1.5 °C Long-term Global Goal and Decarbonization of Energy System

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Sources of information in slides below include, among others:
1. IPCC WGIII AR5

*This presentation derives information from varied sources. The responsibility of the contents and views expressed are solely that of the presenter*
Adequacy of the Long Term Global Goal (LTGG) in the light of the ultimate objective of the Convention
COP 16 (held in Cancun) recognized “that deep cuts in global greenhouse gas emissions are required according to science, and as documented in the *Fourth Assessment Report* of the Intergovernmental Panel on Climate Change, with a view to reducing global greenhouse gas emissions so as to **hold the increase in global average temperature below 2 °C above pre-industrial levels**, and that Parties should take urgent action to meet this long-term goal, consistent with science and on the basis of equity”.

The COP also decided to **periodically review the adequacy of this long-term global goal** in the light of the **ultimate objective of the Convention** (theme 1 of the 2013–2015 review), and overall progress towards achieving the long-term global goal, including a consideration of the implementation of the commitments under the Convention (theme 2).

The 2013–2015 review was also tasked with the consideration of the **strengthening the long-term global goal**, referencing various matters presented by the science, including in relation to a temperature rise of 1.5 °C. The COP carried out the 2013–2015 review with assistance from a joint SBSTA/SBI contact group. COP 18 established the SED to support the work of the joint contact group and ensure the scientific integrity of the review through a focused exchange of views, information and ideas.
**Scope:**
Adequacy of the **long-term global goal** in the light of the ultimate objective of the **Convention**; and the overall progress made towards achieving the long-term global goal, including a consideration of the commitments under the Convention.
5. The 2 °C limit should be seen as a defence line.

10. While science on the 1.5 °C warming limit is less robust, efforts should be made to push the defence line as low as possible.
Limiting global warming to below 2 °C is still feasible and will bring about many co-benefits, but poses substantial technological, economic and institutional challenges.

- Costs are manageable
- Iteratively reassessing feasibility
- Periodic reviews would provide opportunity to (re)assess overall progress
21. *Invites* the Intergovernmental Panel on Climate Change to provide a special report in 2018 on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways;

17. *Notes with concern* that the estimated aggregate greenhouse gas emission levels in 2025 and 2030 resulting from the intended nationally determined contributions do not fall within least-cost 2 °C scenarios but rather lead to a projected level of 55 gigatonnes in 2030, and *also notes* that much greater emission reduction efforts will be required than those associated with the intended nationally determined contributions in order to hold the increase in the global average temperature to below 2 °C above pre-industrial levels by reducing emissions to 40 gigatonnes or to 1.5 °C above pre-industrial levels by reducing to a level to be identified in the special report referred to in paragraph 21 below;
1.5 °C Long-term Global Goal & Framing of Decarbonisation Scenarios for the Energy Sector
Emissions Pathways and Associated low carbon energy supply (IPCC AR5)
Global mitigation costs and consumption growth in baseline scenarios

<table>
<thead>
<tr>
<th>Percentage point reduction in annualized consumption growth rate over 21st century (%-point)</th>
<th>Consumption growth rate (0.03 to 0.05)</th>
<th>Consumption growth rate (0.01 to 0.09)</th>
<th>Consumption growth rate (0.03 to 0.13)</th>
<th>Consumption growth rate (0.04 to 0.14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03</td>
<td>0.04</td>
<td>0.06</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>(0.01 to 0.05)</td>
<td>(0.01 to 0.09)</td>
<td>(0.03 to 0.13)</td>
<td>(0.04 to 0.14)</td>
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</tr>
</tbody>
</table>

- **84th Percentile**
- **Median**
- **16th Percentile**

**Global Mitigation Costs and Consumption Growth (IPCC AR5)**
Climate change mitigation can result in co-benefits for human health and other societal goals (IPCC AR5)

Based on Figures SPM.6 and 12.23
$2^0C$ Budget (AR5): Closing Mitigation Window

65% of our carbon budget compatible with a $2^\circ C$ goal already used

Total Carbon Budget:

2900 GtCO2

Amount Used 1870-2011:

1900 GtCO2

Amount Remaining:

1000 GtCO2

IPCC AR5 WGI SPM
Post-AR5: INDCs + Paris Agreement

Cancun Pledges (2020) and Post-INDC (2025-30) Scenarios

Figure 7

Global emission levels resulting from the implementation of the communicated intended nationally determined contributions by 2025 and 2030 in comparison with emission trajectories consistent with action communicated by Parties for 2020 or earlier.

Source: Intergovernmental Panel on Climate Change Fifth Assessment Report scenario database and own aggregation.
Global Emissions: INDC vs. 2 °C & 1.5 °C Scenarios

Figure 2
Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions and under other scenarios

Sources: Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report scenario database, 1.5 °C scenarios from scientific literature (see footnote 18), IPCC historical emission database and intended nationally determined contribution quantification.

Abbreviations: AR4 = Fourth Assessment Report of the Intergovernmental Panel on Climate Change, GWP = global warming potential, INDC = intended nationally determined contribution, IPCC AR5 = Fifth Assessment Report of the Intergovernmental Panel on Climate Change, n = number of scenarios, yr = year.
Figure 11
Comparison of cumulative CO\textsubscript{2} emissions under different scenarios

<table>
<thead>
<tr>
<th></th>
<th>Staying below 2\textdegree{}C with &gt;50% probability</th>
<th>Staying below 2\textdegree{}C with &gt;66% probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>as at 2011</td>
<td>1890 GtCO\textsubscript{2}</td>
<td>1300</td>
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<tr>
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<tr>
<td>as at 2025</td>
<td>1890 GtCO\textsubscript{2}</td>
<td>533</td>
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<tr>
<td></td>
<td></td>
<td>767</td>
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<tr>
<td>as at 2030</td>
<td>1890 GtCO\textsubscript{2}</td>
<td>739</td>
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<td>561</td>
</tr>
</tbody>
</table>

Source: Intergovernmental Panel on Climate Change Fifth Assessment Report scenario database and own aggregation.

Abbre\textit{viation}: INDCs = intended nationally determined contributions.
**Figure 13**
Cumulative CO₂ emissions consistent with the goal of keeping global average temperature rise below 1.5 °C

Staying below 1.5°C with >50% probability by 2100

- **as at 2011**: 1,890 GtCO₂, 550
- **as at 2025**: 1,890 GtCO₂, 533, remainder
- **as at 2030**: 1,890 GtCO₂, 550, 189, exceedance

**Source**: Intergovernmental Panel on Climate Change Fifth Assessment Report scenario database and own aggregation.

**Abbreviation**: INDCs = intended nationally determined contributions.
Energy system transformations for limiting end-of-century warming to below 1.5 °C

Joeri Rogelj¹,²*, Gunnar Luderer³*, Robert C. Pitzcker³, Elmar Kriegler³, Michiel Schaeffer⁴,⁵, Volker Krey¹ and Keywan Riahi¹,⁶
Emissions profiles & temperature outcomes of 1.5°C Scenario

Figure 1 | Emission profiles and temperature outcomes of 1.5°C-consistent scenarios.

Ref: Rogelj et al., Nature Climate Change | Vol 5 | June 2015
Global Decarbonization Overview

Ref: Rogelj et.al., Nature Climate Change | Vol 5 | June 2015
Mitigation Costs for 1.5 °C and 2 °C Scenarios

Figure 4 | Mitigation costs for 1.5 °C and 2 °C scenarios.

Ref: Rogelj et al., Nature Climate Change | Vol 5 | June 2015
1.5°C and Energy System Transformation
Initial thoughts on 1.5 °C Scenario: What does it mean to the Energy System?

Energie Einsparungen (Effizienz, Umwandlung und Verhalten)
~40% Verbesserung bis 2030
~95% EE bis 2030

< 2.0 W/m²

Source: Sterner et al. 2016 after WBGU, 2011
Carbon Flux

Source: Kolp and Nakicenovic. 2016
Mitigation Risks of 1.5 °C versus 2 °C?
The Pending Agenda of decarbonization

• How much higher are mitigation costs?
• Impacts on sustainable development including poverty eradication
• Technology needs, including negative emissions, and risks not to meet them
• Impacts on food security, e.g. by BECCS
• Impacts on biodiversity, e.g. by BECCS
• Impacts on carbon cycle by more ambitious mitigation (e.g. forests)
• Overshoot risks (temperature, atmos. GHG conc.), irreversibility
Reframing the Assessment

• **Timing:** Closing window of opportunity
  • Innovation cycle
  • Behavior and institutions

• **Cost-benefit Framing:** Looking through ethical lens
  • Irreversibility
  • Uncertainty
  • Equity (Inter and intra generational)

• **Reframing**
  • Bottom-up country driven assessments
  • Prevent creating new lock-ins
  • Implementation Focus (Technology cooperation)