

# LOW CARBON FINANCE FOR THE STATE OF TAMIL NADU: INVESTMENTS, GAPS, AND BARRIERS

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**January 2015**

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## Acknowledgements

We are indebted to the government officials of the State of Tamil Nadu and the experts for speaking with us at length and sharing their experiences and invaluable insights. The support and cooperation extended by the different departments of the Government of Tamil Nadu, contacted for the fulfillment of our data requirements during the course of the study, is gratefully acknowledged.

We sincerely thank Ms. Santha Sheela Nair IAS (Retired), Vice Chairperson, State Planning Commission, Government of Tamil Nadu for hosting two round table discussions with the government officials of the State in order to share and review the results and findings from the study. We express our gratitude to Kunal Sharma, Senior Program Manager, Shakti Sustainable Energy Foundation and Sriya Mohanti, Program Associate, Shakti Sustainable Energy Foundation for reviewing different draft versions of the report and providing their valuable feedback.

We convey our appreciation of Mr. V. Subramanian, Senior Advisor, IFMR for helping us with the overall planning and execution of an outreach and dissemination strategy for this project. We sincerely thank Shakti Sustainable Energy Foundation for supporting this work.

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## Acronyms

<b>ADB</b>	Asian Development Bank	<b>GDP</b>	Gross Domestic Product
<b>AfDB</b>	African Development Bank	<b>GHG</b>	Green House Gases
<b>APRRFC</b>	Accelerated Program for Restoration and Regeneration of Forest Cover	<b>GoI</b>	Government of India
<b>AT&amp;C</b>	Aggregate Technical and Commercial Losses	<b>GoTN</b>	Government of Tamil Nadu
<b>BEE</b>	Bureau of Energy Efficiency	<b>HADP</b>	Hill Area Development Programme
<b>BNEF</b>	Bloomberg New Energy Finance	<b>HP</b>	Horse Power
<b>CCA</b>	Carbon Credit Aggregation	<b>ICT</b>	Information and Communications Technology
<b>CCS</b>	Carbon Capture and Sequestration	<b>IEC</b>	Information, Education and Communication
<b>CFL</b>	Compact Fluorescent Lamp	<b>IEE</b>	Industrial Energy Efficiency
<b>CPEIR</b>	Climate Public Expenditure and Institutional Review	<b>IID</b>	Integrated Infrastructure Development
<b>DAC</b>	Development Assistance Committee	<b>IIUS</b>	Industrial Infrastructure Upgradation Scheme
<b>EAPs</b>	Externally Aided Projects	<b>IMF</b>	International Monetary Fund
<b>EBRD</b>	European Bank for Reconstruction and Development	<b>INR</b>	Indian Rupees
<b>EC</b>	Energy Conservation	<b>IPP</b>	Independent Power Producers
<b>ECBC</b>	Energy Conservation Building Code	<b>IT</b>	Information Technology
<b>EE</b>	Energy Efficiency	<b>ITDP</b>	Integrated Tribal Development Program
<b>EET</b>	Energy Efficient Technologies	<b>JICA</b>	Japan International Cooperation Agency
<b>EIB</b>	European Investment Bank	<b>JNNSM</b>	Jawaharlal Nehru National Solar Mission
<b>IFC</b>	International Finance Corporation	<b>LED</b>	Light Emitting Diode
<b>IDB</b>	Inter-American Development Bank	<b>LNG</b>	Liquefied Natural Gas
<b>ESCOs</b>	Energy Service Companies	<b>LULCF</b>	Land Use, Land-Use Change and Forestry
<b>FiT</b>	Feed in Tariff	<b>MDB</b>	Multilateral Development Bank
<b>FY</b>	Financial Year	<b>MNRE</b>	Ministry of New and Renewable Energy
		<b>MSECDP</b>	Medium Small Enterprises-Cluster Development Programme

<b>MSME</b>	Micro, Small and Medium Enterprises	<b>SFURTI</b>	Scheme of Fund for Regeneration of Traditional Industries
<b>MU</b>	Million Units	<b>SGDP</b>	State Gross Domestic Product
<b>MW</b>	Mega Watt	<b>SME</b>	Small and Medium Enterprises
<b>NABARD</b>	National Bank for Agriculture and Rural Development	<b>SPO</b>	Solar Purchase Obligation
<b>NAPCC</b>	National Action Plan on Climate Change	<b>SPV</b>	Solar Photovoltaic
<b>NMSA</b>	National Mission for Sustainable Agriculture	<b>SRI</b>	System of Rice Intensification
<b>NREL</b>	National Renewable Energy Laboratory	<b>T&amp;D</b>	Transmission and Distribution Losses
<b>O&amp;M</b>	Operation and Maintenance	<b>TEQUP</b>	Technology and Quality Upgradation Support to MSMEs
<b>OECD</b>	Organisation for Economic Co-operation and Development	<b>TIIC</b>	Tamil Nadu Industrial Investment Corporation
<b>OOF</b>	Other Official resource Flows	<b>TNEI</b>	Tamil Nadu Electrical Inspectorate
<b>PDA</b>	Personal Digital Assistant	<b>TN</b>	Tamil Nadu
<b>PFM/JFM</b>	Participatory Forest Management/ Joint Forest Management	<b>ULB</b>	Urban Local Bodies
<b>PPA</b>	Power Purchase Agreement	<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>R&amp;D</b>	Research and Development	<b>USD</b>	US Dollars
<b>RAPDRP</b>	Restructured Accelerated Power Development and Reforms	<b>VC/PE</b>	Venture Capital/Private Equity
<b>RE</b>	Renewable Energy	<b>WGDP</b>	Western Ghats Development Program
<b>RTI</b>	Right to Information	<b>WISE</b>	World Institute of Sustainable Energy
<b>RWH</b>	Rain Water Harvesting	<b>ZLD</b>	Zero Liquid Discharge
<b>SAPCC</b>	State Action Plan on Climate Change		

# Executive Summary

## Introduction

The need for climate finance reporting of public and private domestic capital is pertinent especially at a time when nations are aiming to mobilize large sums of domestic financial resources in order to meet their GHG emissions reduction commitment. India has already made a voluntary domestic commitment that by pursuing proactive policies it will reduce the emissions intensity of its GDP by 20-25 per cent over the 2005 levels by the year 2020. The Government has also responded with a National Action Plan on Climate Change (NAPCC) which was launched in the year 2008 with eight national missions (focusing on both adaptation and mitigation) which are intended to attain sustainable development with co-benefits for tackling climate change. The Economic Survey of India estimates that it will cost USD 38 billion to meet the climate goals of the NAPCC. States too have been directed to formulate the State Action Plan on Climate Change (SAPCC) within a time frame in line with the objectives of the NAPCC. At this stage the finances for implementing the action plans are not very clear, specifically at the sub-national level, while at the national level a number of financing options are being contemplated.

The absence of a clear articulation of low carbon funding requirements and an audit of low carbon investment at the sub-national level has encouraged this study. As a case in point, this study assesses the current status of the low carbon finance landscape in the State of Tamil Nadu. Low carbon finance reporting at the State level will provide a comprehensive analysis of the relative levels of public and private investments and serve as a benchmark to draw conclusions about the efficacy of public subsidy to leverage private sector expenditure. This exercise is also important for understanding the investment gaps that need to be filled in order to meet the low carbon targets proposed by the State. This report attempts to bring together public and private sector low carbon investment data and highlights some of the barriers to investment. This report covers mitigation oriented climate finance, and provides substantially high granularity in sector-level reporting for the financial years (FY) 2010 and 2011.

## Results and Findings

### Low Carbon Investment Requirement in Tamil Nadu

The State of Tamil Nadu has two strategic documents that articulate its plans for low carbon interventions in the State – Tamil Nadu Vision 2023 and the Tamil Nadu SAPCC.

- Although the Vision 2023 was not written from a low carbon growth perspective, several interventions have been identified that would contribute to low carbon growth in the State. The total budgetary requirement for low carbon interventions as per the Vision 2023 for the period 2012-23 stands at Rs. 6,20,200 Crores.
- Total budgetary requirement for low carbon interventions as specified in the SAPCC document for the period 2012-22 is Rs. 31,206 Crores.

The total estimates as well as the sector-wise requirements vary widely across the two documents. The nature of interventions in each sector is also quite different. It is, therefore, very difficult to combine the numbers provided in the two documents and come up with a total requirement for the State. Nonetheless the two strategic documents together provide an important reference and helps point out gaps in estimates and investment requirements.

### Investment towards Low Carbon Interventions in Tamil Nadu

Total public expenditure towards low carbon interventions for FY 2010-11 was INR 2,511.44 Crores. This is approximately 0.6% of the State Gross Domestic Product (SGDP) for the same year. This expenditure increased to 2% of the SGDP in

FY 2011-12 to INR 8,710.12 Crores. Energy and Transport sectors form the bulk of the investments for both the years. These are also the sectors that experienced the biggest jump in investment, while investment in other sectors namely Agriculture, Industry, and LULUCF remained more or less constant. In the Transport sector, the Metro Rail Project of Chennai, implemented jointly by the State and Central Governments with a loan from Japan International Cooperation Agency (JICA) is the largest ongoing project directly contributing to emission reductions.

Investment in energy has been largely driven by the wind sector, although the State has made considerable inroads in capacity addition through solar and biomass as well. Under the Jawaharlal Nehru National Solar Mission (JNNSM), the State has been commissioned to add 22 MW of installed capacity using Solar Photovoltaic technology. Similarly, biomass combustion-based power projects with an installed capacity of 161.5 MW have been commissioned in the State. The State has approved establishment of biomass gasification-based power plants with an installed capacity of 41.2 MW, while several waste-to-energy biogas based power projects have also been undertaken with the financial assistance of MNRE.

With favorable policy and regulatory frameworks and economic incentives, Tamil Nadu has been successful in attracting private sector investments into renewable energy development and related markets in the State. Private sector investments in the State in the past six years have been towards wind and biomass subsectors, with investments peaking during the financial years 2010-11 and 2011-12. Public sector investments into development of renewable energy were made in the form of purchase of power from Independent Power Producers (IPP) to meet State demand, capacity addition in certain instances, investments into upgradation and modernization of machinery, assessment studies and demonstration projects, capital and tax subsidies for manufacture and installation.

In terms of energy savings potential, Tamil Nadu exceeds the national average, constituting over 10% of the total energy savings potential of 75,364 MU across all States in India. Tamil Nadu offers tremendous opportunities for mainstreaming energy efficiency initiatives across all sectors, and particularly in the agricultural, domestic and industrial sectors. While the State has undertaken a range of energy efficiency projects and initiatives across different sectors, its EE potential largely remains unrealized owing to various technical, financial, institutional and information barriers.

Afforestation projects contribute the bulk of the investments in the LULUCF sector. Major projects like TN Afforestation Project, tree cultivation in private lands, TN Biodiversity Conservation and Greening Project come under this category. There has been a marginal increase in spending in this sector over the two years. Waste management has received a considerable amount of attention and has experienced a substantial increase in investment from INR 0.5 Crores in FY 2010-11 to INR 5 Crores in FY 2011-12.

In the Agriculture sector, the State Government has implemented a variety of initiatives and incentives to promote increased water use efficiency, crop based interventions, integrated farming, effective and economic utilization of inputs, and rain-fed cultivation. Expenditure on schemes related to sustainable cultivation practices increased three fold from INR 17.63 Crores in FY 2010-11 to INR 53.02 Crores in FY 2011-12. Soil and moisture conservation, and groundwater recharge are the other important schemes in terms of investments.

### Low Carbon Investment Gaps and Barriers

Given the lack of credible low carbon investment requirements and long term data on actual investments, it is very difficult to analyze investment gaps. However, certain observations have been made based on the findings:

- The annual low carbon investment requirement as per the Vision 2023 (2012-23) is INR 6, 20,200 Crores whereas the same as per the SAPCC (2012-22) is INR 31,206 Crores. It should be noted that the SAPCC estimates are not robust and highly on the conservative side. Total low carbon public expenditure in FY 2010-11 was INR 2,178.79 Crores whereas in FY 2011-12 it increased to INR 5,649.123 Crores. It is important for the State to maintain this level of investment and increase it in the subsequent years to be able to achieve its low carbon targets.
- The increase in investment between the two financial years is driven largely by the investment in Renewable Energy and Transport. Although the Transport sector has experienced a jump, there are no new initiatives as such apart from the on-

going Chennai Metro Rail Project. While the Agriculture sector investment goes up by about 50%, investments in Industry and LULCF remain stagnant.

- Feed-in tariff payments based on PPAs for procurement of power from renewable energy sources account for a substantial percentage of the total Energy sector investments in both the years. This underscores the need for providing incentives for private sector investments in order to meet the State's low carbon targets.
- When it comes to planned Government expenditure, current spending falls considerably short of future requirements in most sectors. For example, in Energy Efficiency, TNEI, the State nodal agency for implementing the BEE schemes has made a total investment of INR 0.0074 billion in FY 2010-11 and INR 0.0006 billion in FY 2011-12 towards implementing energy efficiency and conservation measures in the State. The planned investment in SAPCC translates into an annual requirement of INR 2.5 billion to be utilized for EE and conservation measures in the proposed sectors. The current average annual investment in the State for carrying out similar activities (for baseline years 2010-11 and 2011-12) is only INR 0.004 billion, which is a mere 0.16% of what is proposed in the SAPCC document.

The challenges for investment in low carbon interventions are well understood and widely recognized. However, some of the State-specific challenges include poor evacuation infrastructure, non-bankability of PPAs in the RE sector, and non-affordability of energy efficient pump-sets in the Agriculture sector. In the Transport sector, Tamil Nadu is a major manufacturing hub and receives bulk of its State Domestic Product from this sector, especially the automobile sector which holds a 35% share in total Indian auto components market. Discouraging private vehicles would not only jeopardize the economy but also affect the State's ability to attract more investment in the future.

## Concluding Remarks

- This study represents one of the first attempts to quantify low carbon finance at the sub-national level in India. Given that India does not have either a domestic or international mandate to invest in low carbon growth, there are no budgetary heads created either in the national or State accounts to map investments that promote such activities. It was, therefore, important to define the boundaries of this study and adopt an appropriate methodology to both identify low carbon activities in the Indian context as well as to measure investments that have gone into them. Given the uncertainties in ascertaining actual expenditure data at the State level, this study has erred on the conservative side while coming up with investment numbers.
- Investments in low carbon interventions for the State of Tamil Nadu are supposed to increase further now that the State is implementing a dedicated solar policy with ambitious targets. In addition, the TN SAPCC is also in the process of getting finalized and has estimated substantial investment requirements. Current levels of investment, although significant, are not enough compared to future requirements.
- Although there are barriers to low carbon investment in Tamil Nadu, the first step is for the State to recognize the importance of measuring such investments. This study creates the baseline by mapping low carbon investments for FY 2010-11 and FY 2011-12. It also develops a framework and methodology to capture public expenditure and private investments in low carbon interventions at the sub-national level that is comparable to other recognized international climate finance tracking methodologies. It is now important that the State continues this exercise and increases its investment targets in subsequent years. It is equally important to come up with reliable cost estimates for Tamil Nadu's low carbon investment requirements. The TN Vision 2023 and the SAPCC serve as good starting points, but more robust methodologies need to be developed.
- While India is thinking through various institutional mechanisms to access funds from the Green Climate Fund, States should also assess their respective capacities to absorb such funds. Measuring the quantum and effectiveness of current low carbon investments is a step in that direction. Now that almost all Indian States have developed their State Action Plans on Climate Change, it is also recommended that they adopt a common methodology in order to track and compare their low carbon investments and gaps, and be prepared to access international funds once the mechanisms and funds are in place.

# 1 Introduction

In recent times, climate finance has gained a lot of importance at international climate negotiations. This has resulted in a commitment to substantially augment the flow of climate finance (to the tune of USD 100 billion per year by 2020 for tackling the needs of developing countries) from “a wide variety of sources, public and private, bilateral and multilateral, including alternative sources” (UNFCCC, 2010). Putting together an all-inclusive representation of climate finance flows is necessary to this effort. Comprehending the nature and magnitude of support that is being made available to enhance efforts towards low-carbon development, how these types of support are consistent with countries’ needs and whether financial resources are being spent effectively is critical to encouraging trust among countries and ensuring the efficient use of the existing financial resources (Buchner, Falconer, Hervé-Mignucci, Trabacchi, & Brinkman, 2011).

A vast number of organizations and initiatives are engaged in monitoring, tracking and analyzing diverse pieces of climate finance. However, there is still lack of clarity with respect to the nature and magnitude of climate finance that is flowing and where it is flowing from and to. The official systems instituted for the purpose of tracking climate finance primarily focus on public outflows from developed countries. Some of these official systems are: the UNFCCC National Communications, OECD Rio Markers and the Joint MDB approach for climate finance reporting.

The approaches mentioned above track international aid. However, climate finance has a deep domestic inclination: the bulk of global climate finance investments are made in the same country from which they originate (Buchner, et al., 2013). The maximum uncertainties of climate finance are however associated with “private and South-South flows to developing countries as well as domestic flows” (Caruso & Ellis, 2013). And although public and private domestic capital has a significant role, there is a dearth of reliable or comprehensive data sources on such flows (Corfee-Morlot, Guay, & Larsen, 2009).

Studies on climate oriented domestic budgets are limited, but increasing. Several Asian and Pacific developing countries in recent times have conducted a ‘Climate Public Expenditure and Institutional Review’ (CPEIR) to code climate activities funded through national budgets. On the basis of a range of different budget years between 2010 and 2012, CPEIR studies assess that the governments of Bangladesh, Indonesia, Nepal, and Thailand, jointly routed around USD 4 billion, through government budgets toward climate activities. CPEIR data are indicative rather than statistically precise estimates due to complications involved in terming and tracking climate finance (Buchner, et al., 2013).

The need for climate finance reporting of public and private domestic capital is pertinent especially at a time when nations are aiming to mobilize large sums of domestic financial resources in order to meet their GHG emissions reduction commitment. India has already made a voluntary domestic commitment that by pursuing proactive policies it will reduce “the emissions intensity of its GDP by 20-25 per cent over the 2005 levels by the year 2020” ( Expert Group on Low Carbon Strategies for Inclusive Growth, 2011). It is widely recognized that investments over the next decade in low carbon interventions such as clean energy and transport and energy efficiency projects will have to be stepped up in order to meet and exceed emissions targets.

The Government has also responded with a National Action Plan on Climate Change (NAPCC) which was launched in the year 2008 with eight national missions (focusing on both adaptation and mitigation) which are intended to attain sustainable development with co-benefits for tackling climate change. The Economic Survey of India estimates that it will cost USD 38 billion to meet the climate goals of the NAPCC. Although India has not apportioned its emission reduction targets to specific missions, it is expected the Jawaharlal Nehru National Solar Mission and the National Mission for Enhanced Energy Efficiency will contribute significantly to this goal.

States too have been directed to formulate the State Action Plan on Climate Change (SAPCC) within a time frame in line with the objectives of the NAPCC. At this stage the finances for implementing the action plans are not very clear, specifically at the sub-national level, while at the national level a number of financing options are being contemplated. Although numerous financing options have been deliberated consisting of resources through budgetary support, Finance Commissions, levies/ carbon tax, creation of Green/ Clean Funds, loans from multi-lateral institutions and taking advantage of prevailing and forthcoming global funding windows, it is important to ascertain the quantum of funds required and the nature and magnitude of low carbon investment currently happening at the sub-national level.

The absence of a clear articulation of low carbon funding requirements and an audit of low carbon investment at the sub-national level has encouraged this study. As a case in point, this study assesses the current status of the low carbon finance landscape in the State of Tamil Nadu. Low carbon finance reporting at the State level will provide a comprehensive analysis of the relative levels of public and private investments and serve as a benchmark to draw conclusions about the efficacy of public subsidy to leverage private sector expenditure. This exercise is also important for understanding the investment gaps that need to be filled in order to meet the low carbon targets proposed by the State. This report attempts to bring together public and private sector low carbon investment data and highlights some of the barriers to investment. This report covers mitigation oriented climate finance, and provides substantially high granularity in sector-level reporting for the financial years (FY) 2010 and 2011.

## 2 Methodology

A combination of approaches and methods were used for various components of the study as outlined below.

### 2.1 MAPPING LOW CARBON FINANCE

In order to map the total amount of investments in low carbon activities, the first step is to define the approach for low carbon finance reporting. This study looked at several approaches that are used to track international aid from a climate perspective. A brief description of these approaches is provided in Annexure I. According to a recent IMF Working Paper, green investment is defined as “the investment necessary to reduce greenhouse gas and air pollutant emissions, without significantly reducing the production and consumption of non-energy goods” (Eyraud, Wane, Zhang, & Clements, 2011). Green investment includes both public expenditure and private investment.

The components of green investment can be summarized as the supply factor, the demand factor and the mixed factor. Supply factors include low-emission energy supply sources such as large hydro, nuclear energy, renewable sources of electricity, research and development (R&D) in clean energy, and carbon capture and sequestration (CCS) technologies. Demand factors are energy efficiency measures in the energy-consuming sectors, which include Industry, Agriculture, Transport, Services and Households. Mixed factors include energy efficiency in the electricity sector (generation, transmission, distribution) (Eyraud, Wane, Zhang, & Clements, 2011).

This study largely follows the above mentioned definition, with a few exceptions, in order to report the low carbon finance in the State of Tamil Nadu. Investments in seemingly controversial categories such as nuclear power and large scale hydro-power have not been included in this study (Inderst, Kaminker, & Stewart, 2012). The study has also looked at the typology of climate change mitigation interventions of the Joint MDB climate finance tracking approach in order to screen the mitigation interventions.

### 2.2 DATA AND SOURCES

Low carbon finance reporting for the State of Tamil Nadu can be categorized along two broad sources: Public Expenditure and Private Investment.

#### 2.2.1 PUBLIC EXPENDITURE

##### **LOW CARBON INTERVENTION MAPPING:**

In order to ascertain the type and nature of low carbon interventions in the State of Tamil Nadu, relevant low carbon activities have been mapped from Departmental reports (Policy Notes, Citizen’s Charter, public statements made by the Departments of the Government of Tamil Nadu). The following Departments have been included for mapping low carbon interventions in the State of Tamil Nadu: Agriculture Department, Energy Department, Handlooms, Handicrafts, Textiles and Khadi Department, Industries Department, Municipal Administration and Water Supply Department, Transport Department, Department of Environment, Department of Forest, Micro, Small and Medium Enterprises Department.

##### **ASSESSMENT OF PUBLIC EXPENDITURE ON LOW CARBON INTERVENTIONS:**

Public expenditure for low carbon finance reporting includes expenditure incurred by the State Government; Central assistance to State and Externally Aided Projects (EAPs). The financial data for low carbon interventions is drawn from meetings with Department officials and Right to Information (RTI) queries, performance budgets of various Departments and Annual Reports of State Government Departments. This has facilitated in obtaining an estimate of the public



expenditure on low carbon interventions. Public expenditure under all relevant Departments was analyzed for the FY 2010-11 and FY 2011-12. In cases where data on actual expenditure was not available, the research team has used budgetary estimates/ revised estimates as proxies. The low carbon finance data that was collected has been collated and presented sector-wise for ease of understanding and comparison with investment requirements.

### **2.2.2 PRIVATE INVESTMENTS**

In order to ascertain the level of private investment, data has been drawn from Bloomberg New Energy Finance (BNEF) for the purpose of tracking deal flows in renewable energy by sources and asset classes. This data includes private domestic and private international investments. The key investment categories provided in the BNEF database can be summarized as follows: a) Asset Financing b) Public Markets c) Venture Capital/Private Equity and d) Mergers and Acquisition. The private sector data set pertains to renewable energy investments only. Since private sector investment data pertaining to energy efficiency is not available in the BNEF database, the private sector low carbon investment is a conservative estimate. Private flows in renewable energy for the State of Tamil Nadu have been tracked for the same base years – FY 2010 and FY 2011.

## **2.3 DATA GAPS AND LIMITATIONS**

For certain initiatives/schemes (identified as low carbon interventions) announced by the Government, there is a time lag between the announcement and disbursement of funding. This might lead to a significant overestimation of the actual low carbon public expenditure. For the purpose of this study, such low carbon initiatives (where data on disbursements could not be ascertained) have not been taken into account. The following are the list of initiatives that have not been considered:

- According to Energy Department Policy notes for 2011-12, the State had proposed a budget outlay of INR (Indian Rupees) 6,134.58 Crores towards strengthening grid infrastructure for wind evacuation. However, discussions with State officials indicate that the amount has not been sanctioned entirely till date and is likely to be utilized only over a period of time.
- Department of Municipal Administration and Water Supply has taken up different low carbon initiatives pertaining to this sector. An amount of INR 124.54 Crores was allotted for 126 Urban Local Bodies (ULB) to implement solid waste management during 2011-12. However, the magnitude of funding disbursed under this initiative is unclear.
- During 2011-12, the State Government commissioned the setting up of 12 co-generation plants in co-operative and public sector sugar mills at a total project cost of INR 964.88 Crores, which included a central financial assistance of INR 58.25 Crores. The mills are expected to be operational during 2014-15. Since the project allocations and expenditures for the financial year 2011-12 have not been specified in the financial statements or policy notes of the Energy Department during 2011-12, for purposes of the study, the public sector investments against this component include only the central financial assistance of INR 58.25 Crores as this amount was released during this year.

In addition to this, there were challenges with respect to the lack of available expenditure data on certain Government programmes/schemes (which were mapped as low carbon interventions during the analysis). This may have resulted in errors of omission. Such interventions have not been included while computing the low carbon investment for the State of Tamil Nadu.

Certain limitations to the BNEF database include: a) Absence of information on energy efficiency projects and investments b) Unavailability of project development time frames and break-up of investments by financial year c) Unavailability of investments by asset class in INR denomination, which renders it difficult to compare project level investments within the renewable sector. As a consequence, our private sector investment figures are only a conservative estimate of actual private investments towards GHG mitigation in the State.

## 3 Results and Findings

### 3.1 LOW CARBON INVESTMENT REQUIREMENT IN TAMIL NADU

Although the Government of India has voluntarily committed to reduce the emissions intensity of its GDP by 20 -25% by 2020 in comparison to 2005 levels, this target has not been apportioned among the Indian States. Several States have come up with their State Action Plans on Climate Change (SAPCC); however, there are no clear mitigation targets. The State of Tamil Nadu has two strategic documents that articulate its plans for low carbon interventions in the State – Tamil Nadu Vision 2023 and the Tamil Nadu SAPCC.

In 2012, the Government of Tamil Nadu prepared the ‘Tamil Nadu Vision 2023’ document with a view to: formulate a vision and growth strategy with sector specific sub-strategies, recognize the thrust areas for growth and the barriers to achieving growth in such areas, identify critical projects in important sectors and institutional mechanisms for eradicating administrative delays in implementation of projects. Although the Vision 2023 was not written from a low carbon growth perspective, several interventions have been identified that would contribute to low carbon growth in the State.

The low carbon interventions identified in the Vision 2023 can be classified under the following sectors: a) Energy b) Agriculture c) Industry d) Transport and e) Environment and Forest. Although there are investments planned in Industry and Environment & Forest sector, there are no interventions that are low carbon in nature. Table 1 below summarizes the focus areas and corresponding budgetary requirements for low carbon interventions as per the Vision 2023. Detailed list of low carbon interventions and their estimated costs are provided in Annexure II.

Table 1: TAMIL NADU VISION 2023, 2012 - FOCUS AREAS AND COST ESTIMATES	
Sector	Cost Estimates (INR Crores)
Energy	3,90,000
Agriculture	30,200
Transport	2,00,000
Industry	-
Environment and Forest	-
<b>Total (2012-23)</b>	<b>6,20,200</b>
<b>Annual</b>	<b>56,400</b>

**Source:** Tamil Nadu Vision 2023

In 2013, the Govt. of Tamil Nadu came out with the State Action Plan on Climate Change. The document has listed strategies for climate change mitigation and adaptation across various sectors and has also provided cost estimates for some of those. This study has identified those strategies that have potential to reduce GHG emissions and used the cost estimates for both the 12<sup>th</sup> and the 13<sup>th</sup> Five Year Plan as long term financial requirements for the State. The strategies are categorized into the following sectors: a) Energy b) Agriculture c) Forests and Biodiversity and d) Sustainable Habitats. Table 2 below summarizes the focus areas and corresponding budgetary requirements for low carbon interventions as specified in the SAPCC document. Detailed list of low carbon interventions and their estimated costs are provided in Annexure III.

**Table 2: TAMIL NADU STATE ACTION PLAN ON CLIMATE CHANGE - FOCUS AREAS AND COST ESTIMATES**

Sector	Cost Estimates (INR Crores)
Energy	29,219
Agriculture	77
Forests and Biodiversity	623
Sustainable Habitats	1,287
<b>Total (2012-22)</b>	<b>31,206</b>
<b>Annual</b>	<b>3,120</b>

**Source:** *Tamil Nadu State Action Plan on Climate Change, 2013 (Final Draft)*

As is evident from Tables 1 and 2 above, the total estimates as well as the sector-wise requirements vary widely across the two documents. The proposed renewable energy investment in the Vision 2023 is INR 800 billion whereas in the SAPCC it is only INR 57.53 billion. Renewable energy investments constitute 20% of the proposed low carbon investments in the Vision 2023 and the potential low carbon investments constitute 87% of the overall planned investments in the energy sector as per the Vision 2023. For the SAPCC, however, the total planned investments for Energy sector (RE and EE combined) is 292.19 billion which is much conservative when compared to the Vision 2023.

The SAPCC aims to capitalize on low hanging fruits such as conversion to LEDs and CFLs, green homes etc., whereas the Vision 2023 proposes substantial investments in Ultra Mega Power Projects, LNG terminals, and Gas grids. The SAPCC proposes a disproportionate amount of investment in reducing T&D losses even when TN claims to be a State with one of the lowest T&D losses in the country.

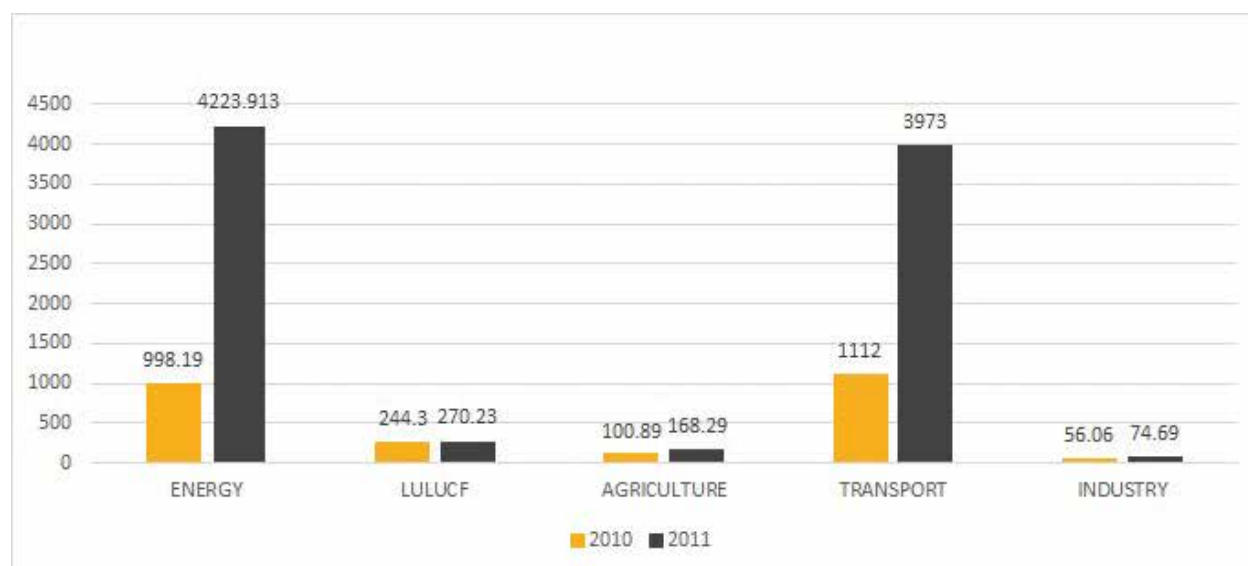
The discrepancy is true for other matching sectors such as Agriculture and Transport as well. In a Roundtable<sup>1</sup> discussion in March 2014, it was pointed out by several TN State Government officials that the SAPCC cost estimates are not robust and they are miniscule compared to what the State already spends on what it considers as climate change activities. It should, however, be noted that the Vision 2023 was not written from the perspective of low carbon growth. It is, therefore, very difficult to combine the numbers provided in the two documents and come up with a total requirement for the State. Nonetheless the two strategic documents together provide an important reference and helps point out gaps in estimates and investment requirements.

## 3.2 INVESTMENT TOWARDS LOW CARBON INTERVENTIONS IN TAMIL NADU

### 3.2.1 SUMMARY RESULTS

Low carbon public expenditure under all relevant Departments was analyzed for FY 2010-11 and FY 2011-12. This was coupled with PPAs for procurement of power from renewable energy sources for the same financial years to compute an estimate of the total low carbon finance in the State. In order to avoid double counting, private investment in RE sources was not included in these calculations. However, these numbers have been noted in the subsequent sector analysis on energy to give a sense of the amount of private funds that have been leveraged from public expenditure.

<sup>1</sup> The Roundtable titled "Financing Low Carbon Growth at the State Level" was organized by the TN State Planning Commission with the Institute for Financial Management and Research as the Technical Partner, on March 17, 2014.

**Figure 1: TAMIL NADU'S PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS (INR CRORES)**

**Source:** IFMR-LEAD's analysis

Total public expenditure towards low carbon interventions for FY 2010-11 was INR 2,511.44 Crores. This is approximately 0.6% of the State Gross Domestic Product (SGDP) for the same year. This investment increased to 2% of the SGDP<sup>2</sup> in FY 2011-12 to INR 8,710.12 Crores. Energy and Transport sectors form the bulk of the investments for both the years. These are also the sectors that experienced the biggest jump in investment, while investment in other sectors namely Agriculture, Industry, and LULUCF remained more or less constant. In the Transport sector, the Metro Rail Project of Chennai, implemented jointly by the State and Central Governments with a loan from Japan International Cooperation Agency (JICA) is the largest ongoing project directly contributing to emission reductions. The regenerative braking technology used in the project saves huge amount of energy and subsequently avoids a lot of GHG emissions.

Investment in energy has been largely driven by the wind sector, although the State has made considerable inroads in capacity addition through solar and biomass as well. Under the Jawaharlal Nehru National Solar Mission (JNNSM), the State has been commissioned to add 22 MW of installed capacity using Solar Photovoltaic technology. Similarly, biomass combustion-based power projects with an installed capacity of 161.5 MW have been commissioned in the State. The State has approved establishment of biomass gasification-based power plants with an installed capacity of 41.2 MW, while several waste-to-energy biogas based power projects have also been undertaken with the financial assistance of MNRE.

With favorable policy and regulatory frameworks and economic incentives, Tamil Nadu has been successful in attracting private sector investments into renewable energy development and related markets in the State. Private sector investments in the State in the past six years have been towards wind and biomass subsectors, with investments peaking during the FY 2010-11 and FY 2011-12. Public sector investments into development of renewable energy were made in the form of purchase of power from IPPs to meet state demand, capacity addition in certain instances, investments into upgradation and modernization of machinery, assessment studies and demonstration projects, capital and tax subsidies for manufacture and installation.

<sup>2</sup> Gross State Domestic Product at Constant 2004-05 prices for the State of Tamil Nadu for FY 2010-11 and FY 2011-12 is INR 403,416 Crores and INR 433,353 Crores respectively.

In terms of energy savings potential, Tamil Nadu exceeds the national average, constituting over 10% of the total energy savings potential of 75,364 MU across all States in India. Tamil Nadu offers tremendous opportunities for mainstreaming energy efficiency initiatives across all sectors, and particularly in the agricultural, domestic and industrial sectors. While the State has undertaken a range of energy efficiency projects and initiatives across different sectors, its EE potential largely remains unrealized owing to various technical, financial, institutional and information barriers.

Afforestation projects contribute the bulk of the investments in the LULCF sector. Major projects like TN Afforestation Project, tree cultivation in private lands, TN Biodiversity Conservation and Greening Project come under this category. There has been a marginal increase in spending in this sector over the two years. Waste management has received considerable amount of attention and has experienced a substantial increase in investment from INR 0.5 Crores in FY 2010-11 to INR 5 Crores in FY 2011-12.

In the Agriculture sector, the State Government has implemented a variety of initiatives and incentives to promote increased water use efficiency, crop based interventions, integrated farming, effective and economic utilization of inputs, and rain-fed cultivation. Expenditure on schemes related to sustainable cultivation practices increased three fold from INR 17.63 Crores in FY 2010-11 to INR 53.02 Crores in FY 2011-12. Soil and moisture conservation, and groundwater recharge are the other important schemes in terms of investments. Major initiatives targeted by these schemes include System of Rice Intensification (SRI), sustainable sugarcane production, vermicomposting, system of millets intensification, intensification of red-gram cultivation, and accelerated pulses development program. Although investments in the study period are considerably low when compared to other sectors, a number of schemes have been announced that would lead to substantial investments in the coming years.

### 3.2.2 SECTOR SPECIFIC FINDINGS

#### **ENERGY (RENEWABLE ENERGY AND ENERGY EFFICIENCY)**

One of the leading States to promote harnessing of Renewable Energy (RE) – primarily, wind, solar and biomass energy, Tamil Nadu boasts of total renewable energy installed capacity of 7999.025 MW, which accounts for 30% of the total installed renewable capacity of 26,677.10 MW in India. The State ranks first in the country in wind energy generation, with more than 6696 MW of installed wind mills that constitute over 40% of the installed capacity for wind generation in the country (Government of Tamil Nadu, 2012).

While capacity addition has been largely driven by the wind sector, the State has made considerable inroads in capacity addition through solar and biomass as well. Under the Jawaharlal Nehru National Solar Mission (JNNSM), the State has been commissioned to add 22 MW of installed capacity using solar photovoltaic technology. Similarly, biomass combustion-based power projects with an installed capacity of 161.5 MW have been commissioned in the State. The State has approved establishment of biomass gasification-based power plants with an installed capacity of 41.2 MW, while several waste-to-energy biogas based power projects have also been undertaken with the financial assistance of MNRE.

Tamil Nadu is, however, far behind Gujarat and Rajasthan in terms of grid-based solar power generation. Gujarat boasts of a total installed capacity of 185 MW and Rajasthan 120.5 MW, in contrast to the 7 MW in Tamil Nadu (Ministry of New and Renewable Energy, 2011). Even among solar off-grid applications, Tamil Nadu lags considerably behind States such as Kerala, Rajasthan, Chhattisgarh and Andhra Pradesh. The case to transition towards renewable energy sources to meet the growing energy demand is made stronger when considering the total assessed renewable energy potential of the State. According to the recently released “Action Plan for Comprehensive Renewable Energy Development in Tamil Nadu”, a study undertaken by World Institute of Sustainable Energy (WISE), Shakti Sustainable Energy Foundation and CII on behalf of the Tamil Nadu Energy Development Agency, Chennai, Tamil Nadu has a total (reassessed) RE potential of 720,000 MW, which includes grid-connected and off-grid power.

**Table 3: TOTAL (REASSESSED) RENEWABLE ENERGY POTENTIAL FOR TAMIL NADU**

<b>Grid-connected RE Technology</b>	<b>Independent Potential in TN</b>
Solar PV (NREL data)	2,59,700 MW
CSP (NREL data)	78,505 MW
Wind 80 m (no farmland)	36,344 MW
Wind 80m (farmland)	1,60,510 MW
Repowering	1,370 MW
Wind 80m (offshore)	1,27,428 MW
Wind-solar hybrid	7,913 MW
Bagasse-based co-gen	1,073 MW
Energy plantations	10,800 MW
<b>Off-grid Technology</b>	<b>Potential in Tamil Nadu</b>
Rooftop PV	29,642 MW
Solar water heating	16.15 million sq.m
Solar pumping	7,041 MW

**Source:** Action plan for Comprehensive Renewable Energy Development in TN, December 2012

With favorable policy and regulatory frameworks and economic incentives, the State has been successful in attracting private sector investments into renewable energy development and related markets in the State. Private sector investments in the State in the past six years have been towards wind and biomass sub-sectors, with investments peaking during the years FY 2010-11 and FY 2011-12.

**Table 4: PRIVATE SECTOR INVESTMENTS BY ASSET CLASS (IN \$ MILLION) FROM FY 2007-08 TO FY 2013-14**

<b>Asset Class</b>	<b>Wind</b>	<b>Biomass</b>	<b>Solar</b>
Corporate Debt	38.30	0.00	0.00
Mergers & Acquisitions	334.25	468.63	0.00
Public Markets	107.78	203.60	0.00
VC/PE	361.50	55.00	59.47
<b>Total</b>	<b>841.84</b>	<b>727.23</b>	<b>59.47</b>

**Source:** Bloomberg New Energy Finance Data

**Table 5: PRIVATE SECTOR INVESTMENT IN RENEWABLE ENERGY SOURCES**

<b>Source</b>	<b>2010-11</b>		<b>2011-12</b>	
	<b>Capacity (MW)</b>	<b>Investment (INR Crores)</b>	<b>Capacity (MW)</b>	<b>Investment (INR Crores)</b>
Wind	838.475	5,242.31	1,438.90	9,496.25
Solar	5	96.79	10	102.65
Biomass, Waste, Co-gen	82.45	446.99	31	139.08
Small Hydro	0	0	0	0

**Source:** Bloomberg New Energy Finance Data

Public expenditure towards development of renewable energy were made in the form of purchase of power from IPPs to meet State demand, capacity addition in certain instances, investments into upgradation and modernization

of machinery, assessment studies and demonstration projects, capital and tax subsidies for manufacturing and installation.

**Table 6: FEED-IN TARIFF PAYMENTS FOR PROCUREMENT OF POWER BASED ON POWER PURCHASE AGREEMENTS (PPAs)**

Source	2010-11		2011-12	
	Power Purchase (MUs)	Power Purchase (INR Crores)	Power Purchase (MUs)	Power Purchase (INR Crores)
Wind	148	58	5893	2369
Solar	2	1	11	9
Co-generation	388	256	1285	650
Biomass	38	18	73	33

**Source:** TANGEDCO, GoTN

Total capital assistance for all sources, including both GoTN and Gol was INR 48 Crores in FY 2010-11, which increased substantially to INR 308 Crores in FY 2011-12. A detailed list of all Government schemes and expenditure towards promoting renewable energy in the State for the two financial years is provided in the Table 7 below. The total investments (includes public and private sources) towards renewable energy is included in Annexure IV.

**Table 7: SUMMARY OF PUBLIC EXPENDITURE IN RENEWABLE ENERGY SOURCES FOR FY 2010-11 AND FY 2011-12**

Description	2010-11 (INR Crores)	2011-12 (INR Crores)
Capacity Addition	-	-
Capital Assistance (State, Gol)	48	308
Modernization (State, Gol - RAPDRP)	617	855
Assessment Studies		0.1025
<b>Total</b>	<b>665</b>	<b>1,163</b>

**Source:** Policy Notes and RTIs from Energy Department, GoTN

The Tamil Nadu Government has attempted to promote Energy Efficiency (EE) interventions by introducing several policies and undertaking energy conservation initiatives across different sectors. According to “State-wise Electricity Consumption & Conservation Potential in India”, a report prepared by National Productivity Council for the Bureau of Energy Efficiency (BEE), Gol, sectoral energy consumption is highest in agricultural, domestic and industrial sectors and the energy savings potential is also high in these sectors. The report identifies the State-wise energy consumption patterns and savings potential across all sectors. Table 8 below shows Tamil Nadu’s energy savings potential against total energy sales of 59,045 MU during 2007-08 and consumption patterns of 51,773 MU.

**Table 8: TAMIL NADU’S ENERGY CONSUMPTION PATTERN AND SAVING POTENTIAL**

Sector	Consumption (MU)	Savings Potential (MU)
Agricultural Pump-sets	10,030	3,000
Commercial Buildings	960	192
Municipalities	571	126
Domestic	13,006	2,600
SME & Large Industries	27,206	1,904
<b>Total</b>	<b>51,773</b>	<b>7,822</b>

**Source:** National Productivity Council, BEE, Gol

This savings potential of 7,822 MU in Tamil Nadu exceeds the national average, constituting over 10% of the total energy savings potential of 75,364 MU across all States in India. These figures indicate that Tamil Nadu offers tremendous opportunities

for mainstreaming energy efficiency initiatives across all sectors, and particularly in the agricultural, domestic and industrial sectors. TNEI is the State Designated Agency appointed by BEE to co-ordinate, regulate and enforce the provisions of the Energy Conservation Act, 2001 and to implement BEE schemes and other energy conservation measures in Tamil Nadu. The agency has been fulfilling its functions and activities under the exclusive technical guidance and financial support of BEE.

While the State has undertaken a range of energy efficiency projects and initiatives across each of these sectors, its EE potential largely remains unrealized owing to various technical, financial, institutional and information barriers. A detailed list of all public sector schemes and expenditure undertaken by the Energy Department, GoTN, to promote energy efficiency in the State for the two financial years is provided in Annexure IV.

## LAND USE LAND USE CHANGE AND FORESTRY

This section includes expenditure by the Department of Environment and Department of Forest. Summary of Government spending on initiatives in FY 2010-11 and FY 2011-12 that directly or indirectly reduce GHG emissions in this sector are listed in Table 9 below. A detailed list of all the schemes/programs and expenditure relevant to this sector is provided in Annexure V.

**Table 9: SUMMARY OF PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS IN THE LULUCF SECTOR FOR FY 2010-11 AND FY 2011-12**

Name of the Initiative	Investment made in 2010-11 (INR Crores)	Investment made in 2011-12 (INR Crores)
Training and awareness generation on green initiatives	2.05	3.25
Research activities	0.1	0
Laying of road using plastic waste	47.3	54
Afforestation projects	161.23	167.7
Forest restoration and regeneration projects	6.22	15.74
Waste management	0.05	5
Soil and moisture conservation	27.35	24.54
<b>Total</b>	<b>244.3</b>	<b>270.23</b>

**Source:** Policy Notes and direct communication with Department of Environment and Department of Forest

Schemes and programs related to afforestation form the bulk of the investments in this sector. Projects include Tamil Nadu Afforestation Project, tree cultivation in private lands, Tamil Nadu Biodiversity Conservation and Greening Project. Training and awareness generation activities include program for school students as well as capacity building at the professional level through waste management training for engineers. Although these initiatives do not reduce emissions directly, they create the building blocks for a low carbon pathway. There have also been a few pilot initiatives in plastic waste management and using plastic for co-incineration in cement kiln. Soil and water conservation projects are one of the major focus areas for the Government, especially under the Western Ghats Development Program (WGDP) and Hill Area Development Program (HADP). Initiatives such as these lower the chances of ground water depletion, thereby conserving the excess electricity required in pumping water. Restoration and regeneration projects have not received enough attention despite the huge potential and need for eco-restoration of the Pallikaranai marshland and putting in place a robust monitoring mechanism.

## AGRICULTURE

The TN Government is keen to usher in a second green revolution in the State and has identified several thrust areas like increased water use efficiency, crop based interventions, integrated farming, effective and economic utilization of inputs and rain-fed cultivation in order to make it a reality. Government spending in the last few years points towards a few focus areas like sustainable practices, water conservation, and watershed development. Strengthening of research infrastructure, using ICT tools, proper use of technology in farm etc., as envisioned in the Vision 2023, can supplement the current activities towards a low carbon pathway in this sector.



Government expenditure for the FYs 2010-11 and 2011-12 by the Department of Agriculture that directly or indirectly reduce carbon emissions are presented in Table 10 below. Various expenditure items have been combined under relevant initiatives to provide a summary picture. Detailed list of all the schemes/programs and expenditure relevant to this sector has been provided in Annexure VI.

**Table 10: SUMMARY OF PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS IN THE AGRICULTURE SECTOR FOR FY 2010-11 AND FY 2011-12**

Name of the Initiative	Investment made in 2010-11 ( INR Crores)	Investment made in 2011-12 (INR Crores)
Sustainable cultivation practices	17.63	53.02
Efficient utilization of Environmental resources	0.69	0.43
Wasteland and watershed development	24.86	18.55
Soil and moisture conservation	32.74	71.29
Groundwater recharge	24.97	25
<b>Total</b>	<b>100.89</b>	<b>168.29</b>

**Source:** Policy Notes and direct communication with Department of Agriculture and various wings of the department (Agricultural Engineering, Horticulture, Watershed Development Agency)

Organic farming practices and soil health improvements through application of bio-fertilizers and green manure are some of the important areas where spending by the Department directly reduced GHG emissions. Watershed development and other water management activities like wasteland development, soil and moisture conservation, rainwater harvesting, and run-off management, in addition to reducing GHG emissions, also conserve the resources efficiently and sustainably. There is a substantial increase in spending on initiatives related to sustainable cultivation practices and soil-moisture conservation in FY 2011-12 over FY 2010-11. These initiatives include System of Rice Intensification (SRI), sustainable sugarcane cultivation practices, vermicomposting, system of millets intensification, intensification of red gram cultivation, and accelerated pulses development program. Other activities such as efficient utilization of environmental resources and ground water recharge receive very little investments. The scheme to replace old pump sets with new energy efficient ones has not taken off very well in the State. Possible reasons behind this are discussed in the section pertaining to barriers of low carbon investment.

## TRANSPORT

Owing to their nature and scale, low carbon transport projects generally take a lot of time and effort in terms of both planning and actual implementation. Often, they involve temporary and permanent displacement of traffic and local inhabitants. Hence these projects are generally taken up and implemented one at a time. The State of Tamil Nadu is currently implementing the INR 14,600 Crores Metro Rail Project in the city of Chennai.

Metro rail emits the lowest amount of carbon di-oxide amongst various modes of public transport and doesn't cause air pollution in the city, making it a cleaner mode of transit (Connecting Chennai City Better). Moreover, it is based on energy efficient technology which requires a fifth of energy per passenger kilometer compared to road transport modes. The indirect effects on environment include reduced congestion on road and subsequent low emissions from on-road vehicles. The Metro Rail Project of Chennai, being implemented jointly by the State and Central Governments with a loan from Japan International Cooperation Agency (JICA) is the largest on-going project directly contributing to emissions reduction. The regenerative braking technology used in the project saves huge amount of energy and subsequently avoids a lot of GHG emissions. This technology will help the project become eligible for carbon credits under Kyoto Protocol.

The estimated cost of the project is INR 14,600 Crores excluding State taxes and vacant State Government land. The contributions from various sources are depicted in Table 11 below. The JICA<sup>3</sup> loan is repayable in 30 years with a moratorium of 10 years.

**Table 11: FUNDING PATTERN FOR CHENNAI METRO RAIL PROJECT**

Particulars	Amount with Central Taxes only (In INR Crores)	Percentage Contribution
Equity by Government of India	2,203	15
Equity by Government of Tamil Nadu	2,203	15
Sub-ordinate Debt by Government of India	1,469	10
Sub-ordinate Debt by Government of Tamil Nadu	220	1.5
JICA loan @ 1.3 % pa to GOI/Market borrowing @ 12% p.a.	8,590	58.5
<b>Total</b>	<b>14,685</b>	<b>100</b>
<b>Total contribution of Government of Tamil Nadu excluding State taxes</b>	<b>2,423</b>	

*Source: Website of Chennai Metro Rail Limited*

The first phase of the project with two corridors is expected to be completed during 2014-15. Apart from the environmental benefits, each metro is expected to displace 16 buses, 300 four-wheelers and 600 two-wheelers from the road, thereby reducing congestion as well as travel time for the commuters (Single train trip to equal 16 buses, 300 cars and 600 bikes, 2012). Table 12 below presents the planned and actual expenditures for the project for FY 2010-11 and FY 2011-12.

**Table 12: PLANNED AND ACTUAL INVESTMENTS FOR CHENNAI METRO RAIL PROJECT FOR FY 2010-11 AND FY 2011-12**

Name of the Scheme	Planned Investment: without Taxes and Duties in 2010-11 (In INR Crores)	Planned Investment: with Central Taxes only in 2010-11 (In INR Crores)	Actual Investment: made in 2010-11 (In INR Crores)	Planned Investment: without Taxes and Duties in 2011-12 (In INR Crores)	Planned Investment: with Central Taxes only in 2011-12 (In INR Crores)	Actual Investment: made in 2011-12 (In INR Crores)
Chennai Metro Rail Project	3,080	3,484	1,112	2,705	3,096	3,973

*Source: Compiled from various websites*

## INDUSTRY

The low carbon schemes in the Industry sector were mainly towards developing clean source of power generation, enhancing industrial energy efficiency and management of waste. These schemes (presented in Annexure VII) together led to an investment of INR 56.06 Crores in FY 2010-11 and INR 74.69 Crores in FY 2011-12. In the Handlooms, Handicrafts, Textiles industry, free loans to the tune of INR 200 Crores, to ensure zero liquid discharge by installing any clean technology, i.e., Brine Reuse Technology or Nano Technology was provided for common effluent treatment plants. The Government had sanctioned a sum of INR 179.34 Crores as interest free loan to 18 common effluent treatment plants (for adopting the above mentioned technologies) out of which INR 24.36 Crores was released in FY 2011-12.

The low carbon incentives for Micro, Small and Medium Enterprises (which are routed through the Tamil Nadu Industrial Investment Corporation) include loans for setting up new wind mills, the Credit-Linked Capital Scheme for Technology Upgradation of Small and Micro Industries and the Technology Upgradation Fund Scheme. The Corporation granted INR 40.17 Crores in FY 2010-11 and INR 43.36 Crores in FY 2011-12 as loans to set up new windmills. Under the Credit-Linked Capital Scheme for Technology Upgradation of Small and Micro Industries, loans amounting to INR 11.27 Crores

in FY 2010-11 and INR 3.6 Crores in FY 2011-12 were disbursed to Small & Medium Enterprises. In addition to this, INR 4.62 Crores in FY 2010-11 and INR 3.3728 Crores in FY 2011-12 was granted under the Technology Upgradation Fund Scheme.

This is likely to be a conservative estimate of public expenditure in the industry sector. Several schemes and projects have been announced by Department of MSME that facilitate GHG emissions reduction; however, actual investments in these schemes for the study years could not be ascertained due to lack of available data. The financial incentives and other benefits offered to MSMEs to promote small scale industrial energy efficiency are presented in Annexure VIII.

## 4 Low Carbon Investment Gaps and Barriers

### 4.1 INVESTMENT GAPS

Given the lack of credible low carbon investment requirements and longer term data on actual investments, it is very difficult to analyze investment gaps. However, certain observations have been made based on the findings:

- The annual low carbon investment requirement as per the Vision 2023 (2012-23) is INR 6,20,200 Crores whereas the same as per the SAPCC (2012-22) is INR 31,206 Crores. It has already been noted earlier that the SAPCC estimates are not robust and highly on the conservative side. Total low carbon public expenditure in FY 2010-11 was INR 2,178.79 Crores whereas in FY 2011-12 it increased to INR 5,649.123 Crores. It is important for the State to maintain this level of investment and increase it in the subsequent years to be able to achieve its low carbon targets.
- The increase in investment between the two financial years is driven largely by the investment in Renewable Energy and Transport. Although the Transport sector has experienced a jump, there are no new initiatives as such apart from the on-going Chennai Metro Rail Project. While the Agriculture sector investment goes up by about 50%, investments in Industry and LULCF remain stagnant.
- Feed-in tariff payments for on-grid power purchase agreements account for a substantial percentage of the total Energy sector investments in both the years. This underscores the need for providing incentives for private sector investments in order to meet the State's low carbon targets.
- When it comes to planned Government expenditure, current spending falls considerably short of future requirements in most sectors. This point is illustrated below by taking planned investments and actual expenditure in Energy Efficiency as an example.

Table 13 below presents the planned EE investments in key sectors over a period of ten years (covering the 12th and 13th FYP – 2012 to 2022) as per the TN SAPCC:

**Table 13: PLANNED ENERGY EFFICIENCY INVESTMENTS IN SAPCC (FIGURES IN BILLION INR)**

Focus Areas	Twelfth Plan	Thirteenth Plan	Total
Government buildings	5.1	5.3	10.4
Street lighting	2	3	5
Energy efficient homes initiative	4	1	5
Industries (SME clusters)	2	2	4
Awareness generation	0.05	0.05	0.1
Buildings (domestic/commercial)	0.05	0.1	0.15
<b>Total</b>	<b>13.2</b>	<b>11.45</b>	<b>24.65</b>

**Source:** Tamil Nadu SAPCC, 2013 (Final Draft)

As per the investment data presented earlier, TNEI, the State nodal agency for implementing the BEE schemes has made a total investment of INR 0.0074 billion in FY 2010-11 and INR 0.0006 billion in FY 2011-12 towards implementing energy efficiency and conservation measures in the State. The planned investment in SAPCC translates into an annual requirement of INR 2.5 billion to be utilized for EE and conservation measures in the proposed sectors. The current average annual investment in the State for carrying out similar activities (for baseline years FY 2010-11 and FY 2011-12) is only INR 0.004 billion, which is a mere 0.16% of what is proposed in the SAPCC document.

## 4.2 BARRIERS TO LOW CARBON INVESTMENT

The challenges for low carbon investment are well understood and widely recognized. This study, therefore, aimed at understanding some of the State-specific challenges. Some of the important sector-wise findings are presented below:

### 4.2.1 RENEWABLE ENERGY

The key challenges for each of the RE sources are presented in Table 14.

**Table 14: KEY BARRIERS TO RENEWABLE ENERGY INVESTMENTS IN TAMIL NADU**

Source	Challenges
Wind	Poor evacuation and transmission infrastructure
	Absence of forecasting and scheduling mechanisms, levy of forecasting penalties
	Low tariff rates in comparison to other States
	PPA payment delays
	Levy of high infrastructure development costs
	Land availability
	Repowering related issue
Solar	Levy of Panchayat tax
	Clarity in Feed in Tariff (FiT), L1 bidding process
	Poor evacuation infrastructure
	Weak implementation procedures for rooftop installations
	Ambitious project development timelines
	Bankability of PPAs
Biomass	High CAPEX and OPEX of battery backup in solar rooftops
	Policy challenges – example, exclusion of industrial consumers in the net metering scheme
	High fuel costs
	Tariff revisions alone insufficient to guarantee project viability
	Absence of mechanisms to promote sustained biomass supply
Absence of focused R&D towards cost reduction and improved efficiencies of bioenergy technologies	

Our discussions with stakeholders and experts underscored the widespread acceptance gained by the State's solar policy. Given the huge potential and the ambitious targets of the TN solar policy, some of the implementation challenges as highlighted by experts are given below:

- Through its L1 bidding process for selection, the State appears to be establishing an appropriate FiT for solar power. The cost estimates for normal allocation of 1 MW power plant reveals very little margin given the lower tariffs. Recently TNERC came with a final solar tariff order which, according to various stakeholders, could not address issues like actual Capacity Utilization Factor (CUF); realizable O&M costs etc. This, coupled with the falling rupee value, makes projects less attractive to developers.
- Stricter implementation norms need to exist for SPO and REC along with proper guidelines in case of default and fixed penalty procedures.
- Currently, TNEB does not provide any financial help to developers. Though Letter of Credit (LOC) would be issued to the developers assuring payment, the Board still owes a considerable amount to the wind energy sector.
- Currently, the Government helps in acquiring land for big projects. It is recommended that the Government puts forth a land acquisition policy for projects of scale of 100 to 200 MW. Implementing land acquisition for projects of less capacity would be difficult.

- Evacuation of renewable power is a prevalent issue mainly because of the intermittent nature of the source. The State needs to strengthen its capacity on this aspect.
- From a developers' perspective, Viability Gap Funding (VGF) or Capital Subsidies are a better option as opposed to Feed-in-tariffs, as they cover upfront payment and improve the commercial viability of a project. While the cost of project financing is lowered, VGF or capital subsidies do not incentivize project developers to improve operational efficiencies through the life span of a project. Mechanisms such as GBI or FiTs are essential to ensure higher operational efficiencies and cleaner power generation. The nature of funding instrument and their benefits and drawbacks need to be understood clearly prior to committing the necessary public finances to promote solar projects.
- With respect to off-grid applications, financial models would have to evolve based on project specific conditions, upon ascertaining demand, ability to pay back and frequency of payback.
- Restriction of net metering to only domestic consumers serves as a disincentive to industrial and commercial consumers who will benefit from a net metering policy which will reduce their unit cost of procurement of solar power.
- Awareness creation is crucial to the uptake of household level solar energy installations.

#### 4.2.2 AGRICULTURE

The challenges in the agriculture sector are more generic in nature. A couple of the more important ones are highlighted below:

- One of the major mitigation strategies in this sector is the replacement of traditional pump-sets with energy efficient ones. Though there are several initiatives by State and Central Governments to accelerate this replacement, the actual rate is very slow. The most important concern is affordability. Even after subsidies the cost of energy efficient pumps are on the higher side. The Horse Power (HP) based flat electricity tariff is making matters worse leading farmers to buy cheap and inefficient pumps.
- At the Central level, the National Mission for Sustainable Agriculture (NMSA) has several drawbacks like focusing on big farmers, being highly technology driven, ignoring overuse of chemical fertilizers, and absence of adequate credit and insurance policy.

#### 4.2.3 TRANSPORT

Some of the more general barriers such as huge capital and O&M costs of mass transport systems, lack of political will to reduce the growth of private vehicles etc. apply in the case of TN as well. However, certain State-specific challenges are mentioned below:

- Tamil Nadu is a major manufacturing hub and receives bulk of its State Domestic Product from the transport sector, especially the automobile sector which holds a 35% share in total Indian auto components market. Discouraging private vehicles would not only jeopardize the economy but also affect the State's ability to attract more investment in the future.
- The city of Chennai has recently experienced huge protests and agitation while introducing a parking fee in one of the busy areas of its Central Business District. Along with increasing per capita income, the perception that private vehicles (two and four wheelers) symbolize status and public transport portrays lack of affordability has increased manifold.

#### 4.2.4 INDUSTRY

One of the foremost problems that impinge on investment in Industrial Energy Efficiency (IEE) is the lack of available funds. There are several factors that obstruct the effortless availability of funds to be invested in EE projects. These challenges are well documented and include deficiency of internal financing and limited access to bank financing for MSMEs and SMEs, paucity of information, awareness and communication regarding EE options, cost of project development and transaction, insufficient risk assessment, and insufficient training and capacity building of ESCOs, loan officers and risk managers.

## 5 Concluding Remarks

This study represents one of the first attempts to quantify low carbon investments at the sub-national level in India. Given that India does not have either a domestic or international mandate to invest in low carbon growth, there are no budgetary heads created either in the national or State accounts to map investments that promote such activities. It was, therefore, important to define the boundaries of this study and adopt an appropriate methodology to both identify low carbon activities in the Indian context as well as to measure investments that have gone into them. Given the uncertainties in ascertaining actual expenditure data at the State level, this study has erred on the conservative side while coming up with investment numbers. The final investment figures were also verified and vetted by all relevant State Departments at the Roundtable discussion organized by the Tamil Nadu State Planning Commission.

Total low carbon investment in FY 2010-11 was INR 2,511.44 Crores. This is approximately 0.6% of the State Gross Domestic Product (SGDP) for the same year. This number increased significantly to 2% of the SGDP in FY 2011-12 to INR 8,710.12 Crores. This is supposed to increase further now that the State is implementing a dedicated solar policy with ambitious targets. In addition, the TN SAPCC is also in the process of getting finalized and has estimated substantial investment requirements. Current levels of investment, although significant, are not enough compared to future requirements.

Although there are barriers to low carbon investment in Tamil Nadu, the first step is for the State to recognize the importance of measuring such investments. This study creates the baseline by mapping low carbon investments for FYs 2010-11 and 2011-12. It also develops a framework and methodology to capture low carbon investments at the sub-national level that is comparable to other recognized international climate finance tracking methodologies. It is now important that the State continues this exercise and increases its investment targets in subsequent years. It is equally important to come up with reliable cost estimates for Tamil Nadu's low carbon investment requirements. The TN Vision 2023 and the SAPCC serve as good starting points, but more robust methodologies need to be developed.

Finally, while India is thinking through various institutional mechanisms to access funds from the Green Climate Fund, States should also assess their respective capacities to absorb such funds. Measuring the quantum and effectiveness of current low carbon investments is a step in that direction. Now that almost all Indian States have developed their State Action Plans on Climate Change, it is also recommended that they adopt a common methodology in order to track and compare their low carbon investments and gaps, and be prepared to access international funds once the mechanisms and funds are in place.

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## Annexures

### ANNEXURE I: NOTE ON SELECT CLIMATE FINANCE TRACKING METHODOLOGIES

UNFCCC National Communications: As per this, Annex II countries report funding activities to developing nations with a view to promote climate change mitigation and adaptation. Additionally, the Non-Annex I countries are expected to furnish information on the support received. Reporting is linked to the Multilateral Development Banks' (MDBs') financial commitments.

OECD Rio Markers: Presently, the OECD's Creditor Reporting System (CRS) is the most inclusive source of data on bilateral and multilateral Official Development Assistance (ODA) and Other Official resource Flows (OOF). Data is publicly accessible in the CRS Aid Activities database. The database encompasses more than 90% of all aid funds flowing from OECD countries and multilateral organizations. The Development Assistance Committee (DAC) is entrusted with the responsibility of monitoring the aid that is directed towards the global environmental objectives of the Rio Conventions. Since 1998, the OECD has monitored climate change mitigation-specific aid by employing a policy marker system known as the Rio Markers. In 2009, the DAC introduced a new marker to map contributions directed at adaptation interventions, which has subsequently been used from 2010 onwards. In this approach, the activity "should be classified as climate-change-related" if it "contributes to the integration of climate change concerns with the recipient countries' development objectives through institution building, capacity development, strengthening the regulatory and policy framework, or research". Donors are mandated to mark each funded project as "principal", "significant", or "not targeting" the policy objective. For an activity to be categorized as having adaptation or mitigation as a "principle objective", it must be determined that it "would not have been funded but for that [adaptation/mitigation] objective". This is in divergence with activities categorized as having adaptation or mitigation as a "significant objective" which have "other prime objectives, but have been formulated or adjusted to help meet climate concerns" (OECD, 2011)

Joint MDB approach for Climate Finance Reporting:<sup>4</sup> This was recently formulated on the basis that climate finance and development are strongly associated. The approach was developed and defined in 2012 and varies in how it deals with mitigation and adaptation. The MDB approach for mitigation is based on three principles. First, it is activity-based and it emphasizes on the type of activity to be implemented. It does not focus on "its purpose, the origin of the financial resources, or its actual results." Second, mitigation activities considered are expected to facilitate emission reductions, based on past knowledge and or technical assessment. Third, certain activities present mitigation as well as adaptation co-benefits. Intermingling of the financing of adaptation and mitigation activities results in double counting and should hence be avoided.

The MDB approach for adaptation is based on three principles. First the tracking is purpose, context and activity based. Three design process criteria must be met for finance to be reported. The first criteria is that it must include a statement of intent to tackle or advance climate resilience in order to distinguish between adaptation to current and future climate change and good development. Additionally, it must include a framework of climate vulnerability and link project activities to it.

Second, the adaptation tracking framework follows a conservative approach in order to encourage good adaptation projects to accelerate towards a shift to resilient communities and systems. Activities that do not clearly coincide

<sup>4</sup> The Multilateral Development Banks (MDBs) comprise of African Development Bank (AfDB), the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Inter-American Development Bank (IDB), the World Bank (WB) and the International Finance Corporation (IFC)

with all the above criteria are excluded from reporting. Third, project activities must attend to the current drivers of vulnerability, create resilience to current and future climate risks, include climate risks into investments, particularly for infrastructure with a long lifetime and integrate management of climate risk into plans, institutions and policies (Duarte & Alatorre, 2012).

All types of instruments (be it debt, equity, guarantees, technical assistance) along with grants and the financial commitments of the MDBs are linked to reporting through this approach. All categories of financial resources are entitled for coverage regardless of origin - including MDBs' own resources and their managed investments. External resources are segregated from MDBs' own resources in the interest of countering the double counting issue. The MDBs also have projects which are not included into joint reporting. Therefore, the total investments are smaller than the actual investments.

This approach is directed at supporting MDBs and other organizations who might be interested in joining or understanding their climate commitment. The approach currently is a work in progress and expectantly will head to steady convergence in the direction of a consistent approach for climate finance monitoring (Group of Multilateral Development Banks (MDBs), 2013).

## ANNEXURE II: LIST OF LOW CARBON INTERVENTIONS AND THEIR ESTIMATED COSTS (TN VISION 2023)

Sector	Initiative	Cost Estimate (INR Crores)
Energy	Ultra Mega Power Projects	50,000
	Wind	25,000
	Solar	55,000
	LNG Terminal	20,000
	Gas grid	20,000
	T&D	2,00,000
	Smart grids	20,000
	<b>Total (A)</b>	<b>3,90,000</b>
Agriculture	Water source improvement	16,000
	Horticulture parks	6,000
	Micro-irrigation for horticulture crops	6,400
	ICT tools for agriculture extension	1,800
	<b>Total (B)</b>	<b>30,200</b>
Transport	High speed rail between major cities	1,20,000
	Dedicated freight corridor between Chennai- Thoothukudi	15,000
	City transport (metro/monorail for two cities other than Chennai)	65,000
	<b>Total (C)</b>	<b>2,00,000</b>
	<b>Grand Total (A+B+C)</b>	<b>6,20,200</b>

**ANNEXURE III: LIST OF LOW CARBON INTERVENTIONS AND THEIR ESTIMATED COSTS (TN SAPCC - FINAL DRAFT)**

<b>Sector</b>	<b>Initiative</b>	<b>Cost Estimate (INR Crores)</b>
Energy	AT&C loss reduction	21,000
	Mapping and auditing of govt. buildings	40
	Implementation of audit findings	1,000
	Mapping and auditing of streetlights for conversion to LED	101
	Conversion of streetlights to LEDs	400
	Conversion to green homes	200
	Replacement of bulbs to CFLs	300
	Awareness generation on EC and EE	10
	Drafting and implementing building bye-laws	15
	Efficiency improvement in SMEs	400
	Increasing grid connected RE capacity	2,500
	Off-grid RE	3,253
	<b>Total (A)</b>	<b>29,219</b>
Agriculture	Minimum or no tillage, mulching, contour farming	4.1
	Promotion of integrated nutrient management	9.2
	Procurement and distribution of green manure seeds	9.2
	Production and distribution of bio-fertilizers	2.18
	Vermicomposting	1.14
	Bio-pesticides	1.27
	SRI	8.92
	Drip irrigation	14
	Training on micro-irrigation	0.77
	Training on SRI method	1.07
	Training on RWH	25.2
	<b>Total (B)</b>	<b>77.05</b>
Forests and Biodiversity	PFM/JFM	200
	Industrial plantation	200
	Agro/Farm forestry	200
	Renewable energy for powering freezer facility	1
	Research on estimating mitigation potential on TN forests	3
	Promotion of region specific tree plantation for higher carbon sequestration	13.48
	Estimating carbon sequestration of different forest types	3.5
	Urban forestry and Carbon potential	1.8
	<b>Total (C)</b>	<b>622.78</b>

**ANNEXURE III: LIST OF LOW CARBON INTERVENTIONS AND THEIR ESTIMATED COSTS (TN SAPCC - FINAL DRAFT)  
(CONTINUED)**

<b>Sector</b>	<b>Initiative</b>	<b>Cost Estimate (INR Crores)</b>
Sustainable Habitats	Implementing ECBC in institutional/commercial and residential sectors	0.1
	Developing housing policy including climate change aspects	0.1
	Promoting alternate construction material to reduce stress on natural resources	0.1
	Research on long term impacts of alternate materials relating to strength, heat absorption etc.	0.1
	Policies for green management of solid and liquid wastes within houses	643.35
	RWH and ZLD from commercial/institutional and residential buildings	0.1
	Satellite townships to decongest cities	0
	Implementation of source segregation and proper disposal of waste	643.35
	Promoting alternate energy sources as well as replacing existing equipment, appliances with energy efficient ones	0
	Developing efficient integrated transport system	0
	Greening of urban spaces	0
	<b>Total (D)</b>	<b>1,287.20</b>
<b>Grand Total (A+B+C+D)</b>	<b>31,206.03</b>	

**ANNEXURE IV: PUBLIC EXPENDITURE AND PRIVATE INVESTMENT TOWARDS LOW CARBON INTERVENTIONS IN THE ENERGY SECTOR**

Schemes and Initiatives	Investment made in FY 2010-11 (INR Crores)	Investment made in FY 2011-12 (INR Crores)
<b>PRIVATE INVESTMENT IN RENEWABLE ENERGY SOURCES</b>		
Wind	5242.31	9496.25
Solar	96.79	102.65
Biomass	446.99	139.08
Small Hydro	0	0
<b>Total Private Investment</b>	<b>5786.09</b>	<b>9737.98</b>
<b>RENEWABLE ENERGY SCHEMES AND INITIATIVES</b>		
Biomass Power Programme	1.5	0
Waste-to-energy	2.92	1.59
Bagasse based Cogeneration	0	58.25
Biogas based distributed grid power generation programme	1.47	0.12
Assessment	0	0.1025
Micro hydel projects	9.4	15.17
Roof-top SPV	1.01	0
Solar Steam Cooking systems	0.63	0
Solar air-conditioning systems	1.73	0
Solar air heating systems	0.26	0
Solar water heating systems	26.25	0
Rural Village Electrification	1.1	0
Special Area Demo Programme	0.5	0
Solar Powered Green Houses	0	180
Solar Powered Street Lights	0	50.5
Special Area Demo Programme - Raj Bhawan	1	0
Renewable energy park	0	1.41
Battery operated vehicles	0	0.1
Part II schemes	0	0.67
Assessment Studies	0	0.1025
Modernization (GoTN, GoI - RAPDRP)	617.03	854.84
<b>Total (A)</b>	<b>664.8</b>	<b>1162.855</b>

**ANNEXURE IV: PUBLIC EXPENDITURE AND PRIVATE INVESTMENT TOWARDS LOW CARBON INTERVENTIONS IN THE ENERGY SECTOR - (CONTINUED)**

Schemes and Initiatives	Investment made in FY 2010-11 (INR Crores)	Investment made in FY 2011-12 (INR Crores)
<b>ON-GRID POWER PURCHASE AGREEMENT</b>		
Wind	58	2369
Solar	1	9
Co-generation	256	650
Biomass	18	33
<b>Total (B)</b>	<b>333</b>	<b>3061</b>
<b>ENERGY EFFICIENCY (SCHEMES AND INITIATIVES)</b>		
State Energy Conservation Fund (Annual Action Plan)	0.08	0.03
Investment Grade Energy Audit	0.16	0
Demonstration Project	0.04*	0.03**
LED Village Campaign	0.11	0
<b>Total (C)</b>	<b>0.39</b>	<b>0.06</b>
<b>Total Public Investment (A+B+C)</b>	<b>998.19</b>	<b>4223.915</b>

\*Lime kiln manufacturing units in SME cluster, Tirunelveli

\*\* Solar power plant at TNEI HQ, Guindy

**ANNEXURE V: PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS IN THE LULUCF SECTOR**

<b>Schemes and initiatives</b>	<b>Investment made in FY 2010-11 (INR Crores)</b>	<b>Investment made in FY 2011-12 (INR Crores)</b>
<b>TRAINING AND AWARENESS GENERATION ON GREEN INITIATIVES</b>		
Awareness program for school students	2.05	2.17
Information, Education and Communication (IEC) activities	0	1
Training of engineers in waste management	0	0.06
Training for greening urban areas	0	0.02
<b>Total (A)</b>	<b>2.05</b>	<b>3.25</b>
<b>RESEARCH ACTIVITIES</b>		
Funded from Environment protection and renewable energy development fund	0.1	0
<b>Total (B)</b>	<b>0.1</b>	<b>0</b>
<b>LAYING OF ROAD USING PLASTIC WASTE</b>		
Laying of road	47.3	50
Collection centre and shredding machine	0	4
<b>Total (C)</b>	<b>47.3</b>	<b>54</b>
<b>AFFORESTATION PROJECTS</b>		
TN afforestation project	44.33	54.94
National Afforestation program	8.6	2.87
Implementation of bridge plan of Green India Mission	0	0
Tree cultivation in private lands	16.53	12.72
Massive tree planting program	0	29.4
TN biodiversity conservation and greening project – JICA	41.2	21.11
Teak plantation on river Padugai lands	8.9	5.49
Growing thorn less bamboo on lands not designated for food crops	0.12	0
Karuvel plantation in tank foreshores	0	0.22
Green cover program	0.31	0
Social and farm forestry	41.2	40.92
Cashew plantation	0.04	0.03
<b>Total (D)</b>	<b>161.23</b>	<b>167.7</b>



**ANNEXURE V: PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS IN THE LULUCF SECTOR - (CONTINUED)**

Schemes and Initiatives	Investment made in FY 2010-11 (INR Crores)	Investment made in FY 2011-12 (INR Crores)
<b>FOREST RESTORATION AND REGENERATION PROJECTS</b>		
Accelerated program for restoration and regeneration of forest cover (APRRFC)	0	0.15
Restoration of Pallikaranai marshland	0	5.49
Forest conservation, development and regeneration	6.22	10.1
<b>Total (E)</b>	<b>6.22</b>	<b>15.74</b>
<b>WASTE MANAGEMENT</b>		
Clearing plastic waste and its proper disposal	0	5
Co-incineration of plastic waste in cement kiln	0.05	0
<b>Total (F)</b>	<b>0.05</b>	<b>5</b>
<b>SOIL, MOISTURE AND WATER CONSERVATION</b>		
Western Ghats Development Programme (WGDP)	2.7	3.25
Hill Area Development Programme (HADP)	4.25	4.16
Model rain water harvesting structures in school	0	0.02
Soil and water conservation	20.4	17.1129
<b>Total (G)</b>	<b>27.35</b>	<b>24.5429</b>
<b>Grand Total (A+B+C+D+E+F+G)</b>	<b>244.3</b>	<b>270.23</b>

**ANNEXURE VI: PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS IN THE AGRICULTURE SECTOR**

Schemes and initiatives	Investment made in FY 2010-11 (INR Crores)	Investment made in FY 2011-12 (INR Crores)
<b>SUSTAINABLE CULTIVATION PRACTICES</b>		
System of Rice Intensification (SRI) through demonstration	14.93	21.08
Sustainable sugarcane initiatives	0	12.35
Organic farming practices	0	0.07
Vermicomposting of agricultural waste	0	0.12
Green manure crops (with 25% subsidy)	0	0.52
System of Millets Intensification	0	9.97
Intensification of Redgram Cultivation through demonstration	2.7	5.26
Accelerated Pulses Production Program	0	3.65
<b>Total (A)</b>	<b>17.63</b>	<b>53.02</b>
<b>EFFICIENT UTILIZATION OF ENVIRONMENTAL RESOURCES</b>		
Distribution of Personal Digital Assistant (PDA) for creating digital database at field level	0	0.43
Replacement of old pump sets	0.69	0.0002
<b>Total (B)</b>	<b>0.69</b>	<b>0.4302</b>
<b>WASTELAND AND WATERSHED DEVELOPMENT</b>		
National Wasteland Development Program in Rain fed areas	10.93	6.64
Integrated Watershed Development Program	13.93	11.91
<b>Total (C)</b>	<b>24.86</b>	<b>18.55</b>
<b>SOIL AND MOISTURE CONSERVATION</b>		
Soil and moisture conservation programs	0	40.09
In tribal areas under Integrated Tribal Development Program (ITDP)	1.562	3.4473
In catchment areas of river valley project	16.81	12.36
Rain water harvesting and runoff management program	4.9962	4.9964
Western Ghats Development Program (WGDP)	6.9821	7.9996
Hill Area Development Program (HADP)	2.39	2.4
<b>Total (D)</b>	<b>32.7403</b>	<b>71.2933</b>
<b>GROUNDWATER RECHARGE</b>		
NABARD assisted program	0	0.0001
Artificial groundwater recharge initiatives	24.97	25
<b>Total (E)</b>	<b>24.97</b>	<b>25.0001</b>
<b>Grand Total (A+B+C+D+E)</b>	<b>100.89</b>	<b>168.29</b>

**ANNEXURE VII: PUBLIC EXPENDITURE TOWARDS LOW CARBON INTERVENTIONS IN THE INDUSTRY SECTOR**

<b>Schemes and Initiatives</b>	<b>Investment made in FY 2010-11 (INR Crores)</b>	<b>Investment made in FY 2011-12 (INR Crores)</b>
The Tamil Nadu Industrial Investment Corporation (TIIC) (granted loans to set up new windmills)	40.17	43.36
The Credit-Linked Capital Scheme for Technology Upgradation of Small and Micro Industries is implemented by the TIIC	11.27	3.6
Technology Upgradation Fund	4.62	3.37
Interest free loan for Common Effluent Treatment Plants	0	24.36
<b>Grand Total</b>	<b>56.06</b>	<b>74.69</b>

**ANNEXURE VIII: FINANCIAL INCENTIVES AND OTHER BENEFITS OFFERED TO MSMEs TO PROMOTE SMALL SCALE INDUSTRIAL ENERGY EFFICIENCY**

Name of the scheme	Low Carbon Components of Funding	Description of the Incentive
Additional capital subsidy to promote cleaner and environment friendly technologies operated by Department of MSME	Cleaner and environment friendly technologies	The amount of subsidy provided is 25% of value of the environment friendly plant and machinery installed with a ceiling of INR 3 lakhs. The prospective beneficiaries of this scheme are: All new and existing MSMEs (manufacturing) which are located in industrially backward blocks or agro based enterprises.
Special capital subsidy for thrust sector enterprises for 13 identified thrust sectors operated by Department of MSME	Two of the identified sectors are solar energy equipment and pollution control technologies	The amount of subsidy provided is 15% of value of the plant and machinery with a ceiling of 30 lakhs. The prospective beneficiaries of this scheme are: new enterprises/expansion & diversification enterprises which are located anywhere in the State.
Term loan obtained for Technology upgradation/ Modernization schemes operated by Department of MSME	Technology upgradation/ Modernization	The amount of subsidy provided is 3% of the interest on term loan with a ceiling of INR10 lakhs on term loan taken up to INR 100 lakhs (Subject to a maximum of INR10 lakhs per enterprise over a period of five years on term loan taken up to INR100 lakh). The prospective beneficiaries of this scheme are: new enterprises/ existing enterprises which are located anywhere in the State.
Technology Development Fund for evolving cleaner and/or energy efficient or IT enabled technologies for Micro, Small & Medium Manufacturing Sector operated by Department of MSME	Cleaner and/or energy efficient technologies	50 % of the project cost is covered through this scheme with a ceiling of INR 2.5 lakhs. The prospective beneficiaries of this scheme are Small developmental projects undertaken at the behest of MSME Association by IIT-Madras, Universities in the State including Deemed Universities, Engineering Colleges, Polytechnics, and Central Government Institutions of Excellence.
Scheme of Fund for Regeneration of Traditional Industries (SFURTI) operated by Ministry of MSME	Technology Upgradation	Extent of funding is 75% technology upgradation.
Industrial Infrastructure Up gradation Scheme (IIUS) operated by Ministry of Commerce (including Department of Industrial Policy & Promotion)	Effluent treatment and Solid waste disposal	75% of the project cost subject to a ceiling of INR60 crore. Grant for drainage & water supply system to be restricted to 25% of the total grant.
Integrated Infrastructure Development (IID Scheme subsumed under MSECDP	Drainage and pollution control facilities	60% of the project cost with a ceiling of INR 6 Crores.
Technology and Quality Up gradation Support to MSMEs (TEQUP) operated by Ministry of Textiles	Capacity Building of MSME Clusters in Energy Efficient Technologies (EET), Implementation of EET as per the global standards and Setting up of Carbon Credit Aggregation Centres (CCA) for introducing Clean Development Mechanism	As regards the capacity building the funding support provided is 50-75% with specific ceiling for each sub component.









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