IPCC Special Report on Global Warming of 1.5°C #SR15
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.
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.
The report in numbers

- 91 Authors from 40 Countries
- 133 Contributing authors
- 6000 Studies
- 1,113 Reviewers
- 42,001 Comments
• Every bit of warming matters

• Every year matters

• Every choice matters
Understanding Global Warming of 1.5°C
Where are we now?

Since pre-industrial times, human activities have caused approximately 1°C of global warming.

• Already seeing consequences for people, nature and livelihoods

• At current rate, would reach 1.5°C between 2030 and 2052

• Past emissions alone do not commit the world to 1.5°C
Projected Climate Change, Potential Impacts and Associated Risks
Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

• Less extreme weather where people live, including extreme heat and rainfall
• By 2100, global mean sea level rise will be around 10 cm lower but may continue to rise for centuries
• 10 million fewer people exposed to risk of rising seas
Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

• Lower impact on biodiversity and species

• Smaller reductions in yields of maize, rice, wheat

• Global population exposed to increased water shortages is up to 50% less
Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

- Lower risk to fisheries and the livelihoods that depend on them

- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050
Emission Pathways and System Transitions Consistent with 1.5°C Global Warming
Greenhouse gas emissions pathways

- To limit warming to 1.5°C, CO₂ emissions fall by about 45% by 2030 (from 2010 levels)
  - Compared to 25% for 2°C

- To limit warming to 1.5°C, CO₂ emissions would need to reach ‘net zero’ around 2050
  - Compared to around 2070 for 2°C

- Reducing non-CO₂ emissions would have direct and immediate health benefits
Greenhouse gas emissions pathways

- Limiting warming to 1.5°C would require changes on an unprecedented scale
  - Deep emissions cuts in all sectors
  - A range of technologies
  - Behavioural changes
  - Increased investment in low carbon options
Greenhouse gas emissions pathways

- Progress in renewables would need to be mirrored in other sectors
- We would need to start taking carbon dioxide out of the atmosphere
- Implications for food security, ecosystems and biodiversity
Greenhouse gas emissions pathways

• National pledges are not enough to limit warming to 1.5°C

• Avoiding warming of more than 1.5°C would require CO₂ emissions to decline substantially before 2030
Strengthening the Global Response in the Context of Sustainable Development and Efforts to Eradicate Poverty
Climate change and people

• Close links to United Nations Sustainable Development Goals (SDGs)

• Mix of measures to adapt to climate change and reduce emissions can have benefits for SDGs

• National and sub-national authorities, civil society, the private sector, indigenous peoples and local communities can support ambitious action

• International cooperation is a critical part of limiting warming to 1.5°C
Cumulative emissions of CO₂ and future non-CO₂ radiative forcing determine the probability of limiting warming to 1.5°C
Cumulative emissions of CO$_2$ and future non-CO$_2$ radiative forcing determine the probability of limiting warming to 1.5°C.
Cumulative emissions of CO$_2$ and future non-CO$_2$ radiative forcing determine the probability of limiting warming to 1.5°C

b) Stylized net global CO$_2$ emission pathways

Billion tonnes CO$_2$ per year (GtCO$_2$/yr)

C) Cumulative net CO$_2$ emissions

Billion tonnes CO$_2$ (GtCO$_2$)

d) Non-CO2 radiative forcing pathways

Watts per square metre (W/m$^2$)
Cumulative emissions of CO₂ and future non-CO₂ radiative forcing determine the probability of limiting warming to 1.5°C

Global warming relative to 1850-1900 (°C)
CO2 emissions decline from 2020 to reach net zero in 2055 or 2040.

b) Stylized net global CO2 emission pathways

CUMULATIVE CO2 EMISSIONS IN PATHWAYS REACHING NET ZERO IN 2055 AND 2040

Cumulative CO2 emissions in pathways reaching net zero in 2055 and 2040.

SPM 1 | Cumulative emissions of CO2 and future non-CO2 radiative forcing determine the probability of limiting warming to 1.5°C.

c) Cumulative net CO2 emissions

d) Non-CO2 radiative forcing pathways

Billion tonnes CO2 per year (GtCO2/yr)

Billion tonnes CO2 (GtCO2)

Watts per square metre (W/m²)
Cumulative emissions of CO$_2$ and future non-CO$_2$ radiative forcing determine the probability of limiting warming to 1.5°C.
Cumulative emissions of CO$_2$ and future non-CO$_2$ radiative forcing determine the probability of limiting warming to 1.5°C

b) Stylized net global CO$_2$ emission pathways

Billion tonnes CO$_2$ per year (GtCO$_2$/yr)

c) Cumulative net CO$_2$ emissions

Billion tonnes CO$_2$ (GtCO$_2$)

d) Non-CO$_2$ radiative forcing pathways

Watts per square metre (W/m$^2$)

Non-CO$_2$ radiative forcing reduced after 2030 or not reduced after 2030
Cumulative emissions of CO$_2$ and future non-CO$_2$ radiative forcing determine the probability of limiting warming to 1.5°C.
How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems
SPM2 | How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

- **Purple** indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.
- **Red** indicates severe and widespread impacts/risks.
- **Yellow** indicates that impacts/risks are detectable and attributable to climate change with at least medium confidence.
- **White** indicates that no impacts are detectable and attributable to climate change.
SPM2 | How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Impacts and risks associated with the Reasons for Concern (RFCs)

Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high
How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high
By 2.5°C, **biome shifts** and species range losses escalate to very high levels – adaptation options are very limited (**irreversible**).

**Key transition between 1.5°C to 2.0°C** due to extensive shifts of biomes and a doubling or tripling of the number of plants, animals or insects losing over half of their climatically determined geographic ranges.

No detection and attribution of impacts of global warming on terrestrial ecosystems.

**Differences become much larger between 1.5°C and 2.0°C**
a) Global emissions pathway characteristics
b) Characteristics of four illustrative model pathways
SPM3a | Global emissions pathway characteristics

Pathways limiting global warming to 1.5C with no or limited overshoot

Global total net CO₂ emissions

Timing of net zero CO₂

Pathways with no or limited overshoot
SPM3a Global emissions pathway characteristics

Timing of net zero CO₂

Global total net CO₂ emissions

Pathways with a **higher overshoot**
Pathways limiting global warming below 2°C (not shown)

SPM3a Global emissions pathway characteristics

Global total net CO₂ emissions

Timing of net zero CO₂
Emissions of non-CO₂ forcers are also reduced or limited in pathways limiting global warming to 1.5°C with no or limited overshoot, but they do not reach zero globally.
SPM3a| Global emissions pathway characteristics

Four illustrative model pathways

Global total net CO₂ emissions
SPM3b | Characteristics of four illustrative model pathways

Breakdown of contributions to global net CO₂ emissions in four illustrative model pathways

- **Fossil fuel and industry**
- **AFOLU**
- **BECCS**

**P1**: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

**P2**: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

**P3**: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

**P4**: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.
SPM3b Characteristics of four illustrative model pathways

Breakdown of contributions to global net CO₂ emissions in four illustrative model pathways

- **Fossil fuel and industry**
- **AFOLU**
- **BECCS**

### Characteristics of four illustrative model pathways:

1. **P1** - Innovation and lower energy demand, with development
2. **P2** - Innovation and sustainability focus
3. **P3** - Middle of the road, historical patterns of development
4. **P4** - Resource and energy intensive
**P1**: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.
SPM3b | Characteristics of four illustrative model pathways

**P2**

Billion tonnes CO₂ per year (GtCO2/yr)

**P2**: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.
**SPM3b** | Characteristics of four illustrative model pathways

**P3**

Billion tonnes CO₂ per year (GtCO2/yr)

**P3**: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.
P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.
### Characteristics of four illustrative model pathways

<table>
<thead>
<tr>
<th>Global indicators</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>Interquartile range</th>
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<tbody>
<tr>
<td>Pathway classification</td>
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<td>No or low overshoot</td>
<td>No or low overshoot</td>
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<td>-58</td>
<td>-47</td>
<td>-41</td>
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<td><strong>Land area of bioregion crops in 2050 (million hectares)</strong></td>
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**Temperature and emissions**

**Energy systems**

**Carbon dioxide removal**

**Agriculture**
### SPM3b | Characteristics of four illustrative model pathways

#### Temperature and emissions

<table>
<thead>
<tr>
<th>Global indicators</th>
<th>No or limited overshoot</th>
<th>Higher overshoot</th>
<th>No or limited overshoot</th>
<th>Interquartile range</th>
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### Characteristics of four illustrative model pathways

#### Energy systems

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<tr>
<td>Final energy demand** in 2030 (% rel to 2010)</td>
<td>-15</td>
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<td>Down in 2050 (%)</td>
<td>77</td>
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<td>63</td>
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### Characteristics of four illustrative model pathways

**Carbon dioxide removal**

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<th>Global indicators</th>
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<tr>
<td></td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
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<tr>
<td>Cumulative CCS until 2100 (GtCO₂)</td>
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<td>687</td>
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<td>of which BECCS (GtCO₂)</td>
<td>0</td>
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<td>414</td>
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**SPM3b| Characteristics of four illustrative model pathways**

### Agriculture

<table>
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<th>Global indicators</th>
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<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>Interquartile range</th>
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<tr>
<td>Land area of bioenergy crops in 2050 (million km²)</td>
<td>0.2</td>
<td>0.9</td>
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<tr>
<td>Agricultural CH₄ emissions in 2030 (% rel to 2010)</td>
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<td>1</td>
<td>14</td>
<td>(-30,-11)</td>
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<td>in 2050 (% rel to 2010)</td>
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<td>2</td>
<td>(-47,-24)</td>
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<tr>
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<td>-26</td>
<td>15</td>
<td>3</td>
<td>(-21,3)</td>
</tr>
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<td>in 2050 (% rel to 2010)</td>
<td>6</td>
<td>-26</td>
<td>0</td>
<td>39</td>
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Indicative linkages between mitigation and sustainable development using SDGs

Indicative linkages between mitigation options and sustainable development using SDGs. The linkages do not show costs and benefits.

Mitigation options deployed in each sector can be associated with substantial positive effects (synergies) or negative effects (trade-offs) with the Sustainable Development Goals (SDGs). The degree to which this potential is realized will depend on the selected portfolio of mitigation options, mitigation policy design, and local circumstances and context. Particularly in the energy demand sector, the potential for synergies is larger than for trade-offs. This framework individually assessed options by level of confidence and takes into account the relative strength of the assessed mitigation/SDG connections.

Source: IPCC Special Report on Climate Change 2014
Indicative linkages between mitigation and sustainable development using SDGs

<table>
<thead>
<tr>
<th>SDG1</th>
<th>SDG2</th>
<th>SDG3</th>
<th>SDG4</th>
<th>SDG5</th>
<th>SDG6</th>
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<tr>
<td>No Poverty</td>
<td>Zero Hunger</td>
<td>Good Health and Well-being</td>
<td>Quality Education</td>
<td>Gender Equality</td>
<td>Clean Water and Sanitation</td>
<td>Affordable and Clean Energy</td>
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<th>Energy Supply</th>
<th>Energy Demand</th>
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<td>Trade-offs</td>
<td>Synergies</td>
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**Diagram Description**

- **Energy Supply**: Shows trade-offs and synergies between energy supply and SDGs.
- **Energy Demand**: Displays trade-offs and synergies related to energy demand.
- **Land**: Illustrates trade-offs and synergies in land use.

The diagram visually represents the complex interactions and linkages between energy systems and sustainable development goals, highlighting areas where mitigation efforts can also support broader development objectives.
SPM4 | Indicative linkages between mitigation and sustainable development using SDGs

Length shows strength of connection

The overall size of the coloured bars (from 0 to 100%) depict the relative potential for synergies and trade-offs between the sectoral mitigation options and the SDGs.
Indicative linkages between mitigation and sustainable development using SDGs

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Indicative linkages between mitigation and sustainable development using SDGs

Length shows strength of connection

The overall size of the coloured bars (from 0 to 100%) depict the relative potential for synergies and trade-offs between the sectoral mitigation options and the SDGs.

Shades show level of confidence

The shades depict the level of confidence of the assessed potential for Trade-offs/Synergies

Very high  Low
Indicative linkages between mitigation and sustainable development using SDGs

- Mitigation may result at the same time into synergies and trade-offs

- Particularly in the energy-demand sector, the potential for synergies is larger than for trade-offs.
Thank you for your attention!

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