

11:15-12:00 Presentation:

Kalundborg refinery - A practical case of how to produce low-aromatic fuels

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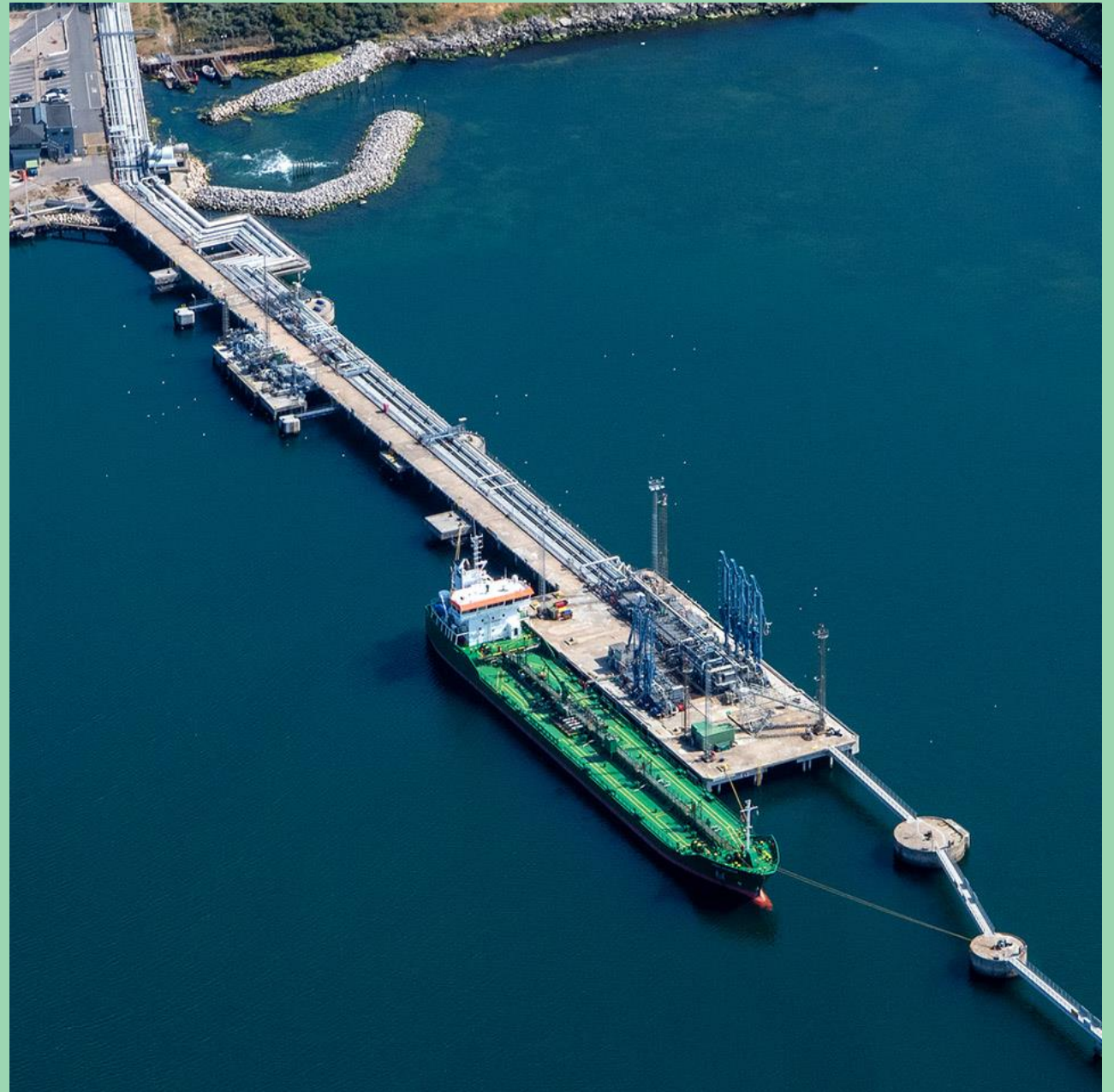


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Kalundborg Refinery

Copenhagen Contrails
Conference 2025



March 26, 2025

Kalundborg Refinery:

A practical case of how to produce low-aromatic fuels

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Kalundborg Refinery

- Denmark's largest refinery with 370 employees in and around the plant in Kalundborg.
- Part of Kalundborg Symbiosis since 1972 – an industrial circular economy recycling resources.
- Produces more than 15% of Denmark's energy. Refines up to 5.5 million tonnes of oil products annually – equivalent to Denmark's total fuel consumption.
- Imports and exports fuel and crude oil to and from 500 tankers annually. Fuel is transported from Kalundborg by ship or pipeline to Hedehusene.
- Taken over by Klesch Group (KG) 1 January 2022.



Low-Aromatic Jet Fuel: Technology and Production

Ideally, we start with eSAF, but...

- Lack of green electricity production, hydrogen infrastructure, and storage capacity
- Slow implementation of climate requirements for aviation
- Scaling up and developing a new industry
- European electricity shortage



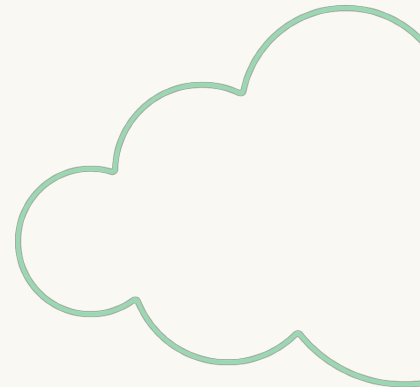
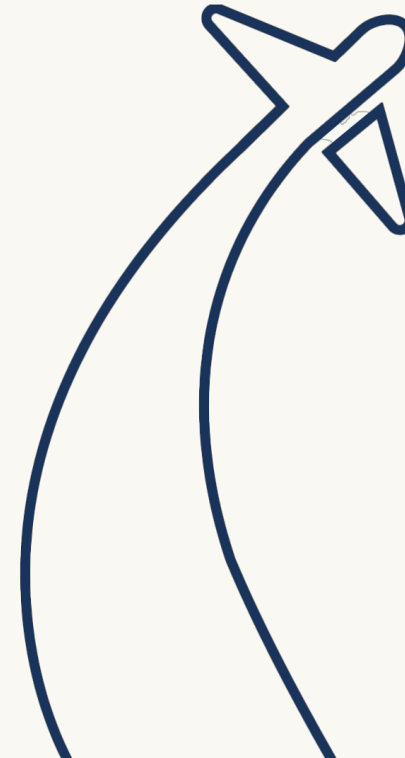
The Science Behind Aviation's Climate Impact

- While CO₂ emissions are a major concern, studies show that up to two-thirds of aviation's climate impact comes from non-CO₂ effects, primarily condensation trails (contrails).
- These contrails form when soot and volatile particles interact with moisture at high altitudes, creating artificial cloud formations that trap heat.
- Reducing the number of particulates in jet fuel significantly decreases contrail formation and the associated warming effect.



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of an aircraft's climate impact comes from so-called non-CO₂ effects.



Technology

What is low-aromatic jet fuel?

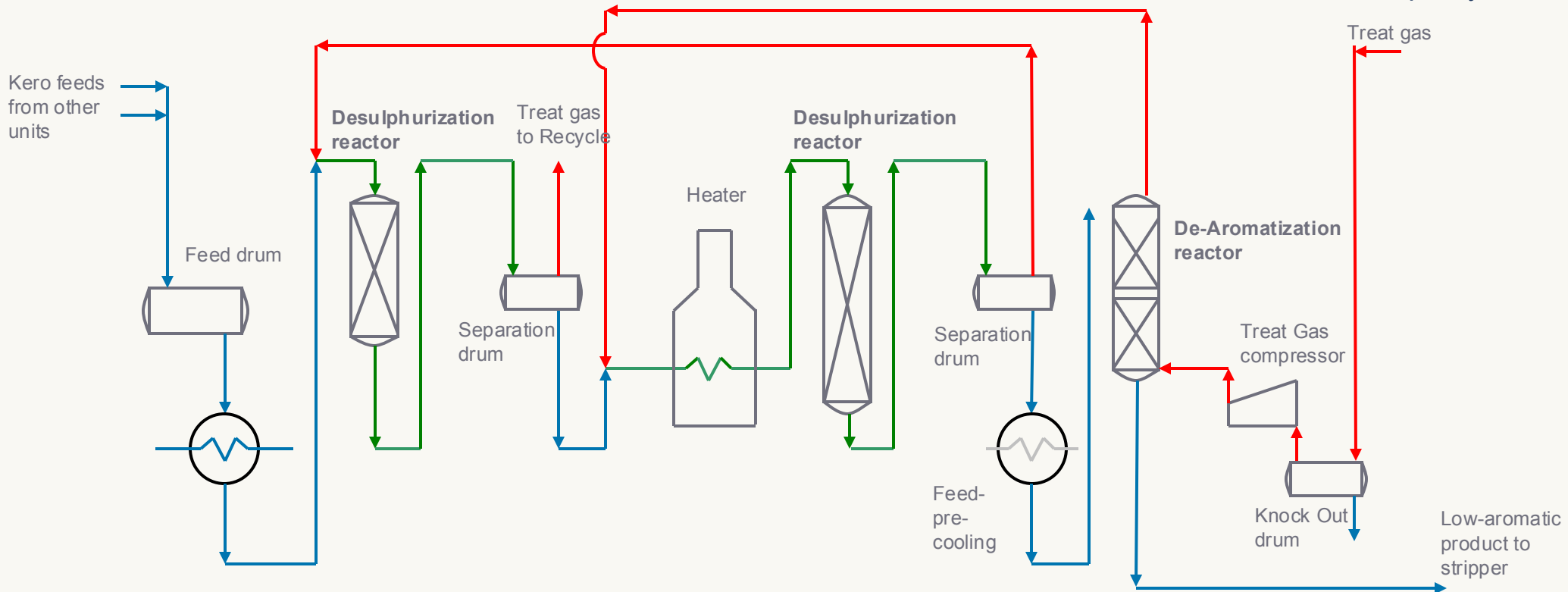
- A modification of standard Jet A1 fuel that reduces its aromatic content from 17 to 8 % (or lower).
- Achieved by adding a small amount of hydrogen to refine the fuel and eliminate aromatic compounds.
- Results in cleaner combustion and significantly fewer particulate emissions.



Hydro Treating with De-aromatization

1 mio.

Kalundborg Refinery has a low-aromatic Jet Fuel capacity of 1 million m³.



Future production at Kalundborg Refinery

The production process at Kalundborg Refinery:

- Existing infrastructure can be adapted to produce low-aromatic jet fuel within two years.
- Full-size: 1,000,000 m³/yr.
- Only minor adjustments to the refining process are needed.
- At Kalundborg Refinery, we have the technology, expertise, capacity, and distribution channels in place to scale production quickly.



Market Mechanisms & need for Government Support

The Climate Benefits of Low-Aromatic Jet Fuel

- 20% reduction in non-CO₂ effects with just a 50% reduction in aromatics.
- Fewer ultrafine particles in aircraft exhaust, leading to cleaner air around airports.
- Immediate climate impact: Can be implemented much faster than full-scale sustainable aviation fuels (SAF), making it a key transition solution.
- Comparable energy efficiency: Maintains the same energy density as conventional jet fuel, ensuring no loss in aircraft performance.



Challenges in Implementing Low-Aromatic Jet Fuel

- Cost gap: Low-aromatic jet fuel is 10-15% more expensive than conventional Jet A1.
- Market barriers: Airlines will not voluntarily switch to a higher-cost fuel without economic incentives.
- Lack of regulatory requirements: No existing mandates require airlines or fuel suppliers to adopt low-aromatic alternatives.
- Investment risks: Without financial certainty, refineries are hesitant to modify infrastructure for low-aromatic fuel production.



Policy Solutions to Support Low-Aromatic Jet Fuel

- Financial compensation for airlines to cover the price difference, funded by Denmark's aviation passenger tax.
- CAPEX subsidies for refineries to help cover investment costs in modifying production facilities.
- Regulatory requirements to mandate a phased reduction in aromatic content in jet fuel, aligning with the EU's upcoming SAF mandates from 2027.
- EU collaboration: Pushing for stronger incentives and requirements at the European level to ensure widespread adoption.



The Political Landscape and Opportunities

- Denmark's 1-billion-DKK aviation transition fund presents a critical opportunity to prioritize low-aromatic jet fuel.
- The upcoming EU Council Presidency provides a unique moment to push for stricter EU-wide regulations on aromatic content in jet fuel.
- By leading in this transition, Denmark can set a precedent for other European nations and establish itself as a frontrunner in cleaner aviation policies.



Economic and Strategic Benefits for Denmark



- Strengthening Denmark's position in green aviation technology.
- Ensuring energy security by reducing reliance on external fuel imports.
- Complementary to SAF development: Provides an immediate emissions reduction strategy while the SAF market scales up.



Key takeaways

- Low-aromatic jet fuel is a practical, scalable, and cost-effective solution for mitigating aviation's non-CO₂ climate impacts.
- Production can start quickly with the right policy and financial incentives.
- Denmark has a unique opportunity to drive this change at both the national and EU level.
- We must act to ensure aviation's non-CO₂ effects are prioritized on the European agenda.
- Denmark can support low-aromatic jet fuel through airline compensation, CAPEX subsidies for refineries, regulatory requirements for reducing aromatics from 2027, and by pushing for stronger incentives and requirements at the European level.



Q&A

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