

# Scoping Report

## *Strengthening National MRV Systems- Options and Approaches for India*

Submitted to  
UNEP DTU

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This publication has been produced as part of a component of the Initiative for Climate Action Transparency project (ICAT) implemented by UNEP DTU Partnership (UDP). The views expressed in this publication are those of the authors and do not necessarily reflect the views of UDP.

## PREPARED UNDER

Initiative for Climate Action Transparency (ICAT) project supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, the Children's Investment Fund Foundation (CIFF), the Italian Ministry of Ecological Transition (IMET) and ClimateWorks.



The ICAT project is managed by the United Nations Office for Project Services (UNOPS)



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## Introduction

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India has put forth ambitious yet well-balanced set of goals in its Nationally Determined Contributions (NDCs). The emphasis is on addressing climate change and development challenges using a co-benefits approach. India's commitment to combat climate change is well articulated in its NDCs as follows:

1. To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
2. To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
3. To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
4. To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF).
5. To create an additional carbon sink of 2.5 to 3 billion tonnes of CO<sub>2</sub> equivalent through additional forest and tree cover by 2030.
6. To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
7. To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
8. To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.

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 at international level<sup>1</sup> and also to meet the needs at the domestic level. Internationally, it would help India to meet new international requirements as part of the Paris Agreement<sup>2</sup>. Domestically, 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.

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<sup>1</sup> According to the Paris Agreement Article 13.7, "Each Party shall regularly provide the following information:

- (a) A national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases, prepared using good practice methodologies accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement;
- (b) Information necessary to track progress made in implementing and achieving its nationally determined contribution under Article 4."

<sup>2</sup> Modalities of which will be informed by the experience and learnings of the transparency arrangements under the Convention, including NATCOMs, BURs and ICA. Some existing system is captured in Annex I of this note.

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 BUR report of India, the monitoring and evaluation of government policies and programmes is an integral part of assessing the financial allocations. The monitoring includes both, financial and physical targets. In addition, systems exist for review of overall impacts at highest policymaking 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. However, 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 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."

For developing any MRV framework, it is important to define the boundary including identification of sectors and related policies/programs based on their contribution to India NDCs and GHG mitigation potential. The scoping report highlights key policies and programs from select sectors (renewable energy, transport, buildings and agriculture) which are mainly responsible for country's GHG emissions and having greater GHG reduction potential, thus contributing largely to achieving NDCs commitments. The table below illustrates a qualitative assessment of India's NDCs goals and its linkage with each identified sector:

NDC goal	Linkage with each sector			
	Buildings	Renewable Energy	Transport	Agriculture
To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	Direct	Indirect	Indirect	Direct
To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.	Direct	Direct	Direct	Direct
To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.	Direct	Direct	Direct	Direct
To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance	Indirect	Direct	Indirect	Indirect

NDC goal	Linkage with each sector			
	Buildings	Renewable Energy	Transport	Agriculture
including from Green Climate Fund (GCF).				
To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.	Indirect	Indirect	Indirect	Direct
To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.	Indirect	Indirect	Indirect	Direct
To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.	Direct	Direct	Direct	Direct
To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.	Direct	Direct	Direct	Direct

This scoping report is an attempt to map India’s key programs and policies on GHG mitigation, specifically aimed at strengthening reporting on INDCs, as well as institutional arrangements for domestic MRV system. The report will form the basis undertaking detailed assessment of existing monitoring and reporting systems and develop appropriate options and approaches for a suitable MRV framework,

## 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 40% share of renewables. With 250-300 days of solar availability potential in India, solar power is poised to be a viable source for energy generation and Carbon emissions reduction. The launch of National Solar Mission (NSM) has enabled large-scale deployment of solar 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. A brief summary of above mentioned and other sources is shown in table 1 below:

Source	Installed Capacity (MW)	Target 2022(MW)
Wind power	32,715.37	60,000.00
Solar power - Ground Mounted	14,751.07	100,000.00
Solar power – Rooftop	823.64	
Biomass power (Biomass & Gasification and Bagasse Cogeneration)	8,181.70	*10,000.00
Waste-to-Power	114.08	
Small hydropower	4,399.35	5,000.00
<b>TOTAL</b>	<b>60,985.21</b>	<b>175,000.00</b>

TABLE 1 SOURCE-WISE GRID-CONNECTED INSTALLED (2017) AND TARGET (2022) CAPACITIES IN MW

Generation from Solar and Wind power are emission neutral. However, for PV and Wind systems, emissions are primarily linked to manufacturing processes, with fuel and electricity consumption. Additionally, major manufacturing for Polycrystalline Si and Si wafer are done outside the country. There are no specific methodologies available. Assembling consumes electricity, however emissions from electricity consumption is accounted under IPCC (2006) Energy Sector. Considering the operational life cycle of these components, the net emissions are zero.

Universalizing access to clean and modern energy to all is one of India’s primary goals, where a multipronged approach of increased generation from renewable energy sources and measures for residential, commercial and industrial energy efficiency improvement, is being adopted. Increased capacity building of solar and wind power in the country are directly linked to United Nations Sustainable Development Goal <sup>7</sup>.

In India, energy security is of primary concern. While, the headroom for Carbon usage is still positive for the country, India has increased its renewable energy capacity to support reliable energy access. Energy access through renewable generation directly links to low carbon development, besides having a positive effect on the environment. Additionally, since the renewable energy sector development in the country is in sync with the global markets and investments, it has created an enhanced scope for skilled employment, thus creating a positive indirect impact on the economy.

## 1. Scoping matrix

**National Action Plan on Climate Change (NAPCC)** was launched in 2008 by the Government of India to achieve a sustainable development path by addressing the economic and environmental objectives. Eight missions form the core of NAPCC focused on promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.

**The National Solar Mission (NSM)** was one of the key missions under NAPCC that was launched for significantly increasing the share of solar energy in the total energy mix of India. It was also envisaged to constitute a major contribution by India to the global effort to meet the challenges of climate change. The Mission has set the ambitious target of deploying 20,000 MW of grid connected solar power by 2022 is aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022. The solar mission was further divided into phase-I (2010-2013) and phase-II (2013-17) and phase-III (2017-2022) for deployment of solar power in the country. Further, Government has revised the target of Grid Connected Solar Power Projects from 20,000 MW by the year 2021-22 to 100,000 MW by the year 2021-22 under the NSM in 2015<sup>3</sup>. The target of 100,000 MW will comprise of 40,000 MW solar rooftop and 60,000 MW large and medium scale grid connected solar power projects.

**Ambitious target of 175 GW of Renewable Energy by 2022-** Of the 175 GW target of renewable energy, solar and wind will contribute to 100GW and 60GW respectively by 2022 to be achieved as part of the NDC announced by the Government of India. As per Ministry of New and Renewable Energy (MNRE), as on 31st October 2017, **a total of 32.72<sup>4</sup> GW of wind power and 15.60 GW of solar power (ground mounted and rooftop) have been achieved.**

The target of 100 GW for solar power has been distributed for each year until 2022 and is given in table 1:-

Table 1: Year wise and cumulative target of solar power by 2022<sup>5</sup>

<sup>3</sup> <http://www.mnre.gov.in/solar-mission/jnnsn/introduction-2/>

<sup>4</sup> <http://mnre.gov.in/mission-and-vision-2/achievements/>

<sup>5</sup> <http://mnre.gov.in/file-manager/UserFiles/GW-Solar-Plan.pdf>

S. No	Year	Yearly Target (in MW)	Cumulative Target (in MW)	Yearly capacity added (in MW)	Cumulative Capacity (in MW)
1	2015-16	2,000	5,000	3018.883	6762.853
2	2016-17	12,000	17,000	1964.77	8727.62
3	2017-18	15,000	32,000		
4	2018-19	16,000	48,000		
5	2019-20	17,000	65,000		
6	2020-21	17,500	82500		
7	2021-22	17,500	<b>1,00,000</b>		

Wind power potential is concentrated in 7-8 wind resource rich states of India. Therefore, the target of 60 GW for wind power has been distributed for each state<sup>6</sup> until 2022 and is given in table 2:-

Table 2: State wise and cumulative target of wind power by 2022

S.No	State/UTs	Wind (MW)	Capacity achieved as on March 2017 <sup>7</sup>
1	Rajasthan	8600	4280
2	Gujarat	8800	5340
3	Madhya Pradesh	6200	2500
4	Maharashtra	7600	4770
5	Andhra Pradesh	8100	3620
6	Telangana	2000	-
7	Karnataka	6200	3750
8	Tamil Nadu	11900	7860
9	Others	600	160
	<b>Total</b>	<b>60000</b>	<b>32280</b>

### Policy enabling framework for Renewable Energy

Enactments prior to the Electricity Act 2003 (EA 2003 or 'the Act') had no specific provisions, which would promote renewable or non-conventional sources of energy

1. **Electricity Act, 2003**<sup>8</sup>- The EA 2003 provides for policy formulation by the Government of India and mandated State Electricity Regulatory Commissions (SERC's) to take steps to promote renewable sources of energy within their area of jurisdiction. Further, EA 2003 has explicitly stated the formulation of National Electricity Policy (NEP), National Tariff Policy (NTP), and Plan thereof for developing power systems to ensure optimal utilization

<sup>6</sup> <http://mnre.gov.in/file-manager/UserFiles/Tentative-State-wise-break-up-of-Renewable-Power-by-2022.pdf>

<sup>7</sup> <http://mnre.gov.in/schemes/grid-connected/solar-thermal-2/>

<sup>8</sup> <http://www.cercind.gov.in/Act-with-amendment.pdf>

of all resources including renewable sources of energy. NEP also stated that the purchase of renewable power by the DISCOMs should be through competitive bidding.

Under the following sections of the Electricity Act, an enabling environment was created for promotion of renewable energy in the country.

- **Section 61(h). (Tariff regulations)-** The promotion of co-generation and generation of electricity from renewable sources of energy
  - **Section 63. (Determination of tariff by bidding process)-** The Appropriate Commission shall adopt the tariff if such tariff has been determined through transparent process of bidding in accordance with the guidelines issued by the Central Government.
  - **Under Section 86. (1) (e) (Functions of State Commission)-** Promote co-generation and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee
  - **Section 62. -** Central Electricity Regulatory Commission (CERC) released (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations- These regulations shall apply in all cases where tariff, for a generating station or a unit thereof based on renewable sources of energy, is to be determined by the Commission under Section 62 read with Section 79 of the Act.
2. **National Tariff Policy, 2006-** Introduction of NTP in 2006 triggered fixation by SERCs of a minimum percentage of Renewable Purchase Obligation (RPO) from RE sources as targets for state distribution companies and other obligated entities taking into account availability of such resources in the region and its impact on retail tariffs and procurement by distribution companies at preferential tariffs determined by the SERCs. The recent amendments in NTP in 2016 mention promotion of renewable energy as a crucial objective of the policy.
3. **The New Tariff Policy 2016,** development of renewable energy has been given a special consideration. New tariff policy pursues the following initiatives that will help in capacity addition and promote interstate transaction of RE power:-
- SERCs to fix RPO trajectory to reach 17% of the renewable energy in the total energy mix by 2022, which also includes 8% from solar power.
  - The policy also specifies Renewable Generation Obligation (RGO) which is applicable to the new coal/lignite-based thermal plants to install renewable energy capacity which will be at least 10% of their total capacity, which in turn can be sold it through bundling with conventional electricity

- To promote renewable energy interstate exchange of power, the policy waived off inter-state transmission charges and losses for solar and wind power

### Renewable purchase obligation

Renewable Purchase Obligation (RPO) is a mechanism by which the obligated entities are obliged to purchase certain percentage of electricity from Renewable Energy sources, as a percentage of the total consumption of electricity. RPOs are categorized into Solar and Non- Solar RPO. The target for RPO percentage is set by the State Electricity Regulatory Commission and varies from state to state. RPOs were introduced to give markets a push for renewable power in India.

The Ministry of Power has issued guidelines, for long-term growth trajectory for RPO of Non solar as well as for Solar. Though the guidelines have been issued, the final targets will be set by each individual state's electricity regulatory commission (SERC). In order to achieve the target of 175,000 MW of renewable capacity by March 2022, MNRE has notified the RPO uniformly for all States/ UTs initially for three years from 2016-17 to 2018-199 as given in the table 3:

Table 3: Long-term trajectory for RPO

S.No	Long term trajectory	2016-17	2017-18	2018-19
1	Non-solar	8.75%	9.50%	10.25%
2	Solar	2.75%	4.75%	6.75%
	<b>Total</b>	11.50%	14.25%	17%

<sup>9</sup> <http://reconnectenergy.com/blog/2016/07/ministry-of-power-sets-green-energy-targets-for-state-discoms/>

Table 4: Key policies/programmes/regulations/ incentives for renewable energy promotion

Program/Policy/ Regulation/Act	Stated Objective	NDC linkage?	Impacts or potential (Direct/in direct)	Applicability/ Sectors covered	Starting Year/ Baseline	Implementation Entity
<b>Feed-in-tariff (wind)</b>	To promote wind power generation in the states of India	Yes, for increasing share of non-fossil fuel based power	Indirect	Wind energy sector	2009	CERC, SERC Wind Developers
<b>Competitive bidding (wind) scheme for Inter- State Transmission System (ISTS) connected Wind Power Projects<sup>10</sup></b>	To enable distribution companies of the non-windy States to fulfill their non-solar renewable energy purchase obligation, through purchase of wind power at a tariff determined by transparent bidding	Yes, for increasing share of non-fossil fuel based power	Direct- Capacity addition	Wind energy sector	2016	SECI, MNRE, Distribution Utilities, Wind Developers, SERC
<b>Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid</b>	These guidelines have been formulated for procurement of wind power through transparent process of bidding under	Yes, for increasing share of non-fossil fuel based power	Direct- Capacity addition	Wind energy sector	2017	MNRE, Ministry of Power, Distribution Utilities, Wind

<sup>10</sup> <http://mnre.gov.in/file-manager/grid-wind/Scheme-for-Setting-up-of-1000-MW-ISTS-connected-Wind-Power-Projects.pdf>

Program/Policy/ Regulation/Act	Stated Objective	NDC linkage?	Impacts or potential (Direct/in direct)	Applicability/ Sectors covered	Starting Year/ Baseline	Implementation Entity
Connected Wind power projects	section 63 of the Electricity Act. This will enable distribution utilities to procure wind power at competitive rates in a cost effective manner.					Developers, SERC
<b>Competitive bidding (solar)</b> Solar Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Solar PV Power Projects <sup>11</sup> .		Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Solar sector	2017	SECI, MNRE, solar developers, distribution utilities, SERC's

<sup>11</sup> [http://mnre.gov.in/file-manager/grid-solar/Guidelines\\_for\\_Tariff\\_Based\\_Competitive\\_Bidding\\_Process.pdf](http://mnre.gov.in/file-manager/grid-solar/Guidelines_for_Tariff_Based_Competitive_Bidding_Process.pdf)

Program/Policy/ Regulation/Act	Stated Objective	NDC linkage?	Impacts or potential (Direct/in direct)	Applicability/ Sectors covered	Starting Year/ Baseline	Implementation Entity
Scheme for setting up over 300 MW of Grid-Connected Solar PV Power Projects by with Viability Gap Funding <sup>12</sup>		Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Defence Establishments under Ministry of Defence and Para Military Forces	2015	MNRE, Distribution utilities, solar developers etc.
Implementation of Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects. (20,000 MW for 5 years from 2014-15)	The scheme will support the States in setting up solar parks at various locations in the country with a view to create required infrastructure for setting up of Solar Power Projects	Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Solar sector	2014	SECI, MNRE, Distribution utilities, solar developers etc.
Viability Gap Funding (VGF) scheme • 750 MW VGF Scheme		Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Solar sector	2015	Distribution utilities, Bulk consumers, state utilities SECI

<sup>12</sup> <http://mnre.gov.in/file-manager/annual-report/2016-2017/EN/pdf/4.pdf>

Program/Policy/ Regulation/Act	Stated Objective	NDC linkage?	Impacts or potential (Direct/in direct)	Applicability/ Sectors covered	Starting Year/ Baseline	Implementation Entity
<ul style="list-style-type: none"> <li>• 2000 MW VGF Scheme</li> <li>• 5000 MW VGF Scheme</li> </ul>						
Scheme for setting up of 1000 MW of Grid connected Solar PV power projects		Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Projects to be set up CPSUs and Govt. organizations	2015	
15000 Mw Grid-Connected Solar Pv Power Plants Through Ntpc Ltd.		Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Solar sector	2014	NTPC Ltd./ NVVN
3000 MW Grid Connected Solar PV Power Projects 'State Specific Bundling Scheme		Yes, for increasing share of non-fossil fuel based power	Direct-Capacity addition	Solar sector	2014	NTPC Ltd. / NVVN, CERC, SERC

Program/Policy/ Regulation/Act	Stated Objective	NDC linkage?	Impacts or potential (Direct/in direct)	Applicability/ Sectors covered	Starting Year/ Baseline	Implementation Entity
Fiscal Incentives						
Direct tax benefits						
Accelerated Depreciation	Financial benefit to attract private sector investment	Not linkage	direct	Direct- Capacity addition	Wind and solar sector	2002 Ministry of Finance, IREDA
Other benefits						
<ul style="list-style-type: none"> <li>• Tax holiday</li> <li>• Generation based incentive</li> </ul>	- Facilitate the large IPP's and foreign direct investors who aren't able to take AD benefit	No linkage	direct	No direct linkage	Wind and solar	- 2010- 2012 Ministry of Finance, IREDA IREDA

Accelerated Depreciation (AD) benefit, which was first introduced in 1994, with a depreciation rate of 100 per cent. In 2002, the depreciation rate was reduced to 80 per cent and the scheme was subsequently withdrawn completely in March 2012. AD was reinstated in 2014 at 80% after many stakeholders voiced for this encouragement. The AD tax benefit provided the required financial benefit to attract private sector investment in the wind sector, and facilitated the entry of a new class of investors comprised of high net worth individuals (HNIs), corporations, and small and medium sized enterprises.

The Generation Based Incentive (GBI) scheme was introduced in the 2010 financial year as an alternative to the AD scheme but this also lapsed in 2012.

## 2. Policy prioritization for detailed assessment

### 2.1. Criteria/rationale

The promotion of renewable energy in the country is governed by various policies, programmes and regulations as explained in the section above. However, the announcement of 175 GW target of renewable energy capacity by 2022 in the NDC majorly focuses on deployment of solar (100GW) and wind (60 GW) power in the country. Therefore, it is important to look at the policies or regulations that are governing the renewable capacity addition, particularly grid connected wind power and solar power projects in the country.

In case of wind power, feed-in-tariffs along with fiscal incentives have seen a manifold increase in capacity addition in the past. However, in case of solar power, grid connected solar power projects under the various schemes such as solar park scheme, VGF scheme, defence scheme, CPCU scheme are implemented by MNRE in phase-II under the National Solar Mission for driving the growth of the solar sector.

## 3. Selected Policy description

### 3.1. Detailed description

#### **Policies and drivers for wind energy sector**

##### **A. Fiscal incentives**

The Government promotes wind energy sector in the country through fiscal incentives such as accelerated depreciation, concessional custom duty on certain components of wind electric generators and loan from Indian Renewable Energy Development Agency (IREDA) & other financial institutions. In addition, 100 percent FDI through automatic route is allowed in the renewable energy sector including wind energy sector. Generation based incentive scheme for grid interactive wind power projects was launched in 2009 by MNRE.

##### **B. Feed-in-tariff\***

Under the CERC regulations for tariff determination, feed-in-tariffs were announced by the windy states in India. Wind power was procured by the Distribution Utilities at Feed-in-tariff determined by the respective State Electricity Regulatory Commission (SERC).

#### **Policies and drivers for solar energy sector**

##### **A. Fiscal incentives**

All solar projects have been historically eligible to avail depreciation of 80% of asset value but this rate has been reduced to 40% from April 2017<sup>13</sup> onwards. A 10-year income tax holiday has been offered to solar projects so far, but this benefit has been withdrawn from April 2017 onwards.

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<sup>13</sup> [http://www.bridgetoindia.com/wp-content/uploads/2017/05/BRIDGE-TO-INDIA\\_India-Solar-Handbook\\_2017-1.pdf](http://www.bridgetoindia.com/wp-content/uploads/2017/05/BRIDGE-TO-INDIA_India-Solar-Handbook_2017-1.pdf)

## **B. Auction/Bidding\*\***

Selection of capacity for Phase-II, grid connected projects is being done via different schemes such as Bundling, Viability Gap Funding (VGF). This allocation of target capacity may be altered depending upon the availability of resources. The implementation of these schemes will be done through the mode of auction and bidding. In August 2017, Ministry of Power has also released Solar Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Solar PV Power Projects<sup>14</sup>.

## **C. Solar RPO**

According to the NSM, the solar power purchase obligation for States may start with 0.25% in the phase-I and to go up to 3% by 2022. This could be complemented with a solar specific Renewable Energy Certificate (REC) mechanism to allow utilities and solar power generation companies to buy and sell certificates to meet their solar power purchase obligations. CERC and SERCs have issued various regulations including solar RPOs, REC framework, tariff, grid connectivity, forecasting etc. for promoting solar energy. Many States have come up with their own Solar Policy.

### 3.2. Direct or indirect impacts

The policy assessment with respect to GHG emissions reduction for renewable energy sector will be through the capacity addition of renewable power in the grid while off-setting the carbon emissions from the conventional power. This renewable power capacity addition since the launch of the selected policy/programme/regulation will provide direct impacts on the GHG emissions. Addition of renewable power capacity in the total energy mix will also have indirect impacts on the employment generation or job creation in the country. Estimation by a think tank reveals that over 300,000<sup>15</sup> workers will be employed in the next 5 years, to achieve India's solar and wind energy targets. It also estimated that an additional employment of 45,000 might be created with strong domestic solar module manufacturing. Indirect impact may also include; a) development of grid infrastructure, b) development/improvement of existing transport infrastructure (for example transporting the wind turbines to sites) and c) industry development for domestic solar module/cell manufacturing etc.

The RE sector links directly with India's NDC goals and SDGs and therefore offers the following benefits and co-benefits:

#### 1) Social Benefits

- Better energy access
- Healthier individuals owing to cleaner environment
- Community well-being

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<sup>14</sup> [http://mnre.gov.in/file-manager/grid-solar/Guidelines\\_for\\_Tariff\\_Based\\_Competitive\\_Bidding\\_Process.pdf](http://mnre.gov.in/file-manager/grid-solar/Guidelines_for_Tariff_Based_Competitive_Bidding_Process.pdf)

<sup>15</sup> <http://ceew.in/pdf/CEEW%20NRDC%20-%20Greening%20India%27s%20Workforce%20report%2020Jun17.pdf>

## 2) Economic Benefits

- Employment and livelihood generation
- Reduced stress on coal and oil imports
- Reduced energy intensity on GDP
- Reduced per capita emissions

## 3) Environmental Benefits

- Addition of 175 GW RE capacity would result in a potential
- Reduced GHG Emissions
- Combatting Climate Change

### 3.3. Existing MRV approaches

There are no MRV systems in place currently.

### 3.4. Existing data collection and archiving systems

REC Registry reports the RE capacities installed, accredited, registered and RECs issued, redeemed through Power exchanges and redeemed through self-retention state-wise. It also reports the source-wise categories of Wind, Urban or Municipal waste, Solar thermal, Solar PV, Small hydro, Biomass, Bio-fuel cogeneration and others. For example, the registry reports 748 MW of Solar PV has been accredited out of which 731 MW has been registered and 73, 74, 528 RECs have been issued.

- There will be a central level agency to be designated by the Central Commission for registration of RE generators participating in the scheme.
- The RE generators will have two options - either to sell the renewable energy at preferential tariff fixed by the concerned Electricity Regulatory Commission or to sell the electricity generation and environmental attributes associated with RE generation separately.
- On choosing the second option, the environmental attributes can be exchanged in the form of REC. Price of electricity component would be equivalent to weighted average power purchase cost of the distribution company including short-term power purchase but excluding renewable power purchase cost.
- The Central Agency will issue the REC to RE generators.
- The value of REC will be equivalent to one MWh of electricity injected into the grid from renewable energy sources.

- The REC will be exchanged only in the Power Exchanges approved by CERC within the band of a floor price and a forbearance (ceiling) price to be determined by CERC from time to time.
- The distribution companies, Open Access consumer, Captive Power Plants (CPPs) will have option of purchasing the REC to meet their Renewable Purchase Obligations (RPO). Pertinently, RPO is the obligation mandated by the State Electricity Regulatory Commission (SERC) under the Act, to purchase minimum level of renewable energy out of the total consumption in the area of a distribution licensee.
- There will also be compliance auditors to ensure compliance of the requirement of the REC by the participants of the scheme.

### 3.5. Existing government financial monitoring systems of sectors, programmes and schemes REC certificates database POSOCO (similar)

Reliable financial monitoring systems are not in place. There is data on financial disbursement at the central level. For instance, the NCEEF Fund, which was dissolved recently, contained information on budgetary allocations to respective ministries/central bodies undertaking the various activities.<sup>16</sup> However, there are no real-time monitoring systems in place. Ground reports are non-transparent and have high uncertainty.

## Conclusion

In the section 3, policy prioritization has been drawn out for solar and wind sectors. However, to study the overall emission reduction in renewable energy sector from the perspective of policy design and implementation, and linking with NDC goals, the project will shortlist few policies from the listed ones in section 3. It is suggested to look into the following policies/programmes/incentives for detailed assessment:-

- a) Feed-in-tariff policy for wind energy sector that has increased the capacity of wind and overall RE in energy mix of the country in the last two decades
- b) Competitive bidding for solar energy sector that has currently reduced the per unit price of solar power generation with a vision of capacity addition by 2022.

The assessment of these above mentioned policies may give comprehensive understanding of both the sectors in terms of policy design and implementation. This assessment will be useful to showcase the landscape of two different policy regimes i.e. feed-in-tariff and competitive bidding and the respective resultant emission profile during the years.

<sup>16</sup> [http://doe.gov.in/sites/default/files/NCEF%20Brief\\_post\\_BE\\_2017-18.pdf](http://doe.gov.in/sites/default/files/NCEF%20Brief_post_BE_2017-18.pdf)

## Transport

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As per the Biennial Update Report (2015) submitted by India to the UNFCCC, India emitted 2,137 million tonnes of CO<sub>2</sub> equivalent GHGs in 2010 with energy sector accounting for a significant share of 71%. The energy sector emissions encompass emissions from electricity production, fuel combustion in industries, transport and fugitive emissions, out of which, emissions from the transport sector is a significant contributor. India's transport sector accounts for almost 99.6% of the total petrol and 70% of the total diesel consumption in the country (Nielsen, 2013). It is estimated that 98.5% of the total energy consumption in transport sector in India is met through petroleum products (TERI, 2016). Since transport sector is a major user of fossil energy, it has a significant environmental impact; transport sector is a key contributor to global warming through CO<sub>2</sub> emissions and significantly contributes to air pollution, including nitrous oxides and particulates. The transport sector emissions include all GHG emissions from road transport, railways, aviation and navigation. With rapid economic growth, the demand for all transport services has gone up and is now heavily dominated by road transport with a registered CAGR of 9.9% in 2006-16 (MoRTH, 2018). Road transport accounts for 86% of passenger and almost two-thirds of the freight movement. In 2007, 87% of the total CO<sub>2</sub> equivalent emissions in transport sector were emitted by road transport followed by aviation and railways at 7% and 5% respectively (INCCA, 2010).

To reduce emissions from the transport sector and to move towards a low carbon economy, India is focusing on a lot of initiatives to build up energy efficient and low carbon transport systems. Transportation energy use and its impact on environment through GHG emissions is determined by a number of factors such as vehicle efficiency, vehicle use and distance travelled, type of fuels and energy sources and overall system efficiency of transport infrastructure (Gulati, 2012). In order to reduce the emissions intensity of GDP by 33-35% by 2030 from 2005 level India has a definite plan of action for clean energy and energy efficiency in various sectors including transport with a focus on low carbon transport infrastructure, public transport systems and energy efficient railways to reduce environmental impact of transport sector. In order to achieve a safe, smart and sustainable green transport network, government has come up with a number of adaptation and mitigation strategies and actions (India's INDCs to UNFCCC)<sup>17</sup>:

- Government endeavours to increase the share of Railways in total land transportation from 36% to 45%, thereby decreasing the load on less efficient diesel operated road traffic.
- Dedicated Freight Corridors (DFCs) are being introduced across the country in order to shift the freight from road to the low carbon intensive mode rail transport. Indian Railways is also installing solar power on its land and rooftops of coaches. *Apart from the*

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<sup>17</sup>

<http://www4.unfccc.int/ndcregistry/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf>

*implementation of above cited programmes, Indian Railways is also taking other sustainability related initiatives in the areas of energy efficiency and conservation, renewable energy, use of alternative fuel, afforestation and water use efficiency* **Invalid source specified.:**

- With the focus on moving 'people' rather 'vehicles' Mass Rapid Transit System (MRTS) are being introduced.
- In order to promote faster adoption and manufacturing of hybrid and electric vehicles in the country with the help of incentives the Faster Adoption and Manufacturing of Hybrid & Electric Vehicles (FAME) scheme is being implemented as a part of the National Electric Mobility Mission Plan (NEMMP) 2020.
- Under the Vehicle Fuel Efficiency Program, in 2014, Government of India finalised 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.
- National Policy on Biofuels (2015) has adopted an aspirational target of 20% blending of biofuels, both for bio-diesel and bio-ethanol.
- To address the issue of climate change initiative, Director General of Civil Aviation (DGCA) has also laid down policy guidelines for all the airlines and airports to check their carbon footprint on an annual basis.

Policy/Program/ Scheme	Stated Objective	NDC linkage and Target	Policy Status
<b>Dedicated Freight Corridors (DFCs)<sup>18</sup></b>	Dedicated Freight Corridor Corporation of India Limited (DFCCIL) will decongest already saturated road network & promote shifting of freight transport to more efficient rail transport. This shift is expected to offer significant reduction of Green House Gas (GHG) emissions in transport sector in India.	<ul style="list-style-type: none"> <li>• Focus on introducing two freight corridors: Western Dedicated Freight Corridor (WDFC) covering a length of 1504 Kms and Eastern Dedicated Freight Corridor (EDFC) covering a length of 1856 Kms.</li> <li>• An estimated reduction of 457 million tonnes of CO<sub>2</sub> over a period of 30 years.</li> </ul>	<ul style="list-style-type: none"> <li>• First Goods train was run on EDFC track on Durgawati - Sasaram (56 km) section on 30.03.2016.</li> <li>• Work is still in progress on both corridors.</li> <li>• <b>Status of Contracts:</b> WDFC: <i>Civil</i>: 100% <i>System</i>: 100% EDFC: <i>Civil</i>: 83% <i>System</i>: 62%</li> <li>• Construction of these two corridors to be completed by 2019.</li> <li>• Overall Physical Progress: - 37.1%</li> <li>• Overall Financial Progress: - 34.8%</li> </ul>

<sup>18</sup> [http://dfccil.gov.in/dfccil\\_app/Home](http://dfccil.gov.in/dfccil_app/Home)

Policy/Program/ Scheme	Stated Objective	NDC linkage and Target	Policy Status
<b>Metro Rail Policy- 2017<sup>19</sup></b>	Improve the current urban transport systems.	Delhi metro has become India's first carbon credit earning MRTS project and has the potential to reduce about 0.57 million tonnes of CO <sub>2</sub> eq annually <sup>20</sup> .	<ul style="list-style-type: none"> <li>Operational Projects: 370 kms – 8 cities.</li> <li>In Progress: 537 kms in 13 cities including above 8.</li> <li>Planning and Appraisal: 595 kms in 13 cities including 10 new cities<sup>21</sup>.</li> </ul>
<b>Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME), 2015</b>	Under this scheme, Govt. aims to achieve a vehicle population of 6-7 million electric/hybrid vehicles in India by 2020.	<ul style="list-style-type: none"> <li>Estimated to achieve 9500 million litres of fuel savings (MoEF, GoI, 2015).</li> </ul>	<ul style="list-style-type: none"> <li>As per the data available around 175232 vehicles have been sold until now<sup>22</sup>.</li> <li>As per the Notifications from Department of Heavy Industry (DHI), Phase I of FAME scheme was initially implemented for two years commencing from 1<sup>st</sup> April 2015 and has now been extended up to 31<sup>st</sup> March 2018<sup>23</sup>.</li> </ul>

<sup>19</sup> [http://moud.gov.in/upload/whatsnew/59a3f7f130eecMetro\\_Rail\\_Policy\\_2017.pdf](http://moud.gov.in/upload/whatsnew/59a3f7f130eecMetro_Rail_Policy_2017.pdf)

<sup>20</sup> <http://www4.unfccc.int/ndcregistry/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf>

<sup>21</sup> <http://pib.nic.in/newsite/PrintRelease.aspx?relid=170009>

<sup>22</sup> <http://www.fame-india.gov.in/>

<sup>23</sup> <http://www.fame-india.gov.in/ViewNotificationDetails.aspx?RowId=15>

Policy/Program/ Scheme	Stated Objective	NDC linkage and Target	Policy Status
<b>Vehicle Fuel Efficiency Program<sup>24</sup></b>	Light duty vehicle efficiency standards for passenger cars weighing less than 3500 kg. The efficiency standards have been set out for all the new cars manufactured or imported from April 2017. For this purpose, manufacturers must meet a new car average fleet target of 130g CO <sub>2</sub> /Km in 2017 and 113g CO <sub>2</sub> /Km in 2022 (ICCT) <sup>25</sup> .	<ul style="list-style-type: none"> <li>• The standards will achieve a reduction of 50 million tonnes of CO<sub>2</sub><sup>26</sup>.</li> <li>• Under the program, India aims to improve fuel standards by switching from BS IV fuels to BS V/BS VI across country in near future.</li> </ul>	<ul style="list-style-type: none"> <li>• Light duty passenger vehicle fuel efficiency standards were postponed by a year and came into force on April 2017.</li> <li>• Fuel economy norms for HDVs have been accepted and are to be implemented.</li> <li>• Currently there are no CO<sub>2</sub> emission standards for light commercial vehicles.</li> </ul>

<sup>24</sup> <http://www.egazette.nic.in/WriteReadData/2014/158019.pdf>

<sup>25</sup> [https://www.theicct.org/sites/default/files/India\\_PVstds-facts\\_dec2014.pdf](https://www.theicct.org/sites/default/files/India_PVstds-facts_dec2014.pdf)

<sup>26</sup> <http://www4.unfccc.int/ndcregistry/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf>

## 1. Dedicated Freight Corridors (DFCs)

India's railway network is one of the world's largest and most extensive networks. With a capacity of carrying 23 million passengers every day, the highest in world and it is the 4<sup>th</sup> largest freight transporter. Being an energy efficient mass transport system railways are 12 times more efficient in freight traffic as compared to road transport **Invalid source specified..** At present, the Indian Railway's quadrilateral (connecting Delhi, Mumbai, Chennai and Howrah) and diagonals (Delhi-Chennai, Mumbai-Howrah) comprise 16% of the total route and carried more than 52% of the passenger traffic and generated 58% of revenues through freight traffic. With the line capacity utilization of 115% to 150% the Howrah - Delhi and Mumbai - Delhi trunks on Eastern and Western Corridors respectively are highly saturated. Due to inadequate infrastructure and poor services railways freight share has come down from 83% in 1950-51 to a mere 35% in 2011-12. Subsequently, the freight share on the National Highways along these corridors comprising only 0.5% of the road network carried almost 40% of the road freight<sup>27</sup>. Realising the potential of Indian Railways in attaining the goal of sustainable economic development and efficient transport network, two world-class freight corridors along the Eastern and Western routes are being introduced on India's busiest and congested corridors. As per the planning over the period of 30 years starting from 2016-17, Eastern DFC will carry 1975 billion tonne-km of freight and 3241 billion tonne-km of freight will be catered by Western DFC on a cumulative basis<sup>28</sup>.

### Direct or Indirect Impacts:

The introduction of Eastern Dedicated Freight Corridor (EDFC) and Western Dedicated Freight Corridor (WDFC) is expected to generate two major impacts on the freight movement. It will lead to a shift in freight transportation from road to rail which will play a key role in achieving the increase from 36% to 45% in inter modal share of railways by 2030. Along with this, the shift will lead to significant reduction of Greenhouse Gas (GHG) emission in transport sector in India and improved technologies will lead to energy efficient freight rail transport. The project is expected to reduce emissions by about 457 million ton CO<sub>2</sub> over a period of 30 years.

### Existing MRV approaches:

As a part of assessing the impact of the DFC project, DFCCIL has come out with the Cumulative Impact Assessment (CIA) Study for the proposed project from Ludhiana to Mughalsarai section on EDFC. The study has been undertaken to identify the cumulative impacts of the project on Valued Environmental Components (VECs)<sup>29</sup>.

In 2011, as a part of capturing the Carbon footprint of the project, DFC undertook a detailed study on GHG emission reduction potential of the two corridors. The findings from the study are **Invalid source specified.:**

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<sup>27</sup> [http://dfccil.gov.in/dfccil\\_app/Background](http://dfccil.gov.in/dfccil_app/Background)

<sup>28</sup> [http://dfccil.gov.in/upload/DFC\\_write\\_up\\_GHG\\_emission\\_analysis2003.pdf](http://dfccil.gov.in/upload/DFC_write_up_GHG_emission_analysis2003.pdf)

<sup>29</sup> [http://dfccil.gov.in/upload/CIA\\_final\\_Version\\_Dec\\_2016.pdf](http://dfccil.gov.in/upload/CIA_final_Version_Dec_2016.pdf)

- In 2016-17 emissions under 'No-DFC scenario' would have been 8.7 million ton CO<sub>2</sub> while those in case of DFC scenario would be 2.59 million ton CO<sub>2</sub>.
- On the basis of projections, in 2041-42, GHG emissions under 'No-DFC scenario' would have been 33.2 million ton CO<sub>2</sub> while those in case of DFC scenario would be 5.97 million ton CO<sub>2</sub>.
- Over the period of 30 years, cumulative GHG emissions in the 'No-DFC scenario' would have been 582 million ton CO<sub>2</sub> while those in case of DFC scenario would be 124.5 million ton CO<sub>2</sub>.

**Existing data collection systems, monitoring systems:**

DFCCIL was set up as a Special Purpose Vehicle under the administrative control of Ministry of Railways for carrying out all the activities related to DFCs. It is responsible for carrying out all the assessments linked to the project. All the key findings and progress related information are regularly published through its annual reports and project assessment reports<sup>30</sup>.

**2. Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME):**

Considering the fact that transport sector in India is a major consumer of crude oil and road transport accounts for more than 80% of the fuel consumption. Emissions from transport sector are also a cause of concern and therefore, the government is focusing on partnering with industries to invest in sustainability mobility solutions (Gulati, 2012) . Hence, as a part of initiating and implementing these solutions the National Electric Mobility Mission Plan (NEMMP) 2020 was launched by Government of India in 2013 and it aims to achieve national fuel security by promoting hybrid and electric vehicles in the country. Through the mission the government targets to gradually ensure a vehicle population of about 6-7 million electric/hybrid vehicles in India by the year 2020. Under the mission, the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) scheme was launched in 2015 with an annual outlay of 75 Cr.

Government is coming out with a composition of fiscal and monetary incentives to promote the uptake of the policy:

- Demand creation by incentivising buyers to purchase electric/hybrid vehicles by providing monetary support.
- Focus on in house technology development and domestic production
- Supply side incentives
- Promoting charging infrastructure

**Direct or Indirect Impacts:**

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<sup>30</sup> [http://dfccil.gov.in/dfccil\\_app/Home](http://dfccil.gov.in/dfccil_app/Home)

The direct impact as outlined by the Government will be expected savings of 9500 million litres of crude oil equivalent to INR 620 billion savings if targeted sales will be reached. Government with the help of composite schemes and incentives aims to make hybrid and electric vehicles to be the first choice of buyers which will further ensure to provide a clean and gasoline free transportation option to the people and will eventually reduce the oil import burden.

**Existing MRV approaches:**

National Automotive Board (NAB) under the Department of Heavy Industry (DHI) is responsible for overseeing the uptake status of EVs and the subsequent fuel savings and CO<sub>2</sub> reductions.

**Existing data collection systems, monitoring systems:**

Ministry of Heavy Industries & Public Enterprises, Department of Heavy Industry (DHI) along with consultation from National Automotive Board (NAB) will be implementing the policies and recommendations. The funding for any new schemes will be done either through augmentation of already existing funds or through new allocations. The proposal of schemes/initiatives, reviewing and monitoring of various initiatives will be done by NATRiP Implementation Society (NATIS)/ National Automotive Board (NAB) with the support of the Working Group on Demand & Supply with representation from all the stakeholders. NATIS/NAB will also be responsible for the recommendations of the course corrections, if required, for the consideration and decision of the National Council Electric Mobility (NCEM) and National Board for Electric Mobility (NBEM) (Gulati, 2012).

India's fast-paced development has come up at a cost of unsustainable energy use and fuel consumption, the increased transport demand has resulted in increased environmental impacts. Hence, the way transport sector of India shapes its expansion trajectory will determine the future sustainability of the crucial resources and the ecology. Considering India's response towards development of policies towards 2030 mitigation goal in the transport sector and its endeavor towards a low carbon economy this study will broadly focus on the policies, which will increase the freight movement through Indian Railways; Dedicated Freight Corridor in particular will play an important role towards this direction. Apart from this, the study will also look into the electric mobility framework of the Indian Government. The analysis will further look into the related policies and programs for these two major initiatives and their implementation pathway.

## Buildings

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India is a fast urbanizing country. (GOVERNMENT OF INDIA, MINISTRY OF URBAN DEVELOPMENT, 2016) As per the census report-2011, about 31.1% of the population was residing in the urban areas, which is expected to reach 40% and 50% respectively by 2031 and 2051. Urbanization is very closely related to the three aspects of Sustainable Development namely, Social, Economic and Environmental. Urbanization is leading to increased demand for infrastructure related to better standard of living such as working spaces, residential spaces, commercial spaces, road networks etc. With the increasing pressure on the cities to provide more and more living and working spaces to the growing population, an increase in construction of building has been observed lately, as habitat forms one of the basic needs for human beings. Buildings are one of the major contributors for environmental degradation. (Hoffman & Henn, 2008) They consume 40% of the world's energy, 40% of the world's material, 16% of the world's water and are responsible for emitting 40% of the world GHG emissions. (Berardi, 2017) It is estimated that 75% of the buildings that will be existing in 2030 in India are yet to be built. Therefore, considering the projected growth in the buildings sector it has become important to tap the energy requirement of the sector to mitigate the consequent GHG emissions. If the policy framework are let to be implanted in the same manner as today, the energy requirement (thermal energy requirement) from building sector is estimated to grow respectively (Centre for Science and Environment, 2013) 90% and (Global Buildings Policy Network, 2013) 200% by 2030 and 2050 as compared to 2005, and the GHG emission are expected to increase fivefold and tenfold respectively (1.1 Gt)

The Ministry of Power (MoP), Government of India (GoI), with the goal of maximizing energy efficiency in the India economy, through Bureau of Energy Efficiency (BEE) has initiated many energy efficiency initiatives. Buildings as a sector have been identified under the National Mission on Sustainable Habitat and various implementation measures such as efficient lighting programme, standards and labeling programme, Energy Conservation Building Code (ECBC), Pradhan Mantri Avas Yojna, Housing for All etc. have been adopted by the GoI to enhance energy efficiency in the sector.

Most of the GHG emission accounted from the buildings are related to the energy use by the buildings and are hence perceived as indirect emissions as they are counted at end use rather than at source. However, the emissions can be mitigated through a series of passive and energy efficient measures such as; proper building orientation, use of locally available material, energy efficiency end use systems etc. Apart from mitigating GHG from the sector, energy efficiency in buildings also provides co benefits such as safe living conditions, improved living standards, creation of green jobs etc.

#### 4. Scoping matrix

Program/Policy	Stated Objective	NDC linkage?	Impacts or potential (Direct/indirect)	Applicability/covered	Sectors	Starting Year/Baseline	Implementation Entity
Energy Conservation and Building Code (ECBC 2017) <sup>31</sup>	Promoting energy efficiency in the building sector	Yes, contributing to indirect emission reduction and promoting sustainable way of living	Indirect as they are related to minimizing the energy consumption from the building through introduction of passive and energy efficient measures	Applicable to Commercial buildings on voluntary basis. The minimum load requirement for a building to be ECBC compliance is 100kW 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	only buildings on basis. The minimum load requirement for a building to be ECBC compliance is 100kW 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	2007	BEE responsible for developing the code, State Designated Agencies (SDAs) for regulating the code and Urban Local Bodies (ULBs) for checking the compliance to the code

<sup>31</sup> [https://beeindia.gov.in/sites/default/files/tender\\_document/BEE\\_ECBC%202017.pdf](https://beeindia.gov.in/sites/default/files/tender_document/BEE_ECBC%202017.pdf)

Program/Policy	Stated Objective	NDC linkage?	Impacts or potential (Direct/indirect)	Applicability/covered	Sectors	Starting Year/Baseline	Implementation Entity
Standards and Labeling Programme <sup>32</sup>	Promoting energy efficiency .To provide the consumer an informed choice about the energy saving and thereby the cost saving potential of the marketed household and other equipment	Yes, contributing to indirect emission reduction and promoting sustainable way of living	Indirect as it is linked with appliance energy efficiency.	The programme covers appliances like Room Air Cons, Frost Free and direct cool Refrigerator, Tubular Florescent Lamps, Distribution transformers, color TVs and electric geysers on mandatory basis and Induction motors, pump sets, ceiling fans, LPG-stoves, washing machines, laptops, office equipment's etc. on voluntary basis		2006	BEE for developing the policy , Private Industries for complying to the requirement of policy , DIPP for checking the compliance to the policy framework

<sup>32</sup> <https://beeindia.gov.in/content/standards-labeling>

Program/Policy	Stated Objective	NDC linkage?	Impacts or potential (Direct/indirect)	Applicability/covered	Sectors	Starting Year/Baseline	Implementation Entity
BEE Star rated Buildings <sup>33</sup>	The programs at making commercial building energy efficient	Yes, contributing to indirect emission reduction	Indirect as it is related to energy consumption from the building.	BEE has a star rating programme called the BEE Buildings Star Rating System based on the actual performance of a building in terms of its specific energy usage in kWh/sq.m/year. The programme rates existing buildings (office buildings, Shopping malls, hotels, hospitals, and IT parks) on a one to five-star scale, with five stars being the most efficient.		2009	BEE developing and regulating the code. Third party BEE certified auditor and evaluator are responsible for checking the compliance to the scheme.
Bachat Lamp Yojana <sup>34</sup>	The programs aims at promoting energy efficient artificial	Yes, contributing to indirect emission reduction	Indirect it is related to reducing energy consumption from Artificial lighting system from building	Under the program a working Incandescent bulb is exchanged by a CFL by the distribution company. The scheme is registered as		2009	BEE is responsible for regulatory framework

<sup>33</sup> <https://beeindia.gov.in/content/existing-building>

<sup>34</sup> <https://beeindia.gov.in/content/bachat-lamp-yojana-bly-0>

Program/Policy	Stated Objective	NDC linkage?	Impacts or potential (Direct/indirect)	Applicability/covered	Sectors	Starting Year/Baseline	Implementation Entity
	lighting system		buy providing energy efficient luminaires.	Clean Mechanism Activities (CDM POA).	Development Programme of		
National Programme for LED-based Home and Street Lighting <sup>35</sup>	The programs aims at promoting energy efficient artificial lighting system	Yes, contributing to indirect emission reduction	Indirect it is related to reducing energy consumption from Artificial lighting system buy providing energy efficient luminaires	Under the programme, LED bulbs are being distributed in a phased manner from March 2015 onwards. The entire project of installing LED bulbs for domestic and street lighting in 100 cities was targeted for completion by March 2016. However, the high cost of LEDs and inadequate information of their comparative advantages has limited their demand	national	2015	BEE for regulating scheme

<sup>35</sup> <https://medium.com/@virilesarkariniti/prakash-path-way-to-light-the-national-led-program-ff50e4c400b4>

Program/Policy	Stated Objective	NDC linkage?	Impacts or potential (Direct/indirect)	Applicability/covered	Sectors	Starting Year/Baseline	Implementation Entity
Green Rating for Integrated Habitat Assessment (GRIHA) <sup>36</sup>	The rating system aims at enhancing resource efficiency in the buildings sector	Yes, contributing to indirect emission reduction	Indirect at it aims at bringing resource and energy efficiency in building by minimizing its consumption and enhancing energy efficiency	GRIHA is the national rating system for green building design, developed and implemented by The Energy Resources Institute (TERI) and the Ministry of New and Renewable Energy (MNRE). All new central Government and public sector buildings are to comply with the requirements of at least three-star GRIHA ratings.		2005	The GRIHA Council is responsible for developing, regulating and checking the compliance to the code
LEED India <sup>37</sup>	The rating system aims at enhancing resource efficiency in the buildings sector	Yes, contributing to indirect emission reduction	Indirect at it aims at bringing resource and energy efficiency in building by minimizing its consumption and enhancing energy efficiency	LEED India is the localized version of the international rating system and is administered by the Indian Green Building Council (IGBC).			Indian Green Building Council is responsible for developing, regulating and checking the compliance to the code

<sup>36</sup> <http://grihaindia.org/>

<sup>37</sup> <https://igbc.in/igbc/redirectHtml.htm?redVal=showLeednosign>

## 5. Policy prioritization for detailed assessment

### 5.1. Energy Conservation Building Code:

The Energy Conservation Act 2001 (EC Act), “An Act to provide for efficient use of energy and its conservation and for matters connected therewith or incidental thereto” enacted by the Central Government of India, declared Commercial buildings along with fourteen other users as designated consumers. Commercial buildings whose connected load was more than 100kW or 120 kVA came under the scope of the EC Act. To carry out energy efficiency activities in the commercial building sector, The Energy Conservation Building Code (ECBC) was developed by Bureau of Energy Efficiency (BEE). ECBC has also been recognized as one of the implementation measures for mitigating GHG emissions from the building sector by the Ministry of Environment Forestry and Climate Change (MoEF&CC) in the first biennial report submitted by India to UNFCCC. The rating system existing in the country namely GRIHA, LEED also rely on the ECBC for compliance to energy efficiency. The code is however voluntary in nature and 10 states including Andhra Pradesh, Haryana, Odisha, Pondicherry UT, Punjab, Rajasthan, Telangana, Uttarakhand and West Bengal have notified the implementation of code. The other states are in the process of notifying the code. The interesting fact, which also makes it important to tap the adoption of code, is that the states are relaxed in modifying the requirement of code as per their specific requirements. As per the 18<sup>th</sup> EPS report published by CEA, commercial building consume 11% of the total electricity consumed at national level. With the growing demand for commercial spaces due to urbanization, it becomes important to tap the potential of the code and develop an effective MRV mechanism for the same.

### 5.2. Standards and Labeling Appliances :

Energy conservation refers to the act of reducing the energy used, which may be achieved through efficient energy use or by decreasing the consumption of energy sources, but maintaining the comfort in the building. With the given scenarios of energy consumption by building sector and potential for GHG mitigation, it becomes important to tap the present opportunity. Appliance energy labeling is one of the most effective mechanisms to tap the growing energy demand of the buildings and consequent GHG emissions from the buildings. Energy ‘labeling’ is one of the most cost effective policy tools for improving energy efficiency and lowering energy cost of appliances/equipment for the consumers. Energy labels can be used stand-alone or complement energy standards. In addition to giving information that allows consumers who care to select efficient models, labels also provide a common energy-efficiency benchmark that can work in association with other policy measures such as procurement programs, financial incentives etc. Under the Standard and Labeling program of BEE following appliances have been included both on mandatory and voluntary basis.

S.NO	Mandatory Appliances	Voluntary Appliances
1	Room Air Conditioners	Induction Motors
2	Frost Free Refrigerators	Pump Sets
3	Tubular Florescent Lamp	Ceiling Fans
4	Distribution Transformer	LPG- Stoves
5	Room Air Conditioner (Cassettes, Floor Standing)	Washing Machine
6	Direct Cool Refrigerator	Computer(Notebooks/ Laptops)
7	Color TV	Ballast (Electronic/ Magnetic)
8	Electric Geysers	Office equipment's (Printer, Copier, Scanner, MFD's)
9		Diesel Engine Driven Mono-set Pumps(link is external)
10		Solid State Inverter
11		DG Sets
12		Variable Capacity Inverter Air conditioners
13		LED Lamps

With the increasing GDP and increasing purchasing power, the sale of the equipment to meet the comfort requirement for the occupants is increasing, therefore the standards and labeling mechanism for appliances will be an effective policy tool to get linked with the MRV framework.

## 6. Selected Policy description

### 4.1 Energy Conservation Building Code 2017

#### 4.1.1 Detailed description:

The Energy Conservation Building Code was published in 2007 by BEE, which was later on revised in 2017. The code defines the norms and standards for the energy performance of the buildings and their components based on the climatic zones, where they are located. The overall purpose of the code is to provide minimum energy performance indices for buildings including envelope, heating ventilation and air conditioning systems, service water heating systems, outdoor and indoor lighting systems and electrical systems. The code defines the typology of buildings to be included under its purview along with the parametric requirement for each typology in different climatic zones.

#### 4.1.2 Direct or indirect impacts

The building sector is both independent and interrelated to various other sectors therefore measures taken to achieve energy efficiency and green growth in the sector is bound to have multiple benefits and co-benefits providing both social, economic and environmental benefits

##### 4) Social Benefits

- Safe living conditions
- Thermally and visually comfortable living conditions
- Better indoor quality

##### 5) Economic Benefits

- Creation of Green Jobs
- Lower electricity bills for tenants
- Lower construction cost for Developers
- High property value for developers

##### 6) Environmental Benefits

- Maximize Energy Savings. It is estimated that Energy Efficient (EE) buildings can save up to 20%-50% energy (United Nations Development, India Programme, 2011)
- Reduced GHG Emissions
- Combatting Climate Change

#### 4.1.3 Existing MRV approaches:

At present there is no MRV framework established or followed in the country to check the compliance of the building sector with the code.

Buildings in India come under the purview of state government. Therefore, a 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.

#### 4.1.4 Existing data collection and archiving systems

There is no mechanism present to collect the data related to building and generate archives. Building sector in India is not under the scope of single ministry and therefore different departments under different ministries are responsible for collecting data relevant to their mandate.

#### 4.1.5 Existing government financial monitoring systems of sectors, programmes and schemes

No existing government financial model was developed to support the uptake of code.

#### 4.1.6 Existing sectoral/project methodologies available on MRV

At present there is no existing sectoral/ project MRV methodology available. (India Specific)

### 4.2 Standards and Labeling Program (S&L)

#### 4.2.1 Detailed description:

The aim of Standards & Labeling Program is to enable the consumer to select from energy efficient appliances and thereby increasing the cost saving potential of the marketed household. The program is expected to affect the energy consumption from buildings in long run will also enable the domestic sector to position itself in the market of energy efficiency.

#### 4.2.2 Direct or indirect impacts

The various direct and indirect impacts accepted out of the program are:

- 1) Social Benefits
  - Access to advance technology
  - Improvement in Living standards
- 2) Economic Benefits
  - Reduced Electricity bills
- 3) Environmental Benefits
  - Reduced GHG Emissions
  - Combatting Climate Change

#### 4.2.3 Existing MRV approaches:

BEE has developed a reporting framework to establish the energy savings achieved through the implementation of the S&L scheme. A representative scheme is as shown



#### 4.2.4 Existing data collection and archiving systems

BEE maintains and published the manufactured units and energy savings estimates. (<https://beestarlabel.com/Home/EnergySavings>)

#### 4.2.5 Existing government financial monitoring systems of sectors, programmes and schemes

No government financial model was developed to support the uptake of code.

#### 4.2.6 Existing sectoral/project methodologies available on MRV

Apart from the MRV framework developed by BEE, no project methodology exists (India specific)

Building stock in India is expected to reach about 10,400 million sq. meters 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 which could help India, to tap the growing energy demand from the buildings and in parallel meet its obligations submitted to UNFCCC. ECBC and Standards & Labeling program 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. Therefore, the present scope of work will focus on analyzing the potential impact of the two policies and their implementation pathways.

# Agriculture Sector

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## 1. Pradhan Mantra Krishi Sinchai Yojana (PMKSY)

The PMKSY is planned to expand the coverage of irrigation system and improve the irrigation water use efficiency in the cropland. The cabinet committee has accord the approval of PMSKY on 1<sup>st</sup> July 2015 to implement across the country with an outlay of Rs. 50,000 crore in five years.

The PMKSY is an amalgamation of ongoing schemes of different ministries of the Govt. of India *viz.* Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation (MoWR, RD&GR), Integrated Watershed Management Programme (IWMP) of Department of Land Resources (DoLR) and the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC).

States will be allowed to draw their own irrigation plan based on the State level Irrigation Plan (SIP) and District Irrigation Plan (DIP) under the supervision of interministerial National Steering Committee. A National Executive Committee (NEC) under the chairmanship of the vice-chairman of the NITI Ayog is proposed to oversee the program implementation and addressing the administrative issues related to the implementation. There are four broad component of the PMKSY;

- i) Accelerated Irrigation Benefit Programme (AIBP)
- ii) Enhancing and improving the irrigation channels (Har Khet Ko Paani)
- iii) Watershed Development
- iv) Development of micro irrigation system (Per Drop More Crop).

The watershed development component of the PMKSY is focused on the ridge area treatment, drainage line treatment, soil and moisture conservation, water harvesting structure, livelihood support activities and other watershed works being implemented by DoLR. While the fourth component is focused on the development of micro level storage structures, efficient water conveyance & application, precision irrigation systems, secondary storage, water lifting devices, extension activities, coordination & management activities being implemented by DAC&FW.

Development of the precision irrigation system, soil moisture conservation can address the greenhouse gas (nitrous oxide) emission from the cropland. Studies have indicated that efficient use of the irrigation water can reduce the nitrous oxide emission by up to 40%. Further, the micro irrigation system development can improve the soil fertigation facility which can reduce the fertilizer use by improving the fertilizer use efficiency of the crop – this can reduce the nitrous oxide emission from the cropland by another ~20%.

## 2. Rainfed area Development

Department of Agriculture and Cooperation launched the Rainfed Area Development program during 2011-12 under the Rastriya Krishi Vikash Yojana to ensure sustainable growth in agriculture in the rainfed areas. Initially, the scheme was overlaid in 10 states with an outlay of 250 crore; however, later extended to another 12states with additional outlay of 150 crore. The program was implemented as a component under the National Mission on Sustainable Agriculture (NMSA) during 2014-15. For the Year 2016-17, budget provision of Rs. 225.0 crore has been made for implementation of the program.

### **2.1. Integrated Farming system**

Integrated farming system is included as a sub-component under the Rainfed Area Development. This subcomponent includes integrated cropping system and fisheries based cropping system. Rice based cropping systems have established significant reduction in the CO<sub>2</sub> equivalent greenhouse gas emission from soil in the rain fed area compared to the rice-rice system (Datta et al., 2011). The study indicates up to 68% reduction in the annual carbon equivalent emission from cropland with the inclusion of the integrated cereal based cropping system.

Studies have reported that the rice-fish integrated farming system can reduce the nitrous oxide emission from the low land rain fed cropland area; however, it increases the methane emission (Datta et al., 2009). There is a net increase in the carbon equivalent emission from the low land rain fed cropland with the incorporation of rice-fish integrated farming system; however, this increases the net economic profit of the farmers' substantially.

### **2.2. Value addition and farm development activities**

Central govt. will provide 100% assistance for Silage making unit consisting of Silo Pit Chaff Cutter and weighing balance up to a limit of 1.25 lakh rupees per farm to increase availability of green fodder for livestock round the year. Studies have suggested that inclusion of green fodder in the fodder reduces the methane emission from enteric fermentation.

### **2.3. Water harvesting system**

Central govt. will provide partial assistance for individual and full assistance for the community water harvesting system development and maintenance of the existing water harvesting system. The state governments of Chhattisgarh, Madhya Pradesh and Maharashtra have developed a scheme to develop 1% of agriculture land of every village as water harvesting system development. This will help to manage the water level during the cropping season, which could reduce the nitrous oxide as well as methane emission from the field.

Additionally, Central government will provide an assistance of INR50000 for the installation of solar/wind based water-lifting devices for irrigation in the cropland. This will reduce the diesel and electric use for water lifting through bore well and deep tube wells. This will reduce the carbon dioxide emission from the burning of diesel in the pump set or from the power plant to develop the electricity from the fossil fuel.

## **3. Soil Health Management**

Soil Health Management (SHM) is one of the most important interventions under NMSA. SHM aims at promoting Integrated Nutrient Management (INM) through:

- Judicious use of chemical fertilizers including secondary and micronutrients in conjunction with organic manures and bio-fertilizers.
- Strengthening of soil and fertilizer testing facilities

- Ensuring quality control requirements of fertilizers, bio-fertilizers and organic fertilizers under fertilizer control order, 1985
- Up gradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations; promoting organic farming practices.

This component of the NMSA is implemented by State Government., National Centre of Organic Farming (NCOF), Central Fertilizer Quality Control & Training Institute (CFQC&TI) and is sanctioned by INM division.

### **3.1. New Urea Policy 2015 - Neem coated urea (NCU)**

Enhanced Efficiency Nitrogen Fertilizers (EENF) are produced to reduce the nitrogen loss from the cropland to the environment. The oil extract of Neem (*Azadirachta indica* A. Juss) or nimin is a proven nitrification inhibitor, which helps to inhibit the nitrification process to slow/control release of nitrate from the fertilizer nitrogen. This provide required time to the crop for the absorption of the nitrate released from the applied fertilizer and minimize the nitrogen loss through nitrification and denitrification process. Thus neem or nimin or neem oil coated nitrogen fertilizers increases the nitrogen uptake in crop and eventually crop productivity. The oil of neem is mixed with the urea to prepare EENF.

National Fertilizers Limited, in the year 2002, standardized the techniques for production of NCU in situ, at its Panipat Unit. Looking into the advantages of NCU and its acceptance by the farmers, Ministry of Agriculture in July 2004, included the Neem Coated Urea in Fertilizer (Control) Order (FCO), 1985. Since 2008, the Ministry of Chemicals and Fertilizers allowed NCU manufacturer to sell NCU at 5% above the MRP, to recover the cost of coating. In the year 2010, it was incorporated as regular fertiliser in Schedule I of the Fertiliser (Control) Order, 1985. The indigenous manufacturers of urea were allowed to produce neem-coated urea up to a maximum limit of 35% of their total production of subsidized urea. In January 2015, the Government of India removed the 35% cap/restriction on the production of neem-coated urea and the indigenous producers of urea were allowed to produce neem-coated urea up to maximum of their total production of subsidized urea. In March 2015, the Government of India decided to make it mandatory for all the indigenous producers of urea to produce 75% of their total production of subsidized urea as neem coated urea.

NCU slow down the process of nitrification of urea, thus decrease the urea requirement by 10-15% without decreasing the crop yield. Additionally, the NCU can reduce the nitrous oxide emission from cropland soil by up to 85%.

#### **Potential GHG Impact:**

- Reduction in nitrous oxide emission from soil up to 85%
- Reduction in overall carbon dioxide emission (production and transportation) as the requirement of fertilizer urea will decrease.

### Potential co-benefits:

- Significant decrease in the fertilizer subsidy
- Improve crop yield
- Reduction in pesticide application to the field.

### 3.2. Soil Health Card

The cropland soil-testing program was started in India during the year 1955-56 to inform farmers about the nutrient status of their cropland soil free of cost or with some nominal fee. Until 2012-13, the analytical capacity of the soil testing laboratories in the country was 128.3 lakh samples per annum. To overcome the shortcoming of the soil-testing program, the Govt. of India launched Soil Health Management (SHM) card scheme under the National Mission for Sustainable Agriculture during 2015 with an outlay of Rs. 568.54 crore for a period of three years. The scheme has been rolled out in the field during the financial year of 2015-16.

The main objective of the soil health card component of the NMSA is to develop and promote soil test based nutrient management in the districts for enhancing nutrient use efficiency.

Nutrient management in soil based on the soil health card can optimize the use of N, P, K fertilizers to soil along with different micronutrients. Datta et al. (2013) have reported low cumulative methane emission from the rice field with optimum yield when N, P and K were applied as required by the soil. The study indicated that nearly 46% decrease in methane emission from the rice cropland with the application of balance N, P,K fertilizers.

## 4. National Program for Bovine Breeding and Dairy Development

The restructured Scheme National Program for Bovine Breeding and Dairy Development (NPBBDD) was launched by merging four existing schemes i.e. Intensive Dairy Development Program (IDDP), Strengthening Infrastructure for Quality & Clean Milk Production (SIQ&CMP), Assistant to Cooperatives and National Project for Cattle & Buffalo Breeding under the National Livestock Policy 2013, with the budget provision of Rs.1800 crores for implementation during 12th Plan. The Scheme has two components namely (i) NPBB and (ii) NPDD. The second one is mainly focused on the infrastructural development for the production and supply of quality milk, while the former is to develop and proliferate selected indigenous bovine breeds of high socio-economic importance.

### 4.1. Rastriya Gokul Mission

The “Rashtriya Gokul Mission” has been launched by the Government for conservation and development of indigenous breeds under the NPBB in a focused and scientific manner. The Rastriya Gokul Mission is focused with an outlay of Rs 500 crore during for three years from 2014-15 to 2016-17. The main objectives of the Rastriya Gokul Mission are, i) development and conservation of indigenous breeds and ii) enhancement of milk production and productivity of cattle using elite indigenous breeds. *National Kamdhenu Breeding Centers* are established in different states under the first objective.

Rashtriya Gokul Mission is being implemented through “State Implementing Agencies (SIA) viz Livestock Development Boards. All Agencies having a role in indigenous cattle

development are “Participating Agencies” like CFSPTI, CCBFs, ICAR, Universities, Colleges, NGOs, and Cooperative Societies.

Studies have indicated that the methane emission is lower with the indigenous breed compared to exotic breeds.

It is envisaged that the following policies/programmes/incentives will be further analysed for assessing GHG reduction potential and their contribution to NDC goals

- a) Soil health card program
- b) New urea policy with emphasis on neem coated urea

This assessment of these two policies will be useful to showcase the resultant emission profile during the years.

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