Community Engagement

Overview of Ammonia projects

AEA Conference 12 November 2024

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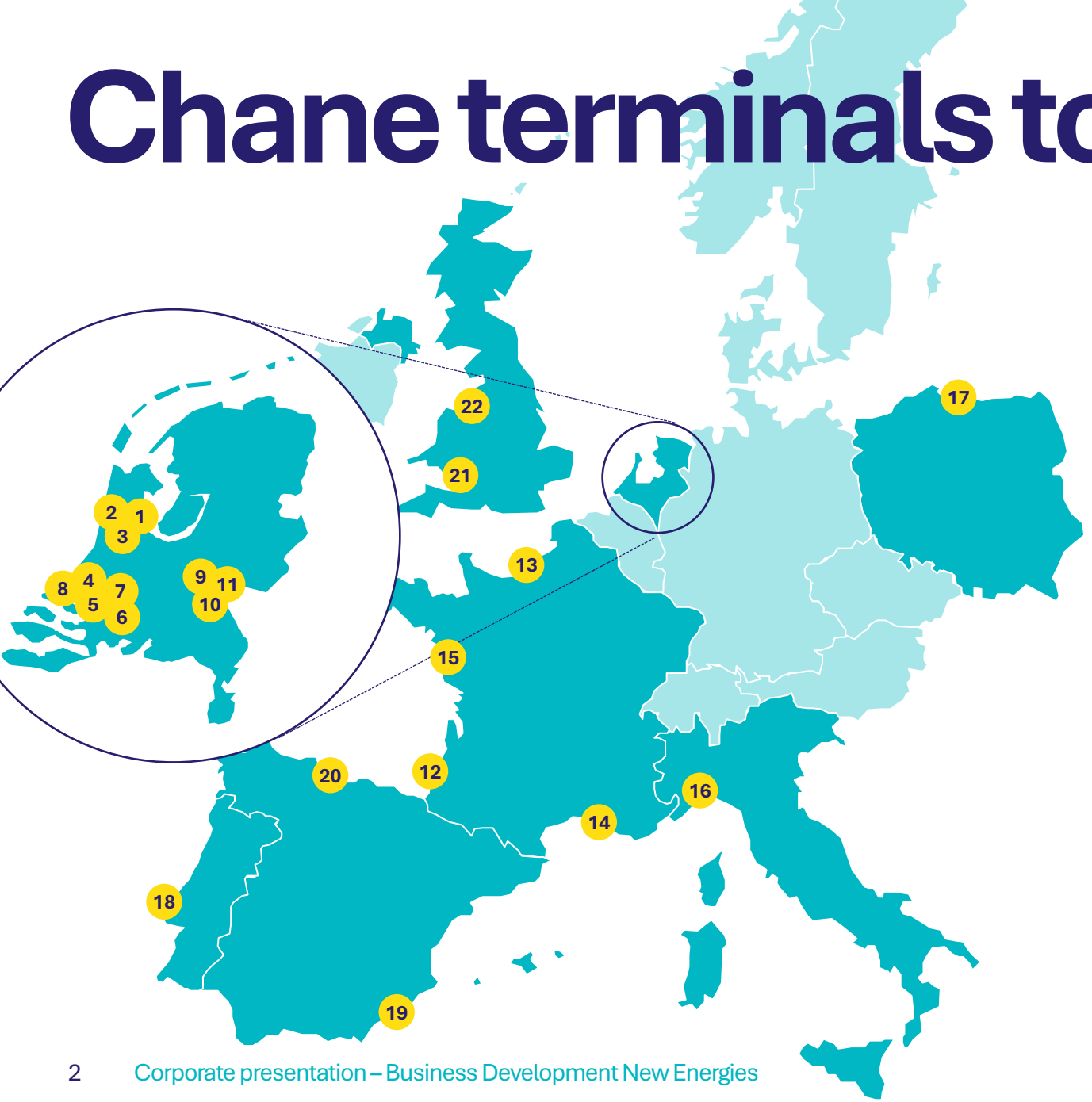
Chane terminals today



1. **Chane Terminal Amsterdam**
   119,000 cbm
2. **Chane Terminal Westerhoofd**
   74,000 cbm
3. **Chane Terminal Zaandam**
   56,000 cbm
4. **Chane Terminal Botlek**
   1,600,000 cbm
5. **Chane Terminal Geulhaven**
   150,000 cbm
6. **Chane Terminal Nieuwe Maas**
   1,400,000 cbm
7. **Chane Terminal Pernis**
   675,000 cbm
8. **Chane Terminal Welplaat**
   110,000 cbm
9. **Chane Terminal Dodewaard**
   20,000 cbm
10. **Chane Terminal Nijmegen**
    80,000 cbm
11. **Chane Terminal Oostkanaalhaven**
    80,000 cbm
12. **Chane Terminal Bayonne**
    125,000 cbm
13. **Chane Terminal Le Havre**
    460,000 cbm
14. **Chane Terminal Marseille**
    107,000 cbm
15. **Chane Terminal Nantes**
    25,000 cbm
16. **Chane Terminal Vado Ligure**
    158,000 cbm
17. **Chane Terminal Gdynia**
    32,000 cbm
18. **Chane Terminal Lisbon**
    170,000 cbm
19. **Chane Terminal Cartagena**
    26,000 cbm
20. **Chane Terminal Santander**
    86,000 cbm
21. **Chane Terminal Avonmouth**
    25,000 cbm
22. **Chane Terminal Liverpool**
    22,000 cbm

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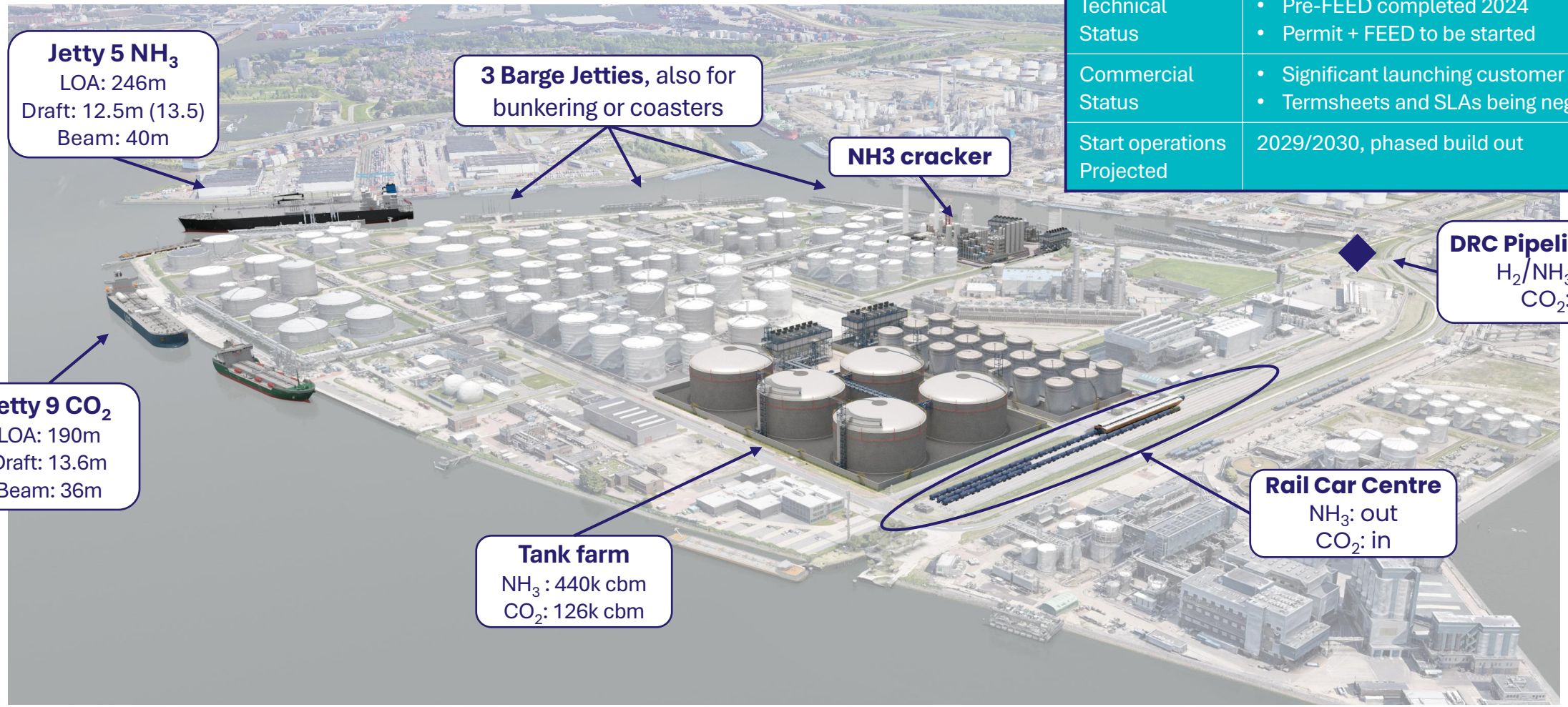
Rotterdam (Netherlands) NH3 import hub

Import hub for NH_3, Export hub for CO_2 volumes

Modalities	Barge, Rail, Pipeline, Truck
Technical Status	• Pre-FEED completed 2024 • Permit + FEED to be started
Commercial Status	• Significant launching customer line-up • Termsheets and SLAs being negotiated
Start operations Projected	2029/2030, phased build out



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Risk and opportunities in accelerating societal support of green NH3 as an alternative for fossil fuels in the Energy Transition

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Drs. Marieke Bloemers

This study (initiated by Chane, formerly Koole Terminals) focuses on

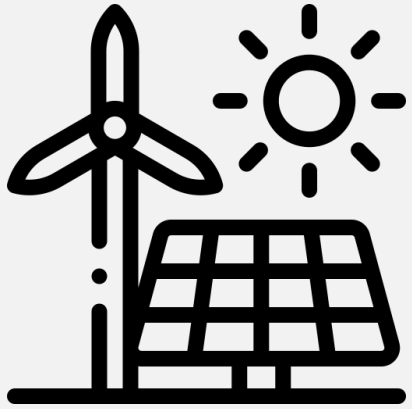
Societal support for NH3 in context of Energy Transition

Focus of survey and personal interviews among experts

Industry

Attitude

Supportive Behavior



Government

Attitude

Supportive Behavior

Public at large

Attitude

Supportive Behavior

Conclusions Survey in general

- **NH3** has a **negative connotation** especially in NL and Europe. Rest of the world, specifically among future exporters operating in less densely populated countries, are much more positive.
- **Industry** beliefs that **NH3 can speed up the Energy Transition** as ammonia can act as an efficient carrier of H2 and can substantially reduce CO2 at a global level as it can replace diesel (ships) and coal (power plants) in the short run.
- **Safety is crucial** and key priority for all actors involved with NH3 projects. A **pipeline** is seen as **a solid solution** (if all safety measures are applied) as trains and ships are seen as a too risky alternative by the public sector as they expect mass public resistance.
- Despite all restraints around NH3, especially **industry** expects **economic advantages** of launching NH3 in NL. It will increase the chance of getting EU subsidies, Port of Rotterdam will remain competitive, and it will increase employment and tax income.
- **NH3** is **not the silver bullet** but **one of the alternatives** for fossil energy. Imported NH3 could prove to be more efficient and readily available than locally produced green hydrogen.
- Respondents see the **Port of Rotterdam and the government** in general as the most obvious **spokesperson** to get societal support for NH3. Clarity by Port of Rotterdam about the intended locations for NH3 storage will help in discussions with (potential) opponents).

Wrap-up **Government Views**

If the end users prefer NH3 we won't stop them, as long as this is done within our strict safety rules and … if the expenses (a.o. pipeline) are paid for by the private sector….

General attitude

- NH3 is not the only alternative for fossil fuels and is in our view too risky
- Support for NH3 will delay an introduction of H2
- NH3 as fuel is useful for industrial purposes (bunkering and heavy industry)
- Industry will in the end go for NH3 (lower costs), if they do, we will not stop them.

Expected role of the business world

- Negative image industry due to recent incidents has to change fast as past behavior has evoked extra suspicion in society about sustainable fuels like NH3
- Positioning NH3 can best be done in showing the full picture of the ET, including the pros and cons of wind farms, methanol and nuclear fusion.

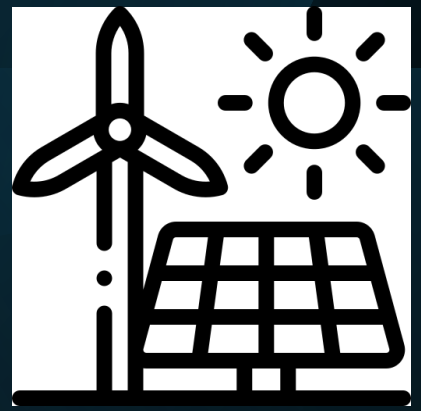
Pipeline

- Building a pipeline automatically implies allowing NH3 in large volumes in NL
- Public sector will be expected to compensate house owners living nearby the trajectory of the pipeline
- Alternative for pipeline is trains over the Betuwelijn (only small volumes)

Government role

- A consistent vision about NH3 is lacking in the public sector, except the overall attitude that safety will always be first.
- Information gatherings with local residents will be more relevant if the business world presents its plans jointly with the public sector. Lacking such a story can make these meetings counter effective.
- Fear for public resistance (simplified by the Omgevingswet) determines government support for a molecular energy source. From that perspective H2 is perceived by them as the least risky.
- Launching NH3 must include explanations of how this will be beneficial for society and for individuals (employment, less CO2, more livable word).

Wrap-up **Industry Views**



Fossil fuels will be replaced gradually by H2 that is transported to global industry by NH3 (ships). In addition, NH3 will substantially reduce CO2 emissions as soon as ships and power plants start using this carbon free energy

H2 and its carrier NH3 will grow in gigantic volumes

- A rise in green (first blue) NH3 volume is expected in the coming decades (600 mln tons), to be used mainly as carrier of H2 and as energy fuel for ships and power plants.
- Without imported NH3 large volumes of H2 for industrial purposes will not be doable.

Costs of energy Transition

- Investors are not eager to finance NH3 projects due to high market entry costs and uncertainty what will be the winning renewable. Creating an equal playing field by applying a global price for CO2 costs will solve this problem to some extent.
- Renewable energy will be substantially more expensive in the starting period compared with fossil energy.
- However, the longer it takes to start producing and using NH3 at a large scale, the higher the expenses will be.

Ammonia societal acceptance

Summary of findings from 60+ interviews with international governmental and industrial organizations

Key Message as starting point for increasing support for NH3 in accelerating the ET (1)

Reducing negative effects of fossil fuels

- About 80% of the world's total fuel usage is fossil (oil, gas, etc.). This form of energy is finite in the long term and has the drawback of releasing carbon dioxide and other greenhouse gases upon combustion. This has a negative effect on global warming and ultimately on human and environmental health.

International community aims at substantial reduction of CO2

- It's no wonder that NGOs exert significant pressure on governments to take action. The EU has already implemented various measures to reduce the negative impacts of fossil energy use. In the Paris agreements, national governments agreed to achieve a substantial reduction in CO2 emissions, partly by prioritizing renewable forms of energy in the long term.

Wind, water and solar will not be enough

- Wind, solar, and water are seen as the best alternatives for electrification. However, given the enormous energy needs of both industry and individual consumers, additional forms of energy will be necessary.

Molecule-based alternatives are a necessity to satisfy the energy needs

- Expectations surrounding molecular forms of energy are high. Hydrogen (H2) is widely seen as a suitable addition to the future energy mix to replace fossil fuels. Ammonia (NH3) can also be a good alternative, not only because it is an efficient carrier of H2 but also due to its applications as fuel for power plants and ships. A transition from fossil fuels to NH3 in these sectors would mean an unprecedented reduction in CO2 emissions worldwide, significantly improving air and sea quality. "The maritime sector consumes approximately 300 million tons of fossil fuel annually. This results in more than 1 gigaton of Greenhouse Gas emissions, equivalent to approximately 3% of all global GHG emissions" (ISPT report, 2024).

All molecule-based energy have their challenges

- Every energy source has its disadvantages. You wouldn't want wind turbines in your backyard, methanol can cause severe health issues, and hydrogen can explode. NH3 is toxic and, without adequate safety measures, can cause fatal accidents.

NH3 is potentially an accelerator of the ET

- The properties of NH3 such as its high energy density, makes it one of the more promising options for storing and transporting carbon free fuel efficiently. The promise of supply certainty will encourage off-takers to implement these products in their business processes and reach the ET goals in time.

Key Message as starting point for increasing support for NH3 in accelerating the ET (2)

NH3 has a negative connotation due to its toxic nature

- Safety is therefore an absolute necessity. The fertilizer industry has been using NH3 for over 100 years and has a good track record in this area. The same applies to companies like Air Products (Yara? OCI), which are also major users of NH3 and have been handling it responsibly for decades. Companies wishing to use NH3 are subject to strict scrutiny by safety services and environmental regulators.

High volumes of NH3 will be produced in a sustainable way

- The EU expects that the volumes of NH3 needed will increase enormously in the coming decades. This concerns sustainably produced NH3 using solar and wind energy in regions of the world where they are readily available. This sustainable and perpetually producible NH3 will be transported by ship, among other means, to European ports such as Rotterdam, where it will be stored in terminals specially designed for NH3 before being transported to end-users in the Netherlands and its Hinterland.

Delta Rhine Corridor avoiding train transports

- These end-users can either use NH3 as fuel or it can be cracked into H2. For H2, a pipeline (Delta Rhine Corridor: DRC) will be laid between Rotterdam and Duisburg with government subsidy. The government still needs to decide whether to permit the construction of a pipeline for NH3 transport. However, given the perceived risks of transporting ammonia by train through their municipalities by local authorities in Brabant and Limburg, opting for a pipeline seems inevitable in the long run.

Who will pay the ferryman?

- The question, of course, is who will pay for this? Several companies in our country and in Germany are willing to do so. However, governments at national and regional levels must first agree to a series of follow-up steps (including allowing the DRC to be made suitable for NH3).

Not investing in NH3 infra structure (or other molecule-based energy) will have negative consequences

- If, ultimately, this does not go ahead, it will be very difficult to achieve the Paris goals on time. Relying solely on H2 from electricity generated by wind farms in the Netherlands is not feasible (reliability of supply is insufficient and investors are withdrawing due to higher interest rates and lack of clarity about subsidies). The future energy mix will therefore need to be broadened with molecular supplements such as NH3.
- Inadequate supply security and affordable volumes of renewable energy will lead companies to postpone investments in this area and turn to better offers from abroad. This is bad for our competitive position and the business climate, and certainly also for our environment, given the widespread desire to achieve significant CO2 reduction volumes.

Develop joint messaging, together with all involved organizations

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Linking forward

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Responsibilities

- Commercial Growth CAPEX Projects
- Terminal GHG Reduction Projects
- Energy Transition and International Business

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Example Projects

- Tripling capacity to remain Europe's largest toll distiller for Sustainable Aviation Fuels
- Expanding leading position in biofuels and feedstock storage with several 100k cbms
- Realising a residual heat and steam connection to decarbonise a terminal

Background

- Chief Commercial Officer – Attero Waste Management
- Associate Partner – OC&C Strategy Consultants
- MSc Business Administration – University of Twente
- MSc Applied Physics – University of Twente