

KUDOHI Yuki, Ph.D.



Deputy Director, Global Zero Emission Research Center (GZR), National Institute of Advanced Industrial Science and Technology (AIST)

2002 Ph.D. (Geosystem Engineering), The University of Tokyo, Japan
2002—2004 National Institute for Environmental Studies, Japan
2004— AIST, Japan

Contribution of Capital Goods on the Life Cycle CO₂ Emissions of Hydrogen Technology – A Case of Ammonia Power Generation –

KUDOH Yuki

Global Zero Emission Research Center (GZR), National Institute of Advanced
Industrial Science and Technology (AIST), Japan

kudoh.yuki@aist.go.jp

Various life cycle studies are conducted on hydrogen energy carriers and technologies to evaluate the environmental benefits of conventional energy technologies. While most of these studies focus only on the emissions attributed to the operation of the hydrogen supply chain or technologies, it should be noted that emissions are also attributed to the capital goods required for the hydrogen supply chain or technologies. In this context, the author's group focused on using ammonia (NH₃) for power generation and conducted a life cycle inventory analysis to understand the contribution of capital goods to the whole life cycle CO₂ emissions. We considered two options for ammonia production: blue and green ammonia. Blue ammonia was produced from natural gas (with and without carbon capture and storage (CCS) option), and green ammonia was produced from solar photovoltaics. Both were produced overseas, imported to Japan and then used in NH₃ co-firing with coal and NH₃ mono-firing power plants. The CO₂ emissions from the operation and the capital goods related to the NH₃ value chain and power generation were calculated. The results indicated that the life CO₂ emissions from the NH₃ mono-firing power plant with a low-carbon NH₃ value chain could be lower than those from the coal power with CCS. The results also revealed that the CO₂ emissions attributed to the capital goods of the fuel value chain might have an enormous impact on the whole life cycle emissions, especially when utilising variable renewable energy with a low capacity factor.