CEEW
THE COUNCIL

EDF
ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

SHAKTI
SUSTAINABLE ENERGY FOUNDATION

Mitigation Instruments for Achieving India's Climate and Development Goals

A White Paper
by the Working Group on Mitigation Instruments

October | 2019

Image: iStock

Mitigation Instruments for Achieving India's Climate and Development Goals

Working Group on Mitigation Instruments

White Paper
October 2019
ceew.in

Disclaimer: The views expressed in this work are those of the Working Group members and do not necessarily reflect the views and policies of the CEEW and Environmental Defense Fund (EDF). The views/ framework expressed in this white paper do not necessarily reflect the views of Shakti Sustainable Energy Foundation (SSEF).

Suggested citation: WGMI. 2019. *Mitigation Instruments for Achieving India's Climate and Development Goals: A White Paper by the Working Group on Mitigation Instruments.* New Delhi: Council on Energy, Environment and Water (CEEW) and Environmental Defense Fund (EDF).

Editor: Dr Arunabha Ghosh, Chief Executive Officer, CEEW.

Cover image: iStock

Publication team: Alina Sen (CEEW), Mihir Shah (CEEW), Twig Designs, and Friends Digital.

Organisations: The **Council on Energy, Environment and Water** (ceew.in) is one of South Asia's leading not-for-profit policy research institutions. The Council uses data, integrated analysis, and strategic outreach to explain and change the use, reuse, and misuse of resources. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions and engages with the wider public. In 2019, CEEW has once again been featured across nine categories in the *2018 Global Go To Think Tank Index Report.* It has also been consistently ranked among the world's top climate change think tanks. Follow us on Twitter @CEEWIndia for the latest updates.

Environmental Defense Fund (edf.org), a leading international nonprofit organization, creates transformational solutions to the most serious environmental problems. EDF links science, economics, law and innovative private-sector partnerships. Connect with us on EDF Voices, Twitter and Facebook.

Shakti Sustainable Energy Foundation works to strengthen the energy security of the country by aiding the design and implementation of policies that encourage energy efficiency, renewable energy and sustainable transport solutions, with an emphasis on subsectors with the most energy saving potential. Working together with policy makers, civil society, academia, industry and other partners, we take concerted action to help chart out a sustainable energy future for India (www.shaktifoundation.in).

Council on Energy, Environment and Water
Sanskrit Bhawan, A-10, Qutab Institutional Area
Aruna Asaf Ali Marg, New Delhi - 110067, India

About CEEW

The Council on Energy, Environment and Water (CEEW) is one of South Asia's leading not-for-profit policy research institutions. The Council uses data, integrated analysis, and strategic outreach to explain – and change – the use, reuse, and misuse of resources. The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with the wider public.

In 2019, CEEW once again featured extensively across nine categories in the *2018 Global Go To Think Tank Index Report,* including being ranked as South Asia's top think tank (15th globally) with an annual operating budget of less than USD 5 million for the sixth year in a row. CEEW has also been ranked as South Asia's top energy and resource policy think tank in these rankings. In 2016, CEEW was ranked 2nd in India, 4th outside Europe and North America, and 20th globally out of 240 think tanks as per the ICCG Climate Think Tank's standardised rankings.

In nine years of operations, The Council has engaged in over 230 research projects, published over 160 peer-reviewed books, policy reports and papers, advised governments around the world nearly 530 times, engaged with industry to encourage investments in clean technologies and improve efficiency in resource use, promoted bilateral and multilateral initiatives between governments on 80 occasions, helped state governments with water and irrigation reforms, and organised nearly 300 seminars and conferences.

The Council's major projects on energy policy include India's largest multidimensional energy access survey (ACCESS); the first independent assessment of India's solar mission; the Clean Energy Access Network (CLEAN) of hundreds of decentralised clean energy firms; the CEEW Centre for Energy Finance; India's green industrial policy; the USD 125 million India-U.S. Joint Clean Energy R&D Centers; developing the strategy for and supporting activities related to the International Solar Alliance; designing the Common Risk Mitigation Mechanism (CRMM); modelling long-term energy scenarios; energy subsidies reform; energy storage technologies; India's 2030 Renewable Energy Roadmap; energy efficiency measures for MSMEs; clean energy subsidies (for the Rio+20 Summit); Energy Horizons; clean energy innovations for rural economies; community energy; scaling up rooftop solar; and renewable energy jobs, finance and skills.

The Council's major projects on climate, environment and resource security include advising and contributing to climate negotiations in Paris (COP-21), especially on the formulating guidelines of the Paris Agreement rule-book; pathways for achieving NDCs and Mid-century Strategy for decarbonisation; assessing global climate risks; heat-health action plans for Indian cities; assessing India's adaptation gap; low-carbon rural development; environmental clearances; modelling HFC emissions; the business case for phasing down HFCs; assessing India's critical minerals; geoengineering governance; climate finance; nuclear power and low-carbon pathways; electric rail transport; monitoring air quality; the business case for energy efficiency and emissions reductions; India's first report on global governance, submitted to the National Security Adviser; foreign policy implications for resource security; India's power sector reforms; zero budget natural farming; resource nexus, and strategic industries and technologies; and the Maharashtra-Guangdong partnership on sustainability.

The Council's major projects on water governance and security include the 584-page *National Water Resources Framework Study* for India's 12th Five Year Plan; irrigation reform for Bihar; *Swachh Bharat;* supporting India's *National Water Mission;* collective action for water security; mapping India's traditional water bodies; modelling water-energy nexus; circular economy of water; participatory irrigation management in South Asia; domestic water conflicts; modelling decision making at the basin-level; rainwater harvesting; and multi-stakeholder initiatives for urban water management.

About EDF

Guided by science and economics, Environmental Defense Fund (EDF) tackles urgent threats with practical solutions.

Our people: EDF is one of the world's largest environmental organizations, with more than 2.5 million members and a staff of 700 scientists, economists, policy experts, and other professionals around the world.

Our values: EDF believes prosperity and environmental stewardship must go hand in hand. EDF builds strong partnerships across interests to ensure lasting success.

Our focus: EDF addresses today's most urgent environmental challenges. Working in partnership with others, EDF focuses where it is best positioned to help, based on its strengths.

Acknowledgments

We acknowledge with deep gratitude the contributions made by the esteemed members of the Working Group on Mitigation Instruments (WGMI). Your knowledge sharing, reviews and feedback right from the inception of this exercise have helped shape this paper tremendously. Thank you for taking out the time to contribute to this joint effort of developing a framework of mitigation instruments for India.

The Council would like to thank Shakti Sustainable Energy Foundation (SSEF) for their support to this project. We are grateful to the Environmental Defense Fund (EDF) for their continued support throughout the project as collaborators.

We thank Dr Nathaniel Owen Keohane, Senior Vice President, Climate, EDF for his views on the potential and prospects of an emissions trading system (ETS) for India. We thank Dr Ruben Lubowski, Chief Natural Resource Economist, EDF, for providing valuable views on mitigation instruments. We are also grateful to Dr Suzi Kerr, Chief Economist, EDF; and Dr Kenneth Robert Richards, Professor, Indiana University; for their views on ETS and carbon taxes in India, respectively. We thank Dr P. C. Maithani, Adviser, MNRE, and Mr Andrew Howard, Independent Consultant, Koru Climate, for their views on Article 6 of the Paris Agreement.

We thank Ms Aparajita Agarwal, TATA Steel Ltd; Mr Hitesh Kataria, Mahindra & Mahindra Ltd; Ms Tamiksha Singh, TERI; Mr Siddharth Chatpaliwar and Ms Arshpreet Kalsi (earlier with SSEF) for their comments and feedback during the Working Group meetings.

We are indebted to the CEEW team – particularly, Dr Arunabha Ghosh – for editing the white paper, and providing us with valuable comments. Thanks to Dr Vaibhav Chaturvedi and Ms Poonam Nagar Koti for collating ideas across the WGMI meetings and putting together this piece. Thanks also to Mr Sahil Khillan and Ms Riddhima Sethi for coordinating and arranging all the WGMI meetings. A special thanks to Ms Alina Sen for managing the production of this white paper and to Mr Mihir Shah for his continous guidance on outreach. Our work would not be easy without the technical assistance of Mr Sachin Kaundal, we thank him for arranging the video conferencing and the technical processes that enabled the meetings to go on successfully.

From the Working Group members

"It is expected that during the next 15 years, India will add new infrastructure, industry, and appliances that are equal to that we have added over the past three decades. It is absolutely crucial that new additions are climate-friendly, and therefore move on the path towards zero carbon emissions. However, the change towards investments in low-carbon infrastructure, industry, and appliances needs to be accelerated, both to ensure that users benefit from lower lifetime costs and avoided stranded assets, and the world benefits from the ever-increasing carbon emissions from these investments. The Mitigation Instruments discussed and reported in this work could help provide the impetus for acceleration and enable a smoother transition towards a zero-carbon emissions future."

DR AJAY MATHUR
Director General, The Energy & Resources Institute (TERI)

"Climate change is both the greatest challenge and the greatest opportunity that we are experiencing. Its debilitating physical impact is becoming clearer each passing day. Mitigation instruments will slow the pace of climate change and perhaps even reverse it at some time. They will certainly help the transition to a low-carbon economy. This white paper is an in-depth study of mitigation instruments and a very useful primer for people who wish to use them effectively."

MR ANIRBAN GHOSH
Chief Sustainability Officer, Mahindra Group

"With every passing year breaking records for temperature rise and extreme weather, the need for enhanced climate action keeps growing. This will not be possible without innovative fiscal and market instruments. India's low-carbon transition will be intricately linked to its broader sustainable development priorities. The measures chosen would be contingent on their effectiveness in delivering on multiple fronts. The Working Group on Mitigation Instruments is the first step towards building an inclusive and informed dialogue on the optimum suite of options available to India."

DR ARUNABHA GHOSH
Chief Executive Officer, Council on Energy, Environment and Water (CEEW)

"WGMI brought together participants from industry and academia for free-flowing discussions to effectively navigate the oncoming climate change challenge. WGMI's white paper describing the basic framework and tenets to be adopted in India's journey on a low-carbon pathway would play a pivotal role in realising the country's climate aspirations. The steel industry will further make efforts to move towards a circular economy for achieving India's climate development goals."

MR CHANAKYA CHAUDHARY
Vice President (Corporate Services), TATA Steel Ltd

"The WGMI was a very timely and necessary initiative to examine the choices available to us on the issue of mitigation instruments. The structured manner in which the group discussions were held, where different perspectives were brought to the table, was commendable. It highlighted the complexities involved in our choice of instruments and thus the need for such deliberations. Kudos to EDF and CEEW for shepherding this initiative."

DR JAI ASUNDI
Research Coordinator, Center for Study of Science, Technology & Policy (CSTEP)

"This white paper provides a good summary of mitigation instruments with emphasis on market instruments. Market instruments should provide stakeholders incentives to act to achieve mitigation targets. Allocation of emission quotas is critical for carbon markets to function effectively to attain the targets."

DR KIRIT S. PARIKH
Chairman, Integrated Research and Action for Development, IRADe

"India will need to directly target carbon emissions mitigation to achieve the goals of deep decarbonisation. The framework proposed by the WGMI is a very useful contribution to the decarbonisation discussion, and will help India in achieving its mitigation goals within its development context."

MR KRISHAN DHAWAN
Former CEO, Shakti Sustainable Energy Foundation (SSEF)

"This paper is a serious attempt at pulling together the existing understanding on the use of economic instruments on mitigation in a coherent and consistent manner, and hopes to inspire a wider debate and public engagement on the possible pathways to feasible implementation for the Indian economy."

PROF. PURNAMITA DASGUPTA
Chair in Environmental Economics and Head, Environmental and Resource Economics Unit
Institute of Economic Growth (IEG)

"Given India's inevitable need for economy-wide emissions reductions, the Working Group on Mitigation Instruments has played an important role in understanding the tools available to achieve these reductions. Selecting the tools best suited for this task will allow India to maintain competitiveness and to continue on a path of inclusive economic growth."

MR RICHIE AHUJA
Senior Director, Global Climate, Environmental Defense Fund (EDF)

"Addressing climate change effectively requires altering the way things are being done today, especially in terms of production and consumption practices in key sectors such as energy, agriculture, transportation, etc. Developing-country specific mitigation instruments can be an effective way of addressing climate change if implemented with the right intent and scale. The design of mitigation instruments to achieve specific policy goals should not be driven by theoretical purity alone, but also by taking into consideration a range of social, political, economic, cultural and administrative challenges. The white paper has tried to refine the understanding of various mitigation instruments and check their applicability in Indian conditions, it has also provided a structured framework to assist the decision making of users."

MS SEEMA ARORA
Deputy Director General, Confederation of Indian Industry (CII)

"The theoretical aspects, including pros and cons, of various mitigation instruments are well known. How do we go about choosing the most appropriate instrument for a given policy objective through an intensive stakeholder driven process is, however, not so clear. The WGMI proposes a process for the same, and would become a strong basis for informing the narrative and choice of appropriate mitigation instruments in the Indian context."

DR VAIBHAV CHATURVEDI
Research Fellow, CEEW

Image: iStock

Contents

Figures

Tables

Abbreviations

AD	accelerated depreciation
AHP	Analytical Hierarchy Process
BAT	best available technology
BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism
CERs	certified emissions reductions
CRMM	Common Risk Mitigation Mechanism
EPIC	Energy Policy Institute at the University of Chicago
ET	emissions trading
ETS	emissions trading scheme
FiT	feed-in tariffs
GBI	generation-based incentives
GHG	greenhouse gases
HFC	hydrofluorocarbon
ICAP	International Carbon Action Partnership
ISA	International Solar Alliance
ITMOs	Internationally Transferred Mitigation Outcomes
JI	Joint Implementation
MSMEs	micro, small and medium enterprises
MWh	megawatt-hours
NCEEF	National Clean Energy & Environment Fund
NDC	nationally determined contribution
NMAs	non-market approaches
PAT	Perform, Achieve and Trade
PMR	Partnership for Market Readiness
R&D	research and development
REC	Renewable Energy Certificate
RPOs	Renewable Purchase Obligations
SCC	social cost of carbon
SEC	specific energy consumption
tCO2e	tonne of CO_2 equivalent
UNFCCC	United Nations Framework Convention on Climate Change
WGMI	Working Group on Mitigation Instruments

Executive summary

India is steadily emerging as a key player in the global energy markets as well as in climate negotiations. The submission of the 'Intended Nationally Determined Contribution' in October 2015, and the recent announcement by the Prime Minister of enhancing India's renewable energy target to 450 GW, are testimony to the fact that India is ready to place aggressive mitigation targets on the table. Although India is already doing more than its fair share in terms of mitigation, it, along with other countries, might need to take on additional targets for the world to achieve the global target of a 'well below Two Degree C temperature increase', as specified in the Paris Agreement.

India, as a developing nation, with competing priorities around limited resources, has to ensure it chooses appropriate and cost-effective options for low-carbon development. Like other countries working to mitigate greenhouse gas (GHG) emissions, India can use multiple options, such as a carbon taxes, an emissions trading scheme (ETS), or a hybrid of ETS and taxes, trading of energy efficiency and renewable energy certificates, and other sectoral policy instruments working in tandem with each other. The key question, however, is 'how does one choose an appropriate mitigation instrument in the Indian context?'

The Working Group on Mitigation Instruments (WGMI) was constituted to deliberate on the potential mitigation instruments for India, and to develop a framework to evaluate these. The WGMI comprised leaders from the industry, academia and the think-tank community.

> **India, as a developing nation, with competing priorities around limited resources, has to ensure it chooses appropriate and cost-effective options for low-carbon development**

Mitigation instruments are going to be critical for India to move towards a low-carbon economy. However, there is no clear narrative in India about the process of selection of an appropriate suite of instruments across sectors for the Indian economy. The purpose of the WGMI was to propose a framework through which such a choice could be informed as well as to initiate the development of a balanced and informed narrative that could address mitigation as well as development priorities simultaneously.

The larger objectives of the Working Group were to: (i) deliberate on the pros and cons of mitigation pathways based on alternative instruments and mechanisms; (ii) devise a framework to systematically investigate the strengths and weaknesses of these pathways with a specific focus on Indian conditions, national priorities, and developmental objectives; and (iii) engage with relevant government ministries and representatives to inform them about the analysis and key insights.

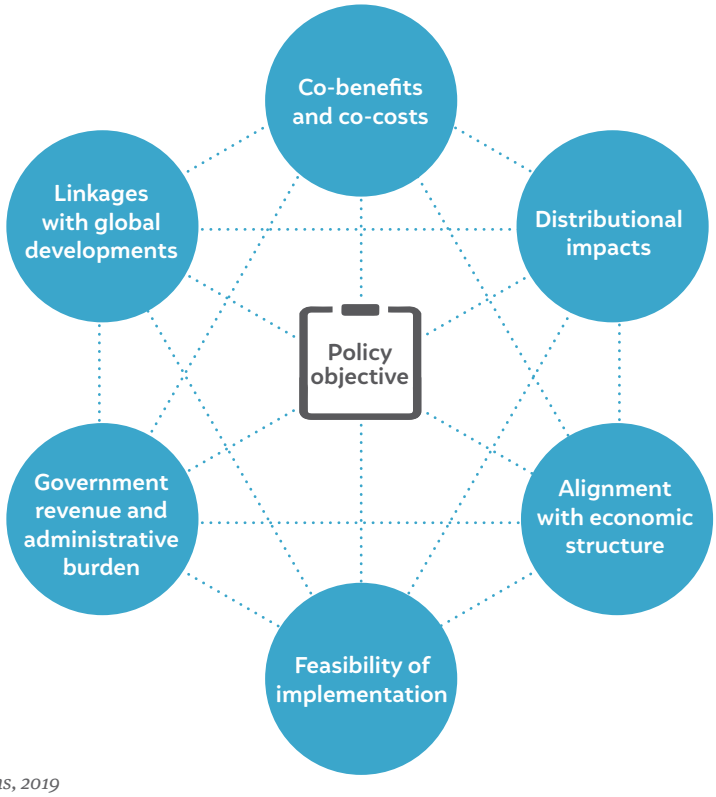
The WGMI members are experts from think-tanks, academia, and the Indian industry. The engagement was devised as a deliberative process and the outcome was shaped based on inputs by all the members. The Working Group engaged in a series of five meetings coordinated by the Council on Energy, Environment and Water (CEEW), India and the Environmental Defense Fund (EDF), USA. The agenda for each meeting was decided by the Working Group members. The group was not expected to endorse a predetermined set of ideas, but present a process that could be followed by stakeholders in India to inform and shape a larger narrative on the issue related to mitigation instruments.

The WGMI members, during the course of the discussions, chose to focus on four specific topics relevant to the debate for India: (i) Emissions Trading Scheme (ETS), (ii) Carbon tax, (iii) Article 6 of the Paris Agreement, and (iv) Company-level initiatives for emission mitigation. These topics were considered topical, policy relevant, and collectively critical for the stakeholders to understand in order to be able to inform the mitigation debate in India. Four meetings of the WGMI were focused on these topics. In terms of the process, the group invited external experts to present their views on each of these topics across four meetings. The group then discussed the issues specific to India related to each of the four topics listed above.

Based on this deliberative process, the white paper presents issues for consideration while choosing

mitigation instruments. The paper does not intend to undertake a theoretical comparison across mitigation instruments, as significant literature is already available on that (e.g. carbon tax versus emissions trading scheme). It seeks to build on this literature. The objective is not to evaluate specific instruments, but to provide a framework of comparing them, and moving towards a balanced and informed narrative. As a summary of the deliberations, the WGMI proposes a framework for choosing appropriate mitigation instruments in the Indian context. The framework has been developed with a view to align the objectives of sustainable development with GHG mitigation. The various dimensions of the framework together seek to address varying aspects and challenges of the mitigation debate in India, while providing a way to move forward towards a low-carbon economy. For any given policy objective, these key dimensions are: co-benefits and co-costs, distributional impacts, alignment with economic structure, feasibility of implementation, government revenue and administrative burden, and linkages with global developments.

Figure E1: A framework for the choice of mitigation instrument



Source: WGMI's deliberations, 2019

Finally, the WGMI suggests an approach to implement the framework, and move from theory to action. The two parts of this approach are: first, to develop an index for quantitatively valuing the alternative mitigation instruments in the context of a particular policy objective; and then, to engage with a broad stakeholder community to arrive at a representative score for alternative instruments. This could be through a Delphi process or any other alternative approach. The white paper also presents a sample case for the same.

The white paper intends to trigger a dialogue in India across stakeholders to arrive at a listing of an appropriate suite of mitigation instruments, through a structured and transparent process, for India.

It is imperative that Indian stakeholders engage in the dialogue, to best align the country's national priorities and sustainable development objectives with the long-term goals of deep decarbonisation.

1. The context: sustainable development, national priorities, and mitigation pathways

India is steadily emerging as one of the key players in global energy markets as well as in climate negotiations. The submission of the 'Intended Nationally Determined Contribution' in October 2015 showed that India is ready to place aggressive mitigation targets on the table. Earlier the Parikh committee report on low carbon strategy for inclusive growth had identified a road map to reach the goals (Planning Commission 2014) that were reflected in the October 2015 submission. Although India has been focusing on mitigation through various policies and instruments, it has communicated clearly to the world that its mitigation efforts and commitments would always be guided by its development challenges and national priorities. Development is going to be the guiding framework for a low-carbon future in India (Shukla, et al. 2015, Busby and Shidore 2016, Saxena, et al. 2017, Chaturvedi, Koti and Chordia 2018, Dubash, et al. 2018).

> **Development is going to be the guiding framework for a low-carbon future in India**

In the past few decades, there has been a marked improvement in outcomes related to basic developmental challenges like food security, health and education in India. However, other challenges have emerged during India's development journey. Air-pollution and water scarcity could be argued as the foremost externality driven challenges. Domestic manufacturing and job creation are also rapidly emerging as policy makers' top priority in India.

Along with these multiple development challenges, climate change is emerging as another important agenda in the list of policy priorities, both in India and abroad (Pahuja, Pandey and Mandal 2014, Kedia 2016, Hourcade, Pottier and Espagne 2018, Pappas, et al. 2018). Indian policy makers have highlighted many times that India has not been a part of the problem, but will be an integral part of the solution. Climate change has already started impacting the Indian economy and natural resources. Although India is already doing more than its fair share in terms of mitigation, Chaturvedi et al. (2018) highlighted that given the role of India in global carbon emissions, it along with other countries, especially high emitting nations, might need to take on additional targets for the world to achieve the global target of 'well below Two Degree C temperature increase', as specified in the Paris Agreement (UNFCCC 2015). At the same time, (Parikh, Parikh and Ghosh 2018) show that within an equitable burden sharing regime, India can live within a 1.5°C world and still grow economically meeting its human development objectives.

2. A Working Group on Mitigation Instruments (WGMI)

India, as a developing nation, with competing priorities around limited resources, has to ensure it chooses appropriate and cost-effective options for low-carbon development. Like other countries working to mitigate GHG emissions, India can use multiple options, such as a carbon tax, emissions trading scheme (ETS), or a hybrid of ETS and taxes, trading of energy efficiency and renewable energy certificates, and other sectoral policy instruments working in tandem with each other. Informed discussions among stakeholders on the design, ease of implementation, confidence in outcomes, costs & benefits, etc. of various instruments would be useful as India accelerates its efforts to promote low carbon development.

In current literature and other narratives in India, there is an absence of an informed debate in terms of the process for choosing an appropriate (or a suite of appropriate) mitigation instrument(s). For a given policy objective, there are theoretical and practical arguments for and against alternative mitigation instruments. But there has been a lack of discussion on evaluating these alternatives within the Indian context. The motivation behind creating the 'Working Group on Mitigation Instruments' was to address this gap.

The larger objectives of the working group of experts were to: (i) deliberate on the pros and cons of mitigation pathways based on alternative instruments and mechanisms, (ii) devise a framework to systematically investigate the strengths and weaknesses of these pathways with a specific focus on Indian conditions, national priorities, and developmental objectives, and (iii) engage with the relevant government ministries and representatives to inform them about the analysis and key insights. The overall goal of the working group was to initiate the development of a narrative that would be informed, balanced, and address mitigation as well as development priorities simultaneously.

The working group members are experts from the think tank community, academic experts, and representatives of Indian industry (Table 1). The engagement was devised as a deliberative process and the outcome was shaped based on inputs by all the members as the process unfolded. In the process, the working group engaged in a series of five meetings. The meetings were coordinated by the Council on Energy, Environment and Water (CEEW), India and the Environmental Defense Fund (EDF), USA. The agenda for each meeting was decided by the working group members. The group was not expected to endorse a predetermined set of ideas, but present a process that could be followed by stakeholders in India to inform and shape a larger narrative on the issue related to mitigation instruments.

> **In current literature and other narratives in India, there is an absence of an informed debate in terms of the process for choosing an appropriate (or a suite of appropriate) mitigation instrument(s)**

Table 1: List of WGMI members

S. No.	Name	Designation	Organisation
1	Dr Ajay Mathur	Director General	TERI
2	Mr Anirban Ghosh	Chief Sustainability Officer	Mahindra Group
3	Dr Arunabha Ghosh	Chief Executive Officer	CEEW
4	Mr Chanakya Chaudhury	Vice President (Corporate Services)	TATA Steel Ltd
5	Dr Jai Asundi	Research Coordinator	CSTEP
6	Dr Kirit Parikh	Chairman	IRADe
7	Mr Krishan Dhawan	Former Chief Executive Officer	SSEF
8	Prof. Purnamita Dasgupta	Chair in Environmental Economics and Head, Environmental and Resource Economics Unit	IEG
9	Mr Richie Ahuja	Senior Director, Global Climate	EDF
10	Ms Seema Arora	Deputy Director General	CII- ITC
11	Dr Vaibhav Chaturvedi	Research Fellow	CEEW

The WGMI members, during the course of the discussion, chose to focus on four specific topics relevant to the debate for India: (i) Emissions Trading Scheme (ETS), (ii) Carbon Tax, (iii) Article 6 of the Paris Agreement, and (iv) Company-level initiatives for emission mitigation. These four topics were considered to be topical, policy relevant, and collectively critical for the stakeholders to understand to inform the mitigation debate in India. Four meetings of the WGMI were focused on these topics. In terms of the process, the group invited external experts to present their views on each of these topics across four meetings. The group then discussed the issues specific to India related to each of the four topics listed above.

This white paper provides a summary of the discussions across all these four topics, and proposes a framework to evaluate appropriate mitigation instruments for India.

The discussions on the four topics were used as the basis for evolving a framework for the Indian context. The larger objective is to ignite a structured debate in India with a focus on mitigation instruments, and ultimately develop a stakeholder-driven framework to determine then course of action that supports alignment of economy wide GHG mitigation with India's multiple development priorities.

The WGMI process did not intend to do an indepth primary research on any specific mitigation instrument. The contents of this white paper are based on available literature and expert knowledge on the issue, which could give us some important insights related to mitigation instruments applied in the Indian context.

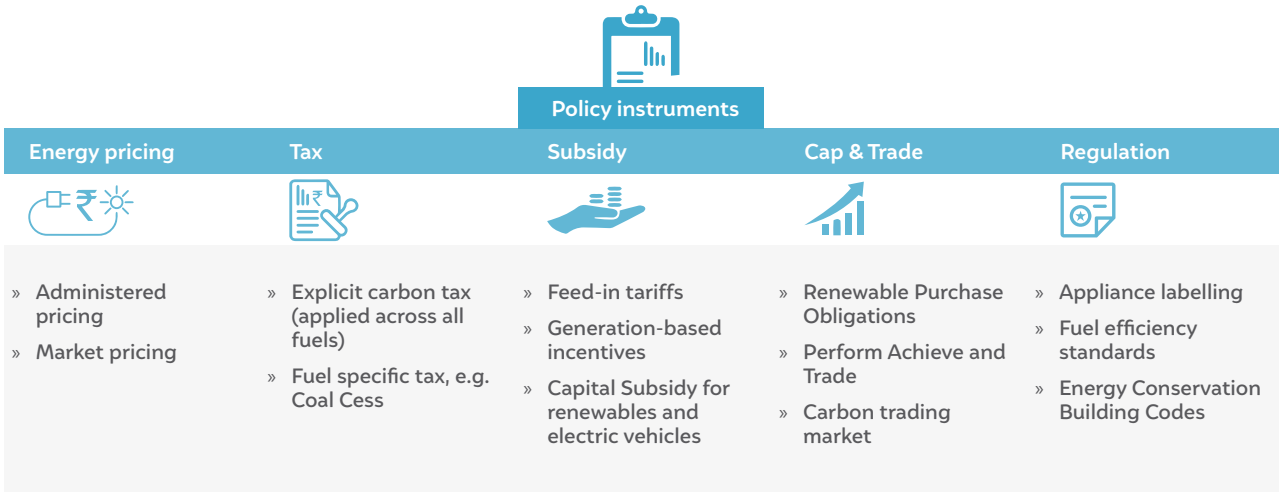
3. Mitigation instruments: landscape

The emission reduction necessarily require a broad range of policy instruments and providing a broader context within which different instruments work will contribute significantly towards evaluating the possible options. In this section, we provide an outline of the complete landscape, by defining and detailing the need of mitigation instruments. In order to understand the possibilities of adopting different instruments for future, we provide a brief overview of already adopted mitigation instruments in India.

3.1 Defining mitigation instruments

For the purpose of our debate, we define mitigation instruments as 'instruments that aim to mitigate greenhouse gases (GHG), either by explicitly valuing carbon equivalent emissions, or by implicitly reducing GHG emissions through incentives and regulations across emission sources'. Thus, as per our definition, any incentive or regulation-based instrument that reduces greenhouse gas (GHG) emissions either directly or indirectly is a mitigation instrument.

Figure 1: Different types of policy instruments



Source: Adapted from Planning Commission (2014)

3.2 Why do we need mitigation instruments?

We argue that it is critical to employ dedicated mitigation instruments that either directly or indirectly mitigate GHG emissions, to drive the Indian economy towards a low-carbon society. Mitigation policies need to be developed and deployed to give clear and long-term policy signals to investors and stakeholders. In the absence of such signals, markets will continue to be shaped by business and policy interests that might not necessarily value climate change mitigation as one of the primary goals for the society. As such, mitigation instruments intend to modify the incentive structure of markets, and drive them in the desired direction of low carbon economy. It is, hence, imperative to think about mitigation instruments in a structured way that can inform and support the transition process.

3.3 Existing mitigation instruments in India

India has been using mitigation instruments to accelerate the transition towards a low-carbon economy. Some of the key instruments that have been and are being implemented in India are: (i) Perform, Achieve and Trade (PAT), (ii) Renewable Energy Certificate (REC) trading scheme, (iii) coal cess, and (iv) sectoral incentives like feed-in tariffs (FiT), generation-based incentives (GBI), accelerated depreciation (AD) for solar and wind electricity. Since there is a good deal of literature available for these instruments, we present a short description on each.

> **Mitigation policies need to be developed and deployed to give clear and long-term policy signals to investors and stakeholders**

The PAT scheme focuses on enhancing industrial energy efficiency in India by trading energy efficiency certificates (Kumar and Agarwala 2013, Bhandari and Shrimali 2018). The scheme, announced in 2008, focuses on big energy consumers (called designated consumers) and specifies reduction targets for individual designated consumers in terms of their specific energy consumption (SEC, energy consumed per unit output), as compared to the base year value. Consumers that over-achieve their targets can sell energy efficiency certificates to consumers that under-achieve. The scheme is currently in its second phase. The REC trading scheme is a nation-wide market for trading renewable energy certificates, measured in terms of megawatt-hours (MWh) of renewable electricity produced (Kumar and Agarwala 2013, Narula 2013, Thapar, Sharma and Verma 2016). The demand for RECs is driven by the Renewable Purchase Obligations (RPOs), which mandate a specific percentage of renewable energy share in generation to be achieved by Indian states. A dedicated institutional architecture has been created to issue RECs to generating companies, who can trade these on a dedicated trading platform.

The coal cess is a clean energy cess on coal produced and imported in India, with an objective to fund clean energy in the country through the revenue collected. The revenue is collected in a dedicated fund called the National Clean Energy & Environment Fund (NCEEF). The current coal cess is at USD 5.62/tonne of coal. The cess collected during 2010-11 and 2017-18 amounts to USD 121.34 billion (Pandey 2019). Although only a fraction of the fund has been actually utilised to fund clean energy projects, the financial resource, if deployed for the intended purpose, is significant enough to play an important role in financing India's clean energy transition.

There is a plethora of sectoral incentives for promoting cleaner and efficient energy. These range from incentives for renewable energy, energy efficient appliances, to low-carbon vehicles. The sectoral incentives are both in the form of monetary incentives (like FiTs for rooftop solar or GBI and AD for wind electricity) or regulatory nudges (like star-labelling for energy efficient appliances or advance market commitments for the bulk procurement of LED bulbs to dramatically reduce their prices and increase household penetration). It is well accepted in India's energy community that these sectoral incentives have been instrumental in increasing the deployment of both solar/wind based generation in the grid, as well as energy efficient appliances. Clearly, while such sectoral incentives do not put a direct price on carbon, they have been instrumental in reducing emissions indirectly in the Indian economy.

> **Sectoral incentives do not put a direct price on carbon, they have been instrumental in reducing emissions indirectly in the Indian economy**

4. Potential mitigation instruments for meeting India's policy objectives

Four WGMI deliberations focused on different mitigation instruments for identifying the strengths and weaknesses of each with a special focus on Indian conditions, the pros and cons of alternative mitigation instruments is known in theory. The important thing is to understand and compare these within the Indian context, which will shape the choice as well as design of mitigation instruments.

4.1 Domestic emissions trading scheme (ETS)

An emissions trading scheme deals with trading in emission rights (Laing, et al. 2013, Pearse 2016, Villoria-Sáeza, et al. 2016). ETS works by establishing an overall cap on emissions in a political jurisdiction or a sector, and the industries collectively need to achieve the given emissions cap. Thereafter, both cap and trade, which have their respective merits, are linked for emission mitigation at the least cost. While an absolute cap ensures that the target will be met, which will ultimately limit pollution, trading simultaneously provides flexibility to the businesses, promotes innovation, and enables cost-effective cuts in pollution.

As of mid-2018, over 50 jurisdictions had carbon emissions trading markets in place, with many more expressing interest in moving forward to test and deploy ETS[1]. The key learning from different

1 Based on presentation by Dr Nathaniel Keohane (EDF, USA) at second WGMI meeting, 4 July 2019, New Delhi.

experiences of domestic implementation of ETS is that no one-size fits all contexts. Countries need to tailor the ETS to their own context and requirements. A well-designed greenhouse gas focused ETS system aligns with domestic/national priorities such as climate and clean energy goals, reducing air pollution, economic development and poverty alleviation, while also driving global climate action.

While evaluating the performance of an ETS system, the ultimate measure of performance should be emissions cap, not the price. Judging the performance of a carbon market by its price is a fundamental flaw in the assessment. The price of carbon is a means to achieve a mitigation target, and is not an end in itself. This is because price is a useful measure of stringency, whereas the ultimate measure of performance is the emissions cap through which mitigation will be achieved. Competitive allocation process such as reverse auctions, where vendors/sellers bids rather than buyers, could be very useful approach for price discovery, where the end goal is to cap the emissions (Ghosh, et al. 2012).

> **While evaluating the performance of an ETS system, the ultimate measure of performance should be emissions cap, not the price**

In order to increase the effectiveness of an ETS, it is clear that complementary policies are also needed. In EU-ETS, the complementary policies focus on renewable energy deployment, energy efficiency improvement, energy prices for fuel switching, and emissions reduction. Even in California, cap and trade contributes towards only a share of emission reductions. Complementary policies such as energy efficiency standards, renewable portfolio standards, building standards, incentivising public transport, and many others help the economy meet its aggregate GHG reduction targets.

Information and analysis from European and California's ETS system shows that the administrative cost of creating ETS is very low, less than 1% of the marginal cost of abatement.

Within India, a pilot emissions trading market for air pollution is already underway in the state of Gujarat (EPIC-India 2019). While this focuses on local air pollution rather than carbon dioxide emissions, the learnings are expected to be valuable for all ETSs.

Emissions Trading Scheme: Design considerations for India

Designing an ETS for India would need good understanding of operational schemes across the world. But the design architecture should draw from or consider the context of local realities. An ETS, or any policy for that matters, requires a strong foundation of data, as well as robust institutions for monitoring and implementation. Designing an ETS that is durable and has built in capacity to be responsive to changing circumstances will lead to willing compliance of facilities within the cap and trade structure. The handbook on design and implementation of ETS in practice sets out a 10-step process, and each step involves a series of decisions or actions that shape major features of the policy (PMR-ICAP 2016). The handbook draws on both conceptual analysis and on some of the most important practical lessons learned to date from implementing ETSs around the world.

Scope: The scope of emissions covered within the ETS jurisdiction needs to be defined, covering the geographic area, sectors, emissions sources, entities and GHGs for which allowances will have to be surrendered. The ETS scope defines the boundaries of the policy. It, therefore, has implications for the number of regulated entities, the share of emissions facing a carbon price, and effort sharing between the covered and uncovered sectors to meet economy-wide emissions reduction targets. For India, this would mean large energy consumers and carbon dioxide emitters would be covered, something very similar to the current coverage under the PAT scheme. India will need to think how to address emissions from its small and medium industries, either through inclusion in the ETS or through other mechanisms that leverage the ETS, if it decided to go ahead with such a system.

> **India will need to think how to address emissions from its small and medium industries, either through inclusion in the ETS or through other mechanisms that leverage the ETS, if it decided to go ahead with such a system**

Sector coverage: With complementary policies in place, within the Indian framework, the assessment was that a potential ETS would need to first cover the most emission-intensive sectors, as well as sectors that have a high impact on aggregate carbon dioxide emissions, and then extend its coverage to

less emissions-intensive sectors. The share of GHG emissions by a particular sector needs to be the basis of defining the scope in terms of sector coverage. Figure 2 shows the global experience of different ETSs in terms of sector coverage.

Figure 2: Sector coverage in existing emission trading schemes

Source: ICAP (2016)
Note: Systems in bracket indicate upstream coverage

Point of regulation: To reduce the administrative costs, some jurisdictions have placed the point of regulations as "upstream" like fuels in California, Quebec and New Zealand while others have adopted "downstream" options to align with existing regulatory systems, such as in the EU for large point sources of emissions. Placing the point of regulation as "upstream" may involve lower administrative costs because downstream emissions are generally spread across many small entities with a high transaction cost of implementing and monitoring the regulation. For example, it is easier to measure emissions at the level of refinery rather than millions of vehicles on road. Also, upstream regulation avoids risk of leakage between and within sectors. It was also argued that the ultimate emissions are calculated on the basis of carbon content of fuel, thus upstream orientation could potentially be more beneficial for India. The point of regulation is important, and needs to be debated if an ETS were chosen for India.

Co-benefits: Colombia started pricing carbon through a carbon tax, and then moved to an emissions trading system. Both of these aimed to internalise the costs that carbon emissions impose on society by placing a price on emissions while also generating co-benefits. As an experience from the Indian PAT scheme, waste utilisation across sectors has witnessed significant growth after the scheme came into operation. Understanding the potential economic, environmental and social co-benefits that could arise as a result of explicit design and implementation of an ETS could be useful for India.

> **Understanding the potential economic, environmental and social co-benefits that could arise as a result of explicit design and implementation of an ETS could be useful for India**

Type of cap: While many ETS around the world, have absolute capping mechanism, the group discussed different types of caps that could be applied in India. It was generally accepted that a decreasing absolute cap on emissions would not be appropriate for India at this stage of economic development. India could choose either an increasing cap, or a cap based on emission intensity of value added. The choice of cap would be determined by many considerations, including what is happening in the international market. Indepth research and stakeholder discussions is required to select an appropriate form of cap for India.

Permit allocation: Emission permits can be allocated either freely or via auctioning. When freely allocated, the government or ETS management authority has to decide the basis of permit allocation to various industries and allocate these accordingly. As an alternative, auctioning allows the companies to bid for allocation permits depending on their choice of how much they want to mitigate, which is itself a function of many factors.

Finally, a distinction should be made between a regular cap and trade system and what is called a **"baseline and credit system",** e.g. PAT, where a baseline is identified for each source, and the requirement is for the source to hold emissions to some percentage of that baseline. The EU-ETS is a regular cap and trade system, where there is a larger cap, and all the entities within that cap collectively need to achieve the limit.

4.2 Carbon taxes

A carbon tax explicitly states a government-generated price on GHG emissions. To meet this definition, we argue that the tax should be applied to two or more sources using the same tax rate per tonne of CO_2 equivalent (tCO_2e). This implies that any other tax prevailing in the Indian economy that is presented as a shadow carbon tax (for example the coal cess) is not really a carbon tax in the technical sense, as it is not being applied on more than one fuel at the same rate. The coal cess and excise duties on petrol and diesel are some of the measures which have been designed for the explicit purpose of revenue generation but may (under certain conditions) deliver a co-benefit of emissions mitigation.

GHG emissions mitigation is the main stated objective of a carbon tax instrument. Generally, carbon taxes are used for mitigating carbon dioxide emissions. In principle they can be used for mitigating non-CO_2 GHG emissions as well. For example, many experts have argued for reducing hydrofluorocarbon (HFC) emissions through a carbon tax. A recent paper discusses a potential carbon tax structure for India (EY 2018). For more on carbon taxes, please see (Stram 2014), (Gupta 2016), (Parry, Mylonas and Vernon 2017), (Pradhan, et al. 2017),(Partnership for Market Readiness 2017), (Gupta, Bandyopadhyay and Singh 2019).

Carbon taxes have been levied in many jurisdictions. Currently, there are 26 carbon tax systems worldwide, spanning a range of developed and developing countries, which accounted for approximately USD 33 billion in revenue in 2017. Carbon taxes have been levied on fossil fuels in Chile, Estonia, Finland, France, Iceland, Ireland, Japan, Switzerland, United Kingdom and Sweden. Countries such as Denmark, Norway and Slovenia have a tax structure over fuel and non-fuel sources of emissions. It has been estimated that by 2020, existing and planned taxes will cover about 5 per cent of CO_2 emissions. However, some countries, specifically Australia and Italy have discontinued carbon taxes due to national political reasons.

> **There are 26 carbon tax systems worldwide, spanning a range of developed and developing countries, which accounted for approximately USD 33 billion in revenue in 2017**

As an environmental tool, carbon taxes aim to induce or force decision-makers to act on the available knowledge. Their primary function is to correct externalities and directly induce changes in emissions by putting a price on carbon. They are different from other types of policy tools, mainly those that focus on research and innovation, and those that seek to address imperfect or asymmetric information. These other policy tools could be useful complements to carbon tax systems in any country. Several policy instruments can address externalities – damages borne by the society due to emissions – but a country needs

to thoroughly compare all options not only in terms of characteristics but also through the lens of political, economic, institutional and social context.

Carbon taxes: design considerations for India

Once the carbon tax is adopted as a policy choice, five different decisions must be made for a context-specific and appropriate carbon tax.

Tax base: The first step is to determine type of gases and sectors to be covered, because the GHG emissions have many sources such as fossil fuels, industrial processes, waste, agriculture and forestry. One needs to consider political feasibility, point of application (upstream or downstream), relative contributions of chosen gases and, ultimately, the difficulty faced with monitoring, reporting and verification when choosing the sectors.

Point of regulation: Determining the point of regulation affects the administrative costs because there are generally many more actors downstream than upstream, and applying tax upstream could reduce the administrative burden. The point of application is critical if there are price controls. In the absence of price controls, the price signal passes throughout the supply chain. Some sources such as forest carbon losses and methane emissions from landfills do not have an upstream part, where emissions occur on-site. Remote sensing technique is one way out to estimate emissions from large open source areas where emissions are difficult to estimate. The point of regulation is important, and needs to be debated if an ETS were chosen for India.

Tax rate: There are two considerations while determining the tax rate. First, finalising the basis of the original carbon tax rate, and second, the trajectory of tax rate over time. A wide range of tax rates has been adopted by different countries. For example, Chile, Japan, Iceland and the United Kingdom have a tax range of USD 3 to USD 16 per tCO_2e. On the other end of the spectrum, Sweden levies a carbon tax of approximately USD132 per tCO_2e. There are four basic approaches to setting the carbon tax rate. First, the social cost of carbon (SCC) approach that matches the carbon tax rate to estimates of the social costs of GHG emissions. Second, the abatement target approach, which involves choosing a carbon tax rate that is expected to result in abatement levels consistent with the jurisdiction's emission reduction objectives. Third, the revenue target approach, designed to generate a particular amount of revenue through the application of the carbon tax. Fourth, the benchmarking approach, it links the tax rate to carbon prices in other jurisdictions, particularly neighbouring countries, trading partners and competitors (Partnership for Market Readiness 2017).

Many jurisdictions adopt an increasing carbon tax over time. The tax rate might be low during the initial phase to allow market participants and the economy to adjust, and then it could be progressively increased. There are different approaches to increase the tax rate across time. First, a static carbon tax rate is a stable and highly predictable price signal. But jurisdictions might choose to index the tax rate to the rate of inflation so that the tax rate in real terms is constant (for example, Iceland). Second, gradually increasing carbon tax, to soften the impacts associated with a sudden and unpredictable emissions tax increase, by starting at a relatively low level and gradually increasing it to the long-term tax level intended (for example, France). Third, formula-based tax adjustments, to build in rate adjustments that are automatically triggered by key developments such as economic downturns, shifts in trade conditions and technological advances that might affect the SCC (for example, Switzerland). Fourth, *ad hoc* political intervention, here, Jurisdictions can allow the political process to determine the adjustments to be made to the tax rate (for example, Finland) (PMR, 2017).

Avoiding undesired impacts: Avoiding unwanted effects of the carbon taxation such as carbon leakage and negative distributional impacts is important. Carbon leakage occurs in the case of no incentive for GHG emission mitigation in neighbouring jurisdictions and can be addressed through cross-border controls and border adjustments. Negative impacts on competitiveness is one of the unwanted effects that may arise because a carbon tax increases the input cost, which puts the covered sectors at a competitive disadvantage (Ghosh 2009; 2010; 2011). Tax reduction measures such as exemptions directly reduce the amount of carbon tax to be paid. Measures such as border adjustments and consumption-based taxation is another way of reducing competitiveness within sectors in international markets. These uncertainties could be reduced through a variety of interventions, including border or cross-border adjustments and

controls, as well as fiscal reforms. On the other hand, it is argued that a carbon tax can enhance long-term competitiveness by spurring innovation and supporting low carbon economic growth.

Revenue management and distribution: Revenue management and distribution is arguably one of the most critical aspects of administering a carbon tax system. The revenue generated by carbon taxes needs to be strategically put in use. There are two basic approaches for using carbon tax revenue. The first is 'revenue neutrality', whereby the revenue collected is remitted back to households and business while reducing other taxes. It is a simple and transparent mechanism to nudge behaviour towards low-carbon choices, and is politically palatable. The second approach is to increase spending, such as using the revenue to support government initiatives and to pursue public policies. Transferring the revenue directly into the general budget, earmarking for specific uses, and using revenue to reduce debt are some of the options. Indian industry representatives emphasised the importance of judicious use of the carbon tax revenue collected. Lack of trust in the process of judicious use of tax revenue could lead to industry favouring other instruments over an explicit carbon tax.

> **Revenue management and distribution is arguably one of the most critical aspects of administering a carbon tax system**

4.3 Article 6 and international emissions trading

Article 6 of the Paris Agreement addresses different forms of international cooperation and is perhaps best known for its recognition of carbon market instruments. It fosters a global approach to addressing the challenge of climate change and is a key feature of the Agreement. It offers countries the opportunity to cooperate with one another when implementing their Nationally Determined Contributions (NDC). The Article consists of three approaches of cooperation between Parties. First, country-led cooperative approaches under Article 6.2 and 6.3; secondly, a mechanism to promote mitigation and sustainable development, under Articles 6.4 to 6.7; and thirdly, a framework for non-market approaches, discussed under Articles 6.8 and 6.9. Market mechanisms existed before the Paris Agreement, primarily under the Kyoto Protocol in the form of Joint Implementation (JI), Clean Development Mechanism (CDM), and Emissions Trading (ET). However, Article 6 tries to give a different shape to the mechanisms. For more on Article 6, please see (Calliari, Davide and d'Aprile 2016), (Marcu 2016), (EBRD 2017), (Howard, et al. 2017), (Stavins and Stowe 2017), (Webb and Wentz 2018). We discuss some important aspects related to Article 6:

Origin, evolution and progress on Article 6: Article 6 creates an incentive to increase ambition for GHG mitigation over time. Article 6.2 is about the recognition of countries' own cooperative market mechanisms and Article 6.4 creates a UNFCCC governed crediting mechanism. International cooperative markets fall within the context of Article 6, where the transfer of mitigation outcomes – often through carbon markets – to meet NDC obligations is a key issue for consideration. Transfers of mitigation outcomes provide experience with tracking and accounting that may provide helpful lessons for the guidance being set under Article 6.2. Non-market approaches (NMAs) are also addressed in the same article, although these, while being extremely important, may be less in need of an international mandate. Divergent views of different economies have refined the Article since the Paris Agreement.

Accounting and modalities of determining ITMOs: The system for transferring mitigation results from one country to count towards another country's NDC target, referred to in Article 6 as Internationally Transferred Mitigation Outcomes (ITMOs), provides an opportunity. ITMOs give a chance to countries to collaborate on mitigation action, generally by exchanging finance, technology and know-how in return for tonnes of cost-effectively achieved mitigation. This may be of particular interest to countries, which gained little from the CDM opportunity. Importantly, if mitigation has been counted as a contribution towards the host country's NDC, it would be necessary to make accounting adjustments so that these are not counted both in the host and in the partner country. This demands that a robust accounting system of double entry book keeping and corresponding adjustments should be in place for international transfers.

There are two ways of accounting for these transfers: emissions-based accounting and budget-based accounting. Under emissions-based accounting, reductions used by an acquiring country are subtracted

from the emission shown in its national emissions inventory and must be correspondingly added to the emissions total of the transferring country. Thus, the accounted emissions from the acquiring country will be lower than its actual emissions. Alternatively, adjustments may be applied in reverse to the levels of emissions allowed under NDCs, which is the budget-based accounting for transfers. These alternative accounting approaches can potentially co-exist. The adjustments themselves are also not yet clear. Ultimately, the focus should be on which ITMOs are used towards NDCs. Some accounting methods involve direct measurements of this use while others rely on transfer and acquisition information to approximate it.

Most of the countries have submitted their NDCs for a single year (2030), and a few of have multi-year targets from 2020 until 2030. The timing of accounting for the ITMOs in international trading is an issue. The following are possible options that offer consistency of accounting treatment for countries with 2030 single-year targets: (i) Vintage limitation: ITMOs transferred only in 2030 will be counted and all that happened during 2020 until 2029 will not be counted; (ii) Annualising transfers: An average of transfers between 2020 and 2030 is considered as the number of ITMOs sold or bought for meeting an NDC target for 2030; and (iii) Multi-Year trajectories: Accounting is made equivalent to cumulative accounting for multi-year NDCs over a longer period of 2020 to 2030 (NDCs would not need conversion). The essence of the Article 6 is to find the common thread in the divergent views of the countries. Generally speaking, the more flexible are the rules for Article 6, the easier it will be for countries to accept them, as long as the accounting system ensures that environmental integrity is respected.

> **The more flexible the rules for Article 6, the easier it will be for countries to accept them, as long as the accounting system ensures that environmental integrity is respected**

Relation with other articles of Paris Agreement: Coherence across the Articles of the Paris Agreement is important. Article 4, on NDCs and NDC accounting, governs relationship of actual and target (budget) emissions and also provides information needed to determine and apply adjustments. It also provides the wider context of accounting adjustments for ITMOs but is currently considerably less clearly specified than Article 6. Article 13 is about the transparency framework governing reporting content and timing and is the medium to formally communicate accounting adjustments. It is likely to mandate a tabular format to summarise all Party accounting. Article 9 has the potential for blending climate finance and market finance.

Considerations for the use of Article 6: Article 6 provides an opportunity to meet NDCs and cannot be seen in isolation. Carbon markets always look at the least cost approach for meeting the targets. A market mechanism should keep three things in mind: first, preserving environmental integrity; secondly, be fair to all parties and not to put any country at a disadvantage; and thirdly, be transparent, accountable and honoured. From past experience, certified emissions reductions (CERs) under the CDM projects were not being honoured as promised and the companies faced heavy losses.

Countries interested in receiving support for mitigation action via Article 6 need to consider several issues. Crucially, they need to consider which actions require such international support and where they can afford to give up mitigation benefits to a partner country instead of using this mitigation towards their own NDC. The need to balance international support and the export of mitigation outcomes is an important feature of Article 6 and a key difference from the CDM.

A formal international entity may be needed to measure and verify mitigation outcomes. Whatever rules are adopted at the international level, they must be robust and should give space to the countries to decide what is in their interest and what represents sustainable development. Information asymmetry is a significant bottleneck in international markets. Countries have much to gain from having clear and accessible institutional mechanisms, and governments could play an important role in creating transparent carbon markets.

Using Article 6 to reduce emissions within the scope of its NDC will mean having to make accounting adjustments so that the mitigation is not counted towards India's NDC targets. Using Article 6 outside this scope may not incur such adjustments, and the rules for this are yet to be decided.

Building trust through market mechanisms: First, countries need to understand their positions and other parties' position in the international market. There is a lot of appetite among countries for adding new frameworks and infrastructure for market mechanisms. In order to build trust and confidence in such a mechanism, a robust accounting system, transparent reporting of emissions and timely review of the process are needed. These would provide an opportunity to nudge the process and deliver the obligations that countries have signed. It also provides room for the private sector to become involved, by ensuring that appropriate cross-border adjustments are done. The risk of carbon leakage is, however, not thoroughly understood, so the circumstances in which border carbon adjustments are appropriate and workable needs to be understood. Trust in the process is paramount, and decision makers have to ensure that the process is trusted by all the stakeholders.

Sectoral vs nation-wide approach for international markets: While defining the terms of environmental integrity, a sectoral approach could be one of the ways to inform the design. An illustration of the sectoral approach could be that mitigation targets for the electricity generation sector in one country could be offset through mitigation in another country only in the electricity sector. Thus, trading is adopted within defined sectors across borders. A nationwide approach would entail that mitigation outcomes may be traded across sectors. Cost effectiveness should be a key element in this choice, but this could also be driven by sector-specific considerations. Mitigation at a large scale is important and sectoral approaches are key for this, but these are not the only options available.

> **Using Article 6 to reduce emissions within the scope of India's NDC will mean having to make accounting adjustments so that the mitigation is not counted towards India's NDC targets.**

Industrial perspective on Article 6 inclusion: Industries have technologies, which could generate ITMOs in the future. There are some breakthrough technologies such as green cluster, hydrogen technology and scrap steel production, but there is less clarity over how industries should use them in the carbon credit market. Some of the purchasing decisions are based on shadow price considerations and internal targets are being set to promote competition and reduce emissions within industrial groups. There is a lot that India has learnt from the PAT mechanism, a stepping stone that could help India in designing actions under Article 6. Industries could align their targets with India's NDC targets and also have similar targets in their own portfolios (i.e. 40% renewable energy sources to power their industries).

4.4. Company-level interventions

Companies across industries are taking a leadership role in the transition towards a low carbon economy. Policy nudges and incentives at the macro level ultimately have to translate into actions on the ground, and industry- and firm-level leadership is going to be crucial. Traditionally, companies have viewed mitigation through the lens of different categories of emissions:

(i) Scope 1: Emissions that occur directly within the company's boundaries. To control direct emissions from owned or controlled sources, most of the companies in India are considering energy efficiency as their key mitigation instrument whether voluntarily or through regulations.

(ii) Scope 2: Indirect emissions from the generation of energy purchased from other sources forms the part of scope 2 emissions, and several mitigation instruments are available for Scope 2 emissions. Green power purchase is one of the options that companies are practising.

(iii) Scope 3: All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company. The most promising approach for decarbonising Scope 3 emissions, as per the Confederation of Indian Industry, is to give incentives to suppliers to adopt more environmentally sustainable technologies and practices. This approach is most feasible in industries that have well-organised supply chains, like the auto industry. Increasingly, companies are experimenting with internal mitigation instruments, most commonly carbon pricing (WEF 2016, Ahluwalia 2017, CDP 2017, Gajjar and Adhia 2018, C. Gajjar 2018). This is an important area of analysis, to better understand the appropriate mitigation instruments for Indian companies.

WGMI deliberations on industry leadership highlighted the following key insights for thinking about mitigation

instruments within the context of industry led actions:

Any mitigation intervention and associated instrument should make business sense: The first important point to be highlighted is that the core business of any company should not be impacted because of any company level mitigation intervention and associated instrument. Unless there is a larger policy equally applicable on all competitors, businesses will be apprehensive of considering deep mitigation that could harm their business interests and competitive edge. Ideally, the mitigation instrument and choice should align well with the business interests of the company. The investment in the instrument should have a clear and certain payback period, which could motivate the company to make the choice. One such example is the PAT scheme, which has been picked up by the industries, as it enhances energy efficiency as well as saves on the energy costs for the company in the long run. Till now, these targets have been designed for large industries but small industries are also more inclined towards energy efficiency, which could be a trigger to reduce emissions. MSME sector has the potential of improving energy efficiency through institutional reforms, energy benchmarking, targeted energy audit programme, energy savings target programme (Biswas, Sharma and Ganesan, Factors Influencing the Uptake of Energy Efficiency Initiatives by Indian MSMEs 2018). Ultimately, the business should grow, while delivering on the goal of emission reduction. Some interesting questions that need to be explored are: Can carbon price reduce the effective cost of doing business? Or can carbon price enhance the competitiveness of the business? These are counterintuitive questions, but have the potential to change the narrative around internal carbon price in companies.

> **Any mitigation intervention and associated instrument should make business sense**

Focus on the Best Available Technology (BAT): Technologies are the key to mitigation. For example, at Tata Steel, implementation of best practices, adopting best available technologies, and a focus on emerging technologies forms the basis of mitigation strategy and choice of mitigation instruments. Zeroing in on the BAT is challenging and could require significant investment. For example, HIsarna technology for iron making has a lower carbon footprint, is less dependent on imports and follows the principle of circular economy, achieving zero waste through recycling, but requires significant investment in its development (Biswas, Ganesan and Ghosh 2019) Similarly, companies need to find the BAT that could help them in meeting the objectives of their respective businesses, as well as mitigation GHG emissions.

Understanding emissions inventory and future emissions trajectory: Understanding a company's baseline emissions is an essential building block for developing company level mitigation strategy. Baseline emissions imply both current emissions across all processes, as well as a long-term business-as-usual emissions trajectory depending on the potential growth trajectory of the company and the technological changes that are expected to come with time and incorporated in the company's operations. This analysis gives an idea of what are the biggest sources of emissions within a company, and how emissions from these and overall emissions are expected to grow in the next two or three decades. This information becomes a basis for action.

> **Understanding a company's baseline emissions is an essential building block for developing a company level mitigation strategy**

Science-based target setting: Targets are considered to be science-based if they are in line with the goals of the Paris Agreement, and informed by the latest climate science. World over, many companies have adopted science-based targets for mitigation as it is grounded in the latest reliable information and provides a direction in which the collective effort needs to move. For example, Tata Steel's vision is to reduce the emission intensity of steel production from 2.5-tonnes CO_2 per tonne of steel production to 1.8-tonnes CO_2 per tonne of steel production by2025. Mahindra & Mahindra intended to reduce its specific emissions by 25% by 31 March 2019 over 2016 and extend the target to further 25% in the next 3 years. Aligning internal emission reduction targets with larger targets such as net carbon neutrality by second half of the century (or sooner) or science-based targets, could be one of the ways of achieving company-level reduction while aligning with the larger objective.

Policy support is a must: Many companies are taking voluntary actions to mitigate carbon dioxide emissions. However, guidance and support through policy is

a must. Appropriate regulations should be devised to guide the industrial community, recognising that regulation achieves the desired results only if economically feasible alternatives are available. Robust scientific analysis should underpin any choice of policy and regulation, so that the objectives of the policy decision are met in reality.

A portfolio of mitigation instruments should be available: Different companies have varying contexts, as well as varying mitigation requirements. To ensure that these different needs in different contexts are addressed adequately, it is imperative that a portfolio of mitigation instruments is available to companies. Ideally, the mix of instruments should exist at a sectoral level because all instruments, be it an emissions trading scheme or an explicit carbon tax, have their merits and demerits.

Direct mitigation versus revenue generation: The experience of Indian industry with internal carbon tax has been that it is a very useful source of revenue that can be utilised for green interventions in the company, for instance to enhance energy efficiency or renewable energy in the energy portfolio. The objective of mitigation is important, rather than the value of carbon price in itself. If an internal carbon price is aligned with other measures, say purchasing renewables-based electricity from the market, the mitigation objective could be achieved even with a low internal carbon price in combination with other mitigation choices. Mitigation through a very high internal carbon price appears to be an unpopular choice within companies. Mitigation by using revenue from an internally feasible level of carbon price along with complementary mitigation choices, not driven only by a carbon price, might be more effective. This interesting practical view is inconsistent with the general view of economists that a carbon price is the most effective instrument for mitigation and the claim that a low level of carbon price would not be able to deliver deep mitigation. It is indeed logical that at a low level of carbon price, the relative choice between a low carbon option and a carbon intensive option might not change. As the price rises, however, the margin of this choice will narrow down, and carbon price would not be just a source of revenue but would end up determining decisive changes in the technology choices of companies. If, however, a high level of carbon price is unpopular or infeasible to implement, a lower level of carbon price with complementary policies might be an effective alternative approach. Deep mitigation is important, not the level of carbon price in itself.

Mitigation by using revenue from an internally feasible level of carbon price along with complementary mitigation choices, not driven only by a carbon price, might be more effective

Multiple criteria for selection of internal mitigation instrument: Ultimately, there cannot be only one metric that can determine the choice of an appropriate mitigation instrument for the company.
The multiple variables that will impact this choice include its emissions inventory and future emissions trajectory, the success rate of already applied instruments, financial implications (pricing and recurring costs) of the carbon price, GHG abatement potential, physical space requirement for the chosen low-carbon technology, compatibility with current assets and closure requirements. All this forms the basis of selecting mitigation instruments in the general sense. Specific companies might have a few other relevant criteria for their choice. To better understand these sector specific and company specific trade-offs, more industrial and academic research and development (R&D) is required to better understand the technological and financial challenges related to decarbonisation of the industrial sector. Corporate leadership and setting direction is going to play a vital role in this effort. A uniform price for all sectors might create excessive burden for the small players in the sector. From a large firm's point of view the mitigation instrument should also enhance brand visibility and assist with regulatory compliance, society at large needs to consider unaddressed social and environmental costs along with the transaction and administrative costs of alternative mitigation instruments.

5. A framework for choosing mitigation instruments in the Indian context

As a summary of the deliberations, the WGMI proposes a framework for choosing appropriate mitigation instruments in the Indian context. The framework has been developed with a view to align the objectives of sustainable development with GHG mitigation. The various dimensions of the framework, as described below, together seek to address varying aspects and challenges of the mitigation debate in India, while providing a way to move forward towards a low-carbon economy.

Policy objective: Understanding the policy objective is an important first step while evaluating the choice of a mitigation instrument. The policy objective could be promoting R&D, or carbon emissions reduction, local pollutant reduction, enhancing renewable energy penetration or domestic manufacturing. Each of these could require a different approach in terms of mitigation instrument. For example, enhancing industrial energy efficiency could be effective through the Perform, Achieve and Trade Scheme of Bureau of Energy Efficiency (BEE), while targeted carbon emissions reduction might be best achieved through a cap and trade scheme. The policy objective becomes the fulcrum, and all the dimensions of the framework have to be viewed through the lens of the given policy objective.

Distributional impacts: There are various groups of stakeholders in India who would be impacted in the transition process towards a low carbon economy. The chosen mitigation instrument could have an impact on how the impacts are distributed across these various groups. For example, a carbon tax could end up being regressive if it impacts low-income households through higher electricity prices or transportation fuel prices. Trade-exposed industries could witness a change in competitive dynamics. The extent of distributional impacts will depend on the stringency of the policy, as well as existence or absence of any companion policy that mitigates the negative impacts to specific groups. Any mitigation effort has to ensure that the disadvantaged and low economic groups are not hurt.

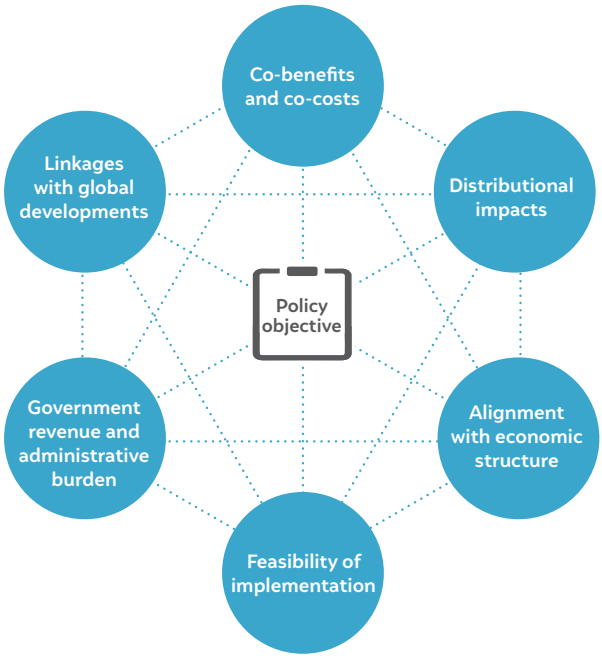
Micro, small and medium enterprises (MSMEs) are capital constrained and employment intensive. If these are impacted, additional policies might be required to compensate for any negative impact to this sector. A higher cost of electricity or energy should ideally not adversely impact the livelihoods of small entrepreneurs. Therefore, any assessment of mitigation instruments should list the stakeholders who could be impacted, assess the winners and losers, and explore ways to address the trade-offs through complementary policies. Distributional impacts are a critical part of understanding the political economy of the transition, the understanding of which is imperative to aid a smoother transition.

Alignment with Indian economic structure: The Indian economy has certain peculiarities, which might not be shared by other major economies. First, the share of manufacturing economy is low for the level of per capita income and the size of the economy. Consequently, the current policy of the government relies heavily on enhancing the domestic manufacturing base. Secondly, MSMEs account for a significant proportion of economic value creation as well as jobs within the country. Any mitigation instrument has to align well with the economic structure and policies of the government for it to succeed in the objective of mitigation (Biswas, Ganesan and Ghosh 2019).

Co-benefits and co-costs: The importance of co-benefits of carbon dioxide mitigation actions has been emphasised in the literature for a long time, and the argument is well accepted by Indian stakeholders. The most important co-benefits, arguably, are related to local air pollution, water, energy security, and jobs among others. However, evaluating co-benefits and co-costs of various mitigation instruments within the larger framework has not been undertaken. Different instruments could have different co-benefits, and their impact could vary for the same co-benefit. The co-benefits of an economywide carbon tax would be different from a sector specific mitigation instrument. Even at the sector level, different mitigation instrument could have different co-benefits. Similarly, there could be potential co-costs associated with any instrument. While evaluating mitigation instruments, it is important to understand the co-benefits, as well as the co-costs.

Impact on government budget and administrative burden: Mitigation instruments in some cases could entail a budgetary expenditure for the government, e.g. subsidies towards electric vehicles in transportation sector, while in some cases these could lead to revenue

Figure 3: A framework for the choice of mitigation instrument.



Source: WGMI's deliberations, 2019

for the government, for example in the case of carbon taxes or a domestic ETS. Budgetary constraints could become an important reason for non-preference towards a policy. Similarly, the possibility of revenue could be a motivation of the government. A high administrative burden could be another factor in deciding against a policy, especially if it has to be implemented at a wide scale. A high transaction cost in the initial stages of implementation of any instrument could work against the choice of this instrument. But from the economywide perspective, this aspect is only one aspect along with other key elements of the framework. The assessment of relevant mitigation instruments for India should look at the larger picture across many different elements and perspectives.

Linkages with global developments: The climate debate is a global one. The Article 6 of the Paris Agreement focuses on the Internationally Transferred Mitigation Outcomes (ITMOs). Countries need to choose their own strategies and instruments within this larger context of the global debate. Ideally, one should account for potentially possibilities of interactions and linkages with global developments. For example, does the international risk transfer instrument, Common Risk Mitigation Measure (CEEW, CII, TCX, TWI 2017) as being proposed at the International Solar Alliance (ISA), end up aligning well with a regulatory instruments to promote solar energy at home? Does the presence of several ETS across many regions provide an incentive for India to think about a domestic ETS over a domestic carbon tax-based system? Linkages with global developments are important to understand not just for devising a domestic mitigation strategy, but also for the choice of an appropriate mitigation instrument for the domestic economy in India.

Feasibility of implementation: The feasibility of implementation of the preferred instrument is a must. For example, for the objective of mitigating emissions, a carbon tax might be the most preferred instrument by experts, but if industry and consumers do not prefer any form of additional tax, then it might not be the best choice even if it were best from the perspective of economic and distributional efficiency. A revenue-neutral measure would be warranted in that case. On the other hand, some instruments may not find political acceptability even if industry prefers them. Of course, one could argue that implementing any policy instrument through a specific policy instrument would be feasible if the government showed strong willingness to implement. But experience suggests that if a policy choice is unpopular among the constituents, then in many cases the government dilutes the implementation of the policy. The feasibility of implementation can also be altered through changing the incentive structure of the stakeholders, which might itself be a challenge in many cases.

Table 2: Creating an index for assessment of potential mitigation instruments

	The alignment of the mitigation instrument under consideration with the given dimension of assessment framework is:			
	Negative	Neutral	Positive	Overall score
Distributional impacts	-1	0	1	
Alignment with Indian economic structure	-1	0	1	
Co-benefits and co-costs	-1	0	1	
Impact on government budget and administrative burden	-1	0	1	
Linkages with global developments	-1	0	1	
Feasibility of implementation	-1	0	1	

Source: WGMI's deliberations, 2019

6. Implementing the framework: from theory to action

The framework described in section 5 is a critical starting point for choosing an appropriate mitigation instrument. For a given policy objective, one mitigation instrument can score high on one dimension while others can score high on some other dimensions. Assessing individual dimensions and comparing across instruments does not make sense as the objective is to present a holistic evaluation of various instruments while comparing them. The dimensions, hence, need to be unified to present such a holistic view. This is critical to take the theoretical framework into practical action. We propose two steps to facilitate this.

Step 1: Create a simple yet powerful index for quantitatively valuing mitigation instruments: An index is a useful way to compare across potential mitigation instruments, and present a unified view across all the dimensions. We propose an index where experts can rate each of the dimensions of the assessment framework on whether the mitigation instrument under consideration aligns well with the given dimension or not. Table 2 presents the details of such an index. In this, all the dimensions are given equal weightage, something that can be changed if stakeholders feel so. To make the index easy to compute, stakeholders could give only three values to the dimensions, depending on whether the alignment of the mitigation instrument with the specific dimension of the framework is positive, negative, or neutral.

The range of the aggregate scores for any given respondent would be from -6 to +6. If there are n respondents, a simple average should be used to calculate the final score in the above range. Ideally, the instrument chosen should have a positive score, as well as highest among the alternatives considered.

Step 2: Engage with the broad stakeholder community to arrive at a representative score for alternative instruments: Whereas creating an index is an important first step, equally critical is to harness the expertise across the wider expert community as well as to provide legitimacy to the process of choosing the mitigation instrument. Subject experts should be requested to rank the various dimensions of alternative instruments for any given policy objective. For some situations this could be in the form of online survey, for other situations this could be in the form of ranking during a roundtable discussion. The number of respondents should ideally be reported with the average index scores. The other options would be to go through a Delphi process, which is an iterative and intensive exercise with a group of stakeholders representing all the key stakeholder communities. There could be other tools like the Analytical Hierarchy Process (AHP), which could allow sequential processing and assigning user preferences/weights. Irrespective of the approach, the larger idea is to take a collective opinion on alternative instruments across a broad representation of stakeholders.

It should be highlighted here that in addition to a policy objective, the respondent would need some information about the specific design of the mitigation instruments being compared, since this will have

implications on the respective dimension scores of the instruments. Some information related to key design parameters related to the mitigation instruments, to the extent possible,should be conveyed to the respondent in order to provide an informed response. It is important that the respondent is educated about the various mitigation instrument options and has access to examples, data, etc. in order to arrive at reasonable and informed conclusions on each of the index dimensions.

Such a scoring should be done by many experts, and the aggregate average score across all the respondents should be taken as a representation of collective expert stakeholder knowledge and preference. The structured framework gives an excellent basis for an informed debate. An averaged score across many experts for each of the dimension would give a very good sense of expert view on why one instrument is preferred over the other, and what are the perceived strengths and weaknesses of alternative mitigation instruments. An informed debate around these aspects of the framework and expert responses would be instrumental in creating a balanced and informed narrative in the mitigation instrument debate, and help in choosing an appropriate instrument for facilitating the progress towards India's mitigation ambition.

A sample case below presents how the framework can be implemented in practice.

'Carbon Tax' versus 'Carbon Trading Scheme' for reducing emissions up to a given emissions cap?

The table below presents a sample ranking as given by a hypothetical respondent. The expert needs to be provided with not just the list of potential alternative instruments, but also some key design features, which would help in informing the assessment. Any expert respondent scores each of the dimensions for two (or more) mitigation instrument alternatives available as per her view on these, given a certain policy objective. In the example given here, the policy objective is reduction of emissions up to a target emissions cap. The two alternative mitigation instruments presented to the expert respondent are a 'carbon tax' and a 'carbon trading scheme'. Based on the scores given to the individual dimensions, the overall score given by the individual respondent for carbon trading scheme is 3, while that for the carbon tax is -2.

	Alternative mitigation instruments							
	Carbon tax				Carbon trading scheme			
	⊖	⊕	○	DS	⊖	⊕	○	DS
Distributional impacts	-1	0	1	-1	-1	0	1	-1
Alignment with Indian economic structure	-1	0	1	1	-1	0	1	0
Co-benefits and co-costs	-1	0	1	1	-1	0	1	1
Impact on government budget and administrative burden	-1	0	1	-1	-1	0	1	1
Linkages with global developments	-1	0	1	-1	-1	0	1	1
Feasibility of implementation	-1	0	1	-1	-1	0	1	1
		Aggregate score		-2		Aggregate score		3

⊖ Negative ⊕ Positive ○ Neutral DS Dimension score

Source: WGMI's deliberations, 2019

7. Conclusion

The 'Working Group on Mitigation Instruments' was constituted to deliberate on the key potential mitigation instruments for India, and for developing a framework to evaluate these. The WGMI consisted of leaders from the industry, academic and think tank community. Mitigation instruments are going to be critical for India to move towards a low carbon economy. However, there is no clear narrative in India about the process of selection of an appropriate suite of mitigation instruments across sectors for the Indian economy. The purpose of the WGMI was to propose a framework through which such a choice can be informed.

This white paper presents issues for consideration while choosing mitigation instruments. The paper does not intend to undertake a theoretical comparison across mitigation instruments, as significant literature is already available on that (e.g. carbon tax versus emissions trading scheme). It seeks to build on this literature. The objective is not to evaluate specific instruments, but to provide a framework of comparing them, and moving towards a balanced and informed narrative.

> **The objective is not to evaluate specific instruments, but to provide a framework of comparing them, and moving towards a balanced and informed narrative**

Through this paper, we present a framework to evaluate alternative mitigation instruments for any given mitigation policy objective. The framework has six dimensions – distributional impacts; alignment with Indian economic structure; co-benefits and co-costs; impact on government budget and administrative burden; linkages with global developments; and feasibility of implementation. We present an approach through which experts can score the various dimensions of the framework for alternative mitigation instruments within the context of a specific policy objective. We discuss an index to move from the theoretical framework to action, and present an example for the same. We suggest that a collective framework-based assessment, either through an online survey or in-person stakeholder roundtable discussion, would be instrumental in a structured comparison of alternative mitigation instruments and their perceived strengths and weaknesses.

The white paper intends to trigger a continuing dialogue in India, between different stakeholders, through which we can arrive at the appropriate suite of mitigation instruments for India, through a structured and transparent process. It is imperative that Indian stakeholders engage in the dialogue, to best align the country's national priorities and sustainable development objectives with the long-term goals of deep decarbonisation.

References

Ahluwalia, M. B. 2017. *"The business of pricing carbon: how companies are pricing carbon to mitigate risks and prepare for a low-carbon future."* Center for Climate and Energy Solutions, pp. 1–40.

Bhandari, D., and G. Shrimali. 2018. *"The perform, achieve and trade scheme in India: An effectiveness analysis."* Renewable and Sustainable Energy Reviews 81, pp. 1286-1295.

Biswas, T., K. Ganesan, and A. Ghosh. 2019. *"Sustainable Manufacturing for India's Low-carbon Transition: Four bets for Hard-to-abate Sectors."* Issue Brief. New Delhi: Council on Energy, Environment and Water.

Biswas, T., S. Sharma, and K. Ganesan. 2018. *"Factors Influencing the Uptake of Energy Efficiency Initiatives by Indian MSMEs."* New Delhi: Council on Energy, Environment and Water.

Busby, J. W., and S. Shidore. 2016. *"When decarbonization meets development: The sectoral feasibility of greenhouse gas mitigation in India."* Energy Research & Social Science 23, pp. 60-73.

Calliari, E., M. Davide, and A. d'Aprile. 2016. *"Unpacking the Paris Agreement."* Review of Energy, Environment and Economics - Re3, Fondazione Eni Enrico Mattei, Italy.

CDP. 2017. *"Putting a Price on Carbon: A Handbook for Indian Companies."* Handbook, Carbon Disclosure Project.

CEEW, CII, TCX, TWI. 2017. *"Common Risk Mitigation Mechanism (CRMM) Feasibility Study."* Council on Energy, Environment and Water, Confederation of Indian Industry, The Currency Exchange Fund, and Terrawatt Initiative

Chaturvedi, V., P. N. Koti, and A. R. Chordia. 2018. *"Sustainable Development, Uncertainties, and India's Climate Policy: Pathways towards Nationally Determined Contrubution and Mid-Century Strategy."* New Delhi: Council on Energy, Environment and Water.

Dubash, N. K., R. Khosla, N. D. Rao, and A. Bhardwaj. 2018. *"India's energy and emissions future: an interpretive analysis of model scenarios."* Environmental Research Letters 13 (7).

EBRD. 2017. *"Operationalising Article 6 of the Paris Agreement."* European Bank for Reconstruction and Development.

EPIC-India. *"Developing India's First Emissions Trading Scheme."* 2019. Energy Policy Institute Chicago-India. Accessed July 2019. https://epic.uchicago.in/project/developing-indias-first-emissions-trading-scheme-2/.

EY. 2018. *"Discussion Paper on Carbon Tax Structure for India."* Ernst & Young LLP.

Gajjar, C., and V. Adhia. 2018. *"Reducing Risk, Addressing Climate Change through Internal Carbon Pricing: A Primer for Indian Business."* Working Paper, World Resources Institute - India.

Gajjar, C. 2018. *"Internal Carbon Pricing Primer Case Studies."* World Resources Institute - India.

Ghosh, A. 2009. *"Enforcing Climate Rules with Trade Measures: Five Recommendations for Trade Policy Monitoring."* In Climate Finance: Regulatory and Funding Strategies for Climate change and Global Development, by Richard Stewart, Benedict Kingsbury and Bryce Rudyk, 272-280.

Ghosh, A. 2010. *"Making climate look like trade? Questions on incentives, flexibility and credibility."* Policy Brief, Centre for Policy Research.

Ghosh, A. 2011. *"Seeking Coherence in Complexity?: The Governance of Energy by Trade and Investment Institutions."* Global Policy 2(S1), pp. 106-119.

Ghosh, A., B. Muller, W. Pizer, and G. Wagner. 2012. *"Mobilizing the Private Sector: Quantity-Performance Instruments for Public Climate Funds."* Oxford Energy and Environment Brief, The Oxford Institute for Energy Studies, pp. 1-15 .

Gupta, M., K.R. Bandyopadhyay, and S. K. Singh. 2019. *"Measuring effectiveness of carbon tax on Indian road passenger transport: A system dynamics approach."* Energy Economics 81, pp. 341–354.

Gupta, M. 2016. *"Willingness to pay for carbon tax: A study of Indian road passenger transport."* Transport Policy 45, pp. 46-54.

Hourcade, J. C., A. Pottier, and E. Espagne. 2018. *"Social value of mitigation activities and forms of carbon pricing."* CEPII (Centre d'Etudes Prospectives et d'Informations Internationales).

Howard, A., T. Chagas, J. Hoogzaad, and S. Hoch. 2017. *"Features and implications of NDCs for carbon markets"*. Accessed at http://www.climatefocus.com/publications/features-and-implications-ndcs-carbon-markets-final-report.

Kedia, S. 2016. *"Approaches to low carbon development in China and India."* Advances in Climate Change Research 7(4), pp. 213–221.

Kumar, R., and A. Agarwala. 2013. *"Energy certificates REC and PAT sustenance to energy model for India."* Renewable and Sustainable Energy Reviews 21, pp. 315-323.

Laing, T., M. Sato, M. Grubb, and C. Comberti. 2013. *"Assessing the effectiveness of the EU."* Working Paper, Centre for Climate Change Economics and Policy and Grantham Research Institute on Climate Change and the Environment.

Marcu, A. 2016. *"Carbon Market Provisions in the Paris Agreement (Article 6)."* Special Report, CEPS.

Narula, K. 2013. *"Renewable Energy Certificates (RECs) in India – A performance analysis and future outlook."* Renewable and Sustainable Energy Reviews 27, pp. 654-663.

Pahuja, N., N. Pandey and K. Mandal. 2014. *"GHG Mitigation In India: An overview of the current policy landscape."* World Resources Institute. Available at: http://mitigationpartnership.net/sites/default/files/wri_workingpaper_india_final.pdf.

Pandey, P. 2019. *"Panel pulls up govt. for diverting coal."* The Hindu, 13 January 2019, accessed at: https://www.thehindu.com/business/Industry/panel-pulls-up-govt-for-diverting-coal-cess/article25986829.ece.

Pappas, D., K. J. Chalvatzis, D. Guan, and A. Ioannidis. 2018. *"Energy and carbon intensity: A study on the cross-country industrial shift from China to India and SE Asia"*, Applied Energy 225, pp. 183–194.

Parikh, K. S., J. Parikh, and P. Ghosh. 2018. *"Can India grow and live within a 1.5 degree CO2 emissions budget?"* Energy Policy 120, pp. 24-37.

Parry, I., V. Mylonas, and N. Vernon. 2017. *"Reforming Energy Policy in India : Assessing the Options."* Working Paper, International Monetary Fund.

Partnership for Market Readiness (PMR). 2017. *"Carbon Tax Guide: A Handbook for Policy Makers."* Partnership for Market Readiness, World Bank, Washington DC

Pearse, R. 2016. *"The coal question that emissions trading has not answered."* Energy Policy 99, pp. 319-328.

Planning Commission . 2014. *"The final report of the expert group on low carbon strategies for inclusive growth."* Planning Commission, Government of India .

PMR-ICAP. 2016. *"Emissions Trading in Practice: A Handbook on Design and Implementation."* Partnership for Market Readiness- International Carbon Action Partnership, World Bank Group.

Pradhan, B. K., J. Ghosh, Y. F. Yao, and Q. M. Liang. 2017. *"Carbon pricing and terms of trade effects for China and India: A general equilibrium analysis."* Economic Modelling 63, pp. 60-74.

Saxena, A. K., I. Gopal, M. Jayakumar, N. S. Prasad, P. Sharma, R. Mathur, S. Chaudhary, et al. 2017. *"Transition in Indian Electricity Sector."* New Delhi: The Energy and Resources Institute.

Shukla, P. R., S. Dhar, M. Pathak, D. Mahadevia, and A. Garg. 2015. *"Pathways to deep decarbonization in India."* Paris: SDSN - IDDRI.

Stavins, R. and R. Stowe. 2017. *"Market Mechanisms and the Paris Agreement."* Available at: https://www.belfercenter.org/sites/default/files/files/publication/2017-10_market-mechanisms-paris_v5.pdf.

Stram, B. N. 2014. *"A new strategic plan for a carbon tax."* Energy Policy 73, pp. 519-523.

Thapar, S., S. Sharma, and A. Verma. 2016. *"Economic and environmental effectiveness of renewable energy policy instruments: Best practices from India."* Renewable and Sustainable Energy Reviews 66, pp. 487–498.

UNFCCC. 2015. *"Adoption of the Paris Agreement."* United Nations Framework Convention on Climate Change.

Villoria-Saeza, P., V. W. Y. Tam, M. d. Merino, C. V. Arrebola, and X. Wang. 2016. *"Effectiveness of greenhouse-gas Emission Trading Schemes implementation: a review on legislations."* Journal of Cleaner Production 127, pp. 49–58.

Webb, R., and J. Wentz. 2018. *"Human Rights and Article 6 of the Paris Agreement: Ensuring Adequate Protection of Human Rights in the SDM and ITMO Frameworks."* SSRN (SSRN).

WEF. 2016. *"Risk Mitigation Instruments in Infrastructure: Gap Assessment."* World Economic Forum.

The Working Group members

Dr Ajay Mathur, Director General, The Energy & Resources Institute (TERI)

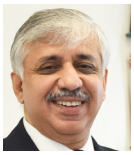
Dr Ajay Mathur earlier headed the Indian Bureau of Energy Efficiency, and was responsible for mainstreaming energy efficiency through initiatives such as the Star Labeling programme for appliances, the Energy Conservation Building Code, and the Perform, Achieve & Trade programme for energy-intensive industries. He was a leading climate change negotiator, and was the Indian spokesperson at the Paris climate negotiations. He served as the interim Director of the Green Climate Fund during its foundational period.At TERI, he has spearheaded the move to accelerate action towards a low-carbon and cleaner economy through the adoption of renewable energy in the Indian electricity sector, enhancing efficiency in buildings and industry, and promoting environmental quality through recycling of material wastes and biotechnology-based solutions. He co-chairs the global Energy Transitions Commission, and one of the climate initiatives of the One Planet Summit.

Mr Anirban Ghosh, Chief Sustainability Officer, Mahindra Group

Mr Anirban Ghosh is the Chief Sustainability Officer at the USD 20.7 billion Mahindra Group. Under his leadership Mahindra has developed an award winning Sustainability framework, become a founding member of the Carbon Pricing Leadership Coalition and been the first to commit to doubling energy productivity. He has, in partnership with the World Bank, facilitated the creation of the Sustainable Housing Leadership Consortium, to accelerate the spread of green buildings in India. Anirban has implemented a shared value project which has tripled per capita income for 20,000 Indians. He takes great pleasure in implementing projects that drive positive change in society and has been acknowledged as a Distinguished Sustainability Officer.

Dr Arunabha Ghosh, Chief Executive Officer, Council on Energy, Environment and Water (CEEW)

Dr Arunabha Ghosh is a public policy professional, adviser, author, columnist, and institution builder. As the founder-CEO of the Council on Energy, Environment and Water, since 2010, he has led CEEW to the top ranks as one of South Asia's leading policy research institutions (six years in a row); and among the world's 20 best climate think-tanks in 2016. With experience in 44 countries, he previously worked at Princeton, Oxford, UNDP, and WTO. In 2015, he was invited by France, as a *Personnalité d'Avenir,* to advise on the COP21 climate negotiations. In 2018, the UN Secretary-General nominated him to UN's Committee for Development Policy. He holds a D.Phil. from Oxford and topped Economics from St. Stephen's College, Delhi.



Mr Chanakya Chaudhary, Vice President (Corporate Services), TATA Steel Ltd

Mr Chanakya Chaudhary serves as Vice President of Corporate Services at TATA Steel Ltd since 2018, and earlier was the Vice President of Raw Material at TATA Steel Ltd from where he has driven many improvements to meet the current challenges and making TATA Steel's Raw Material Supply Chain robust and sustainable. Prior to this, he was designated as the Group Director-Corporate Communication & Regulatory Affairs for spear heading the Communication Strategy and Policy Advocacy for the company. He is also a member of the Jharkhand state CII Council, the Eastern Region CII Council, the Communications Committee of World Steel Association (WSA), and a Working Group member of the Indian Steel Association (ISA). He serves on the Board of many foundations and companies.

Dr Jai Asundi, Research Coordinator, Center for Study of Science, Technology & Policy (CSTEP)

Dr Jai Asundi's research interests lie in the area of information technology for development studies. He is working on decision-support systems for diverse public policy problems. He is a senior member of the IEEE. Prior to CSTEP, Dr Asundi was faculty in Information Systems at the University of Texas at Dallas. He holds a BTech in Chemical Engineering from IIT Bombay, and MS and PhD (Engineering and Public Policy) degrees from Carnegie Mellon University, Pittsburgh.

Dr Kirit S. Parikh, Chairman, Integrated Research and Action for Development, IRADe

Dr Kirit S. Parikh is the Chairman of IRADe, New Delhi. He was Member Planning Commission from 2004 to 2009. He was a Member of the Economic Advisory Council (EAC) of five Prime Ministers of India, Atal Behari Vajpayee, P.V. Narasimha Rao, Chandra Shekhar, V.P. Singh and Rajiv Gandhi. He is the recipient of India's third highest civilian award the Padma Bhushan and the Nobel Peace Prize for IPCC Team on climate change. He has 45 years of experience in climate change, energy and power system modelling and energy-environment policy.

Mr Krishan Dhawan, Former CEO, Shakti Sustainable Energy Foundation (SSEF)

Mr Krishan Dhawan was CEO of the Shakti Sustainable Energy Foundation from May 2012 to August 2019, and he continues as a member of the Board of Directors. Shakti is a grant making organization which engages with policymakers, regulators, civil society, think tanks, academia, business and international organizations in pursuit of an enabling policy framework that is based on sustainable and clean sources of fuel, which ensures affordable and reliable energy access, fosters efficiency in energy use, improves environmental stewardship, and promotes sustainable economic growth and energy security.

Prior to Shakti, Krishan worked with Oracle Corp and Bank of America. Krishan is a founding member of IIMPACT (www.iimpact.org), a non-profit engaged in the education of girls from disadvantaged backgrounds. He is on the Board of the Antara Foundation (www.antarafoundation.org), a non-profit working on maternal and child health issues.

Krishan completed a BA (Hons) in Economics from St. Stephen's College, Delhi and an MBA from the Indian Institute of Management, Ahmedabad.

Prof. Purnamita Dasgupta, Chair in Environmental Economics and Head, Environmental and Resource Economics Unit, Institute of Economic Growth (IEG)

Prof. Purnamita Dasgupta's teaching and research focus is on the relationship between environment and economic development. She has been Visiting Professor at University of Cambridge, UK and Johns Hopkins University, USA. Her recent research includes modelling future socio-economic scenarios for India's National Communications and GHG emissions for India's Nationally Determined Contributions (NDC), choice experiments for enhancing transitions to clean energy use among rural households in India (LPG, LED programs), and cost-benefit evaluations of ecosystem services, climate change impacts and adaptation. Her research has been supported by the Ministry of Environment, Forests and Climate Change (MoEFCC), Finance Commissions, Ministry of Urban Development, UNDP, ICSSR, IDRC, and DFID, among others. She has been Co-ordinating Lead Author of the Intergovernmental Panel on Climate Change (IPCC); Advisor for the IPCC's Scientific Steering Group on Economics, Costing and Ethics; Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) and the Association of Commonwealth Universities, UK. In India, she has served on various committees including member of the committee drafting legislation on Electronic Waste, the Supreme Court committee on NPV for Forests, and the Expert committee to evolve environmental standards in India, among others. She has published widely in books and journals and participates actively in discussions on the environment in various fora.

Mr Richie Ahuja, Senior Director, Global Climate, Environmental Defense Fund (EDF)

Mr Richie Ahuja is an expert in business development strategies and spearheads EDF's engagement in India. He helped to catalyse the formation of other institutions such as Indian Youth Climate Network (IYCN), India's largest youth network on climate change, and Climate Parliament, and independent multi party body of elected leaders focused on addressing climate change in the country. He was a founding member of the Fair Climate Network, a network of NGOs that have worked together to test scalable low carbon rural development approaches such as deploying clean cooking systems. He helped to facilitate the domestic offset program of IndiGo Airlines, India's largest carrier, which allows passengers to offset their climate pollution from travel, and linked this effort with the FCN to generate carbon finance for capital expenditures required for deploying low-carbon technologies. Richie is also a leading voice on "climate smart" agricultural practices, both within India and at the global level, through initiatives such as the Global Alliance for Climate Smart Agriculture, which EDF was integral in launching.

Ms Seema Arora, Deputy Director General, Confederation of Indian Industry (CII)

Ms Seema Arora pioneered the creation of services on Sustainable Development within CII. Her journey with CII began with engaging Indian industry towards the run up to the Earth Summit in 1992. She works on designing innovative products and frameworks to build the business case for industry to invest in Sustainability and CSR. She works with industry, government and community based organisations to develop policy instruments, curate collaborative initiatives across sector and stakeholders and develops innovative voluntary approaches to sustainable development. Her portfolio in CII includes the CII - ITC Centre Of Excellence for Sustainable Development, CII Development Initiatives, CII Foundation, India@75 and the Indian Women Network.

Seema Arora has a bachelor's degree in Engineering from Delhi University. She is a member of World Economic Forum Global Future Council on Biodiversity and the Bio-economy. She is a member of the external review panel for Sustainability Reporting for several global companies. She has twenty-eight years of experience in the field of Sustainable Development.

Dr Vaibhav Chaturvedi, Research Fellow, CEEW

Dr Vaibhav Chaturvedi leads The Council's research on Low-carbon Pathways. His research focuses on Indian and global energy and climate change mitigation policy issues within the integrated assessment modelling framework of the Global Change Assessment Model (GCAM). Vaibhav has been part of Government of India committees for advising on issues related to energy and climate policy. He actively publishes in, and reviews articles for, leading international energy and climate policy journals.

The CEEW-and-EDF convened Working Group on Mitigation Instruments, comprising multi sectoral experts, met five times through 2018-19 to arrive at the framework to identify and compare mitigation instruments appropriate to the Indian context.

Images: CEEW

Council on Energy, Environment and Water (CEEW)

Sanskrit Bhawan, A-10, Qutab Institutional Area
Aruna Asaf Ali Marg, New Delhi - 110067, India
T: +91 (0) 11 4073 3300
info@ceew.in | ceew.in | @CEEWIndia