Green Growth Background Paper

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Green Growth and Climate Change Mitigation in Punjab

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1 Introduction

The state of Punjab located in the north-western part of the country is one of the major food producing state in India, where nearly 62% population live in rural economies. As of 2011, Punjab has 22 districts and a population of 27.7 million. Though the share of agriculture in the total GDP of the state is lowest (23.5% in 2010-11), the state remains predominantly agrarian. Being an agrarian economy, its primary economic sectors are highly vulnerable to variability in the climate as well as its impacts. Figure 1 depicts the observed climate and the variability over Punjab in the past years.

Data analyzed by the Indian Metrological Department (IMD) indicates that the temperatures over Punjab have been rising over the years with an average increase of 0.5 – 1.0 degree C compared to 1971-2000 average. There have been spatial variations in precipitations across the years with some years experiencing more than normal rain fall and some years experiencing deficit rainfall. The annual mean maximum temperature is projected to increase by 1.0-1.8^{o}C with respect to the base line in all parts of Punjab by 2021-2050. An overall increase in annual precipitation is projected in the mid (2021-2050) century by about 13.3%-21.5% with respect to base line 1961-1990.

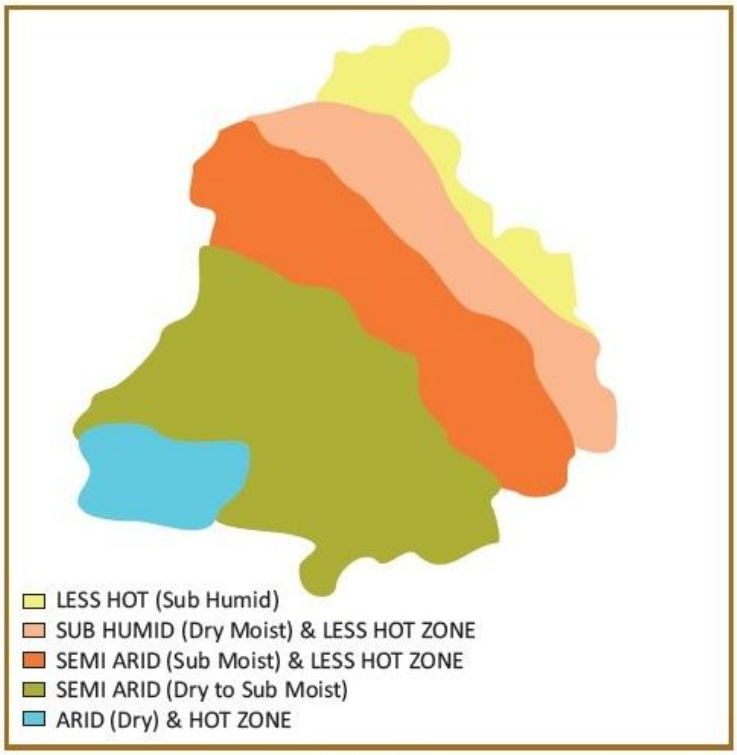

Figure 1: Observed climate over Punjab

Source: Department of soil and water conservation

2 GHG Emission trends

Total emission in the state of Punjab in 2011 was estimated at 46.524 $MtCO_2e$ per year (Center for Ecological Science, 2012). Key sectors leading to emissions in the state are agriculture, industries (particularly SMEs) and transport. GHG Inventory for the state has not been prepared by the State Government yet, which the state is envisaging to establish going forward. A centre of excellence on climate change will be set up to especially address the climate concerns of the agriculture sector, which is a key economic sector in the state. Some key characteristics of the different sectors in the state, important from the climate change mitigation considerations are given below:

- Agriculture, Transport and Industry are the main sectors leading to GHG emissions in the state
- Punjab has the highest fertilizer (239 kg/ha) and pesticide (923g/ha) consumption in the country
- More than 80% of paddy straw (16 million tonnes) being burnt in the fields every year leading to air pollution in rural areas
- Highly mechanized agriculture leading to emissions from the farm
- Total installed capacity in the state is 7706 MW (including central share of 2507 MW), total consumption about 36241 Million Units, and contribution from new and renewable energy sources at 1005 MW (600 MW is grid connected)
- Cropland ecosystem dominant in the state as 84% area under agriculture
- Only 6.87% of total geographical area of the state under forests cover (tree cover: 3.37 and forest cover: 3.50)
- Growth of population, industrialization, urbanization and western lifestyle resulting in generation of large volumes of solid waste.

3 Institutional Arrangements

Punjab State Council for Science and Technology (PSCST) is the nodal agency for all activities related to climate change in the state. It coordinates its activities with other line ministries from the state. Some of them are:

- Punjab Urban Development Agency
- Punjab Energy Development Agency
- Department of Agriculture
- Department of Forest and wildlife preservation

- Punjab Agriculture University
- Department of Rural Development and Panchayats
- Punjab State Farmers Commission
- Punjab Pollution Control Board

The state of Punjab has implemented and/or planned to implement several policies and programmes to achieve the national goal of climate change mitigation. Some of the key policy interventions are discussed in the sections below.

4 Climate change mitigation initiatives in the state

The State Action Plan on Climate Change for Punjab was prepared by the state and endorsed by the National Steering Committee on Climate Change in 2012. For SAPCC implementation, Steering Committee headed by the chief secretary will oversee the activities and eight working groups (WG) with experts drawn from various line departments, universities, technical institutions and industry associations are created to provide technical guidance to the implementing committees. It was prepared by the Department of Science, Technology, Environment and Non-Conventional Energy, Punjab under PSCST which is identified as the nodal agency to coordinate all activities related to SAPCC across the various line departments. Some key policies identified for the state are:

➢ **Promoting share of renewable energy**

The total installed capacity of renewable energy in the state is 569 MW in 2014, of which 134 MW is in small / mini hydel, 62.5MW is in biomass power, 362 MW is in co-generation and 10.5 MW is in solar photovoltaic power sectors. Punjab Energy Development Agency (PEDA) is the nodal agency for all activities related to renewable energy. The state envisages increasing state's contribution to the share of solar and non-solar power in the national grid electricity. For solar, the expected growth of share is at least 4 % of GOI target of 20000 MW i.e. 800 MW. The state has commission the following RPO targets for renewable given in table below.

Table 1: Renewable Purchase Obligation targets for Punjab

Year	2011-12	2012-13	2013- 14	2014-15	2015-16	2016-17	2017 18	2018-19	2019- 20
Non-Solar RPO (%)	2.37	2.83	3.37	3.81	3.9	4.1	4.2	4.3	4.5
Solar RPO (%)	0.03	0.07	0.13	0.19	1.0	1.3	1.8	2.2	2.5
Total	2.4	2.9	3.5	4.0	4.9	5.4	6.0	6.5	7.0

Source: Punjab State Electricity Regulatory Commission, 2015

The state has however been in deficit when it comes to meeting the RPO targets mainly due to non-achievement in newly commissioned renewable projects in the state. Currently, the

total installed capacity in the state is 10.5 MW of solar photovoltaic power. According to data, the capacity required for the state to meet its solar obligation was 72 MW in 2012-13, while for the current financial year, it is 167 MW Punjab has set a target to generate at least 1,000 MW power from renewable energy resources like solar, biomass, co-generation, mini-hydel and solar roof tops by 2017. It would require strong policy support in years to fulfill its objectives.

- **Energy Efficiency in Industries**

Among large industrial sectors, food processing, chemicals and ceramics are majorly targeted under the energy efficiency policy of the state government. These together are capable of achieving 3-7% improvement in energy efficiency in industries not covered under the PAT scheme of BEE. In the case of SMEs, policies on energy efficiency can bring about 15-20% energy efficiency in small and medium enterprises (SMEs). Key achievements are listed below:

- PEDA has compiled a database of 678 industries having connected load of 500KW or more.
- Energy audit is conducted in 24 industries which indicate total annual energy saving potential of approx. 11,407 MWh (PEDA, 2014).
- Fifteen Designated Consumers have been identified in the state. Energy Managers have been appointed in all these industries for submitting annual energy reports to PEDA/BEE.
- PEDA has signed MOU with USAID/IRG for undertaking energy conservation activities in the state under ECO-III project with a focus on promoting energy efficiency in Small and Medium Enterprises and Buildings. The cluster of SME in Textile industries at Ludhiana has been identified and work is in progress in these industries.

- **Energy Efficiency in Buildings**

Punjab aims to move towards mandatory pursuance of Energy Conservation and Building Code (ECBC) norms for climate proofing building envelops of both old and new commercial, public and residential buildings in cities. All housing programmes/schemes of the government for the EWS's will strive to make provision for compulsory inclusion of building designs with ECBC/GRIHA norms to protect this section from extreme heat and also to introduce energy efficiency in their houses. The ECBC Code was designed and adopted nationally in the year 2007, which authorized state nodal agencies to review and revise it to make it more state specific. The PEDA has given this assignment to the Indian Institute of Architects (IIA) Chandigarh-Punjab Chapter to amend and design ECBC for the state. It is currently under review by the Cabinet for final approval.

Energy audit have been conducted in three state govt. headquarters buildings for adoption of energy efficiency measures viz. PSEB Head office, Patiala, PUDA Bhawan, Mohali and MARKFED House, Chandigarh. Net energy saving potential of 187 MWh has been identified in these energy audits.

For energy efficiency efforts, replacement of conventional street lights with LEDs and consumer appliances are also targeted by the government. Capacity building and awareness building programmes to help generate demand for energy efficient appliances and technologies, conduct training of key stakeholders for reporting, monitoring and evaluation are also among the key activities.

- **Increase in forest cover**

The state government has prepared plans to add at least 8.13% more area under forest and tree cover by 2022 to the existing area bringing the total area under forest and tree cover in the state to 15% of its total geographical area. Activities to enhance forest density in the Shivaliks will be undertaken. The aim is to improve green cover in the degraded forest area in this region by the end of 2020 and stabilize Shiwalik tracts to prevent soil degradation, avoid unsustainable agriculture.

- **Sustainable Agriculture**

In order to adapt to the adversities of climate change, the state government of Punjab has identified certain policies and programmes to create capacities within the state. Promoting crop diversification as per the suitability of production in different agro-climatic zones is one of the primary strategies. Realizing advantages of efficiency of C3 vs C4 crops (based on process of photosynthesis of plants) in achieving enhanced CO_2 environment is also being explored. Sustainable management of agricultural crop residue to avoid the ill effects of farm burning will be practiced. Since agriculture is the main economic activity in the state, total financial outlay of Rs. 10730 crores is envisaged to undertake the above activities.

- **Low Carbon Transport**

Policy shift towards integrated public transport system is prepared. Strategies to extend Metro to 4 cities (Amritsar, Jalandhar, Ludhiana and Mohali) and integrated feeder bus services to and from the proposed metro stations will be provided as additional service. Creation of additional parking spaces based on projected passenger vehicle density by 2030s will be accommodated in the policies. Separate tracks for non-motorized vehicles will be established. Other strategies include, developing real time passenger information systems, installations of dynamic traffic lights, development of fast moving freight corridor between the industrial towns of Punjab (Amritsar, Ludhiana and Jalandhar) to connect to the dedicated rail freight corridor being constructed linking Ludhiana to Kolkata in the east and Mumbai in the west.

Another innovative policy proposal being considered by the government is on battery operated/SPV operated/ alternate fuel operated small bus services to travel small distances. And provide car free days in different zones of the state to decongest the roads. State government is also considering declaring markets and heritage areas as no fossil fuel driven vehicle zones.

State government will undertake enhanced fuel efficiency norms to help reduce emissions from transport sector in the state. This could be complemented by replacement of 700 old buses of Punjab Roadways with engines that can accept fuel with latest EURO—IV norms.

- **Waste Sector**

State government plans to realize 20% of 100 MW energy generation potential from waste in Punjab by 2022.The state plans to set up about 10 solid wastes to energy plants of 2 MW each depending on the degradable organic content available in each of the disposal sites.

- **Strategic knowledge development**

Develop a Centre of Excellence in an existing R&D body to address all research and technology development and demonstration issues related to climate change, establish a climate change cell within the government that will coordinate and provide policy guidance on climate change in the state (Figure 2).

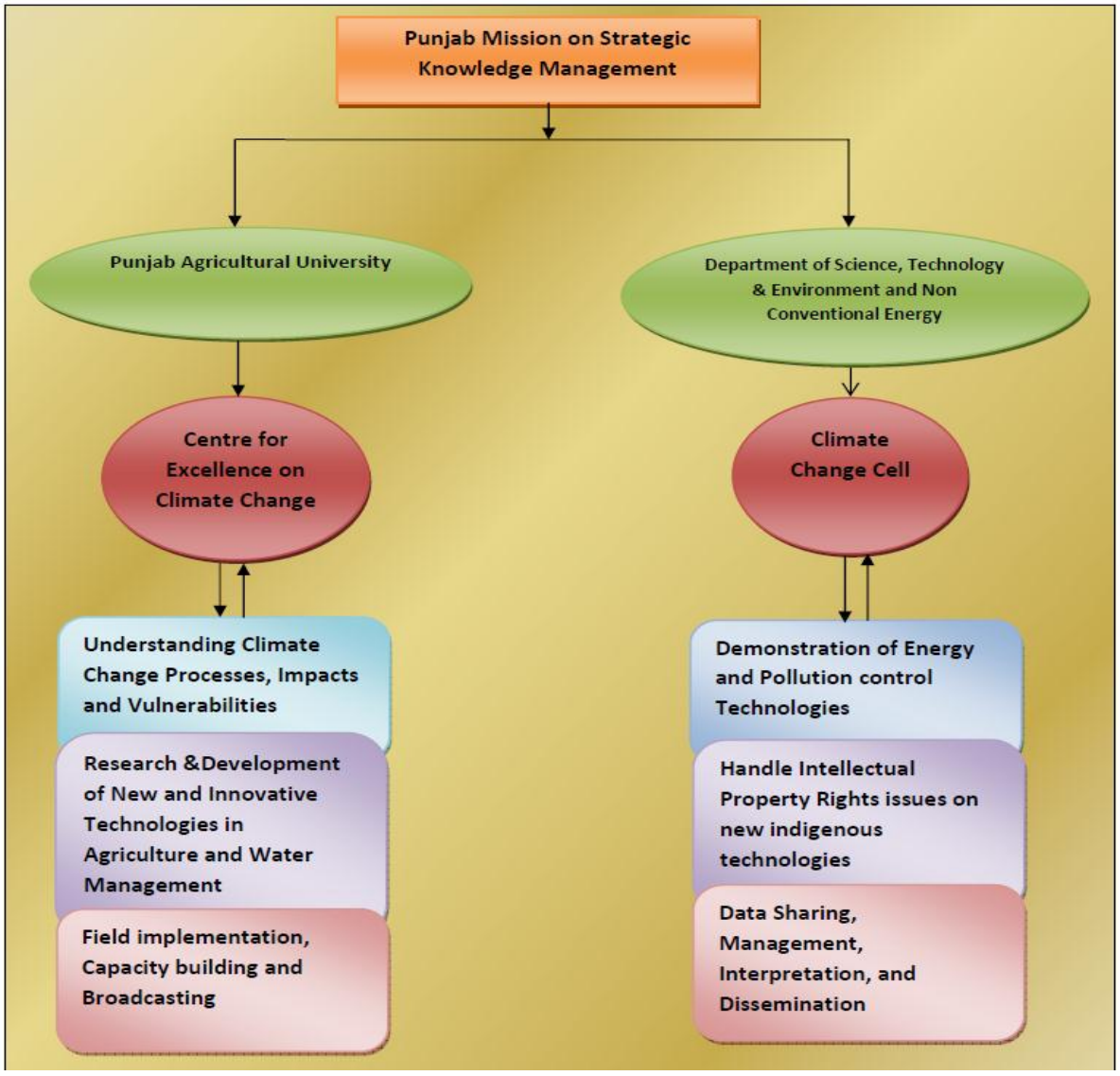

Figure 2: Responsible Institutions for Strategic Knowledge Management on Climate Change in Punjab

Source: Punjab State Action Plan on Climate Change, 2012

➢ **Specific Promotional schemes**

- A cumulative total of 1.16 lakh family type biogas plants upto 2011 have been set up in the state of Punjab against estimated potential of 4.5 lakh plants.
- Support for Research & Development and pilot project demonstration on advanced high energy density batteries, ultra capacitors, control systems and other components for battery operated electric, plug hybrid and hybrid electric vehicles for surface transportation.
- Provision of financial incentives for solar water heating systems in homes

5 Barriers, challenges and opportunities

Due to the specific landscape characteristics of the state, there are certain challenges that the state faces in its pursuit of green growth and climate change mitigation strategies. These are highlighted in the policy process for climate change mitigation in the state.

➢ In order to maximize grain productivity, vast areas have been put under intensified rice and wheat cropping system. These have become synonymous with excess use of chemical fertilizers, over extraction of ground water, and burning of crop residue to quickly get the field cleared for the next seasonal crop. GHG emissions from agricultural fields have therefore become a major contributor in the state.

➢ Most of the land in Punjab is agriculturally fertile land which makes it difficult for the state to expand its forest area beyond a particular capacity as directed in the draft forest policy of the country. It is trying to reach the target by planting more and more trees outside the agricultural fields.

➢ Pressures of development and large scale settlements have threatened the local ecosystem as well as cropping pattern in the state making it extremely vulnerable to the impacts of climate change.

➢ Urban planning in a manner which does not degrade the environment as well as withstand the vagaries of climate is expanding rapidly which will pose a challenge for the state in terms of its sustainable housing facilities.

➢ Increasing energy demand and inefficient energy consumption in industries especially in SMEs and pumping water systems in agriculture sector are posing serious challenges. Central Electricity Authority (CEA) estimates indicate that the deficit in peak electricity demand in Punjab can be as high as 14%. To address the challenges of energy deficits while having a co-benefits of mitigating GHGs have led the state to employ policies and programmes which would effectively meet this goal.

➢ Melting of glaciers is a cause of concern for the state's agriculture since most of it is dependent on canal irrigation.

6 Ways forward

The state of Punjab plans to implement activities listed for climate change mitigation in its State Action Plan on Climate Change (SAPCC). The state would be required to identify roadmap for financial resources to meet the envisaged funding of Rs 58796 crores to undertake activities listed within its SAPCC. Some interesting measures suggested for policy identification are in the following lines:

- To identify use of unproductive land, international border (553km), as well as roof top to generate solar energy for the state. Undertake feasibility studies for development of solar cities within the state and increase coverage of solar street lightening in rural areas.

- The Centre has approved setting up of a climate change center in the state to monitor the variations in the climate and its adverse effects on the crops. The central government has already sanctioned Rs 2.5 crore to set up the centre. It will work under the Science and Technology Department of the state government and will be run by PSCST. Institutional capacity building will be undertaken for the same.

- The state plans to identify strategies for energy conservation particularly in the agriculture sector and shift from mechanized agricultural pumps to solar pumps

- It will promote and develop biomass based gasifiers. Biogas development programme would be promoted through setting up large size Institutional/Nigh Soil based biogas plants and Family Size biogas plants.

- State will strengthen policies and enforcement to meet RPO compliance by the state

- State will undertake wide scale adoption of ECBC for Punjab

- It will ensure data management, sharing and dissemination on climate change mitigation issues particularly

- It will aim to strengthen the capacity of research on climate change, collaboration possibilities with national and international institutions working on this subject will be explored and also gear some of the activities in line with the climate change network programmes of MoEF, ICAR, CSIR, DST, ISRO, Earth Sciences and other programmes that are being carried out in the country.

In the longer run, state will promote and develop of waste to energy projects (approx. within next 15 years), Create awareness & publicity in masses to adopt non-conventional energy sources and energy saving / conservation. Currently the state is working towards identifying potential for developing a wide scale Nationally Appropriate Mitigation Actions (NAMA) project for the state.

Reduced GHG emissions from the agricultural sector through intensive policy on farm mechanization and fertilizer applications will be the key intervention sector for Punjab. Sustainable habitat through adoption of mass public transportation and city planning will also remain critical in climate change mitigation strategy planning.

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