



© John finney photography / Getty Images

Climate Change and its risks

a Munich Re perspective

Wiesbadener Alternative Konferenz – 13. Oktober 2022

Dr. Thomas Krismer / Munich Re
Climate Advisory



About Munich Re

climate change on our agenda since >50 years now



Munich Re Group expertise in reinsurance, primary insurance and asset management.

Reinsurance



Primary insurance



Asset Management



Risk management Solutions



Nat Cat and climate change – our core business

- Climate change as strategic topic for global reinsurance business
- Munich Re is a leading provider of climate change adaptation and mitigation measures



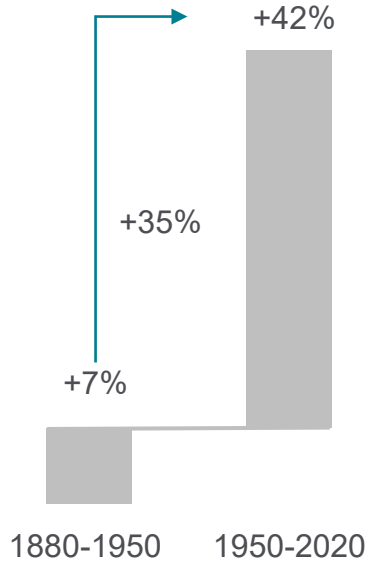
Climate change and risks

Global warming due to anthropogenic greenhouse gas emissions **increases natural hazards**

Global warming

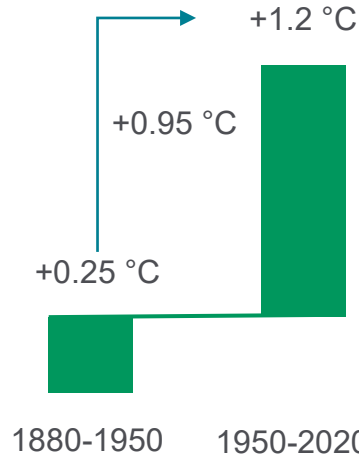
Increasing CO2 emissions and accelerating global warming since 1950

Increase of CO2 in the atmosphere (%)



Amount atmospheric CO2 compared to preindustrial average

Increase of global mean temperature (°C)



Global mean temperature compared to preindustrial average

+1.2°C global warming compared to preindustrial levels

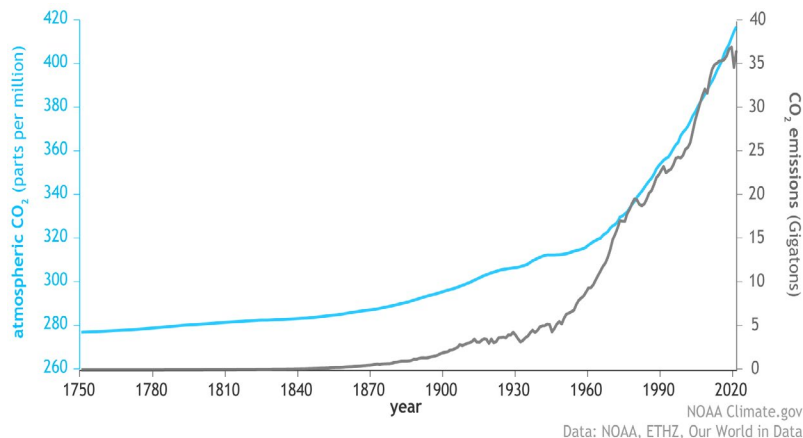
- substantial increase of CO2 emissions and acceleration of global warming since 1950s
- human induced climate change is 85 times faster than naturally observed
- increasingly hard for societies to adapt at faster rates than climate change

Temperature change & CO2 emissions

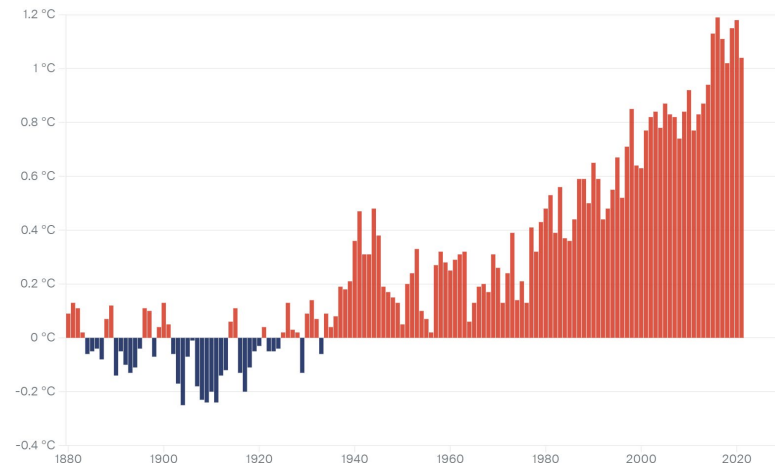
Last six decades each warmer than previous, last 13 of 20 years warmer than previous

Emissions rose from 15bn tons p.a. in 1960 to >35bn tons p.a. by 2020

Linear temperature trend (1881-2021): 1.2°



Atmospheric carbon dioxide amounts (blue line) and annual emissions (grey line) since 1750

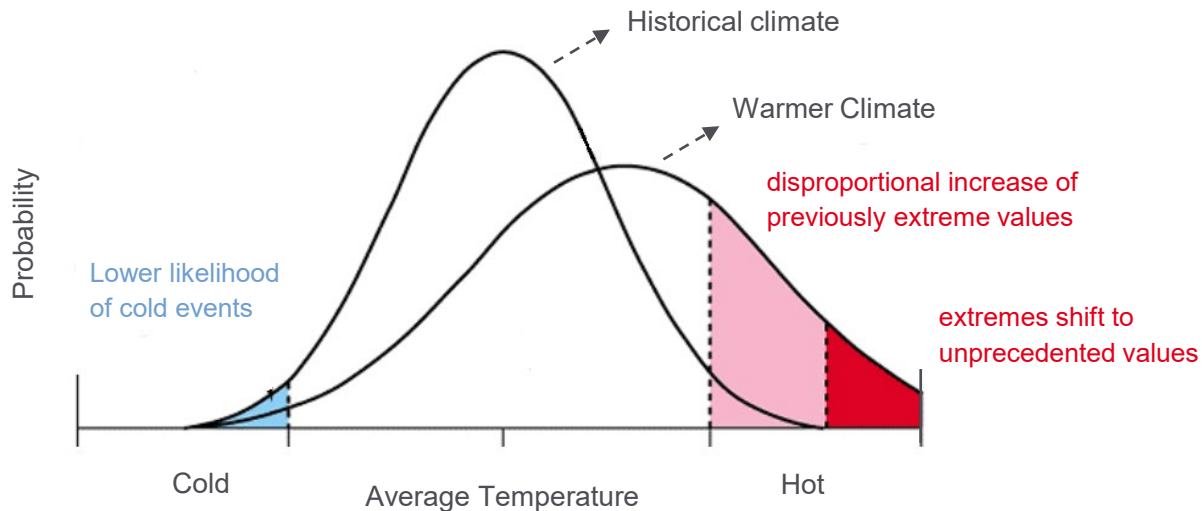


Annual temperature anomalies (°C) since 1980 (baseline: 1880-1900 average)

Effect of global warming

changing probability distributions

Small increase in average temperatures → large increase in probability of extremely hot events



Effect of global warming: impact on natural hazards

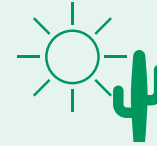
state of science (IPCC): increase in frequency and/or intensity of natural perils



More frequent
temperature extremes



Increase in wildfire
hazard



Increase in extreme drought
conditions



environments favorable to severe thunderstorms,
shifts in tornado activity & severe hail events
("Severe Convective Storms")



Increase in frequency &
intensity of heavy rainfall
events



More intense Tropical
Cyclones with more rain &
higher storm surges

Hurricanes and Convective Storms

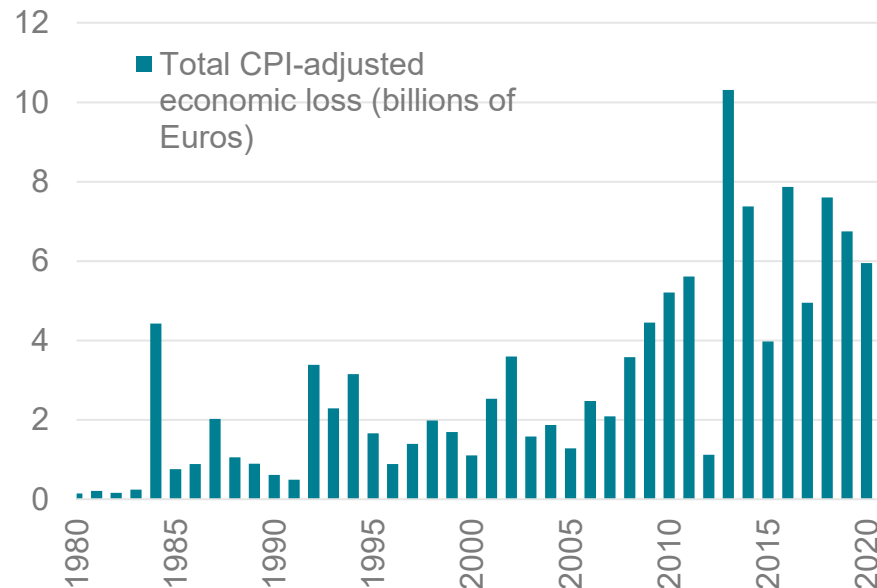
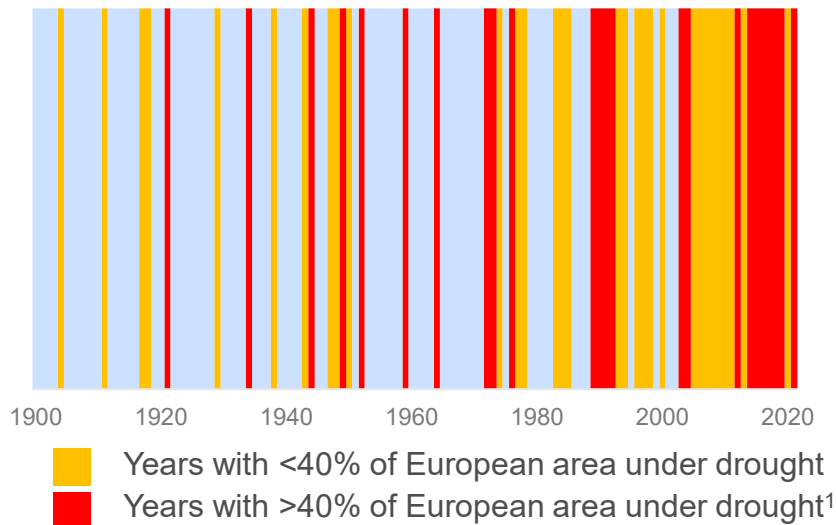
Climate change and socioeconomic factors drive loss experience

Increasing drought frequency and area
(example: Europe)¹

Increasing annual cost of SCS
(example: Europe)²



Year and area in Europe under drought

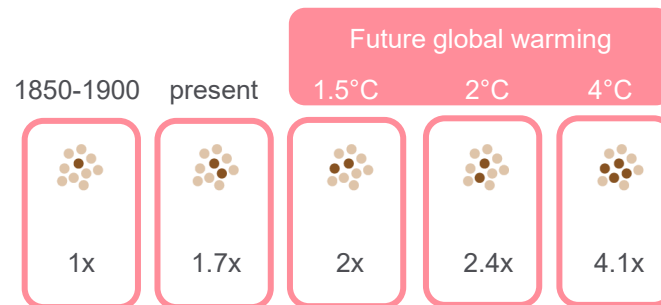


Effect of global warming: Impact on drought and crop yield

More droughts and loss of yield with additional warming

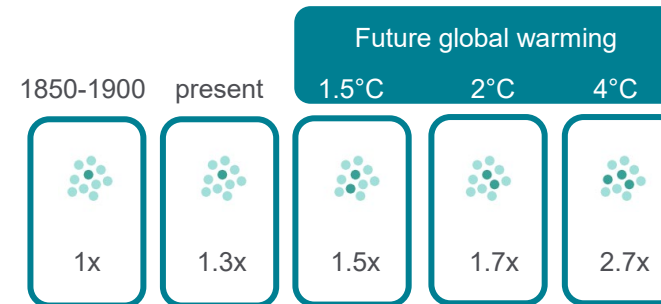
Today's 10-year agricultural drought occurs 40% more often at 2° global warming than today (more than twice as often at 4°C)

Frequency of 10-year drought (global average)



Today's 10-year heavy precipitation occurs 30% more often at 2° global warming than today (twice as often at 4°C)

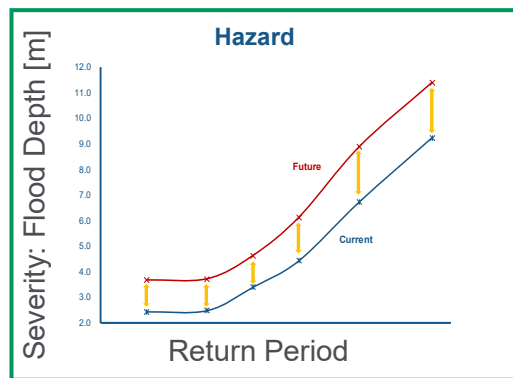
Frequency of 10-year heavy precipitation (global average)



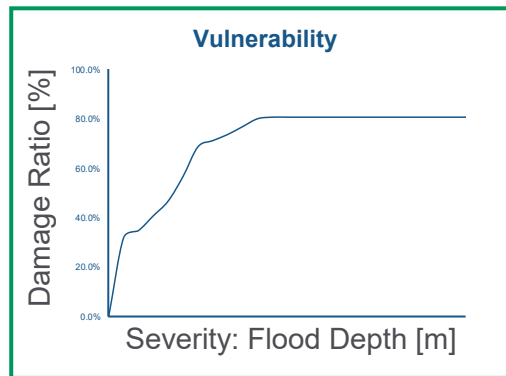
Climate Risk Assessment

Increasing hazard raises costs and requires adaptation strategies. Example: Real Estate

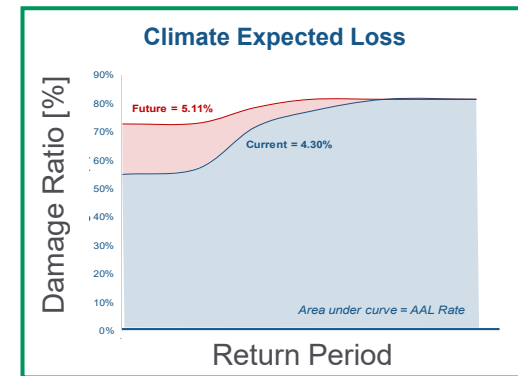
- ▶ **Climate Expected Loss (CEL):** annual expected damages from natural disasters to physical assets (current and future conditions; various RCP scenarios; various horizons).
- ▶ Calculated at **individual location level** by combining Munich Re Climate models and asset vulnerability relationships, expressed as **percentage of damages** to be applied to building value.




Munich Re Climate Models



Munich Re Insurance expertise





Transition to a zero carbon economy

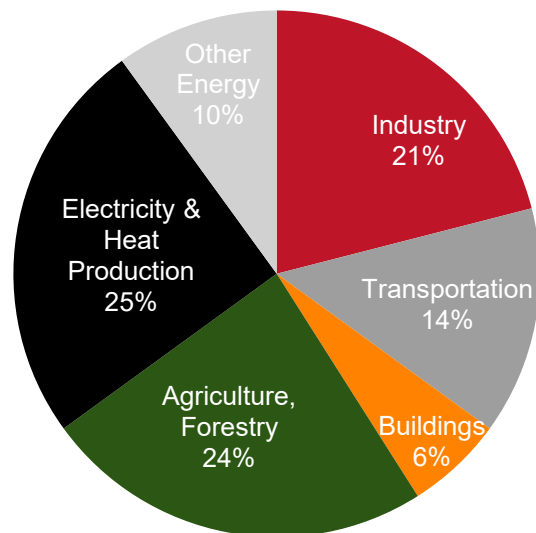
Renewable energy for virtually all applications necessary to **keep manageable warming levels**

GHG emissions from industrial and private activity





Fossil fuel and industrial processes largest global emitters

In 2019, anthropogenic greenhouse gas (GHG) emissions amounted 36 Gt CO₂ *

To stay well below 2°C global warming, appr. 900 Gt CO₂ might still be emitted, starting in 2020**



The largest global emitters after electricity from coal, gas and oil (25%):

-  Iron and steel, cement and chemical production (16%)
-  Road transport (12%)
-  Residential and commercial buildings (6%)
-  Livestock (6%)

Electricity & Heat Production: Burning of coal, natural gas, oil for electricity & heat

Industry: Fossil fuels burned on site at facilities for energy

Agriculture, Forestry, and Other Land Use: Agriculture and deforestation

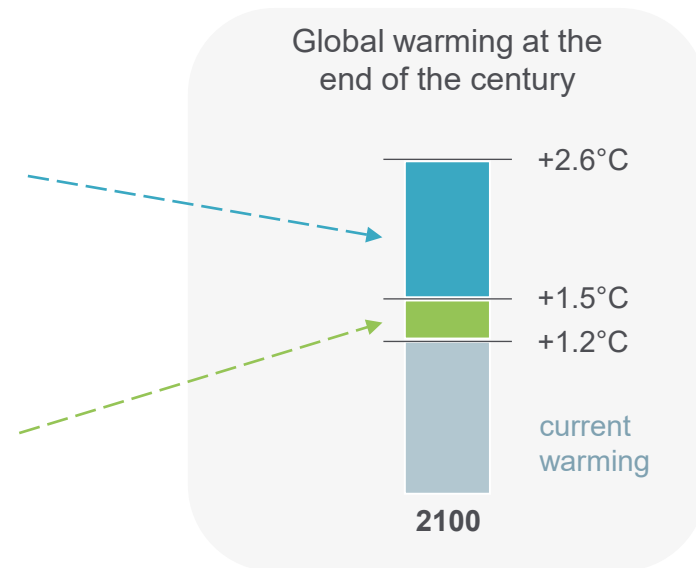
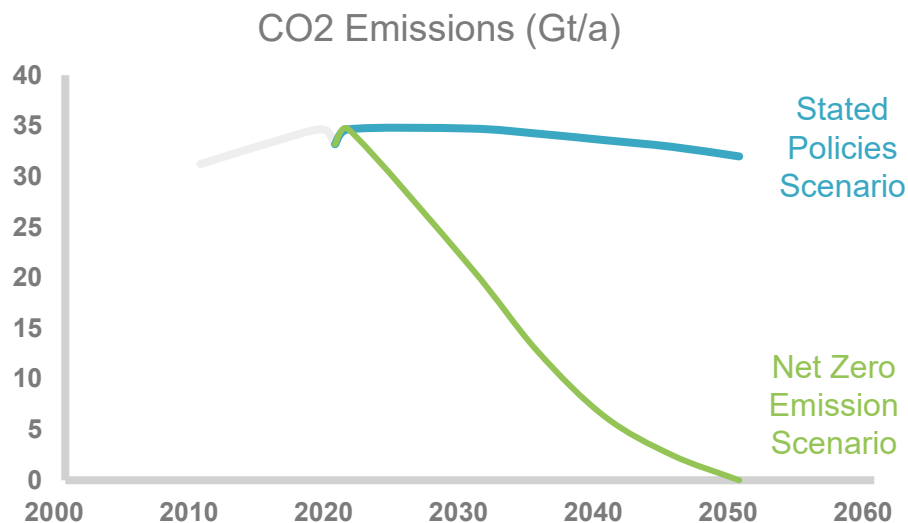
Transportation: Fossil fuels burned for road, rail, air, and marine transportation

Buildings: Energy generation & burning fuels for heat in buildings or cooking in homes.

[Global Greenhouse Gas Emissions Data](#) | [US EPA](#)

Socioeconomic climate scenarios project plausible futures

existing and planned policies insufficient to limit global warming to well below 2°C



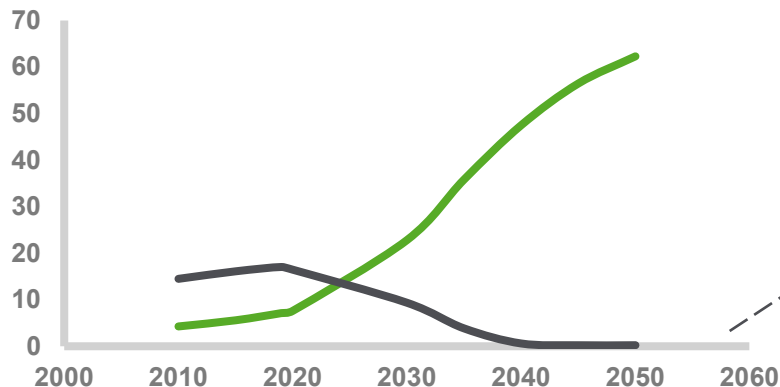
STEPS: The IEA Stated Policies Scenario (STEPS) illustrates the consequences of existing and stated policies for the energy sector. It includes only the firm policies that are in place or have been announced by countries, including Nationally

NZE: Net-Zero Emissions by 2050 Scenario (NZE), which describes how energy demand and the energy mix will need to evolve if the world is to achieve net-zero emissions by 2050.

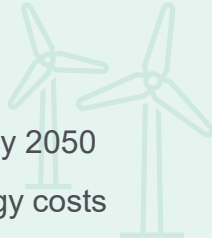
Transition to net zero power generation

Rapid phase out of fossils, quadrupled installment rates of solar and wind power

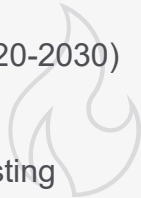
Electricity Generation IEA NZE 2050
(TWh)



Electricity Generation from Renewables

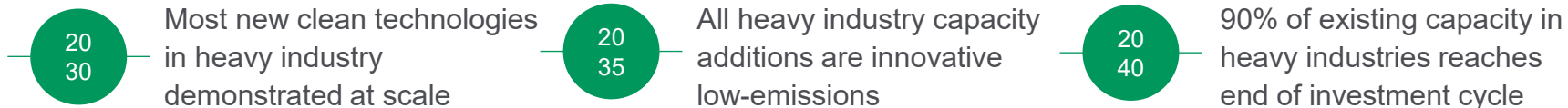
- +12% CAAGR (2020-2030) ~ +4x 2019
 - 80% of total electricity from solar, wind & hydro by 2050
 - 60% of solar/wind increase at no additional energy costs
 - Storage & dispatchable generation crucial for grid stability
- 

Electricity generation from unabated fossil fuels:

- Total phase out until 2050 (~ minus 5% CAAGR 2020-2030)
 - No new coal, oil & gas
 - End of investment cycle and early retirement of existing electricity from fossil fuels
- 

Decarbonizing industrial supply chains

Hydrogen as key component to generate process heat and fuel heavy transport



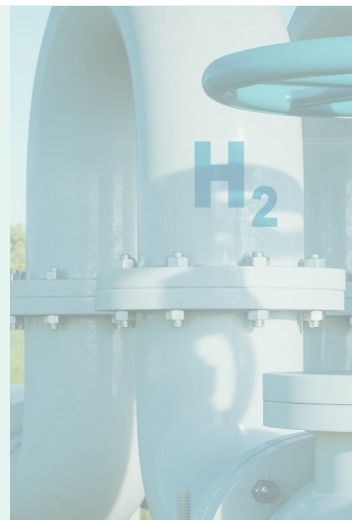
H₂ blast furnace, electric arc furnace



Chemical absorption of CO₂ and other CCUS, H₂ and electricity for heat



CCUS, cement recycling & non-carbonate calcium sources



H₂ Value chain needs public and private engagement via integrated planning and investments

Managing Technical Risks

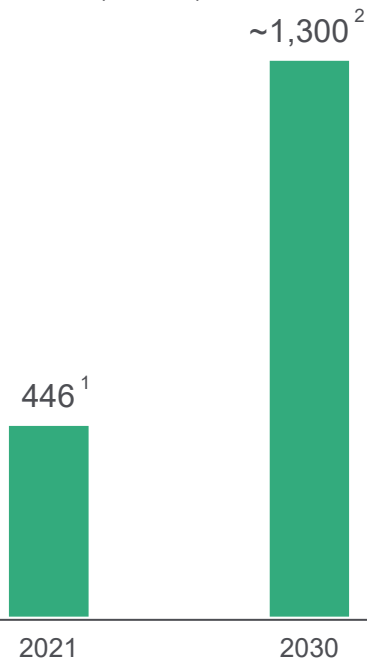
The insurance industry **derisks investments** and thus enables the energy transition

Insurance market for climate technologies sees strong growth



Large investments in renewables needed

Actual and needed annual investment in power generation from renewables (US\$ bn)



Around USD 4 trillion investments in clean energy ecosystem annually needed by 2030 (peak oil&gas invests in 2014 ~1.2tn)



70% of these investments have to be carried out by the private sector (developers, consumers & financiers)



Since 2020 clean energy investment risen to 12% from just 2% in 2015. ~30% of 2022 investments went towards renewable power¹ Solar PV takes up almost half of new investments in renewal energies¹



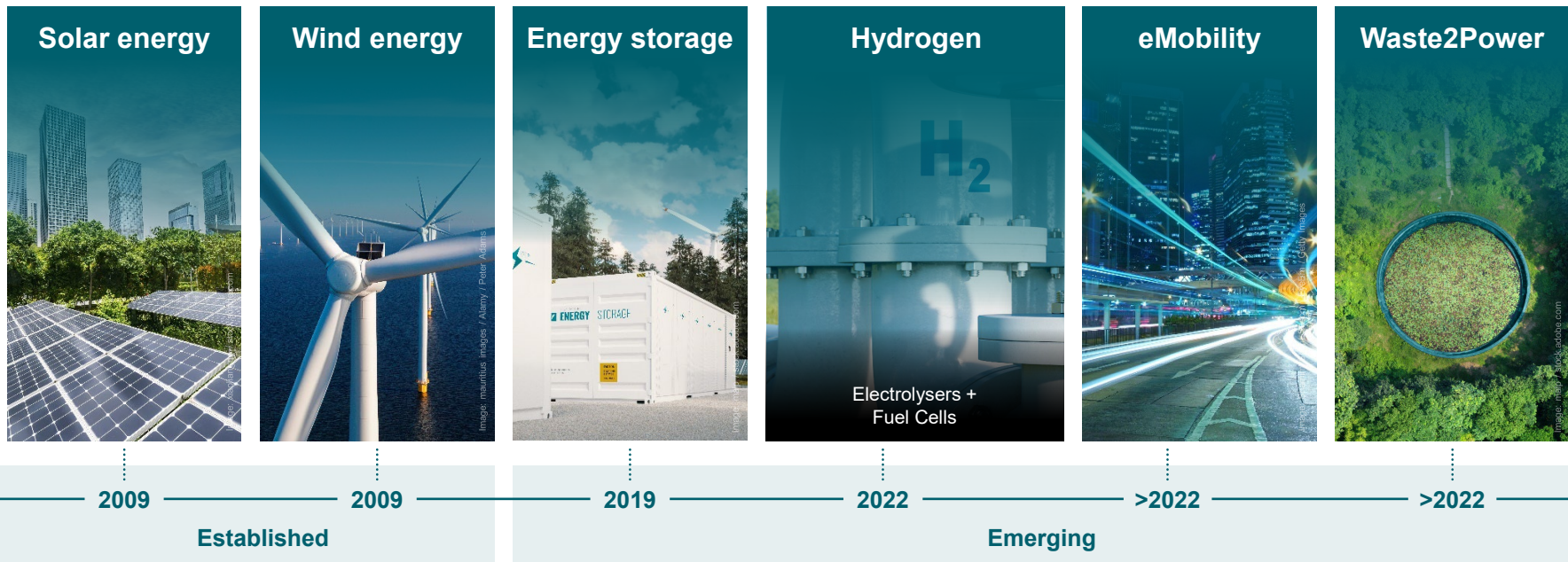
Already today, renewables, grids and storage accounts for >80% of total power sector investments¹



Enable: Solutions for established and emerging technologies

Green Tech Solutions

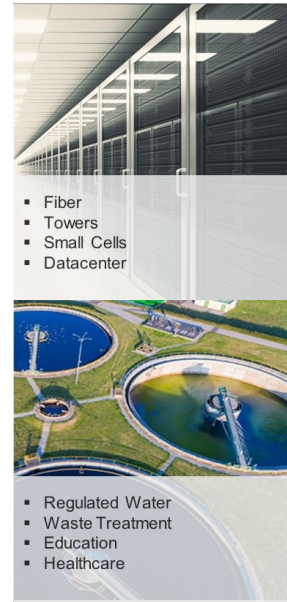
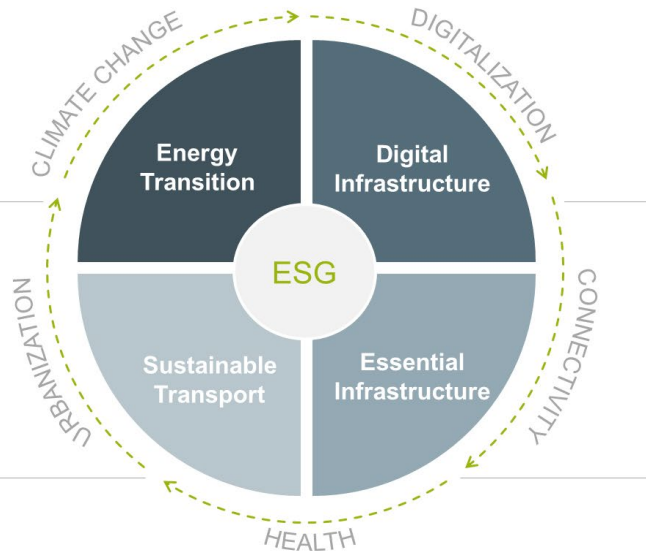
For manufacturers, projects and investors



New deals in 2022 – dynamic market growth

Capital sources for new climate technology

MEAG European Infrastructure One ("MEIO")



Signatory of:



SUSTAINABLE DEVELOPMENT GOALS

We support the Sustainable Development Goals



MEAG offers institutional investors the opportunity to invest alongside Munich Re into European infrastructure equity following four key investment themes. The fund will utilize Munich Re's expertise in terms of technical due diligence, climate change/ NatCat, ESG and insurance and provides attractive, long-term returns with strong downside protection.



Technical, NatCat, Insurance, ESG

Capital sources for new climate technology

Technologies in early deployment & research stage need public/private de-risking

Concessionary public and Philanthropic capital (e.g grants) / Dev. Finance & Multilateral Institutions

Blended Finance

Equity / Debt

Ideation Stage

Concept and application of solution have been formulated

- Cement from non-carbonate calcium sources.
- Hydrogen storage - Adsorbents



Prototype Stage

Prototype or components proven in conditions to be deployed

- High density batteries
- Iron ore refining using electrolytic hydrogen
- Synthetic fuels



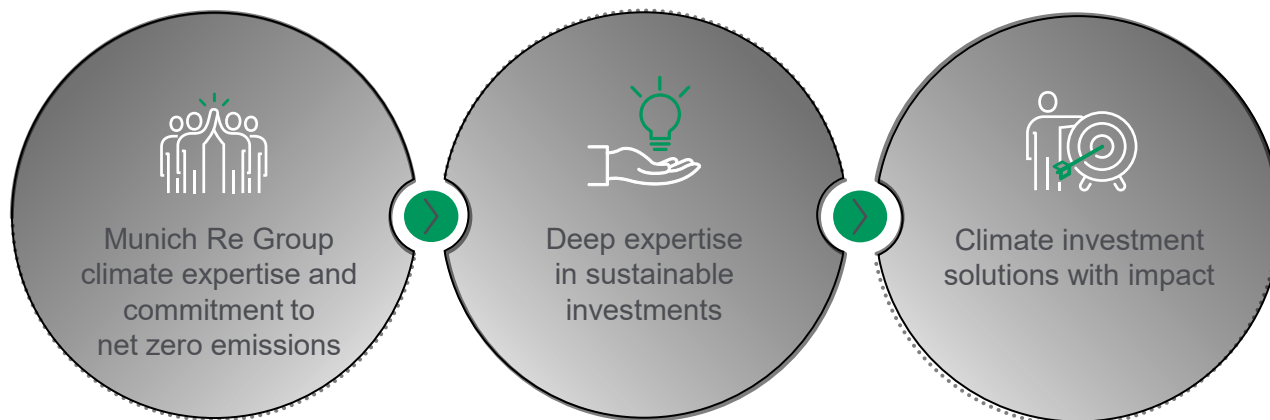
Commercialisation Stage

commercially available; might need improvements to be competitive

- Green Electrolytic hydrogen
- Integration of Photo Voltaic systems into building skins.
- Lithium-ion battery at grid-scale or behind-the-meter



Transforming climate investment expertise into solutions



For us, acting responsibly means creating lasting financial and environmental value

What we do

- We deliver market-driven investment solutions for climate committed asset owners
- We balance financial performance and climate impact
- We capitalize the vast climate know-how of Munich Re and its experts

Corporate facts

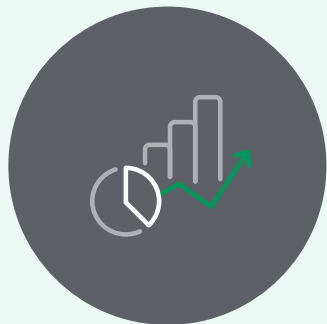
- Founded in 2019
- EUR 1.3bn AuM*
- 15 passionate experts*
- 100% owned by Munich Re
- Member of Net Zero Asset Manager Initiative + UN PRI

NET ZERO
ASSET
MANAGERS
INITIATIVE

 **PRI** | Principles for Responsible Investment

The EUA Strategy enables simultaneously financial and environmental benefits

Key features



Munich Re Investment
Partners EUA Strategy



Asset class Commodities / Physical EU Emission Allowances



Impact Enabling a direct decarbonisation effect of the real economy



Vehicle Luxembourg RAIF-FCP structure customised to institutional investor needs


Direct ownership ensures EUA price exposure plus CO2 mitigation effect

© 2022 Münchener Rückversicherungs-Gesellschaft Aktiengesellschaft in München ("Munich Re").

All rights reserved.

The content of this presentation (including, without limitation, text, pictures, graphics, as well as the arrangement thereof) is protected under copyright law and other protective legislation. These materials or any portions thereof may be used solely for personal and non-commercial purposes. Any other use requires Munich Re's prior written approval.

Munich Re has used its discretion, best judgement and every reasonable effort in compiling the information and components contained in this presentation. It may not be held liable, however, for the completeness, correctness, topicality and technical accuracy of any information contained herein. Munich Re assumes no liability with regard to updating the information or other content provided in this presentation or to adapting this to conform with future events or developments.



Thank you for your attention

Global warming due to anthropogenic greenhouse gas emissions **increases natural hazards**

Renewable energy for virtually all applications necessary to **keep manageable warming levels**

The insurance industry **derisks investments** and thus enables the energy transition

Thomas Krismer
Contact: TKrismer@Munichre.com
Website: www.munichre.de

Munich RE 

“Disabling”: MR’s CO₂ emissions reduction

In business operations and on both sides of the balance sheet

	<h2>ASSETS</h2> <p>Financed CO₂ emissions</p> <p>No investment in companies with revenue:</p> <ul style="list-style-type: none"> ▪ Thermal coal >15%¹ ▪ Oil sands >10% 	<h2>LIABILITIES</h2> <p>Insures CO₂ emissions (primary, direct, fac.)</p> <p>No insurance for</p> <p>Thermal coal: new coal mining, power plants, related infrastructure³</p> <p>Oil and gas (exploration/production): new and existing oil sand sites, related infrastructure</p>	<h2>OWN CO₂ EMISSIONS</h2> <p>From operational processes</p> <p>Reducing our direct impact</p> <ul style="list-style-type: none"> ▪ Carbon-neutral since 2015 ▪ Reduction of 44% per employee since 2009 	
Today				
2025	<p>Emissions²:</p> <ul style="list-style-type: none"> ▪ Total: –25% to –29% ▪ Thermal coal: –35% ▪ Oil and gas: –25% 	<p>–35% emissions⁴</p>	<p>–5% emissions Utilising the expertise of HSB Solomon</p>	<p>–12% emissions per employee of Munich Re Group</p>
2050	<ul style="list-style-type: none"> ▪ Total: net-zero (2050) ▪ Thermal coal: full exit (2040) 	<p>Full exit (2040)</p>	<p>Net-zero emissions (2050)</p>	<p>Net-zero emissions (2030)</p>

¹ Exceptions for companies with revenues in thermal coal between 15% and 30% are possible in individual cases, where an active engagement dialogue has been established with the company.
² Based on sub-portfolio of equities, corporate bonds and real estate at the end of 2019. ³ Minor exceptions apply such as sites in countries with <90% electrification rate. ⁴ “Produced tonnes of thermal coal / MW capacity insured” used as proxy for emissions: base year 2019