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H_2 – a key element today and in the future for BASF

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Hydrogen & P2X

Copenhagen, June 15th 2023

BASF – We create chemistry

- Our chemistry is used in almost all industries
- We combine economic success, social responsibility and environmental protection
- Sales 2022: €87.3 billion
- EBIT before special items 2022: €6.9 billion
- Employees (as of December 31, 2022): 111,481
- 6 Verbund sites and 239 other production sites
- Around 82,000 customers from various sectors in almost every country in the world

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BASF’s segments

Chemicals

Petrochemicals

Intermediates

Materials

Performance Materials

Monomers

Industrial Solutions

Dispersions & Resins

Performance Chemicals

Surface Technologies

Catalysts

Coatings

Nutrition & Care

Care Chemicals

Nutrition & Health

Agricultural Solutions

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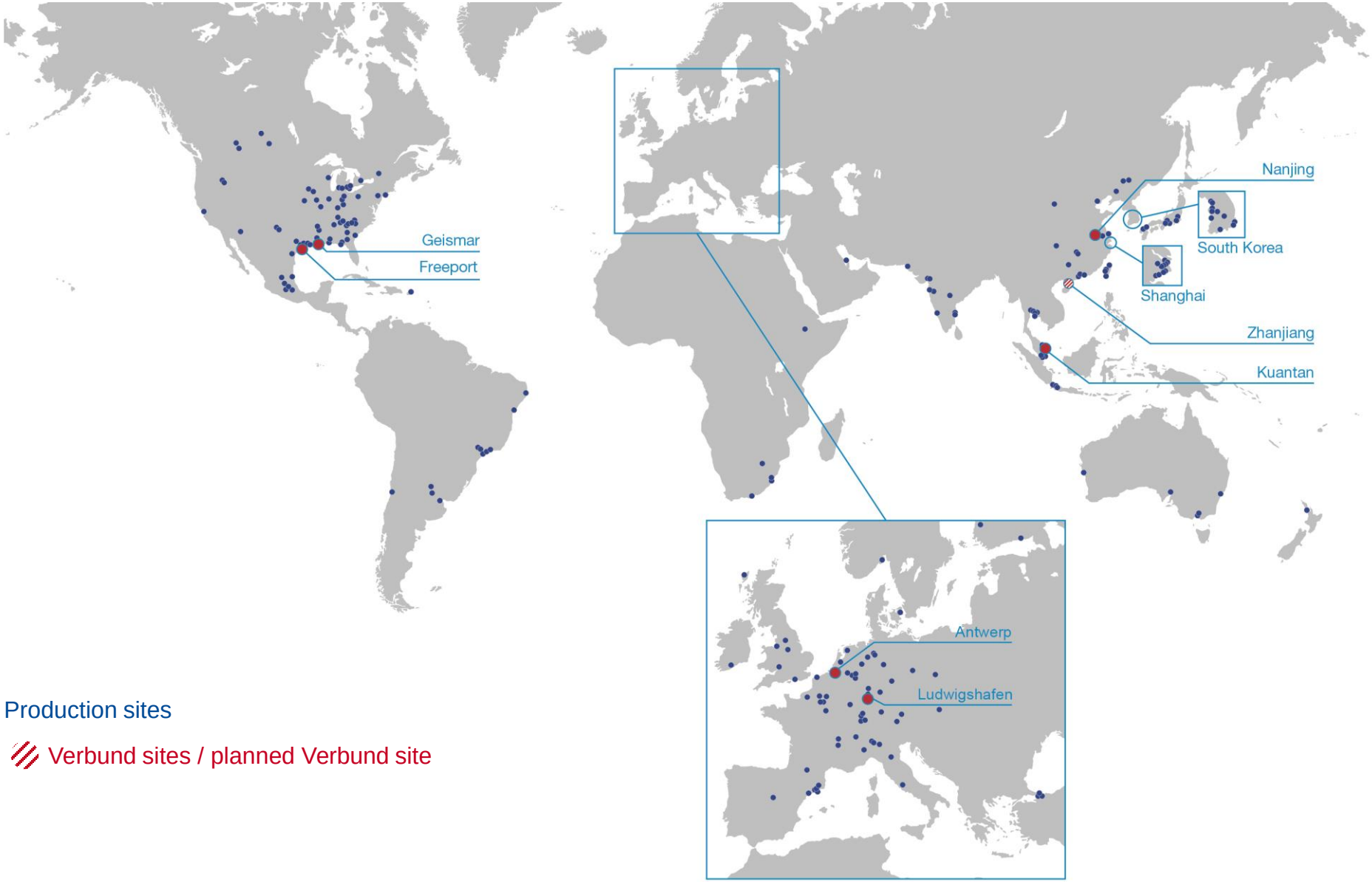
BASF worldwide: Production and Verbund sites



Production sites

Verbund sites / planned Verbund site

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We create chemistry for a sustainable future – BASF's emission targets

25%

CO_2 emissions reduction

(compared with 2018)*

net zero

CO_2 emissions*

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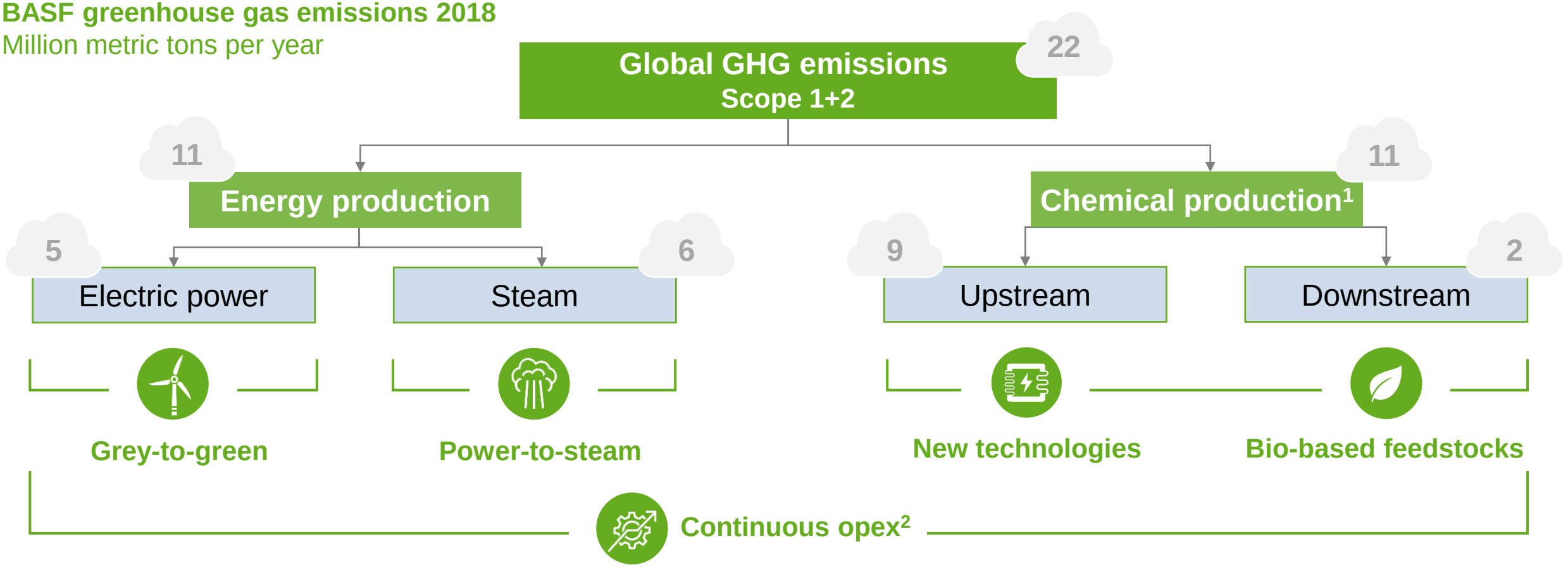
* Scope 1 and Scope 2; 2030 target compared with 1990: 60% CO_2 reduction

No downstream transformation without upstream transformation

BASF greenhouse gas emissions 2018
Million metric tons per year



[1] Includes emissions from process energy [2] Operational excellence measures

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Hydrogen as a raw material

- **Hydrogen is an irreplaceable raw material for many products** in the chemical industry, but the current production process is associated with **high CO_2 emissions.**
- BASF pursues a **make-and-buy approach** to secure access to **low-carbon hydrogen**
- BASF is scaling up **new technologies** for production of clean hydrogen
- **Availability** and **price** of hydrogen as critical success factors
- **A clear legal framework is key,** which allows technology-open transformation

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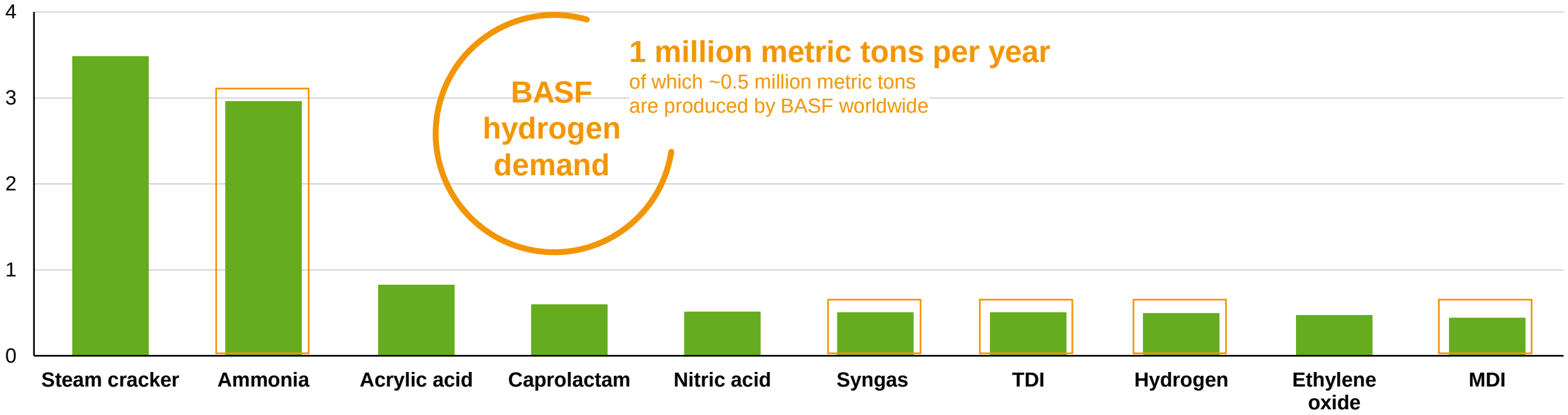
The use of hydrogen as a raw material is a key lever for CO_2 emission reduction across several technologies

Greenhouse gas emission profile of BASF technologies

Energy and chemistry emissions, million metric tons per year*



Achieving the production of CO_2-free hydrogen will tackle 2 to 3 million metric tons of our CO_2 emissions across several technologies

* Based on nameplate capacities, excluding emissions from B companies

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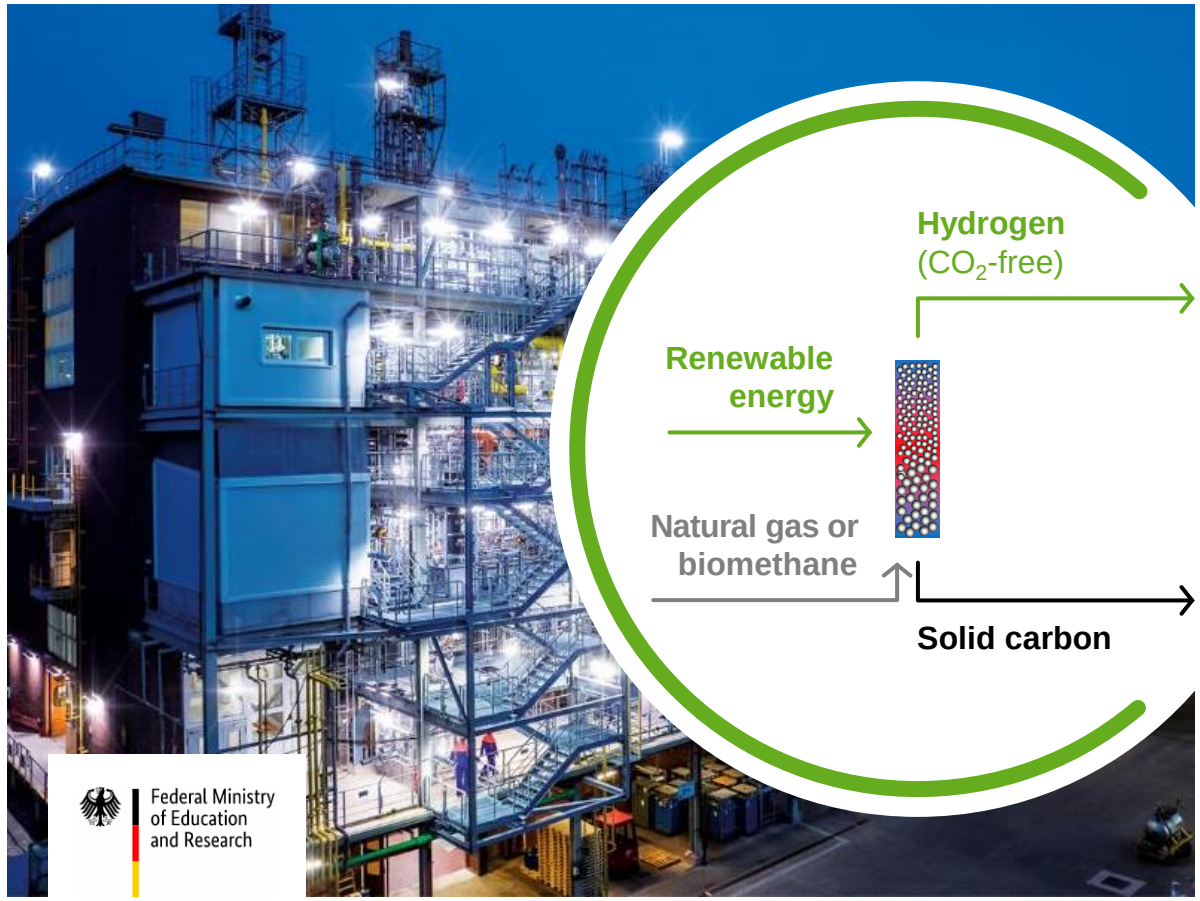
Methane pyrolysis* – process innovation to reduce CO_2 emissions



- Methane pyrolysis is a **low-emission technology.** In this innovative process, (bio)methane is split directly into hydrogen and solid carbon
- **Test plant** at the Ludwigshafen site **in trial operation**
- Key challenges are **process technology and control**
- **Methane pyrolysis** requires around **80% less electricity** than water electrolysis and is virtually **carbon-free if renewable energy is used**

* Project sponsored by the Federal Ministry of Education and Research (Grant number 03SF0571A)

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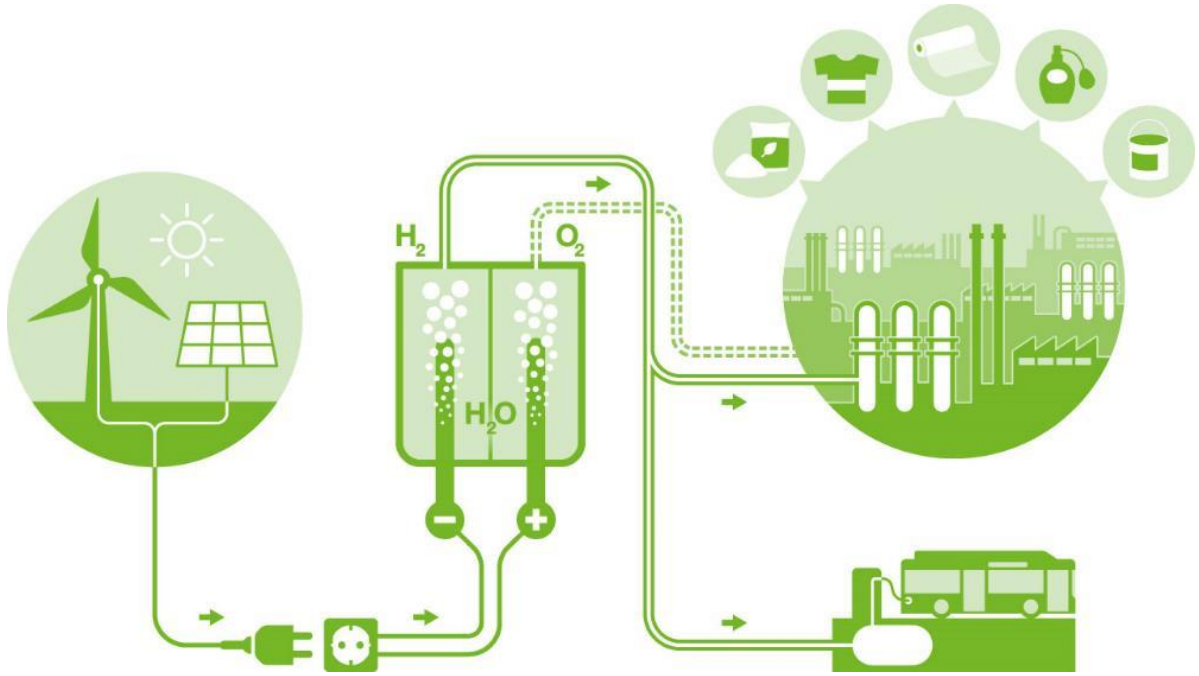
Water electrolysis in Ludwigshafen – BASF's Hy4Chem project



- In **water electrolysis**, water is split directly into its two components, hydrogen and oxygen
- If the required energy comes from **renewable sources**, the process is **carbon-free**
- We are working with Siemens Energy **on a project for the construction of a PEM** (proton exchange membrane) water electrolyzer with a **capacity of 54 megawatts**
- Hydrogen to be used in **BASF Verbund** and for **local community hydrogen mobility market**
- BASF applied for funding by the German Federal Ministry for Economic Affairs and Climate Action (BMWK)

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PEM-Electrolysis needs high-performance, low PGM*-loading catalysts

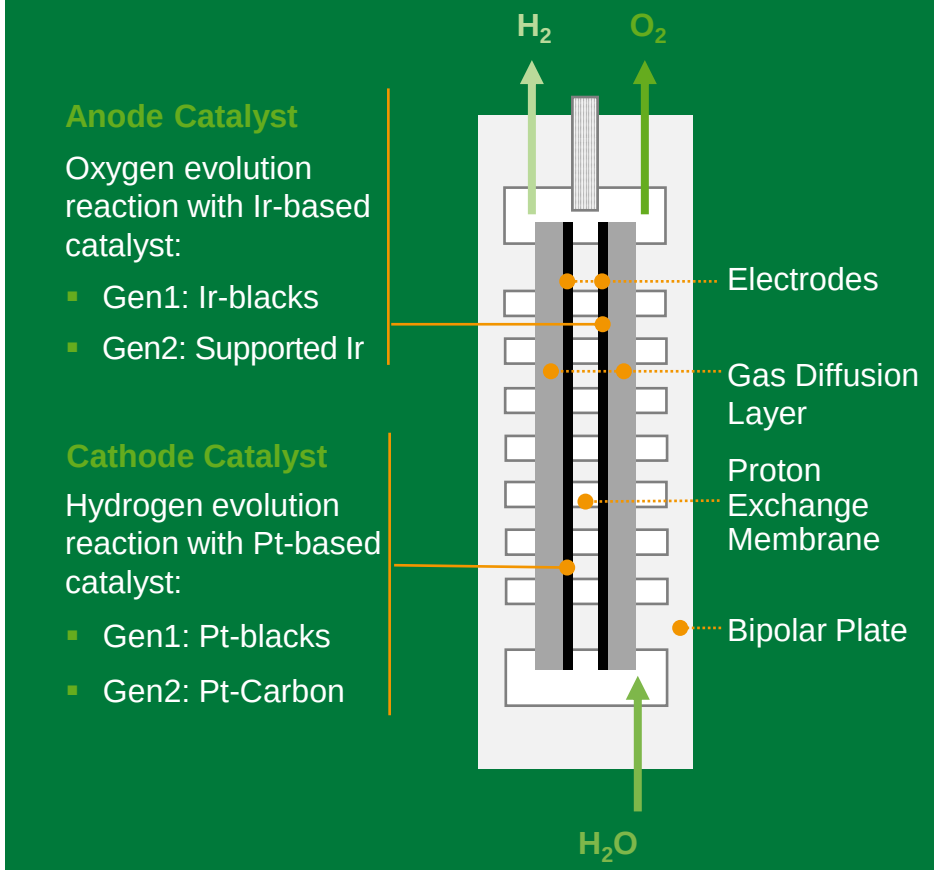
- Ir- and Pt-based electrocatalyst are key to high efficiency and long-term stability of the electrolyzer stack
- Today´s limited Ir-supply and the projected demand growth for PEM-electrolyzers call for the development of catalysts that combine lower Ir-loadings with higher efficiency

BASF catalysts offer various benefits to our customers:

- ✓ Low-PGM loading
- ✓ High efficiency & performance
- ✓ High corrosion stability for enhanced lifetime
- ✓ PGM handling: sourcing, supply and recycling

*Platinum Group Metals

PEM Electrolyzer and catalysts



Increasing importance of Hydrogen as an energy vector

- After renewable power, **H_2 is the energy vector** of choice for the transformation
- **Future BASF hydrogen demand as energy vector** is expected to be significant
- Build-up of gas infrastructure must be **accelerated to meet huge demand.**
- A **pipeline connection to BASF sites in Europe** is key to access cost-competitive H_2 and BASF is looking at different **supply routes** to ensure the connection

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