International Partnership for Hydrogen and Fuel Cells in the Economy

IPHE Hydrogen Production Analysis Task Force

November 17, 2022

Ammonia Energy Association Meeting

Phoenix, AZ

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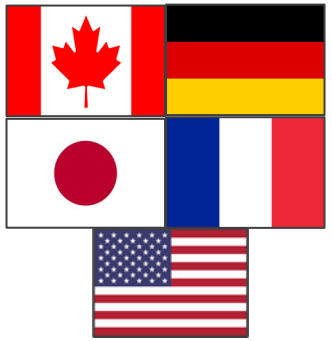
IPHE: Global Government-to-Government Partnership to Accelerate Hydrogen and Fuel Cell Deployments

Formed in 2003

Chair

Vice-Chairs



Past Chairs

Priorities:

1. **Share Information on Latest Developments**
2. **Inform Future Government Policy**
3. **Foster Collaboration**

The IPHE addresses these Priorities by,

- **Coordinating and Sharing Information** – at Bi-Annual Steering Committee Meetings, and through Webinars, Brochures, Newsletter
- **Developing Country Updates** – Country Profiles at www.iphe.net
- **Working Groups:**
    1. Regulations, Codes, Standards & Safety (RCSS)
    2. Education & Outreach (E&O)
- **Task Forces:**
    1. H_2 Production Analysis – Working Paper Ver2 Published
    2. H_2 Trade Rules – Paper Published, Potential new work

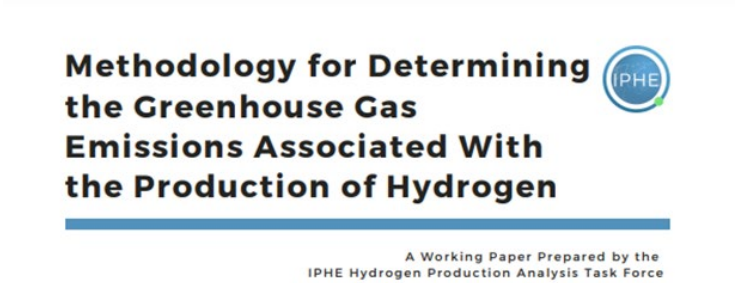
And coordinate with other International initiatives including IRENA, IEA, CEM/MI, WEF, H2 Council, and the Breakthrough Agenda

21 Countries & European Commission

IPHE Hydrogen Production Analysis Task Force (H2PA TF)

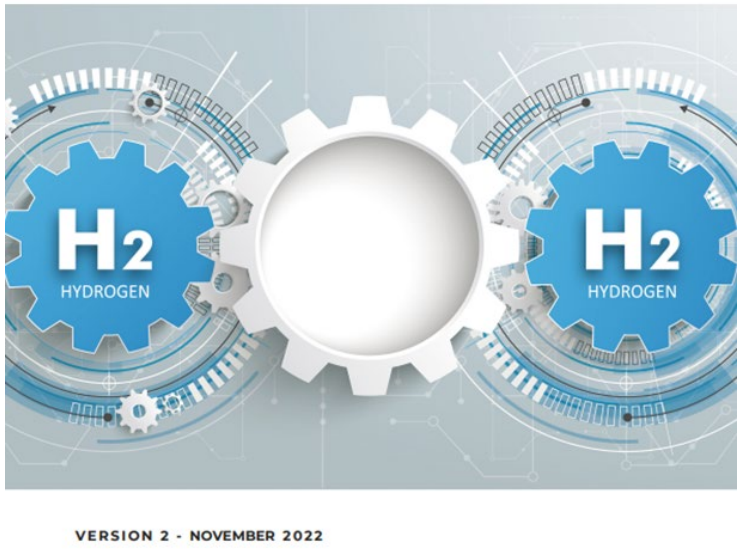
Issue: Facilitate a Global Market in Hydrogen

- Trade needs ***common internationally agreed*** Standards for transport / storage of H2, and tracing the environmental impacts of supplies.



Scope of the H2PA TF (*IPHE is not a Standards Body*)

- Develop a **mutually agreed methodology framework for determining the GHG emissions associated with a unit of H2 production**.



Near-term Outcomes

- Working papers released for public comment:

- Methodology for Determining the Greenhouse Gas Emissions Associated with the Production of Hydrogen Working Paper Ver 2 Nov 2022 (iphe.net)
- IPHE WP Methodology Doc Oct 2021 | iphe

Approach to Develop Accounting Framework

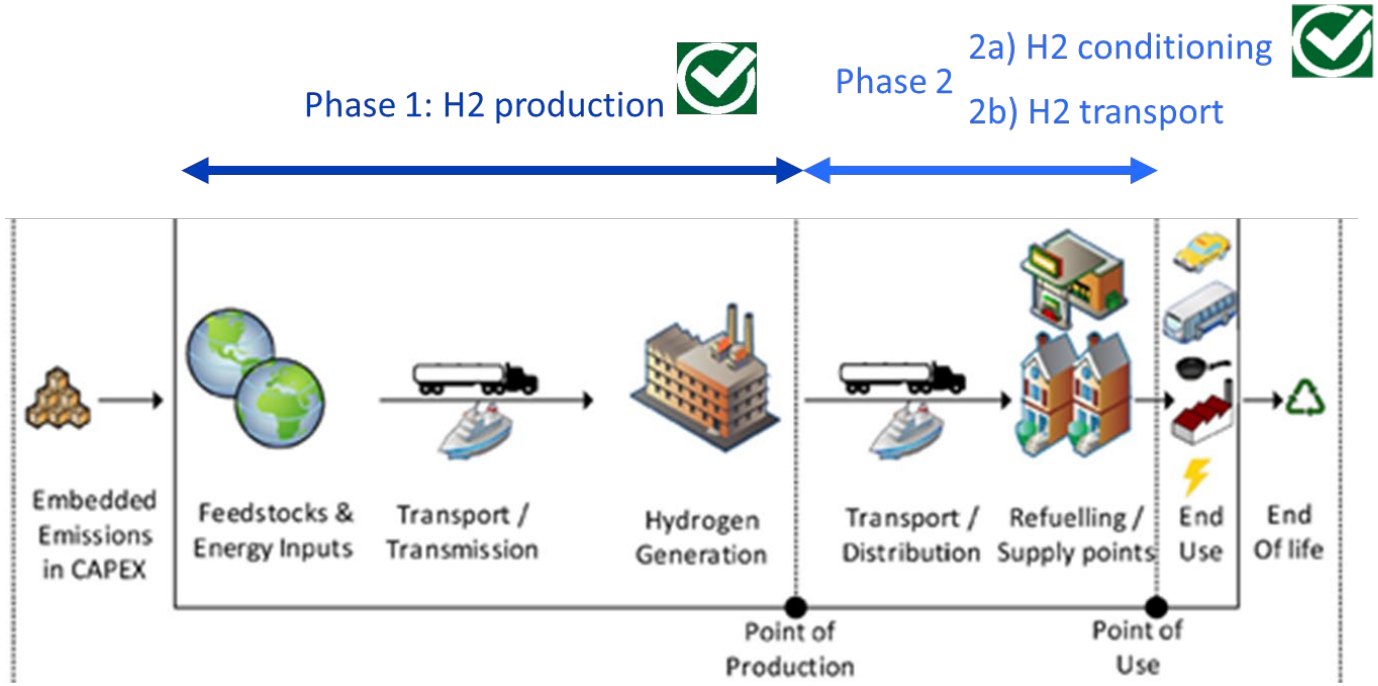
- Review of Boundary Conditions
- Review of Methodologies Being Used Already or Under Development by Various Jurisdictions
- Development of the Methodology to evaluate the Emissions Related to the Production of Hydrogen

Principles Guiding the Process:

1. **Inclusive** – methodologies should not exclude any potential primary energy even if not all production pathways may be covered at a first stage
2. **Flexible** – approaches must allow for unique circumstances and hence be flexible
3. **Transparent** – methodologies must be transparent in approach and assumptions to build confidence
4. **Comparable** – approach should be comparable with the approach used by other technologies to help allow for 'apples to apples' comparisons on emissions
5. **Practical** – methodologies must be practical, facilitating uptake by industry and use in the market.

Accounting Frameworks Developed

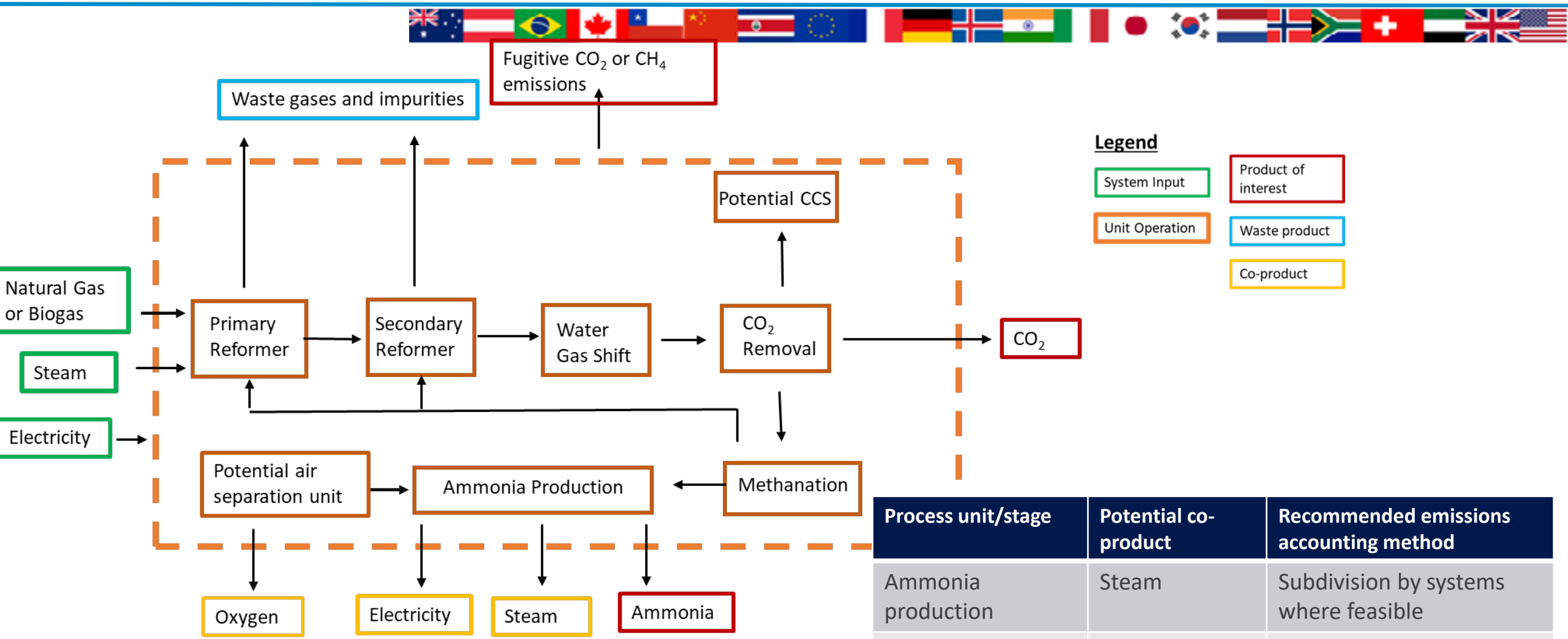
Status: Member countries developed guidance to characterize the emissions of electrolysis, steam methane reforming with CCS, autothermal reforming with CCS, hydrogen production from biomass, by-product hydrogen from industrial pathways, and coal gasification with CCS. Countries have also developed guidance to characterize emissions associated with hydrogen carriers and liquefaction



Next Steps:

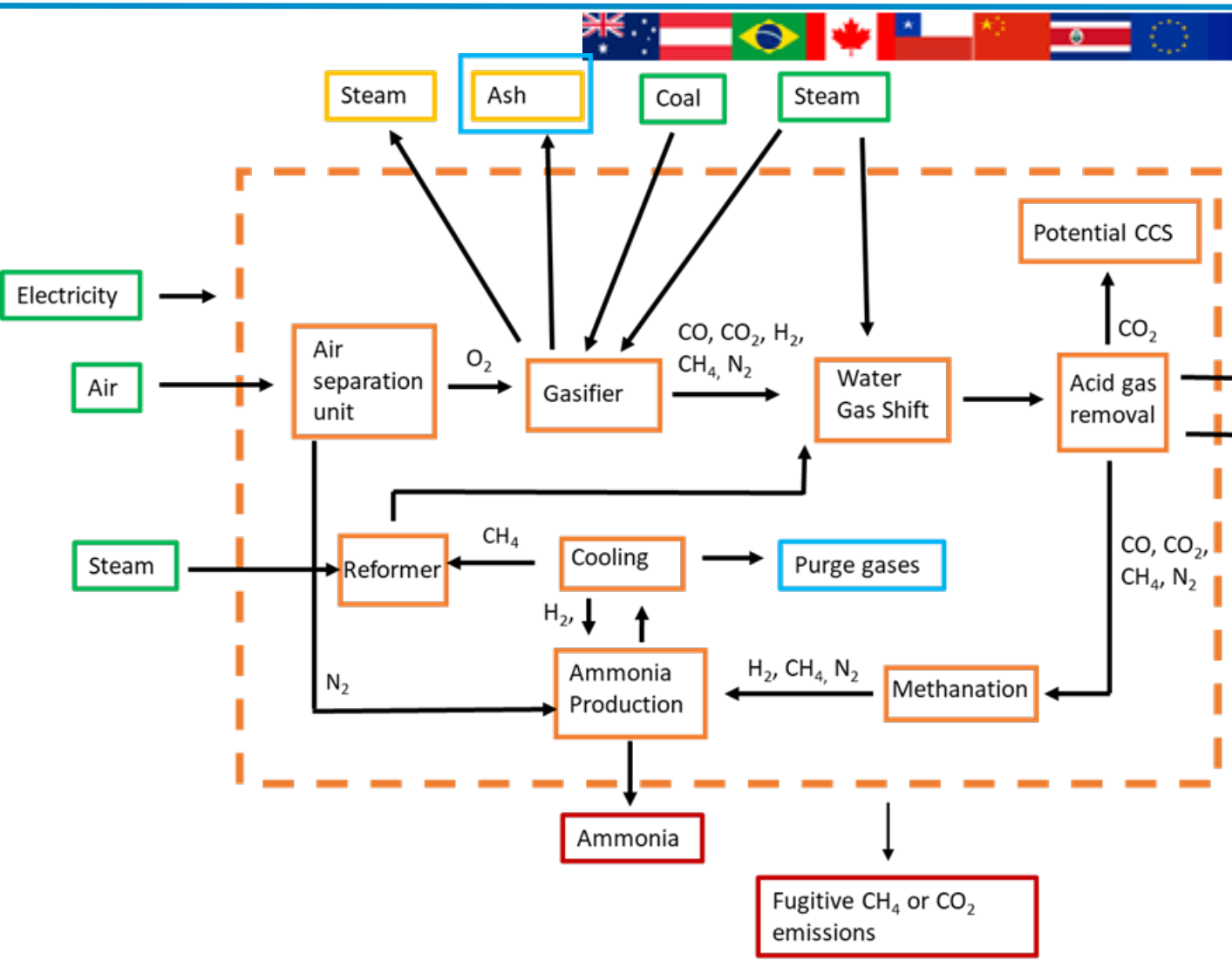
- Working papers being distributed to code committees and regulatory bodies to inform future ISO standards.
- Guidance around Hydrogen Transport underway

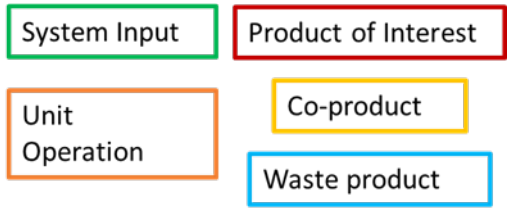
Ammonia Pathway 1: Natural Gas or Biogas with CCS



Process unit/stage	Potential co-product	Recommended emissions accounting method
Ammonia production	Steam	Subdivision by systems where feasible
Ammonia production	Electricity	Subdivision by systems where feasible

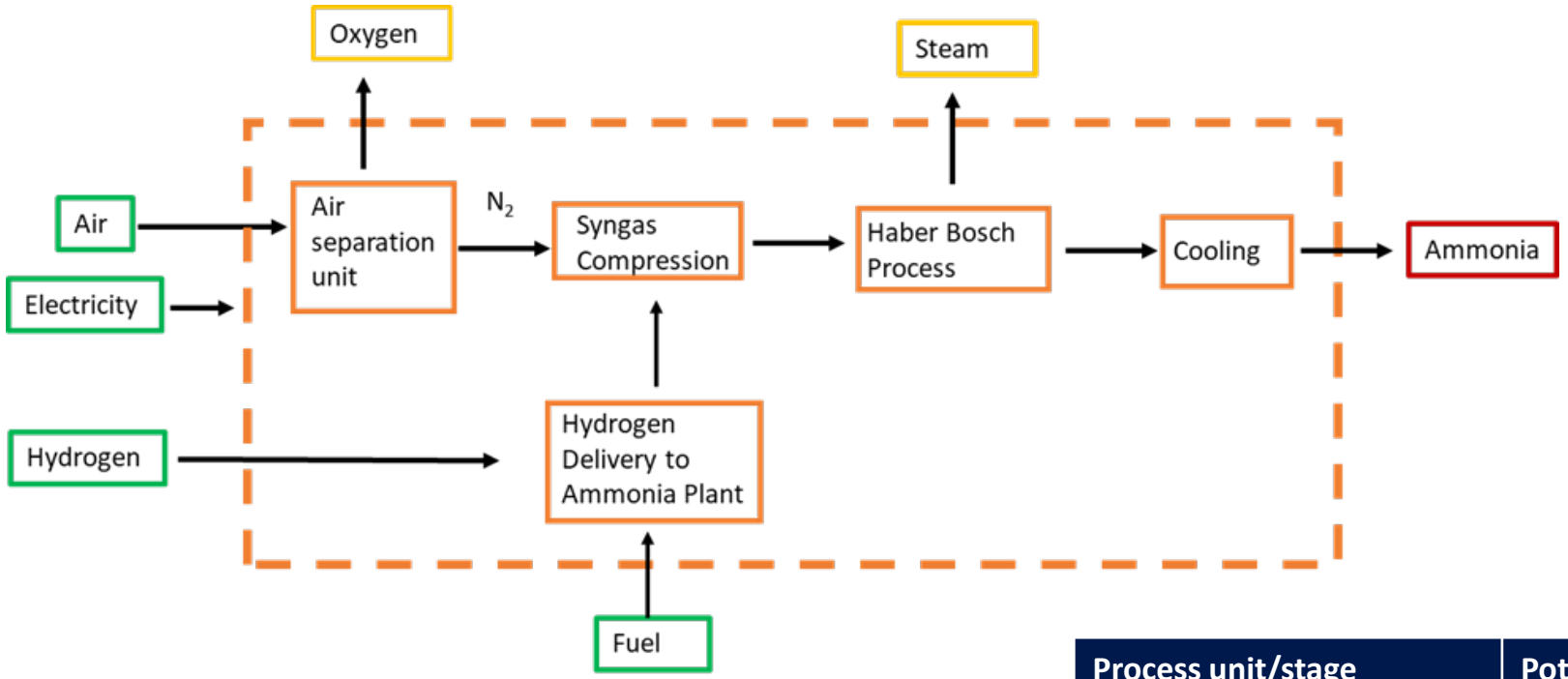
Ammonia Pathway 2: Gasification





Process unit/stage	Potential co-product	Recommended emissions accounting method
Steam generation	Steam	Subdivision by systems
Gasification	Steam	Subdivision by systems
Gasification	Ash	System Expansion
Acid gas removal	Impurities	Mass-based
Gasification	Electricity	Subdivision by systems

Ammonia Pathway 3: Clean Hydrogen with Nitrogen

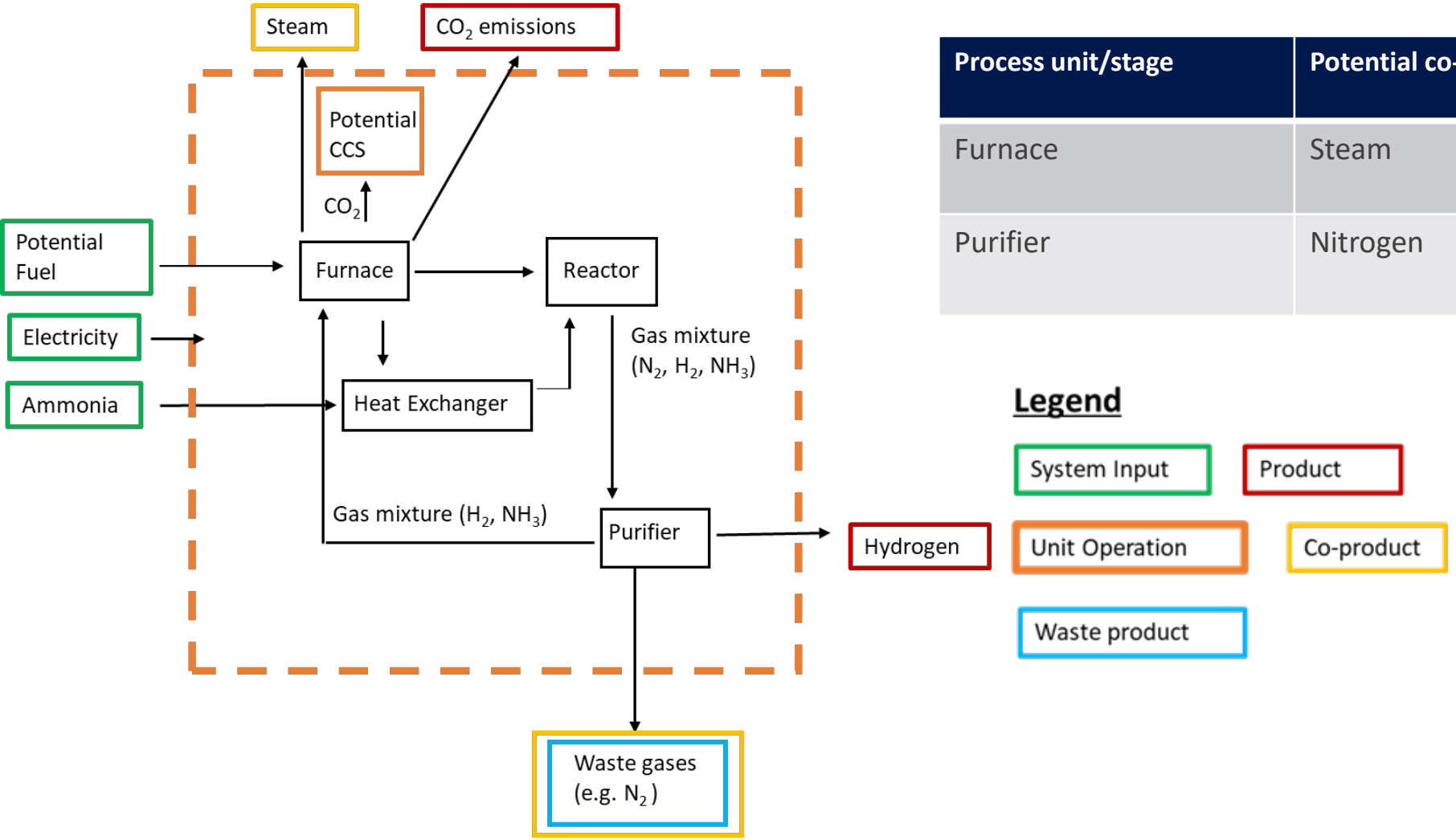


Legend

- System Input
- Product
- Unit Operation
- Co-product
- Waste product

Process unit/stage	Potential co-product	Recommended emissions accounting method
Air Separation Unit	Oxygen	Allocation factors within Ecoinvent
Ammonia production	Steam	Subdivision by systems where feasible

Ammonia Cracking



Process unit/stage	Potential co-product	Recommended emissions accounting method
Furnace	Steam	Subdivision by systems, when feasible
Purifier	Nitrogen	System Expansion

Legend

System Input | Product | Unit Operation | Co-product | Waste product

Key Questions Regarding Implementation of LCA Accounting Methods

- What are best practices for verification of life cycle analyses (e.g. installation of CEMs, third party verification of upstream methane leakage, site inspections)?
- How should market instruments like certificates for renewable energy (e.g. RECs/PPAs) or certificates for natural gas or RNG be accounted for in life cycle analysis?
- How should CO2 utilization be accounted for in future IPHE guidance?
- Should default emissions factors be used to allocate emissions to co-products?
- How should the “materiality” threshold be defined for emissions sources that should be included (e.g. 5%)?

Thank you

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