### 28<sup>th</sup> AIM International Workshop 13 & 14<sup>th</sup> September 2022

# Sustainable Development and Mitigation of Climate Change: IPCC (AR6)

Co-Chairs, Working Group III, Intergovernmental Panel on Climate Change (IPCC)

### PRIYADARSHI SHUKLA & JIM SKEA

**IDCC** INTERGOVERNMENTAL PANEL ON Climate change



### J. SKEA CO-CHAIR, WG III

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### **Sixth Assessment Report** WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

## **Report by numbers**

![](_page_2_Picture_2.jpeg)

![](_page_2_Picture_3.jpeg)

**65** Countries

![](_page_2_Picture_5.jpeg)

![](_page_2_Picture_6.jpeg)

29 % Women / 71 % Men

More than 18,000 scientific papers

![](_page_2_Picture_9.jpeg)

![](_page_2_Picture_10.jpeg)

41 % Developing countries 59 % Developed countries

354 Contributing authors

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![](_page_2_Picture_15.jpeg)

59,212 Review comments

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![](_page_2_Picture_19.jpeg)

**10CC** INTERGOVERNMENTAL PANEL ON Climate change

### Climate Change 2022 Mitigation of Climate Change

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Working Group III contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

![](_page_3_Picture_5.jpeg)

[Matt Bridgestock, Director and Architect at John Gilbert Architects]

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2010-2019: Average annual greenhouse gas emissions at highest levels in human history

![](_page_3_Picture_9.jpeg)

### We are not on track to limit warming to 1.5 °C.

![](_page_4_Figure_2.jpeg)

# 

![](_page_4_Picture_4.jpeg)

### Sixth Assessment Report WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

### ...but there is increased evidence of climate action

[Charlie Chesvick/IStock.com]

![](_page_5_Picture_3.jpeg)

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# Unless there are immediate and deep emissions reductions across all sectors, 1.5°C is beyond reach.

![](_page_6_Picture_3.jpeg)

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### Increased evidence of climate action

![](_page_7_Picture_2.jpeg)

Some countries have achieved a steady decrease in emissions consistent with limiting warming to 2°C.

![](_page_7_Picture_4.jpeg)

### IPCC @@

![](_page_7_Picture_6.jpeg)

Zero emissions targets have been adopted by at least 826 cities and 103 regions

![](_page_7_Picture_8.jpeg)

There are options available now in every sector that can at least halve emissions by 2030

![](_page_8_Picture_1.jpeg)

![](_page_8_Picture_2.jpeg)

![](_page_8_Picture_3.jpeg)

![](_page_8_Picture_4.jpeg)

![](_page_8_Picture_5.jpeg)

Industry

# 

**B** 

### **Demand and services**

![](_page_8_Picture_10.jpeg)

![](_page_8_Picture_11.jpeg)

![](_page_8_Picture_12.jpeg)

### Buildings

![](_page_8_Picture_14.jpeg)

### Transport

![](_page_8_Picture_16.jpeg)

![](_page_9_Picture_0.jpeg)

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### **Demand and services**

- potential to bring down global emissions by 40-70% by 2050
- walking and cycling, electrified transport, reducing air travel, and adapting houses make large contributions
- lifestyle changes require systemic changes across all of society
- **some** people require additional housing, energy and resources for human wellbeing

![](_page_9_Picture_7.jpeg)

![](_page_9_Picture_8.jpeg)

![](_page_9_Picture_10.jpeg)

# Energy

- major transitions are required to limit global warming
- reduction in fossil fuel use and use of carbon capture and storage
- low- or no-carbon energy systems
- widespread electrification and improved energy efficiency
- alternative fuels: e.g. hydrogen and sustainable biofuels

![](_page_10_Picture_7.jpeg)

[Portland General Electric CC BY-ND 2.0, Harry Cunningham/Unsplash, Stéphane Bellerose/UNDP in Mauritius and Seychelles CC BY-NC 2.0, IMF Photo/Lisa Marie David, Tamara Merino CC BY-NC-ND 2.0]

![](_page_10_Picture_9.jpeg)

![](_page_11_Picture_0.jpeg)

# 

### Land use

- can provide large-scale emissions reductions and remove and store CO<sub>2</sub> at scale
- protecting and restoring natural ecosystems to remove carbon: forests, peatlands, coastal wetlands, savannas and grasslands
- competing demands have to be carefully managed
- cannot compensate for delayed emission reductions in other sectors

![](_page_11_Picture_9.jpeg)

![](_page_11_Picture_10.jpeg)

### Industry

- using materials more efficiently, reusing, recycling, minimising waste; currently under-used in policies and practice
- basic materials: low- to zero-greenhouse gas production processes at pilot to near**commercial** stage
- achieving **net zero** is challenging

![](_page_12_Picture_5.jpeg)

[Ahsanization/Unsplash, IMF Focus | Industry and Manufacturing CC BY-NC-ND 2.0, Rwanda Green Fund CC BY-ND 2.0, ILO/M. Fossat CC BY-NC-ND 2.0, Stephen Cornwell Pxhere.com]

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![](_page_12_Picture_9.jpeg)

![](_page_12_Picture_10.jpeg)

![](_page_12_Picture_11.jpeg)

![](_page_13_Picture_0.jpeg)

![](_page_13_Picture_1.jpeg)

### **Cities and urban areas**

- better urban planning, as well as:
- sustainable production and consumption of goods and services,
- electrification (low-emission energy),
- enhancing carbon uptake and storage (e.g. green spaces, ponds, trees)

### There are options for existing, rapidly growing and new cities.

[Pelargoniums for Europe/Unsplash, City of St Pete CC BY-ND 2.0, Victor/Unsplash, EThekwini Municipality, Arne Müseler/arne-mueseler.com, CC BY-SA 3.0 de]

![](_page_13_Picture_9.jpeg)

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### Buildings

- buildings: possible to reach net zero emissions in 2050
- action in this decade is critical to fully capture this potential
- involves retrofitting existing buildings and effective mitigation techniques in new buildings
- requires ambitious policy packages
- zero energy and zero-carbon buildings exist in new builds and retrofits

[Pelargoniums for Europe/Unsplash, City of St Pete CC BY-ND 2.0, Victor/Unsplash, EThekwini Municipality, Arne Müseler/arne-mueseler.com, CC BY-SA 3.0 de]

![](_page_14_Picture_9.jpeg)

![](_page_14_Picture_10.jpeg)

### Transport

- reducing demand and low-carbon technologies are key to reducing emissions
- electric vehicles: greatest potential
- battery technology: advances could assist electric rail, trucks
- aviation and shipping: alternative fuels (low-emission hydrogen and biofuels) needed
- Overall, substantial potential but depends on decarbonising the power sector.

![](_page_15_Picture_7.jpeg)

![](_page_15_Picture_9.jpeg)

## **Carbon Dioxide Removal**

- required to counterbalance hard-to-eliminate emissions
- through **biological** methods: reforestation, and soil carbon sequestration
- at larger scales
- essential to achieve net zero
- agreed methods for measuring, reporting and verification required

![](_page_16_Picture_8.jpeg)

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### new technologies require more research, up-front investment, and proof of concept

[Forest Service Northern Region CC BY 2.0, Fiston Wasanga/CIFOR CC BY-NC-ND 2.0, Climeworks]

![](_page_16_Picture_15.jpeg)

### **Closing investment gaps**

- financial flows: 3-6x lower than levels needed by 2030 to limit warming to below 1.5°C or 2°C
- there is sufficient global capital and liquidity to close investment gaps
- challenge of closing gaps is widest for developing countries

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![](_page_17_Picture_7.jpeg)

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FOR RECIPIENT

THE TREASURY-INTERNAL REVENUE SERVICE

kWh/cycle based on standard test results for 60°C Actual energy consumption will depend Washing performance ABCDEF

Substitute payments in lieu of This

O Crop insur

![](_page_18_Picture_4.jpeg)

### **Policies, regulatory and** economic instruments

- Washing machine
- policy packages and economy-wide packages are able to achieve systemic change

regulatory and economic instruments

have already proven effective in

![](_page_18_Picture_11.jpeg)

ambitious and effective mitigation requires coordination across government and society

[World Bank/Simone D. McCourtie, Dominic Chavez CC BY-NC-ND 2.0, Trent Reeves/MTA Construction & Development CC BY 2.0, IMF Photo/Tamara Merino CC BY-NC-ND 2.0, Olga Delawrence/Unsplash.]

reducing emissions

![](_page_18_Picture_14.jpeg)

![](_page_18_Picture_15.jpeg)

### **Technology and Innovation**

- investment and policies push forward low emissions technological innovation
- effective decision making requires assessing potential benefits, barriers and risks
- **some options** are technically **viable**, rapidly becoming cost-effective, and have relatively high public support. Other options face barriers

**Adoption of low-emission technologies** is slower in most developing countries, particularly the least developed ones.

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# SUSTAINABLE GENALS

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Accelerated climate action is critical to sustainable development.

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### Sixth Assessment Report WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

# **Generation States of the Exidence is** clear: The time for action is now

# Climate Change 2022

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![](_page_22_Picture_7.jpeg)

[Matt Bridgestock, Director and Architect at John Gilbert Architects]

![](_page_22_Picture_9.jpeg)

### Sixth Assessment Report WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

### IPCC plans to organise an expert meeting on scenarios and 0 modelling.

### • The workshop aims at the transition for AR7 and beyond.

![](_page_23_Picture_3.jpeg)

![](_page_23_Picture_4.jpeg)

28<sup>th</sup> AIM International Workshop 13 & 14<sup>th</sup> September 2022

# INDIA'S ENERGY SYSTEM TRANSFORMATION TO NET ZERO

PRIYADARSHI SHUKLA, Distinguished Professor, Ahmedabad University, India

SHIVIKA MITTAL, Imperial College London, UK

![](_page_24_Picture_4.jpeg)

Imperial College London

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![](_page_25_Picture_0.jpeg)

### **AIM'S CONTRIBUTION IN SCIENTIFIC ADVANCEMENT**

Springer Link

Published: 13 August 2011

### An emission pathway for stabilization at 6 Wm<sup>-2</sup> radiative forcing

Toshihiko Masui 🗠, Kenichi Matsumoto, Yasuaki Hijioka, Tsuguki Kinoshita, Toru Nozawa, Sawako Ishiwatari, Etsushi Kato, P. R. Shukla, Yoshiki Yamagata & Mikiko Kainuma

<u>*Climatic Change*</u> **109**, Article number: 59 (2011) <u>Cite this article</u>

5947 Accesses 215 Citations 75 Altmetric Metrics

	Level of inclusion
AIM has contributed to the IPCC AR6 Cycle	Endogenous Exogenous Not represented
(Source: Annex III, WGIII Report, IPCC)	Energy officiency impr
	Energy efficiency impr
	Electrification of
	Electrification
	CCS in ir

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NIES has been instrumental over past two decades to lead forward climate modeling especially in the Asia-Pacific

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energy demand for buildings	Α	С	A	С	А	С	А	А	А	А	А	А	А	А	А	А	А	А	А	С		В	А	А	В	В	А	А	A			
of industrial energy demand	А	С	A	C	A	С	С	А	А	А	А	А	А	С	А	А	А	А	А	С		В	А	А	В	В	А	А	A			
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![](_page_26_Picture_11.jpeg)

### **INDIA'S CLIMATE POLICIES**

• At COP26 India pledged and updated its NDC targets:

- To reach net-zero carbon emissions by 2070.
- To reduce emissions intensity of GDP by 45 percent by 2030, from 2005 level.
- To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.
- We assessed current policies and net zero scenarios using Stakeholder inputs and AIM/CGE model.

### **Current Policies Scenarios**

![](_page_28_Figure_2.jpeg)

### EMISSIONS

![](_page_28_Figure_4.jpeg)

### **Net-Zero Scenarios**

### ELECTRICITY GENERATION MIX

### **Current Policies Scenarios**

![](_page_29_Figure_2.jpeg)

A shift away from coal will pose important political economy questions for coaldependent States

### **Net-Zero Scenarios**

### **KEY FINDINGS**

- industrial opportunities.
- Much-reduced threat of potentially catastrophic climate outcomes, assuming the world transitions to Net Zero with India.
- The energy system requires significant changes in net zero scenario (CCS) technology.
- the emissions from economic growth.

• Near-term macroeconomic costs will have to be balanced against new

with high reliance on renewable energy and carbon capture and storage

Electrification of end use sector plays an important role for decoupling

![](_page_31_Picture_0.jpeg)

# Thank You