AMMONIA-COFIRING IN COAL PLANTS IN JAPAN

EMISSIONS IN AUSTRALIA/JAPAN SUPPLY CHAIN

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Zero- Carbon Energy Asia-Pacific

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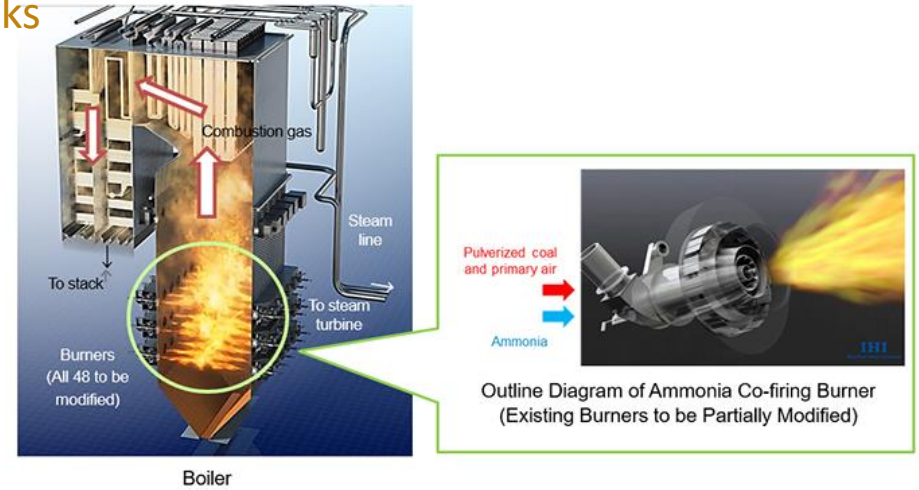


https://www.ihi.co.jp/en/all_news/2021/resources_energy_environment/1197406_3360.html

Australian National University

Ammonia-coal co-combustion

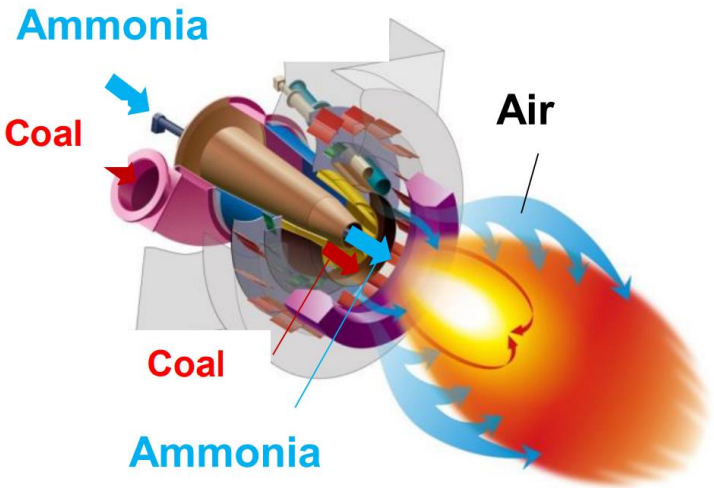
Ammonia attractive as hydrogen energy vector

- Established international trade
- Relatively easy storage
- Most of hydrogen energy value retained

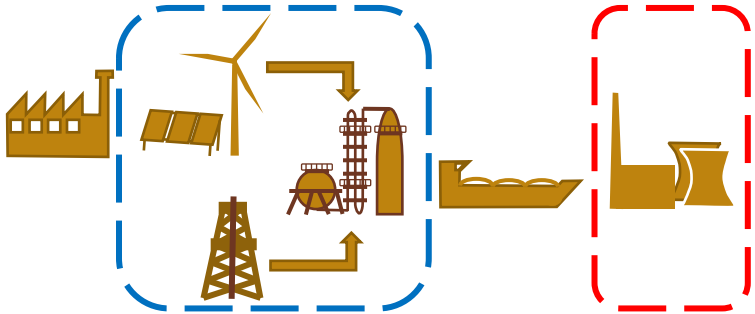
Ammonia poor combustion properties

Coal co-combustion

- Ammonia use established
- Trials demonstrate 20% ammonia (LHV) feasible



https://nh3fuelassociation.org/wp-content/uploads/2018/11/AEA-Imp-Con-01Nov18-Toshiyuki-Suda-Session-2.pdf



ANU image

Australia/Japan Supply Chain: Emissions

Estimate Japan would require 23MT of ammonia per annum based on forecast 2030 fleet

Emissions in Australia

- Energy sources
  - Methane production emissions
  - Renewable energy development
- Production process emissions

Focus on national accounting boundaries

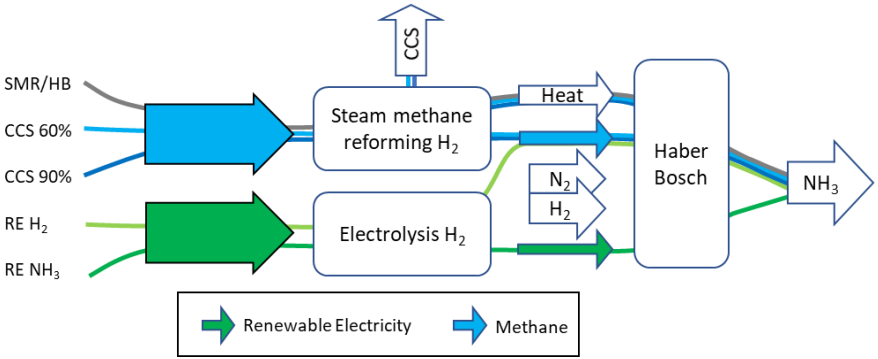
- Exclude shipping and overseas manufacturing (scope 3)

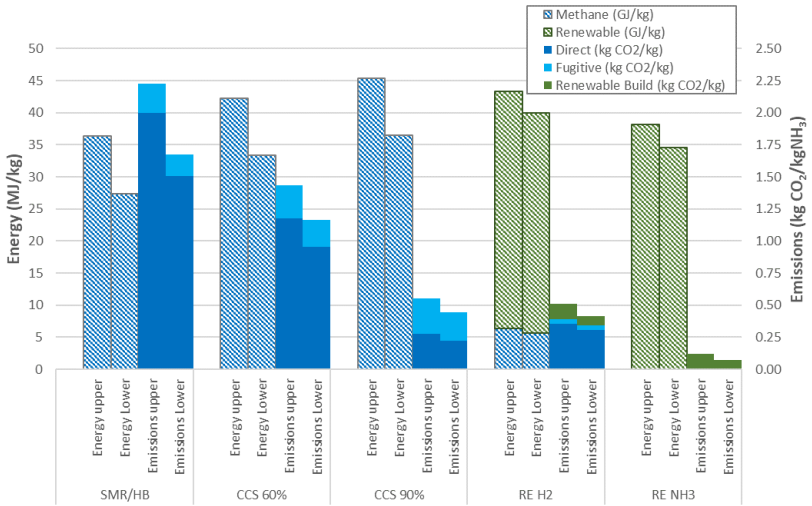
Ammonia production options and analysis

Haber Bosch: Hydrogen reacts with nitrogen

Analysed options considered in Australia

- SMR/HB - steam methane reformed hydrogen
- CCS 60% - SMR/HB with CCS after water shift
- CCS 90% - SMR/HB with 90% CCS from flue
- RE H_2 - Hydrogen from renewable electricity electrolysis
- RE NH_3 - All electric from renewable electricity





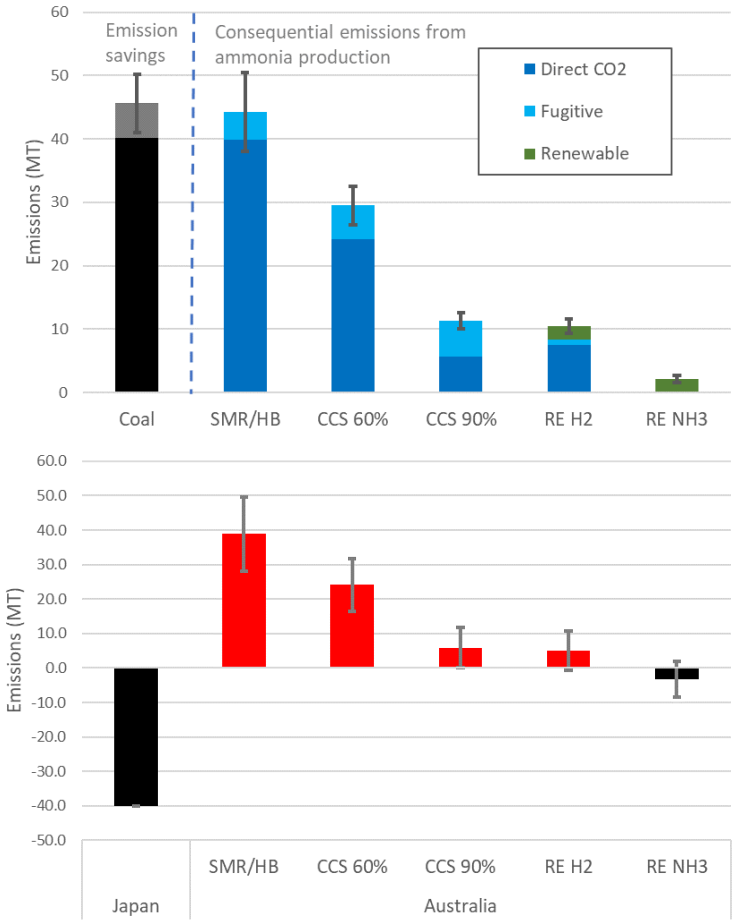
Energy and emissions intensity of ammonia

Energy inputs determined by technology

- Increased energy needed for CCS
- Large contribution from electrolysis

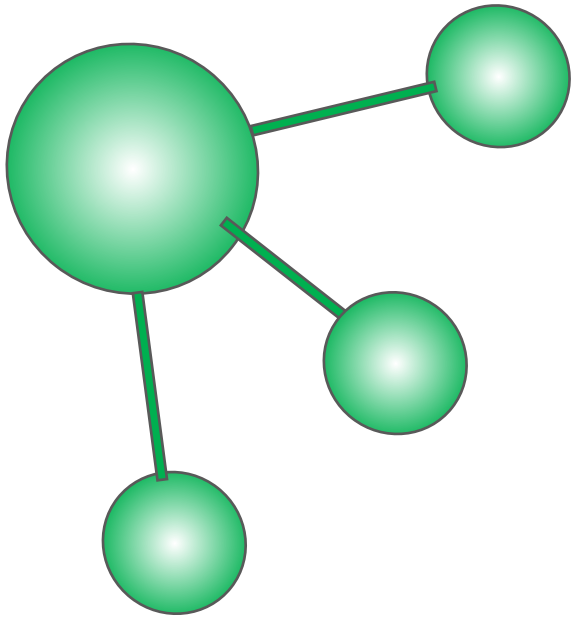
Emissions determined from the energy inputs

- Methane
  - direct + fugitive - captured
- Renewable electricity
  - construction + O&M



National emissions

- Significant emissions savings from coal displacement
- Standard ammonia production shift of emissions from Japan to Australia
- Fugitive emissions increasingly significant in CCS options
- Full renewable option decreases emissions in Australia and Japan
  - No coal fugitives



Low emission policy

Need drivers for higher cost low emissions ammonia production

- Carbon pricing
- Certification
- Carbon boarder adjustment measures
- Internationally Transferred Mitigation Outcomes

THANK YOU

Contact Us

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