ANALYZING THE ECONOMIC POTENTIAL OF ELECTRIFIED AMMONIA PRODUCTION

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Today, new technologies are emerging that use electricity to produce low-carbon ammonia — a versatile commodity that can be sold locally as fertilizer, traded as an export good or used to temporarily store electricity when supply exceeds demand.

It's an enticing idea for energy producers, who often sell their excess electricity to neighbouring markets at a significant loss. But do the numbers add up? To find out, WISE researcher XiaoYu Wu and his colleagues carried out detailed analyses on the potential economic risks and benefits.

As a model, the team used a Haber-Bosch ammonia plant powered by Ontario's electricity grid. They started by calculating the plant's lifetime production costs per tonne of ammonia under different scenarios, incorporating capital and operating costs, capacity factors, plant sizes and more.

Next, they evaluated the profits or losses of using excess electricity from the Ontario grid to produce ammonia for local markets, export, and energy storage. Under the base scenario, selling ammonia to local and export markets generated positive revenues, but using it to store energy was unprofitable.

The picture changed under more optimistic conditions. The researchers identified three potential scenarios involving higher commodity prices, lower electricity prices and improved production technologies where ammonia revenues were up to four-and-a-half times higher than those for electricity exports.

They also note that profits aren't the only consideration. Boosting local ammonia production can alleviate fertilizer shortages, enhancing food security. At the same time, producing ammonia using low-carbon electricity instead of traditional methods using fossil fuels can significantly cut carbon emissions.

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