INTERGOVERNMENTAL PANEL ON climate change

THIRTY-FOURTH SESSION OF THE IPCC
Kampala, 18-19 November 2011

IPCC-XXXIV/Doc. 18, Rev.1
(13.XI.2011)
Agenda Item: 10
ENGLISH ONLY

PROGRESS REPORT

Working Group III contribution to the Fifth Assessment Report

(Submitted by the Co-Chairs of the IPCC Working Group III)

Following a request by Working Group III TSU a revised document has been issued in order to provide the correct chapter outline

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PROGRESS REPORT
Working Group III contribution to the Fifth Assessment Report

1. Background and Overview

Working Group III informed the Panel about the author nomination/selection process and the coordination efforts across Working Groups in the Progress Report submitted to IPCC-XXXII in Busan, Republic of Korea, 11-14 October 2010 (see IPCC-XXXII/Doc.12). This report highlighted the careful approach taken by WGIII in the author selection process a) ensuring appropriate scientific expertise for addressing the plenary approved outline of the WGIII contribution to the AR5; b) representing the full range of scientific views in the chapter teams; c) providing regional and gender balance in the chapter teams. During IPCC XXXIII delegates were informed about progress on the cross-Working-Group scenario development process and the required coordination with the relevant scientific communities (IPCC-XXXIII/Doc.4). Delegates were also updated on the organization of a series of IPCC joint Expert Meetings (IPCC-XXXIII/Doc.15) for the AR5. This progress reports documents AR5 related activities that have taken place after IPCC-XXXIII and provides an outlook to activities planned for the year 2012.

2. Changes to WGIII AR5 Schedule

WGIII has undertaken some changes to its working schedule without affecting the overall schedule of the AR5 approved by the Panel. The changes *reduce* overlap with the government review periods of the other Working Groups from 6 to 3 weeks. "Government and expert review" will take place 9 weeks earlier than originally planned. Working Group III Bureau and Co-Chairs decided to undertake these changes based on the experience made during the finalization of the Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN), where the overall schedule had to be delayed in order to secure IPCC quality standards. WGIII will therefore require CLAs to submit the final draft of their AR5 chapters 6 weeks earlier than previously scheduled. This will provide the opportunity for Co-Chairs, in collaboration with Review Editors, to ensure that a high quality Working Group III contribution to the AR5 can be submitted in time for the final government distribution, which remains unaffected from the changes in the detailed timeline. The changes in the schedule have been undertaken in coordination with the IPCC Secretariat and the other Working Groups:

- Cut-off Paper submission: 31st January 2013
- Government and expert review: 25 February – 22 April 2013
- LAM4: 1-5 July 2013
- Cut-off Paper acceptance: 3 October 2013

A complete overview of the schedule in relationship to the schedules of the other Working Groups is provided in Appendix A.

3. Progress since IPCC-XXXIII (Abu Dhabi, United Arab Emirates • 10-13 May 2011)

Expert Meetings

In support of AR5 development, Working Group III Co-Chairs and TSU held a series of expert meetings jointly with the other IPCC Working Groups:

- WGI / WGII / WGIII Expert Meeting on Geoengineering – Lima, Peru (20-22 June 2011)
- WGII / WGIII Expert Meeting on Economic Analysis, Costing Methods, and Ethics – Lima, Peru (23-25 June 2011)

More details about these meetings is provided in a separate status report submitted by the Working Groups for IPCC-XXXIV.

Working Group II kindly accepted WGIII participation at the *Africa Regional Expert Meeting* taking place in Accra, Ghana, 9-11 August 2011. The local host (University of Ghana) graciously accepted the extra responsibility and made arrangements to accommodate 49 participants (30 from WGII and 19 from WGIII), plus IPCC and START representatives. The groups met in joint sessions on Days 1 and 3, covering topics such as uncertainty language, the New Scenarios process, and AR5 cross-cutting issues; on Day 2, the authors split into WG-specific groups to discuss the use of non-journal based literature, literature review methods, responding to review comments, cross-chapter coordination on African issues, media training, and TSU-supported tools and services accessible via a password-protected web site. The expert meeting received favourable reviews from both the participants and the local organizers.

Working Group III further organized the *First Expert Meeting on Scenarios as an Integrative Element for the WGIII Contribution to the AR5 (SIE-1)*. The meeting was held back-to-back prior to the First Lead Author Meeting in Changwon City, Republic of Korea, 10-11 July 2011. It was attended by 18 WGIII lead authors, 4 IPCC office holders and 4 scientific members of the WGIII TSU. 11 participants were supported by Trust Fund money in the context of the First Lead Author Meeting (see below). It was the main aim to develop a mutual understanding of the various scenario activities across the relevant chapters of the WGIII contribution to the AR5 and to set-up a process for their integration. Responsible authors were identified in key chapters to facilitate exchange and drive this integration process forward. This very successful meeting highlighted the importance of scenarios as an integrative element to the WGIII contribution of the AR5 and the sustained efforts required to allow for such integration. WGIII Co-Chairs, TSU and authors will continue to work hard on this issue and will reconvene prior to the Second Lead Author Meeting in Wellington, New Zealand, 17-18 March 2012.

Lead Author Meetings

Working Group III held its First Lead Author Meeting (LAM1) in Changwon City, Republic of Korea, 12-15 July 2011. The meeting was generously funded by the Government of the Republic of Korea. The Greenhouse Gas Inventory & Research Center of Korea (GIR) kindly served as the local host. Its president Mr. Seung Jick Yoo established a secretariat to help with meeting arrangements. IPCC Vice-Chair Prof. Dr. Hoesung Lee was pivotal for the meeting arrangement. Overall, 200 of the 230 (coordinating) lead authors participated as well as 9 IPCC Office Holders and 10 members of the Working Group III TSU. 82 of 108 Trust Fund supported trips were used to support LAM1 and scenario workshop (SIE-1) participation by authors as well as Working Group Co- and Vice-Chairs from developing countries and economies in transition.

The main purpose of LAM1 was to initiate the writing of the Zero-Order Draft. The chapter teams finalized their detailed chapter outlines, developed an overall storyline for their chapters and allocated writing tasks to individual chapter team members. They further identified common themes across chapters and Working Groups, such as the treatment of uncertainty, emission trends or sustainable development, as well as modes of collaboration on these issues in a series of meetings on cross-cutting issues. Authors also discussed areas of insufficient coverage in the peer reviewed scientific literature and how to include non-peer-reviewed sources of high quality to fill these gaps. Chapter teams finally started reviewing their own expertise portfolios, in order to identify the need for further contributing authors. The TSU in collaboration with Working Group Co-Chairs, Vice-Chairs and experienced lead authors provided guidance to the writing teams on Conflict of Interest, the overall schedule of the AR5 including the WGIII writing process, confidentiality, the treatment of uncertainty and communication. Moreover, authors were familiarised with web resources and tools provided for the writing process by the TSU. WGIII started implementing its interim Conflict of Interest Policy at LAM1 and will have all authors, WGIII Bureau members and professional staff of the TSU under the umbrella of the policy no later than the Second Lead Author Meeting (LAM2)

taking place in March 2012. There was a common perception among meeting participants that LAM 1 was an excellent start into the writing process and WG III Co-Chairs, Bureau and TSU are working hard to sustain this initial success throughout the assessment cycle.

Writing Process

After LAM1 chapter teams started preparing the *Zero-Order-Draft* (ZOD). Interim drafts will be submitted to the TSU on 21 October 2011 and circulated internally to facilitate cross-chapter coordination. Final versions of the ZOD have to be submitted by Coordinating Lead Authors (CLAs) to the TSU by 2 December 2011. WGIII Co-Chairs, Bureau, and TSU are currently setting-up the review process organisationally and technically. The ZOD review will remain largely internal to WGIII, but IPCC leadership, sister working groups, SYR TSU and individual experts will be invited to provide their comments. Circulation to a wider expert community is not envisaged due to the early status of the draft. This informal review will ask reviewers to critically reflect on the adequacy of the chapters in addressing the plenary-approved outline taking into account chapter structure, coverage, gaps, balance and cross-chapter consistency.

The WGIII plenary-approved outline for the AR5 has been modified in places in order to address the topics identified by the plenary in a fluent and structurally consistent way. WGIII Co-Chairs supported by the TSU will ensure that all topics identified in the plenary-approved outline will be fully covered in the WGIII contribution to the AR5. The updated outline of the chapters is provided in Appendix B.

Changes in AR5 writing teams

The following changes to the AR5 chapter teams have been undertaken due to authors resignations:

- *Chapter 2*: Anthony Patt (Austria) replaces Joanne Linnerooth-Bayer (Austria), who resigned as lead author, but remains part of the chapter 2 writing team as contributing author.
- *Chapter 3*: Rashid Hassan (South Africa) replaces Mamadou Diawara (Germany), who resigned as lead author. Don Fullerton (USA) replaces Gilbert Metcalf (USA), who resigned as lead author.
- *Chapter 4:* Marc Fleurbaey (USA) replaces Partha Dasgupta (United Kingdom), who resigned as coordinating lead author. Sivan Kartha (USA) replaces Adil Najam (USA), who resigned as coordinating lead author. A replacement for Sivan Kartha, who had been lead author prior to his elevation to coordinating lead author, is yet to be nominated.
- *Chapter 6*: Ibrahim Abdel Gelil resigned as a lead author. A replacement is yet to be nominated.
- *Chapter 8*: Steven Plotkin (USA) resigned as lead author, but will continue his input to the AR5 as a contributing author. He is replaced by Daniel Sperling (USA). Lee Schipper (USA), review editor of chapter 8, sadly passed away. Elisabeth Deakin (USA) is the new review editor of the chapter.
- *Chapter 10*: Yacob Mulugetta (Ethiopia) replaces Francis Yamba (Zambia), who resigned as lead author.
- *Chapter 12*: Naison Mutizwa-Mangiza (Kenya) resigned as lead author. One lead author has yet to be nominated. Three vacant LA positions are currently being filled.
- *Chapter 13*: Axel Michaelowa (Switzerland), formerly a lead author for chapter 14, has joined the writing team of chapter 13.
- Chapter 14: Michael Rauscher (Germany) replaces John Whalley (Canada), who resigned as lead author.
- *Chapter 15*: The vacant lead author position has been filled with Shunsuke Managi (Japan). A replacement is yet to be nominated.

WGIII Author Contribution Policy

WGIII Co-Chairs – subject to approval of the WGIII Bureau - intend to *remove inactive lead authors* (LAs) after the submission of the ZOD with a strong commitment to maintain the approved regional balance in the core (CLAs & LAs) WGIII writing team. The IPCC depends on voluntary contribution of individuals. In order to avoid a disproportionate work burden on active writing team members – in particular CLAs – and secure expertise in all relevant areas of the core writing team, it is important to make sure that all core writing team members are contributing to the drafting process. LA removal takes place in a two-stage process. CLAs are asked to report authors who have failed to make a written contribution by the (interim) October deadline of the ZOD. WGIII will then issue an email to these authors asking for the reasons behind their non-delivery, urging for written input to the ZOD and highlighting the consequences of continued non-delivery. Whenever possible, Co-Chairs will talk to these LAs personally. Unless very special circumstances exist, LAs who continue to fail in making a written contribution to the final ZOD in December will be informed that they are no longer part of the WGIII AR5 core writing team. These LAs will then be replaced by appropriate experts from the respective regions to keep the regional balance. However, WGIII will offer these authors continued participation in the AR5 process in the role of contributing authors – particularly when they come from developing countries.

4. Milestones 2012

In 2012 WGIII will continue working hard to make good progress with the AR5. The following major milestones are foreseen:

- **16 December 2011 – 27 January 2012, Internal Review Zero-Order Draft**: Comments will subsequently be compiled by the TSU and made available to the chapter teams no later than 13 February 2012.
- **17-18 March 2012, Second Expert Meeting on Scenarios (SIE-2), Wellington, New Zealand**: Scenarios have a key role in the WGIII contribution to the AR5 as an integrative element. Authors from all relevant chapters will meet to coordinate and integrate the scenario activities across chapters. The meeting is kindly supported by the government of New Zealand and the Climate Change Research Centre of Victoria University of Wellington.
- **19-23 March 2012, Second Lead Author Meeting (LAM2), Wellingon, New Zealand**: The meeting is kindly supported by the government of New Zealand and the Climate Change Research Centre of Victoria University of Wellington. The general aim of the meeting is to work within the chapter teams towards the First Order Draft based on the comments from the ZOD and to progress on cross-cutting issues across chapters and working groups.
- **4 June 2012, First Order Draft (FOD) due**: The TSU will subsequently compile the FOD for distribution to registered experts.
- **22 June – 20 August 2012, Expert Review of First Order Draft (FOD)**: In the upcoming of this first public review period in the WGIII AR5 cycle, WGIII will put out a call for expert reviewers. This will also include an invitation to government focal points and observer organisations to name potential expert reviewers, who will subsequently be addressed by the TSU. Experts can register for the review and will then be provided access to the FOD on 22 June 2011. They will submit their comments to the TSU via a secure website.
- **Expert Meeting for Businesses and NGOs**: Based on the good experiences made during the SRREN, WGIII will organize and execute an Expert Meeting for Businesses and NGOs. The meeting aims to gather structured input for consideration by the AR5 authors from these communities based on the FOD. The meeting will take place during the Expert Review Period (22 June – 20 August 2012). The location still has to be decided.
- **3-4 November 2012, Third Expert Meeting on Scenarios, location tbc.**
- **5-9 November 2012, Third Lead Author Meeting (LAM3), location tbc**.

Appendix A: WGIII timeline in relation to other Working Groups

	Working Group I	Working Group II	Working Group III
2009			
13-17 July	AR5 Scoping Meeting Venice (Italy)	AR5 Scoping Meeting Venice (Italy)	AR5 Scoping Meeting Venice (Italy)
2010			
8-11 November	First LA Meeting Kunming (China)		
2011			
11-14 January		First LA Meeting Tsukuba (Japan)	
12-15 July			First LA Meeting Changwon City (Republic of Korea)
18-22 July	Second LA Meeting Brest (France)		
12-15 December		Second LA Meeting San Francisco (USA)	
16 December – 10 February (2012)	First Order Draft Expert Review		
2012			
19-23 March			Second LA Meeting Location TBD
16-20 April	Third LA Meeting (Morocco)		
11 June – 6 August		First Order Draft Expert Review	
22 June - 20 August			First Order Draft Expert Review
31 July	Papers submitted		
22-26 October		Third LA Meeting Location TBD	
5-9 November			Third LA Meeting Location TBD
5 October – 30 November	Second Order Draft Government and Expert Review		
2013			
14-19 January	Fourth LA Meeting Location TBD		
31 January		Papers submitted	Papers submitted
11 March			
15 March	Papers accepted		
25 February – 22 April 2013			Second Order Draft Government and Expert Review
29 March – 24 May		Second Order Draft Government and Expert Review	
7 June – 2 August	Final Government Distribution of the SPM		

1 -5 July			Fourth LA Meeting Location TBD
15-19 July		Fourth LA Meeting Location TBD	
31 August		Papers accepted	
23-26 September	WGI Session to approve SPM and accept underlying document (Sweden)		
3 October			Papers accepted
28 October – 20 December		Final Government Distribution of the SPM	
13 December – 10 February (2014)			Final Government Distribution of the SPM
2014			
17-21 March		WGII Session to approve SPM and accept underlying document Location TBD	
7 – 11 April			WGIII Session to approve SPM and accept underlying document Location TBD
October	Session to approve Synthesis Report		
	Final publication and translation of the summaries in 6 official UN languages	Final publication and translation of the summaries in 6 official UN languages	Final publication and translation of the summaries in 6 official UN languages

Appendix B – Revised, detailed outline WGIII

The WGIII plenary-approved outline for the AR5 has been modified in places in order to address the topics identified by the plenary in a fluent and structurally consistent way. WGIII Co-Chairs supported by the TSU will ensure that all topics identified in the plenary-approved outline will be fully covered in the WGIII contribution to the AR5. Recognising that outline headings at the 2nd level (e.g. 1.2, 1.3) are plenary approved, tentative third level headings are presented here to ensure complete transparency and give a sense of the current status of the chapters.

Chapter 1: Introductory Chapter

1.1 Introduction
1.2 Main messages and changes from previous assessment
    1.2.1 Lessons learned since AR4
    1.2.2 New challenges for the AR5
1.3 Historical, current and future trends
    1.3.1 Review of four decades of greenhouse gas emissions
    1.3.2 Current trends and time scales
    1.3.3 Scale of the mitigation challenge
1.4 Mitigation challenges and strategies
    1.4.1 Reconciling priorities and achieving sustainable development
    1.4.2 Uncertainty and risk management
    1.4.3 Interactions between mitigation and adaption
    1.4.4 Encouraging international collective action
    1.4.5 Promoting investment and technological change
1.5 Roadmap for WG III report

Chapter 2: Integrated Risk and Uncertainty Assessment of Climate Change Response Policies

2.1 Introduction
2.2 Risk and uncertainty in climate change
2.3 Tools for analysing uncertainty and risk
2.4 Risk perception and responses to risk and uncertainty
2.5 Managing uncertainty, risk and learning (robust policy response strategies and instruments)
2.6 Metrics of uncertainty and risk
2.7 Conclusions and gaps in knowledge
2.8 Frequently asked questions

Chapter 3: Social Economic and Ethical Concepts and Methods

3.1 Introduction – the goals and key messages of this chapter
3.2 Justice, equity and responsibility
3.3 Economics, rights and duties
3.4 Ethical and socio-economic concepts and principles
3.5 Aggregation of costs and benefits
3.6 Assessing methods of policy choice
3.7 Metrics of costs and benefits
3.8 Behavioural economics and culture
3.9 Policy instruments and regulations
3.10 Technological change
3.11 Frequently asked questions

Chapter 4: Sustainable Development (SD) and Equity

4.1 Introduction
- 4.1.1 Key messages of AR4 and SRREN
- 4.1.2 Summary of key developments since AR4
- 4.1.3 Narrative (key messages)

4.2 Approaches and indicators
- 4.2.1 Approaches to SD and equity
- 4.2.2 Indicators of SD and equity

4.3 Determinants, drivers and barriers
- 4.3.1 Population
- 4.3.2 Education and mind-sets
- 4.3.3 Behaviours
- 4.3.4 Policy and institutions (including climate change policies)
- 4.3.5 Means of implementation (finance and technology) under international agreements
- 4.3.6 Actors
- 4.3.7 Legacy of expectations of development
- 4.3.8 Technology

4.4 Development pathways
- 4.4.1 Framing of pathways, main dimensions along which pathways differ
- 4.4.2 Risk and uncertainty, thresholds (social, ecological, economic)
- 4.4.3 Transition between pathways

4.5 Production, trade, consumption and waste patterns
- 4.5.1 Development pathways and production, trade, consumption and waste
- 4.5.2 Carbon (or GHG) accounting/carbon footprint

4.6 Mitigative capacity and mitigation
- 4.6.1 Defining mitigative capacity as “preconditions for mitigation”, drivers (and barriers) to mitigation
- 4.6.2 Synergies and trade-offs between mitigative capacity and SD
- 4.6.3 Equitable burden-sharing as way to minimize trade-offs

4.7 Links to adaptive capacity and adaptation
- 4.7.1 Similarities and scope for integration across adaptation and mitigation
- 4.7.2 Differences between adaptive capacity and mitigative capacity
- 4.7.3 Equity and burden sharing
- 4.7.4 Possible topics: risks and uncertainties, uncertainty of pathways and SD, discounting and SD, historical responsibilities, well-being and SD, behavioural aspects

4.8 Integration of framing issues in the context of sustainable development

4.9 Implications for subsequent chapters

4.10 Frequently asked questions

Chapter 5: Drivers, Trends, and Mitigation

5.1 Introduction: breaking trends, a hard or a soft approach
- 5.1.1 Drivers for climate change
- 5.1.2 Trends and breaks
- 5.1.3 Learning and midcourse corrections
- 5.1.4 Overview of the chapter

5.2 Global trends in stocks and flows of greenhouse gases and short-lived species

5.3 Key drivers of global change
- 5.3.1 Demography (including population, urbanization)
- 5.3.2 Economic development
- 5.3.3 Energy demand and supply
- 5.3.4 Sectors (transport, buildings, industry, human settlements)
- 5.3.5 Agriculture, Forestry, Other Land Use (AFOLU) and fisheries & aquaculture

5.4 Consumption and behavioural change
    5.4.1 Development and lifestyles
    5.4.2 Lifestyles
5.5 Production and trade patterns
    5.5.1 Production patterns
    5.5.2 Nature of international trade
    5.5.3 Infrastructure choices and lock-in
5.6 Technological change
    5.6.1 Energy efficiency
    5.6.2 Carbon-free energy and decarbonisation
    5.6.3 Non-energy sectors
    5.6.4 Dynamics and drivers of technological change, barriers (timing of technology deployment, learning)
5.7 Co-benefits and trade-offs of mitigation actions
    5.7.1 Environmental co-benefits and trade-offs
    5.7.2 Socio-economic co-benefits and trade-offs
5.8 Carbon and radiation management and other geo-engineering options including environmental risks
    5.8.1 Carbon dioxide removal
    5.8.2 Solar radiation management
5.9 The system perspective: linking sectors, technologies and consumption patterns
5.10 Frequently asked questions

Chapter 6: Assessing Transformation Pathways

6.1 Tools of Analysis
    6.1.1 Tools for the development of transformation pathways
    6.1.2 Methodological issues
    6.1.3 Model inter-comparison and diagnostics
    6.1.4 Tools for the interpretation of modelling results
6.2 Climate stabilization: Concepts, costs and implications for the macro economy, sectors and technology portfolios, taking into account differences across regions
    6.2.1 Baseline scenarios
    6.2.2 Overview of stabilization (including overshoot pathways)
    6.2.3 The economic implications of stabilization
    6.2.4 Mitigation in the context of impacts and adaptation
    6.2.5 Policy structures for mitigation
    6.2.6 International strategies and stabilization
    6.2.7 Technology transitions and stabilization
    6.2.8 Land and stabilization
6.3 Integrating long- and short-term perspectives
    6.3.1 Baseline emission projections 2010 – 2030
    6.3.2 Stabilization pathways 2010 – 2030
    6.3.3 Explanation of ranges
    6.3.4 Dynamics and path dependence
6.4 Integrating technological and societal change
    6.4.1 Framing technological change
    6.4.2 The role of technical change for climate stabilization
    6.4.3 The role of societal and behavioural change for transformation
6.5 Sustainable development, and transformation pathways, taking into account differences across regions
    6.5.1 Sustainable development (SD) implications of transformation pathways
    6.5.2 SD and baseline scenarios (e.g. as in SRES scenarios)
    6.5.3 Integrated assessment of SD and climate stabilization scenarios
    6.5.4 Other approaches to the assessment of SD and climate stabilization scenarios
    6.5.5 Aligning SD and climate change policies and actions to gain co-benefits

6.6 Risks of transformation pathways
    6.6.1 Technology risks
    6.6.2 Operational risk of transformation pathways
    6.6.3 Potential environmental risks of transformation pathways
    6.6.4 Other societal risks of transformation pathways
6.7 Integrating sector analyses and transformation scenarios
    6.7.1 Introduction and methodology
    6.7.2 Synthesis of sectoral analysis and comparison with transformation pathways
    6.7.3 Regional sectoral analysis and transformation pathways
    6.7.4 Conclusion
6.8 Frequently asked questions

Chapter 7: Energy Systems

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition]

7.1 Introduction
    7.1.1 Goals and context
    7.1.2 Summary of AR4
7.2 Energy production, conversion, transmission and distribution
    7.2.1 Global energy balance and energy flows
    7.2.2 Global and regional energy markets
    7.2.3 Scale of global energy related GHG emissions
7.3 New developments in emission trends and drivers
    7.3.1 Global trends
    7.3.2 Regional trends
    7.3.3 Current policies and commitments and GHG emission reduction challenge
7.4 Resources and resource availability
    7.4.1 Fossil fuels
    7.4.2 Nuclear energy
    7.4.3 Renewable energy
7.5 Mitigation technology options, practices and behavioural aspects
    7.5.1 Mitigation in fuel extraction
    7.5.2 Energy efficiency in fossil fuels conversion
    7.5.3 Energy efficiency in transmission and distribution
    7.5.4 Fossil fuel switching
    7.5.5 Carbon Dioxide Capture and Storage (CCS)
    7.5.6 Renewable energy
    7.5.7 Nuclear energy
    7.5.8 Alternative carriers
    7.5.9 Summary
7.6 Infrastructure and systemic perspectives
    7.6.1 Electrical power system
    7.6.2 Heating and cooling networks
    7.6.3 Fuel supply systems
7.7 Climate change feedback and interaction with adaptation
    7.7.1 Climate change impacts on energy demand
    7.7.2 Climate change impacts on energy supply
7.8 Costs and potentials
    7.8.1 Current levelized cost of energy
    7.8.2 Historic costs and potential future costs evolution
    7.8.3 Infrastructure costs
    7.8.4 Energy supply cost curves

7.9 Technological, environmental and other risks and uncertainties; and social acceptability
    7.9.1 Supply chain risks and hazards
    7.9.2 Operational risk and accidents
    7.9.3 Social acceptability
7.10 Co-benefits, trade-offs, spill-over effects
    7.10.1 Economic and social development, energy affordability and access
    7.10.2 Energy security
    7.10.3 Ecological and health effects
7.11 Barriers and opportunities
    7.11.1 Physical and technological aspects
    7.11.2 Financial barriers and investment barriers and opportunities
    7.11.3 Inertia in energy systems physical capital stock turnover
    7.11.4 Cultural, institutional, and legal barriers and opportunities
    7.11.5 Human capital capacity building
7.12 Sectoral policies
    7.12.1 Market design and instruments
    7.12.2 Regulatory policies
    7.12.3 Governance and stakeholders
    7.12.4 Energy sector specific policy aspects
7.13 Sectoral implication of transformation pathways and sustainable development
7.14 Gaps in knowledge and data
7.15 Frequently asked questions

Chapter 8: Transport

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition]

8.1 Freight and passenger transport (land, air, sea and water)
    8.1.1 Goals and context of chapter
    8.1.2 Summary of AR4
    8.1.3 Passenger and freight transport energy demand by mode
    8.1.4 Direct and indirect emissions,
    8.1.5 Greenhouse gas emissions by mode
8.2 New developments in emission trends and drivers
    8.2.1 Drivers and trends in CO2 emissions
    8.2.2 Non-CO2 greenhouse gases, black carbon and aerosols
8.3 Mitigation technology options, practices and behavioural aspects
    8.3.1 Incremental vehicle technologies
    8.3.2 New propulsion systems
    8.3.3 Fuel options
    8.3.4 Practices and behavioural issues
    8.3.5 Comparative analysis
8.4 Infrastructure and systemic perspectives
    8.4.1 Path dependencies of transport infrastructures
    8.4.2 Path dependencies of technologies
    8.4.3 Path dependencies of urban form and mobility
8.5 Climate change feedback and interaction with adaptation
    8.5.1 Changes in emissions due to changes in in environmental conditions of combustion
    8.5.2 Impact of accessibility and feasibility of transport routes
    8.5.3 Impact of extreme weather events on transport
8.6 Costs and potentials
    8.6.1 Activity effect component
    8.6.2 Structure effect component
    8.6.3 Energy intensity effect component
    8.6.4 Carbon intensity effect component

8.7 Technological, environmental and other risks and uncertainties; and social acceptability
    8.7.1 Technological risks
    8.7.2 Environmental risks
    8.7.3 Social acceptability
8.8 Co-benefits, trade-offs, spill-over effects
    8.8.1 Co-benefits
    8.8.2 Trade-offs
    8.8.3 Spill-over effects
8.9 Barriers and opportunities
    8.9.1 Major possibilities for transport technologies and practices to reduce GHG
    8.9.2 Barriers
    8.9.3 Opportunities
8.10 Sectoral implications of transformation pathways and sustainable development
    8.10.1 Interaction between transport and sustainable development
    8.10.2 Implications of transformation pathways on sustainable development
8.11 Sectoral policies
    8.11.1 Road transport
    8.11.2 Rail transport
    8.11.3 Marine transport
    8.11.4 Aviation
    8.11.5 Infrastructure and urban planning
    8.11.6 Mobility access and sustainable development
8.12 Gaps in knowledge and data
8.13 Frequently asked questions

Chapter 9: Buildings

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition]

9.1 Introduction
9.2 New developments in emission trends and drivers
    9.2.1 GHG emission trends from buildings by region
    9.2.2 Buildings energy use trends by region, end-use and building type
    9.2.3 Identification of main drivers of building-originated emissions
    9.2.4 Changing housing/construction/ consumption patterns in developing countries
    9.2.5 Culture, occupant behaviour, lifestyle, service levels
9.3 Mitigation technology options and practices, behavioural aspects
    9.3.1 Summary of mitigation options
    9.3.2 Significant technological developments since AR4
    9.3.3 Zero energy/carbon and energy plus buildings
    9.3.4 Deep retrofits
    9.3.5 Exemplary energy buildings from around the world
    9.3.6 Affordable low-energy housing
    9.3.7 Building materials
    9.3.8 Equipment, lighting, appliances, Information and Communication Technology (ICT)
    9.3.9 Integrated radiation management and mitigation in buildings and communities
    9.3.10 Mitigation of non-CO2 emissions, an integrated perspective
    9.3.11 Non-technological mitigation options
    9.3.12 Energy management and control systems, opportunities through ICT systems and infrastructures, building operation, commissioning
    9.3.13 Cooking
9.4 Infrastructure and systemic perspectives
    9.4.1 Systems and lifecycle approaches to mitigation options
    9.4.2 Buildings-energy supply integration
    9.4.3 Integrated and holistic approaches to low-carbon buildings

9.5 Climate change feedback and interaction with adaptation
    9.5.1 The impact of climate change and climate change mitigation on building energy use
    9.5.2 Overview: synergies and trade-offs between mitigation and adaptation in buildings
    9.5.3 Radiation management through buildings
9.6 Costs and potentials, scenarios
    9.6.1 Potential for mitigation opportunities
    9.6.2 Costs of mitigation options
    9.6.3 Transformation scenarios for the building sector (shorter term)
9.7 Technological, environmental and other risks and uncertainties; and social
9.8 Co-benefits, trade-offs, spill-over effects
    9.8.1 Overview of multiple benefits, trade-offs and spill-over effects
    9.8.2 Human Health & Safety: air quality implications of high-efficiency buildings, indoor air, cooking benefits, workplace productivity
    9.8.3 Macroeconomic effects: impacts on economy, employment, income
    9.8.4 Energy security
    9.8.5 Environmental benefits: water savings, air quality
    9.8.6 Social implications: poverty alleviation, equity, distributional impacts, gender
    9.8.7 Integrating co-benefits into decision-making frameworks
9.9 Barriers
9.10 Sectoral implication of transformation pathways and sustainable development the building sector in top-down scenarios
    9.10.1 Implications of long-term transformations for the shorter-term; the lock-in effect
9.11 Sectoral policies, programs
    9.11.1 Introduction
    9.11.2 Emerging policy instruments in buildings
    9.11.3 Assessment of policy instruments in the building sector
    9.11.4 Assessment of policy packages
    9.11.5 Financing opportunities
    9.11.6 Implementation and enforcement challenges
9.12 Gaps in knowledge and data
9.13 Frequently asked questions

Chapter 10: Industry

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition]

10.1 Introduction
10.2 New developments in extractive industries, manufacturing and services (including tourism)
    10.2.1 Past trends and current status
    10.2.2 Industrial activity and its drivers
10.3 New developments in emission trends and drivers
10.4 Material substitution, material reuse and waste
10.5 Mitigation technology options, practices and behavioural aspects (including efficiency improvements, household and industry waste)
    10.5.1 Sector-wide mitigation approaches
    10.5.2 Sector specific mitigation opportunities
    10.5.3 Mining
    10.5.4 Tourism
10.6 Infrastructure and systemic perspectives
    10.6.1 Influence of boundary definitions on effectiveness of mitigation policy
    10.6.2 Intercompany cooperation (national/ transnational)
    10.6.3 Increasing material efficiency through system integration
    10.6.4 Industry infrastructure and clusters
    10.6.5 Cross sectoral aspects
    10.6.6 Limitations of linking strategies

10.7 Climate change feedback and interaction with adaptation
    10.7.1 Impacts of climate change
    10.7.2 Trade-offs and synergies
10.8 Costs and potentials
    10.8.1 Definitions
    10.8.2 CO2: energy efficiency, energy input switch
    10.8.3 Non-CO2 gases
    10.8.4 Material substitution, material efficiency and material recycling
    10.8.5 Summary of costs and potentials in the industrial sector
10.9 Technological, environmental and other risks and uncertainties, and social acceptability
    10.9.1 Technological
    10.9.2 Environmental
    10.9.3 Other risks and uncertainties
    10.9.4 Social acceptability
10.10 Co-benefits, trade-off effects, spill-over effects
    10.10.1 Co-benefits
    10.10.2 Trade-off effects
    10.10.3 Spill-over effects
10.11 Barriers and opportunities (technological, physical, financial, institutional, cultural, legal, etc.)
    10.11.1 Challenges and opportunities for urban/industrial symbiosis
    10.11.2 Technology
    10.11.3 Physical
    10.11.4 Institutional
    10.11.5 Social
    10.11.6 Investment
10.12 Sectoral policies
    10.12.1 Sector-wide policies
    10.12.2 Supportive instruments
    10.12.3 Sector-specific policies
    10.12.4 Consumption-side policies (for commercial products, services)
10.13 Sectoral Implications on transformation pathways and sustainable development
    10.13.1 Sustainable development
    10.13.2 Assessment of pathways, feasibility of pathways from sectoral perspective, long term mitigation options, technology deployment, system transitions
10.14 Gaps in knowledge and data
10.15 Frequently asked questions

Chapter 11: Agriculture, Forestry and Other Land Use (AFOLU)

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition]

11.1 Introduction
11.2 New developments in emission trends and drivers
    11.2.1 Production and consumption trends in agriculture and forestry
    11.2.2 Trends of C fluxes from different land use and land use change
    11.2.3 Trends of non-CO_2 GHG emissions from agriculture
    11.2.4 REDD+ activity
11.3 Mitigation technology options and practices, and behavioural aspects
    11.3.1 Introduction
    11.3.2 Mitigation effectiveness (non-permanence: human and natural impacts; displacement; saturation)
    11.3.3 Sustainable development and behavioural aspects
11.4 Infrastructure and systemic perspectives
    11.4.1 Introduction – overall approach and key messages
    11.4.2 Systemic perspectives (including integrated land-use assessment)
    11.4.3 Sustainable development and behavioural aspects

11.5 Climate change feedback and interaction with adaptation (includes vulnerability)
    11.5.1 Synergies, trade-offs and interactions with adaptation and other mitigation options
    11.5.2 Climate change feedback, natural disturbance and extreme events
11.6 Costs and potentials
11.7 Technological, environmental and other risks and uncertainties; and social acceptability (complementary to risks associated with climate change)
    11.7.1 Possible risks to other climate drivers
    11.7.2 Possible risks to non-climate drivers
    11.7.3 Mitigation practices and ecosystem services
11.8 Co□benefits, trade□offs, spill□over effects
11.9. Barriers and opportunities
11.10 Sectoral implications of transformation pathways and sustainable development
11.11 Sectoral policies
    11.11.1 Forests
    11.11.2 Agriculture
11.12 Gaps in knowledge and data
11.13 Frequently asked questions

Chapter 12: Human Settlement, Infrastructure and Spatial Planning

[Note: All sections should consider regional specificities including as appropriate to developed and developing countries and economies in transition]

12.1 Introduction
12.2 Human settlements and GHG emissions
    12.2.1 Range of human settlement types
    12.2.2 Urbanization and emissions trends
    12.2.3 Drivers and process of urban development
12.3 Urban form and infrastructure
    12.3.1 Form, density, structure and fragmentation
    12.3.2 Built environments and material composition
    12.3.3 Land use and regional planning
    12.3.4 Behaviour as driver and consequence of urban form
    12.3.5 Barriers and opportunities
12.4 Urban systems: activities, resources, and performance
    12.4.1 Conceptual framing of urban systems and GHG implications
    12.4.2 Urban sectors and options for reducing direct emissions
    12.4.3 Urban system external linkages and options for reducing embedded/indirect emissions
    12.4.4 Mitigation opportunities of direct and indirect emissions of urban systems
12.5 Spatial planning and climate change mitigation
    12.5.1 Integrated spatial planning
    12.5.2 Urban strategies for mitigation (intro pointing out opportunities for new/future cities vs. existing cities)
    12.5.3 Implementation instruments
    12.5.4 Barriers and opportunities
12.6 Governance, institutions, and finance
    12.6.1 Local governance and responses to climate change
    12.6.2 The role of sub-national governments in urban mitigation
    12.6.3 The role of civil society organizations
    12.6.4 Private sector initiatives
    12.6.5 Financing urban mitigation
    12.6.6 Barriers and opportunities for the governance of urban mitigation
12.7 Urban climate change mitigation: experiences and opportunities
    12.7.1 Urban climate mitigation plans and implementation
    12.7.2 Low carbon cities
    12.7.3 Eco-cities

12.7.4 Synergies between climate change mitigation and economic growth
12.8 Sustainable development, co-benefits, trade-offs, and spill-over effects
12.8.1 Sustainable development challenges at the urban scale
12.8.2 Co-benefits and trade-offs of sustainable development strategies
12.8.3 Co-benefits and adaptation synergies of mitigating the Urban Heat Island
12.8.4 Urban carbon sinks
12.9 Gaps in knowledge and data
12.10 Frequently asked questions

Chapter 13: International Cooperation: Agreements & Institutions

13.1 Introduction
13.2 Framing concepts and an assessment of means for international cooperation
13.3 International agreements: examples and lessons for climate policy
13.4 Climate policy architectures
13.5 Multilateral and bilateral agreements and institutions across different scales
13.6 Linkages between international and national policies
13.7 Linkages between international and regional cooperation
13.8 Interactions between climate change mitigation policy and trade
13.9 Mechanisms for technology and knowledge development, transfer, diffusion
13.10 Capacity building
13.11 Investment and finance
13.12 The role of public and private sectors and public-private partnerships
13.13 Performance assessment on policies and institutions including market mechanisms
13.14 Frequently asked questions

Chapter 14: Regional Development and Cooperation

14.1 Introduction
14.2 Development Trends and their emission implications at the regional level
14.2.1 Overview of trends in economic development and GHG emissions
14.2.2 Energy and development
14.2.3 Urbanisation and development
14.2.4 Consumption and production patterns in the context of development (including role of structural change and trade)
14.2.5 Production and development
14.3 Options, Policies, and Mechanisms for mitigation at the regional level
14.3.1 Reconciling development and low carbon options and policies at the regional level
14.3.2 Technology development and transfer, including the role of public and private sectors and public private partnerships (leapfrogging)
14.3.3 Investment and finance, including the role of public and private sectors and public private partnerships
14.4 Evaluating existing regional experiences
14.4.1 Participation in climate-specific policy instruments, evaluation (e.g. CDM)
14.4.2 Focus on existing regional cooperation processes and their mitigation impacts
14.4.3 Climate-relevant Investment and finance (including FDI)
14.4.4 Technology development and transfer (leapfrogging)
14.5 Taking Stock and Options for the future
14.5.1 Opportunities and barriers for different regions and regional cooperation
14.5.2 Options for the future
14.6 Frequently asked questions

Chapter 15: National and Sub-national Policies and Institutions

15.1 Introduction
15.2 Characteristics and classification of policy instruments and packages
- 15.2.1 Criteria for assessment of policy instruments
- 15.2.2 Climate policies and other energy policy objectives
- 15.2.3 Regulations and standards
- 15.2.4 Taxes and charges including border adjustments and subsidy reductions
- 15.2.5 Tradable permits
- 15.2.6 Voluntary agreements
- 15.2.7 Information policies
- 15.2.8 Land and infrastructure planning
- 15.2.9 Multi-objective policies
- 15.2.10 Policy packages

15.3 Institutions and Governance
- 15.3.1 Introduction
- 15.3.2 Models of governance
- 15.3.3 Institutions, governance and policies
- 15.3.4 Appropriateness of current institutions and governance
- 15.3.5 The role of public and private sectors and public-private partnership

15.4 The role of stakeholders including NGOs
- 15.4.1 Introduction
- 15.4.2 Theories of stakeholder interaction

15.5 National, state and local linkages
- 15.5.1 Introduction
- 15.5.2 Current status
- 15.5.3 Theoretical consideration
- 15.5.4 Niche and social experiments
- 15.5.5 Ex-post analyses

15.6 Approaches and tools used to evaluate policies and institutions
- 15.6.1 Methods and approaches for policy assessment

15.7 Assessment of the performance of policies and measures, including their policy design, in developed and developing countries taking into account development level and capacity
- 15.7.1 Introduction
- 15.7.2 Regulations and standards
- 15.7.3 Taxes and charges and removal of subsidies including border adjustments
- 15.7.4 Tradable permits
- 15.7.5 Voluntary agreements
- 15.7.6 Information policies
- 15.7.7 Other policies having impacts to GHGs emissions
- 15.7.8 Co-benefits: assessment of non-climate outcome and relevance to sustaining those policies
- 15.7.9 Impact of technological and institutional infrastructure on the effectiveness of policy
- 15.7.10 Conclusion

15.8 Technology policy and R&D policy
- 15.8.1 Public funding of research
- 15.8.2 Human capital/ training
- 15.8.3 Public purchase of low-carbon technologies
- 15.8.4 Purchase mandates/deployment targets
- 15.8.5 Intellectual property rights

15.9 Synergies and trade-offs among policies
- 15.9.1 Interaction of technology policies and GHG reduction policies
- 15.9.2 Other Interactions
- 15.9.3 Interactions of different polices at different national level
- 15.9.4 Mainstreaming mitigation into multi objective policies

15.9.5 Inter-linkage of non-climate policy goals with mitigation measures to widen policy goals
15.9.6 Options for mainstreaming
15.10 Capacity building
15.10.1 Capacity to Mitigate
15.10.2 Capacity to Formulate Policies
15.10.3 Capacity to Implement Policies
15.10.4 Capacity to Evaluate Policies
15.11 Links to adaptation
15.11.1 Introduction
15.11.2 Mitigative capacity and adaptation capacity link
15.11.3 Provision of local public good by government as ways to mitigate and adapt simultaneously
15.11.4 Multi-objective analysis
15.11.5 Mainstreaming mitigation and adaptation to development policies
15.11.6 Land use planning effects on mitigation and adaptation.
15.12 Investment and finance
15.12.1 Introduction
15.12.2 Any policies change direction of investments by public and private sectors
15.12.3 Climate policy governmental budget in comparison with other budget that have climate consequence
15.12.4 Role of Green investment index
15.12.5 Information/ finance/ consultation package to promote efficiency including public and private sectors, at individual level
15.13 Frequently asked question

Chapter 16: Cross-Cutting Investment and Finance Issues

16.1 Financing low carbon investments, opportunities and key drivers
16.1.1 Rationale of this chapter
16.1.2 Opportunities for mitigation, drivers and co-benefits
16.1.3 Public and private sector perspectives and motivations
16.1.4 Roadmap to the chapter
16.2 Enabling environments
16.2.1 Development strategies and policy goals
16.2.2 Barriers and frameworks
16.3 Scale of financing at national, regional and international level in short-, mid- and long-term
16.3.1 Methodology
16.3.2 Country/Region assessment
16.3.3 International aggregation of needs
16.4 Financing developed countries' mitigation activities
16.4.1 Sources
16.4.2 Financial instruments: Conventional and innovative
16.4.3 Sector specifics
16.5 Financing mitigation activities in and for developing countries
16.5.1 Sources
16.5.2 Financial instruments: Conventional and innovative
16.5.3 Sector specifics
16.6 Financing technology development and transfer
16.6.1 Funding approaches for development
16.6.2 Transfer
16.7 Institutional arrangements for mitigation financing
16.7.1 Local level
16.7.2 National level
16.7.3 International level

16.8 Synergies and trade-offs between financing mitigation and adaptation
    16.8.1 Multiple benefits and trade-offs related to finance
    16.8.2 Integrated approaches
16.9 Frequently asked questions