Retrofitting Grey to Blue and Green – Making Net-zero Ammonia Possible

R. Ostuni - AEA Phoenix
16 November 2022
Casale delivers technologies to the ammonia chain covering >95% of current markets.
Dedicated to support customers representing 38% of the global ammonia footprint.
Near-Zero retrofits to trigger the Ammonia Sector Transition.

The Scenarios to Net-Zero Ammonia Sector by 2050 (1)

The graph shows two scenarios:
- **Lowest Cost Scenario**
- **Fastest Abatement Scenario**

First milestones for the production (2)

- (2025) “Transitional” capacity implemented 10-27Mt/y.
- (2025-27) Appearance of “near-zero” capacity with scope 1&2 emissions reduction -92%-99%.
- (2030) “Near-zero” capacity implemented 48-118Mt/y by newbuilds plus retrofits.

Retrofit - opportunities

- Solutions for near-zero blue and green ready & aligned with milestones of the scenarios.
- 500+ plants without cannibalizing newbuilds.
- Decarbonize at lower capex and faster. Also, possibility for capacity increase (+30% +50%), market expansion, gas savings.
- Lower scope 1&2 emissions of fertilizer chain.

Challenges

- Shorter ROI vs residual asset lifetime.
- Specificity & limitation of existing plant requires a tailored design.
- Slimmer retrofit opportunities than newbuilds.

---

**MPP Explore pathways to net zero ammonia, 2022**

**CO2 emissions intensity includes scope 1 and 2 only.**

---

(1) MPP Explore pathways to net zero ammonia, 2022

(2) MPP – Ammonia sector Explore pathways to net zero ammonia, exhibits 2.2, 2.6
Australian green retrofit for 100% emission-free ammonia.

Project Status: Front End Engineering Design

-100% scope 1&2 CO$_2$ emissions -0.7Mt/y
+30% capacity increase : 900 MTD to 1’150 MTD

Front end replacement with electrolysis – 50kt/y green H$_2$
Revamping of the loop & converter

https://www.casale.ch/news/ammonia-revamping-from-grey-to-green
Blue Ammonia and Urea retrofit with CO₂ utilization for Melamine.

Project Status: Completed in 2022.

- Ammonia 1'000 t/d with 370'000 Mt/y captured CO₂ (>70%)
- 82'000 Mt/y of CO₂ fixed in melamine product

For new retrofit projects: opportunity of full retrofit to blue ammonia with >95% CO₂ capture

Take-home messages

Existing 500+ plants are an opportunity to expedite the decarbonization of the ammonia industry.

Experience of Casale with Green and Blue ammonia retrofits provides confidence to reach reported by MPP 92-99% emission reduction – matching newbuilds – and aligned with the early implementation milestones of the MPP scenarios.

Near zero retrofits (green and blue) can cumulate emission reduction at less capex per ton decarbonized, with additional benefits of increased capacity (+30% +50%), market expansion, reduced natural gas consumption, and decarbonization of the fertilizer chain.

Retrofits impose challenges of shorter ROI and specific plant needs, which require a tailor made approach to the lowest cost of reducing emissions. Number of retrofit opportunities for near zero retrofits is today slimmer than newbuilds – both are needed.
Casale retrofit solutions linked to the needs of Ammonia Sector Strategy to decarbonization in the MPP report.

**Plant updating**
- Process Optimization
- Equipment Upgrade
- Site integration

- Reduce scope 1&2 emissions ammonia plant
- Increase low-carbon ammonia capacity
- Reduce gas consumed per ton of ammonia

**Blue Retrofit**
**Flexiblue®**
- CO₂ capture
- >95% captured CO₂ emissions (*)
- 0...50% increase (*)
- 0...20% reduction (*)

**Green retrofit**
**Flexigreen®**
- Injection of green H₂ Max use of green kWh
- 10...100% avoided CO₂ emissions (*)
- 0...30% increase (*)
- 10...100% reduction (*)

(*) Reported values for a typical case. Contact Casale to assess benefits to your plants.

Contact: Federico MAFFIETTI - Green Technologies Business Development Manager – f.maffietti@casale.ch
PLANTS FOR A NEW PLANET. SINCE 1921.

Raffaele Ostuni – r.ostuni@casale.ch

Retrofitting Grey to Blue and Green – R. Ostuni – AEA Phoenix 2022