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# thyssenkrupp Uhde | Johnson Matthey

## The Power of Partnerships

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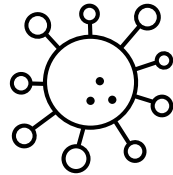


# Through partnering, organisations can innovate to solve their customers' & the world's challenges

## Nike+ app for Apple Watch

**Enhanced device functionality** and **increased Nike's reach** into digital fitness.

Collaboration resulted in **increased sales** and **strengthened brand loyalty**<sup>1</sup>



## Scientific Collaborations

During the COVID-19 pandemic **93 partnerships** were formed to support the development of **283 registered vaccines**<sup>2</sup>

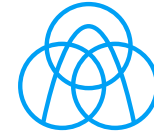
## Nissan & Renault

Renault & Nissan purchase a proportion of each other's shares to **collaborate on product development** and **strategic thinking**.

**10% of new car sales worldwide** are **Renault** and **Nissan**<sup>3</sup>



RENAULT



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## thyssenkrupp Uhde & JM

join forces to offer **world leading integrated solution for blue ammonia technology**

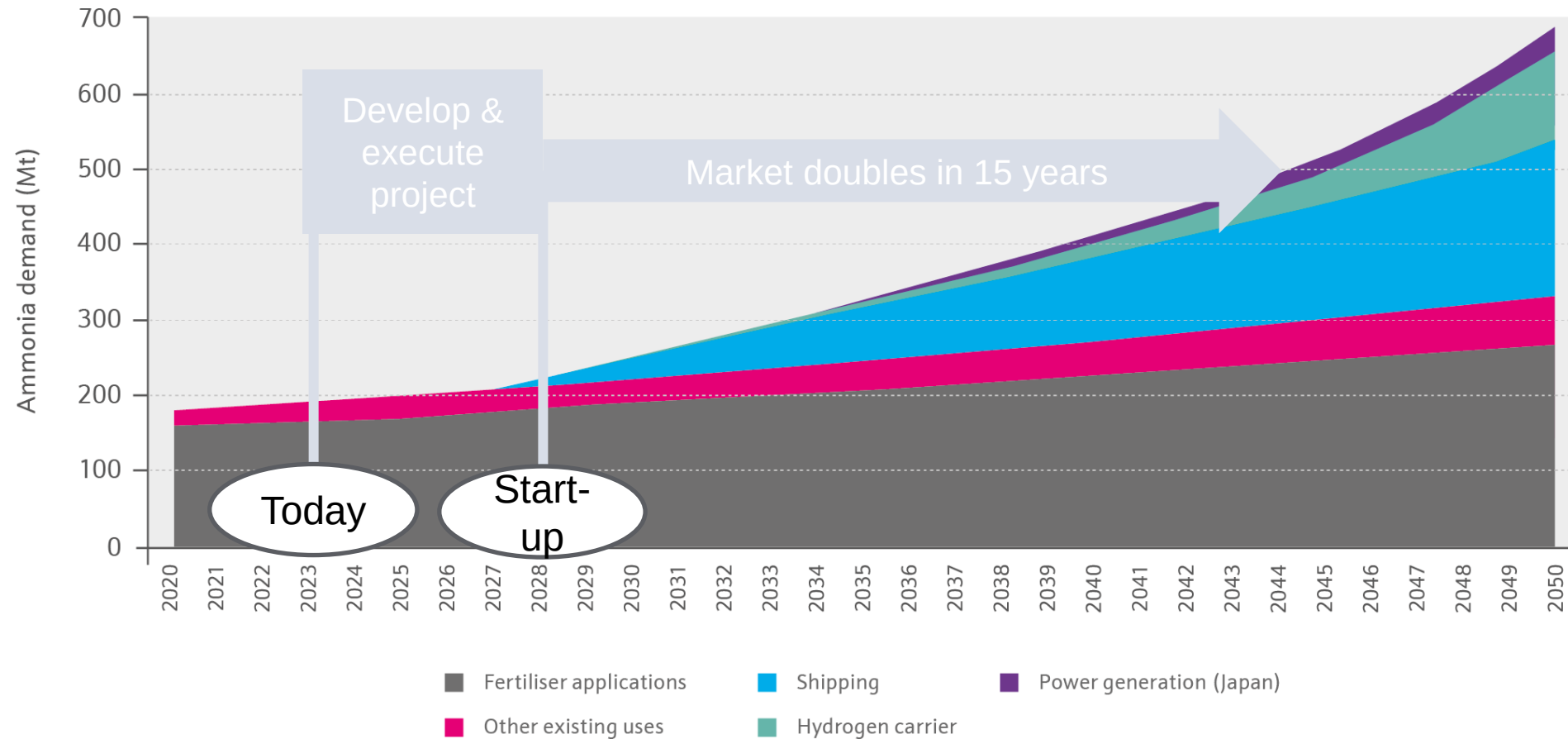
[1] (9) Leveraging Strategic Partnerships: Case Studies in Business Collaboration | LinkedIn

[2] Collaboration in times of crisis: A study on COVID-19 vaccine R&D partnerships - PMC (nih.gov)

[3] IG-PowerLinx-Jan19 copy

# The need for low carbon intensity ammonia is growing

The pull of new opportunities emerging for ammonia, that positively affect demand



Source: Innovation Outlook, Renewable Ammonia; IRENA in partnership with Ammonia energy Association; 2022

# Carbon Intensity: Mapping the transition

Legislation is increasingly focussed on **carbon intensity** not **colour**

## Global Clean Hydrogen Standards

US Clean Hydrogen Production Standard  
 **$\leq 4 \text{ kg CO}_2\text{e per kg H}_2$**   
Four levels in the IRA

China Hydrogen Alliance  
 **$\leq 4.9 \text{ kg CO}_2\text{e per kg H}_2$**

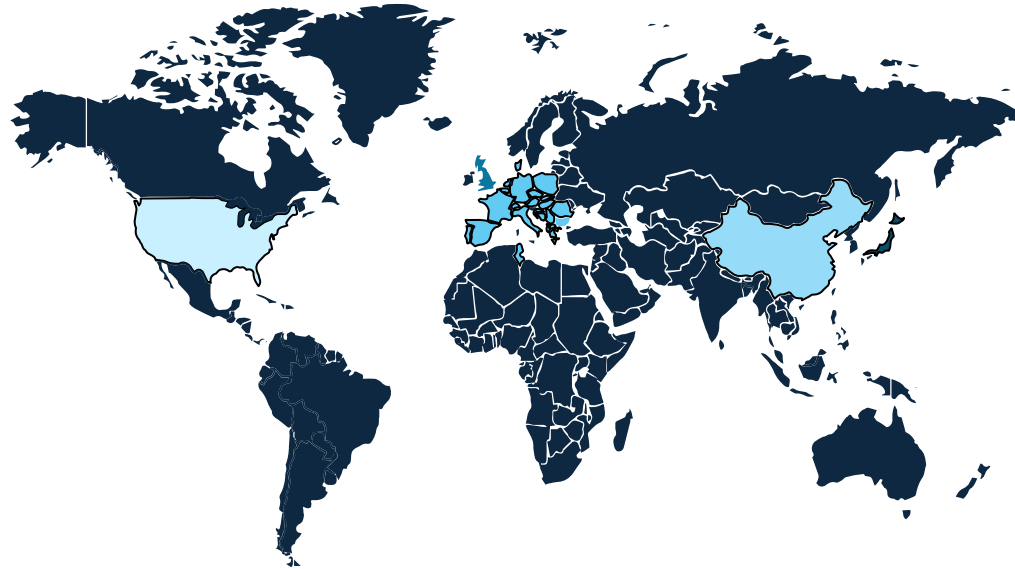
Expected EU regulations  
 **$\leq 3.3 \text{ kg CO}_2\text{e per kg H}_2$**

UK Low Carbon Hydrogen Standard  
 **$\leq 2.4 \text{ kg CO}_2\text{e per kg H}_2$**

Japan Clean Hydrogen Standard  
 **$\leq 3.4 \text{ kg CO}_2\text{e per kg H}_2$  and  
 $0.84 \text{ kg CO}_2\text{e per kg NH}_3^*$**

S. Korea Clean Hydrogen Certification  
**Four grades –  $< 4.0 \text{ kg CO}_2\text{e per kg H}_2$**

**CertifHy**  
Voluntary international standard  
 **$\leq 4.4 \text{ kg CO}_2\text{e per kg H}_2$**



Note: some values are for well to gate emissions, others are well to port

**1,418**  
Clean hydrogen  
projects  
announced as of  
Oct 2023 <sup>1</sup>

**51**  
Hydrogen  
strategies in action  
around the world<sup>2</sup>

**+30%**  
Investment  
growth from Jan  
2023 to Oct 2023

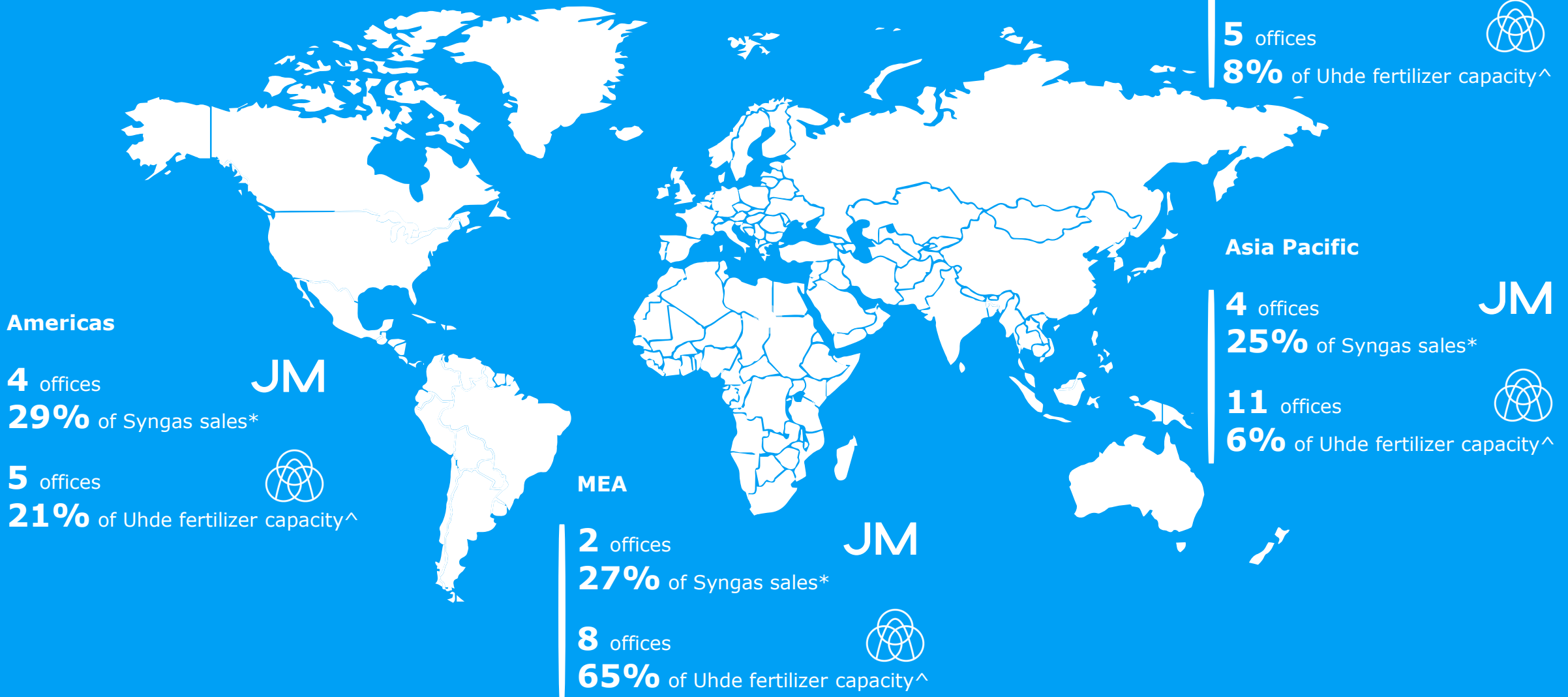
**\$570bn**  
Total announced  
investment <sup>1</sup>

<sup>1</sup> Hydrogen Insights December 2023, Hydrogen Council & McKinsey Company

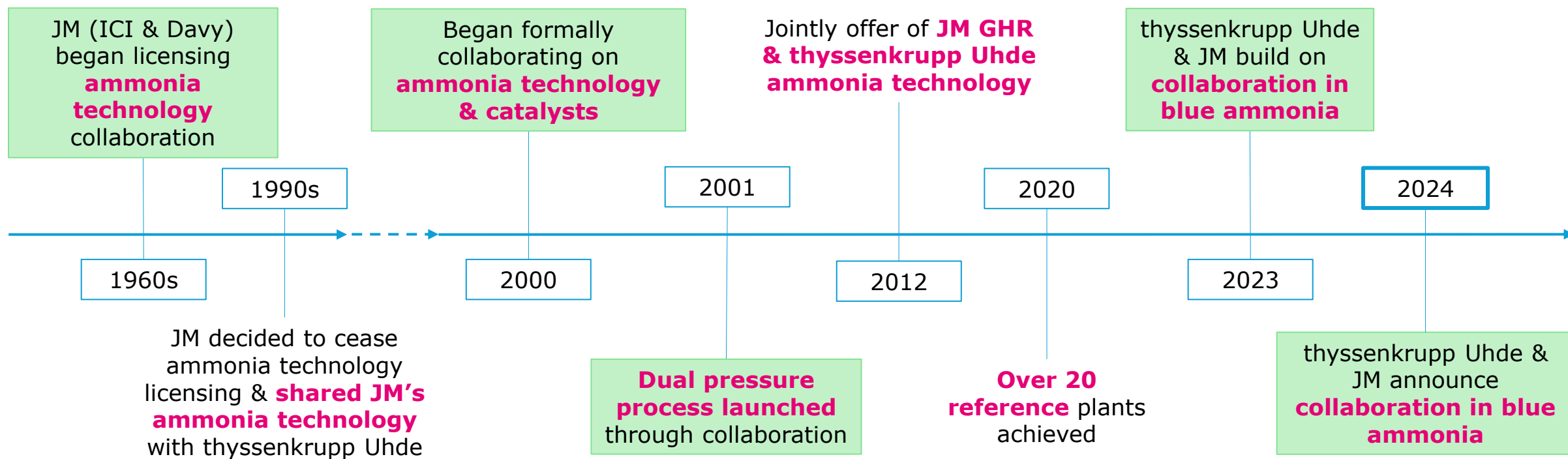
<sup>2</sup> BNEF, Hydrogen Strategies, Dec 2023

\* Only Japan has announced a threshold for ammonia carbon intensity for gate-to-gate

# JM & thyssenkrupp Uhde have a global footprint



## JM & thyssenkrupp Uhde have a long, successful **history of working together**

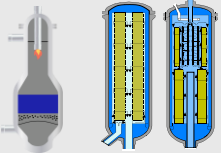
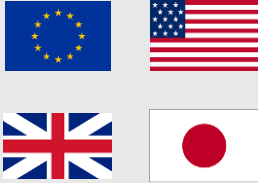


**100+ years** combined syngas experience

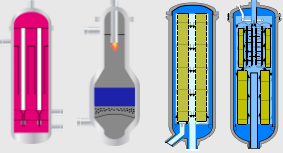
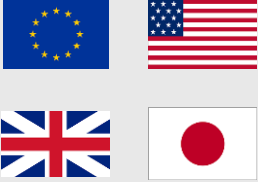
**25 year partnership**

Collaboration on **20+ ammonia reference plants**

# Our customers can choose from two **leading blue ammonia technologies**

|                          | Flowsheet<br>ATR only or<br>GHR/ATR                                               | Steam<br>Integration                       | Proven<br>Technology                                                               | Product<br>Flexibility                                                                           | Carbon<br>Intensity | Carbon<br>Standards                                                                 | Feedstock<br>efficiency |
|--------------------------|-----------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------|-------------------------|
| 1<br>ATR<br>steam drives |  | Fully integrated<br>high-pressure<br>steam |  | $H_2$  $NH_3$ | World<br>Class      |  | World<br>Class          |

Our ATR based ammonia flowsheet, uses **familiar steam drives** supporting integration with the ammonia loop

|                                 |                                                                                    |                             |                                                                                     |                                                                                                  |        |                                                                                      |         |
|---------------------------------|------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------|---------|
| 2<br>GHR/ATR<br>electric drives |  | De-coupled<br>steam systems |  | $H_2$  $NH_3$ | Lowest |  | Highest |
|---------------------------------|------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------|---------|

Our GHR/ATR based ammonia flowsheet is the **lowest carbon intensity** decreasing with the electricity grid and has options to **de-couple ammonia & hydrogen** products

## Together thyssenkrupp Uhde & JM provide **world leading blue ammonia** technology



- ✔ **One-stop-shop** with fully **integrated** flowsheet
- ✔ **Catalyst & technology** developed together
- ✔ World's **largest single-train ammonia** plant
- ✔ **130 ammonia plants realized** worldwide
- ✔ **Over 30 ATR or ATR/GHR** plants worldwide
- ✔ All parts of flowsheet offered **commercially referenced**
- ✔ Proven **ATR burner life** of 10 years+
- ✔ **Increased catalyst life** due to unique ATR design



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