



## INTISARI

Dekarbonisasi industri *ammonia* sering dianggap langkah penting untuk mengurangi emisi dari sektor *Industrial Process and Product Use* (IPPU). Dekarbonisasi pada industri *ammonia* didorong oleh *Nationally Determined Contribution* (NDC) dengan melakukan peningkatan efisiensi melalui optimasi pemanfaatan gas bumi (*feedstock*) dan *CO<sub>2</sub> recovery* pada *Primary Reformer* dan dokumen NDC Indonesia tahun 2022, Indonesia berambisi untuk menurunkan emisi GRK pada industri *ammonia* dengan mematok target penurunan sebesar 3,95 MT CO<sub>2</sub> dan sebesar 4,65 MT CO<sub>2</sub> dengan bantuan Internasional. Salah satu cara yang dapat dilakukan adalah dengan mengintegrasikan teknologi *Carbon Capture and Storage* (CCS) dengan industri *ammonia* untuk menghasilkan *blue ammonia*. Penelitian ini bertujuan untuk mengevaluasi dampak ekonomi dan lingkungan dari produksi *blue ammonia*. Hasil penelitian didapatkan bahwa simulasi penangkapan CO<sub>2</sub> dari *flue gas* industri *ammonia* menggunakan Aspen HYSYS dan didapatkan efisiensi penangkapan karbon sebesar 99,6% dengan kemurnian produk CO<sub>2</sub> mencapai 97%. Selain itu, hasil perhitungan *Levelized Cost of Ammonia* (LCOA) didapatkan peningkatan harga jual *blue ammonia*, namun masih berada di kisaran yang menarik dan cukup kompetitif serta sejalan dengan harga yang berlaku di pasaran. Kenaikan harga tersebut diakibatkan adanya penambahan teknologi CCS yang diintegrasikan pada industri *ammonia*. *Blue ammonia* memiliki nilai perhitungan IRR sebesar 24,054%, nilai ini lebih besar daripada suku bunga bank, sehingga dapat dikatakan bahwa investasi ini menarik. Pada dampak lingkungan, hasil perhitungan *Life Cycle Assessment* (LCA) didapatkan bahwa implementasi teknologi CCS mampu menurunkan beberapa kategori dampak, salah satunya penurunan signifikan terhadap kategori *Global Warming Potential* (GWP) hingga 61%. Oleh karena itu, dengan skema insentif yang tepat, kami percaya bahwa produksi *blue ammonia* dapat menjadi pilihan yang menurunkan emisi selama era transisi energi.

**Kata kunci:** *Blue Ammonia, Carbon Capture and Storage, Techno-economics Analysis, Life Cycle Assessment*



## ABSTRACT

*Decarbonization of the ammonia industry is often considered an important step to reduce emissions from the Industrial Process and Product Use (IPPU) sector. Decarbonization of the ammonia industry is driven by the Nationally Determined Contribution (NDC) by improving efficiency through optimization of natural gas utilization (feedstock) and CO<sub>2</sub> recovery in the Primary Reformer and Indonesia's 2022 NDC document, Indonesia is ambitious to reduce GHG emissions in the ammonia industry by setting a reduction target of 3.95 MT CO<sub>2</sub> and by 4.65 MT CO<sub>2</sub> with international assistance. One of the ways that can be done is by integrating Carbon Capture and Storage (CCS) technology with the ammonia industry to produce blue ammonia. This study aims to evaluate the economic and environmental impacts of producing blue ammonia. The results showed that the simulation of CO<sub>2</sub> capture from flue gas of ammonia industry using Aspen HYSYS obtained a carbon capture efficiency of 99.6% with CO<sub>2</sub> product purity reaching 97%. In addition, the results of the calculation of Levelized Cost of Ammonia (LCOA) obtained an increase in the selling price of blue ammonia, but still in an attractive range and quite competitive and in line with the prevailing prices in the market. The price increase is due to the addition of CCS technology integrated into the ammonia industry. Blue ammonia has an IRR calculation value of 24.054%, this value is greater than the bank interest rate, so it can be said that this investment is attractive. On environmental impacts, the results of the Life Cycle Assessment (LCA) calculation found that the implementation of CCS technology is able to reduce several impact categories, one of which is a significant reduction in the Global Warming Potential (GWP) category by 61%. Therefore, with the right incentive scheme, we believe that blue ammonia production can be an option that reduces emissions during the energy transition era.*

**Keyword:** *Blue Ammonia, Carbon Capture and Storage, Techno-economics Analysis, Life Cycle Assessment*