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# Renewable Hydrogen in Industry Decarbonisation

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EU experiences and challenges

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工业脱碳中的可再生氢气——欧盟的经验与挑战

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# About us

## Who we are:

Agora Industry is a think tank, policy lab, and part of the **Agora Think Tanks**

## What we do:

We develop **scientifically sound** and **politically feasible strategies** for a successful pathway to **climate-neutral industry** – in Germany, Europe and internationally

## How we work:

We are independent and non-partisan, with a diverse financing structure – **our only commitment is to climate action**

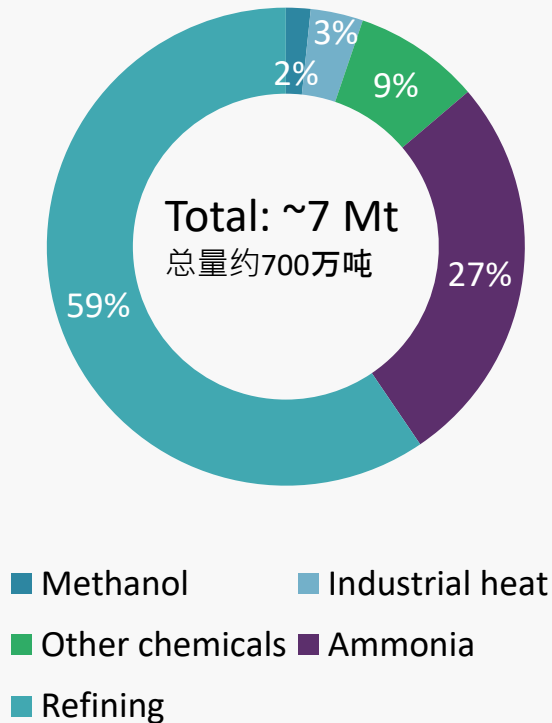
## Where we take action:

Agora Industry has offices in Berlin, Brussels, Beijing and Bangkok, and cooperates with a wide network of partner think tanks on the ground

# Today's industrial hydrogen consumption in the EU amounts to 7 Mt p.a.

目前欧盟的工业氢年消耗量为 700 万吨

Hydrogen use by application  
氢的应用

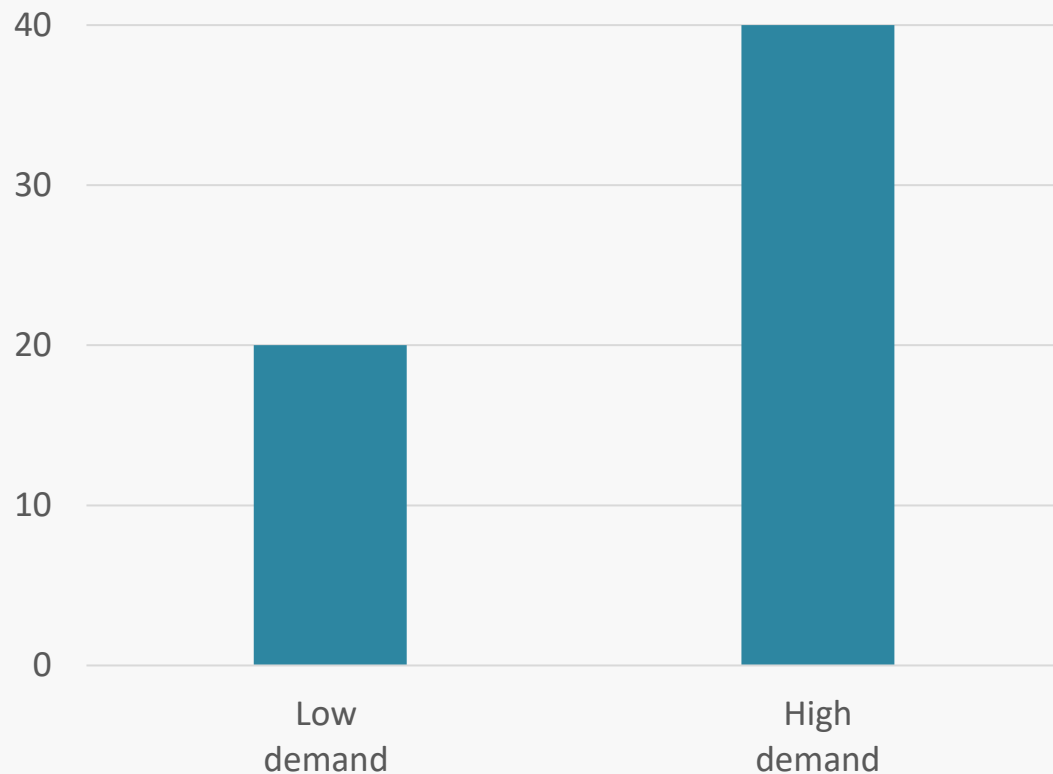


- **Refining** is dominant, but only ~20% of it is for industrial feedstocks. Total refining will decline with rising electrification of transport.  
用于炼油的占比最大，但其中只有约20%用作工业原料。随着运输电气化程度的提高，氢气在炼油业的使用量将会下降
- **Ammonia** is mainly needed for nitrogen fertilizer production  
氨主要用于氮肥的生产
- **Methanol** and other chemicals (acids etc.)  
甲醇和其他化学品（比如各类酸）
- **Industrial heat** demand is met by burning mostly by-product hydrogen  
工业用热需求主要通过工业副产氢来满足
- **Emerging applications such as steel** are not shown here (less than 1%)  
氢冶金等新兴技术运用没有呈现在图例中（占比小于1%）

# By 2050, the EU's industrial hydrogen demand will amount to 20 to 40 Mt

到2050年，欧盟工业氢需求量将达到2000万至4000万吨

Industrial demand for pure hydrogen 2050 in Mt p. a.  
2050 年工业对氢的需求量 ( 百万吨/年)

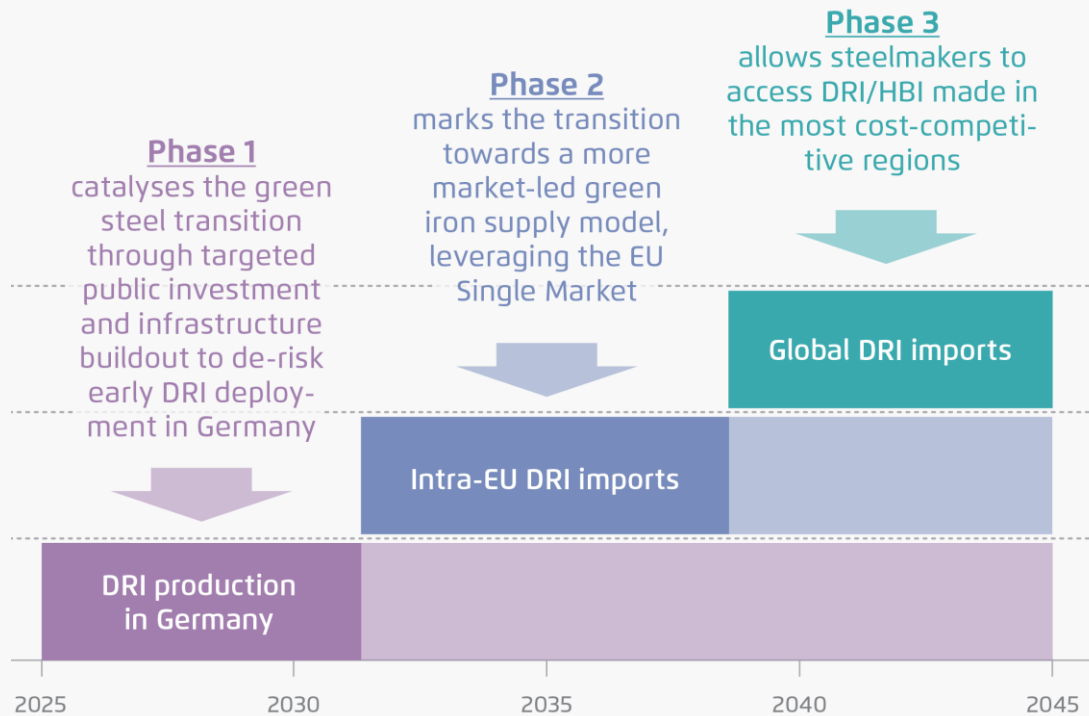


- **Direct reduction of iron (DRI)** with hydrogen is an important new use case  
氢直接还原铁(DRI)是一项重要的氢能应用新案例
- **High H2 demand** scenario: Feedstock production entirely in Europe  
氢能高需求情景：原料全部在欧盟生产
- **Low H2 demand** scenario: ~50% of imports of high-value chemicals and sponge iron (DRI) to Europe  
氢能低需求情景：欧盟进口的高价值化学品以及海绵铁 ( DRI) 约占50%

# Imports are part of a three-phase approach to climate-neutral steel production

## 进口是钢铁生产实现气候中和的三阶段战略中的重要构成

Phases from the perspective of Germany and the EU  
从德国和欧盟角度观察的三个阶段



The three-phase strategy could entail:

三阶段战略可以包含：

1. Supporting domestic green iron projects in Europe  
支持欧盟境内的绿钢项目
2. Leveraging the EU single market and  
利用欧盟单一市场
3. Complementing this with green iron imports into EU  
并兼顾欧盟的绿钢进口

→ Note: Chinese version of Agora publication on Green Iron Trade forthcoming

敬请留意：Agora关于绿钢交易的中文版研究即将推出（日期待定）

# Germany's chemical industry could transition to biomass, recycling & hydrogen

## 德国化学工业或将朝生物质能、回收利用和氢能转型

Share of feedstocks for chemicals  
化工业的原料份额占比

Status quo 目前份额



Climate-positive scenario  
气候正效益时的份额



→ **Today**, German industry heavily depends on expensive and unsecure imported fossil fuels

现今，德国工业严重依赖昂贵且进口贸易充满不确定的化石燃料

→ **Domestic recycling and biomass** will strengthen resilience, reduce import costs of fossil fuels, create jobs and lead to negative emissions

发展国内循环利用和生物质能将增强产业韧性，降低化石燃料进口成本，创造就业机会，并带来负排放

→ **International trade** with green intermediate products could further reduce costs.

推行绿色中间产品的国际贸易可进一步降低成本

→ **Recommendation**: Create international alliances for fossil-free chemicals

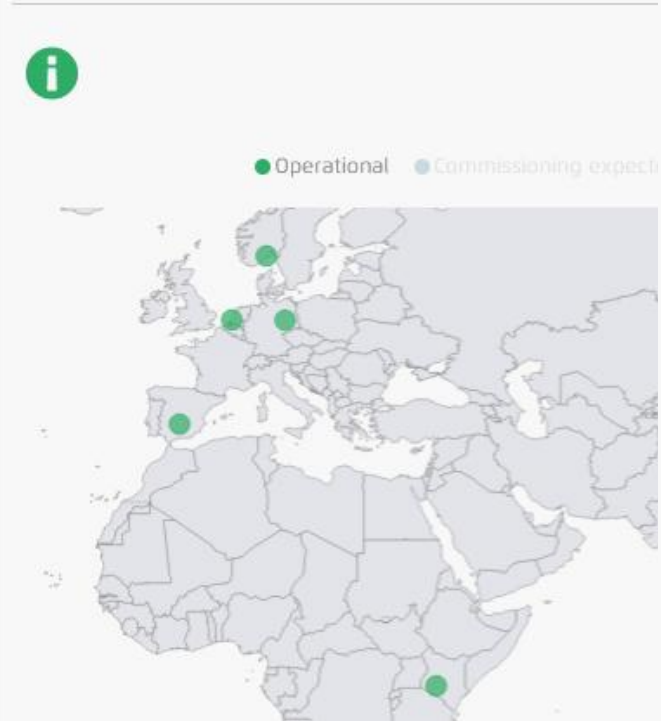
建议：建立国际零化石燃料化工联盟

# Renewable ammonia: Demand and supply challenges

## 可再生氨：供需面临的挑战

Green fertiliser projects in operation  
正在运行的绿色肥料项目

Global Renewable Fertiliser Projects



- **Demand side:** How to distribute the green premium for renewable fertiliser along the value chain?  
( $<1\%$  for a loaf of bread, but significant for farmers)  
需求端：如何将可再生肥料的绿色溢价分配到价值链的各个环节？（虽不到价值链的1%，但对农民来说意义重大）
- **Supply side:** Unclear transformation path beyond 15-20% drop-in renewables for brownfield ammonia plants based on steam-methane reforming  
供应端：对于采用蒸汽甲烷重整技术的棕地氨厂而言，超过15-20%可再生能源替代率的转型路径尚不明确
- **Decentralized renewable nitrogen fertiliser** with or without hydrogen production step will likely have a role to play in some locations, as described in new Agora publication  
正如Agora最新发表文章所述，分散式可再生氮肥，无论是否包含制氢步骤，都可能在一些地区发挥作用

# Challenges to hydrogen in industry and recommended approaches

## 工业氢面临的挑战以及推荐的应对方法

### Challenges

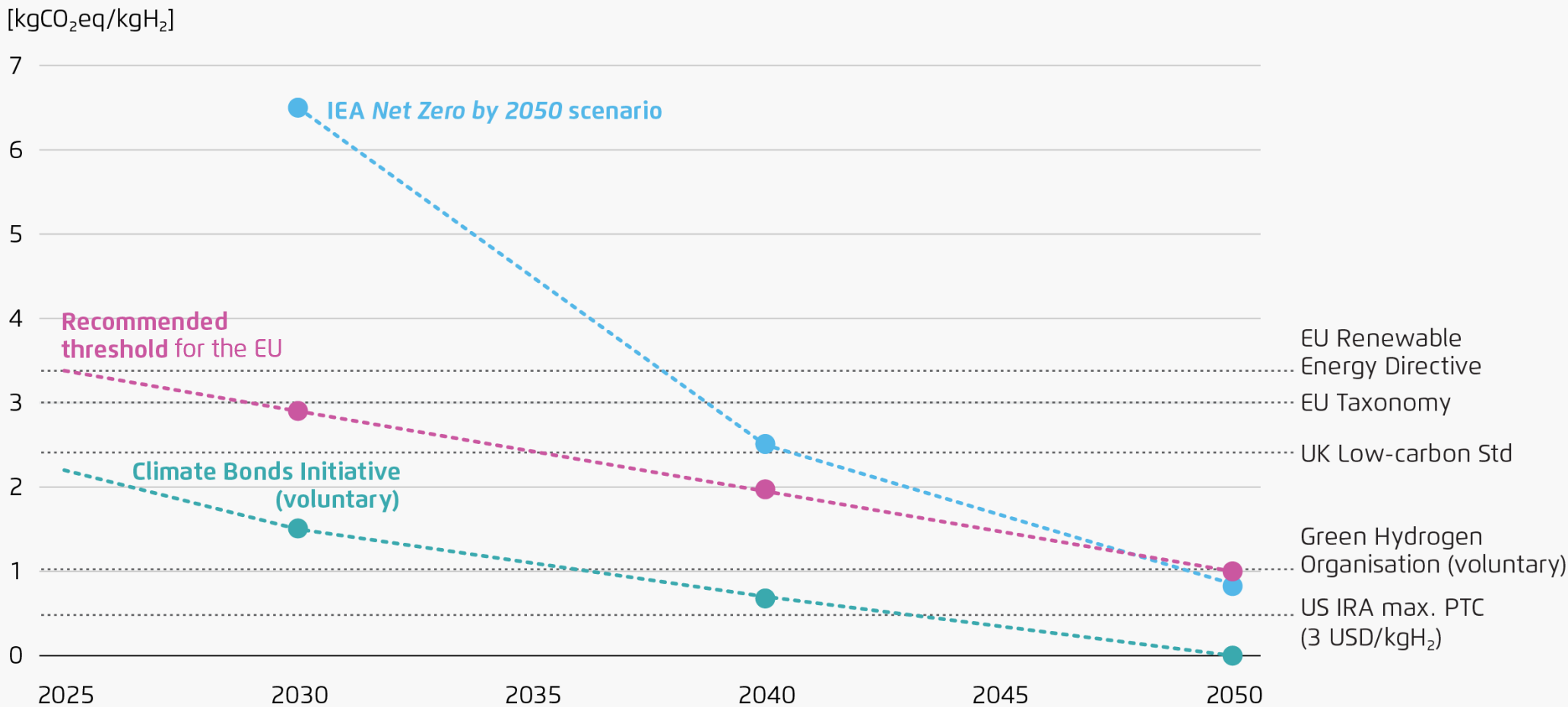
- Supply: Higher cost of renewable hydrogen  
供应：可再生氢成本较高
- Infrastructure: Financing H<sub>2</sub> pipelines through Europe  
基建：如何为经过欧洲的输氢管提供财政支持
- Demand: Missing long-term offtake  
需求：长期需求无法保障

### Recommendation

- Carbon pricing (ETS) with carbon leakage protection  
推行碳定价（ETS）及碳泄漏保护机制
- Enable intertemporal cost allocation for pipelines  
为输氢管道启用跨期成本分配
- Carbon contracts for difference to bridge cost gap  
利用碳差价合约弥补成本缺口
- Establish and scale green lead markets for steel, chemicals and fertiliser, e.g. via aligned labelling and standards  
通过比如统一国际标签和标准，建立并扩大钢铁、化工和化肥行业的绿色先导市场

# Outlook: The EU needs a periodically tightening GHG threshold for hydrogen

展望：欧盟需要定期收紧氢能温室气体排放阈值



9 | Note: The system boundaries and implementation details of these standards and requirements differ. Agora Energiewende and Agora Industry (2024): [Low-carbon hydrogen in the EU](#).

# Summary

- **Industrial demand** for climate-neutral hydrogen in the EU is expected to rise to 20–40 Mt p.a. by 2050  
预计到2050年，欧盟对气候中性氢的工业需求将增至每年2000万至4000万吨
- **Sustainable biomass** can contribute to a shift away from fossil-based feedstocks  
可持续生物质能有助于摆脱对化石原料的依赖
- **Carbon pricing and policies for securing offtake** and infrastructure financing are key for hydrogen development  
碳定价以及保障长期需求和基础设施融资的政策是氢能发展的关键
- **Importing intermediate products** to the EU would reduce pure hydrogen demand and cost  
进口中间产品到欧盟或将降低纯氢的需求和成本
- **Establishing international partnerships** for future trade in green iron or chemicals should start early and consider aligned labelling and standards  
应尽早启动建立针对未来绿钢或化学品贸易的国际伙伴关系，并考虑采用统一的国际标签和标准

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# Thank you for your attention!

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Do you have any questions or comments?

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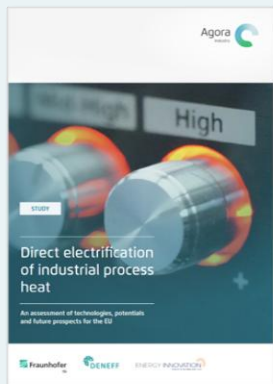
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# Publications and tools on electrons and molecules by Agora Industry

## Electrons



*Power-2-Heat  
Impulse*



*Direct electrification of industrial process heat  
Study*



*EU map with production cost of electrons and molecules  
Tool*



*Low-carbon hydrogen in the EU  
Impulse*



*Hydrogen imports to Germany  
Study (DE)*

*Prioritising hydrogen for the most effective uses  
Slide deck*

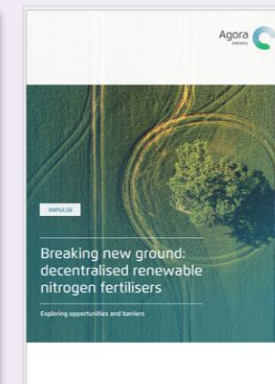
## Molecules



*Insights on hydrogen (publication series)  
Global (EN), Argentina (ES), Brasil (PT), SEA (EN), Tool*



*Industrial value chain transformation  
Impulse PtX cost tool*



*Green Fertiliser  
Impulse Global Green Fertiliser Tracker*