

Mitigation Talks

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From the Series Editor's Desk

While Katowice Package was an important milestone in operationalizing the Paris agreement, the increased momentum for enhance climate action seems to be losing pace. This issue tries to see developments in international climate policy and more specifically on actions taking place in India.

The first article in the issue focuses on tracking of progress of Nationally Determined Contributions (NDCs) under Article 4 of the Paris Agreement, in accordance with the Modalities, Procedures and Guidelines (MPGs) of the Enhanced Transparency Framework (ETF) and what lessons can be learnt from India.

The second article emphasises on the role of availability of finance and capabilities across different levels of governance and actors. Taking three examples from India, namely REDD+, Pradhan Mantri Ujjwala Yojana (PMUY), and Solar Mamas, the next article proposes mitigation policy as an opportunity to insert justice concerns actively into the low-carbon transition of economy. Similarly, in the next article author takes the case of Bhungroo from India and proposes how women welfare can be enhanced through Technological Solutions.

The last article looks at the financial challenges of agriculture sector in India. It further, presents the case of Suryashakti Kisan Yojana (SKY) Gujarat government scheme which offers financial instruments with associated benefits to the farmers.

Measurement, Reporting and Verification framework for mitigation policies and actions: Lessons Learnt from India

The Rulebook Is out, the Real Work Starts Now!

Abhishek Kaushik, Associate Fellow, TERI

Email: Abhishek.Kaushik@teri.res.in

The Katowice climate package adopted during CoP24 by all countries party to the Paris Agreement is an important milestone towards operationalizing the Paris Agreement. It clearly defines ways and means of limiting global warming to well below 2°C while pursuing efforts to limit the increase to 1.5°C. Decision adopted at COP24 mandates each Party to provide the information necessary to track progress in implementing and achieving its Nationally Determined Contributions (NDC) under Article 4 of the Paris Agreement, in accordance with the Modalities, Procedures and Guidelines (MPGs) of the Enhanced Transparency Framework (ETF). This further requires parties to identify indicators to track progress towards the implementation and achievement of its NDC under Article 4. Indicators shall be either qualitative or quantitative. Progress indicators are specific, measurable metrics, which support systematic tracking of how policies are being implemented and whether they are on course to achieve their NDC targets and objectives. This approach also gives flexibility in the choice of measurement and progress indicators. As countries are aggressively working towards meeting their NDC goals, need of a national Measurement, Reporting and Verification (MRV) framework for tracking progress of mitigation policies and actions becomes crucially important.

Further, all Parties are required to submit new and increasingly ambitious climate plans (NDC) by 2020 and every 5 years thereafter. For effective implementation and successful achievement of India's INDC, it is pertinent to systematically track progress of actions, plans and policies. This raises an important research question on the nature and scope of transparency regime that could be put in place at the domestic level to measure/track the progress on actions, plans and policies in sectors that will contribute to achieving India's NDCs.

A domestic transparency framework for India is needed to meet the requirements both under the international regime (under the Paris Agreement) and also at the domestic level. Particularly at the domestic level, it will be helpful to track emissions, emission reductions and effectiveness of policy implementation. It will facilitate the creation of data management system, which is reliable, accurate, and transparent. This is crucial for assessing the effectiveness of policy implementation and to provide feedback for improving on the policy implementation gaps. Given the emphasis on transparency at international level, this might result in improved access to developed

country support in terms of finance, technology, and capacity building.

As per Biennial Update Report (BUR) of India, the monitoring and evaluation of government policies and programmes are an integral part of assessing the financial allocations. The monitoring includes both financial and physical targets. Also, systems exist for review of overall impacts at highest policy-making levels. Further, it states that national climate change programmes and other similar national programmes have a measuring and reporting systems, such as for energy efficiency, renewable energy, agriculture and forestry sector programmes, and projects. But these monitoring and evaluation systems do not conduct any MRV for GHG emissions and mitigation, though data collected under such systems could be used for greenhouse gas (GHG) assessment. BUR also highlights that "India does not have any GHG monitoring and mitigation assessment-related domestic MRV arrangements presently. Establishing an integrated domestic MRV system for GHG mitigation actions is a capacity building need for India."

TERI in collaboration with UNEP DTU is pursuing a research study supported by Initiative on Climate Action Transparency (ICAT), with the key objective of assessing the existing monitoring and reporting systems, gaps and developing appropriate options and approaches for MRV of mitigation policies and actions in India. The focus of the research is to assess policies and schemes that have an impact of climate change and having the maximum GHG mitigation potential. For the pilot phase, following sectors/sub-sectors and key policies were chosen for the detailed assessment and development of MRV approaches:

- Transport sector: India's transport sector is highly dominated by road transport and accounts for 90% of the passenger movement and 67% of the freight traffic¹, thus accounting for very high fuel consumption and CO₂ emissions. In the passenger road transport sub-sector, it was recognized that the vehicle fuel efficiency and electric mobility programs have the maximum potential for GHG emission reduction from the transport sector and thus largely contributing in achieving India's NDC target of emission reduction. In addition, the focus of the current policies in the transport sector is on the

¹ <http://morth.nic.in/showfile.asp?lid=3141>

development of public transport infrastructure and energy-efficient transport systems, as they have a higher potential for emission reduction and thereby contribute to the overall emission reduction for the country.

- Buildings sector: Building stock in India is expected to reach about 10,400 million square metres by 2030 as compared to year 2005 (Environmental Design Solutions Ltd, 2010). With the growing infrastructure requirement, the need for energy from the buildings is also expected to grow exponentially. Buildings are responsible for consuming close to about 40% of the electricity and are projected to consume 76% by 2040 (Center for Science and Environment, 2014). In artificially conditioned buildings, about 60–70% of the energy is linked to space cooling and providing comfort to its occupant. Therefore, it becomes important to acknowledge the policies and code that could help India, in tapping the growing energy demand from the buildings and parallelly meeting its obligations submitted to UNFCCC. Energy Conservation Building Code (ECBC) and star labeling program for buildings are the two most important policies lined by the Government of India in the biennial report submitted to UNFCCC to tap the GHG mitigation from the buildings sector. In the building sector, it was assessed that the ECBC 2017 and Standards and Labeling (S&L) Program have the maximum potential both in terms of achieving energy efficiency and GHG mitigation. For the pilot phase, only ECBC is assessed for developing options and approaches for MRV framework. This will also

help in complimenting BEE's work for assessing the policy impact using ex-post approach.

- Renewable energy: The Indian renewable energy sector has seen a rapid rise in capacity addition, investment, and policy development in the recent years. About 18% of total installed capacity of India is powered via renewable sources, which accounts for around 60 GW. One of the NDC goals includes achieving about 40% cumulative electric power-installed capacity from non-fossil fuel-based energy resources (majorly renewable energy) by 2030. With 250–300 days of solar availability potential in India, solar power is poised to be a viable source for energy generation and GHG emissions reduction. The launch of National Solar Mission (NSM) has enabled large-scale deployment of solar photovoltaic (PV) plants across the country. Under the scheme, a total solar target of 100 GW has been set by the Government of India. Installed wind power capacity is around 32 GW, with a 2022 target of 60 GW, which accounts for about 61% of total renewable energy capacity. In the renewable energy sector, the focus is on assessing key policies in the solar sector owing to the overarching national targets set in Jawaharlal Nehru National Solar Mission (JNNSM) and subsequent auction guidelines underpinning tenders focusing on high-capacity RE addition. It is recognized that the ground-based solar utility projects should be considered for developing MRV framework for a package of policies including incentives, regulations, duties, and tenders that influence uptake of these projects.

List of key policies, their possible impacts on GHG emissions and estimated mitigation potential					
Sector (sub-sector)	Key policies	Status	Possible GHG impacts	Institutions involved and type of data currently monitored	GHG mitigation potential/achieved (million tCO ₂ e) ²
Renewable energy (utility-scale solar)	Viability Gap Funding scheme (VGF) for 750 MW capacity addition under JNNSM Phase-II, Batch-I	Launched in 2013, around 680 MW of the total capacity is already commissioned in seven states ³ . The total VGF disbursement, as on December 2017 was Rs. 704.69 crore and no further capacity is likely to be added under this scheme as reported by the Ministry of New and Renewable Energy (MNRE)	Avoided emissions owing to addition of solar plants instead of obtaining the same capacities through establishment of thermal power plants. However, the schemes will also result in emissions due to domestic manufacturing of RE equipment (e.g., solar PV modules, invertors, etc.) as required by the scheme	CEA – total electricity demand and generation, India grid emission factor	Till 2018, VGF-750 MW scheme has achieved a net emission reduction of 0.25 million tCO ₂ e (high generation scenario). In total, all three schemes have a total mitigation potential of 15.83 million tCO ₂ e till 2022 from 2015 baseline (ex-ante scenario)
	VGF scheme for 2000 MW capacity addition under JNNSM Phase-II, Batch-III	The solar projects of 2000 MW capacity under the state-specific VGF scheme will be set up in the solar parks of various states, to be developed through coordinated efforts of central and state agencies. As implementation of solar parks have begun recently, it could be possible that solar parks in some of the states do not become available soon. For such states, solar projects would be allowed to be located outside solar parks with land being provided either by the state government or arranged by the solar power developers (SPDs)		SECI – solar-installed capacity through VGF and solar park schemes, net generation Project developers – plant utilization factor, project-level generation data DISCOMs – share of renewable and fossil-based electricity in the total energy mix	

² TERI analysis based on ICAT guidance for assessing GHG impacts of the policies. The ICAT guidance are available at: <https://climateactiontransparency.org/icat-guidance/>

³ As per Ministry of New and Renewable Energy (MNRE) Annual Report 2017–18

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Renewable energy (utility-scale solar)	Solar Parks Scheme	MNRE had drawn a scheme to set up a number of solar parks across various states in the country, each with a capacity of solar projects generally above 500 MW. The target is to install 40 GW by 2022			
Transport (road transport)	Vehicle Fuel Efficiency Program	Under the Vehicle Fuel Efficiency Program, in 2014, Government of India finalized India's first light duty passenger vehicle fuel efficiency standards and is in the process of bringing out the norms for heavy duty vehicles. India also aims to improve fuel standards by switching from Bharat Stage IV (BS IV) to Bharat Stage V (BS V)/ Bharat Stage VI (BS VI) across the country in near future	The overall impact of the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme, BS standards and CAFÉ standards on GHG reduction will depend on two opposite effects. Reduction in fossil fuel use from business as usual scenario is inevitable and this will bring down GHG emissions; however, there will be increased use of electricity due to increased share of EVs, which will increase the GHG emissions. Therefore, the net effect will depend on GHG intensity of the electricity used by electric vehicles.	VAHAN dashboard (an online portal by Ministry of Road Transport and Highways)- Number of Registered Vehicles by vehicle-type and fuel-type (as provided by regional transport authorities)	In ex-ante scenario, CAFÉ norms, BS standards and FAME-I scheme together have the GHG mitigation potential to the tune of 35.2 million tCO ₂ e during 2020-2030 period
				Fuel consumption and fuel efficiency - Values on total fuel consumption in transport sector are available through Petroleum Planning & Analysis Cell (MoPNG) for the year 2013. In order to accurately assess the fuel consumption, data on fuel-wise fleet composition is required.	
				Vehicle utilization and occupancy factors - Such data is available for a few cities through their Comprehensive Mobility Plans and research reports. Emission factors for fuel consumption (petrol, diesel, CNG, LPG, etc.) - country specific provided by MoEF&CC and default by IPCC	

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Transport (road transport)	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME), 2015	In order to promote the uptake of electric vehicles, the initial roadmap was laid out through the National Electric Mobility Mission Plan (NEMMP) 2020 in 2013. Further, under NEMMP, the implementation and adoption of electric vehicles were supported by a scheme named, Faster Adoption and Manufacturing of (Hybrid & Electric Vehicles, 2015 (FAME India).	Together the two policies are expected to lead to an increased share of electric and hybrid cars, resulting in improvement in overall fuel economy for LDVs.	Electric cars sales/ registration data – Society of Manufacturers of Electric Vehicles (SMEV), Department of Heavy Industries (Ministry of Heavy Industries and Public Enterprises)	
				On-road registered vehicles – Road transport yearbook published by MoRTH; details of registered vehicles can also be found on the national registry portal	
		As per the notifications from Department of Heavy Industry (DHI), Phase I of FAME scheme was implemented for 3 years commencing from April 1, 2015 up till March 31, 2019. In March 2019, the government announced FAME II scheme with an outlay of INR 96,340 million till 2022		Trip length, occupancy factors – can be collected by conducting primary surveys by involving agencies like CRR, RITES	

List of key policies, their possible impacts on GHG emissions and estimated mitigation potential					
Sector (sub-sector)	Key policies	Status	Possible GHG impacts	Institutions involved and type of data currently monitored	GHG mitigation potential/achieved (million tCO ₂ e) ²
Buildings (Large Commercial Buildings)	Energy Conservation and Building Code (ECBC 2017) ⁴	The code formed by the Bureau of Energy Efficiency, Ministry of Power in 2017 (Revision 2017) includes mandatory and prescriptive requirement for new commercial buildings to incorporate energy efficiency features at building design stage. The minimum load requirement for a building to be ECBC compliance is 100 kW or 120 kVA. It is applicable to all new constructions and retrofitted building or parts of building having defined load with no difference in compliance approach. Till date, 13 states/UTs have notified the implementation of ECBC and 23 states have made amendment to the code	<ul style="list-style-type: none"> Use of efficient material for building envelop, heating ventilation and air conditioning and lighting will have a significant impact on energy consumption, thereby results in emission reduction Switch to renewable energy sources for heating and electrical power will further result in reduction of GHG emissions 	Bureau of Energy Efficiency (Ministry of Power) – average energy use intensity of commercial building sub-sector	The total GHG mitigation potential until 2030 is equivalent to 107 million tCO ₂ e from 2005 level (ex-ante scenario)
				Bureau of Energy Efficiency (Ministry of Power) – total energy consumption by commercial buildings	
				State Designated Agency (SDA) – total built-up area added each year in the states	
				Central Electricity Authority (Ministry of Power) – annual average grid emission factor for state and variations due to policy interventions in power sector and other factors	
				BEE empanelled energy auditors – monitoring and verifying buildings' energy performance	

⁴ https://beeindia.gov.in/sites/default/files/tender_document/BEE_ECBC%202017.pdf

Conclusion

A robust and integrated MRV framework with defined institutional set-up to assess GHG impacts and other sustainable co-benefits of key policies and actions is much needed for fulfilling the accounting and reporting requirements of the Paris Agreement and its enhanced transparency framework (Article 13 of the Paris Agreement). Under Article 4, Parties are required to account for their NDCs, which include GHG targets, non-GHG targets, and actions. An integrated MRV system for GHG mitigation requires streamlined data management systems, improved analytical capabilities, and most importantly, active coordination between all stakeholders and the various nodal agencies within the government for GHG mitigation across regions, sectors, and time. A systemic MRV framework will also support developing countries (including India) to engage in voluntary cooperative approaches described in Article 6.2 and the mechanism to contribute to the mitigation of GHG emissions and support sustainable development established under Article 6.4 of the Paris Agreement. Article 6 also specifies that the countries that choose to participate in the exchange of internationally transferred mitigation outcomes (ITMOs) to meet nationally determined contributions must apply robust accounting methods to avoid double counting. An integrated MRV framework would be useful to transparently assess the GHG and sustainable development impacts of the policies and actions that may be transferred to another country.

There are several challenges (related to finance, capacity building and technology) towards establishing monitoring and verification process for GHG inventory and mitigation actions in a developing Party. This includes lack of coordination among different ministries, limited availability of activity data for calculating emissions, lack of regulatory mechanisms for monitoring and evaluating for tracking policy impacts, among others. These challenges can be overcome by following a coordinated approach and working with other ministries and agencies aside from the national UNFCCC focal point (usually the Ministry of Environment). In most advanced developing countries, support needs to be provided in

order to better understand the use of standardized tools and methodologies that make it possible to track the progress of mitigation actions, particularly those policies or actions that are contributing in achieving NDC goals.

In India, although many policies are formulated at the national level, states have a larger role to play towards its on-ground implementation and tracking progress. For instance, ECBC code existing at central level is required to be adopted by the state government to make the code applicable. Once the code is made mandatory by the state government, it is then the responsibility of the state development agencies (SDAs) for implementation and enforcement of code at municipal level. The enforcement authority is generally with the municipal authorities in form of building byelaws, which form the basics of requiring clearances for construction of buildings. The local building department has jurisdiction for determining the administrative requirements relating to permit applications. Due to lack of capacities and relevant information, at present no MRV framework has been adopted by the states to check the compliance to the code.

India is progressively working towards establishing a domestic MRV system. So far multiple efforts have been made to build MRV for the specific sectors, actions and programs but not for GHG mitigation directly. MRV is currently scattered and varies with respect to policy, action and sector. This results in a strong need to integrate all these individual actions into one common platform so as to address challenges such as transaction cost, time, etc. It is then important to strengthen and streamline capacities and capabilities of relevant national institutions (including central, state, district, research institutions, civil societies, etc.) with national priorities, and bring in suitable mechanisms that ensure the improvement of transparency over time. Indian climate institutions should follow a facilitative approach that complements existing institutions to promote mainstreaming of transparency considerations in a manner consistent with development. This implies nudging and provoking existing sectoral bodies to seek co-benefits opportunities in reporting on mitigation actions and mainstream climate transparency into development decisions.

Ambition and Implementation Trickle Down: How Finance Matters

Manish Kumar Shrivastava, Assistant Professor, TERI School of Advanced Studies, New Delhi

Email: manish.shrivastava@terisas.ac.in

Successful implementation of current Nationally Determined Contributions (NDCs) with subsequent ambitious revision holds key for achieving the temperature-control targets established in the Paris Agreement. The focus, therefore, is squarely on the effectiveness of national efforts. In a developing-country context, lack of institutional capacity has been identified as a major implementation bottleneck in different contexts (IPCC 2018). The implementation challenges are deepened further by the general lack of capacity (technical, institutional, and financial) at the lower levels of governance (Mathur and Shrivastava 2015). The fact that most of the Parties to the Paris Agreement have submitted their NDCs may be construed as an indicator of existence of some degree of national capacity to visualize aspirations and future course of development. By no means, however, this inference can be extended to actual capacity to implement, without further empirical analysis. The varying degree of uncertainties associated with capacity and political will towards actual implementation in different country contexts has profound implications for the prospects of any meaningful upward revision of NDCs. This article illustrates the relationship between prospects of ambition and capacity to implement through examples from India. The arguments presented here are based on preliminary findings of the ClimateSouth project.¹

Raising Ambition of Indian NDC

From the implementation perspective, India's current NDC is skewedly dependent on national capacities in renewable energy infrastructure development, and promotion of energy efficiency. The NDC targets of reducing energy intensity of GDP as well as increasing installed capacity from non-fossil fuels sources are deeply inter-related. Realization of large-scale renewable energy projects, and enhancement of efficiency standards in large manufacturing utilities and transport systems will play a crucial role (Mathur and Shrivastava 2017) in realizing decoupling of emissions, energy consumption and growth. By no means, this undermines the role of small scale, decentralized interventions. In fact, as we would argue in following paragraphs, it is the successful implementation of such interventions, for example, proliferation of solar roof tops and efficient lighting, which may give India the definitive edge in robust enhancement of implementation capacity.

The dependence of national capacities appears to be enough as far as the current NDC targets are concerned. However, as pointed out by the IPCC (2018) and Bai et al. (2018), the challenge of implementation lies in ensuring that the rapid urbanization is decoupled from GHG emissions. Whether or not the cities have capabilities to implement climate actions will be critical in achieving the goals of the Paris Agreement.

Capability of Indian Sub-National Actors

While the lack of capabilities at sub-national and local government levels has been widely recognized, it is worth exploring what local governments are doing to address GHG mitigation, and how they are doing it. The experience of sub-national governments in carrying forward national visions and programs as well as undertaking independent actions is a good indicator of how climate action can be deeply embedded in the overall governance fabric.

Preliminary findings from the project Climate South and the views expressed by researchers currently engaged in sub-national climate policy projects, particularly focused on cities at the roundtable discussion on "Urban India and Climate Change Research"² make it evident that the sub-national actors are extensively dependent on national government initiatives. While this is truer for mitigation actions than adaptation initiatives, generally, aberrations are only exceptional. The primary dependence on national government appears to be technical, manifested in terms of identifying priorities and defining actions. For example, most of the climate actions related to mitigation are driven by national programs such as the Smart Cities Mission. Even on adaptation the actions or policies in place follow the guidelines from the National Disaster Management Authority. The exceptions are those programs in cities that emerged in response to prior experience with impacts, such as the Heat Action Plan for Surat.

If the nationally driven local climate actions are contrasted with internationally supported climate action in cities, three observations can be made. First, local governments tend to respond to those initiatives that come with financial provisions. If a national or international initiative is based on voluntary action by cities without any financial assistance, barring few exceptions, measurable progress is not seen. It is also

¹ Strengthening Non-State Climate Action in Global South, implemented by The Energy and Resources Institute in India.

² Organized by the Centre for Policy Research, New Delhi, at India Habitat Centre, 20 December 2018

reflected in the fact the continued action in cities mostly take the form of transition from one project to another supported by transnational initiatives. Second, the local governments rely on technical consultants for designing climate projects or programs. These experts are mostly funded through external support. Third, and perhaps the most telling observation is that new institutional capacities are rarely built at local level that can independently carry forward climate action. This, however, does not mean the absence of learning about institutional requirement, rather a lack of incentive and purpose for creating lasting institutional architecture.

How Finance Matters

Beyond the obvious role as means of implementation for achieving set goals, finance functions as an important catalyst towards building technical and institutional capabilities. The sub-national climate action in India offers following insights into the broader role that finance can play in long term, particularly in the context of possibility of raising ambition of NDCs:

- *Alignment across different levels of governance:* The prospects of availability of finance to comply with guidelines or participate in programs initiated by higher level of governance not only encourage local government units to act, but also to tailor-made actions to the guidelines and objectives. Provision of finance hence serves as a pull-instrument for readjusting local priorities.
- *Effectiveness of existing institutions:* Finance also lubricates the institutional machinery put in place to mobilize different actors and their capacities. Active participation of local institutions in national initiatives not only makes the institutional system functional but also brings forth the inconsistencies, creating opportunities for improving effectiveness.
- *Technical exposure and demonstration:* In the bid to secure finance for proposed action, local institutional

actors' technical capacity is enhanced through learning by doing. Successful implementation encourages replication and creates more demand from the potential beneficiaries. Moreover, this process mobilizes local technical expertise, however, inadequate it may be. The local experts benefit from collaborations with external expert organizations (e.g., GlZ in Kochi) who work with local institutions in the visualization process.

- *A bottom-up blueprint for implementation:* Although it has not been seen in practice yet, a continued replication of centrally funded, locally designed and implemented actions can potentially offer useful insights into how technical and institutional capacities at local level may be enhanced.

To sum up, the above discussion asserts the important instrumental role that availability of finance will play in building and expanding implementation capabilities across different levels of governance and actors. By extension, sustained and progressively increased provision of finance will hold the key for progressive enhancement of NDC ambitions.

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Towards a Gender-Just Mitigation Policy

Kavya Michael¹, Manish Shrivastava², Arunima Hakku³ and Kavya Bajaj⁴

¹ Associate Fellow, Centre for Global Environment Research, Earth Science and Climate Change, TERI.

E-mail: kavya.michael@teri.res.in

² Assistant Professor, TERI School of Advanced Studies.

Email: manish.shrivastava@terisas.ac.in

³ Research Associate, Centre for Global Environment Research, Earth Science and Climate Change, TERI.

Email: arunima.hakku@teri.res.in

⁴ Researcher, Centre for Global Environment Research, Earth Science and Climate Change, TERI.

Email: kavyabajaj.teri@gmail.com

The emergence of environmental justice movement reconceptualized our understanding of environment as expressive of social relations and, hence, social justice concerns. Scholars of political ecology¹ argue that access to environmental resources as well as exposure to environmental harms are manifested through social process and power structures. Emphasizing on the concept of a linked human bio-physical system many argue that the environment and climate system are essential inputs for the development of capabilities that are essential determinants of well-being.² The climate change literature that largely engages with social identities like gender is copiously adaptation centric, routinely emphasizing women's vulnerability and capacity to adapt. Gender justice concerns still remain an extraneous concern to mitigation policy, arguably pointing to a glaring research and policy gap. Addressing this gap requires building coherence between existing literature on climate justice, gender justice, and environmental justice and mitigation.

The Paris Agreement has infused a renewed sense of urgency about rethinking the current models of development and transition towards a low carbon economy. Pathways to a new economy can come with its own sets of trade-offs with significant justice implications for social identities like gender. Unlike adaptation-centric gender justice literature, the domain of mitigation policy provides us with significant opportunities to insert justice concerns actively into the low-carbon transition of economy. How can such a transformative mitigation policy be envisaged?

The preliminary step in enhancing gender justice is to recognize the economic and cultural forms of gendered exclusion in the mitigation space as well as the

relevant opportunities presented. Capitalizing on these opportunities, steps need to be identified for long-lasting capability development. This can be better understood by looking at three examples from India: REDD+, Pradhan Mantri Ujjwala Yojana (PMUY), and Solar Mamas.

India's submission to UNFCCC's Gender Action Plan (GAP) Report mentions the REDD+ and PMUY as schemes that lead to women's empowerment. However, a critical examination of these schemes depicts embedded structures of economic and androcentric exclusions, removal of which, apparently, has been deemed outside the purview of these interventions. India's REDD+ strategy is built upon the operational framework of existing schemes and programmes like the Joint Forestry Management Program (JFM), and the Green India Mission. While REDD+ framework emphasizes on compulsory representation of women³ lack of recognition of gendered forms of injustices manifested in the way men and women access forest resources, and participate in decision making processes is hardly taken into consideration. It is even argued that operationalizing the REDD+ framework without adequate capability development of women can accentuate gendered vulnerabilities by restricting access to forest use for fuel, fodder or non-timber forest produce.⁴

The PMUY was formulated to view the problem of energy access through the lens of woman empowerment.⁵ However, the programme itself has reinforced, rather

¹ Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (2005). At risk: natural hazards, people's vulnerability and disasters. Routledge.

² Leach, M., Mearns, R., & Scoones, I. (1999). Environmental Entitlements: Dynamics and Institutions in community-based natural resource management, *World Development* 27 (2): 225–247.

³ Ministry of Environment Forests and Climate Change, Government of India. 2018. National REDD+ Strategy INDIA. Details available at <http://www.moef.nic.in/sites/default/files/India%20National%20REDD%2B%20Strategy%20released%20on%2030.08.2018.pdf>

⁴ Elias, M., & Grosse, A. (2017). Unpacking 'gender' in India's Joint Forest Management Program: lessons from two Indian states. Biodiversity International. Details available at https://www.biodiversityinternational.org/fileadmin/user_upload/Unpacking_gender_in_India_s_Joint_JFM_2017.pdf

⁵ Ministry of Petroleum & Natural Gas, Government of India. 2017. About PMUY. Details available at <http://www.pmujiwalayojana.com/about.html>

than weakening, gendered roles (cooking) by making women the official owners of a cooking apparatus (LPG connections). Beyond providing women with LPG connections, the scheme's lack of consideration of the economic capabilities of households, that is, their ability to afford subsequent refills, as well as the absence of initiative to engage women as stakeholders in the planning, conceptualization, and operationalization phase of the programme has been widely debated.

A review of debates of REDD+ and PMUY suggests that mitigation-oriented policies and programmes can be a better vehicle of enhancing gender justice provided their conception moves beyond 'women empowerment' through nominal participation and 'entitlements' to creating opportunities and development of capabilities. Investment in gender-sensitive education, health services, income-generation opportunities and emphasis on developing women's agency can enable the achievement of the goals associated with 'participatory decision-making processes'.

In this light, the Solar Mamas programme supported by the Ministry of External Affairs through the Indian Technical and Economic Cooperation (ITEC) programme⁶ is an exemplary scheme that targets women from non-electrified villages. The programme focuses on building women's technical know-how, emphasizes on building women's capability through imparting training in alternative livelihoods, agency development, self-awareness and recognition of their aspirations. As complementing initiatives of the scheme it also focuses on sensitising the larger community, encourages a dialogue around taboo topics in the society such as reproductive health thereby enabling effective mainstreaming of women in the male-dominated solar engineering domains. This is perhaps an ideal example of the transformative potential of mitigation policy in addressing gendered biases embedded in the society in the forms of resource distribution, misrecognitions, and building essential capabilities for 'gender-just transitions'.

Bhungroo: A Study in Enhancing Women's Welfare through Technological Solutions

Arunima Hakhu, Research Associate, TERI

Email: arunima.hakhu@teri.res.in

Background

The agriculture sector in India has undergone rapid feminization due to various intersecting reasons—poverty, male migration to urban centres, ensuring food security for the household (Vepa, 2005; Rao, 2006; Garikipati, 2009). In 2018, 44% of the labour force was employed in the agriculture sector (World Bank, 2019). In the same year, 42% of this labour force was female (National Council of Applied Economic Research [NCAER], 2018). In fact, 80% of all economically active women are employed in agriculture (Oxfam, 2018) despite owning less than 2% of the land (NCAER, 2018).

In India, 51% of net sown area in India is rainfed (Reserve Bank of India, 2019). Paradoxically, while roughly 12% of total geographical area is prone to annual flooding (Singh, 2018), about 68% of cultivable land is drought prone (National Disaster Management Authority, 2017). Not only is this indicative of a water mismanagement issue, it also adds to the multiple stressors that impact risks women farmers face. Thus, climate change stands to impact landless women, the predominant demographic engaged in agricultural labour in India.

Bhungroo is a low-cost sustainable water management technology. It is designed to harvest rainwater that waterlogs agricultural land. It is an adaptation tool in that it builds resilience in communities by recharging groundwater, reduces soil salinity, secures livelihoods by storing water for drinking and irrigation, and aids in establishing food security. It is also a mitigation tool: Naireeta Services Private Limited (NSPL), through its Sustainable Green Initiatives Forum (SGIF), offers capacity building to train farmers to become Women Climate Leaders. These leaders are then trained to extend these services to the local community.

How Does it Work?

NSPL targets farmers through rigorous data-backed analysis to identify “ultra-poor farmers and agro labours” (NSPL, 2019; interview with NSPL’s Biplab Ketan Paul, 2019). It facilitates the installation of Bhungroo units, freeing 10 acres of land from water logging. The harvested water can be used to irrigate 20 acres of land. One Bhungroo unit typically services 5 families in India. Each unit is touted to ensure at least 30 years of food security, making 1–4 Mlts of harvested water available annually for agricultural use. With water at their disposal

throughout the year, these farmers can then cultivate multiple crops. NSPL estimates its impact on livelihoods by an increase of \$210–700 in the family incomes of beneficiaries (NSPL, 2019). Along with ensuring food security, Bhungroo systems have helped families in securing assets required for animal husbandry and allied sectors, further diversifying the risk faced by farmers.

NSPL, through SGIF, also undertakes extension of knowledge-based services related to agriculture input sourcing and usage, crop protection and sales, and advocacy. By training 20 Women Climate Leaders, SGIF has equipped approximately 98 women farmers in various communities¹ with the option to avail of aforementioned agricultural and allied services through the year. In enabling such capacity building, it has impacted 327 women groups, comprising of nearly 20,000 people.² In training Women Climate Leaders, SGIF has created a space for evidence-based advocacy within the local context, inspiring community members to actively participate in local governance (ibid.). This has positive impacts on community resilience in the face of climate change.

Why Does it Work?

Bhungroo looked at as a mitigation tool identifies avenues of participation that fosters gender justice (Michael *et al.*, 2019). Through Bhungroo, NSPL targets poor women farmers, recognizing the differential impacts they face due to lack of income and access to water management services. By training women as leaders, it also recognizes the importance of including these women’s lived experiences within local governance and community engagements.

Through Bhungroo, SGIF imparts knowledge ownership that equips women with technical skills. Not only are women trained to oversee the upkeep of Bhungroo units, they are also trained to provide extension services within the target community. This enhances their capabilities as envisioned by Michael *et al.*, translating

¹ Bhungroo has impacted women farmers in Gujarat, Uttar Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Jharkhand, Odisha, and Madhya Pradesh in India. The technology has succeeded in improving lives in Ghana, Bangladesh, Togo, Zimbabwe, and Madagascar as well.

² Interview with Biplab Ketan Paul, 2019.

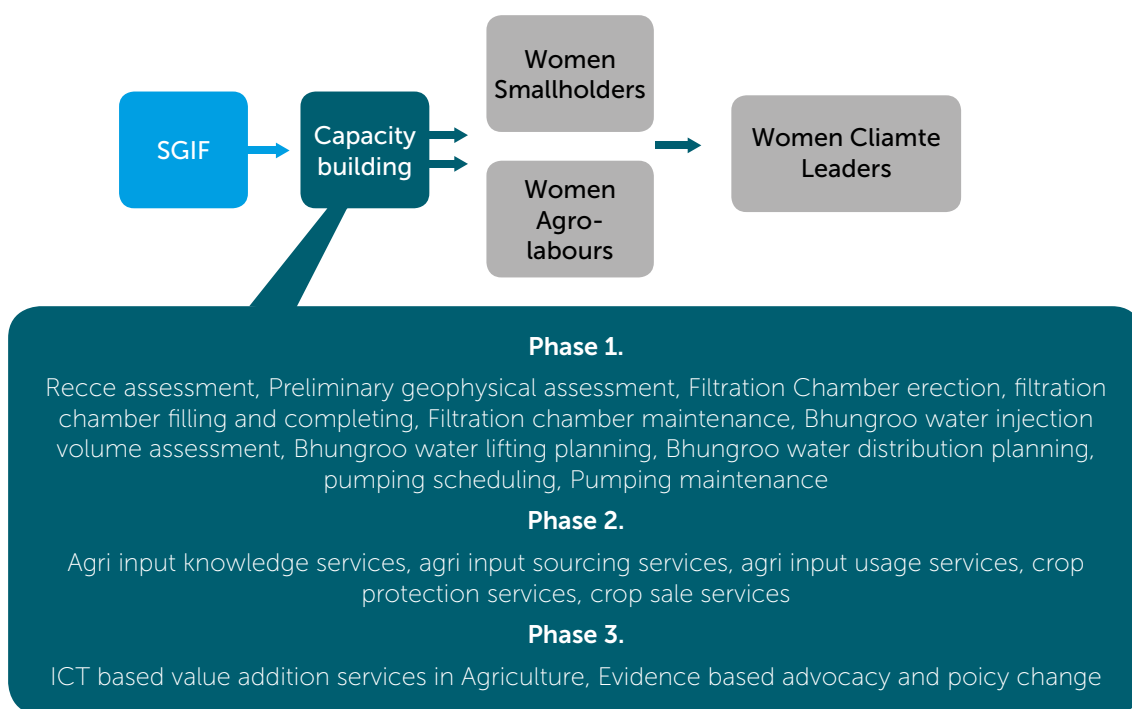


Figure 1: SGIF Activity flow chart (SGIF, 2019)

into real outcomes such as steady income streams, asset acquisition, and enhanced participation in community decisions.

Conclusion

Analysing the Bhungroo initiative through a gendered lens shows that there are ways to create inroads for gender debates even when proffered solutions are technology centred. Bhungroo as a project evolved through a series of trials and errors.³ These helped tailor the project to the needs of communities in which the technology was deployed, indicative of responsiveness necessary to improve project effectiveness.⁴ The initiative successfully combines climate solutions with gender justice. It succeeds in mainstreaming gender concerns by recognizing the differential vulnerability experienced by economically disadvantaged women farmers (due to landlessness, dependence on monsoons for agricultural productivity, crop destruction due to water logging, and lack of social security nets).

While the core NSPL team itself employs a few women, the SGIF mainly comprises women farmer volunteers. The initiative thus recognizes the needs of beneficiaries at the decision making and implementation levels. This recognition translates into capability outcomes ranging

from steady income streams, improved livelihoods, food security, access to water management solutions, and effective participation in local governance. The initiative delivers sustained results because it enhances the agency and livelihoods of target beneficiaries.

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³ Ibid.

⁴ For example, Mr Paul highlighted that in context of project implementation in Bangladesh, it took two years of consistent advocacy for Bhungroo to become a socially-accepted intervention.

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Learning from Practice: Deploying Innovative Financial Interventions at Scale

¹Aanchal Pruthi, Project Associate, TERI

Email: aanchal.pruthi_c@teri.res.in

²Tamiksha Singh, Associate Fellow, TERI

Email: Tamiksha.Singh@teri.res.in

Leveraging investments for climate resilient agricultural practices is essential to address the interwoven challenges of climate change mitigation, adaptation and food security. However, the flow of climate funds, especially private sector contributions are majorly directed towards mitigation, leaving scarce public funds as the only source for financing adaptation. Whilst, funding for agriculture sector has been historically challenging due to complexities in evaluating the impact of agricultural interventions, the lack of adaptation funds further restricts the adoption of required adaptation measures in the sector. To move past this shortfall, there is a dire need for India to leverage learnings from existing adaptation pilots that use innovative financial approaches to achieve climate benefits as well as design and deploy additional pilot projects. This will result in the formulation of more effective and efficient large-scale programmes and policies.

Below, is detailed one such innovative pilot programme, which was successfully replicated to a sub-national policy.

Case Study: Development of Gujarat's SKY Scheme

India's reliance on groundwater for irrigation has underpinned its agricultural production and growth since the Green Revolution. Groundwater in India has largely been pumped out using diesel powered engines, with a shift towards electric pumps in the last few decades, making these a significant source of the country's GHG emissions. Further, grid based thermal power has been heavily subsidised for farmers, which has acted as a perverse incentive for farmers to easily extract groundwater, subsequently leading to its overexploitation. So overall, the use of agricultural pumps has led to the inefficient use of energy, overexploitation of water resources and also increased the carbon intensity of the agricultural sector.

This complexity of India's energy-water nexus has further been exacerbated by the adverse impacts of climate change. The occurrence of high temperatures and erratic rainfall pattern has significantly affected water availability and thus, India's agricultural yield. The situation highlights the urgent need for exploring sustainable alternatives in agricultural practices, with one of those being the deployment of solar pumps for irrigation.

Impacts of Dhundi SPICE Pilot Project

- The use of 40 diesel pumps has been reduced to ten.
- 9 solar pumps installed in the village and being used collectively by farmer cooperatives
- 46% decline in energy consumption as compared to average farmer, resulting in decline in GHG emissions
- Farmers earned additional income of about INR 950000 (USD 13754.8)
- Increased reliability as solar power in contrast to the available grid power is more predictable and freely available during daytime.

One such project, conducted as a pilot for exploring the viability of solar pumps, was the Dhundi Solar Pump Irrigators' Cooperative Enterprise (SPICE). SPICE was started in 2016 by IWMI- Tata Water Policy program at Gujarat's Dhundi village. The model sought to make solar pumps affordable for farmers by providing a 90% capital cost subsidy. To enhance farmers' income streams, the project facilitated farmers to form cooperatives and sell surplus electricity back to the grid at fixed Feed in Tariff (FiT) to The Madhya Gujarat Vij Company limited, under a 25 year power purchase agreement. To encourage efficient utilization of resources, SPICE included a provision for bonuses for producing green energy and conserving water. These bonuses have promoted climate smart groundwater irrigation as the potential for selling off surplus power promoted a carefully measured withdrawal and application of water and energy. The pilot was successful and led to a decline in energy consumption and rise in farmers' income. The pilot Dhundi SPICE successfully culminated into the statewide Suryashakti Kisan Yojana (SKY) Gujarat government scheme.

Building on the Dhundi SPICE pilot project, a subsidy scheme was launched in June 2018 by the Government of Gujarat, called the "Suryashakti Kisan Yojana (SKY)". The scheme aims to promote solar power in agriculture and increase the farmer's self-reliance for their energy needs. The scheme envisages to target 12000 farmers, and encourage them to switch to solar based power for irrigation, across the 33 districts of Gujarat. The implementation is planned in a phased manner, with the

first phase being the building of 137 solar power feeder lines and installation of 175 MW solar photovoltaic panels. The SKY scheme, in line with Dhundi SPICE, includes the following components that aim at making it financially and technically viable for farmers to give up on their grid-based electricity connections for agriculture purposes (See Table). It should be noted that the ability to sell off excess power to the grid and the associated incentives, encourages farmers to also conserve resources (water and electricity) and achieve resource efficiency.

that fulfill their mandated renewable purchase obligations (RPO). In line with the Dhundi SPICE, the approach used in SKY scheme also offers an opportunity to phase down the conventionally high energy subsidies to farmers and reverse the perverse incentive provided by the government.

- Strengthen the capacity of farmers to understand and adopt suitable measures for improving resilience
- Identifying ways to mainstream climate resilient

Table: Financial instruments used in SKY Scheme and their associated benefits to the farmers		
Financial Instrument	Details	Benefits to farmer
Capital cost subsidy	<ul style="list-style-type: none"> • Government provides 60% subsidy on solar pumps • Farmers pay 5% of upfront cost and 35% is repaid as loan (Within 7 years) 	Provision of government subsidy provides coverage to the high cost of solar pumps and makes them financially affordable for farmers.
Feed in Tariff (FiT)	<ul style="list-style-type: none"> • Farmers receive INR 3.5/kWh as FiT for electricity fed back into the grid • Evacuation based incentive (EBI) for initial 7 years 	Provision of FiT and EBI serves an additional source of income that helps farmers to repay their loans.
Performance Guarantee and Insurance	<ul style="list-style-type: none"> • A performance guarantee is applicable on the solar photovoltaics provided to the farmers. • Government provides insurance on solar photovoltaic for initial 7 years. 	Performance guarantee and insurance ensures free maintenance of photovoltaic for first seven years.

Outcomes of the Study: Emerging good practices to be further strengthened and scaled

- Design sustainable finance models to address the specific financial barriers to adopting required climate actions

The SKY financial model is designed in a way that makes it financially viable and sustainable for all stakeholders involved. The provision of government subsidy makes adoption of solar pumps more acceptable for farmers while providing them a climate proof reliable source of irrigation. The provision of FiT and Evacuation based incentives (EBI) further incentivizes the farmers to effectively utilize resources, making it a sustainably viable option. Therefore, the model offers a concrete elucidation to stop possible groundwater exploitation as it motivates the farmer to use, sell and save, thus ensuring profitability and sustainability through this system.

It also opens an avenue for farmers to supplement their income by pooling in surplus solar power, hence making it a profitable option. Further, benefits are reaped by DISCOMS that buy solar power from farmers and generate Renewable Energy Certificates

practices at all levels of financial decision-making is important for climate proofing future investments. The Dhundi pilot indicated the opportunity for lenders to incentivise farmers to efficiently manage resources through provision of resource conservation incentives that was replicated in the form of EBI and FiT in the case of SKY scheme. Both Dhundi and SKY also involve trainings to properly equip farmers to use solar pumps. Such awareness and training sessions for farmers can help them better understand the value of an intervention and take informed action.

- Building cooperatives as platforms for demand aggregation to make adoption of climate resilient solutions financially viable

Establishing farmer cooperatives, as seen in the Dhundi SPICE, enables demand aggregation and pooling of resources that can enable farmers to collectively access and manage finance at better terms. As seen in the Dhundi pilot, the financial burden of individual farmer within a cooperative was lowered down since the cost and the associated risks for buying a solar pump was divided among all members. This led to improvement in the ability of vulnerable groups, like the small farmers, to invest in climate smart farm equipment and technologies, as well as prepare to collectively manage the impact of climate extreme events.

Conclusion

Conducting pilot studies, like the Dhundi SPICE, is important to demonstrate the viability of innovative financial interventions for complex issues such as climate change, and understand its highly uncertain risk-return profile as well as its adoption potential by the people. The Dhundi pilot clearly helped in understanding the market growth potential of solar pumps in the state of Gujarat, as well as its potential advantages for the agriculture, energy and water sector, and thus led to the launch of the SKY scheme. It also highlighted challenges, such as the need to regulate the over exploitation of water resources through careful consideration of monetary value of incentives, which will be addressed at the scale up stage. The design of SKY has incorporated lessons

both from the Dhundi Pilot and constant feed received from farmers.

A similar approach of solarizing irrigation has been scaled up at the national level through the formulation of the Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM) Scheme in 2018, but the scheme is currently open to modifications in line with past pilot experiences. Therefore, to make the best use of the scarce funding available in climate adaptation, especially for the agriculture sector, it is pivotal to identify innovative climate financing practices and adopt an iterative, 'learning by doing' approach. This will act as a crucial starting point to bridge the current gaps in the delivery of climate investment both at the national and sub-national levels.

The Paris Agreement sets an ambitious goal of keeping the increase in temperature rise well below 2°C. Almost all countries put forward their INDCs as a start towards meeting this goal, which will be further revised as NDCs. Further, countries also agreed to undertake regular stock-taking to assess whether they will be able to reach their commitment and to what extent their efforts are enabling them to keep the GHG emissions trajectory on track with the above-mentioned goal. The achievement of these goals will depend on: i) effective implementation and ii) enabling means of implementation or support. Continued analysis, deliberations, and knowledge sharing is imperative for countries to implement their 'nationally determined contributions' along with identifying specific international cooperation needs. This project aims to contribute to this effort. The focus of the project is on issues related to implementing NDCs in both the international and domestic context. The following activities will be undertaken under this project:

1. Tracking of Nationally Determined Contributions and domestic linkages with SDGs
2. Role of international cooperation and domestic innovation on climate finance
3. Technology cooperation needs for implementing and enhancing India's NDC
4. Understanding gender dimension in mitigation actions

This series of Mitigation Talks acts as a platform to initiate discussions on various issues under these four themes.

For more information, contact:

Neha Pahuja

Fellow, TERI

The Energy and Resources Institute (TERI)
Darbari Seth Block,
IHC Complex, Lodhi Road,
New Delhi 110 003

Tel: 24682100 or 41504900

Fax: 24682144 or 24682145

Web: www.teriin.org

E-mail: neha.pahuja@teri.res.in