Options and challenges for achieving scenarios related to a 1.5°C goal

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The remaining carbon budget





Image source: NASA blue marble

The remaining 1.5°C carbon budget

2200 ±320 GtCO₂ EMITTED until 2017 by human activities

Remaining carbon budget

580 GtCO₂ left (50% chance of 1.5° C) 420 GtCO₂ left (66% chance of 1.5° C)

± 400 GtCO₂ geophysical uncertainty ± 250 GtCO₂ depends on non-CO₂ reductions

Currently: $42 \pm 3 \text{ GtCO}_2/\text{yr}$ annually



Image background: NASA blue marble / Data: Chapter 2 IPCC SR1.5

REMAINING

The emission reduction challenge

Billion tonnes of CO₂/yr



The emission reduction challenge



Global non-CO₂ characteristics

Pathways limiting warming to 1.5°C with no or limited overshoot (less than 0.1°C):

- Also strongly reduced

C.

- Do not reach zero globally



Not all 1.5°C pathways are created equal





Image source: Natalie Behring (Aurora Photos) / IPCC SR1.5 SPM.3B

IOCC

Achieving 1.5°C-compatible reductions



Limiting warming to **1.5°C** would require **rapid**, **far-reaching** changes on an **unprecedented scale**

- 1. In the next decade
- 2. In all systems
 - Energy
 - Land
 - Urban and infrastructure
 - Industrial
- 3. Stringent action everywhere



Image source: Gerhard Zwerger-Schoner (Aurora Photos)

Key components of the transition



Energy sector – key strategies

- 1. Improve energy efficiency Final energy demand in 2050, +20 to -10% rel. to 2010 levels
- 2. Electrify energy end use (mobility, buildings, industry)
- 3. Decarbonize the power sector (carbon-intensity of electricity about 0 or negative in 2050)
- 4. Subst. residual fossil fuels with low-carbon options (e.g. sustainable bio-based fuels for transport)



Image source: Gerhard Zwerger-Schoner (Aurora Photos)

Key energy system transitions



Global primary energy in 1.5°C pathways

Renewables are scaled up robustly,

meeting about 15% of primary energy in 2020 meeting 25-35% of primary energy in 2030 meeting 50-65% of primary energy in 2050

Fossil fuels as a groups show a clear decline, but with important variations

- **Coal:** strong robust strong decline
- Oil: also declines but to a lesser degree
- **Gas:** use varies from strong reductions to increases, depending on capture technologies (CCS)



Image source: Robert van Waarden (Aurora Photos)

Strategic variations in 1.5°C energy system transitions



Where do we stand today?







Not yet on track...

National pledges under the Paris Agreement are not enough to limit warming to 1.5°C

- Pledges lead to total global greenhouse gas emissions of 52-58 GtCO₂e/yr in 2030
- 1.5°C pathways with no or limited overshoot show a 25-30 GtCO₂e/yr range



Image source: www.vertic.ca

Where do we stand today?



Installed global photo-voltaic capacity



Image source: Robert van Waarden (Aurora Photos) / Creutzig et al. 2018

Where do we stand today?



Global coal use robustly declines in 1.5°C pathways

approx. 60-75% reduction by 2030, rel. 2020 approx. 75-95% reduction by 2050, rel. 2020

But not yet in the real world

- Greenpeace (2015): Decline in coal delivering green "tipping point"
- *Climate Analytics (2016):* Current coal plans worldwide are inconsistent with the Paris Agreement
- Edenhofer et al. (2018): Reports of coal's terminal decline may be exaggerated
- IEA WEO 2018: Flat coal demand under New Policies Scenario
- *Hannam et al. (in prep.):* Several global databases tracking coal power show a 25% decline in planned capacity between Jan 2016 to July 2018



Image source: Robert van Waarden (Aurora Photos) / Contact Phil Hannam: phannam@alumni.princeton.edu

NTERGOVERNMENTAL PANEL ON Climate change

Energy system investments



KEY FEATURES:

- 830 billion USD additional to 4°C baseline
- Context: Zero carbon system investments roughly order of magnitude smaller than annual energy expenditures



Image source: IPCC SR1.5 Figure 2.27

Are these changes feasible?



Image source: IPCC SR1.5 FAQ4.1

INTERGOVERNMENTAL PANEL ON Climate change

UNEF

WMO

Mitigation choices matter for sustainable development



- Robust synergies with good health (SDG3), clean energy (SDG7), sustainable cities (SDG11), responsible production and consumption (SDG12), life below water (SDG14)
- Potential trade-offs with no poverty (SDG1), no hunger (SDG2), clean water (SDG6), energy access (SDG7)
- Demand-side measures allow to maximize synergies (energy, materials, and land efficiency)



Achieving scenarios compatible with a 1.5°C goal requires that we...

INTERGOVERNMENTAL PANEL ON CIIMATE CHARGE

Global Warming of 1.5°C

An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.



1. Act now

to keep future options open

2. Act everywhere

efforts in all sectors are needed to reach global zero CO₂ emissions

3. Act thoughtfully

develop strategies maximizing synergies and taking into account the local context, use a wide array of measures and actions

4. Act jointly

collaboratively and including national and subnational authorities, civil society, the private sector, and local communities

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http://www.ipcc.ch/report/sr15/

Thank you

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