Our journey to net zero 2050

Dr. Martin Brudermüller
Chairman of the Board of Executive Directors

BASF Capital Markets Day, March 26, 2021
Cautionary note regarding forward-looking statements

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Our commitments to reaching the Paris Climate Agreement

2030
25% CO₂ emissions reduction (compared with 2018)¹

2050
net zero CO₂ emissions¹

¹ Scope 1 and Scope 2; 2030 target compared with 1990: 60% CO₂ reduction
Our journey to net zero 2050

The levers for our transformation

1. The transformation is underway on our sites
2. Capex plan and prerequisites
3. Business opportunities through low-carbon products

BASF Capital Markets Day, March 26, 2021
I Keynote
Leading the journey to transform the chemical industry

- BASF Verbund
- BASF data
- BASF expertise
- BASF technologies

We create chemistry for a sustainable future
Our path to reduce BASF emissions from 2018 to 2030

BASF greenhouse gas emissions (Scope 1 and Scope 2) 2018–2030

CO₂ reduction in business as is 2018

- Grey-to-green
- Power-to-steam
- New technologies
- Bio-based feedstocks
- Opex
- Temporary measures

CO₂ increase from growth

- Growth (organic, inorganic)
- Verbund site South China

2018

- 21.9

2030 Business as is 2018

- 50%

2030

- 25%
Our path to reduce BASF emissions from 1990 to 2050

BASF greenhouse gas emissions (Scope 1 and Scope 2) 1990–2050

- CO₂ reduction in business as is 2018
  - >45%
  - 21.9
  - Grey-to-green
  - Power-to-steam
  - New technologies
  - Bio-based feedstocks
  - Opex
  - Temporary measures

- CO₂ increase from growth
  - ~75%
  - ~60% 100%
  - Growth (organic, inorganic)
  - Verbund site South China

1990  2018  2030 Business as is 2018
  
2030

2050
No downstream decarbonization without upstream decarbonization

BASF greenhouse gas emissions 2018 million metric tons per year

Global GHG emissions Scope 1+2

Energy production

- Electric power: 5
- Steam: 6

Chemical production\(^1\)

- Upstream: 9
- Downstream: 2

\(^1\) Includes emissions from process energy
No downstream decarbonization without upstream decarbonization

BASF greenhouse gas emissions 2018
million metric tons per year

Global GHG emissions
Scope 1+2

22

Energy production

11

Electric power

5

Grey-to-green

Steam

6

Power-to-steam

Chemical production

11

Upstream

9

New technologies

Downstream

2

Bio-based feedstocks

Continuous opex

1 Includes emissions from process energy
2 Operational excellence measures
Our levers to reduce BASF’s CO₂ emissions

Our journey to net zero 2050

- Grey-to-green
- Power-to-steam
  - New technologies
  - Bio-based feedstocks
  - Continuous opex

Temporary measures

Offsetting

Global GHG emissions
Scope 1+2
The ultimate lever for CO₂ reduction is electrification with renewable energy
Build-up of renewable energy production must be accelerated to meet demand

Example: Germany

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>2020 Total Primary Energy Consumption TWh</th>
<th>2020 Electricity Consumption TWh</th>
<th>2050 Electricity Demand Scenario TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil</td>
<td>2527</td>
<td>231 (31 Other)</td>
<td>963</td>
</tr>
<tr>
<td>Nuclear</td>
<td>196</td>
<td>245</td>
<td>224</td>
</tr>
<tr>
<td>Renewable</td>
<td>549</td>
<td>64</td>
<td>628</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3182</strong></td>
<td><strong>346</strong></td>
<td><strong>1815</strong></td>
</tr>
</tbody>
</table>

1 AG Energiebilanzen e.V.  2 Federal Ministry for Economic Affairs and Energy (BMWi)  3 VCI  4 Strategy&
Offshore wind energy is a cost-competitive technology today and will be even more attractive in the future

- Non-subsidized offshore wind parks are already **competitive today**
- Offshore wind parks **will become even more competitive** going forward
- **Cost reductions** for offshore wind parks mainly driven by technology improvements, increased capacities and longer service life, as well as lower installation and running costs

### Expected electricity cost development (LCOE) € per megawatt hour

Source: THEMA Consulting Group – European Power Market Outlook February 2021

1 Levelized cost of electricity (LCOE): Cost of producing a megawatt hour of electricity over the life of a power station
2 CCGTs (combined cycle gas turbine plants)
To meet our high demand for renewable energy, we will focus on two pillars ensuring additionality.

BASF’s additional green power demand for large European sites
Ludwigshafen, Antwerp and Schwarzheide, terawatt hour per year

**Make: Invest in own assets**
- Building up portfolio of own assets
- Goal: Secure long-term supply at producer economics

**Buy: Purchase green power from third parties**
- Contracting power purchase agreements and renewable energy certificates (PPA/REC)
- Goal: Diversified portfolio (technologies, regions) at current, attractive prices

We will combine both pillars – make and buy – to one diversified portfolio taking into account costs, flexibility and availability.
Capturing the energetic potential of waste heat for steam production
CO$_2$-free steam production in the BASF Verbund with heat pump technology at unprecedented scale

BASF will install heat pumps and steam compressors to use waste heat from chemical plants for steam production.

Energy flow at Ludwigshafen site:

- **20 TWh** Fossil energy (natural gas)
  - 8 TWh from chemistry
  - 14 TWh cooling water
    - 8 TWh air cooling
    - 6 TWh diffusive loss

BASF will create a Verbund Ludwigshafen system with heat pump technology for high-scale CO$_2$-free steam production.
Competitive green energy in Tarragona enabled value-adding replacement of steam turbine with an eDrive

- The propane dehydrogenation plant operates an eDrive, which replaced a steam turbine in 2018
- Investment recovered in less than two years thanks to reduced energy costs
- CO₂ emissions reduced by 34 kilotons per year, production increased by freed-up cooling capacity

Commerially available technologies can be adapted to local needs and opportunities – the right mix makes the difference
We focus on scaling up low-emission technologies to industrial levels
Ten base chemical production technologies cause the majority of BASF’s CO₂ emissions

Greenhouse gas emission profile of BASF technologies
Energy and chemistry emissions, million metric tons per year¹

BASF has identified its CO₂-intensive processes and is addressing them

¹ Based on nameplate capacities, excluding at-equity consolidated companies
BASF, SABIC and Linde join forces to realize the world’s first electrically heated steam cracker furnace

- Goal is to drive concepts and faster implementation through combined strengths
  - BASF and SABIC: extensive know-how and intellectual property in developing chemical processes; long-standing experience and knowledge in operating steam crackers
  - Linde: expertise and intellectual property in developing and building steam cracking furnace technologies and driving future industry commercialization
- Construction of a demonstration plant depending on funding granted – application to E.U. Innovation Fund and German funding program “Decarbonization in Industry”
- If funding is granted, startup could happen as fast as 2023
The use of hydrogen as a raw material is a key lever for CO₂ emissions reduction across several technologies

Greenhouse gas emission profile of BASF technologies
Energy and chemistry emissions, million metric tons per year¹

Achieving CO₂-free hydrogen production will tackle 2 to 3 million metric tons of our CO₂ emissions across several technologies

¹ Based on nameplate capacities, excluding at-equity consolidated companies
Water electrolysis plant will integrate internally produced green hydrogen into our Verbund

Seamless integration into BASF Verbund

- Application for funding through IPCEI Hydrogen Technologies and Systems (Important Project of Common European Interest) has been submitted
- Start-up of water electrolysis targeted for 2024, investment of €90 million, capacity of 8,000 metric tons
- Hydrogen to be used in BASF Verbund and for local community hydrogen mobility market

Water electrolysis is a commercially available technology but consumes large amounts of electricity
Methane pyrolysis combines low emissions with low energy demand

- Methane pyrolysis requires around 80% less electricity than water electrolysis.
- Funding for pilot reactor was granted by German Federal Ministry of Education and Research.
- Pilot reactor at the Ludwigshafen site is being started up.
- Start-up of first commercial plant projected for 2030.

We have achieved a milestone in scaling up our groundbreaking methane pyrolysis process for hydrogen production.
Carbon capture storage technology being evaluated at our Antwerp Verbund site

BASF is supporting a feasibility study evaluating carbon capture storage (CCS) installation through project consortium Antwerp@C.

- Opportunity to reduce CO₂ emissions on an industrial, cost-efficient scale with partners.

- CCS initiatives in port of Antwerp recognized as Projects of Common Interest (PCI) by the European Commission.

- Final investment decision targeted for 2022, depending on public funding granted.

Antwerp@C – CCS value chain in Port of Antwerp

- CO₂ capture
- Local transport
- International transport
- Offshore CO₂ storage

- Emitter
- Gathering pipeline
- CO₂ terminal
- CO₂ storage
- Local transport via pipeline
- International transport via ship
- Offshore CO₂ storage
Decarbonization requires a broad technology portfolio

**Carbon Management**

**Low-CO₂**

**Bio-based**

**Ccycled**

**Circular Economy**

<table>
<thead>
<tr>
<th>Technology</th>
<th>CO₂ avoidance potential (metric tons of CO₂/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane pyrolysis</td>
<td>~0.9</td>
</tr>
<tr>
<td>Heat pumps</td>
<td>~0.6-1.0</td>
</tr>
<tr>
<td>eDrive NH₃</td>
<td>~0.7</td>
</tr>
<tr>
<td>eFurnace</td>
<td>~0.2</td>
</tr>
<tr>
<td>Water electrolysis</td>
<td>~0.2</td>
</tr>
</tbody>
</table>

Target: We aim at doubling our circular sales to reach €17 billion by 2030

Focus on closing the loops

- Renewable-based feedstocks
- Recycled-based feedstocks
- Enable recyclability and/or biodegradability
Bio-based raw materials can be used as feedstocks, partially replacing fossil feedstocks
Entry points for bio-based feedstocks in BASF value chains

In the BASF Verbund, bio-based feedstocks can be used as a drop-in solution, in part using new, dedicated processes.
Continuous improvements that make a difference today
Our upstream integration allows large improvements with single measures

- Avoiding 145,000 tons of CO₂ equivalents per year through optimized process control
- **Nitrous oxide (N₂O) decomposition** in nitric acid cluster was further improved from 99% to 99.9%, residual N₂O was reduced by a factor of 10 to 0.1%
- Key to success were state-of-the-art process modelling capabilities; improvement could be achieved **without major plant modifications or investments**
- One of more than 1,500 operational excellence measures we are currently pursuing to reduce CO₂ emissions and improve energy efficiency
Our journey to net zero 2050

1. The levers for our transformation

2. The transformation is underway on our sites

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4. Business opportunities through low-carbon products
New Verbund site in South China – the integrated chemical complex with the lowest projected CO₂ emissions in the world

- Guangdong Verbund site will emit **50% less CO₂** than gas-powered petrochemical sites
- Targeted use of **state-of-the-art technologies** and supply with **renewable energy** as main levers
- Renewable energy supply ensured through **direct power purchase**
- Connected **investment of local energy provider** in onshore wind farm and photovoltaic facilities

Projected BASF CO₂ emissions of Verbund site in South China

<table>
<thead>
<tr>
<th>Million metric tons</th>
<th>Coal-powered petrochemical site</th>
<th>Gas-powered petrochemical site</th>
<th>Ph 1 full start-up</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6–9</td>
<td>4.2</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>

- Syngas incl. CO₂ recycling
- Cracker pre-heating
- Cracker eDrive
- Power supply

Renewable energy

- Renewable energy supply ensured through **direct power purchase**
- Connected **investment of local energy provider** in onshore wind farm and photovoltaic facilities

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Integrating renewable energy and stabilizing supply at the Schwarzheide site

- Proof of concept for energy transformation at mid-sized chemical sites
- Modernization of BASF cogeneration plant on site
  - Investment of €73 million enables start-up within minutes to buffer fluctuations in electricity supply
  - CO₂ emissions reduced by 16%
- BASF is considering investing in its own solar farm with more than 20 MW to supplement local electricity supply
- Concept under development to integrate industrial-scale batteries based on BASF technology for energy storage
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Major capex for further transformation only expected beyond 2030

<table>
<thead>
<tr>
<th>Projected capex</th>
<th>billion €</th>
</tr>
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<tbody>
<tr>
<td>2021–2025</td>
<td>&lt;1</td>
</tr>
<tr>
<td>2026–2030</td>
<td>2–3</td>
</tr>
<tr>
<td>2030+</td>
<td>&gt;10</td>
</tr>
</tbody>
</table>
The transformation requires a supportive legislative and regulatory framework

Focus E.U./Germany:

- **Cooperation:** Ensure close interaction between policy makers and business to support the implementation of the European Green Deal

- **Competitiveness:** Design an E.U. Industry Policy that strengthens industry through a predictable climate and energy policy framework

- **Innovation:** Remove policy-induced costs to incentivize large-scale investments in CO₂-neutral production technologies – at German level, e.g., EEG reform, funding programs, contracts for difference

- **Infrastructure:** Speed up capacity expansion for generation and transportation of electricity from renewable energy sources

- **Allocation:** Prioritize industrial hydrogen use over energy and heating, secure hydrogen and green energy supply for industrial users
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We are a key enabler to help our customers decarbonize their value chains

Low-carbon products

Grey-to-green  Power-to-steam  New technologies  Bio-based feedstocks  Continuous opex
Cradle-to-gate Product Carbon Footprints for BASF’s portfolio available by end of 2021 based on process emissions, energy demand and upstream emissions
Offering our customers choices to reduce their CO$_2$ footprint

**BASF Product**

- **Recycled content**: 20%
- **Bio-content**: 10%
- **CO$_2$**: [Bar chart indicating a specific value]

**Sales price**: €3.27 per kg  
**Carbon footprint**: 1.8 kg CO$_2$ per kg
Product Carbon Footprint allows targeted discussions with customers on desired sustainability properties of products

Aroma ingredient example
Cumulative reduction of CO₂ emissions, %

- Current process
- Renewable energy
- Renewable feedstocks (e.g., green hydrogen)
- Other

Reduction potential: up to ~85%

- Product Carbon Footprint ensures unprecedented transparency along the value chain
- Choice of raw materials, technology or energy supply helps tailor product properties to customer needs
- Cross-industry standardization required around calculation of CO₂ footprints of products
BASF will work all levers to reduce CO₂ emissions

- BASF is establishing certified, full CO₂ tracing (Product Carbon Footprint) and needs transparency from its suppliers for this

- To support its suppliers and the industry, BASF will share its knowledge to create an international standard for CO₂ transparency tools

- BASF will work together with its suppliers and expects them to reduce the CO₂ footprint of their products
Economics of decarbonization

Impact on sales and profitability
► Above-average volume growth of products with low carbon footprint due to rising demand
► Customers’ willingness to pay higher prices for low-emission products
► Higher margins expected for products with low carbon footprint produced in BASF’s Verbund

Impact on capex and costs
► Increased capex partially mitigated through public funding for pioneering, new technologies
► Minor incremental costs of mass balance approaches in existing Verbund assets

Impact of external environment
► High initial variable costs for renewable energy have to decline with increased availability and favorable regulatory changes
► A supportive overall regulatory environment will drive positive economics and accelerate transformation
BASF’s journey to net zero 2050: Key takeaways

► We are a **key enabler** in the net zero transformation of base chemicals and downstream value chains

► Globally, we want to reduce our absolute CO₂ emissions **by 25% by 2030 compared with 2018**

► This means that, **compared with 1990**, we aim to reduce our global CO₂ emissions **by 60% by 2030**, exceeding the European Union’s target

► We aim to achieve **net zero CO₂ emissions at BASF by 2050**

► We are a **front-runner** in offering our customers a portfolio of products with lower carbon footprints to enable their decarbonization