# Contribution of Capital Goods on the Life Cycle $CO_2$ Emissions of Hydrogen Technology – A Case of Ammonia Power Generation –

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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 $CO_2$ 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 $NH_3$ co-firing with coal and $NH_3$ mono-firing power plants. The $CO_2$ emissions from the operation and the capital goods related to the $NH_3$ value chain and power generation were calculated. The results indicated that the life $CO_2$ emissions from the $NH_3$ mono-firing power plant with a low-carbon $NH_3$ value chain could be lower than those from the coal power with CCS. The results also revealed that the $CO_2$ 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.