Intro to IPCC, evolution and assessment process

Key messages from AR5

Key messages from 1.5 C report

Planning for AR6, chapter structure and timeline

CCSD Seminar
IPCC Assessment Process for AR5 and AR6 and Key findings of IPCC AR 5 WG III

Dr. Shobhakar Dhakal
Asian Institute of Technology
Coordinating Lead Author, IPCC WGIII, AR6
Coordinating Lead Author, IPCC WGIII, AR5

Source: All of these material are prepared based on IPCC AR5 Reports and deliberations only.
Role of IPCC

- “Policy-relevant” and yet “policy-neutral”...... but never “policy-prescriptive”
- Honest broker between experts and decision makers in business, politics and civil society
- Exploring opportunities and synergies, making trade-offs explicit
- Provide insights how policy instruments and incentives could be designed
- Identifying knowledge gaps
What’s the purpose of IPCC reports?

- To bridge the gap between science and policymakers
  - Providing policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation
  - Providing a scientific basis for governments at all levels to develop climate related policies
  - **NB 2015 marked a pivot point**: policy makers moved from a focus on the ‘what’ and the ‘why’, to a focus on solutions and implementation i.e. the ‘where’, ‘when’, ‘how’ and ‘who’.

- A mechanism to build inter-regional dialogue and international consensus

“The IPCC walks a wavering line between science, which requires independence, and diplomacy, which demands responsiveness to government preference.”

(Victor, 2015, in Nature)
Past history of key climate events

• 1979 — The first World Climate Conference (WCC)
• 1988 — The Intergovernmental Panel on Climate Change is set up
• 1990 — IPCC publishes first assessment report. IPCC and second World Climate Conference call for a global treaty on climate change. United Nations General Assembly negotiations on a framework convention begin
• 1992 — The INC adopts UNFCCC text. At the Earth Summit in Rio, the UNFCCC is opened for signature along with UNCBD and UNCCD
• 1994 — UNFCCC enters into force
• 1995 — IPCC 2nd Assessment Report
• 1995 — The first Conference of the Parties (COP 1) in Berlin
Past history of key climate events

- 1996 — The UNFCCC Secretariat is set up to support the Convention
- 1997 – Kyoto Protocol adopted at COP-3 (Milestone)
- 2001 – IPCC published 3rd Assessment Report
- 2009 - COP15 Copenhagen (Milestone)
- 2014 - IPCC Published 5th Assessment Report
- 2015 - Paris Agreement (Milestone)
- 2022 – IPCC Published 6th Assessment Report
- 2023- Paris Agreement Stocktake
UNFCCC and IPCC Linkages

- Both endorsed by UN General Assembly
- IPCC reports are used as a science basis by UNFCCC for assisting parties to facilitate agreements, ex.
  - IPCC First Assessment Report was instrumental in establishing the Intergovernmental Negotiating Committee for the UNFCCC
  - Second Assessment Report in 1995 provided inputs to negotiation that led to establish Kyoto Protocol
  - Request from UNFCCC to do 1.5 degree special report
  - Etc

UNFCCC organizational chart indicating SBSTA as a link between the IPCC and the COP.
Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA) facilitates the distribution and application of climate change-related data and scenarios.
Roles and Expectations of Authors

Coordinating Lead Authors (CLAs)
- Overall responsibility for coordinating major sections of the report
- Lead the development of crosscutting scientific or technical issues

Lead Authors (LAs)
- Write designated sections
- Synthesise material drawn from literature
- To take account of review comments

Contributing Authors (CAs)
- Prepare technical information (text, graphs or data) for assimilation by LAs into the draft sections
A clear and up to date view of the current state of scientific knowledge relevant to climate change

- The IPCC Fifth Assessment Report

**Working group I**

*The Physical Science Basis*

- 259 authors
- 39 countries
- 54,677 comments

**Working Group II**

*Impacts, Adaptation and Vulnerability*

- 309 authors
- 70 countries
- 50,444 comments

**Working Group III**

*Mitigation of Climate Change*

- 235 authors
- 57 countries
- 38,315 comments
Structure of an IPCC Report

- Summary for Policymakers
- Technical Summary
- Chapters
  - Executive Summary
  - Assessment
  - FAQs
  - Supplementary Material
- Annexes
- Glossary
IPCC reports are the result of extensive work of many scientists from around the world.

1 Summary for Policymakers
1 Technical Summary
16 Chapters
235 Authors
900 Reviewers
More than 2000 pages
Close to 10,000 references
More than 38,000 comments
Key essence of assessment making

1. Reviewing comprehensively the relevant scientific, technical and socio-economic literature
2. Describing consistent transformation pathways
3. Evaluating costs, risks and opportunities of different pathways in a consistent way within and across Chapters and WGs
4. Specifying underlying value judgments and worldviews
5. Communicating quantitative and qualitative uncertainties
6. Using neutral language along good scientific practice
7. Making text, figures and tables accessible
Exploring the entire solution space and describing consistent transformation pathways
Exploring the entire solution space and describing consistent transformation pathways.
Communicating Uncertainty
• Formal language: Standardized summary terms for all IPCC Working Groups
• Explicit valuation of evidence and agreement as a basis for each key finding – Traceable accounts in chapters
→ Transparent uncertainty evaluation will increase reliability of and trust in key findings

Use of Reliable Scientific Literature
• Ensure that all relevant statements and lines of discussion are properly substantiated by adequate literature, and ensure that all relevant text undergoes appropriate review
• “Procedure for using non-published/non-peer-reviewed sources in IPCC Reports”
→ Take into account quality and potential bias of assessed literature
The IPCC Uncertainty Guidance Note

Guidance Note for Lead Authors of the
IPCC Fifth Assessment Report on
Consistent Treatment of Uncertainties

IPCC Cross-Working Group Meeting on Consistent Treatment of Uncertainties
Jasper Ridge, CA, USA
6-7 July 2010

Core Writing Team:

![Diagram showing the relationship between agreement, evidence type, and confidence scale.]

- High agreement
  - Limited evidence
- Medium agreement
  - Limited evidence
- Low agreement
  - Limited evidence
- High agreement
  - Medium evidence
- Medium agreement
  - Medium evidence
- Low agreement
  - Medium evidence
- High agreement
  - Robust evidence
- Medium agreement
  - Robust evidence
- Low agreement
  - Robust evidence

Confidence Scale
How to Ensure the Credibility of the Assessment?

- Conflict of Interest Policy
- The Review Process
- Role of Review Editors
- Communication with the Media
- Transparency
What is the IPCC writing and review process?

- Scoping
- Approval of Outline
- Nomination of authors
- Government and Expert Review - 2nd Order Draft
- Expert Review - 1st Order Draft
- Selection of authors
- Final draft report and SPM
- Government review of final draft SPM
- Approval & acceptence of report

Leading author meetings (LAMs)

Source: Adapted from IPCC, 2013
The IPCC Process Mapping

Creating an IPCC Report

- Governments Nominate Experts for Report
- IPCC Bureau Selects Authors
- Authors Prepare Zero Order Draft
- Authors Prepare 1st Order Draft
- Authors Prepare 2nd Order Draft
- Authors Prepare Final Draft
- IPCC Plenary Approves Report and Accepts SPM
- Final Distribution
- Publication
- Late 2014
- Apr 2014
- Dec 2013 – Feb 2014
- Sep 2012 – Feb 2013
- May – Nov 2013
- Feb – Apr 2014

- Oct 2011
- Jan – Jun 2012
- Jun – Aug 2012
- Mar – May 2012
- Dec 2013 – Feb 2014

- Nov 2010 – Jan 2012
- Expert Review
- Expert & Government Review
- Government SPM Review
Review is a fundamental aspect of assessment

IPCC reports undergo a multi-stage, open and transparent review process. Drafts, comments, and responses are published after release of the final report.
Review is a fundamental aspect of assessment

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The Role of Review Editors

- Assist the Working Group in identifying reviewers for the expert review process;
- Ensure that all substantive expert and government review comments are afforded appropriate consideration;
- Advise lead authors on how to handle contentious/controversial issues;
- Ensure genuine controversies are reflected adequately in the text of the Report; and
- Submit a written report to the Working Group Session.

Without REs accepting the chapter, it will not be published as part of the AR5!
### AR5 WG III Outline

#### I: Introduction
- 1. Introductory Chapter

#### II: Framing Issues
- 2. Integrated Risk and Uncertainty Assessment of Climate Change Response Policies
- 3. Social, Economic and Ethical Concepts and Methods
- 4. Sustainable Development and Equity

#### III: Pathways for Mitigating Climate Change
- 5. Drivers, Trends and Mitigation
- 6. Assessing Transformation Pathways
- 7. Energy Systems
- 8. Transport
- 9. Buildings
- 10. Industry
- 11. Agriculture, Forestry and Other Land Use (AFOLU)
- 12. Human Settlements, Infrastructure and Spatial Planning

#### IV: Assessment of Policies, Institutions and Finance
- 13. International Cooperation: Agreements and Instruments
- 14. Regional Development and Cooperation
- 15. National and Sub-national Policies and Institutions
- 16. Cross-cutting Investment and Finance Issues
• GHG emission growth have accelerated despite ongoing efforts

• Climate change mitigation, if unabated, would result into 3.7-4.8°C world (which is undesirable)

• There is a significant shift in emission structure in recent decades regionally, along income groups, and sectors

• While mitigation challenges exist the low climate stabilization mitigation pathways are possible, options are there

• Delaying of mitigation would entail more costs and limit options

• But such pathways needs significant efforts from policies and institutions, investments and international cooperation
Towards AR6

• 43rd Session of IPCC in April 2016 agreed that the AR6 Synthesis Report would be finalized in 2022 in time for the first UNFCCC global stocktake.

• The three Working Group contributions to AR6 will be finalized in 2021

• AR6 Scoping Meeting, Addis Ababa, Ethiopia, 1 – 5 May 2017

• **CHAPTER OUTLINE OF THE WORKING GROUP III CONTRIBUTION TO THE IPCC SIXTH ASSESSMENT REPORT (AR6)**
  – FORTY-SIXTH SESSION OF THE IPCC, Montreal, Canada, 6 – 10 September 2017
# Working Group III contribution to AR6

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<thead>
<tr>
<th>Chapter</th>
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<th>Description</th>
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<td>1. Introduction and framing</td>
<td>High-level assessment of emission trends, drivers and pathways (3 chapters)</td>
<td>Set up sustainable development as key framing concept</td>
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<td>Balancing sources and sinks/warming levels</td>
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<td>3. Mitigation pathways compatible with long-term goals</td>
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<td>NDCs, emissions peaking, mid-century long-term low greenhouse gas emission development strategies</td>
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<tr>
<td>4. Mitigation and development pathways in the near- to mid-term</td>
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<td>Orients sectors to human needs</td>
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<td>Sectoral chapters (8 chapters)</td>
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<tr>
<td>5: Demand, services and social aspects of mitigation</td>
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<td>The sectoral core: maps on to inventories</td>
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<tr>
<td>6: Energy systems</td>
<td>9. Buildings</td>
<td>Responses not captured by sectoral framing</td>
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<tr>
<td>7. Agriculture, Forestry, and Other Land Uses</td>
<td>10. Transport</td>
<td>Institutions, policies and cooperation</td>
</tr>
<tr>
<td>8. Urban systems and other settlements</td>
<td>11. Industry</td>
<td>Financial flows + technological innovation</td>
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<tr>
<td>12. Cross sectoral perspectives</td>
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<td>Synthesis sustainable development in different geographical scales</td>
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<tr>
<td>Institutional drivers (2 chapters)</td>
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<td>13. National and sub-national policies and institutions</td>
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<td>14. International cooperation</td>
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<td>Financial and technological drivers (2 chapters)</td>
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<td>15. Investment and finance</td>
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<td>16. Innovation, technology development and transfer</td>
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<td></td>
</tr>
<tr>
<td>Synthesis (1 chapter)</td>
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<tr>
<td>17. Accelerating the transition in the context of sustainable development</td>
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Lead Author Meetings

LAM 1
- Getting to know each other
- Agree on chapter structure

LAM 2
- Taking stock and work planning
- Identify cross-cutting issues
- Review feedback on Zero Order Draft (ZOD)
- Develop plan for First Order Draft (FOD)

LAM 3
- Responding to review comments
- Agree on Summary for Policymakers (SPM) structure and content
- Review feedback on First Order Draft (FOD)
- Develop plan for Second Order Draft (ZOD)

LAM 4
- Responding to review comments
- Review feedback on Second Order Draft (SOD)
- Plan final draft of chapter, and SPM

IPCC
Intergovernmental Panel on Climate Change
WMO
World Meteorological Organization
UNEP
United Nations Environment Programme
### WG III AR6: provisional dates

<table>
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<th>Event</th>
<th>Date</th>
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<tr>
<td>1st Lead Author Meeting</td>
<td>1 – 7 April 2019</td>
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<tr>
<td>Submission of ZOD to TSU for compilation</td>
<td>7 July</td>
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<tr>
<td>Internal Review of ZOD</td>
<td>22 July – 1 September</td>
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<tr>
<td>2nd Lead Author Meeting</td>
<td>30 September – 4 October</td>
</tr>
<tr>
<td>First Order Draft Expert Review</td>
<td>13 January – 8 March 2020</td>
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<tr>
<td>3rd Lead Author Meeting</td>
<td>13 – 17 April</td>
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<tr>
<td>Second Order Draft Expert and Government Review</td>
<td>13 July – 13 September</td>
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<td>4th Lead Author Meeting</td>
<td>25 – 31 October</td>
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<td>Final Government Review of the Summary for Policymakers</td>
<td>15 February – 11 April 2021</td>
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<tr>
<td>IPCC acceptance/adoption/approval</td>
<td>12 – 16 July 2021</td>
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GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.

Based on Figure 1.3, GHG emissions grew at a rate of +1.3% per year from 1970 to 2010, with a significant increase of +2.2% per year in the period 2000-2010. The total emissions reached 49 Gt (Uncertainty: ±4.5 Gt) in 2010.
About half of cumulative anthropogenic CO$_2$ emissions between 1750 and 2010 occurred in the last 40 years.
Regional patterns of GHG emissions are shifting along with changes in the world economy.
GHG emissions rise with growth in GDP and population; long-standing trend of decarbonisation of energy reversed

Based on Figure 1.7
GHG emissions rise with growth in GDP and population; long-standing trend of decarbonisation of energy reversed.
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.
Mitigation involves substantial upscaling of low-carbon energy

- Rapid improvements of energy efficiency
- A tripling to nearly a quadrupling of the share of zero- and low-carbon energy supply from renewables, nuclear energy and fossil energy with carbon dioxide capture and storage (CCS), or bioenergy with CCS (BECCS) by the year 2050
- 2° scenarios typically rely on the availability and large-scale deployment of carbon dioxide removal technologies, but both are uncertain
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.

Based on Figures 6.32 and 7.16
Global costs rise with the ambition of the mitigation goal but impact to GDP is nominal.

Based on Table SPM.2
Availability of technology can greatly influence mitigation costs

- Limits on nuclear, solar and wind influence mitigation costs much less
- Carbon capture and storage as well as bioenergy particularly influence mitigation costs

Based on Figure 6.24
Mitigation can result in large co-benefits for human health and other societal goals.

Based on Figures 6.33 and 12.23
Low stabilization scenarios are dependent upon a full decarbonization of energy supply in the long term.
Baseline scenarios suggest rising GHG emissions in all sectors, except for CO2 emissions in the land-use sector.
Mitigation requires changes throughout the economy. Systemic approaches are expected to be most effective based on Figure TS.17.
Interdependencies: Mitigation efforts in one sector determine efforts in others

Based on Figure TS.17
Decarbonization of energy supply is a key requirement for limiting warming to 2°C

Contribution of Low Carbon Technologies to Energy Supply (430-530 ppm CO$_2$eq Scenarios)

Based on Figure 7.11
Energy demand reductions can provide flexibility, hedge against risks, avoid lock-in and provide co-benefits.

Further we reduce energy demand:
- The more flexibility in our choice of low carbon technologies;
- The better we can hedge against supply side risks;
- The smaller infrastructure lock-in will be; and
- The larger co-benefits will be.

Based on Figure 7.11
The wide-scale application of available best-practice low-GHG technologies could lead to substantial emission reductions.
Examples from power supply: Many technologies exist to reduce GHG emissions, but do so to different degrees.

Some Mitigation Technologies for Electricity Generation

Emission Intensity [gCO₂/KWh]

- Solar Photovoltaic - Utility Scale
- Dedicated Biomass
- Pulverized Hard Coal with CCS
- Nuclear
- Wind Onshore
- Gas Combined Cycle
- Hydropower
- Pulverized Hard Coal

* Median Value in Mitigation Scenarios (430-530 ppm CO₂eq by 2100); Based on Direct Emissions
1 In gCO₂/kWh; Based on Lifecycle Emissions
Costs of many power supply technologies decreased substantially, some can already compete with conventional technologies.

Some Mitigation Technologies for Electricity Generation

<table>
<thead>
<tr>
<th>Emission Intensity [gCO₂/kWh]</th>
<th>Cost of Electricity [USD_{2010}/MWh]</th>
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<tr>
<td>1000</td>
<td>[Max]</td>
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<td>800</td>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Average Intensity</th>
<th>Cost of Electricity</th>
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<tr>
<td>2010</td>
<td></td>
<td>Solar Photovoltaic - Utility Scale</td>
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<tr>
<td></td>
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<td>Dedicated Biomass</td>
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<tr>
<td></td>
<td></td>
<td>Pulverized Hard Coal with CCS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nuclear</td>
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<tr>
<td></td>
<td></td>
<td>Wind Onshore</td>
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<td>Gas Combined Cycle</td>
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<tr>
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<td>Pulverized Hard Coal</td>
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* Median Value in Mitigation Scenarios (430-530 ppm CO₂ eq by 2100); Based on Direct Emissions
1 In gCO₂/kWh; Based on Lifecycle Emissions
2 Levelized Cost of Electricity in USD_{2010}/MWh; Based on High Full Load Hours

Based on Figure 7.7
Example transport: several strategies exist to reduce emissions from transportation.

Some Mitigation Technologies for Light Duty Vehicles

Options in 2010

- Gasoline
- Hybrid Gasoline
- Electric, (600 gCO₂/kWhₑ)

Options in 2030

- Gasoline
- Hybrid Gasoline
- Hybrid Gasoline/Biofuel
- Electric, (200 gCO₂/kWhₑ)

Emissions Intensity [gCO₂/p-km]

Average Intensities of 2010 Stock
Private costs of reducing emissions in transport vary widely. Societal costs remain uncertain.

Some Mitigation Technologies for Light Duty Vehicles

Options in 2010

- Gasoline
- Hybrid Gasoline
- Electric, (600 gCO₂/kWhₑ)

Options in 2030

- Gasoline
- Hybrid Gasoline
- Hybrid Gasoline/Biofuel
- Electric, (200 gCO₂/kWhₑ)

Average Intensities of 2010 Stock

Emissions Intensity [gCO₂/p-km]

Mitigation Cost [USD 2010/ tCO₂]

1 Levelized cost of conserved carbon; calculated against 2010 new gasoline (2030 optimized gasoline) for 2010 (2030) options. Mitigation cost are based on point estimates ±100 USD 2010/tCO₂ and are highly sensitive to assumptions.

Based on Figure TS.21
Effective mitigation will not be achieved if individual agents advance their own interests independently.
Substantial reductions in emissions would require large changes in investment patterns and appropriate policies.

- For comparison, global total annual investment in the energy system is presently about USD 1200 billion.
There has been a considerable increase in national and sub-national mitigation policies since AR4.

- In 2012, 67% of global GHG emissions were subject to national legislation or strategies; 45% in 2007
- Yet, no substantial deviation in global emissions from the past trend
- Plans and strategies are in early stages of development and implementation in countries

Based on Figures 15.1 and 13.3
Sector-specific policies have been more widely used than economy-wide policies.

![Chart showing options for different types of policies](chart.png)

Based on Figure 10.15
Climate change mitigation is a global commons problem that requires international cooperation across scales.

- International cooperation on climate change has become more institutionally diverse over the past decade.
Forms of international cooperation vary in their focus and degree of centralization and coordination.
Effective mitigation will not be achieved if individual agents advance their own interests independently.

Based on Figure 13.2
Summary messages – once again

- GHG emission growth have accelerated despite ongoing efforts.
- Climate change mitigation, if unabated, would result into 3.7-4.8°C world (which is undesirable).
- There is a significant shift in emission structure in recent decades regionally, along income groups, and sectors.
- While mitigation challenges exist the low climate stabilization mitigation pathways are possible, options are there.
- Delaying of mitigation would entail more costs and limit options.
- But such pathways needs significant efforts from policies and institutions, investments and international cooperation.
Thank you
shobhakar@ait.ac.th

www.mitigation2014.org
Impacts of mitigation on GDP growth is nominal

- Loss in global consumption in 2030: 1.7% (median)
- Loss in global consumption in 2050: 3.4% (median)
- Loss in global consumption in 2100: 4.8% (median)

Current GDP vs. GDP with stringent mitigation (reaching ≈ 450 ppm CO2eq in 2100)