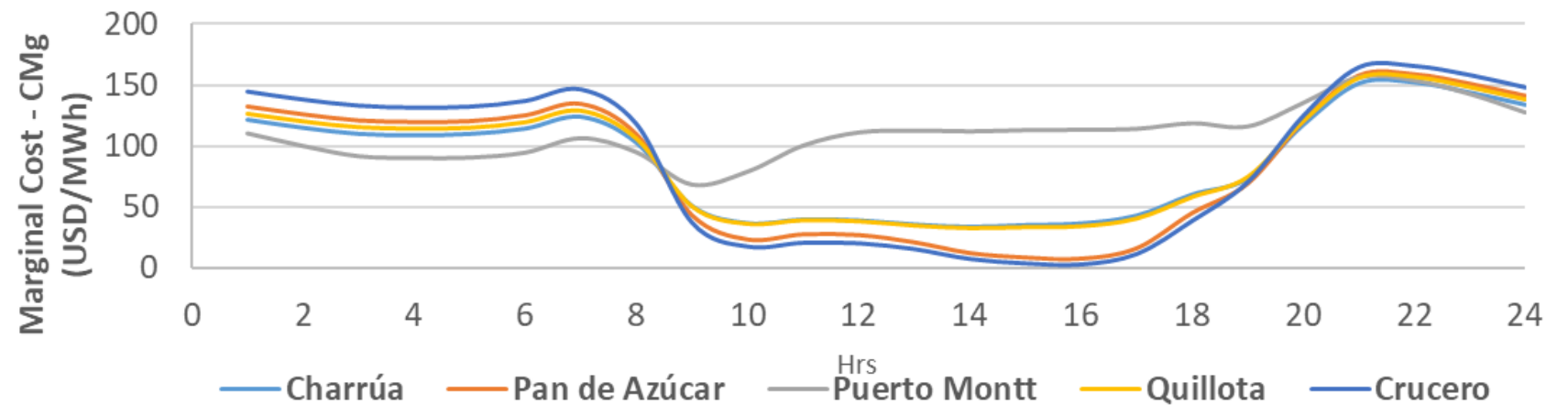
Methanex Chile S.A.
 Emissions **217,676 t/a**

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SITE PROFILING

Electrical price structure and market



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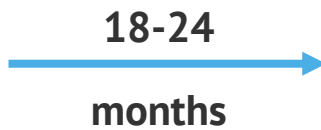
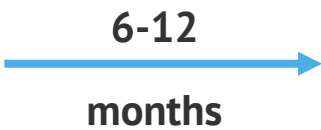
PERMITTING PROCESS

Preliminary activities

Environmental permit

Plant construction & certification

Final activities



- Preparation of environmental study
- Application for electrical connection
- Architecture project

- Review all the information provided by the project owner

- Include the certification by a third-party organization
- Request authorization permit with the SEC for the operation

- Start of operation

Principal institutions

Environmental Assessment Service (SEA)

1

- Verifies and approves the environmental impact study/declaration of the plant

Superintendency of Electricity and Fuels (SEC)

2

- Verification of compliance to regulations and standards governing installations
- Certification by a 3rd party auditing body

Municipality

3

- Provides the building permit
- Request authorization permit with the SEC for the operation

National Energy Commission (CNE) and National Electric Coordinator (CEN)

4

- Conducts studies and provides grant permits for connection to the electrical system
- Provides the plant operating permit

OVERVIEW

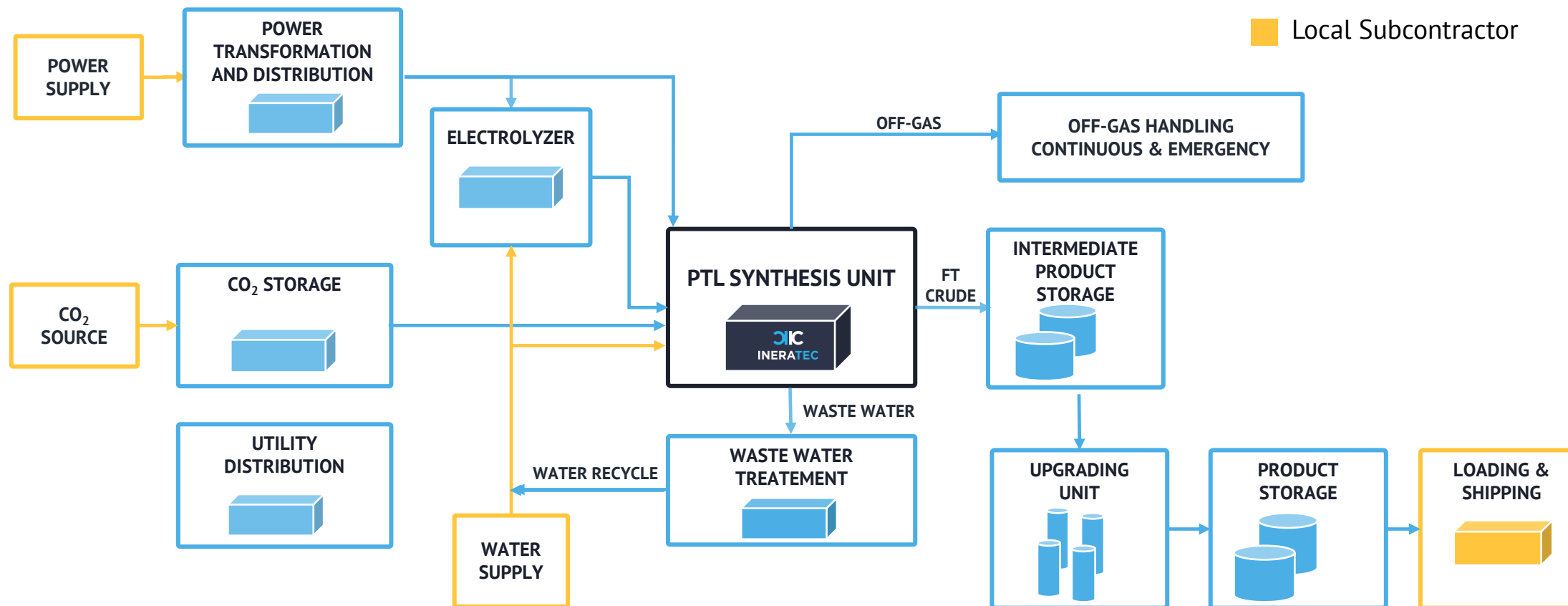
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- 1 Synthesis
- 2 Electrolysis
- 3 H₂-Compression
- 4 H₂ Purifier
- 5 H₂ Storage
- 6 Hydrocracking
- 7 Isomerisation
- 8 Heater
- 9 Distillation
- 10 Product Storage
- 11 Truck Loading
- 12 CO₂ Storage
- 13 Cooling Water
- 14 Cold Water
- 15 Compressed Air System
- 16 Nitrogen
- 17 Flare
- 18 Waste-Water Treatment
- 19 Heat/Power Plant
- 20 Control room
- 21 Social Rooms
- 22 Parking Area
- 23 Solar parc

Block Diagram

- INERATEC
- INERATEC Subcontractor
- Local Subcontractor



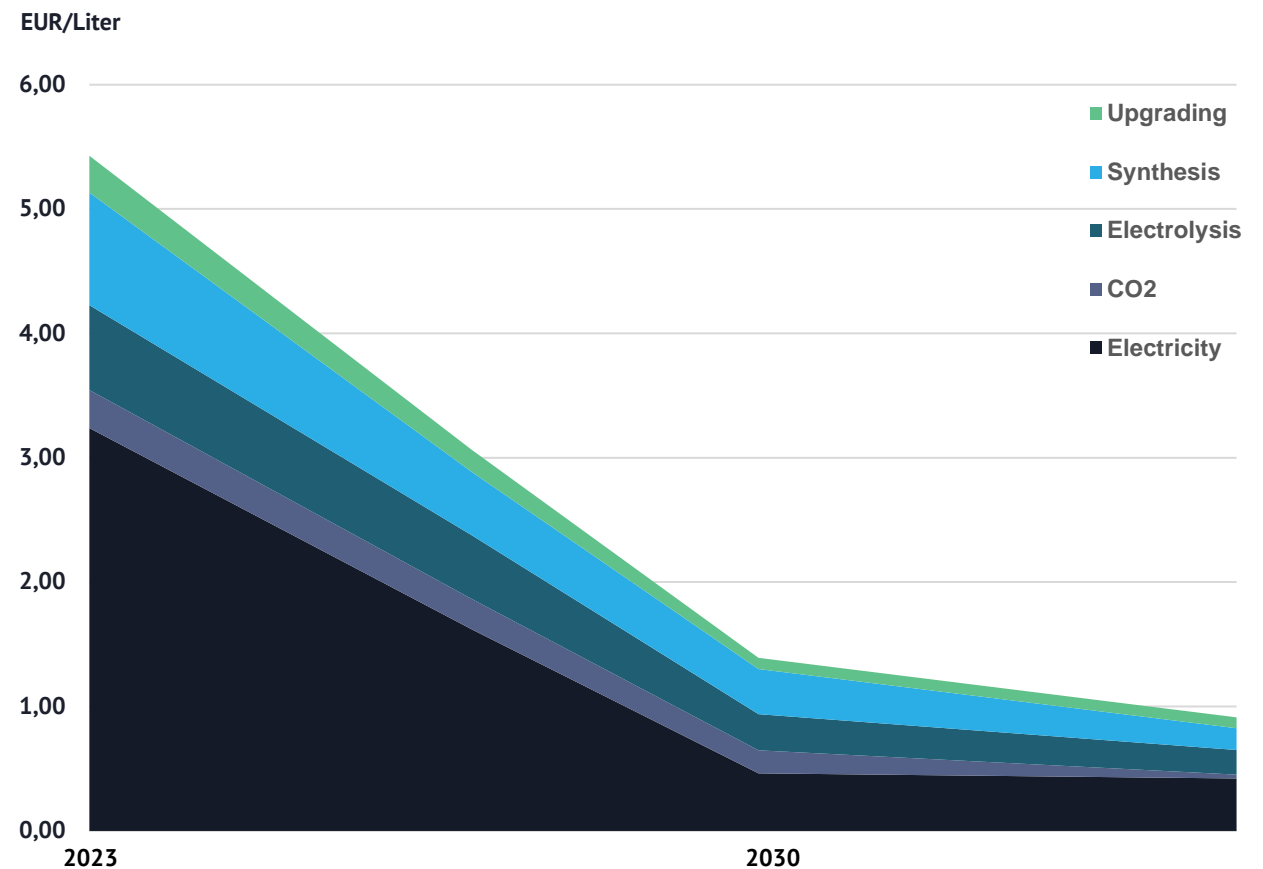
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Production cost expectations for eSAF

PRODUCTION COST OPTIMIZATION

- Reduce electricity price
- Reduce CO₂ cost
- Reduce CAPEX of electrolysis + increase efficiency
- Reduce CAPEX of PtL synthesis + increase efficiency
- Reduce CAPEX of upgrading unit for eSAF production

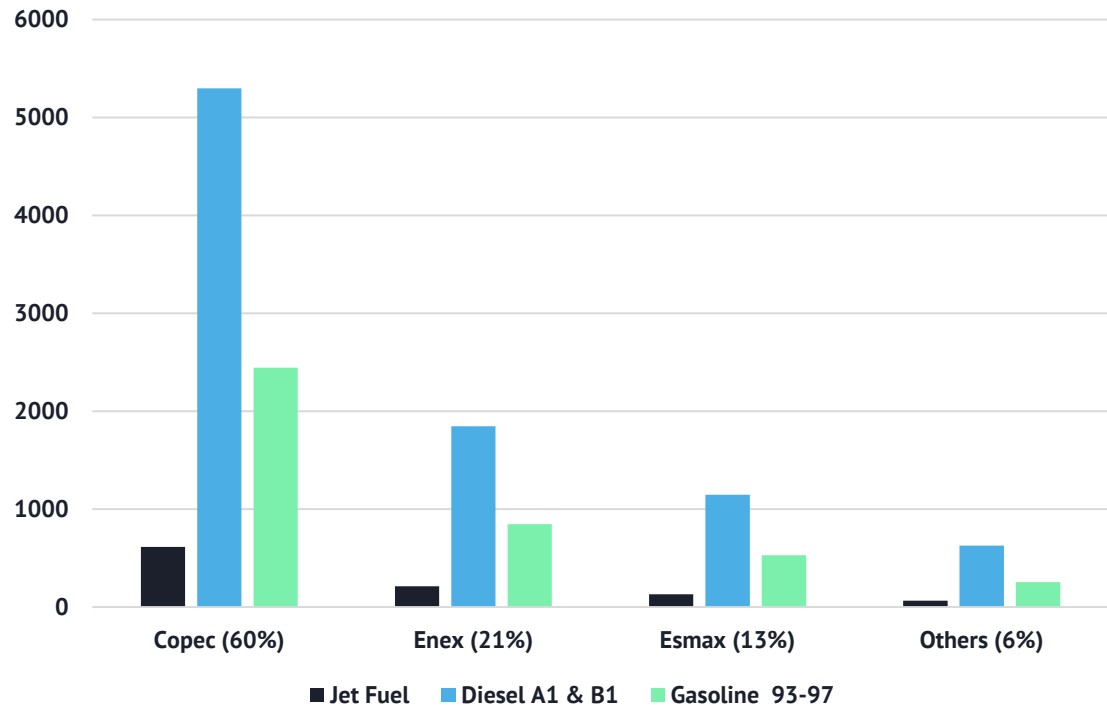


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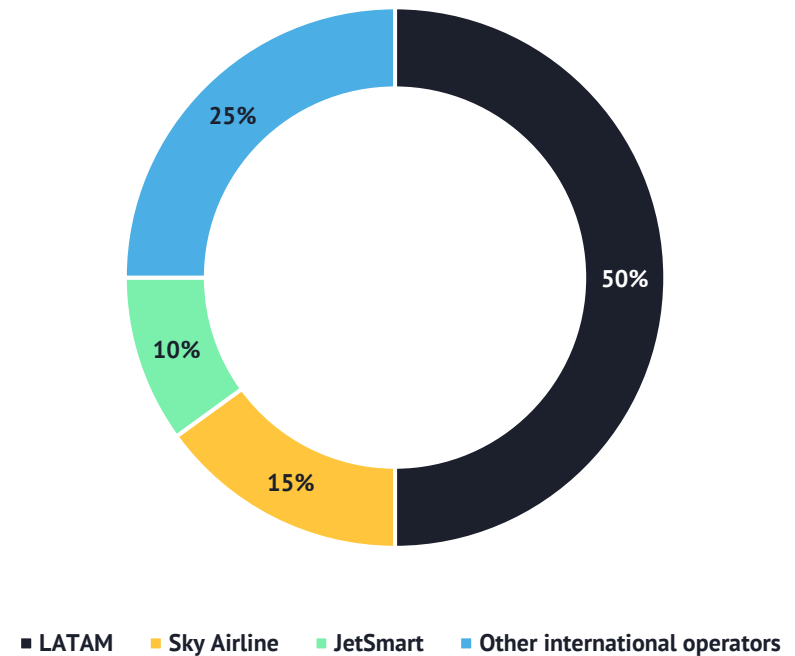
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Total Distribution Market

TOTAL FUELS DISTRIBUTED
(2020, in kton/year)



TOTAL CONSUMPTION JET FUEL
(2020)



GET TO KNOW US

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