STATE ACTION PLAN ON CLIMATE CHANGE

2021 – 2030

VERSION - II

GOVERNMENT OF HIMACHAL PRADESH
DEPARTMENT OF ENVIRONMENT, SCIENCE & TECHNOLOGY

STATE ACTION PLAN ON CLIMATE CHANGE

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Government of Himachal Pradesh

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ABBREVIATIONS

AD	Adaptation
AIBP	Accelerated Irrigation Benefit Programme
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
Avg	Average
BL	Base Line
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CB	Capacity Building
CBD	Convention on Bio-diversity
CBR	Child Birth Ratio
CGWB	Central Ground Water Board
CHC	Community Health Centre
CT	Community Toilet
DDUGY	DeenDayal Upadhyaya Gram Jyoti Yojana
DEST	Department of Environment, Science and Technology
DSM	Demand Side Management
ECBC	Energy Conservation Building Code
Eg	For example
Eqv	Equivalent
GoI	Government of India
GP	Gram Panchayat
GSDP	Gross state domestic product
GWh	Giga Watt hour
Ha	Hectare
ICMR	Indian Council of Medical Research
IHHL	Individual Household Latrine
IMD	India Meterological Department
INCCA	Indian Network of Climate Change Assessment
INDC	Intended Nationally Determined Contribution
JNNSM	Jawahar Lal Nehru National Solar Mission
LED	Light Emitting Diode
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act

MI	Mitigation
MIDH	Mission for Integrated Development of Horticulture
Mn, Mn	Million
MoEFCC	Ministry of Environment, Forest and Climate Change
MoP	Ministry of Power
NAPCC	National Action Plan on Climate Change
NDC	Nationally Determined Contributions
NFSM	National Food Security Mission
NHP	National Health Portal
NICRA	National Innovations on Climate Resilient Agriculture
NRDWP	National Rural Drinking Water Programme
NRHM	National Rural Health Management
PHC	Primary Health Centre
PT	Public Toilet
PWD	Public Works Department
RCP	Representative Concentration Pathway
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RKVY	RashtriyaKrishi Vikas Yojna
SAPCC	State Action Plan for Climate Change
SBM	Swachh Bharat Mission
SDG	Sustainable Development Goals
SPV	Solar Photo Voltaic
Sq. m	Square meter
ULB	Urban Local Body
w.e.f	With effect from

Chief Minister
Himachal Pradesh
Shimla-171002

MESSAGE

I am happy to note that the Department of Environment, Science & Technology, Himachal Pradesh has updated "Himachal Pradesh State Strategy & Action Plan on Climate Change-2021". This report is of immense importance as it provides a comprehensive strategy to protect our vulnerable Himalayan Eco-systems and ensure sustainable economic growth of the State. The State Government is committed to a holistic approach to address climate change challenges. We strongly believe that there is a need to protect our environment, strengthen our energy security and spur economic growth through continued efforts and sustained actions.

The State Government is committed to taking affirmative actions at grass-root level aimed at encouraging innovation and cost-effective clean energy technologies that would not only help our economy to reduce greenhouse gas emissions but also to make our economy vibrant in the times to come and to put our state on carbon resilient growth trajectory. Himachal Pradesh State Strategy & Action Plan on Climate Change-2021 will create institutional linkages with the National Action Plan on Climate Change, and provide a framework of implementation for different stakeholder departments, organizations and institutions functioning in the State.

I am given to understand that the Ministry of Environment, Forest & Climate Change, Government of India, the GIZ (India) has extended technical support towards this endeavour and experts of the Department of Environment, Science & Technology alongwith GIZ team have worked tirelessly to complete this document under the able guidance and supervision of Sh. Prabodh Saxena, IAS, Additional Chief Secretary (Env,S&T) to the Government of Himachal Pradesh. I am sure Himachal Pradesh State Strategy & Action Plan on Climate Change-2021 will facilitate tackling issues pertaining to climate change vulnerability especially in sectors viz. agriculture, horticulture, water resources, forests and biodiversity.

I extend my gratitude to the Ministry of Environment, Forest & Climate Change, Government of India & compliment team of experts of GIZ and the Department of Environment, Science & Technology for bringing out this updated Strategy and Action Plan on Climate Change for Himachal Pradesh.

(Jai Ram Thakur)

Chief Secretary
Himachal Pradesh

MESSAGE

Impacts of climate change are already being felt, particularly by the most vulnerable, and will continue to grow in severity and frequency. There is a political imperative to ensure that real and tangible progress is made across all climate change related issues in the critical decade to 2030. The spirit of collaborative and constructive effort can play an important role to achieve the set targets.

After the United Nations Framework Convention on Climate Change (UNFCC) agreements, the National Action Plan on Climate Change (NAPCC) responds to the country's vital and pressing requirements by prioritizing development efforts and strengthening current and future programmes and schemes to address various needs in a very sustainable manner. Our country has taken a lead not only in adaptation measures but also on mitigation side.

Climate change variability, and even some economic activities have posed a detrimental effect on the entire Himalayan Ecosystem and we are quite vulnerable to likely impacts. The importance of urgent and practical action to avert, minimise and address loss and damage, tailored to national and local circumstances is required. It is critical that a defined adaptation and mitigation strategy for climate change challenges be made an intrinsic component of Himachal Pradesh's developmental trajectory.

Himachal Pradesh has widely attended and contributed to the national priorities significantly from time-to-time w.r.t. climate change issues. I am extremely glad to learn that Government of Himachal Pradesh is ready with version-2 of State Action Plan on Climate Change, for 2021-2030 in line with National priorities. The action plan will further strengthen the process adopted to achieve state specific SDGs besides, providing a roadmap for conservation of our vulnerable ecosystem. We need to act on locally-owned plans, institutional capacity, technical expertise and accessible finance as critical enablers to achieve this.

Adapting to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation will be required everywhere, but must be prioritized now for the most vulnerable people with the fewest resources to cope with climate hazards. The rate of return can be high. For instance early warning systems for disasters, for instance, save lives and property, and can deliver benefits up to 10 times the initial cost.

This document, will facilitate policymakers, planners, officials, scientists, and stakeholders in better comprehensions of complexities of climate change and inter-linkages among environmental and economic issues, enabling them to work in a manner that fosters sustainable development in the State.

Ministry of Environment, Forest & Climate Change, Government of India has extended support in bringing out this document, with technical support from GIZ (India), Department of Environment, Science & Technology, Government of Himachal Pradesh is highly appreciable. I complement the entire team headed by Sh. Prabodh Saxena, IAS, Additional Chief Secretary & Sh. Sudesh Kumar Mokhta, IAS, Director (Env.,S&T), for preparing this comprehensive 'State Action Plan on Climate Change- 2021-30' roadmap for Himachal Pradesh.

(Ram Subhag Singh)

Addl. Chief Secretary (Env., S&T) to the
Government of Himachal Pradesh

MESSAGE

The world is grappling with the impacts of climate change, and India is not an exception. Variations in weather and climate, such as changes in rainfall, rising temperature resulting in more floods, droughts, or heavy rain, frequent and severe heat waves. Indian Himalayan Region is one of the most sensitive & prone regions to changing climatic conditions. Glaciers in Himachal Himalayas have started facing significant changes since last decade.

Government of India has launched eight Missions as part of the National Action Plan on Climate Change (NAPCC) in specific areas based on sectoral level assessment of the impact of climate change and envisaged required interventions needed to address these impacts. Under the guidance from MoEF&CC, the State Government prepared and adopted its 1st Action Plan on Climate Change in year 2012 and now the revision of State Action Plan on Climate Change (SAPCC) has been carried out following a comprehensive framework as guided by the MoEF&CC, in line with the Nationally Determined Contributions (NDC)& Sustainable Development Goals (SDG).

The climate challenge is the unintended by product of our economic development and prosperity, but we are set to face the consequences at large be it regional or local. It is up to us to innovate ourselves out of this global challenge and sustain the prosperity at the same time. It is the duty of all innovators, policy makers and citizens to maintain the effort to deal with the defining challenges of the present time for ensuring future which is secure and safe. I am confident that the SAPCC document will give the entry points for mainstreaming climate change actions in all sectoral schemes & programmes of the state Government in line with SDGs.

On behalf of State Government Department of Environment, Science & Technology, Himachal Pradesh, I extend our gratitude to the Ministry of Environment, Forest & Climate Change, Government of India for providing the financial assistance to undertake the revision of SAPCC and GIZ which not only provided valuable technical guidance but also provided their wholehearted support in bringing out this scientific strategic document.

All the organizations, research institutions and the government departments which have provided valuable data base and guidance will in turn be benefitted from this effort. I would like to place on record a special word of appreciation for Sh. Ashish Chatuervedi Director (CC) GIZ & Sh. Sudesh Kumar Mokhta, IAS, Director (Env., S&T), and his team in the Department of Environment, Science & Technology, Himachal Pradesh who have put in their best effort to develop this Strategy and Action Plan after putting together huge database for carrying out vulnerability assessment at panchayat level.

(Prabodh Saxena)

Director
Environment, Science & Technology,
Himachal Pradesh

MESSAGE

Climate change, a phenomenon of global concerns, is becoming a serious threat to the very existence of humanity and the climate risk challenge is growing by leaps and bounds. Since the phenomenon of climate change is ever evolving and dynamic, the response to mitigate its adverse effects has also to be dynamic, evolutionary and in line with emerging threats and national and international frameworks. The individual frameworks such as "Paris Agreement" have led countries to make their individual arrangements to reduce emission and take mitigation and adaptation measures expressed as "Nationally Determined Contributions". The mitigations and adaptation measures need to take developmental needs of the Country and State into account.

We have to look at the "State Strategy and Action Plan on Climate Change (SAPCC)" document in this light and the implementation thereof with such a perspective of flexibility in the long run. The first SAPCC was prepared by the Department of Environment, Science & Technology in the year 2012 as per the guided structure and initiatives enunciated in the National Action Plan for Climate Change.

In view of the fact that SAPCC is a dynamic document, the 'State Strategy and Action Plan on Climate Change- 2021' has been revised to focus on broad state-specific traits as far as practicable with the available knowledge and understanding through a comprehensive process. This framework document will certainly help the state machinery in orienting their endeavors in the relevant fields and sectors to cope up and adapt with the ensuing and potentia l impacts of climate change. This document will also be useful in prioritizing and implementing various kinds of mitigation measures in the State under overall guidance of Ministry of Environment, Forest & Climate Change, Government of India.

The efforts put in by Sh. Ashish Chaturvedi, Dirctor (CC), Sh. Kirtiman Awasthi, Sr. Policy Advisor, Ms. Somya, Ms. Monika Sharma from GIZ are highly appreciable. The hard work of other experts and professionals - both external and from within the State Government Departments and organizations, all those associated in finalizing this document are acknowledged thankfully.

I on behalf of Department of Environment, Science & Technology Himachal Pradesh acknowledge the efforts of Ministry of Environment, Forests & Climate Change, Govt. of India for encouraging States to bring out such a guiding action plan. I also do acknowledge the efforts of experts from GIZ and Department for revision of the SAPCC-2012 and bring out a new strategy in 2021.

(Sudesh Kumar Mokhta, IAS)

EXECUTIVE SUMMARY

In 2019, Climate Change is an undisputed reality causing severe impacts on the natural environment, human lives, and economic assets & activities, thus posing an urgent need for ambitious mitigation and effective adaptation action. Mitigation and Adaptation need to be well planned and coordinated for maximum efficiency, in particular in contexts with competing development pressures and needs.

In this respect, sub-national planning of action on climate change is a necessary extension of national-level planning. This is particularly so in countries with a federal structure such as India. India's landmark climate change policy and planning document, the 2008 National Action Plan on Climate Change, is therefore complemented by State Action Plans on Climate Change. Himachal Pradesh's first SAPCC 1.0 (HPSAPCC) was launched in 2012. It provided the first state-wide and cross-sectoral climate change impact and vulnerability assessment, and formulated adaptation and mitigation strategies to be carried out by various departments of the state government. These strategies, in turn, were organized into seven State Missions, which very effectively extended the eight National NAPCC missions.

Since the formulation of the HPSAPCC, important changes have impacted the realm of climate change policy planning. Not only have the science, knowledge and understanding of climate change evolved at the global and at the regional level, but so has the policy context, with the ratification of important development and climate goals at the International level. This includes Sustainable Development Goals (SDGs) and the Paris Agreement temperature and adaptation goals. All related Indian commitments, such as those in the Nationally Determined Contributions, and Himachal Pradesh's goals, such as localized SDG targets in Drishti Himachal Pradesh- 2030: Sustainable Development Goals, pose a need for an evolving, appropriate climate change action planning process.

Similarly, State also involves (or) launches many important flagship schemes are of utmost importance to climate change action. In the light of these developments, the HPSAPCC 2.0 was developed to reflect this changing context and enhance effective mitigation & adaptation planning, and action. It takes stock of the degree of HPSAPCC implementation, and uses lessons learnt for climate change action planning for the period 2021–2030.

In order to mainstream climate actions, GoHP started implementing SAPCC after endorsement from the Ministry of Environment and Climate Change (MoEF&CC), Government of India (GoI). Several projects based on sectoral analysis were initiated in the state. Now as per directions of MoEF& CC in order to prepare the SAPCC's of all states on with a uniform structure the process to revise the SAPCCs of HP was initiated under a bilateral project between MoEF& CC, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and GoHP. The main objective of this exercise is to review and prepare a stock taking report of the activities proposed under the State Action Plan of Climate Change-2012 and align the new SAPCC document in light of the Nationally Determined Contribution (NDC) and Sustainable Development Goals (SDG) and redefining actions for next phase envisaged under MoEF&CC directions.

With NDC envisaged actions the projections for some of the indicators in H.P. for 2030 are presented in Table 1, these indicators will be monitored after 2030.

Table 1 : Himachal Pradesh Projections for Year 2030

Indicators	Unit	2011-2012	2030	Remark
GSDP at current prices[1]	In Rs Lakh	7271983	27388159	Holt Model
Population[2]	In '00	69010	80080	ARIMA lag 2
Urban population	In '00	6886	9241	
Per capita GSDP	In Rs	105376	342010	
Electricity demand	In gWh	1005.6	5181.5	

The status of energy consumption and carbon sink as on 2017

		Himachal Pradesh	All India	
Per capita energy Consumption	In kWh	13333[3]	1119.374[4]	The energy intensity of the state is likely to be 2/3rd that of national average by 2030
Forest carbon sink	In million tonnes	175.8 644.534 million tonnes of CO_2eqv 2.48% of India	7082.063 25991.171 CO_2eqv	By 2030 the forest carbon sink in the state will grow to 191.65 mn tons

The state actions in order to address climate change concerns under various policy level interventions are shown in table 2.

Table 2 : Policy Level Interventions in Himachal Pradesh

Key Policy Elements	State Performance
National Action Plan on Climate Change	The state has all eight missions aligned to NAPCC
State Action Plan on Climate Change	The state has prepared SAPCC and duly endorsed by the state and submitted to the MoEF&C in 2012-13
Energy Policy	H.P. Solar Power Policy-2016, Himachal Pradesh Hydro Power Policy-2006 Total inhabited villages (as per Census 2011) - 17882 State has reported 100% villages as electrified Deendayal Upadhyaya Gram JyotiYojana (DDUGJY) Villages covered for providing access to Rural households (Nos): 8570 Electrification of BPL Households (Nos.): 15763 12 new projects launched under DDUGY Grid with scope of Intensive Electrification of 3803 villages out of which 27 villages (1%) has been achieved. Saubhagya: Household Electrification Status 99.17% rural households and 99.7% urban households are electrified till date.[5]
Agriculture Policy	The state has formulated its organic farming policy and brought changes in agriculture development scenario in order to provide sustainable livelihoods to the farming community through organic farming.
Urban Development Policy	State has Himachal Pradesh State Policy of Solid Waste Management (Urban) as prescribed by Urban Development Department, as per Solid Waste Management Rules 2006. HP sustainable tourism policy, 2013 aims at promotion tourism based on carrying capacity of the area and have provisions to regulate various aspects that have detrimental effect on the environment.
Forest Policy	The Government of Himachal Pradesh has developed the Forest Sector Policy and Strategy, 2005 in consonance with Government of India policy guidelines and by making important amendments to the previous Himachal Pradesh Forest Policy of 1980.

Reference
1. Estimates of state domestic product of Himachal Pradesh (GSDP and Population figures based on series 2011-12 to 2016-17)
2. Census of India, 2011
3. Projected from the time series data presented by Power Ministry in 2017
4. Estimated based on CEA data 2017
5. DDUGJY Portal

	This 'community based eco-tourism' policy in the state is proposed with a long-term goal of conserving the rich cultural and ecological heritage of the state, so that various benefits from this conservation endeavour, including the benefits by way of tourism, could continue to accrue to generations to follow.
Eco-tousim & Tourism policy	The policy also aims at achieving the following immediate objectives: ▪ To enable the local communities in managing eco-tourism for optimum economic benefits to them. ▪ To develop ways and means to attract responsible nature and adventure loving tourists to the state so as to broaden the tourism base and place the state firmly on the international tourist map. ▪ To develop infrastructural facilities for such tourism. ▪ To develop and enforce protocols to minimize the negative impacts of traditional tourism on the ecology and social fabric of the area. ▪ To protect cultural integrity of local people and use the same to further eco-tourism concepts. ▪ To generate revenues which could be ploughed back for the maintenance and preservation of the environment.
MSW policy	In view of the serious environmental degradation resulting from the unscientific disposal of MSW, the Ministry of Environment and Forests (MoEF), Government of India, notified the Solid Waste Management Rules, 2016, (SWM Rules), stipulating all municipal authorities to scientifically manage MSW. Compliance criteria for each and every stage of waste management - collection, segregation at source, transportation, processing and final disposal - are set out in the SWM Rules, which include: a. Defined roles and responsibilities of all the stakeholders. b. Mandatory segregation of waste at source and collection of it in segregated manner. c. Dumping of MSW in oceans, rivers, open areas and hill sides are not acceptable. d. The biodegradable waste has to be processed by means of composting, vermi-composting, anaerobic digestion or any other appropriate biological processingfor stabilization of wastes. e. Mixed waste containing recoverable resources should be recycled. Other technologies for treatment such as Pelletisation, Gasification, Incineration etc. require clearance from Pollution Control Board before planning and implementation. Landfilling should be the waste disposal method only for, inert waste and other waste that is not suitable either for recycling or for biological processing.
Urban Transport	Objectives: • To provide connectivity to the remotest corner of the state enabling people to access services and facilities including markets for their farm produce. Special arrangements will be made to address the concerns of women, senior citizens, differently-abled people, farmers and children. Last mile connectivity will be the special focus of mobility planning in urban areas; • Encourage most modern state of art goods transport vehicles entering the market for handling the farm and non-farm produce most efficiently and cost effectively for achieving export oriented growth;
Roads	• Mainstream Road safety concerns in the overall transport planning by bringing all the concerned departments on board. Efforts will be made to incorporate road safety in the educational curriculum at the appropriate levels; • Reduce environmental externalities of transport in Himachal Pradesh by developing suitable tax and non tax incentives and disincentives that encourage environment friendly transport and discourage polluting and unsafe vehicles; • Alternate modes of transport like cable cars, trams and non-mechanised modes will be encouraged to achieve sustainable transport development overtime.
Renewable sources of Energy HIMURJA	H.P. Solar Power Policy 2016- This policy shall be applicable for Solar Photovoltaic (SPV) technology. However, with the growing efficiency in solar thermal and other solar technologies

	and their relevance to the State in context of competitiveness with Solar PV and Small Hydro Power, the state may consider these technologies in due course. **Aims & Objectives:** I. Promote generation of electricity from solar energy for energy security for sustainable development, which is the core Development Policy of the State. ii. Contribute to the National objective of increasing the share of Renewable Energy in total energy consumption, in accordance with climate, environment and macro economic considerations. iii. Strengthen and sustain the Policy of 100% clean electricity consumption in the State, by providing a suitable alternative to coal and gas based power and to provide firm base load power during the sunshine time of the day , so that water in the hydro projects are impounded during day time for peaking power. iv. Empower people in the remote and rural areas with 24x7 powers by way of decentralised solar power supply, especially in the unreliable grid systems in the mountains, to meet their basic needs, enable access to social and commercial services, and technologies v. Contribute to macro policies and strategies on climate change, environment protection and sustainable development. vi. Promote investment, mainly private, so as to derive benefits of jobs, incomes, revenues and growth. vii. Facilitate achieving Renewable Power Purchase Obligation by capacity creations in the State. viii. Create awareness about potentials of renewable energy, especially solar, as a source of reliable, affordable and accessible energy in a decentralised manner, so that efficient use of electricity becomes a way of life, eventually even for cooking needs and transportation needs to power automobiles.
Industry	HP Industrial Investment Policy 2019- Eligible Enterprises for availing incentives under this Policy: (A) All "New Industrial Enterprises" except Industrial Enterprises engaged in manufacturing activities specified in the "Negative List" annexed with this policy; And New Enterprises engaged in "Specified Category of Service Activities" annexed with this policy; And All Existing Industrial Enterprises undertaking Substantial Expansion except Industrial activities as specified in the Negative List And 5 All Existing Service Enterprises engaged in Specified Category of Service Activities undertaking Substantial Expansion will be eligible for incentives, concessions and facilities announced under this policy subject to:- ▪ Fulfillment of the eligibility criteria & conditions as defined under the Rules regarding Grant of Incentives, Concessions & Facilities to Industrial & Service Enterprises in Himachal Pradesh-2019 ▪ Employment of minimum 80% Bonafide Himachlis, at all levels, directly on regular, contractual, daily basis etc. or through contractor or outsourcing agencies at the time of commencement of commercial production/operation as well as for the time period it remains in commercial production/operation in the State by the New Enterprise set up under this policy. In case of Existing Enterprises undertaking substantial expansion, out of additional employment generated due to Substantial Expansion employment to at least 80% of Bonafide Himachlis. (B) Incentives provided under this policy will be admissible from the date of commencement of commercial production/operation or from the date on which respective administrative department issues enabling notification under the relevant statute/law to operationalize incentives notified under this policy, whichever is later.
Abatement of Pollution	The Environment (Protection) Act, 1986 is the umbrella act which encompasses almost all type of regulations for environmental pollution control and management aspects. In fact this act was enacted to provide the prevailing legislation for control of water and air pollution more effectively

and to remove the deficiency of these legislation. The prime objective of the legislation was to plug the existing statutory gaps whereby tremendous responsibilities.

The following prominent rules and notifications are significant in context to the role and functions of the State Government and H.P. State Pollution Control Board:

1. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989.
2. The Hazardous Waste (Management & Handling) Rules, 1989/2000
3. Rules for Manufacture, Use, Import, Export and Storage of Hazardous Microorganism, Genetically Engineered Organisms or Cells, 1989.
4. Noise Pollution (Control and Regulation) Rules, 1999.
5. Bio - medical Wastes (Management & Handling) Rules, 1998.
6. Recycled Plastics Manufacture and Usage Rules, 1999/2003.
7. Municipal Solid Wastes (Management & Handling) Rules, 2000.
8. Ozone Depleting Substances (Regulation & Control) Rules, 2000.
9. Batteries (Management & Handling) Rules, 2000.

Under these Rules regulatory powers have been delegated to State Pollution Control Board by wayof functions that have been entrusted to the Board in addition to the Air (Prevention and Control of Pollution) Act and Water (Prevention and Control of Pollution) Acts.

The Climate Change vulnerability assessment of Himachal Pradesh reveals that most of the districts are facing climatic changes but district Solan and Una are significantly affected over the years. The composite risk in Una and Solan districts has been observed as increasing in terms of vulnerability. Other than these, a considerable improvements have been observed in district Hamirpur in last five years. However, increasing trend of vulnerability have also been observed in Mandi and Shimla districts. In districts of Kullu and Kinnaur there is a slight change observed in the climate change (CC) vulnerability assessment while districts Chamba and Kangra show no change in CC vulnerability in comparison to the baseline.

POVERTY AND FOOD SECURITY

The state has achieved a continuous decline in poverty levels in past few years. Food grain production has by and large remained constant though an increasing trend has been observed in horticulture produce & crops.

NATIONAL MISSION ON SUSTAINABLE AGRICULTURE AND RKVY (Rashtriya Krishi Vikas Yojna)

As a comprehensive scheme, RKVY is addressing issues related to climate change adaptation in agriculture and allied sectors. The allocations under Rainfed Area Development component under the scheme have shown a decrease after 2015-16 while allocations under RKVY show an increasing trend since 2010-11.

WATER MISSION AND WATER USE EFFICIENCY

Water conservation in the state is achieved through micro irrigation activities under National Mission on Micro Irrigation/Pradhan Mantri Krishi Sinchai Yojana/National Mission on Sustainable Agriculture. 1819.69 Ha. area of land has been covered under micro irrigation during 2014-17. The Command Area Development for 2,500 Ha. was proposed in the state. Of this physical target, about 31% physically target has been achieved till 2017.

SWACHH BHARAT MISSION

The state has achieved 100% coverage of IHHL (Individual Household Latrine) with 1,72,536 total household toilets constructed. Under SBM (Urban) 1584 toilets have been constructed till 2018 in various ULBs of the state thereby achieving 14% of the physical target (872 Community and Public Toilets); Solid Waste Management situation is not very good though projects have been undertaken at 39 locations in different cities.

ENHANCEMENT OF CARBON SINK AND GREEN INDIA MISSION

Himachal Pradesh has added 393 km^2 to its forest area. This largely through conversion of medium density, open and scrub forests due to better conservation and management and regrowth in the areas where shifting cultivation used to be practiced. The total carbon stock in the forests of Himachal Pradesh is 175.782 million tonnes which is equivalent to 644,534 million tonnes CO_2. This accounts for 2.48% of the total forest carbon stock of the country.

MISSION ON STRATEGIC KNOWLEDGE FOR CLIMATE CHANGE

In pursuance of the NAPCC, the state has set up a Knowledge Cell on Climate Change, Department of Environment Science and Technology (DEST). The Cell has undertaken two Green House Gas (GHG) Emission inventories of Himachal Pradesh based on activity data 2007 & 2012. The department has also prepared a comprehensive Environmental Master Plan for infrastructure, natural resource management and services sectors in the state. DEST is undertaking hydrological modelling of different river basins at the Panchayat level. So far, Yamuna river basin and Beas river basin assessments have been completed by covering panchayats and villages. Assessment of crops loss due to climate variations, losses due to heavy snowfall or droughts, flash floods has been carried out.

MISSION FOR SUSTAINABLE URBAN HABITAT

Most of the urban habitations of the state are covered under AMRUT and Smart City Mission initiatives of the Central Govt.. These initiatives promote development of green spaces, reduction in pollution causing agents and improved water supply. Major urban centres like Shimla and Kullu in Himachal are covered under AMRUT. Total expenditure under AMRUT during 2015-2018 was about 52.21 Lakhs. Dharamshala and Shimla are covered under the Smart Cities Mission. Dharamshala Smart City Limited (DSCL) have received an aid of Rs. 210 Crore out of which Rs. 11.52 crores have been spent so far.

MISSION ON ENERGY AND SOLAR MISSION

The share of renewable energy in the state has decreased by 5 percentage point. Under the Jawaharlal Nehru National Solar Mission (JNNSM), state has planned to develop a policy for development of New and Conventional Sources and Applications to reduce the emissions and impacts of climate change.

Achievements

- *'Himachal Pradesh Forest Ecosystems Climate Proofing Project' being implemented in Chamba & Kangra districts. Under this project, 600 Panchayats would be targeted for forest conservation, increasing biodiversity and generating income from sustainable forest management.*
- *Under Catchment Area Treatment (CAT) plan implementation, various activities like plantations, nursery development, soil and moisture conservation measures, infrastructure development and other ancillary activities are being carried out regularly.*
- *Water storage structures like ponds, check dams, other civil works, development and conservation of water resources and integrated development of catchments have been implemented. A 20-years old scheme is already being running for checking soil erosion in the forest areas.*
- *Mid-Himalayan Watershed Development Project and Himachal Pradesh Forest Ecosystems Management and Livelihood Improvement Project are two major projects supported by World Bank and Japan International Cooperation Agency (JICA) respectively for enhancement of community participation in forest management. Under Mid-Himalayan Watershed Development Project, Himachal Pradesh sold its carbon credits generated from afforestation/reforestation CDM Project for Rs. 1.93 crore to Spain. The verification of the first cycle of the carbon sequestration has been successfully completed in 2014.*
- *Within CAT plan implementation new nurseries have been raised in the state.*
- *Plantation carried out other than CAT and National Afforestation and Eco Development Board (NAEB) plantations considered under afforestation activities. Urban plantation activity such as "Nagar Van UdyanYojna – Ek Kadam Hariyali ki Or" – Programme for Climate Smart Green Cities" also helping in promoting afforestation.*

ECOSYSTEM, BIODIVERSITY AND LIVELIHOOD SUSTAINABILITY

Himachal Pradesh is bestowed with rich floral and faunal diversity. The floral biodiversity of the state includes forest, diverse vegetation, medicinal and aromatic plants. Out of 89,451 species of fauna found in India, Himachal Pradesh harbours 5721 species of Indian fauna. The state has 77 mammals, 447 birds, 44 amphibians, 83 fishes, 4543 arthropods and 412 other species. Some of the species are confined to the state only.

Due to climate change distribution of tree species across altitudinal zones is changing in the state. Increasing temperature and erratic precipitation threatens to trigger exotic or invasive species to invade in new areas. Rare mountainous species may face extinction due to variation in precipitation.

The State Biodiversity Board has been set up to work on biodiversity conservation through habitat management. The state Govt. is in process of constituting and strengthening Biodiversity Management Committees in the state.

Sectoral Overview

Achievements

- *The biodiversity board,Himachal Pradesh has inventorised different species for access and benefit sharing (ABS) and their trade pattern for its sustainable harvesting.*
- *The Government of India has sanctioned funds for conservation of Pong Wetland, Renuka Lake, Rewalsar Lake and Khajjiar Lake. These are various Ramsar sites and wetlands of national importance in the state. The inventory of all wetlands of implementation through GIS platform is being prepared in the state.*
- *NRM based drought adaptation under national adaption funds is being implemented by strengthening sustainable adaptation activities for livelihood security of marginal committees.*
- *The Govt. of Himachal Pradesh has initiated an Eco-village scheme in order to strengthen the ecosystem, biodiversity conservation and sustainable development of villages.*
- *Detailed project report on reducing glacial outburst and flood risk in Parvati Valley of Kullu District, Himachal Pradesh has been prepared and submitted to GoI under National Adaptation Fund for Climate Change (NAFCC).*
- *Detailed project report has been prepared and submitted for promoting Climate Resilient Agri-Horticulture in Banjar of Kullu district, Himachal Pradesh.*
- *Detailed report for promotion of resilient ecosystem through reduced pressure on forest through propagation of medical plants in Great Himalayan National park, Himachal Pradesh has been prepared and submitted under National Adaptation Fund.*
- *Department is also working to access funding under Green Climate Fund (GCF) for 'Community based water harvesting and natural water resources management project' and 'Himachal Pradesh Climate Resilient Forest Management' projects. These proposals for which have been submitted to Govt. of India.*

FOREST

The State of Forest Report (FSI, YEAR 2017) reveals that 27.12% (15,100 sq. km) of the state's geographical area is under forest cover. Out of 15,100 sq. km, 3110 sq. km area of the forest cover is very dense, 6705 sq. km area of the forest is moderately dense t and 5285 sq. km of area is open. The total carbon stock in the forests of the state is 175.782 million tonnes, which is 644.534 million tonnes of CO2 equivalent. The state constitutes 2.48% of total forest carbon stock of India.

Indicated impacts of climate change in the area:

- Shift of tree species to higher altitudes due to increasing temperatures. The Himalayan pine, Pinuswallichiana, has been reported shifting upwards @ 19 mts./10 years on south slope and 15 mts/10 years on north slope in Saram, Parvati Valley, Himachal Pradesh.
- Change in forest productivity due to carbon enrichment of the atmosphere.

- Increase in tree mortality due to reduced snow fall in higher altitudes.
- Increased susceptibility of threatened floral species to extinction due to climate related stresses in addition to the anthropogenic pressures.
- Climate analysis from the state vulnerability assessment Climate Vulnerability Assessment for the Indian Himalayan Region Using a Common Framework 1 has projected an increase in heat waves, heavy rainfall events, floods and droughts in the future. It may also increase the incidence of forest fires and area afected by soil erosion.

The Government of Himachal Pradesh is working to identify key impacts on, vulnerabilities of and research priorities for the state forest system. This includes:

- Developing strategies in collaboration with hydro power industry for co-management of forest and bio-diversity.
- Developing communication strategies targets, schools, public and private institutions for plantation and regeneration.
- Developing proposals under REDD+ mechanism for additional funding.
- Enhancing of livelihood options of state through agro forestry/farm forestry and biodiversity conservation.
- Expansion of Eco tourism.

Different activities proposed under the sector include mitigation and adaptation activities.

AGRICULTURE

Agriculture is one of the most important sectors of the state's economy and provides directly or indirect employment to 62 per cent of the total workers of the state. It contributes to about 10% of the total GDP of state. The share of agriculture sector is continuously declining in the state but still it continues to be a major contributor to Gross domestic product alongwith the Allied sector including animal husbandry and fisheries.

Kharif crops production in the state is dependent on the behaviour of southwest monsoon as 80% of the cultivated land is rain fed. Impact of changing rainfall patterns was observed on major crops of the state. INCAA report reported the impact of changing snowfall patterns on production of apple growing districts. Under the NICRA project, districts of Kullu, Shimla, Chamba and Bilaspur are indicated to have higher agricultural vulnerability in the state. Climate data from RCP 4.5 and RCP 8.5 indicates an increase in extreme events such as heavy rainfall, heat waves, flash floods and droughts etc. These extreme events have the potential to disturb the agricultural and horticultural production of the state. Vulnerability of agricultural communities, especially with monocultures of wheat/maize and minimal least diversification and low value addition is high.

The Government of Himachal Pradesh is working to enhance the capacity of the agriculture and allied departments to promote sustainable agriculture. These initiatives show the commitment of the state towards achieving the NDC and SDG goals. Under the revised action plan, 9 adaptation activities have been prioritised under planning section.

Achievements

Systems to manage agro climatic risks

- *4, 36,280 farmers got insured in 2013-17 under Weather Based Crop Insurance Scheme by Department of Horticulture.*
- *185325 farmers covered under Rashtriya Krishi Bima Yojna & Pradhan Mantri Fasal Bima Yojana from Rabi 2012 to Kharif 2016 ensuring area of 97845 ha. 578.5 Crore was insured this period.*
- *3760 poly houses have been set up since 2014 under Dr. Y. S. Parmar Kisan Swarojgar Yojna (RIDF 19XIX) covering an area of 72 ha. 412696 Sq. m. covered under playhouses benefitting 554 farmers from MIDH in year 2013-18.*

Foster efficient use of water in agriculture

- *1819.69 ha. Area covered under Micro Irrigation scheme under National Mission for Micro Irrigation by Department of Horticulture during 2014-17.*
- *231.38 ha. converted to irrigated land under PMKSY in one year.*
- *2554 ha. area covered under Micro-Irrigation under Rajiv Gandhi Micro-Irrigation Scheme funded by NABARD under RIDF –XIV during 2015-2018.*

Reduce use of chemicals/ Fertilizers

- *Micronutrients promotion was carried out in 2014-15 on 700 Ha. of land.*

Increase the State's irrigated surface area

- *377 Ha. area was developed under RAD of National Mission for Sustainable Agriculture from 2014-18;*
- *Integrated Water Harvesting System under NMSA covered 4579.5 Ha.;*
- *Under Value Addition and Resource Conservation Greenhouse were 23668 sq m, WHS in command area of 51.7 Ha.;*
- *248.3320 Ha. area was brought under irrigation under Per Drop More Crop component of Pradhan Mantri Krishi Vikas Yojana by constructing water harvesting/water conservation structures in rural areas.*

Expand irrigation and water policies

- *Various schemes for building Borewells and Lift Irrigation schemes are being implemented in the state*
- *Jal Se Krishi Ko Bal is a scheme being implemented in the state.*
- *Solar Power Irrigation Scheme.*

WATER

Himachal Pradesh is known for its entire range of natural fresh water resources. Water resources in state are present primarily in the form of glaciers, rivers and springs. Total live water source storage in Northern States is 18.01 BCM, while available storage is 20% in the capacity of reservoirs. Major rivers of the state are Satluj, Beas, Ravi, Yamuna and Chenab. These rivers receive water from about 800 glaciers in Himachal Himalayas covering 3124.713 km. Climate analysis reveals that temperature increases are greater in uplands than in the lowlands.

Under RCP 4.5 and 8.5 scenarios for southwest monsoon, an increase in precipitation is projected up to 23% towards mid of the century and up to 41% towards end of the century. It also projects an increase in run off in district of Kullu, Chamba and Lahaul & Spiti and increase in evapo-transpiration in districts of Shimla and Sirmaur. High magnitude of floods are also projected in few districts such as Kullu, Kinnaur, Mandi, Kangra, Chamba, Lahaul & Spiti. The Government of Himachal Pradesh has proposed to implement various major adaptation measures through better water resource management, increasing water use efficiency and command area development. Five adaptation activities are prioritised in revised plan of action.

Achievements

Updating of hydrological balances

1. *Under Swan River Channelization Project 2884 Ha. land brought under flood protection;*
2. *Under Seer Khadd Stabilization 120 Ha. Land brought under flood protection;*
3. *584.6 Ha. land has been protected from floods and DPR for Bata river channelization has been prepared.*

Determination of the availability of water in the future for consumption

- *49976 number of drinking samples were collected and tested through Flood Test Kits. At Gram Panchayat level about 393930 samples were collected and tested through FTK and divisional water testing laboratories.*

Forecasting of hydrological trends (flows) based on climate evolution predictions

- *Hydrology project involving integration and comprehensive hydrological data collection and information system has been initiated.*

State Strategy for Integrated Watershed Resources Management and development

- *Water and Sanitation Support Organization provides information, education and communication on water conservation & water harvesting through IEC materials, bills, pamphlets, radio channels. In last five years WSSO communicated 1919 advertisements and audio messages, conducted Awareness programmes, arrangement of one act play for spreading awareness on water conservation at GP level, Poster/Pamphlet distribution on related topics.*

Enhance rain water harvesting installations coverage

- *806 structures with capacity of 3443553.1 cum have been constructed under MNREGA, Sustainability Component of NRDWP, NABARD, AIBP and other funds like plan budget, CRF etc.*

HEALTH

The state government has implemented various schemes and programmes in the Health sector during the last five years as per the provisions of National Health Mission (NHM) and other state specific schemes. Several verticals exist under the umbrella of National Health Mission which deliver specific services and many of them provide adaptation benefits. Climate change impacts have caused an increase in major vector-borne diseases in the state. It is indicated that as per present climatic trends, the temperature is likely to increase in the month of May and up to September in most of Himachal Pradesh's districts (analysed under two scenarios viz; – RCP 8.5 and RCP 4.5). Since physical activities and exposure are more likely in the state, it is important to take precautions under high vulnerability phase which varies in mid-century and end-century. The Government of Himachal Pradesh has prioritised 5 activities in this version of the state action plan on climate change. The state will be focusing more on research work on vector-borne and water-borne diseases, development of required institutional infrastructure keeping specific focus on climate risk management, capacity building of officials and health workers on impact of climate change on human health. Water borne diseases are a major cause of concern in a changing climate.

Achievements

Strengthening of the capabilities of individuals to address prevention and care of adverse effects caused by climate change

- *IEC van organized for Information, Education and Awareness Campaigns communicates with localities to give lectures, organize quizzes and webcast of programmes in Shimla, Dharamshala, Kasauli and Hamirpur.*
- *Surveillance of vector borne diseases is being done on weekly basis and data is shared with Govt. of India. The State Govt. is carrying out daily surveillance of five diseases namely Scrub typhus, Hepatitis A and E & Dengue.*

Create and develop infrastructural capacities to address the potential threat of yellow fever, dengue fever, malaria and vectors such as mosquitoes

1. *Strategies of National vector Borne Disease Programme are implemented for Vector Surveillance & control.*
2. *Capacity Building of Clinicians on new "National Guidelines of Clinical Management of Dengue Fever"*

Apply effective monitoring systems and preparation of emergency plans by including in risk management practices w.r.t. health hazards w.r.t. any climate change related health effects

- *Rashtriya Swasthya Beema Yojana ensures social security and healthcare assurance. The premium cost for enrolled beneficiaries under the scheme is being shared by Government of India and the State Governments. The program has the targeted to cover 70 million households by the end of the Twelfth Five Year Plan (2012-17). Out of total targeted families i.e. 877763, 480588 families are enrolled with 21 private and 155 Public Hospitals empanelled; 116000 smart card holders in last five years receiving.*

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STRATEGIC KNOWLEDGE AND INFORMATION

Strategic knowledge mission for climate change attempts to develop a dynamic knowledge system that would help in attaining the objective of ecosytem level sustainable development. It aims to develop a better understanding by acquiring and upgrading information and knowledge available from the discipline of climate science and analysing the impacts of climate change at the micro and local level and create balance in the ecosytem.

DEST, as the nodal department, deals with all Climate Change rules and business. Under DEST a State Knowledge Cell on Climate Change has been set up under National Mission on Sustaining Himalayan Ecosystem. The cell is working effectively amongst scientific, academic, NGOs and other research institutions inside and outside the state for pursuing research in the field of climate change, and its impact on the Himalayan Ecosystem, so that adaptation plans and polices relevant to the state of Himachal Pradesh can be developed.

The Government of Himachal Pradesh has prioritized 5 activities in revised plan of action with focus on collection and analysis of micro level climate data and projects on the climate changes and vulnerability assessment at the regional micro watershed and local level; identification of research gaps; mapping of knowledge base. Out of the 5 prioritised activities 3 activities are newly proposed while other 2 activities are being brought forward from previous plan of action.

Achievements

Himachal Pradesh Knowledge Cell on Climate Change

- *HPKCCC has been set up under Deptt. of Environment, Science & Technology, Govt. of Himachal Pradesh.*

Creation of a State Level Program for Climate Change Education and Awareness

- *Knowledge on Climate Change is being built through various studies, awareness programmes.*

Capacity Building Programme under Climate Change Adaptation in Rural Areas of India (CCA-RAI)

- *Himachal Pradesh is also implementing the Department of Science & Technology (DST), Govt. of India, in bilateral agreement with GIZ on 'Climate Change Adaptation in Rural Areas-India (CCA-RAI) project'. Under the project, initiatives are being taken for research on climate change and capacity building programmes to strengthen the existing staff of the nodal/ line state and districts department, research institutions, NGOs, women SHGs etc.*

Strengthening the Institutional Framework in Himachal Pradesh for Addressing Climate Change

- *The Knowledge Cell on Climate Change has been set up to coordinate, disseminate, develop and implement various Climate Change actions in State with all stakeholder organizations. The policy and plans are being maintained through this cell.*

Adoption of Technologies for Climate Change Mitigation and Adaptation

1. *River Basin based Hydrological modelling done for two river basins covering five Districts.*
2. *Micro Watershed vulnerability assessment has been carried out for Kullu, Mandi, Hamirpur, Kangra and Sirmaur Districts.*

URBAN SECTOR

Himachal Pradesh is the least urbanized state in India with only growth of 1.45% in urban population which is recorded to be the lowest from year 2001 to 2011. Climate change and its effect are intrinsically linked with unsustainable, unplanned and rapid urbanization. Population growth in urban areas is proportional to the increased stress on infrastructure, which further leads to resource congestion, emission and exploitation which results in deprivation.

The changes due climatic variability may affect ecosystem services. The increase in urban area contributes to the increase in carbon emissions which leads to a drastic change in climate. The overexploitation of water is leading to groundwater table depletion especially in cities like Shimla. A sustainable lifestyle and climate justice to protect the poor and vulnerable from adverse impacts of climate change is the basic objective which the NDC aims to achieve through various commitments. Since NDC commitments are yet to be broken down to be state level, the targets at the state level targets are conceived in line with the national commitments. 7 activities are proposed in the revised plan of action. Out of these 3 activities are for mitigation s and 2 are for adaptation activities.

Achievements

Deen Dayal Antyodaya Yojana – National Urban Livelihood Mission

- *Total 14052 beneficiaries under three components namely Self-Employment Programme (SEP), SMID (Social Mobilization and Institutional Development) and ESTP (Employment through skilled training and placement).*
- *Support Urban Street Vendors (SUSV) was initiated in 2016-17 which included survey training; it has benefited 5040 individuals and is still on-going. Shelter for Urban Homeless has also been added to NULM and new constructions are undergoing..*

Pradhan Mantri Awas Yojana – Housing for All (Urban)

- *Mission for urban area will be implemented during 2015-2022 and this Mission will provide central assistance to implementing agencies through States and UTs for providing houses to all eligible families/ beneficiaries by 2022.*

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

- *Providing basic services (e.g. water supply, sewerage, urban transport) to households and build amenities in cities which will improve the quality of life for all, especially the poor and the disadvantaged is a national priority. An estimate of the funds required over a 20 year period, at 2009-10 prices, was made by the High Powered Expert Committee (HPEC) during 2011. The Committee estimated that Rs. 39.2 lakh crore was required for creation of urban infrastructure, including Rs. 17.3 lakh crore for urban roads and Rs. 8 lakh crores for services, such as water supply, sewerage, solid waste management and storm water drains. Moreover, the requirement for Operation and Maintenance (O&M) was separately estimated to be Rs. 19.9 lakh crore.*

Sewerage Schemes of ULBs

- *There are 54 ULBs (2 Municipal Corporations, 31 Municipal Councils & 21 Nagar Panchayats having population of 6.89 lacs as per 2011 Census) in the State out of which 46 ULBs has so far been covered.*

JNNURM

- *Water supply schemes carried out in 8 ULBs namely – Dharamshala, Ramput, Nagrota, Kangra, Mandi, Kullu, Parwanoo. Urban renewal carried out at Dharamshala and Rewlsar. Sewerage schemes in Baddi and Nalagarh.*

Smart City Mission

- *The mission was started in the year 2015, in two districts – Shimla and Dharamshala; no physical progress has been documented.*

Climate Change Assessment Report (Assessment study for Social & Environment impacts of Eco-Tourism projects Under PPP mode)

- *Trainings are being conducted based on the assessment for FRM chokidars.*
- *High level governing body (Chief Minister is the head) is being formed – it is still at its initial phase.*

Swachh Bharat Mission (Urban)

- *Project timeline is 2014-22, with target of 11266 IHHL are to be constructed in the ULBs of State, Overall applications received as on 31.05.2018 were 5093 from which, 3040 verified and 2428 approved and 1584 constructed (equates to 14% progress against overall target).*

Atal Shresth Shahar Yoina (ASSY)

- *In partial modification to this department notification of even No. dated 28 Oct 2018, the Governor, Himachal Pradesh is pleased to rename the scheme "Shresth Shahar Yojna (SSY)" as "Atal Shresth Shahar Yojana (ASSY)". The Best performing Urban Local Bodies (Municipal Council/Nagar Panchayat) will be felicitated with "Atal Shresth Shahar Puruskar" (earlier named Shresth Shahar puruskar) on 25th December every year on the birth anniversary of Late Sh. Atal Bihari Vajpayee (former Prime Minister of India).*

Jal Shakti Abhiyan

- *Ministry of Jal Shakti (MoJS) has identified 255 Districts and 1,597 Blocks across the country as water stressed. From the information made available by MoJS, total 756 ULBs have been identified as water stressed.*

ENERGY

Access to modern and affordable energy sources is fundamental to driving economic growth and powering human development. Inequalities in availability of energy influence developmental prospects of a society (productivity, health, education) and have a long-term implication on the livelihoods of the poor. The per capita electricity consumption in Himachal Pradesh was 1339 kWh in year 2015-16 in comparison to the national average of 1,075 kWh. The state had a Cumulative Installed Capacity of Grid Interactive Renewable Power of 793.51 MW & 832.54 Mw as on 30-03-2016 and on 30-03-2017, respectively.

Climate change can cause long-term changes in the water flow of the river basins in the state. A long-term change in water flow rate across the river basins in Himachal Pradesh may have deeper implications on the state's hydropower projects. Precipitation is likely to vary from -8% to 12 % over different regions of Himachal Pradesh. Climatic extreme events are expected to adversely impact the power sector infrastructure. Increased weather variability (summer or winter) might exacerbate the existing energy demand supply gap due to increase in heating and cooling loads. In this sector a total of 10 activities are proposed in revised plan of action, out of which, 2 are focused on mitigation and rest on adaptation.

Achievements

Improve Estimates of Potential Savings and Energy Efficiency on a State & Regional Scale by Consumption Sector

- *Implementation of Rooftop SPV plants on residential buildings in accordance with the grid-connecting Rooftop Solar Scheme.*
- *56 Rooftop SPV plants have been installed so far of 1600 KW capacity and potential of 33 GW.*
- *56 beneficiaries from grid-connected system.*
- *Off-grid systems include installation of which is a total of around 1 lakh lights from 2011 to July 2018.*
- *56 Rooftop SPV plants have been installed so far of 1600 KW capacity and potential of 33 GW.*

- *56 beneficiaries from grid-connected system.*

DEMONSTRATION PROJECT

- *The project has been finalised for the street lighting at Municipal Council, Dharamshala, under which 244 Nos. of inefficient street lights will be retrofitted.*
- *A capacity building scheme through the creation of ECBC cells was developed by BEE with the support from UNDP-GEF project.*
- *ECBC Cell has been established in the Directorate of Energy, Shimla, which started functioning w.e.f. 11-04-2017.*
- *A high-powered State level ECBC Committee was constituted on 10-10-2017 headed by Chief Secretary and comprising of Secretaries of all concerned Departments i.e. Town planning/ HIMUDA/ PWD/ State Urban Planning Dept. and ULBs. HPECBC 2018 Rules was approved by the Committee.*

Strengthen the National Energy Efficiency Mission

- *Implementation of off-grid and on-grid SPV plants.*
- *Demonstration project in rural drinking water pumping systems under Agriculture Demand Side Management (AgDSM) scheme.*

Study the Potential for Renewable Energy Generation

- *Training/workshops/meetings/Awareness campaign to promote the development of non-conventional renewable energies in the State have been organised.*
- *Undertaken several Cumulative Environmental Impact Assessment (CEIA) studies.*
- *Energy conservation through market-based instruments like PAT.*
- *Installation of 2 Biomass power plants.*
- *Revival 41 No. improved watermills.*

SUMMARY ALLOCATION OF CLIMATE RELEVANT BUDGET IN DIFFERENT MISSIONS

Under the HPSAPCC 1.0, 40 climate mitigation actions and 74 adaptation actions and 9 actions were of both mitigation & adaptation nature were proposed. The tentative budget to implement these actions was estimated at Rs. 2891 crores for five years. The estimated expenditure from various sources was indicated to be Rs. 2,511 crore which is about 87% of the requirement. Out of the proposed actions in the initial SAPCC, 61% were for adaptation, 32% for mitigation and 7% had characteristics of both mitigation and adaptation. The nature of proposed activities include, 41% of policy interventions, 26% of research based, 27% investment based, 4% are capacity building focused and 2% of pilot based.

» Table 3 : Himachal Pradesh's Sector Wise Estimated Expenditure on SAPCC Implementation

#	Sector	Proposed Budget in Rs. Crore (2012-16)	Allocation in Rs. Crore (2012-16)	Estimated Expenditure in Rs. Crore (2012-16)
1.	Agriculture-Horticulture	1,100	350.63	342.97
2.	Energy	280	164.74	5.78
3.	Water	110	480.1	484.82
4.	Health	105	940.27	1075.94
5.	Urban	551.15	447.56	303.5
6.	Ecotourism	65	0.46	0.47
7.	Forest	195	1263.93	295.25
8.	Strategic Knowledge/ Capacity Building	485	2.53	2.529
	Total	**2,891**	**3,650.53**	**2,511.53**

Table 3 shows that the investment focus has been more on the health sector as it includes RCH Flexi pool and NRHM Flexi Pool. Subsequently, water and agriculture sector have also seen high allocation and corresponding expenditures (from RKVY, PMKSY). This shows strong relevance for NDC and the sectors are highly influenced by climate change aspects.

PRIORITIZED INTERVENTIONS

As discussed in the methodology section, for the purpose of planning three parameters have been selected for identifying three key linkages- (1) The linkages with either NDC or SDG or both, (2) funding linkages, (3) levels of implementation based on the previous practice. The proposed activities have been scaled on this bases on the scale:

0: None
1: Meager
2: Some
3: Decent

They have been assigned weightages as well. The basis of this prioritisation starts with sectoral vulnerability/impact for adaptation and linkages to low carbon development for mitigation strategies.

Overall about 53 planned activities have been identified under eight sectors which have been analysed and their examined based on their linkages under SDG-NDC, funding linkage and implementation potential.

Based on the scoring, majority of the activities proposed have significant linkages to SDG and NDC, and on further analysis based on funding linkage, it has been found that more than 80% of the proposed activities have either reasonable or significant funding linkages, convergence with other programmes and schemes under various sectors.

However, sector wise resource requirement for all the proposed activities for next 10 years have been given in the table 4.

» Table 4 : Himachal Pradesh's sector wise resource requirement for next ten years

Sector	Proposed Budget (as in SAPCC 2021-30) in Rs. Crore	Sources	Funding gap in Rs. Crore
Forest Resource	688.6	Central Schemes	653.90
Agriculture	4895.0	Central and State Schemes	2473.00
Water	4895.0	Central and State Schemes	1800.00
Health	1780.0	Central and State Schemes	643.00
Strategic Knowledge	150.0	Central and State Schemes	137.50
Enhanced Energy Efficiency and Solar Mission	958.1	Central and State Schemes	958.14
Urban	445.0	Central and State Schemes	338.47
Total	**10916.7**		**7004.0**

INTRODUCTION

1 INTRODUCTION

1.1 BACKGROUND

With the effects of global climate change becoming increasingly manifested and visible at the local level, attention to climate policy and planning has increased in the recent years. India brought out its National Action Plan on Climate Change (NAPCC) in 2008. Given India's federal structure a large number of policy actions fall under the purview of State Governments. With this in mind, State Governments were also encouraged to prepare their own State Action Plan on Climate Change (SAPCC) consistent with strategies in the NAPCC. States/UTs were encouraged to integrate State-level variations in ecosystems, geographic conditions, socio-economic scenario, and other factors, while achieving convergence with the existing policies and ongoing programmes and schemes being implemented at the State level. Till date, 33 SAPCCs of States and Union Territories have been approved and are operational. Dedicated climate change institutions/cells have been established in most of the States/UTs to coordinate activities related to climate change. Since the formulation of SAPCCs States/UTs have initiated capacity building actions and demonstration projects to implement SAPCCs. Himachal Pradesh also formulated it's comprehensive State Action Plan on Climate Change (SAPCC) in year 2012 and initiated the process of implementing various sectoral programmes. The State has also successfully mobilized climate finance for adaptation projects under the National Adaptation Fund for Climate Change (NAFCC) which is being implemented in Sirmour district beside one bio-carbon project for carbon credits.

The National and International climate action and policy landscape has evolved since the formulation of SAPCCs. The Paris Agreement (2015) seeks to limit the increase in global mean temperature within 2°C, while working towards limiting it within 1.5°C. India has submitted its Nationally Determined Contribution (NDC) goals for post-2020 with eight different goals, including three major quantifiable goals related to emission reduction, renewable energy and forestry. Over the years, India has pursued major domestic programmes, policies and schemes for climate change mitigation and adaptation actions, particularly in the fields of clean and renewable energy, enhancement of energy efficiency, development of less carbon-intensive and resilient urban development, promotion of waste to wealth, electric vehicles, etc.

The scientific and socio-economic understanding and knowledge on climate change has also advanced over the last few years. The dedicated climate change institutions/cells established in the States/UTs, with the active support of scientific, academic and research institutions, have carried out several regional and sectoral vulnerability studies highlighting the impacts of climate change. The enhanced capacities and improved understanding of sectoral and regional climate variability and projections, GHG Emissions, long-term vulnerabilities, mapping vulnerable regions/social groups/sectors, etc. have helped to identify and prioritize mitigation/adaptation strategies and refine region specific action plans and strategies.

1.1.1 Revision of the SAPCC

The SAPCC revision is thus intended to-

1. Better align national and sub-national adaptation and mitigation planning, and
2. Enhance the evidence-based character and effectiveness of climate policy and planning by integrating recent advancements in knowledge and understanding.

1.1.1 National-Level Climate Policy and Planning Frameworks

As stated above, National Action Plan on Climate Change (NAPCC1) 2008 is India's flagship climate policy document. The NAPCC [1] established 8 National Missions "representing multipronged, long term and integrated strategies for achieving key goals in the context of climate change"[2] which are listed in Table 1.1.

Figure 1.1 : Guiding Principles

Reference

1. https://iasscore.in/ias-prelims/national-action-plan-on-climate-change
2. http://moef.gov.in/environment/climate-change/

PRINCIPLE 7

States/UTs can strengthen existing climate action measures as well as launch new initiatives in their priority sectors. Some of the initiatives can be introduced in the areas of efficient and cleaner technologies, promoting renewable energy generation, reducing emissions from transport sector, afforestation and greening activities and standardising knowledge management system for adaptation and mitigation.

PRINCIPLE 8

Time period of the implementation of SAPCCs should be clearly brought out starting with the implementation cycle of NDCs i.e. 2021-2030 and beyond.

PRINCIPLE 9

Financial resources required for the implementation of the action plan should primarily be leveraged from the existing budget of the State Governments and convergence with the relevant schemes and programmes.

PRINCIPLE 10

SAPCCs should set out the institutional mechanism for implementation including stakeholder engagement, ensuring inclusiveness along with the mechanism for capacity building and monitoring and evaluation with clear indicators for reporting.

Source: "A Common Framework for revision of State Action Plan on Climate Change", Ministry of Environment, Forest and Climate Change, 2019.

Table 1.1 : Eight Missions of the National Action Plan on Climate Change (NAPCC)

Mission Name	Goals and Measures
National Solar Mission	Increase the share of solar energy in the total energy mix
National Mission for Enhanced Energy Efficiency	Enhance energy efficiency through market-based certification mechanisms, cost reductions through R&D, demand-side financing mechanisms, and fiscal instruments
National Mission on Sustainable Habitat	Improvements in energy efficiency in buildings, solid waste management and modal shift to public transport.
National Water Mission	Ensure integrated water resources management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within States.
National Mission for Sustaining the Himalayan Ecosystem	Evolve management measures for sustaining and safeguarding the Himalayan glacier and mountain ecosystem.
National Mission for a Green India	Enhance ecosystem services including carbon sinks.
National Mission for Sustainable Agriculture	Devise strategies to make Indian agriculture more resilient to climate change
National Mission on Strategic Knowledge for Climate Change	Enhance the understanding of challenges of and response to climate change

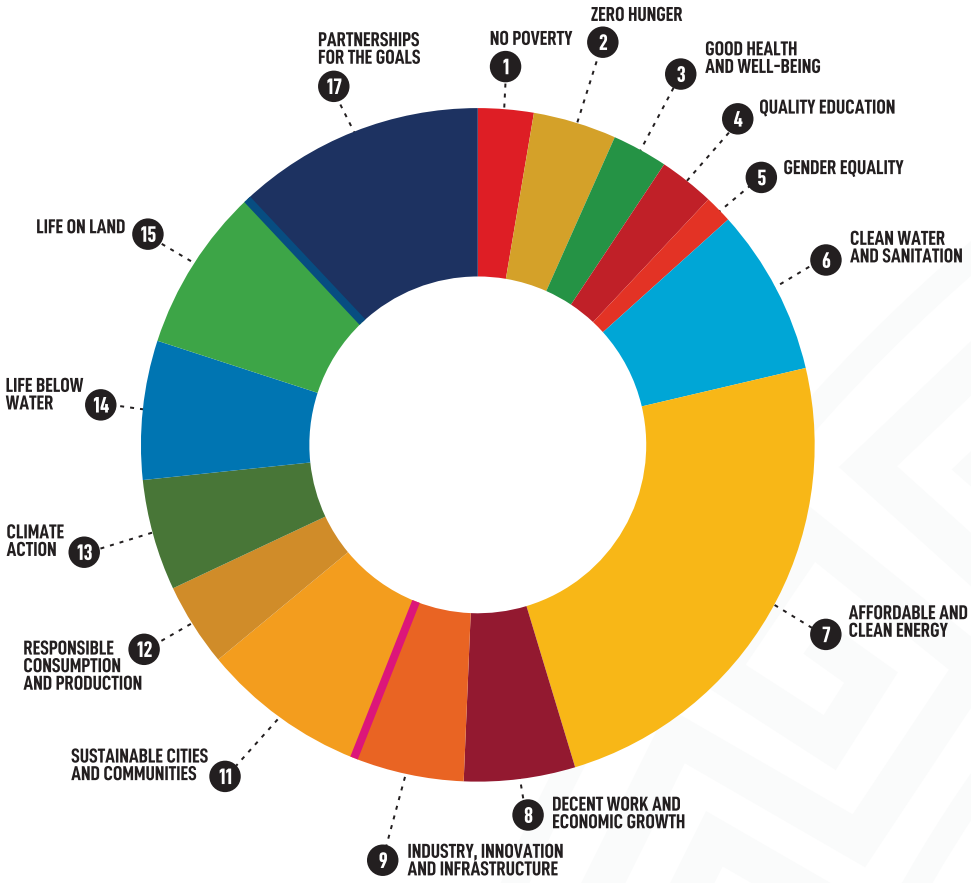
A refinement of India's national mitigation and adaptation goals is provided by the mentioned Nationally Determined Contribution submitted to the UNFCCC. The NDC, initially formulated as the "Intended Nationally Determined Contribution" (INDC) in 2015, sets out eight different goals for the post-2020 period, three of which are quantitative. These goals are listed in Table 1.2, along with an indication of missions formulated in the NAPCC that are relevant to different goals.

» Table 1.2 : India's NDC Goals

#	NDC Goal	Quantitative/ Qualitative	Relevant NAPCC missions
1.	To put forward and propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	Qualitative	All
2.	To put forward and propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	Qualitative	All
3.	To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.	Quantitative	• National Solar Mission • National Mission for Enhanced Energy Efficiency • National Mission on Sustainable Habitat • National Mission for a Green India
4.	To achieve about 40% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance, including from Green Climate Fund (GCF).	Quantitative	• National Solar Mission
5.	To create an additional carbon sink of 2.5 to 3 billion MT of CO equivalent through additional forest and tree cover by 2030.	Quantitative	• National Mission for a Green India • National Mission for Sustainable Agriculture
6.	To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.	Qualitative	• National Mission for Sustainable Agriculture • National Water Mission • National Mission for Sustaining the Himalayan Ecosystem
7.	To mobilize domestic & new and additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.	Qualitative	

Moreover, the NDC goals are strongly linked to the other international agreements and goals, in particular the Sustainable Development Goals (SDGs). This is illustrated in Figure 1.2, which shows the number of actions of relevance to a particular SDG in the Indian NDC.

Figure 1.2 : SDG-NDC Linkages for India's First NDC



Note: The size of the coloured bar indicate the number of actions of relevance to a particular SDG that are mentioned in India's NDC, with bigger bars meaning more mentions.[3]

Table 1.3 : Himachal Pradesh's SAPCC 1.0 State Missions and their alignment with National Missions

State Missions	Alignment with National Mission
State Mission for Ecosystem, Biodiversity and Livelihood Sustainability	National Mission for Sustaining the Himalayan Ecosystem Biodiversity Action Plan
State Mission for Water Resources	National Water Mission
State Mission for Sustainable Agriculture Practices	National Mission for Sustainable Agriculture
State Mission for Health	National Health Mission
State Mission for Forest Resources Conservation	Green India Mission
State Mission for Enhanced Energy Efficiency & Conservation	National Mission for Enhanced Energy Efficiency
State Mission for Urban Planning	National Mission on Sustainable Habitat
State Mission for Climate Change Strategic Knowledge and Information	National Mission on Strategic Knowledge for Climate Change

Reference

3. https://klimalog.die-gdi.de/ndc-sdg/country/IND

By extending the Indian NDC to the state-level, the SAPCC is of utmost relevance to implementation of SDGs.

Figure 1.3 shows results of an analysis of the linkages between proposed SAPCC1.0 actions with the 17 SDGs, plotted against the NDC contribution to the SDGs depicted in Figure 1.2.

Figure 1.3 : SDG-NDC-SAPCC Linkages

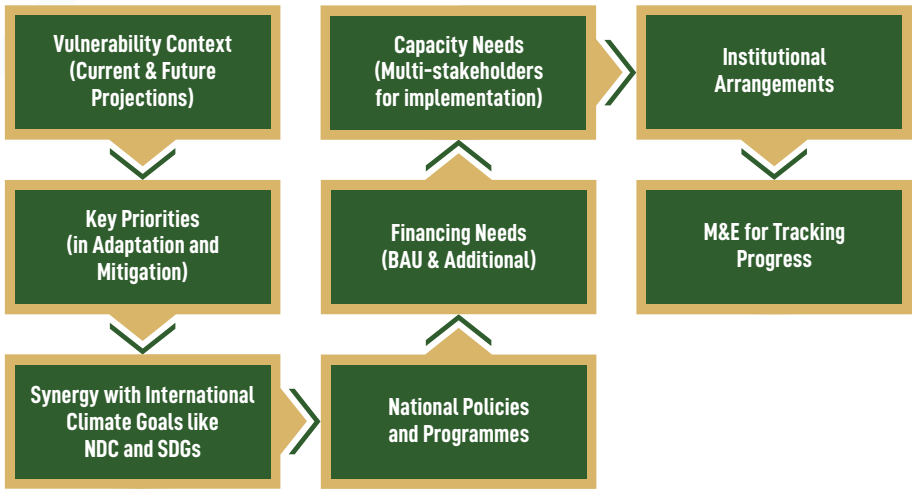
1.2 OBJECTIVE

Considering the evolving context of climate science, policy and actions, the State Action Plan on Climate Change needs to be revised and strengthened. Therefore, the objective of this document is to identify and prioritise mitigation and adaptation strategies in the light of such developments, and to refine the region specific action plan and strategies. More specifically, the SAPCC 2.0 aims to increase the level of ambition, accurateness, specificity and practicability of mitigation and adaptation actions contained, to facilitate progress from planning to action. In order to achieve this, the document at hand (a) takes stock of the implementation of the SAPCC 1.0, to derive conclusions on success factors and challenges to mitigation and adaptation planning in Himachal Pradesh (b) updates forward-looking plans, strategies and actions for ambitious and workable mitigation & adaptation actions, and strategies.

1.3 APPROACH & METHODOLOGY

Himachal Pradesh SAPCC 2.0 builds upon the developments at the national level, various policies & programmes and the national & international commitments made by India on issues related to climate change adaptation and mitigation. The steps taken for HP SAPCC 2.0 are outlined in Figure 1.4.

Figure 1.4 : Approach and Methodology



The detailed methodology used for each of the above steps is explained in the subsequent chapters of this document.

The steps taken for HP SAPCC 2.0 are outlined below. Vulnerability assessment is done as it provides current and future projections, and their impact. Key priorities have been outlined both in adaptation as well as mitigation sectors. Synergy has been established with the International climate goals like NDC and SDG. Capacity development needs have been identified for proper implementation through multi stakeholder consultations. A Business As Usual (BAU) scenario and additional scenarios have been examined for ascertaining financing needs. State adaptation and mitigation strategies for each sector have been kept in line with national policies and programmes. Chapter on monitoring and evaluation shall help to track the progress of the State in coping with climate change. Institutional arrangements have been put in place so that the responsibility for various missions shall rest under individual departments. Each individual department shall then strive to attain all listed objectives within stipulated time-frames and ensure their vertical integration with the National Mission/ Objectives of the NAPCC.

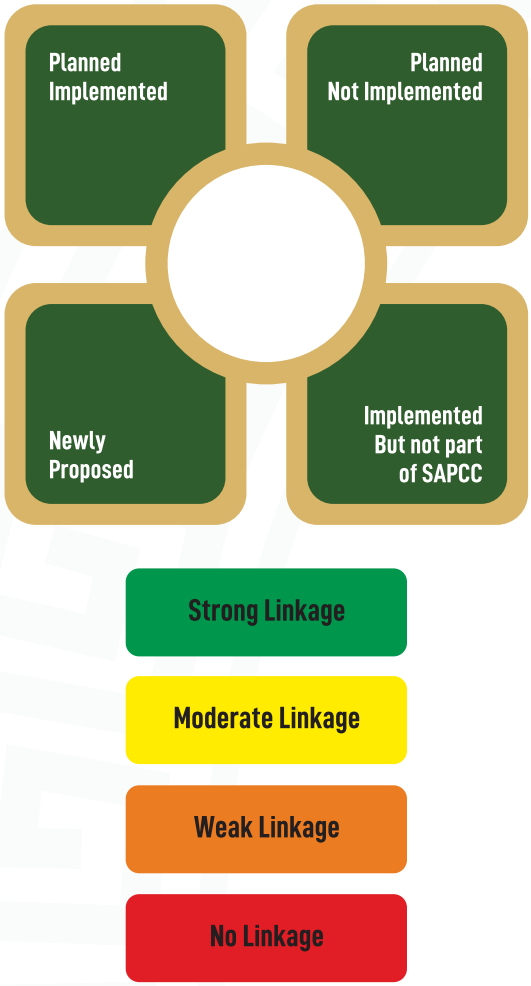
The State specific achievements in the implementation of SAPCC 2012 have been determined from the physical and financial achievements of proposed activities and their alignment with National Missions, NDC and SDGs.

Figure 1.5 : Measuring State's Commitments

A multi-dimensional stock taking method is adopted and the dimensions for the activities are as follows:

1. The activities that were planned by the state nodal departments and implemented properly.
2. The activities that were planned by the state nodal departments but could not be implemented on ground.
3. The activities that are already carried out by the state nodal departments but were not a part of SAPCC 1.0.
4. The activities that are newly proposed by the state nodal departments.

Figure 1.6 : Activity Analysis



The linkages established could be Strong, Moderate, Weak or NIL depending on the extent to which the proposed activities can be linked with NDC, or SDGs, or both.

The following criteria has been used to prioritize the different activities:

- **High Priority Activities:** Activities having strong linkage with NDC and SDGs with low barriers for implementation.
- **Medium Priority Activities:** Activities having linkages with either NDC or SDGs with medium barriers for implementation.
- **Low Priority Activities:** Activities having weak linkages with either NDC or SDGs with high barriers for implementation.
- For investment purposes, High priority and implemented activities will have a weight age of 50%.
- Medium priority and implemented activities will have a weight age of 30%.
- Activities planned with a budget provision but not yet implemented will have a weightage of 20%.

Using this approach and referring to the climate policy context just introduced in this chapter, this document aims to achieve its two fold purpose by way of its contents being organized under distinct chapters briefly described as under:

Chapter 2 introduces the state profile, circumstances, resource endowments and most important, the economic and societal sectors using the latest scientific assessments,

Chapter 3 presents Himachal Pradesh's climate profile, including historical conditions, observed trends and projected climatic changes.

Chapter 4 uses this sectoral and climate information to conduct a vulnerability assessment for the state of Himachal Pradesh, which through comparison with pre-SAPCC 1.0 baseline vulnerability serves as a stocktaking exercise, and through identification of vulnerability hotspots serves as an input to adaptation planning and prioritization. It also presents key observed and projected sectoral impacts.

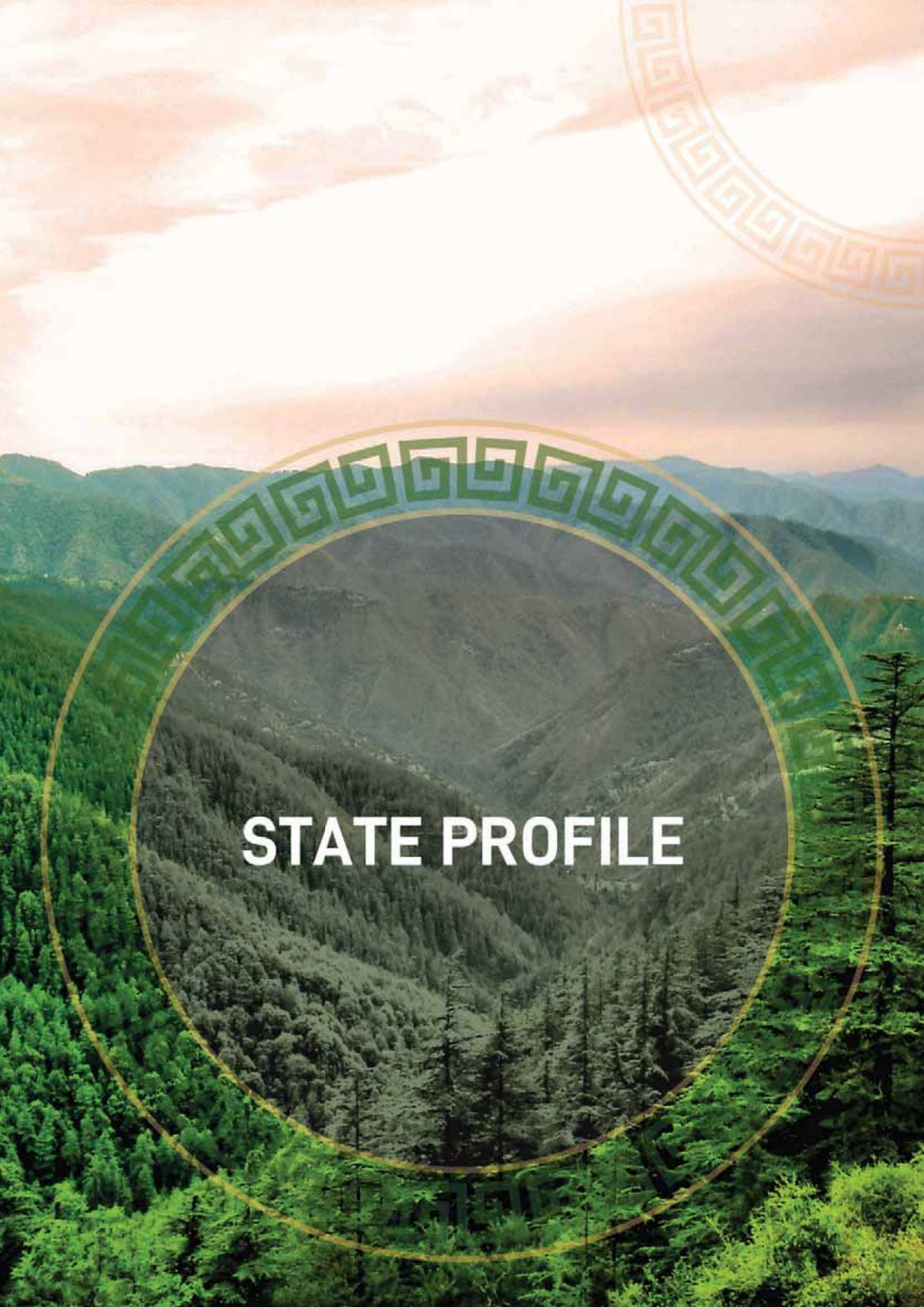
Chapter 5 details both (a) stocktaking and (b) adaptation planning (i) by comprehensively assessing progress towards state targets set out in the SAPCC 1.0 and barriers related to their achievement, and (ii) by identifying forward-looking adaptation strategies for the identified key sectors and areas (forests and biodiversity; agriculture; water; knowledge creation and dissemination; public health).

Chapter 6 repeats these steps for key mitigation areas, namely energy efficiency and renewable energy and urban planning, sustainable habitat sector.

Chapter 7 prioritizes out the identified adaptation and mitigation strategies that are implementable over the SAPCC 2.0 period with given resource limitations, using a set of diverse stakeholder-agreed multi-criteria analysis for ranking of adaptation and mitigation options. Beyond taking stock of financial resources spent on SAPCC 1.0 implementation it also sets out how the prioritized measures shall be funded.

Chapter 8 details the institutional mechanisms involved in the implementation of the SAPCC 2.0.

Chapter 9 concludes by identifying the framework to be followed for monitoring and evaluating the implementation of the plan.



STATE PROFILE

2 STATE PROFILE

2.1 LOCATION, GEOGRAPHY & SIZE

Lying between latitude 30°22'40'' N to 33°12'40'' N and longitude 75°45'55'' E to 79°04'20'' E. Himachal Pradesh is one of 36 States and UTs of India. It is a mountainous state covering an area of 55,673 sq. km. with altitude ranging from 350 meters to 6,975 meters above the mean sea level. Physiographically, the State is divided into five zones (i) Wet sub temperate zone (ii) Humid sub-temperate zone (iii) Dry temperate alpine high lands (iv) Humid sub-tropical zone (v) Sub-humid sub-tropical zone.

2.2 DEMOGRAPHIC PROFILE

As per Census of India (2011), the population of the state was 68,64,602 with a population density of 123 per sq. km. The state has observed a reduction in decadal population growth rate of 12.94% (2001-11) from 17.53% (1991-2001) even though the density of population per sq. km has increased from 109 (2001) to 123 (2011). Out of the total population of 68.64 lakh, 25.19% belongs to Scheduled Caste communities and 5.71% to Scheduled Tribe communities.

Both the communities have a high dependency on natural resources and are as a result, highly vulnerable to climate change. The sex ratio of the state has shown a slight improvement from 968 females per 1000 males in 2001 to 972 females per 1000 males in 2011.

The overall literacy rate has increased from 76.48% in 2001 to 82.8% in 2011. Among males, the literacy rate has increased from 85.35% in 2001 to 89.53% in 2011 whereas in case of females it has made an even more significant jump, from 67.42% in 2001 to 75.93% in 2011. The state has twelve administrative districts including Bilaspur, Chamba, Hamirpur, Kangra, Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur, Solan and Una.

The City of Shimla is the capital of Himachal Pradesh. In terms of area, Hamirpur is the smallest district of state covering an area of 1,118 sq. km. (2.01% of total land area) while Lahaul & Spiti is the largest district spread across 13,835 sq. km. (24.85%). The demographic profile of the state is summarised in Table 2.1 below:

» Table 2.1 : Demographic Profile of Himachal

Particulars	Himachal Pradesh		India	
	2001	2011	2001	2011
Population (in Lakh)	60.77	68.64	10,287.38	12,101.93
Population Decadal Growth Rate (%)		12.81	17.60	21.50
Population Density (person per sq km)	109	123	324	382
% of SC Population	24.72	25.19	-	8.63
Sex Ratio (Per 1000 Males)	968	972	933	943
Literacy Rate (%)	76.5	82.8	64.83	74.04
Male Literacy Rate (%)	85.30	89.53	75.26	82.14
Female Literacy Rate	67.40	75.93	53.67	65.46

Source: Census of India 2001 and 2011

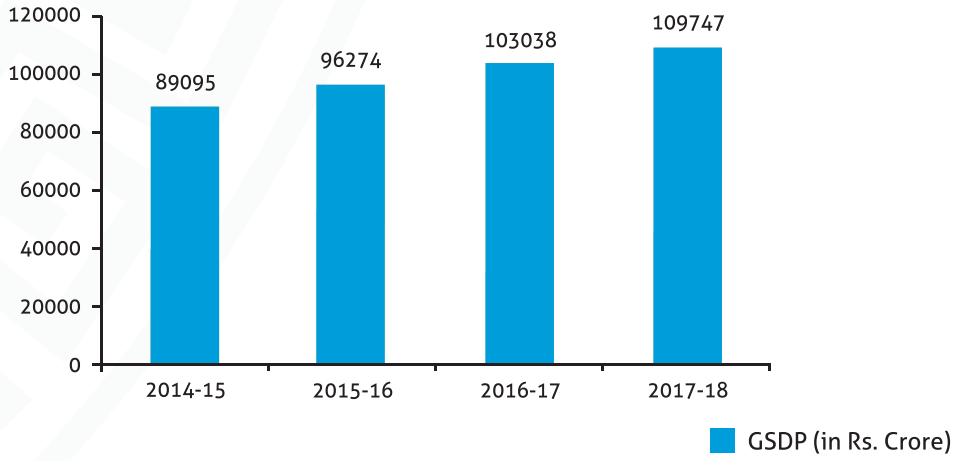
2.3 ECONOMIC PROFILE

Himachal Pradesh is one of the fastest-growing states in India. As per Economic Survey of Himachal Pradesh, the Gross State Domestic Product (GSDP) at current prices, is estimated at 1,36,542 crore in 2017-18 as against 1,25,122 crore in 2016-17 showing an increase of 9.1 percent during the year.

The economy has shown a shift from agriculture sector to industries and services as the percentage contribution of agriculture and allied sectors in total State Domestic Product has declined from 57.9 percent in 1950-51 to 55.5 percent in 1967-68, 26.5 percent in 1990-91 and to 8.8 percent in 2017-18.

The share of industries and services sectors respectively has increased from 1.1 & 5.9 percent in 1950-51 to 5.6 and 12.4 percent in 1967-68, 9.4 & 19.8 percent in 1990-91 and to 29.2 and 43.3 percent in 2017-18. The declining share of agriculture sector does not, however, affect the importance of this sector in the State economy as the state's economic growth still is being determined by the trends in agriculture and horticulture production. It is the major contributor to the total domestic product and has overall impact on other sectors via input linkages, employment and trade etc. Due to lack of irrigation facilities agricultural production in Himachal Pradesh to a large extent still depends on timely rainfall and weather conditions.

Figure 2.1 : GSDP of Himachal Pradesh at current price from 2014-18



2.4 SECTORAL HIGHLIGHTS

2.4.1 Forest & Biodiversity

The forests of Himachal Pradesh have been classified into Coniferous Forests and Broad-leaved Forests. Forests at lower altitudes have Dry Scrub Forests while higher altitudes have Alpine pastures.

Several vegetation zones are found between these categorized forests. These zones include Mixed Deciduous Forest, Chil, Oak, Deodar, Kail, Fir and Spruce. The forest profile of the state is summarised in Table 2.2.

Table 2.2 : Himachal Pradesh- Forest Wealth

Total Forest Cover	15,433.52 Km²
Percentage of state area under forest	27.72 %
Area under VDF (Very Dense Forest)	3112.71 Km²
Area under MDF (Moderately Dense Forest)	7125.93 Km²
Area under OF (Open Forest)	5194.88 Km²
Scrub	315.28 Km²
Total Protected area in the state	33,130 Km²
Reserved Forests	1898 Km²
Total tree cover	829 Km²
Total carbon stock in forests	The total Carbon stock of forests in the State including the TOF patches which are more than 1 ha in size is 252.36 million tonnes (925.32 million tonnes of CO2 equivalent) which is 3.54% of total forest carbon of the country.
Extent of water bodies within forests	124 Km²
Altitudinal Strata of forest	35 species of forest in: Shiwalik Hills Middle Himalayas Himadri Range of Himalayas
Species diversity of state	3,295 plant species with 3120 species of angiosperms, 13 species of gymnosperms and 125 pteridophytes (mainly ferns) and 38 species of orchids. 5721 species of Fauna with 77 mammals, 447 birds, 44 amphibians, 83 fishes, 4543 arthropods and 412 other species (Source: Biodiversity Status and Initiatives in H.P.)
Key Issues and Challenges	• Village forest institutions yet to be mature enough to develop effective leadership and become independent fully-functional entities • Forest conservation and management not adequately supported • Land use policy regarding forest land is absent, Bureaucratic controls yet to yield to a participatory way of management of forests. (Source: Himachal Pradesh Forest Sector Overview Main Report)

2.4.2 Agriculture & Allied Sector

Agriculture is the mainstay of the economy of the state providing direct employment to about 71% of its total population. Agriculture and its allied sectors contribute about 10% of the total GSDP of the state. Animal husbandry and fisheries are important sources of income for rural population. Major Kharif season crops are Maize and Paddy along with other minor crops like Ragi, Millets and Pulses. Wheat is the major Rabi crop. Agricultural profile of the state is summarised in Table 2.3.

Table 2.3 : Himachal Pradesh - Agriculture Sector Overview

Agro Climatic Zones	• Shivalik Hills • Mid Hills • High Hills • Cold Dry Zone
Soil Profile	• Texture: Loam to Clay loam • Acidity: 5.4 to 5.7 (moderate to strongly acidic) • Organic Carbon content: 1 to 3% (medium to high)
Gross Cropped Area	9,86,338 Ha.
Net Sown Area	5,60,154 Ha.
Cropping Intensity	4,26,184 Ha.
Net Irrigated Area	1,12,749 Ha. (as in 2011-12)
Percentage area under irrigation	18-20%
Rainfed Area 80%	80%
Total food-grain production	75,201 MT (2016-17)
Whether food surplus or deficient	Surplus
Crops grown in state	Rice, Maize, Wheat, Barley, Pulses, Chillies, Ginger, Oil seeds
Major Crops	Wheat and Maize
Area under Wheat and Maize	Wheat: 318874 ha. (2017-18) Maize: 280811 ha. (2017-18)
Yield of Wheat and Maize	Wheat: 1.77 Kg/ha Maize: 2.53 Kg/ha
Horticulture crops grown in state	Fruits (Apple, Plum, Peach, Apricot, Pear, Cherry, G almond, Persimon, Olive, Kiwi, Strawberry, Almond, Walnut, Citrus, Mango, Litchi, Papaya, Loquat, Aonala, Grapes, Pomegranate etc.) Vegetables (Cauliflower, Cabbage, Tomato, Bell peppers, Broccoli, Mustard, Spinach, Radish etc.), Spices (Ginger, Turmeric, Chili etc.), Medicinal plants: Acacia catechu, Ajuga paviflora cedru dodara etc.
Key Issues and Challenges	• Changing agricultural landscape due to extreme climatic events. • Lack of modern irrigation systems and inadequate supporting agri-infrastructure. • Missing regional perspective in macro-level policies; policy focus in mountainous areas on resource extraction, revenue maximization. • Lack of marketing channels for marketable surplus from agriculture and horticulture sectors. • Lack of adequate training on climate resilient technology and practices in the sector. • Low income of farmers due to inadequate irrigation facilities.

Source: Himachal Pradesh Agricultural Statistics

2.4.3 Health Sector

State's Directorate of Health Services (DHS) is entrusted with provision of Community Health Services through its network of 90 Community Health Centres, 576 Primary Health Centres and 2085 Sub Centres. The major part of Himachal Pradesh is hilly and mountainous with few small inter-mountain valleys covering about 15% of the area. The status of health infrastructure has improved in past few years.

There are 21 hospitals per million population in Himachal Pradesh with beds per 100,000 population being 124, which is one of the best in the country.[1] (Availability of health services in Himachal Pradesh, 1 Suman, 2 Smita Bhutani; International Journal of Advanced Research and Development Volume 2; Issue 6; November 2017; Page No. 231-238). An overview of state's health sector is summarised in Table 2.4.

Table 2.4 : Himachal Pradesh - Health Sector Overview

	2011	2016
Birth Rate	16.5	16.0
Death Rate	6.7	6.8
IMR	38	25
Total Fertility Rate		17
Cases of Malaria	141 in 2013	106
Institutional Births (%)		76.4
Total reported live births	18281	0.976
Still Birth Rate	10	
Neonatal Mortality Rate	28	
Early Neonatal Mortality Rate	23	
Late Neonatal Mortality Rate	5	
Post NeoNatal Mortality Rate	9	
Under five Mortality Rate	46	
Key Issues and Challenges	• Propagation of vector borne disease (such as malaria, dengue, Japanese encephalitis etc) increased due to heat, drought, flooding and heavy storms, enhanced mass migration of climate change victims. • Scarcity of water leading to consumption of contaminated water which in turn is responsible for increased incidence of Hepatitis A and E in the state. • Increase in malnutrition due to the failure of food disease and injury due to extreme weather events. Low productivity can furthermore lead to economic loss.	

2.4.4 Water Resources

Water resources in the state of Himachal Pradesh are primarily in form of glaciers and rivers. Total live water storage in northern states is 18.01 BCM while the available storage is 20% of the capacity of the reservoirs.[2] Glaciers and glacial lakes are source of north Indian rivers in critical summer months. The trends of rising temperatures and glacier melting in Himalayan ranges are beginning to show their effects on water availability, biodiversity, ecosystem boundary shifts and global feedbacks. Major river systems of the state are Satluj, Beas, Ravi, Yamuna and Chenab. These rivers receive water from 800 glaciers in the Himalayas covering an area of 3124.713 Km². All five river basins cover 55,000 sq. km. of area with catchment area of 53,311 sq. km. The water resources profile of Himachal Pradesh is summarised in Table 2.5.

References
1. Availability of Health Services in Himachal Pradesh
2. Ministry of Water Resources, GoI

Table 2.5 : Himachal Pradesh - Water Resources

Annual Average Rainfall, 2019	1182.2 mm
Annual Avg. Rainfall in 2011	1169.37 mm
Annual Avg. Rainfall in 2016	1026.88 mm
No. of Ground water Monitoring Stations	128
Projected Mean Annual Rainfall	Decrease by 6.8%
Projected Rainfall	Increase by 17.25%
Two major drainage systems	Indus and Ganga Basin
Net Annual Ground Water Availability	0.46 BCM
Annual Ground Water Draft	0.39 BCM
Stage of Ground Water Development	86.37%
Artificial Recharge to Ground Water (AR)	Quantity of surplus surface water to be recharged: 149 MCM Feasible AR structures: 1000 sub surface dykes, 500 check dams, 300 revival ponds, 500 revival of springs, 2000 RTRWH in urban areas
Annual Replenishable ground water resource	0.51 BCM
Key Issues and Challenges	• Huge leakages in supply and distribution systems in several cities of the state. • Contamination of drinking water a major issue.; • Poor Groundwater management legislation . • Water Users Associations cover only 15% of command area for observations and maintenance in the field.

Source: Statistical Abstract Himachal Pradesh, 2010-11, 2015-16, 2018-19 for Rainfall and Ground Water Yearbook, 2018-19.

2.4.5 Energy Sector

Himachal Pradesh's geographical settings is quite suitable for hydro power generation accounting for 25.9% of India's total hydropower potential. The major potential lies in river basins like Satluj, Beas, Chenab and Ravi. The power delivered in the state is entirely metered. Per capita electricity consumption in Himachal Pradesh was 1339 kWh (during year 2015-16) in comparison to the national average of 1,075 kWh. The energy sector scenario of the state is summarised in Table 2.6.

Table 2.6 : Himachal Pradesh - Energy Scenario

State's share from Hydropower Potential	25.9%
Per Capita electricity Consumption[3]	1339 kWh
Energy Intensity	0.053
Per Capita sales of Petroleum Products (kg)	104.4
Household Electrification Status as of Sept 2018[4]	98.9%
LPG Sales figures[5]	75 (Unit)
AT & C losses	11.29%
Rural Firewood Consumption	240,000 MT/Month (IFMR)
Unmet Peak Demand in 2017-18	0
Grid connected Solar Power	14.15 MW
Number of Activities Proposed under Solar Mission of SAPCC	22

References

3. https://knoema.com/atlas/India/Himachal-Pradesh/Consumption-ofelectricity-per-capita
4. Saubhagya Dashboard
5. LPG Profile, Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas

Number of Activities Initiated	15
Key Issues and Challenges	• Lack of institutional capacity and human resources with the state departments. • Lack of mandates for commercial building. • Yet to notify ECBC, implement street lighting and municipal energy efficiency programme • Poor regulatory enforcement • Low capacity of existing T&D network and intra-state power trading.

Source: Central Electricity Authority, Ministry of Power

2.4.6 Urban Sector

Himachal Pradesh is a predominantly rural economy. It is the least urbanized state of the country with only 1.45% growth recorded in urban population between 2001 to 2011. One of the reasons behind this low urbanisation figure is because habitations in the state are not able to fulfil urban classificaton criterion. With the changing climatic conditions, the state has observed rapid changes in precipitation patterns, temperature patterns, number of extreme weather events and its hydrological cycle. The rise in temperature can magnify environment-related diseases especially vector -borne diseases that are also directly linked to status of sanitation facilities. Also, a warmer climate may lead to droughts which have a trigger effect on outbound migration. The urban sector profile of the state is summarised in Table 2.7.

» Table 2.7 : Himachal Pradesh - Urban Development

Total Population	68,64,602
Urban Population	6,88,552
Urban Male Population	371,528
Urban Female Population	317,024
Urban Population Growth Rate	15.61%
Urban Sex Ratio	853
Urban Literate Population	568,000
Urban Literacy	91.10%
Male Literacy Rate	89.53%
Female Literacy Rate	75.93%
Total individual household (urban) latrine application[6]	1584 (till 2018)
Total IHHL[7]	1,72,536
No. of Cities practicing Solid Waste Management[8]	39 locations in 2 cities
Key Issues and Challenges	• Infrastructure for solid waste management is inadequate. • State needs extensive capacity building for water resources and drainage management. • Absence of effective sewage management systems. • Unplanned, haphazard and unauthorized constructions, land degradation and mixed land use need attention • High pressure on limited urban land available. • Inadequate and ineffective regulatory framework to control vehicular emissions. • Sub-optimal level of financial resources.

Source: Urban Census 2011 and Swachh Bharat Urban Dashboard

References

6, 7.and 8. Swachh Bharat Mission Urban Dashboard

2.5 CONTRIBUTION TO NDC IN TERMS OF KEY INDICATORS & POLICIES AND PRIORITIES

Himachal Pradesh accounts for 1.4% of the India's total geographical area and supports 0.57% of the total population of the country. Per capita GSDP for Himachal Pradesh was Rs. 105,376 in 2012 against national per capita GSDP of Rs. 73,750.[9] The state was home to 559 below poverty line persons per thousand in 2011-12 forming 8.06% (22.9% in 2004-05) of the total state population. State's economy is rapidly growing and the per capita GSDP is projected to be Rs. 342,010 by 2030 exceeding the national average. Energy demand of the state will increase to 5181.5 GWh by 2030. Emission intensity of the state GDP is expected to be below national average, considering a high share of hydro power in the state's energy mix in addition to other planned conservation measures.

» Table 2.8 : Key Indicators for the State in Line with INDC

Indicators	Unit	2011-2012	2030	Remark
GSDP at current prices[10]	In Rs Lakh	7271983	27388159	Holt Model
Population[11]	In '00	69010	80080	ARIMA lag 2
Urban population	In '00	6886	9241	
Per capita GSDP	In Rs	105376	342010	
Electricity demand[12]	In gWh	1005.6	5181.5	
The status of energy consumption and carbon sink as on 2017				
		Himachal Pradesh	**All India**	
Per capita energy Consumption[13]	In kWh	1333	1119.37	The energy intensity of the state is likely to be 2/3rd that of national average by 2030
Forest carbon sink[14]	In million tonnes	175.8 644.534 million tonnes of CO_2eqv 2.48% of India	7082.063 25991.171 CO_2eqv	By 2030 the forest carbon sink in the state will grow to 191.65 million tonnes

The secondary sector contributes 41% of the total state GSDP and employs 1.65% of the total workers. In contrast, the primary sector contributes just 19% to state GSDP and 63% workers are dependent on this sector for their employment. The major industries of the state include cement, hydropower, pharmaceuticals and food processing. Lately, the state has been observing erratic rainfall and rapid glacial melting which is likely to effect the hydro power industrial sector of the state. Also, there is an enhanced environmental concern towards the construction of large hydro power projects that may impact the bio-diversity of the fragile eco-system of the state. However, there is considerable scope of increasing the generation of energy from other renewable sources like solar, biomass and wind in Himachal Pradesh where production of energy from renewable sources (other than hydro) has remained virtually stagnant at 5.4 MW (as on April 2017). The conversion of street and domestic lighting load to LED and deployment of efficient city transportation systems has made a positive contribution to INDC.

References

9. World Bank estimate for India, 1 USD=INR 50 in 2012 price
10. Estimates of state domestic product of Himachal Pradesh (GSDP and Population figures based on series 2011-12 to 2016-17 https://himachalservices.nic.in/economics/pdf/GrossDomesticProduct2018.pdf
11. Population Census 2011 https://himachalservices.nic.in/economics/pdf/GrossDomesticProduct2018.pdf
12. Projected from the time series data presented by power ministry in 2017
13. Estimated based on CEA data 2017
14. FSI Report2017

2.5.1 Key development issues and policy triggers

Table 2.9 provides an overview of the state specific policies of key sectors that have contributed to the NDC.

Table 2.9 : State Specific Key sectors - Policies contributing to NDC

Key Policy Elements	State Performance
National Action Plan on Climate Change	The state has all eight missions aligned to NAPCC
State Action Plan on Climate Change	The state prepared and adopted comprehensive SAPCC which was duly endorsed by the State and submitted to MoEF&CC in 2012-13
Energy Policy	• H.P. Solar Power Policy-2016 • Himachal Pradesh Hydro Power Policy 2006 • Total inhabited villages (as per Census 2011) - 17882 • State has reported 100% villages as electrified • Deendayal Upadhyaya Gram JyotiYojana (DDUGJY) • Villages covered for providing access to rural households (No): 8570 • Electrification of BPL Households (Nos.): 15763 • 12 new projects launched under DDUGY Grid with scope of Intensive Electrification of 3803 villages out of which 27 villages (1%) has been achieved. • Saubhagya: Household Electrification Status 99.17% rural households and 99.7% urban households are electrified till date.
Agriculture Policy	The state has formulated its organic farming policy and brought changes in agriculture development scenario in order to provide sustainable livelihoods to the farming community through organic farming.
Urban Development Policy	State has adopted policy on Solid Waste Management (Urban) through Urban Development Department, as per Solid Waste Management Rules 2006.
Tourism policy	HP Sustainable Tourism Policy, 2013 aims at promotion of tourism based on the carrying capacity of the area and has provisions to regulate various aspects that have a detrimental effect on the environment.
Forest Policy	The Government of Himachal Pradesh has developed the Forest Sector Policy and Strategy, 2005 in consonance with Government of India policy guidelines and by making important amendments to the previous Himachal Pradesh Forest Policy of 1980.
Water Policy	Prepared and adopted the reviewed water policy in the state having focus on sustainable use of water resources.
Transport Policy	A new State Transport Policy envisages use of clean fuels dovetailed with strict enforcement of vehicular pollution control measures. Electric buses, e-rickshaws are being aggressively promoted in the state.
Industrial Policy	The State Govt. has reviewed and adopted the New Industrial Policy which provides incentives to industries for publically disclosing their pollution statistics.
Integrated Development of watersheds	To better manage land and water resources, communities are being directly engaged with the process of drawing up micro-watershed plans specific regions.

2.5.2 Performance under NDC-SDG in the last 5 years

Table 2.10 provides details of Himachal Pradesh's ranking in sectoral outcome indicators relevant to INDC and SDGs.

Table 2.10 : Rank of Himachal Pradesh in sectoral outcome indicators relevant to INDC and SDG

Sector		Unit	Year	HP	India	Rank	Year	HP	India	Rank
Energy	Capacity addition[15]	Mega Watt	2012-2013	3770	223344	16	2015-2016	4424	298060	16
	Electrification (village electrification)[16]	Perce-ntage	2011-2012	99.83	93.75	16	2014-2015	99.70	96.69	16
Forest	Enhancement of Forest Cover[17]		2013	14683	697898	18	2017	15100	708273	19
Urban	Slum population accommodation (year-wise house completed under PMAY-Gramin)[18]	No.	2013-2014	6	134728	20	2016-2017	3591	2549979	18
Health	Reduction in vector borne diseases (No. of Malaria cases)[19]	No.	2012	216	1067824	30	2017	95	842095	31
	Reduction in IMR[20]		2012	36	42	14	2016	25	34	17
Water	Area irrigated/ cultivable area (Gross Area Irrigated)[21]	000' Ha.	2010-2011	193	88933	18	2013-2014	200	95772	21
Agri-culture	Food grain production[22]	000 MT	2012-2013	3720.3	257134.6	22	2015-2016	1615	251566.3	20
	Horticulture area[23]	000 MT	2012-2013	2124.81	268847.45	19	2016-2017	2452.04	300642.95	20
	Livestock[24]	No.	2007	6027000	1178530000	20	2012	5948907	1241266621	21

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15. Niti Aayog State Statistics, Installed Capacity
16. Niti Aayog State Statistics, Village Electrification
17. FSI Report
18. PMAY Website
19. NHM
20. Niti Aayog State Statistics, IMR
21. RBI Handbook of Statistics on Indian States
22. RBI Handbook of Statistics on Indian States
23. http://agricoop.nic.in/statistics/horticulture
24. Livestock Census

2.5.3 State Performance on various Sustainable Development Goals

According to NITI Aayog's SDG India Index Baseline Report 2018, the performance of Himachal Pradesh on several SDG goals has been satisfactory as shown in the table below. With a composite score of 69, Himachal Pradesh is ranked high amongst all states. India's average composite score is 57.

SDG #	Sustainable Development Goal	State Score	Performance Category
1 NO POVERTY	No Poverty	60	Performer
2 ZERO HUNGER	Zero Hunger	58	Performer
3 GOOD HEALTH AND WELL-BEING	Good Health & Well Being	62	Performer
4 QUALITY EDUCATION	Quality Education	82	Front Runner
5 GENDER EQUALITY	Gender Equality	42	Aspirant
6 CLEAN WATER AND SANITATION	Clean Water & Sanitation	95	Front Runner
7 AFFORDABLE AND CLEAN ENERGY	Affordable & Clean Energy	62	Performer
8 DECENT WORK AND ECONOMIC GROWTH	Decent Work & Economic Growth	71	Front Runner
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	Industry Innovation & Infrastructure	43	Aspirant
10 REDUCED INEQUALITIES	Reduced Inequalities	98	Front Runner
11 SUSTAINABLE CITIES AND COMMUNITIES	Sustainable Cities & Communities	41	Aspirant
15 LIFE ON LAND	Life on Land	93	Front Runner
16 PEACE, JUSTICE AND STRONG INSTITUTIONS	Peace, Justice & Strong Institutions	91	Front Runner
	Composite Score	**69**	**Front Runner**

2.6 PERFORMANCE UNDER KEY NDC AREA

2.6.1 Adaptation Strategy

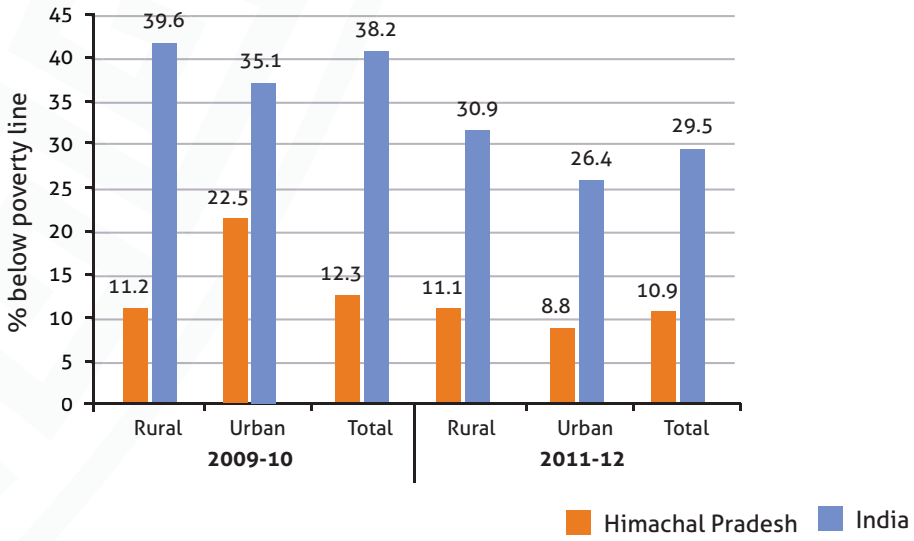
Himachal Pradesh has progressed very well under the various ongoing National Missions to improve livelihoods and simultaneously combat climate change in the state.

2.6.1.1 Sustainable Agriculture Mission

Food Security and Poverty: Ensuring Food Security and Livelihoods

Himachal Pradesh has emerged as one of the states with effective human development outcomes. Overall poverty in the state has decreased fourfold between 1993-94 and 2011. As a major chunk of the population of state resides in rural areas, rural poverty has declined from 36.8% in 1993-94 to 8.5% in 2011-12. This decrease has ensured food security and livelihood of social groups across rural and urban areas. The below poverty line population in the state is likely to reduce to 3.7% by 2030 in the business as usual scenario.

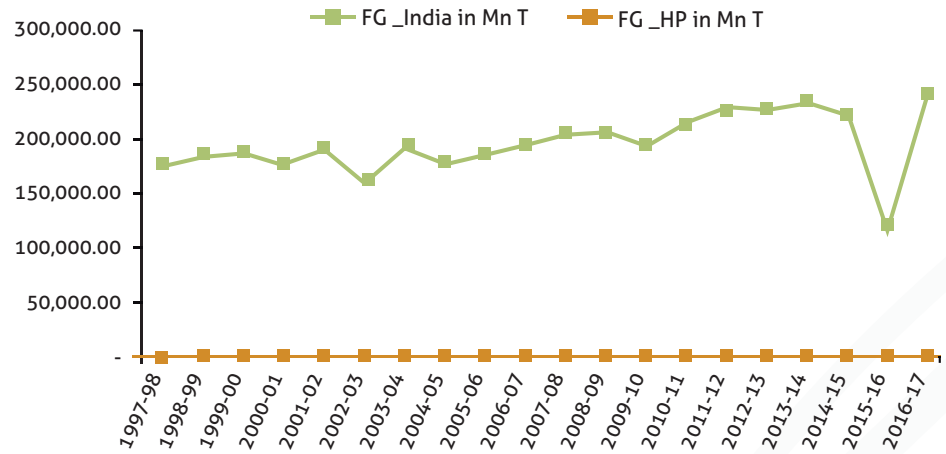
Figure 2.2 : Percentage of People Below Poverty Line



Source: Report of the expert group to review the methodology for measurement of poverty, GoI Planning Commission, June 2014

The total production of food grains in Himachal Pradesh has remained stagnant over the period 2011-12 to 2014-15. It amounts to a minuscule 0.7% of the total food grain production of the country. It is estimated that by the year 2030, food grain production in Himachal Pradesh could be 214,923 million tonnes. The food grain production of the state is expected to be around 1447 million tonnes, a decline from the longterm average. Current food grain production of the state has been showcased in Figure 2.3.

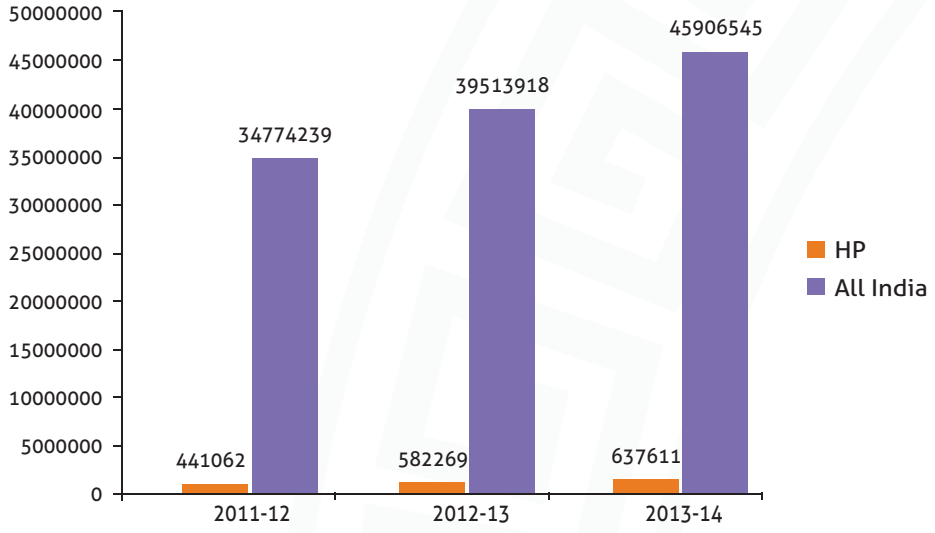
Figure 2.3 : Food Grain Production in Million Tonnes



Source: Agriculture Statistics of Himachal Pradesh

The production of horticultural crops in Himachal Pradesh has seen a steady increase in value terms as indicated by Figure 2.4

Figure 2.4 : Horticultural Crop Value in Rs. (Lakh)



Source: Agriculture Statistics of Himachal Pradesh

National Food Security Mission (NFSM), which is an important investment in improving the adaptive capacity of people in the vulnerable areas, is being implemented in the state. National Food Security Mission (NFSM) aims to increase the production of Rice, Wheat, and Pulses by expanding cropped area, enhancing productivity, restoring soil fertility and creation of employment opportunities. NFSM was launched in state from Rabi season of 2012 for two major components NFSM-Rice and NFSM-Wheat. The NFSM-Rice and NFSM-Wheat are currently operational in 3 and 9 districts of Himachal Pradesh respectively.

The trend in allocations under National Food Security Mission (NFSM) is summarised in Fig. 2.5 (a) & (b).

Figure 2.5 (a) : National Food Security Mission (NFSM) Progress - Himachal Pradesh

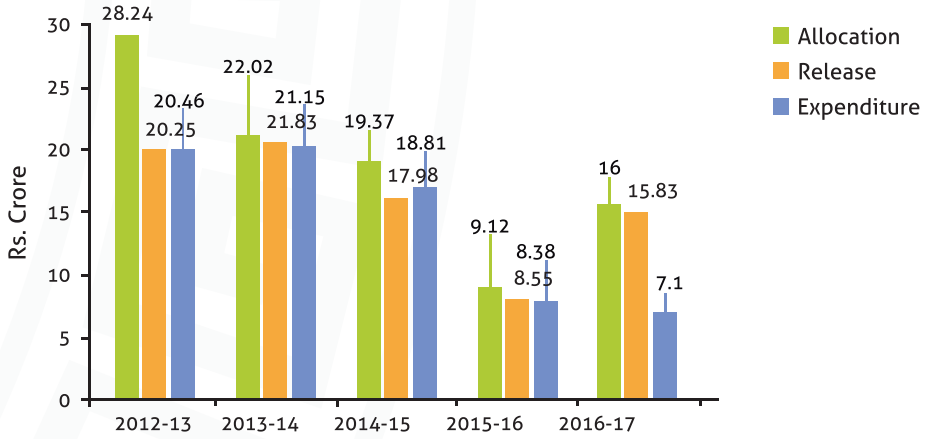
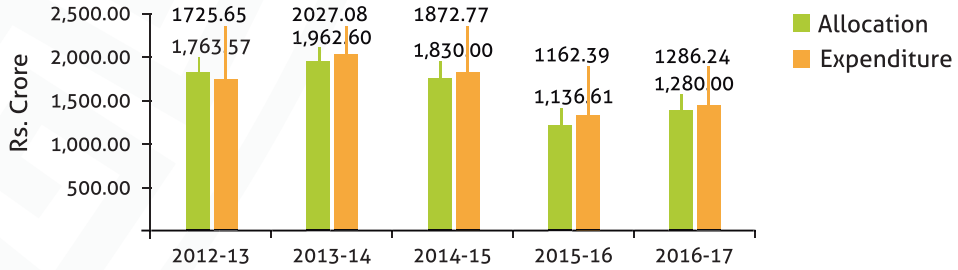
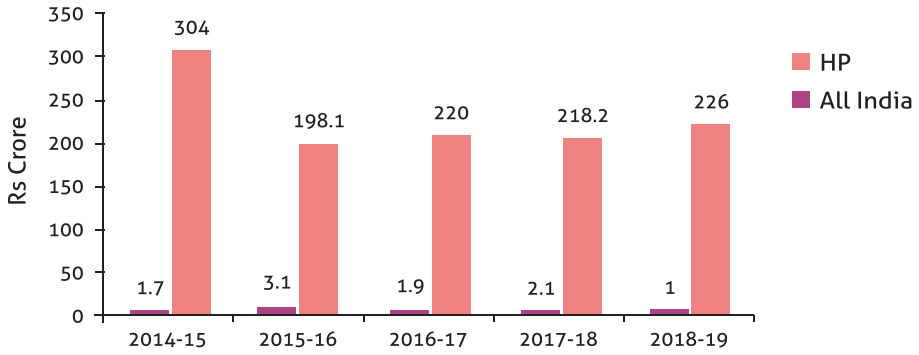


Figure 2.5 (b) : National Food Security Mission (NFSM) - India



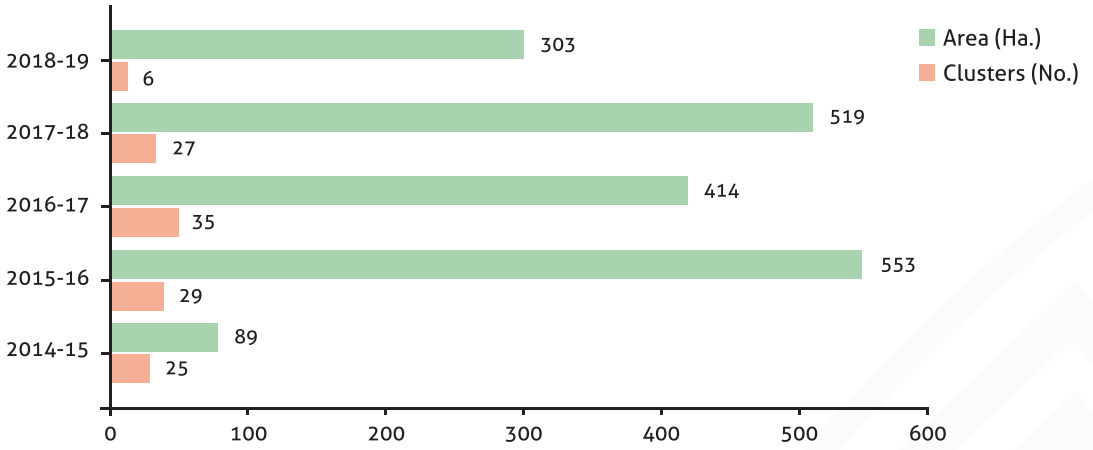
Rainfed Area Development (RAD) is a major component of the National Mission on Sustainable Agriculture (NMSA). Other smaller components are Soil Health Management Scheme, Issue of Soil Health cards and Agro-forestry. The financial allocations for all the components are given below in Figure 2.6.

Figure 2.6 : NMSA - Financial Allocations (Rainfed Area Development)



Source: National Mission on Sustainable Agriculture

Figure 2.7 : Physical progress under Rainfed Area Development Program



Source: National Mission on Sustainable Agriculture

Soil Health Management Scheme involving soil analysis and issue of soil quality health cards has made a steady progress in the state. The primary aim of the scheme is to avoid over usage of chemical fertilizers and appropriate dosage of micro-nutrients for maintenance of soil health throughout the state.

Figure 2.8 (a) : Soil Health Management in H.P. - Financial Allocations (Soil Analysis)

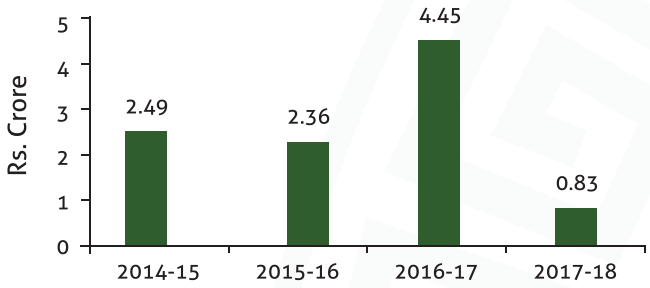
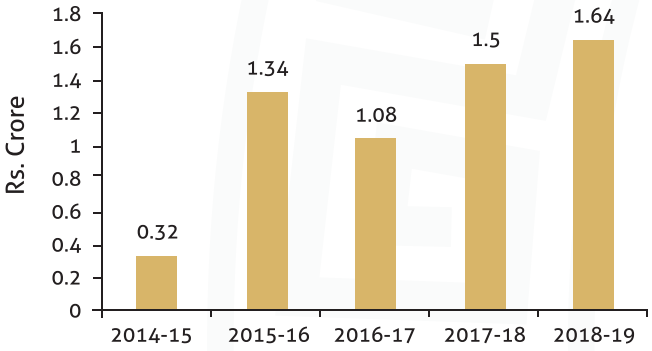


Figure 2.8 (b) : Soil Health Management in H.P. - Financial Allocations (Soil Health Card)



Source: Soil Health Card Scheme Progress Report

Soil Health Analysis is important for adaptive climate resilient agriculture in the state benefitting 1,167,054 farmers as also indicated on progress portal entries for Soil Health Card. Details for samples collected and tested for both cycles are also mentioned in table below:

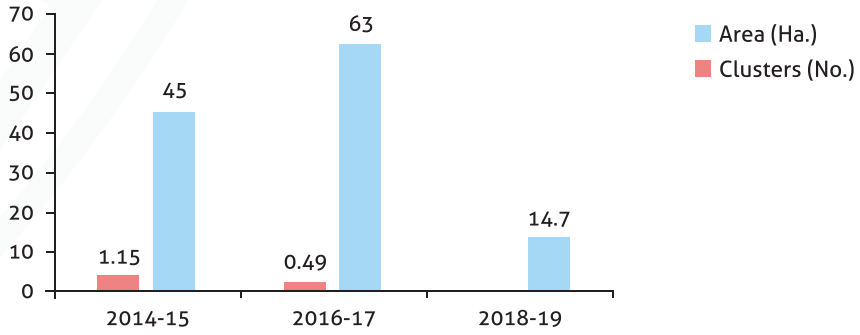
Table 2.11 : Status of Soil Health Card Scheme (2017-19)

State	Himachal Pradesh
Cumulative Target for Soil Samples Collection &Testing during Cycle-II (2017-18 & 2018-19)	100000
No. of Samples Collected (Cycle-II)	100000
Percent Progress of Soil Samples Collected (Cycle-II)	100.00
No. of Samples Tested (Cycle-II)	88400
Percent Progress of Soil Samples Tested (Cycle-II)	88.40
Cumulative Target for Printing & Distribution of SHCs for Cycle-II (2017-18 & 2018-19)	960765
No. of SHCs Printed (Cycle-II)	511834
Percent Progress of SHCs Printed (Cycle-II)	53.27
No. of SHCs Distributed (Cycle-II)	511834
Percent Progress of SHCs Distributed (Cycle-II)	53.27

Source: Soil Health Dashboard

Agro-forestry is also an important component of NMSA. Agro-forestry contributes towards carbon sequestration, soil health improvement and helps local agricultural crops to adapt to climate change. Allocations of funds under Agro-forestry component of NMSA is summarized in Figure 2.9.

Figure 2.9 : Physical progress under Rainfed Area Development Program



Source: National Mission on Sustainable Agriculture

Rashtriya Krishi Vikas Yojna (RKVY) aims at achieving holistic and sustained growth rate in the agriculture and allied sectors by focusing on increasing public investment in these sectors. It is a major contributor towards poverty reduction and enhancing food security in the state.

Table 2.12 : RKVY - Allocations and Expenditure

2010-11		2011-12		2012-13		2013-14		2014-15	
Total Approved Cost (in Crores)	Expenditure Incurred	Total Approved Cost (in Crores)	Expenditure Incurred	Total Approved Cost (in Crores)	Expenditure Incurred	Total Approved Cost (in Crores)	Expenditure Incurred	Total Approved Cost (in Crores)	Expenditure Incurred
74.2155	82.7195	57.7218	56.9784	65.1697	74.1828	162.6721	61.3102	85.3795	104.46

Source: Statement showing allocation release & expenditure of the state under RKVYfor different years

RKVY has strong adaptation linkages with NDC. NDC clearly outlines the appropriate climate adaptive farming systems and allied activities for income generation and value addition. RKVY also aims at soil health management, farmand management and promotion of indigenous farming techniques for resource conservation and water use efficiency. RKVY nests within itself many of the activities proposed under SAPCC. The State Government has increased allocations for these activities to improve the climate resilience.

2.6.1.2 Green India Mission (GIM) and Creation of Carbon Sink

Green India Mission has adopted a landscape management based approach for the implementation of activities on forest and non-forest lands. The criteria for identification of the landscapes also includes vulnerability of forests to climate change, status of forest cover, biodiversity, critical habitats, corridors, potential of area for carbon sink and socio economic criteria like poverty and ethnicity (tribal /non-tribal) etc. Green India mission has been converged with CAMPA and MGNREGA for better targeting. The allocations under this mission available to Himachal Pradesh during 2015-16 & 2016-17 are summarized in Table 2.13:

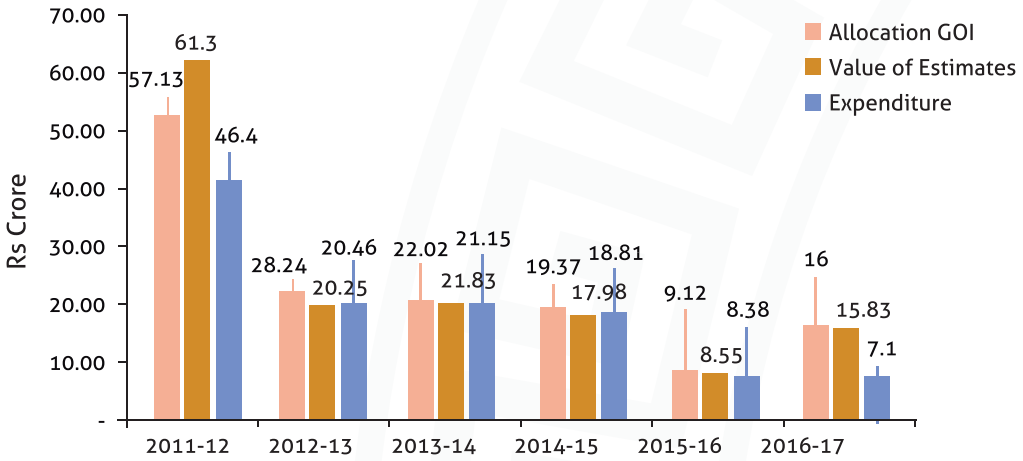
Table 2.13 : RKVY - Allocations and Expenditure

F.Y. 2015-16		F.Y. 2016-17	
Funds Allocated	Funds Utilized	Funds Allocated	Funds Utilized
7009.09	1432.77	3847.31	3176.51

Source: Green India Mission Fund Allocation & Utilization

In addition to funds available under Green India Mission, the state has also been receiving allocations under 'CAMPA' scheme of Govt. of India through the Ministry of Environment, Forests & Climate Change.

Figure 2.10 : CAMPA Progress Report, MoEF&CC



Source: Green India Mission Fund Allocation & Utilization

As per Forest Survey of India (FSI), Himachal Pradesh has added 393 km2 to its total forest area by targeting medium density, open and scrub forests of the state by conservation, afforestation and management strategies. The total carbon stock in the forests of Himachal Pradesh is estimated to be 175.782 MMT (equivalent to 644,534 MMT of CO2,) which is about 2.48% of the total forest carbon stock of the country.

2.6.1.3 National Water Mission

The objective of National Water Mission is conservation of water, waste minimization and ensuring equitable distribution within the state. In accordance with the National Water Policy, the mission aims to increase water use efficiency by 20%. Several schemes of central and state governments seek to achieve this goal. In 2013-14, Himachal Pradesh accounted for just 0.16% of total net irrigated area and 0.2% of total gross irrigated area of the country.[25] Year wise growth of Total Cropped Area and Net Irrigated Area is given in Table 2.14.

Table 2.14 : Net Area Sown, Total Cropped Area and Net Irrigated area in Himachal Pradesh

Year	Net Area Sown (Ha.)	Total Cropped Area (Ha.)	Net Irrigated Area by Source (Ha.)
2009-10	538412	940597	1,06,599
2010-11	543365	938625	1,09,940
2011-12	549964	931862	1,12,749

Source: Economic survey, 2016-17

As per Economic Survey 2016-17, net area sown in Himachal Pradesh is 10.5% of the total geographical area of the state. The irrigation potential of the state is 3.35 Lakh Ha. The Command Area Development (CAD) for 2,500 Ha. has been proposed for which a provision of Rs. 25 Cr. has been made. 31% of the physical target has been achieved till 2017. In order to bridge the gap in CAD activities, 29 major, medium and minor irrigation projects have been included under the programme by the state government. The micro irrigation activities under NMMI/PMKSY/NMSA has convered 1819.69 ha. area during 2014-17. There is still substantial scope for additional micro irrigation projects in the state to achieve water use efficiency goals. Himachal Pradesh has been identified as one of the states suffering from over exploitation of groundwater resources. (2011 assessment of CGWB).

MGNREGA AND CLIMATE BENEFITS (COMMUNITY BENEFIT SHARING)

Strengthening of livelihood generation programmes for rural poor and channeling their efforts towards creation of durable assets is the primary objective of the MGNREGA scheme. Works undertaken under the scheme are also important for climate change adaptation and vulnerability reduction.

Table 2.15 : Benefits under MGNREGA activities for reduction in vulnerability

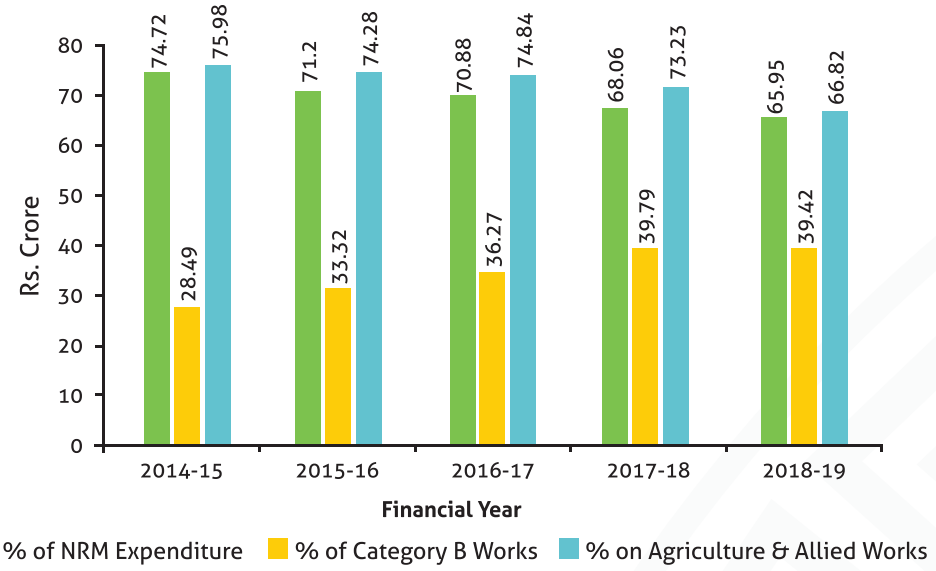
Key Activities	Key benefits helping in climate change adaptation and vulnerability reduction
Public works related to NRM activities	Watershed management promote water conservation, soil moisture conservation; Soil erosion control, Soil quality (nutrient cycling) Flood control (reduced risk), increased water use efficiency through micro and minor irrigation works, increased adaptive capacity through renovation of traditional water bodies
Community Assets or Individual Assets	Improved productivity of land, improvement of livelihood through horticulture, sericulture plantation and farm forestry
Agriculture and Allied works	Increased agricultural productivity
Overall	Wage employment and social protection for the poor

Expenditure of some of the major works undertaken in the state under the aegis of the MGNREGA scheme is given in Figure 2.11.

References

25. Statistical Year Book, India 2017, Ministry of Statistics & Programme Implementation

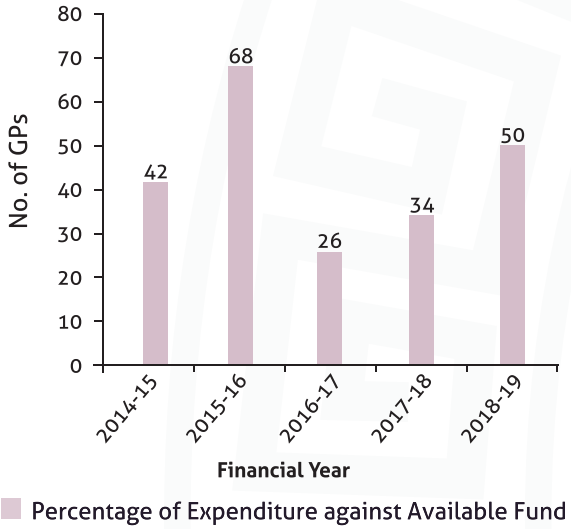
Figure 2.10 : Expenditure on major works taken up under MGNREGA from 2014-19



Source: MGNREGA Website

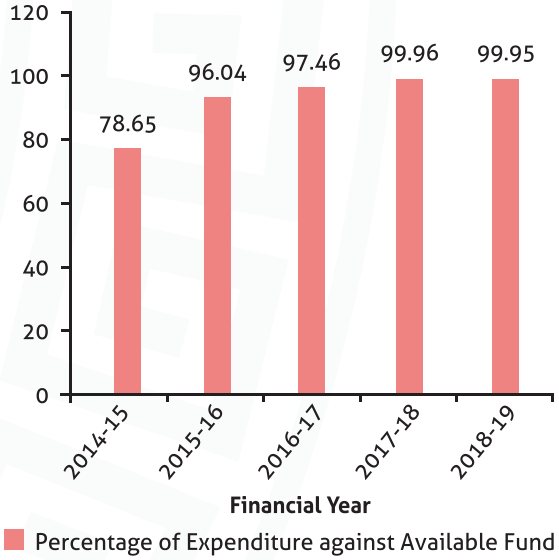
As per the available data regarding expenditure under NREGA over the years, the largest chunk of expenditure over the years has been captured by Agriculture and Allied sectors. The activities undertaken include common infrastructure like vermi-composting pits, community water holding tanks, etc., infrastructure for livestock, fisheries, etc. Second highest expenditure block is for water conservation activities, micro and major irrigation works, afforestation, plantation and land development. Significant funds have also been utilised for Category B works which include improving productivity of land through Farm Ponds, irrigation wells, irrigation channels etc.

Figure 2.11 : Number of GPs with Nil Expenditure



Source: MGNREGA Website

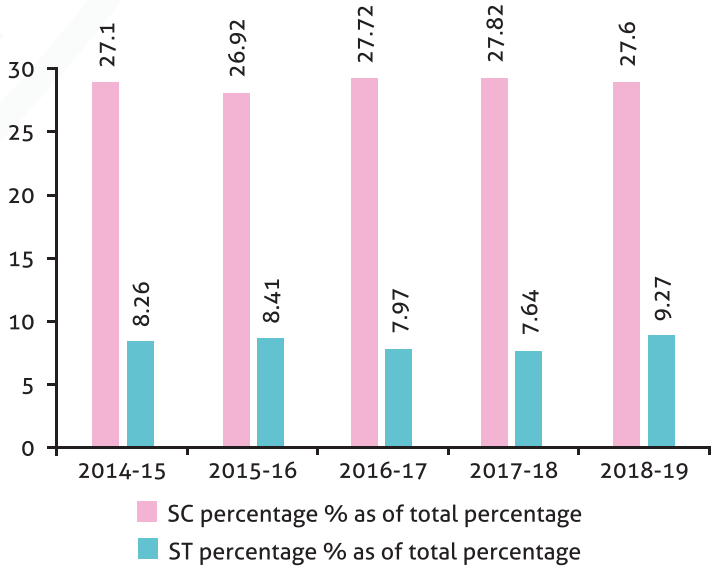
Figure 2.12 : Percentage of Expenditure against Available Fund



Source: MGNREGA Website

Himachal Pradesh has issued 12.34 lakh MGNREGA job cards covering 22.89 Lakh Workers out of which active job cards are 7.34 lakh covering population of 26.77 lakh active workers. MGNREGA activities make a significant contribution for vulnerable SC and ST communities. The proportion of workers from SC and ST communities in total active MGNREGA workers is 26.77% and 6.79% respectively as also summarised in Fig. 2.13.

Figure 2.13 : SC, ST participation in MGNREGA in Himachal Pradesh



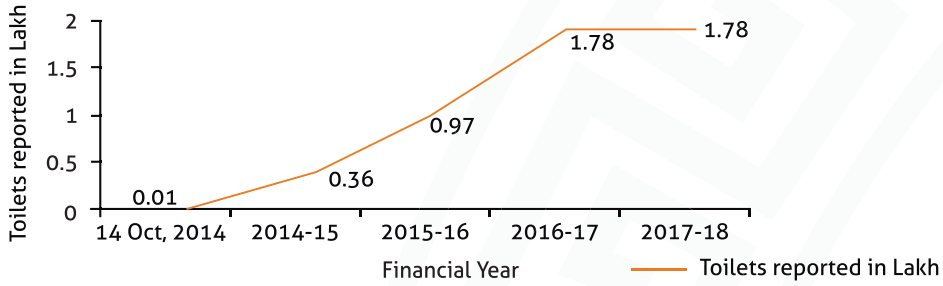
Source: MGNREGA Website

Given the fact that SC & ST populations have a traditionally high dependence on natural resources MGNREGA plays an important role in improving their adaptive capacity.

WATER AND SANITATION

Govt. of India has given a special thrust for improving the level of access to water and sanitation. The launching of **Swachchh Bharat Mission (SBM)** is a transformational step in this direction. SBM seeks to rid the country of the stigma of open defecation by encouraging communities, villages and cities to build and use toilets and contribute towards making their communities, villages and cities Open Defecation Free (ODF). Apart from its direct benefits SBM also has significant potential in reducing emissions, disease burden and create livelihood opportunities. Swachh Bharat Mission has accelerated the efforts to achieve improved standards of water availability and access to sanitation. Major components under the mission are IHHL (Household toilets), Community Toilets, Public toilets, Solid Waste Management, IEC & Public Awareness, and Capacity Building. Till 2018 1584 toilets have been constructed ULBs of state under SBM (Urban) achieving 14% of the target. In addition 872 Community and Public Toilets have also been built. Solid Waste Management projects has been undertaken at 39 locations in two cities.[26] The state has achieved 100% coverage of IHHL with the construction of 1,72,536 household toilets. The progress in this regard is summarised in Figure 2.14.

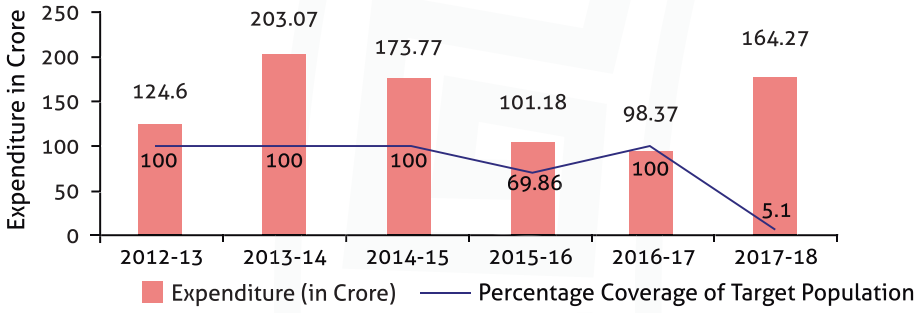
Figure 2.14 : Coverage Status of Toilets in H.P. under Swachh Bharat Mission Gramin



Source: Swachh Bharat Mission Dashboard

As per National Rural Drinking Water Programme, out of 53269 habitations in Himachal Pradesh, 42,992 habitations have been fully covered while, 10,277 habitations have been covered. Year wise expenditure and proportion of target population covered under the scheme is summarised in Fig. 2.15.

Figure 2.15 : Performance of National Rural Drinking Water Programme



Source: Ministry of Drinking Water & Sanitization, NRDWP

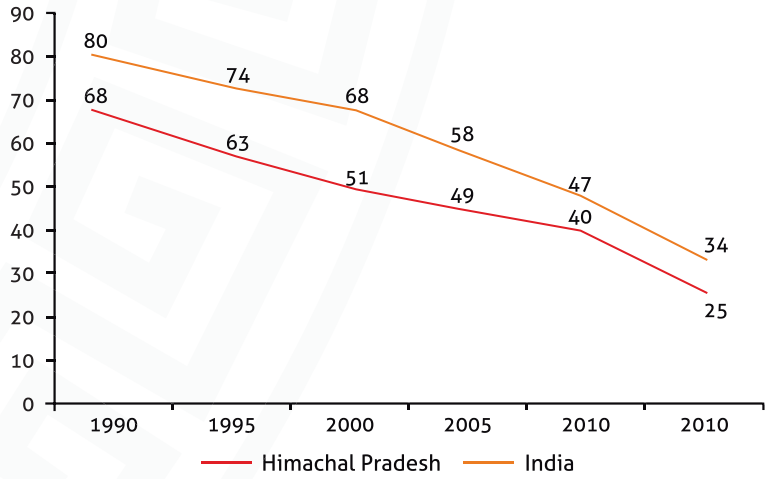
References

26. Department of Urban Development, Himachal Pradesh

2.6.1.4 Improvement in Health Services

There has been considerable improvement in health infrastructure in the state during the period 2005-15. While the numbers of sub centres has stayed by and large the same, PHCs and CHCs have increased from 505 (2005) to 578 (2015). Life expectancy (at birth) for males and females has recorded a slight improvement. For males it has inched from 67.7 Years to 69.3 Years while for females it has gone from 72.4 years to 74.06 years).[27] The states figures are better than the national average. Institutional Deliveries have increased from 43% in 2006 to 76.4% in 2015-16. Sex Ratio of state has decreased from 939 (2010-12) to 924 (2013-15).[28] A comparison of changes in Infant Mortality Rate in for India and Himachal Pradesh are shown in Figure 2.16.

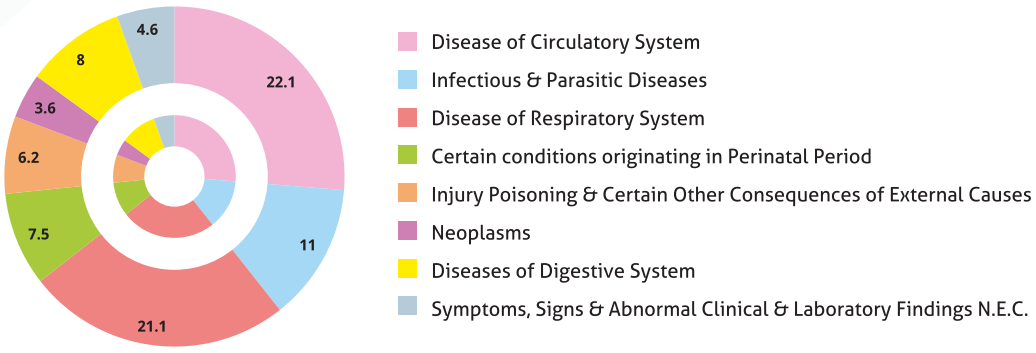
Figure 2.16 : Infant Mortality Rate Comparisons in Himachal Pradesh and India



Source: NITI Aayog Statistics

As per Census data in 2013, major causes for deaths in Himachal Pradesh are diseases of the circulatory system, respiratory system and infective and parasitic diseases. Major infectious diseases include diarrhoea, respiratory tuberculosis, septicaemia etc. Circulatory system diseases include acute rheumatic fever, hypertensive heart disease and others. Distribution of deaths caused due to major 8 groups of diseases is given in Fig. 2.17.

Figure 2.17 : Distribution of Major Cause Group for Deaths in Himachal Pradesh (2013)

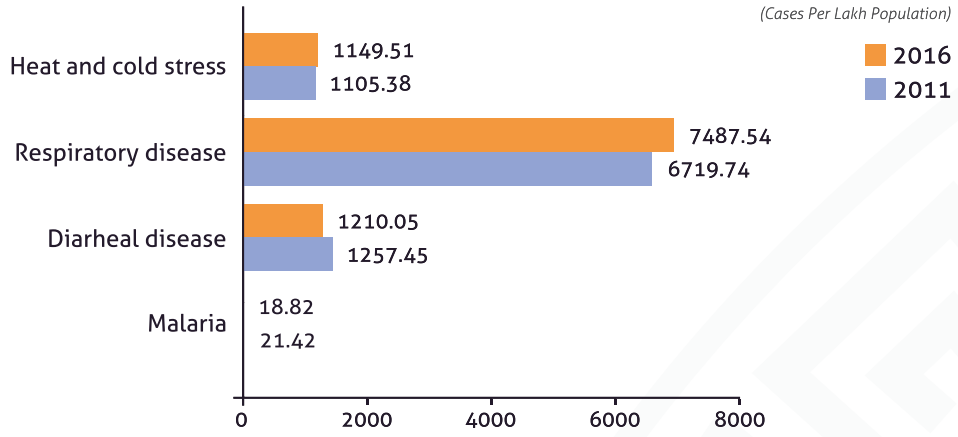


Source: Report on Medical Certification on Cause of Death 2013

References
27. NITI Aayog State Statistics
28. National Family Health Survey

The changes in disease prevalence which have a strong link with environmental factors and climate change has been given in Fig. 2.18.

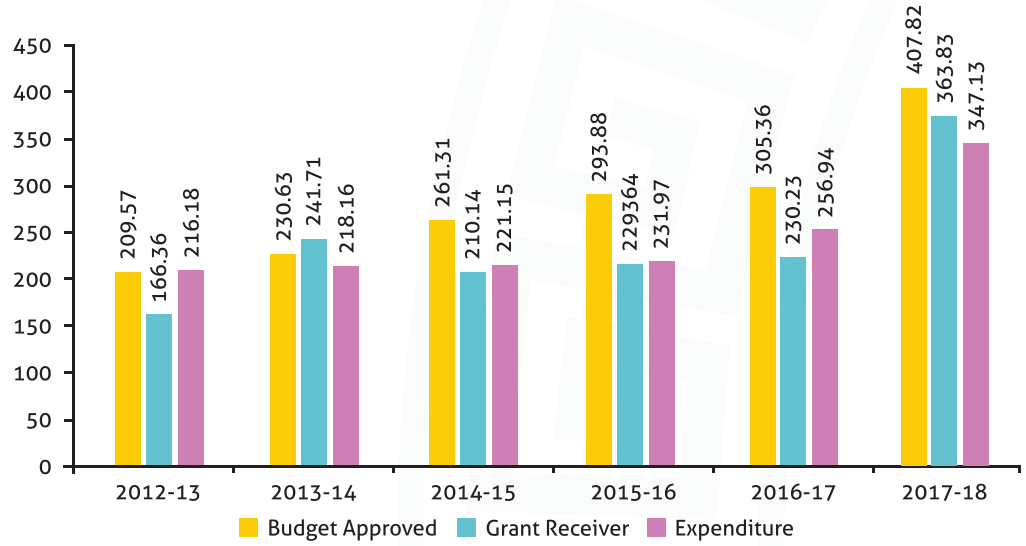
Figure 2.18 : Disease Prevalence



Source: Economic Survey Report

There has been a decline in incidence of malaria but an increase in heat and cold stress, respiratory diseases (associated with air pollution). Diorrhoeal diseases show a marginal decline. National Rural Health Mission has been effective in decreasing the vulnerability of the population in rural areas by enhancing the quality of available healthcare facilities. The mission focuses on accessible, accountable and economical access to health facilities. It focuses on developing a decentralized health delivery system in the state with inter-sectoral convergence. Allocations for NRHM have steadily increased during the period 2012-18 as summarised in Fig. 2.19 is given in graph below:

Figure 2.19 : Financial Allocation by NRHM in Himachal Pradesh



Source: Achievements under NRHM and NUHM, 2018

2.6.1.5 National Mission on Sustaining Himalayan Ecosystem (NMSHE)

The Himalayan ecosystem is endowed with immense natural and geological wealth, water bodies, snow cover, glaciers and forests replete with floral and faunal biodiversity. The people of Himalayan region are repositories of a vast body of traditional knowledge. Anthropogenic climate change is insidiously damaging and weakening the Himalayan ecosystem.

The main objectives of NMSHE are:

1. To enhance National and Institutional capacities to deal with climate change
2. Strengthen the existing institutions for climate adaptation
3. Standardization of Observational systems (Field and Space observations) on climate
4. Disassociate changes from natural and anthropogenic causes for climate change
5. Projection of future trends and assessment of possible impacts on climate change
6. Governance for sustaining Himalayan Eco-system
7. Building state of the Art Institutions in glaciology

NAPCC focused principles are listed below:

- **Protection of vulnerable sections of society–** primarily natural resource management and enhancing livelihood options.
- **Developing human resources–** Skill development is of utmost priority at all levels for the development in livelihoods. It enables all sectors to help communities and empower them with know-how and skills specific to life in mountainous landscape and critical for successful adaptation to climate change.
- **Enhancing ecological sustainability–** it can be done through clear understanding of glacier and river system dynamics by constant monitoring and investigating causes and consequences of disturbance regimes, preventive measures can then be derived which will furthermore, promote conservation of native and endemic elements.

Himachal Pradesh has undertaken numerous studies to assess the vulnerability of the Himalayan Ecosystem. which is available in synthesis report for Kullu, Beas river basin, Yamuna river basin and now has initiated the process for Satluj river basin out of total five river basin in the state.

A Knowledge Cell on climate change has been set up to look after entire gamut of activities associated with climate change knowledge management in Himachal Pradesh. The state has also formulated several projects under NAFCC which are in the pipeline for funding decisions at different levels.

2.6.1.6 National Mission on Strategic Knowledge for Climate Change

Under National Mission on Strategic Knowledge for Climate Change the state has focused on research on various dimensions of climate change. Climate Science Research developed for the state has supported the research on impact of climate change. In pursuance of NAPCC, the state evolved the 'Shimla Declaration on Climate Change and Himalayan Development' in 2009. The Department of Environment Science and Technology (DEST) has also prepared a comprehensive SAPCC and two Green House Gas Emission Inventories of Himachal Pradesh based on activity data for the years 2007 and 2012. The DEST has also prepared a detailed Environment Master Plan for Infrastructure, Natural Resource Management and Services sectors. Assessments completed by the department using space data include the Seasonal Snow Cover Variation during the year 2015-16 in Himachal Pradesh and Report on the inventory of moraine dammed glacial lakes in Satluj, Beas, Chenab and Ravi Basins in Himachal Pradesh.

2.6.2 Mitigation Strategy

2.6.2.1 Energy and Emissions

The total energy demand in the system is expected to be 10369.5 GWh by 2030. This is because of enhanced economic activity driven by industrial growth in the recent past and higher levels of electrification. The per capita energy consumption is likely to be 1294.89 kWh which would be lower than the national average. The peak demand in the state has increased from 1,397 MW in 2012 (April'11 to February'12) to 1,594 MW in 2018 (April'17 to February'18). Deficit percentage has come down from 7.1% to 0 during these years. The share of renewable energy in the overall power mix of state has decreased by 5 percentage points. Numerous hydropower and solar power generation projects have been installed in the state.

Table 2.16 : Changes in share of Renewable Energy

Parameters	2018		2012	
	Himachal Pradesh	India	Himachal Pradesh	India
Total Installed Capacity of Power Utilities (MW)	4018.93	334146.91	921.39	85918.65
Renewable Source (MW)	3754.07	107810.32	921.26	30893.72
Share of Renewable	93.4%	32.3%	99.9%	35.9%

Source: Government of India, Ministry of Power, Central Electricity Authority, Power Sector

Solar Mission: Under the Jawaharlal Nehru National Solar Mission (JNNSM), Govt. of Himachal Pradesh has decided to institutionalise indicators policy development of New and Conventional Sources and Applications to reduce the emissions and subsequent impacts of climate change.

Table 2.17 : State target under National Solar Mission

Solar Mission target by 2022	Grid-connected solar power	Remark
India	100 GW	May achieve it by end of 2020
Himachal Pradesh	776 MW Out of this Roof top solar: 72 MW	Or may not be fully achievable. Though in terms of overall renewable energy including small hydro power the state may do better.

Source: Ministry of New Renewable Energy, Targets under Solar Mission

2.6.2.2 Urbanization and Development of Climate Resilient Urban Centers

In 2001, approximately 9.8% of the total population of Himachal Pradesh was urban which saw a decadal growth of 1.45% during 2001-2011. The primary reason behind very slow rate of growth of urban population is low population density of the state. (habitations in the state are not able to fulfil the criterion of urban classification at most as they require a population density of 400 people per square feet is required, it only has about maximum 123 person per square feet in whole state). As per the Census 2011, the population is likely to grow from from68.65 lakhs to 75.71lakhs between 2011 to 2021. Also, as stated in INDC the growth in population is expected to be 40% by 2030 against 30% in present scenario. In order to cater the needs of the future population keeping in mind the alarming climate change patterns, a sustainable, equitable and inclusive mitigation strategy is required to be formed. The most urban parts of the state are covered under Atal Mission for Rejuvenation and Urban Transformation and

Smart City Mission which promotes green spaces, reduction in pollution causing agents and to improve water supply of the state. This also takes care of other urban amenities like housing, energy consumption, transport, water and solid waste disposal waste management etc. Urban towns, Shimla and Kullu in Himachal are covered under Atal Mission for Rejuvenation and Urban Transformation (AMRUT). The program is expected to increase greenery and reduce pollution through improved public transport, better roads for pedestrians, parking facilities etc.

» Table 2.18 : Fund Flow under AMRUT

Fund released and expenditure under AMRUT (Rs. in lakh)								
	Shimla			Kullu				
Year	Centre Share	State Share	Total	Centre Share	State Share	Total	**Grand Total**	**Total Exp. so far**
2015-16	1588.00	635.00	2223.00	0	0	0	2223.00	**52.21**
2016-17	1276.80	141.87	1418.67	547.20	60.80	608.00	2026.67	
2017-18	1448.30	160.92	1609.22	620.70	68.97	689.67	2298.89	
Total	4313.10	937.79	5250.89	1167.90	129.77	1297.67	6548.56	

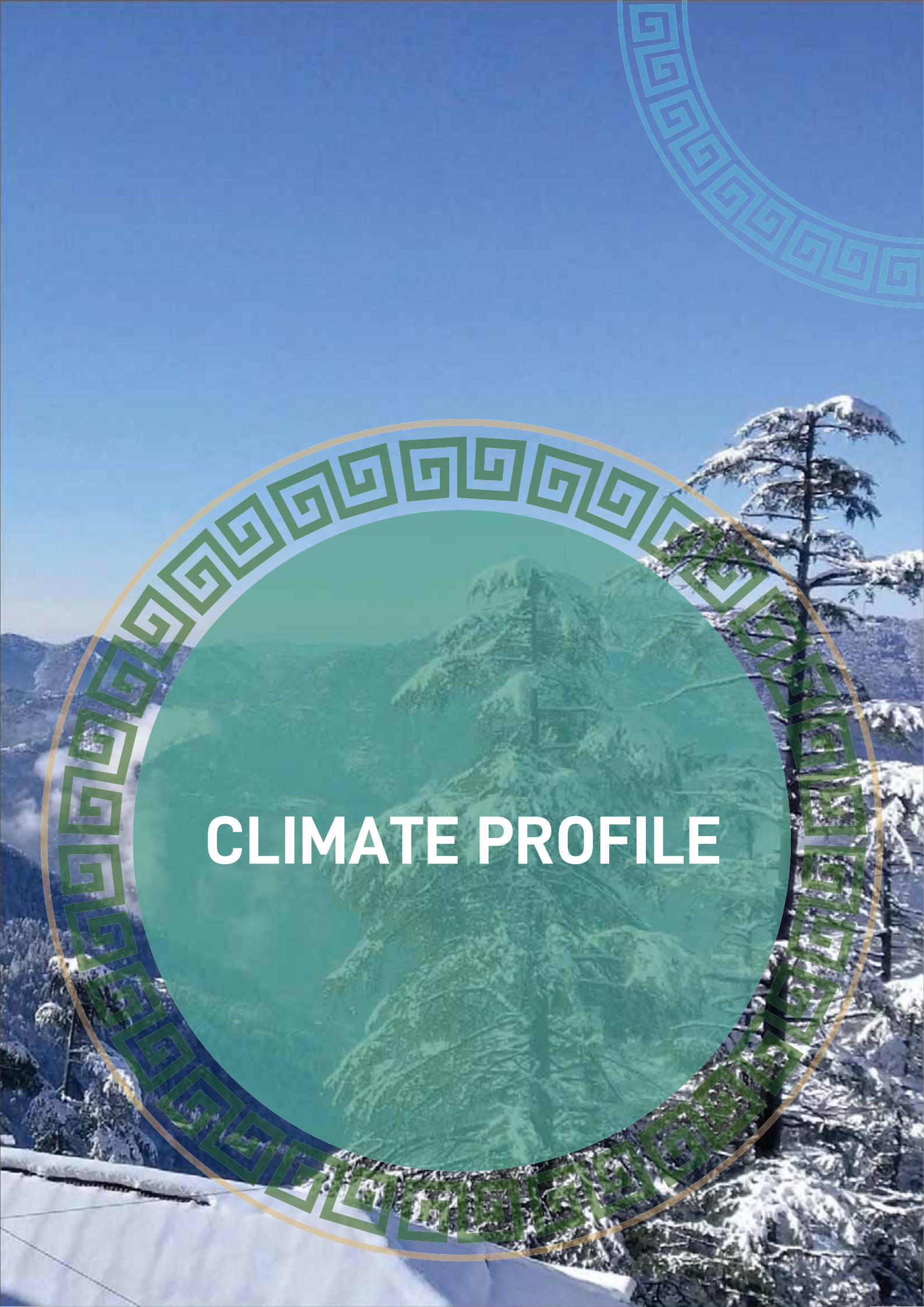
Source: Himachal Pradesh State Annual Action Plan (SAAP)

Smart Cities Mission is being implemented in two major urban centres of Himachal Pradesh namely - Dharamshala and Shimla. Till date, Dharamshala Smart City Limited (DSCL) has received Rs. 210 Crore out of which only 11.52 crores have been spent. 20 crores have been allotted to Shimla Smart City Limited (SSCL). The Smart Cities Mission is designed to promote the following objectives:

i. Adequate water supply
ii. Assured electricity supply with at least 10% of the energy requirement coming from solar,
iii. Sanitation, including solid waste management,
iv. Efficient urban mobility and public transport,
v. Affordable housing, especially for the poor,
vi. Robust IT connectivity and digitalization,
vii. Good governance, especially the e-Governance and citizen participation,
viii. Sustainable environment,
ix. Safety and security of citizens, particularly women, children and the elderly, and
x. Health and education. (Smart city Guidelines, 2015)

Besides this, Lakshay scheme is a temporary scheme launched in the state for aimed at people living in areas which are semi-urban centres, converted to urban from rural or adjoining the major urban centres. The scheme works in lieu of MGNREGA to provide schemes benefits to people who are otherwise not eligible. However, it is an adhoc scheme designed to meet urgent and immediate needs.

Solid Waste Management: The state generates about 342.40 MT of solid waste per day Shimla leading at 90 TPD. The state has prepared a comprehensive action plan for solid waste management. The Shimla Municipal Corporation has set up a waste to energy plant designed to generate 1.7-2.0 MW of electricity by processing about 50-60 MT solid waste generated daily by the city of from Shimla. The existing plant has been revived with an outlay cost of Rs. 42 crores and the MC claims it would meet the requirement of future and shall operate for next 40 years.



CLIMATE PROFILE

3 CLIMATE PROFILE

3.1 HISTORICAL AND PRESENT CLIMATE TREND

Himachal Pradesh is located between 75° 45' 55" E to 79 ° 04' 20" E longitude and 30° 22' 40"N to 33° 12'40" N latitude. The state is situated in southern Himalayas and is landlocked by Jammu & Kashmir in north, Punjab in west and south west, Haryana in south, Uttar Pradesh in south east and China in north. The altitude of the state varies from 350 to 6975 meters above mean sea level. Major seasons experienced in the state are the summer season from mid-April till end of June (alpine zone experiences mild summer), Winter season lasts from late November to end March (snowfall in higher and trans-Himalayan region) and rainy season from June to August.

3.1.1 Temperature

The state experiences high variations in mean annual temperatures. The maximum mean annual temperature i.e. 25°C is recorded in the southern and western parts of Bilaspur district and extreme south-western parts of Solan. The remaining districts experience annual temperatures lesser than 15° C. The average monthly temperature during summer season varies from 26° C in lower outer valleys to 14° C in inner valley zone and that of between 13° to 4°C during winter months. According to Indian Meteorological Department (IMD) daily gridded temperature (maximum and minimum) and rainfall data from 1951-2013 for the state, it has been observed that, the mean annual maximum temperature of the state is 25.90C. (range 24.5 to 27.10C). The analysis of 63 years of data suggests that there has been an increase in annual maximum and minimum temperature of the state. However, both trends are not statistically significant. This means that while the state might have experienced some overall warming since 1951, this trend is not much clear.

3.1.2 Rainfall

Southwestern monsoon causes most rainfall in the state from June to September. In winter season, western disturbances cause snowfall and rainfall in many parts of the state. In Dhauladhar and Pir Panjal regions, rainfall decreases towards Lahaul Spiti and Kinnaur. It has been observed that average annual rainfall of in the state is around 1284.2 mm (range: from 704.7 - 2062.8 mm). The south-west monsoon (JJAS months) rainfall contributes the maximum to annual rainfall amounting to 66 % for the total rainfall the state receives in a year. The analysis of annual rainfall reveals a negative trend indicating that the total amount of rainfall received has been decreasing. The number of rainy days also shows a negative trend. Both trends are statistically significant which means that rainfall and no. of rainy days both have clearly declined since 1951 in Himachal Pradesh.

3.2 FUTURE CLIMATE PROJECTIONS & ANALYSIS

Under AR5, different scenarios are used for projecting key climate variables like temperature and precipitation for the future. RCP 8.5 was developed using the MESSAGE model and the IIASA Integrated Assessment Framework by the International Institute for Applied Systems Analysis (IIASA), Austria. This RCP is characterized by increasing greenhouse gas emissions over

time, representative of scenarios in the literature that lead to high greenhouse gas concentration levels (Riahi et al. 2007). RCP 4.5 was developed by the GCAM modeling team at the Pacific Northwest National Laboratory's Joint Global Change Research Institute (JGCRI) in the United States. It is a stabilization scenario in which total radiative forcing is stabilized shortly after 2100, without overshooting the long-run radiative forcing target level (Clarke et al. 2007; Smith and Wigley 2006; Wise et al. 2009).

A recent study conducted by State Department of Environment, Science & Technology with support from GIZ highlighted following climate trends for the state of Himachal Pradesh.

» Table 3.1 : Summary of Climate Analysis

Observed Climate Data[1] (1951-2013): IMD Gridded Data		
Temperature	**Precipitation**	**Climate Extremes**
Increasing trends in maximum temperature (low confidence) and minimum temperature (low confidence) have been observed	Decreasing trend in annual average precipitation (high confidence) and decreasing trend in annual number of rainy days have been observed (high confidence).	Extreme events like 1 day maximum precipitation, warm nights and warm spell duration indicator show decreasing trend (Low confidence).
Projected Climate Data[2] (2021-50): RCP 4.5 and RCP 8.5		
Projected change in Temperature Under RCP 4.5 T max; 1.4°C T min: 1.4°C	Projected annual precipitation changes Under RCP 4.5 Increase by 5.9%	Projected extreme events: Heavy rainfall, heat waves, floods and drought are likely to increase in future and will play a more significant role in disaster management.
Under RCP 8.5 T max; 1.6°C T min: 1.8°C	Under RCP 8.5 Increase by 14%	

3.2.1 Temperature

The analysis[3] of the projected daily temperatures under various climate change scenarios reveals that:

- Mean annual maximum temperature for RCP4.5 scenario is projected to increase by about 1.4 degrees Celsius by mid-century. For RCP 8.5 scenario is projected to increase by about 1.6 degrees Celsius by mid-century for the State of Himachal Pradesh.
- Mean annual minimum temperature for RCP 4.5 scenarios is projected to increase by about 1.4 degrees Celsius by mid-century. For RCP 8.5 scenario is projected to increase by about 1.8 degrees Celsius by mid-century.

3.2.2 Rainfall

Mean annual rainfall for RCP 4.5 scenario is projected to increase by about 5.9 % towards mid-century. For RCP 8.5 scenario rainfall is projected to increase by about 14 % towards mid-century. General implications of temperature increase may include heat stress, water borne/related health impacts, increase in energy demand for cooling, additional evaporation and evapo-transpiration losses resulting in enhanced irrigation water requirement for crops. Increase in intensity of rainfall events may lead to floods, urban storms, vector borne diseases, loss of work, transport disruption, additional cost for flood proofing factories and warehouses.

References
1. Based on IMD Gridded data for 63 years
2. Based on CORDEX multi-model simulated for Mid Century Scenario (near term to our INDC 2030) under RCP 4.5 and RCP 8.5 scenarios
3. Climate Impacts and Vulnerability Assessment of the Water Sector in the State of Himachal Pradesh, GIZ

Based on the investments made for climate adaptation actions, some changes have been noticed in the vulnerability between 2012 and 2017. However, due to lack of primary data, some critical and important indicators for which data points are available, projection have been chosen.

3.3 DISASTER RISK, LOSS AND DAMAGE IN HIMACHAL PRADESH

Himachal Pradesh is highly vulnerable to various and frequent natural disasters that have a major impact on communities and land. Natural disasters like Earthquakes, Landslides, Flash floods, Cloudbursts, Avalanches, Forest Fires, and Droughts etc. have caused tremendous loss of life and property in the state. Examples of Manmade disasters in the state are dam failures, fires (domestic and wild), accidents, stampedes, boat capsizing, biological, industrial and hazardous chemicals etc. Earthquake poses the biggest threat to the state. The BIS seismic zoning mapped five districts i.e. Chamba, Hamirpur, Kangra, Kullu and Mandi with 53 to 98.6% of area prone to severest intensity of MSIX or more in the state.

» Table 3.2 : District wise percentage of population vulnerable to Earthquake

% of State Population Vulnerable to Earthquake		
District	Zone - IV	Zone - V
Chamba	1.23	6.35
Kangra	0	22.03
Lahul & Spiti	0.53	0.02
Kullu	1.24	5.03
Mandi	0.67	14.16
Hamirpur	0	6.79
Una	3.9	3.48
Bilaspur	1.86	3.75
Solan	8.19	0.05
Sirmaur	7.55	0
Shimla	11.89	0
Kinnaur	1.29	0

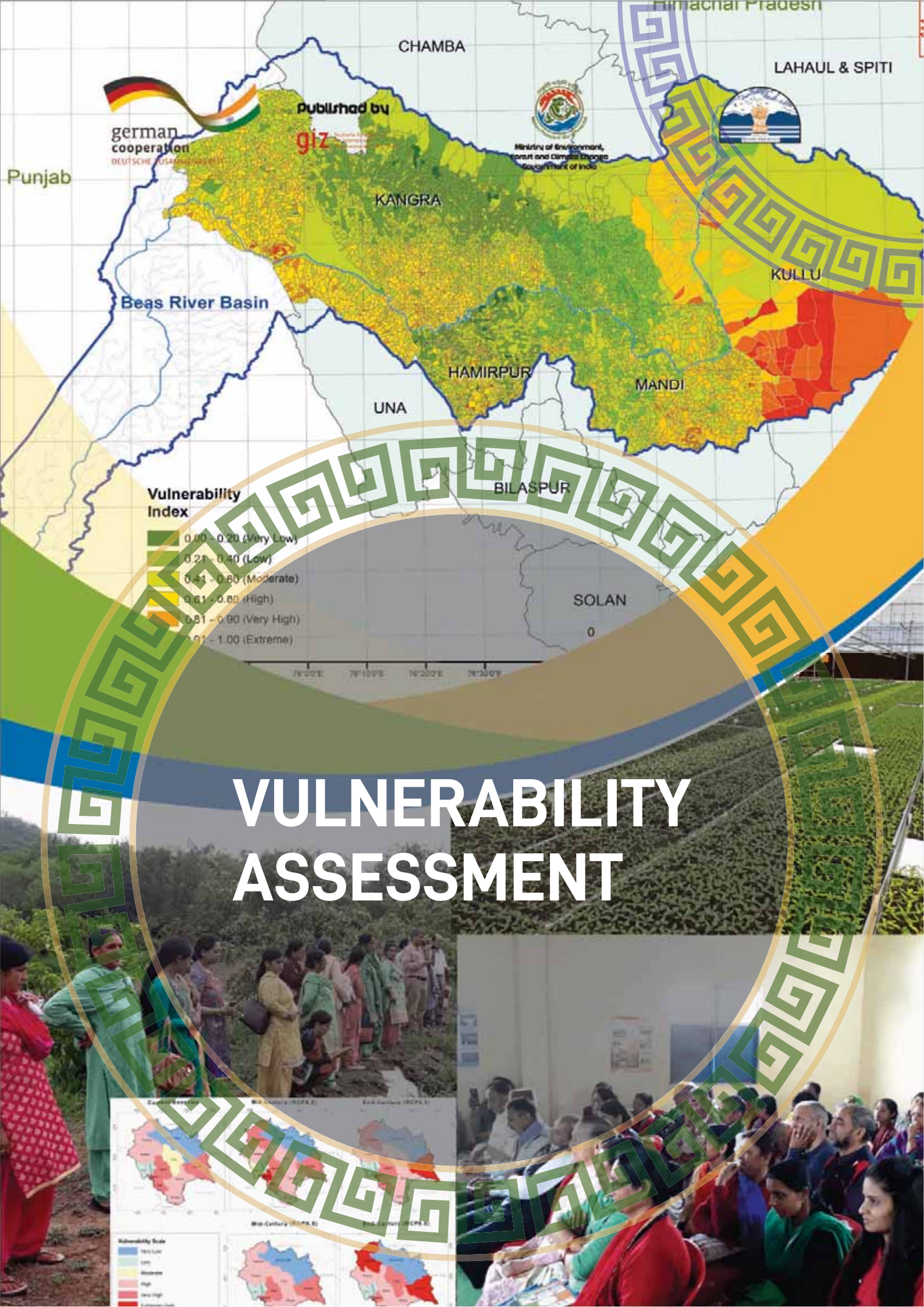
In the context of human vulnerability to disasters the economically and socially weaker segments of the population are the ones that are most seriously affected. Within the vulnerable groups, elderly persons, women, children and disabled persons are exposed to higher risks.

» Table 3.2 : District wise percentage of population vulnerable to Earthquake

Disaster	Year	District	Loss due to disaster
Highest Intensity Earthquake of magnitude 8.0	1905	Kangra and Dharamshala	19,800 people died
Earthquake of magnitude 6.5	1906	Shimla	26 people died, 45 severely injured
Landslide	1993	Kinnaur	Road (NH-22) stretch of about ½ km was completely damaged and slided debris blocked the river Sutlej. Traffic restored after two months

Flash Floods	2000	Shimla, Kinnaur, Bilaspur and Kullu	140 people died, 400 shifted, 12400 sq km. area affected in Shimla, 3500 people and 56 villages evacuated
Flash Floods	2003	Kullu	35 people died in Gadsa Valley
Avalanche	1979	Lahaul & Spiti	237 people killed
Human Induced Temple Stampede	2008	Bilaspur	145 people killed in Naina Devi Temple
GLOF	1997	Satluj Basin, Kinnaur	Washed away six bridges in the Sutlej basin and Kinnaur district was completely cut off

Source: Himachal Pradesh Vulnerability Atlas, SEEDS



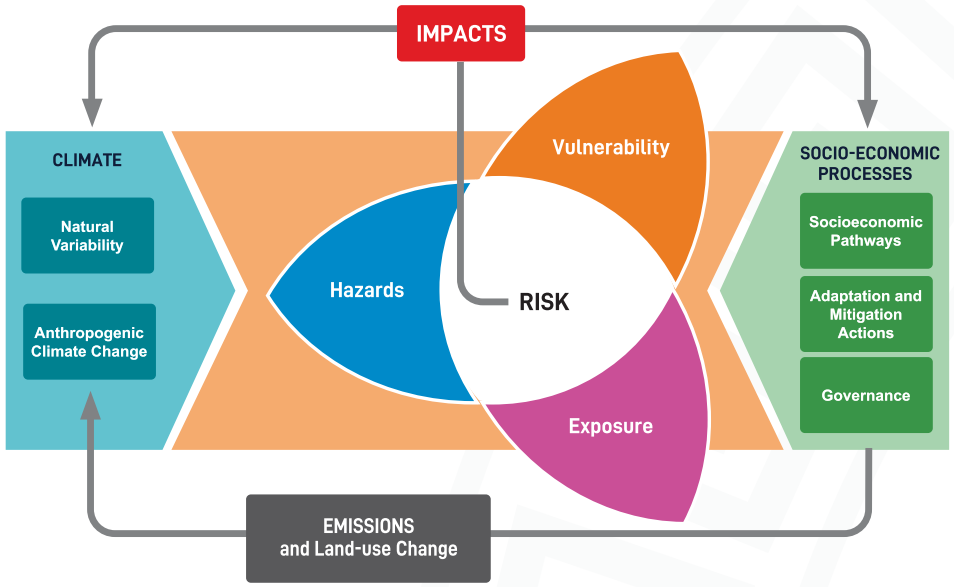
VULNERABILITY ASSESSMENT

4 VULNERABILITY ASSESSMENT

The concept of 'Climate Change Vulnerability' helps one to better comprehend the cause/effect relationships behind climate change and its impact on people, economic sectors and socio-ecological systems. The adaptation strategies and prioritization of resources can also be identified based on vulnerability at different levels. The extent of vulnerability, and its pattern, varies as per the number, types and orientation of the indicators.

Figure 4.1 : Illustration of the core concepts of the WGII AR5.

Change in both climate system (left) and socioeconomic processes including adaptation and mitigation (right) and drivers of hazards, exposure, and vulnerability.



Source: IPCC AR5

4.1 VULNERABILITY

Climate change vulnerability is defined as the propensity to be adversely affected by climate change (IPCC, 2014). It encompasses a variety of concepts and elements including sensitivity, or susceptibility, to harm and lack of capacity to cope with and adapt to future changes (IPCC, 2014). Risk is defined as the potential for consequences where some cost is at stake and where the outcome is uncertain, recognizing the diversity of values.

Risk is often represented as probability of occurrence of hazardous events (likelihood) multiplied by the impacts (or consequences) if these events occur. Risk results from the interaction of vulnerability, exposure, and hazard (IPCC, 2014). Risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems.

The hazards due to temperature and precipitation for the mid-century scenario remain the same during the period 2012-17. The two periods considered for this analysis are: First from 2009-10, 2010-11, 2011-12 (when the initial SAPCC was formulated); second one from period 2013-17. poverty data was available for 2014-15 only and used for both the periods. Some of the data variables that were available for 2016-17 have been used as it is while some variables have been projected. As per the AR5 report the vulnerability is a function of sensitivity and adaptive capacity. Therefore, the combined risk has been computed across three dimensions i.e. hazard, exposure and vulnerability (see figure 4.1 adapted from IPCC AR5).

4.1.1 Approach and Methodology

District level data for 34 indicators was collected for computation of the vulnerability index using the Principle Component Analysis (PCA) method which is a multivariate computer model assigning weight based on the hidden pattern of data without bias (see table 4.1).

As per the vulnerability manual the combined indicator values have been generated using the following steps:

1. This is our point number one in a paragraph and this is it.
2. Normalization of indicators has been carried out.
3. In PCA method Eigen values have been computed and vector multiplications have been carried out to determine category wise weights.
4. As per AR5 Vulnerability is a function of sensitivity and adaptive capacity V = f (sensitivity, adaptive capacity) and risk is a function of hazard (h), exposure (e) and vulnerability (v) R (h, e, v).

In nutshell, the data reveals the change in vulnerability as well as in risk over the last five years. The indicators are given in the table below and are hazard/exposure/sensitivity/adaptive capacity linked in nature.

» Table 4.1 : Example of some of the Indicators for the computation of the combined vulnerability index

Hazard linked	Exposure linked	Sensitivity linked	Adaptive capacity linked (socioeconomic, infrastructure and institution)
• Average annual Maximum temp (°C) change as compared to (1981-2010) • Average annual change in rainfall (%) (1981-2010) • Change in dry spell from baseline in Mid Century • Change in consecutive wet days from baseline in Mid Century • Very heavy precipitation days (>20mm/day) change from baseline mid century	• Sex Ratio • Urban population as a % of total • Decadal growth rate of population from 2001-11 • % SC population • % ST population • Livestock and poultry • Number of Households having Monthly income of highest earning household member % Less than Rs. 5,000	• Literacy rate • Net Sown Area as a % of district geographical area • Net Irrigated area (ha) • Share of agriculture workers • Total food grains yield (kg/ha) • Total Infant Mortality Rate	• Percentage of Electricity access% to total HH • Access to toilets • Share of HH using firewood for cooking • Share of HH using crop residue for cooking • Share of HH using electricity for cooking • Access to Mobile Phone Only % • Households having access to banking services • Road density

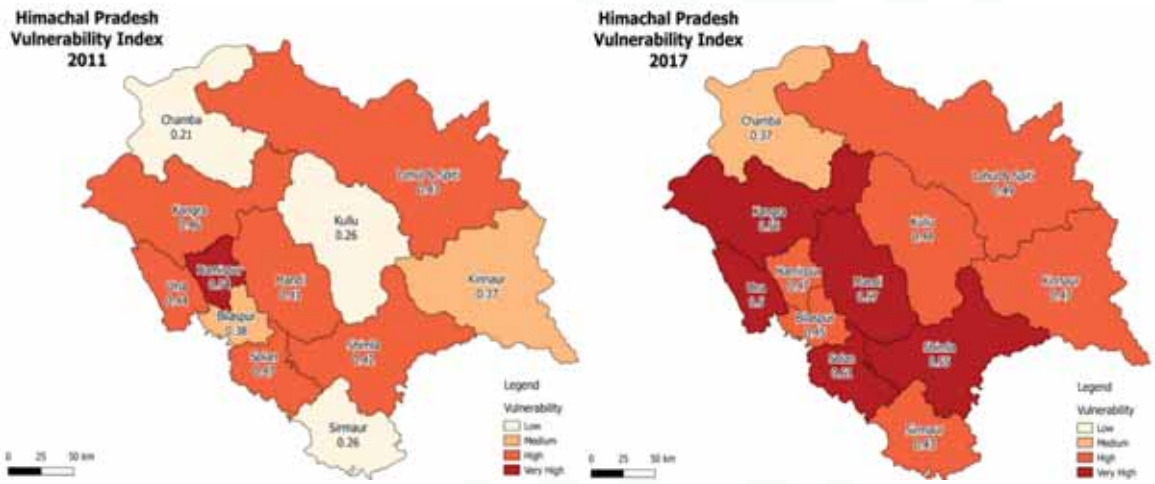
			• Access to Radio/Transistor • Access to Television • Total no. of all scheduled commercial banks per lakh pop (in nos.) • Credit Deposit Ratio (in %) • No. of health centers/ lakh population

For the analysis, Year 2012 i.e. the baseline period when the state climate change action plan was formulated and the 2-3 years period prior to that, for which data from Census and other official sources were available for the districts, was observed. This was used for comparison with either the data available post 2015, or projected for the year 2017, whichever was feasible. Principal component analysis was used to compute the index after required normalization. For the projected figures, only RCP 4.5 and mid-century scenario has been considered. In addition, sectoral vulnerability and impact computed under CCA-RAI (Climate Change Adaptation in Rural Areas of India) project by GIZ for mid-century and end-century scenarios have been summarized.[1]

4.2 CLIMATE VULNERABILITY OF HIMACHAL PRADESH

Result: The risk and vulnerability index for baseline 2011-12 and 2017 have been presented below:

Figure 4.2 : Baseline Vulnerability Index, 2011 and 2017

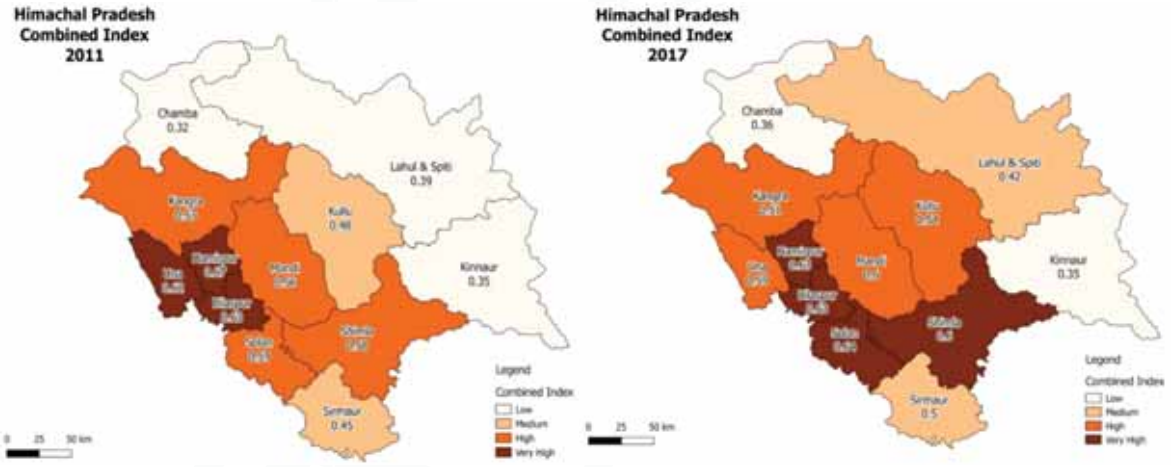


Source: MoEFCC, GIZ and DoE

Reference

1. Climate Change Information Portal http://climatevulnerability.in

Figure 4.3 : Baseline Composite Risk Index, 2011 and 2017



Source: MoEFCC, GIZ and DoE

Climate change induced risk and vulnerability, spatially in last five years since the SAPCC was implemented is shown in table 4.2. Most of the districts showed a marginal change in their vulnerability except for Mandi and Shimla districts where vulnerability has increased further in comparison to 2011-12. Hamirpur district has also shown a considerable improvement. In terms of combined risk assessment Solan district seems to have improved. Risk assessment of district of Una has shown a significant improvement.

Table 4.2 : Spatial spread of Risk and Vulnerability in Himachal Pradesh, 2017

District	Hazard Index	Exposure Index	Vulnerability Index	Combined Risk Index	Composite Vulnerability Rank (2017)	Composite Risk Rank (2017)
Bilaspur	0.913	0.536	0.451	0.633	9	2
Chamba	0.184	0.518	0.368	0.357	12	11
Hamirpur	0.813	0.597	0.470	0.627	7	3
Kangra	0.404	0.553	0.563	0.507	3	8
Kinnaur	0.179	0.394	0.467	0.347	8	12
Kullu	0.723	0.453	0.436	0.537	10	7
Lahaul & Spiti	0.222	0.548	0.492	0.421	6	10
Mandi	0.639	0.588	0.571	0.599	2	5
Shimla	0.801	0.461	0.550	0.604	4	4
Sirmaur	0.583	0.483	0.433	0.500	11	9
Solan	0.868	0.443	0.615	0.642	1	1
Una	0.811	0.473	0.501	0.595	5	6

Table 4.3 showcases the changes in risk and vulnerability of the state:

Table 4.3 : Spatial change in Risk and Vulnerability

District	Composite Vulnerability Rank (2017)	Composite Vulnerability Rank (2011)	Composite Risk Rank (2017)	Composite Risk Rank (2011)
Bilaspur	9	8	2	2
Chamba	12	12	11	12
Hamirpur	7	1	3	1
Kangra	3	3	8	7
Kinnaur	8	9	12	11
Kullu	10	11	7	8
Lahaul & Spiti	6	5	10	10
Mandi	2	7	5	6
Shimla	4	6	4	5
Sirmaur	11	10	9	9
Solan	1	2	1	4
Una	5	4	6	3

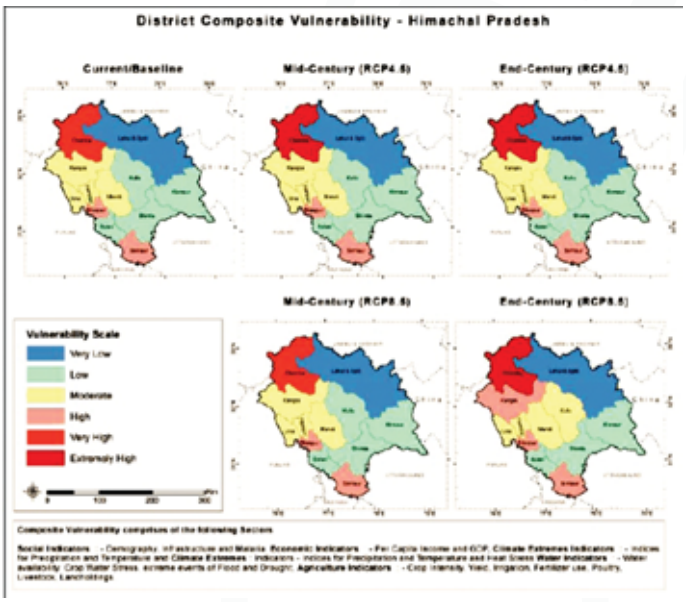
4.2.1 Composite Vulnerability of Himachal Pradesh

The projected sectoral vulnerability computed for water, agriculture, health sectors under two emission scenarios reveals some disturbing trends. The overall Composite Vulnerability (CV) of the Himachal Pradesh is projected to increase towards mid-century and end-century as compared to the baseline for both the IPCC AR5 climate scenarios.

District vulnerability is likely to exacerbate under RCP8.5 scenario as compared to RCP 4.5 scenario towards end century.

The overall climate extremes vulnerability of the districts is projected to increase towards mid and end-century as compared to the current conditions for both the emission scenarios.

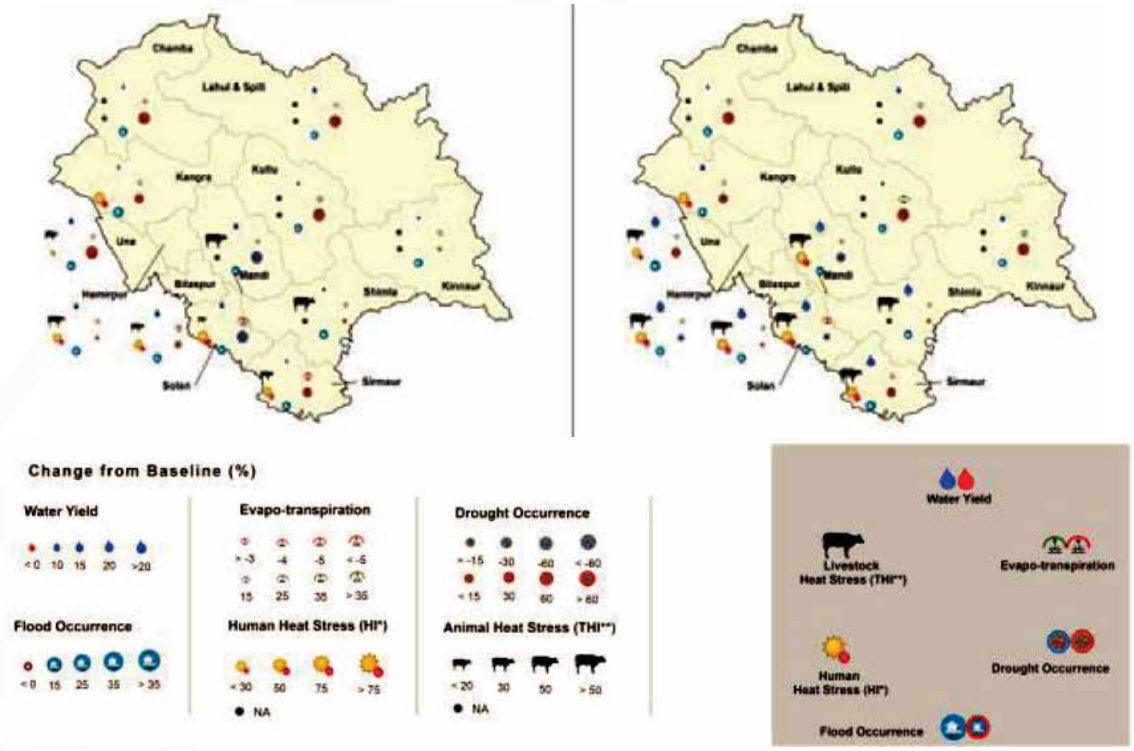
Figure 4.4 : Current and Projected Vulnerability under different Emission Scenarios



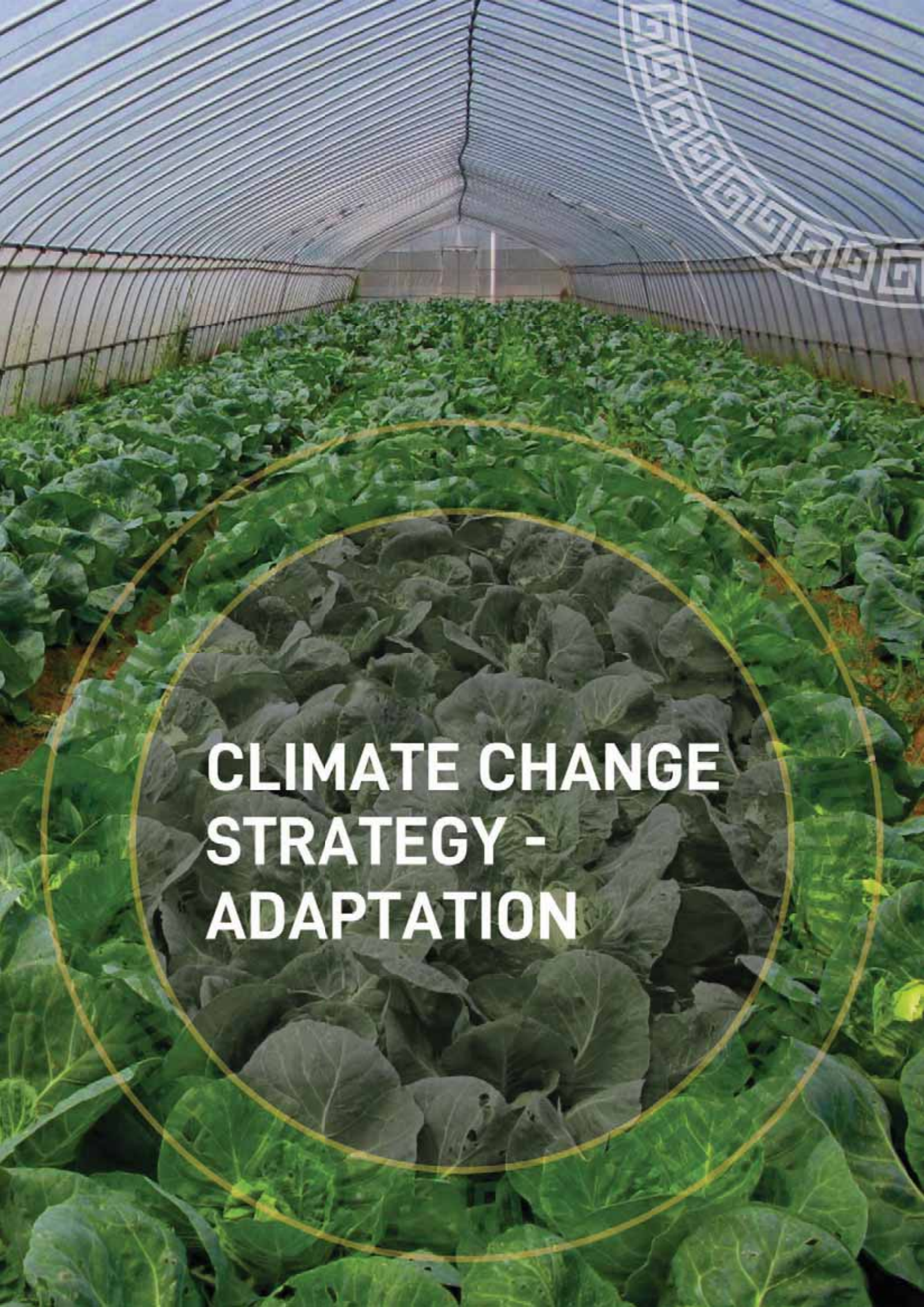
Source: GIZ, 2018

District vulnerability is likely to exacerbate under RCP8.5 scenario as compared to RCP4.5 scenario towards both mid and end-century. The overall water resources vulnerability of the district is projected to increase towards mid and end-century ans compared to the current conditions for both the emission scenarios. The agricultural vulnerability under the National Initiative on Climate Resilient Agriculture (NICRA) project indicates that district Kullu, Shimla, Chamba, Bilaspur are highly vulnerable as far as agriculture related vulnerability are concerned. Similarly, the Kullu district has high GLOF related vulnerabilities. For example, in the central area of Kullu district, a 7-fold increase in the probability of Glacial Lake Outburst Floods (GLOFs) and a 3-fold increase in the downstream areas affected by potential GLOF paths can be anticipated. This amounts to an overall increase in the assigned GLOF hazard level from 'high' to 'very high' (Allen, 2016).

Figure 4.5 : Projected impacts on health sector, allied sector and water sector



As per figure 4.5, the projected impacts are visible as animal and human heat stress, drought incidence, higher level of evapo-transpiration and low water yield. Many policy makers are still apprehensive about long-term climate models for their regular planning process. Nevertheless, the districts having a comparatively high vulnerability score and showing a worsening of the situation as compared to the baseline period, should be on the radar of the policy makers for improving the ability of these districts to reduce hazard risk & sensitivity while enhancing the adaptive capacity. While very little can be done in the short run to address exposure related risk, long term measures should be planned for these areas. Similarly, in the medium term issues related to sensitivity can be addressed. Finally, immediate steps are required to improve the adaptive capacity.



CLIMATE CHANGE STRATEGY - ADAPTATION

5 CLIMATE CHANGE STRATEGY - ADAPTATION

"Climate change adaptation is a response to global warming that seeks to reduce the vulnerability of social and biological systems to relatively sudden change and thus offset the effects of global warming."

5.1 STATE MISSION FOR ECOSYSTEM, BIODIVERSITY AND LIVELIHOOD SUSTAINABILITY

5.1.1 Overview

Himachal Pradesh is bestowed with rich floral and faunal diversity. The floral biodiversity includes forest vegetation and medicinal & aromatic plants. Out of 47,000 plant species found in India, as many as 3295 species are reported in the state. The floral biodiversity also includes higher plants, ferns, mosses, lichens and mushrooms. There are 3120 species of angiosperms, 13 species of gymnosperms and 125 pteridophytes (mainly ferns) and 38 species of orchids.

Out of 89,451 species of fauna found in India, Himachal Pradesh harbours 5721. The state reports having 77 mammals, 447 birds, 44 amphibians, 83 fishes, 4543 arthropods and 412 other species. Some of the faunal species like Kalij, Kokas & Monal pheasants are confined to the state only. The Western Tragopan is endemic to the state. Various bears (Himalayan Black bear & Brown bear), Snow Leopard and Common Indian leopard are also found in the state.

WETLANDS

The Himachal Pradesh State Wetland Authority (HPSWA) was constituted in the year 2017. It is the nodal agency to coordinate the Wetland Conservation Programme with the active participation of all the stakeholders. In view of requirement of a multidisciplinary approach, various departments and agencies (forests, fisheries, tourism, industries, HP Pollution Control Board, HP University, Zoologic Survey of India, state & national level research institutes) are also actively involved in the wetland conservation programmes. Wetlands are amongst our most valuable ecosystems and usually termed as "biological supermarkets" considering the great amount of food attracting varied animal species. The values of benefits provided by wetlands, per unit area, have been consistently shown to be in the orders of magnitude higher than for other ecosystems. They provide a wide range of important benefits to the society including freshwater storage, filtering harmful wastes from water, maintaining surface flow during lean months, buffer for extreme events and reduced risks of flood and drought; livelihoods for a large proportion of population and biodiversity conservation. These valuable functions are the result of the unique natural characteristics of wetlands. Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs. An immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish and mammals can be part of a wetland ecosystem Climate, landscape shape (topology), geology and the movement and abundance of water help to determine the plants and animals that inhabit each wetland. The complex, dynamic relationships among the organisms inhabiting the wetland environment are called food webs. Wetlands in and around a city provide significant services such as water supply and local level climate regulation.

Table 5.1 : Area estimated under wetlands in Himachal Pradesh (in ha)

S.No.	Wet code	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	Inland Wetlands – Natural					
1.	1101	Lakes/Ponds	8	52	0.05	49	26
2.	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3.	1103	High altitude wetlands	42	387	0.39	285	128
4.	1104	Riverine wetlands	-	-	-	-	-
5.	1105	Waterlogged	10	47	0.05	39	19
6.	1106	River/Stream	67	55558	56.41	27153	17063
	1200	Inland Wetlands – Man-made					
7.	1201	Reservoirs/ Barrages	13	41817	42.46	41445	31966
8.	1202	Tanks/Ponds	27	134	0.14	106	29
9.	1203	Waterlogged	3	30	0.03	30	14
10.	1204	Salt pans	-	-	-	-	-
		Total- Inland	170	98025	99.52	69107	49245
		Wetlands (<2.25 ha)	471	471	0.48	-	-
		Total	641	98496	100.00	69107	49245

Sources: National Wetland Atlas 2010 of HP (HIMCOSTE- ISRO- MoEF&CC, GoI)

In addition to providing ecosystem services, wetlands of the state also have rich cultural heritage and recreational importance that attracts a large number of tourists from within India and also from other countries. The wetlands also serve as refuge for thousands of migratory birds. The direct use values of wetlands are:

a. Consumptive uses like agriculture (crop cultivation), fish, fuel-wood and timber collection, pastures, electricity generation.

b. Non-consumptive uses like recreation, aesthetic use, research and education, water transport.

c. The physical uses like water filtration, flood control and protection from soil erosion.

The Himachal Pradesh State Biodiversity Board (HPSBB) was constituted by Govt. of Himachal Pradesh in the year 2005 under Biological Diversity Act, 2002. The HPSBB advises the state Govt. on matters related to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilization of biological resources. It also regulates the commercial utilization of biosurvey and bio-utilization of any biological resources by Indians. HPSBB has the power to restrict any such activity, which violates the objectives of conservation, sustainable use and equitable sharing of benefits. There are about 3000 Biodiversity Management Committees (BMC) constituted in the state.

5.1.2 Impact of Climate Change on the Biodiversity

The primary impacts of rapid climate change on biodiversity of a region are:

1. Increasing temperature and erratic precipitation causes bio-diversity loss, species migration, and extinction.

2. Change in distribution of tree species. The change in species composition due to climate change coupled with unchecked extraction may lead to extinction of economically important medicinal and aromatic plants.

3. Change in distribution of faunal diversity, microorganisms, pests and insects.

4. The anthropogenic pressure poses serious threats to the wetlands of Himachal Pradesh which has resulted in water pollution, siltation, encroachment, deforestation, heavy influx of pilgrims/ tourists, proliferation of aquatic weeds, soil erosion and fish feeding etc. The construction of roads right up to many wetlands has opened up this once remote basin for tourism and economic activities. The increased tourist influx is affecting the breeding waterfowl's. Lack of garbage disposal facilities also affect the wetlands. The over grazing activities also affect the pasture and further lead to soil erosion and land degradation of the catchment area of the wetland ecosystem.

5.1.3 Key Issues and Challenges for Biodiversity Conservation

Following are some issues of concern regarding the biodiversity of the state.

- Lack of awareness among various stakeholders about importance of biodiversity (both wild as well as domesticated). There is lack of knowledge and information about the variety and variability and importance of the species which can help in ecological, social and economic resilience.
- Lack of knowledge on sustainable management, regeneration and extraction of non-timber and minor forest among stakeholders like contractors. This leads to serious impacts on the biodiversity (especially medicinal and aromatic plants).
- Human wildlife conflicts are becoming common in the state. The state is already suffering from monkey menace (monkeys destroy the fruits in the orchards). Many parts of the state have also reported leopard attacks causing outrage among the people against the leopards.
- Poor coordination among the stakeholders like forest authorities, villagers, medicinal plants extractors and the academic institutions regarding conservation and better management of state's biodiversity.
- Heavy pressure on the forest resources due to high demand of fuel wood during prolonged winters.
- Excessive grazing by the goats and cattle which leads to loss of vegetation and makes hilly areas prone to soil erosion.
- The state's ambitious plan to expand its hydroelectric potentials is also putting the biodiversity at risk. In addition to submergence of rich forest areas, the movement of aquatic and terrestrial species for food and mating is also seriously affected by construction of dams/hydel projects.
- Farmers have become more inclined towards the non-environmental rather than older traditional farming methods and have increased depedenence on chemical fertilizers, pesticides, insecticides etc.

5.1.4 Progress Mapping (last 5 years)

5.1.4.1 Physical Progress

» Table 5.2 : Physical progress achieved corresponding to the activities of Himachal Pradesh

Code	Activity	Physical Progress
A/B/1	Evaluation of the effects of climate change on areas of high environmental value/ eco sensitive areas.	The State Centre on Climate Change located in Shimla has carried out following studies in the ecological fragile areas: • Hydrological Modelling of Beas basin • Yamuna Basin • Climate Change Vulnerability amount under IHCAP of DEST

A/B/3	Undertake climate change impact studies using existing information on public land of significant patrimonial value such as glaciers that encompass entire watersheds, glaciers or those that form an oasis in absolute desert ecosystems.	As given in Action code A/B/1
A/B/4	Develop the Integrated Observatory Project in order to precisely measure terrestrial factors that influence climate change.	As given in action code A/B/1
A/B/5	Wetland conservation, restoration programs.	The Govt. of Himachal Pradesh is implementing Wetland Conservation programme through State Wetland Authority for Ramasar sites (Renuka, Chandertal, Pong Dam) and other wetlands of National importance such as Rewalsar, Khajiaretc. These are various Ramsar sites and wetlands of national importance in the state. The HPKCCC is also preparing an inventory of all wetlands of implementation through GIS platform for knowledge sharing.
A/B/6	Protection of glaciers	Some action based analysis has been carried out specifically for glaciers. These are as following: 1. Assessment of seasonal snow cover in the state during 2015-16 2. Development of snow cover atlas of Satluj basin, 2011-12 Space application centre has initiated mapping of snow cover and permanent glaciers in Satluj, Baspa and Chenab basin and glaciers of Spiti Valley. The monitoring of glaciers is critical step in developing strategies for glacier protection.
A/B/7	Develop a State Plan for Climate Change Education and Awareness, by incorporating the subject into curriculum at all educational levels.	Himachal Pradesh is partner state with GIZ for implementing Climate Change Adaptation project in rural Areas of India (CCARAI) with MoEF&CC, Government of India (GoI) to strengthen the capacities of key actors at the state level for planning, implementing, financing, monitoring and evaluating of climate change adaptation measures. HP State Knowledge Cell on Climate Change (HPKCCC) under National Mission for Sustaining the Himalayan Ecosystem (NMSHE) has been setup in the Department of Environment, Science & Technology, Govt. of Himachal Pradesh (GoHP). Through this cell the GoHP intends to place a sound coordination mechanism for ensuring cooperative and cohesive actions on climate change under active coordination with Department of Science Technology (DST), GoI.
A/B/8	Creation of the State Fund for Research on Climate Change and Biodiversity.	State Department of Environment Science and Technology has prepared project proposals under National Adaptation Fund to Ministry of Environment, Forest and Climate Change through NABARD.

5.1.5 Gap/Barrier Analysis

Major gaps identified in the biodiversity sector in Himachal Pradesh are as follows:

- Altitudinal shift due to rising temperature, coupled with unsustainable harvest system, has put various medicinal plant species on the verge of extinction.
- Several independent and site-specific studies have been carried out for climate and biodiversity linkage by universities, research institutions and donor agencies. A Database is required where all such studies can be accessed for the future biodiversity conservation and strategy development.
- The climatic change or variability aspect of

biodiversity conservation, management and research needs to be enhanced. The future strategies for biodiversity conservation must include climate change as one of the key issues apart from the existing ones. It should be included in the annual working plan.

- There is a need of interdepartmental coordination for effective implementation of actions for biodiversity conservation,
- management and research, involving the Forest Department, State Biodiversity Board, Rural Development Department, Panchayati Raj Institutions (PRIs) and hydro-electricity development corporations.

The wetlands are under tremendous threat either due to non-availability of action plans or due to inadequate level of priority given to these ecosystems.

5.2 STATE MISSION FOR GREEN INDIA

5.2.1 Overview of Forest Sector

Himachal Pradesh is endowed with rich ecological and natural resources in its forests for which the state is sometimes also referred as the "Green Pearl" of the Himalayas. According to the State Forest Report (2017), 27.12% (15,100 sq. km) of the state's geographical area is under the forest cover. Out of 15,100 sq. km, 3110 sq. km area of the forest cover is very dense forest, 6705 sq. km area is moderately dense forest & 5285 sq. km of area is open forest. The total carbon stock in the forests of the state is about 175.782 million tonnes, which is around 644.534 million tonnes of CO2 equivalent. The state holds approximately 2.48% of total forest carbon stock of India.

The following table shows the district wise forest cover of Himachal Pradesh:

» Table 5.3 : District-wise Forest Cover of Himachal Pradesh (area is sq. km.)

District	Geographical area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	% age of geographical area	Change	Scrub
Bilaspur	1167	23	161	191	375	32.13	14	0
Chamba	6522	775	986	682	2443	37.46	1	21
Hamirpur	1118	39	86	188	313	28.00	71	2
Kangra	5739	297	1274	626	2197	38.28	130	8
Kinnaur	6401	79	266	278	623	9.73	14	71
Kullu	5503	582	843	562	1987	36.11	22	23
Lahaul &Spiti	13841	15	31	147	193	1.39	3	24
Mandi	3950	368	722	571	1661	42.05	84	28
Shimla	5131	736	1039	624	2399	46.76	9	31
Sirmaur	2825	131	568	688	1387	49.10	2	56
Solan	1936	46	426	394	866	44.73	16	44
Una	1540	19	303	234	556	36.10	27	0
Grand Total	**55673**	**3110**	**6705**	**5185**	**15000**	**26%**	**393**	**308**

5.2.2 Impact of Climate Change on the Forestry Sector

Impact of climate change on the forests of Himachal Pradesh can be uneven due to climatic variances. The high altitude forests of the state are highly vulnerable and shifts in forest types may occur in more than 80% of forests due to climate change. In recent years, due to high summer temperatures, forest fires are getting common in Himachal Pradesh. Due to carbon enrichment, forest productivity may increase initially, but in the longer term, adverse impacts are expected.

Figure 5.1 : Locals trying to contain the forest fire in Dharamsala, Kangra district

The three altitudinal strata of the state: Shiwalik hills, Middle Himalayas and Himadri range of Himalayas, support 35 types of forests. Any change in temperature and precipitation can severely affect the entire ecosystem. The consequences of anticipated/ expected effect of climate change can be the following:

1. Change in distribution of tree species;
2. Shift of tree species to higher altitudes due to increasing temperature. The Himalayan pine, Pinus wallichiana, is reported to be on an upward shift of 19m/10 years on southern and15 m/10 years on northern slopes in Saram, Parvati Valley, Himachal Pradesh.[1] The shift of apple cultivation towards higher altitudes has already been well documented.
3. Change in forest productivity due to carbon enrichment of the atmosphere. However, carbon enrichment is majorly a theoretical concept because upto reaching a certain level, the carbon sequestration potential of trees may reach their saturation level.
4. Increase in tree mortality (for conifers) due to reduced snow fall in higher altitudes.
5. With higher temperature, major tree species like Cedar and Oak may face decline.
6. The trees species may become vulnerable to pest attacks.
7. Increased susceptibility of threatened floral species to extinction due to climate related stress, in addition to the anthropogenic pressures.

A study conducted by Ravindranath et al., (2006)[2] concluded that in a projected climate scenario for the year 2085, 77% and 68% of the forested grids in India are likely to experience a shift in forest types under A2 and B2 scenario, respectively.

It is observed that there will be a shift towards wetter forest types in the north-eastern region and drier forest types in the north western region in the absence of human influence.

The increasing atmospheric CO2 concentration and climate warming may also result in a doubling of net primary productivity under the A2 scenario and nearly 70% increase under the B2 scenario. Climate analysis of the state's vulnerability has projected an increase in heat waves, heavy rainfall, floods and droughts. It may increase incidence of forest fire and soil erosion in the state specially in sensitive areas.

Reference

1. Valley, H.P., 2003. Upward shift of Himalayan pine in western Himalaya, India. Current Science, 85(1), p.135.
2. https://www.researchgate.net/publication/2183030_Impact_of_Climate_Change_on_ Forests_in_India

5.2.3 Key issues and the challenges in the forestry sector

Himachal Pradesh is a mountainous state having forests with rich flora & fauna and immense carbon stock. However, the forestry sector of the state has some key issues in the context of climate change and other anthropogenic/natural stresses. Located in the Himalayan region, the state faces additional challenges as the Indian Himalayan Region is facing major changes due to global warming, temperature rise and erratic precipitation. The forests in Himachal Pradesh, especially at higher altitudes, are highly vulnerable to climate change.

Following are the three major issues in forestry sector:

1. **Participatory forest management for meeting the local livelihood requirements.**
    - Forest institutions at village level need to be strengthened to develop an effective leadership to deal with climate change related issues independently with fully-functional entities. Those who are rich and powerful have more influence on the decision-making processes. Reservations for under-privileged sections in the village forest institutions have not led to their empowerment and traditionally dominant sections of the community do not recognize the power granted to the under-privileged.
    - Roles, mandate, perceived importance and aims are to be streamlined in regard to deal with climate risks and to be coordinated with the members in project sponsored village forest institutions.
    - Existing institutions like Panchayats need to develop adequate understanding of climate change related issues and sustainable management of forests for goods and services they render.
    - The process of providing institutions of participatory forest management is long, tedious and unclear due to existing functional mechanism in forestry sector department as well as at Panchayat and village forest institutions.
2. **Increasing quality and quantity of forest benefits**
    - The annual forestry budget of the state is less than 0.1 % of the total economic value of the forests.
    - The existing government foresters need to have incentives to use their skills in managing and conserving the forests and also additional threats due to climate change.
    - The environmental goods and services provided by the forests of Himachal Pradesh have not been utilised to their full potential. The watershed and biodiversity services provided by the forests have not been accounted for economically market mechanisms like payment for ecosystem services. Even though, the state managed to get the first bio-carbon fund project for India, the rates have not been remunerative enough to the community.
    - Most of the protected areas of Himachal Pradesh are under-represented due to their remote location and there are less than a third of protected areas that have management plans.
    - There is a need to harness the potential of the traditional knowledge of local communities regarding the biodiversity of the forest and its management.
    - Wildlife sanctuaries established in the state are based on individual species instead of taxonomic factors, habitats or ecosystems.
    - The cattle population of Himachal Pradesh is around 5 million. It is 3 times more than its carrying capacity. Excessive, uncontrolled and unregulated grazing has led to degradation of forests. In theory, grazing can also have ecological benefits as it can remove weeds from forest areas. However, a right mix of policy and practical measures to harness the positive use of grazing are needed.

- Unregulated tourism has taken a serious toll on the forests and its resources. Widespread encroachment of natural landscapes for development of hotels and resorts has seriously affected the natural ecosystems in Himachal Pradesh. There is a serious need to strike a balance between nature and tourism.
- The green felling in the state lacks clarity and scientific basis. It has also not been effectively enforced as the extraction of timber before and after the imposition of ban on green fellings remains almost the same.

3. Governance, laws and policy coherence.
   - Land use policy regarding forest is to be defined as there are many stakeholders associated with the forestry sector.

A right mix of administrative and participatory way of management of forests need to be organised and clarity on division of roles and responsibilities among authorities and forest dependent communities needs to be enhanced. The non-forestry sector policies has also affected the forest cover of the state. For example, State Hydroelectric Power Development Policy directly affects the forests. A holistic policy covering both energy and forests needs to be rationalised so that state can exploit its hydroelectric power potential while minimising impact on its forest resources.

5.2.4 Progress Mapping (In the last 5 years)

Himachal Pradesh formulated its Climate Change Action Plan in 2012. Prior to that, the state had come up with Climate Change Mitigation Policy in 2008. The main aim of the policy was to promote clean development mechanism for generating carbon credit benefits. The stock-taking report presents the milestones, targets achieved as well as the roadblocks experienced during the implementation of the SAPCC. Most of the achievements in the forestry sector were achieved through the Himachal Bio-Carbon Fund Project.

» Table 5.4 : Progress achieved corresponding to the activities of Himachal Pradesh

Code	Activity	Physical Progress
A/F/1	Perform an analysis of the vulnerability and adaptation potential of the forest sector resources.	No such specific analysis has been done for forestry sector and its resources in the context with climate change.
A/F/2	Assess and summarize national policies and strategies for adaptation in the forest sector and water resources	No progress.
A/F/3	Conduct a socio-economic assessment of the impact of climate change on the Forestry sector and studies to identify climate change adaptation measures and projects in forest sector of Himachal Pradesh.	A 7-year project has been initiated with the assistance from KfW from 2015-16 onwards. The project "Himachal Pradesh Forest Ecosystems Climate Proofing Project" has been implemented in the districts of Chamba and Kangra. Under this project, 600 Panchayats have been targeted for forest conservation, increasing biodiversity and generating income from sustainable forest management.
A/F/4	Perform studies to identify climate change adaptation measures and projects in forest sector of Himachal Pradesh, especially in alpine area reserves.	No progress.

A/F/5	Implement a genetic improvement program to develop new plant varieties that have been adapted for new climate change scenarios.	No progress.
A/F/6	Target CAT implementation and physical achievement	Under this target various activities such as plantations, nursery development, soil and moisture conservation measures, infrastructure development for forest management and other ancillary activities have been carried out.
A/F/7	Foster and promote efficient use of water in forests	Water harvesting, storage structures like ponds, check dams, other civil works, development of water resources and integrated development of catchments have been implemented. A 20-years scheme is already being running for checking soil erosion in the forest areas.
A/F/8	Target annual basis forest area enhancement community participation	Mid-Himalayan Watershed Development Project and Himachal Pradesh Forest Ecosystems Management and Livelihood Improvement Project are two major projects supported by World Bank and Japan International Cooperation Agency (JICA) for enhancement of community participation in forest management. Under Mid-Himalayan Watershed Development Project, the state sold its carbon credits generated from afforestation/reforestation CDM Project for Rs. 1.93 crore to Spain. The verification of the first cycle of the carbon sequestration was completed in year 2014.
A/F/9	Forest fire and management and control	No decrease in the occurrences of forest fires. No trend observed in forest fire occurrences from 2008-09 to 2015-18.
A/F/10	Target to create nurseries with new varieties.	Within CAT plan implementation new nurseries have been created.
A/F/11	Promote native forest management and recovery	Nil
A/F/12	Promote afforestation	Plantation carried out other than Catchment Area Treatment (CAT) and National Afforestation and Eco Development Board (NAEB) plantations should come under afforestation activities. Urban plantation activity such as "Nagar Van Udyan Yojna – Ek Kadam Hariyali Ki Or" – Programme for Climate Smart Green Cities" should also help in promoting afforestation.
A/F/13	Promote a program to calculate the carbon foot print	Nil
A/F/14	Estimate carbon capture by plantations	Nil
A/F/15	Sustainable management of forests as per agreed upon methodology on REDD+	Nil

Year	Number of fire incidents	Total area affected (in ha)	Estimated loss (INR)
2008-09	572	6586.12	60,05,064
2009-10	1906	24,849.52	2,55,22,928
2010-11	870	7387.63	97,69,363
2011-12	168	1758.15	43,07,878
2012-13	1798	20773.97	2,76,82,589
2013-14	397	3237.52	52,31,011
2014-15	725	6726.4	1,13,26,522
2015-16	672	5749.95	1,34,77,730
2016-17	1789	19162.69	3,27,87,627
2017-18	670	4586.47	55,11,091

A: Adaptation, **M:** Mitigation

5.2.5 Gap/barrier Analysis

Major gaps identified in the forestry sector of Himachal Pradesh are:

- Himachal Pradesh is the first state in the country to initiate applied and basic climate change research by hydrological monitoring activities for various river basins, studies on snow cover and glaciers at higher altitudes. However, climate change related impacts on the state's forest and biodiversity resources still need specific attention. The high-altitude vegetation is of much importance because the effect of climate change is now visible there. There has been a shift of vegetation to higher altitudes due to warming of weather which requires additional, coordinated & multi-disciplinary research.
- Himachal Pradesh has an immense potential for hydro-power development, but the hydroelectricity development has adverse impacts on flora and fauna, like the submergence from reservoirs leading to loss of large primary forest land areas. Also changes in the flow patterns of rivers affects the movement and reproduction of aquatic fauna. Therefore, hydropower development on the rivers needs active involvement and consultations with forestry and wildlife experts.
- Afforestation is good for increasing the forest cover of the state, however, it is equally important to conserve existing forests. The native forests are under severe anthropogenic pressures like the NTFP extraction, uncontrolled grazing, fuelwood collection etc. All these activities, coupled with climate change, can affect the native forest vegetation, floral and faunal biodiversity. There is no separate mandate for regeneration and recovery of native forests.
- Changing climate needs phenotypes that are better adapted to elevated temperatures and erratic precipitation. Genetic improvement of existing tree species is needed through development of specialized nurseries.
- Occurrence of forest fires in the state shows an erratic pattern each year. The fire control and management efforts need to take into consideration changing and unpredictable climate while devising management strategy. Especially during summer dry seasons, the fire control and management needs to be ready for any potential occurrence of fires.
- Urban areas can also be targeted for afforestation activities. Under the Nagar Udyan Yojna for urban plantations, only one city Shimla, has been covered, other major towns/ cities like Hamirpur, Una, Kullu, Nahan, Paonta Sahib, Mandi, Solan and Kasauli need to be brought under this scheme.

5.2.6 Sector- Priority/Strategies for Forest and Ecosystem and Biodiversity

5.2.6.1 Future plans to meet NDC and SDG targets

At the national level actions for climate change mitigation and adaptation in various sectors have been initiated. India's policy measures to combat climate change under NDC has reaffirmed its goal to bring its 33% of the geographical area under forest cover. Increase in the forest cover will deliver mitigation as well as adaptation benefits. Various policy actions like Green India Mission, REDD+ Policy, Joint Forest Management (JFM), National Agroforestry Policy and National Afforestation Programme (NAP) could have direct and indirect mitigation and adaptation benefits.

Table 5.5 : Initiative taken by state under NDC commitments

NDC Commitment – Forestry Sector	Initiatives taken by the state
Government of India plans to bring its 33% of the geographical area under the forest cover.	According to State Forest Report, 2017, HP has added 393 sq. km of its area under the forest cover in comparison to 2015 assessment. The main reason for increase in the forest cover of Himachal Pradesh can be attributed to plantation and conservation activities both within and outside recorded forest areas.
To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forests and tree cover by 2030.	According to the State Forest Report, 2017 the total carbon stock of the state is about 178.782 million tonnes of CO_2 equivalent which is about 2.48% of the total forest carbon of the country. To have a carbon sink of ~191.65mn tons, the state might have to enhance forest and tree cover by 2-3% which could be challenging.

5.2.6.2 Situational Analysis

The state of Himachal Pradesh is already noticing signs of climate change impact on the forestry sector. Due to existing environment and anthropogenic reasons, the state's forests are already under enormous pressure. According to a recent study,[3] altitudinal shift of species like Betul autilis, Abies pindrow, Populus ciliata, Aesculus indica, Pinus wallichiana etc in Parvati Valley and Upper Beas river catchment in Kullu district have been reported. Similarly, studies regarding potential changes in forests due to climate changes are required for Kullu and Kinnaur districts. Such studies can be instrumental in developing future strategies for mitigation and adaptation.

5.2.6.3 Specific Targets under SDG for Himachal Forestry and Biodiversity Sector

Out of 17 goals of SDGs, 3 specific goals are relevant for the forestry sector. These are:

- **Goal#12:** Responsible consumption – achieving economic growth and sustainable development requires reducing the ecological footprints. Efficient management of natural resources is essential to achieve this goal.
- **Goal#13:** Climate Action – helping climate vulnerable regions of the world to develop climate change mitigation and adaptation actions.
- **Goal#15:** Life on land – conserving and restoring the use of terrestrial ecosystems like forests by 2020. Checking deforestation, reducing loss of natural habitats and biodiversity.

The state of Himachal Pradesh has broadly targeted the climate change adaptation actions in the forestry sector that have linkages with SDGs.

Table 5.6: Himachal Pradesh's climate change adaptation actions in forestry sector

Activity	SDG	Target	Indicator
Increasing forest cover under schemes like Green India Mission	Goal #15: Life on land – It aims to conserve and restore the use of terrestrial ecosystems like forests by 2020. Checking deforestation, reducing loss of natural habitats and biodiversity are some of the main objectives.	Increasing the forest cover by afforestation/ reforestation, reducing deforestation and degradation.	Forest cover in % of total geographical area of the state.
Studying of short term and long term impacts climate change impacts on forest ecosystems, its goods and services. This will help in developing actions for mitigation and adaptation	Goal #13: Climate action – helping climate vulnerable regions of the world to develop climate change mitigation and adaptation actions.	Basic and applied research for forestry sector of Himachal Pradesh.	Action points based on research findings.

Reference

3. IHCAP (2016)-Climate Vulnerability, Hazards and Risks: An Integrated Pilot Study in Kullu District, Himachal Pradesh
Source: http://www.hpccc.gov.in/documents/FSI%20Repor %20updated.pdf

Sustainable use of forest resources like fuel-wood, grazing medicinal and aromatic plants	Goal #12: Responsible consumption – achieving economic growth and sustainable development requires reducing the ecological footprints.Efficient management of natural resources is essential to achieve this goal.	Protect and restore existing forests. Sustainable use of forest resources.	Amount of Fuelwood, medicinal and aromatic plants & fodder usage from sustainable sources.

India has considered "Planned Afforestation" as one of the key mitigation measures under its NDC's and Green India Mission is playing a critical role in achieving country's mitigation targets. Conserving existing forests and bringing additional land areas under forest cover may have mitigation and adaptation benefits not only for forestry sector, but also for other mitigation and adaptation measures under India's NDC. For example, conserving existing forests as well as plantations in hilly regions of Himachal Pradesh may increase the carbon sink while also reducing the frequency of landslides and flash floods. In line with NDC commitments and SDG goals, Himachal Pradesh has identified options of mitigation and adaptation measures for the forestry sector. The identified high impact mitigation and adaption options are the following:

1. **Developing a climate change and forestry action plan under Nation Green India Mission and Mission on Eco-Tourism, to access more funds which would include:**

   - Identifying key impacts, vulnerabilities and research priorities on the state forest ecosystem; this includes assessing implications of climate change for native and plantation forests used for timber production; the capacity of forest systems to sequester carbon.
   - Developing strategies in collaboration with hydro-power industry for co-management of forest & bio-diversity; and
   - Developing communication strategies targeted at schools, public and private institutions for undertaking plantations and tree regeneration.
   - Developing proposals under REDD+ mechanism for additional funding.

2. **Develop a climate change and forestry action plan under Nation Green India Mission**

   The state should identify more number of clusters for funding under GIM.

Identification of key impacts, vulnerabilities and research priorities – Support research priorities to fill gaps in climate change and forestry research

Himachal Pradesh is located in the Indian Himalayan Region being one the most vulnerable regions of the world. Due to increasing temperature and precipitation variability, shifting of species towards higher altitudes is already being observed. However, there is a dearth of sector specific studies on climate change. State specific key impacts, vulnerabilities need to be studied given the unique geography and location of the state. It will be necessary to study issues related to forest fire and man-animal conflict.

Direct and Co-benefits:

- Management of forest resources of state
- Reduced risk of forest fires and conflicts

Developing strategies in collaboration with hydro-power generation industry for co-management

Diversion of forest lands for hydro energy development may reduce the forest cover in the state, but the state has immense hydro power energy potential which needs to be tapped for future considering the rising energy demand. Therefore, both forest department and hydropower producers need to develop a common holistic plan to address the concerns of hydropower development in order to minimize loss of forest cover. Funding from CAMPA fund may be helpful. Spending of funds is governed by 'Compensatory Afforestation Funds Rules 2018'

in contradictory which specific activities for which money shall be used for forest and wildlife management as defined under sub rule (2) and sub rule (3) of Rule 5 (2). These activities are not covered under these rules. Thus, in light of CAF Act, 2016 and Rules 2018, no collaboration is possible with hydro projects under CAMPA.

Direct and Co-benefits:

- Higher share of non-fossil fuels
- Additional carbon sinks

Developing communication strategies targeted at schools, public and private institutions

Message about role of forest in climate change mitigation and adaptation should be communicated to general public and relevant stakeholders. Following approaches can be adopted to develop communication strategies:

- Local participatory engagement at municipal, panchayat, village level for disseminating knowledge about greenery and forests.
- Using a variety of alternative communication channels.
- Involvement of local voluntary and self help groups.

Direct and Co-benefits:

- Better awareness levels about effects of climate change and creation of additional carbon sinks

Under the HPFECP project, the activities approved under micro plans prepared by the village forest management consultant of KfW are being carried out effectively.

3. Strengthening of state wetland authority and preparation and implementation of action plans at micro level for conservation and restoration of wetlands

- The state needs to assess the impact of climate change on wetlands eco systems. Determination of trends of and development of models for impact of climate change on biodiversity, eco-system services and Ramsar sites needs to be carried out. Integrated wetland management plans for Ramsar sites based on needs and projection needs to be prepared. Establishing and developing institutional structures and processes for integrated wetland management at the sites are needed based on which wetland health cards for Ramsar sites can be generated. DEST in coordination with Forest Department, State Wetland Authority, Tourism Department, Department of Fisheries, and District Administration aims to conserve wetlands of the state.

Direct and Co-benefits:

- Reduced erosion
- Recharging of aquifers,
- Habitat conservation of wildlife species

Enhancement of livelihood options of state through Agroforestry/farm forestry

Livelihood options for local communities like community based eco-tourism, biomass briquetting, NTFP Collection; cultivation of local medicinal herbs need to be promoted.

Direct and Co-benefits:

- Alternative Livelihood for farmers of the state.

Biodiversity Conservation

Habitat Management of invasive species should be carried out in the state and strengthening of biodiversity management committee of the state needs to be undertaken.

Direct and Co-benefits:

- Increase in ecosystem productivity
- High economic importance

Ecotourism Expansion

Promotion of programs related to traditional culture-based tourism. State government has already started focusing on expansion of eco-tourism through formation of eco –tourism clubs and capacity building programmes for its various stakeholders. These initiatives should be strengthened and sustainably designed.

Direct and Co-benefits:

- Economic benefits to state

5.2.6.4 Synopsis of Activities & Implementation Schedule

Table 5.7 : Activities and Implementation schedule for Himachal Pradesh

S. #	Code	Activity	Name of ongoing scheme from which fund can be accessed	Proposed budget (2021-30) in Rs. Crore	Amount likely from existing central scheme (2021-2030) in Rs. Crore	No. of years	Amount likely from existing state govt. scheme (2021-2030) in Rs. Crore	Gap fun-ding	Implement-ing Department
1.	F-EB/1	Identification of key impacts, vulnerabilities and research priorities- support research priorities to fill gap in climate change and forestry research needs.	Externally aided research projects (JICA assisted PIHPFEM&L) Under this project expenditure on studies: I. Development of Biodiversity Monitoring system= Rs 30 Lakh II. NTFP Research & Cultivation= Rs 100 lakh (The above activities would be committed to the identifica-tion of impacts & research priorities to fill gap in Climate Change and Forestry research needs)	2.6	No central scheme cover these activities	10	No state govt. scheme cover these issues	-	Forest Deptt.
2.	F-EB/2	Developing strategies in collaborating with hydro industry	CAMPA	20.0	-	10	-	-	Forest Deptt. Energy Deptt., Private sector
3.	F-EB/3	Developing communication strategies targeted at schools, public and private sector	Himachal Pradesh Forest Ecosystems Climate Proofing Project (KfW supported)	16.0	-	10	0.10	-	Forest Deptt., Media, Private Sector, PSUs, Education Deptt.
4.	F-EB/4	Strengthening of State Wetland Authority and preparation and implementation of action plans at micro level for conservation and restoration of wetlands	National Wetland Conservation Programme, NMSHE	80.0	10.0	10	2.0	-	DEST, Forest State Wetland Authority, Fisheries , Tourism, District Administrati-on

5.	F-EB/5	Enhancement of livelihood options through Agro forestry/farm forestry		200.0		10			Department of Forest
6.	F-EB/6	Biodiversity Conservation through habitat management and strengthening of Biodiversity committee		170.0	-	10	-	-	Biodiversity Board
7.	F-EB/7	Eco Tourism Expansion		200.0	-	10	-	-	Department of Forest
		Total		688.6	-	10	-	-	-

5.3 STATE MISSION ON SUSTAINABLE AGRICULTURE

5.3.1 Overview of the Sector

Agriculture is the mainstay of the economy of Himachal Pradesh and provides direct employment to around 62 per cent of the total working population of the state. Agriculture and its allied sectors contribute[4] to about 10% of the total GSDP of the state. State has four agro climatic zones i.e. Shivalik Hill, Mid Hill, High Hill and Cold Dry Zone. Each zone has a significant potential for growth of varied crops. Agro-climatically, the region is more suitable for growing off-season vegetables and temperate fruits which have improved economic prosperity of farmers. Other allied sectors such as animal husbandry and fisheries also generate livelihood options for the agrarian population. Maize and paddy are major food-grain crops of the Kharif season in the state. The other minor crops are ragi, millets and pulses while wheat is a major Rabi crop. While the state has improved its cereal crop production, emphasis needs to be given on growth of off-season vegetables, potato, ginger, pulses, oilseeds with adequate inputs, watershed development approach and, bringing more of cultivated area under irrigation.

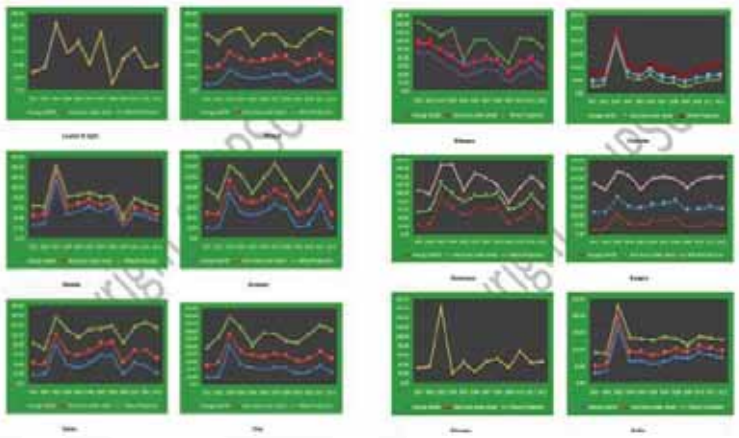
5.3.2 Sector Vulnerability due to Climate Change

Agriculture being the largest occupation and source of livelihood in Himachal Pradesh, agricultural production is adversely affected by climatic variables like temperature and rainfall. Temporal distribution and quantum of rainfall is an important determinant of fluctuations in crop production levels. According to Braun (1991) a 10% decrease in seasonal rainfall from the long-term average generally translates into a 4.4% decrease in the country's food production. Erratic rainfall and associated droughts have historically been a major cause of food shortages and famines (Wood, 1977). Production of kharif crops in the state is dependent on the behaviour of southwest monsoon, as 80% of the cultivated land is rainfed. The impact of rainfall on four major crops viz. wheat, barley, rice and maize has been studied for all districts of Himachal Pradesh. A positive correlation has been observed between the rainfall and production as well as area sown under wheat crop indicating that rainfall is a major factor influencing production as well as area sown under wheat in all districts. The rice production and area sown under rice was also observed to be positively correlated with the quantum of rainfall received during the growing season of rice. For maize, when there was sufficient rainfall during the growing season of maize the production was high however during less rainfall, irregular and untimely rainfall there was decrease in production and area under the crop.[5]

Reference

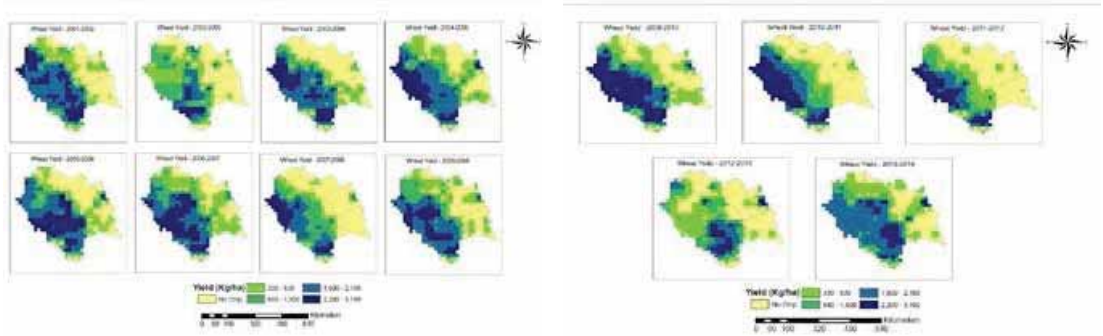
4. Agriculture and its allied sectors contribute to about 12.73 % of the total GSDP of the state Source: Economic Survey 2019-20, HP
5. Impact of Rainfall on Agriculture in H.P. - State Centre on Climate Change

Figure 5.2 : Impact of Rainfall on Wheat in all districts of Himachal Pradesh



As per the INCAA report 2010, three areas in apple growing districts (Kullu, Shimla and Manali) were studied for the impact analysis of weather data increase in precipitation and decreased snowfall during winter months with annual rate of 82.7 mm consequently reflected in the low chilling hours in Kullu district. Cumulative chill units of coldest months reported a decline of more than 9.1 units per year in the last 23 years. This decrease in chill units is reported at rate of 11.9 units in Bajaura, 19 units in Theog region.[6] A study led by ISRO and Agriculture and Soil Department, wheat yield from Coalition for Environmentally Responsible Economies-wheat model was calibrated and validated for variety HPW-89 for Himachal region. The genetic coefficients thus generated were used to simulate the wheat yield in different years starting from 2001-2020 (Ponraj, 2014). As per the IPCC report the wheat yield in the south east asian countries is going to reduce to up to 50% during the next 50 years. The predicted trend observations also showed a decreasing trend line, which is showing a reduction in the wheat yield in the future. As per the graph, the maximum yield is expected in the year 2016, which relates to optimum forecasted weather conditions – like maximum rainfall of 600 mm and optimum maximum and minimum temperatures. The crop yields in the years 2002 and 2012 were observed to be minimum during the entire 25 year period due to the abnormally low rainfall conditions that persisted during 2002 and 2012. The year wise wheat yield maps for the years 2001 to 2025 are given in Figure 5.3.

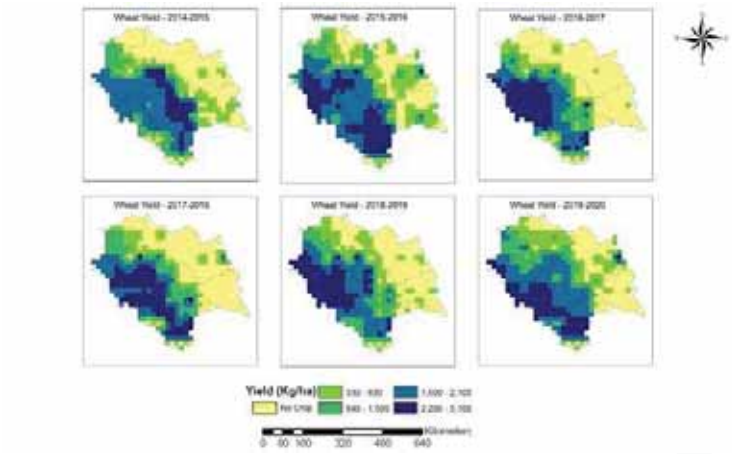
Figure 5.3 : Projected yield of Wheat



Reference

6. Climate Change and India: A 4*4 Assessment a sectoral and Regional Analysis for 2030s

Figure 5.2 : Projected yield of Wheat



Under the NICRA project district Kullu, Shimla, Chamba, Bilaspur were found to are highly vulnerable as far as agriculture related vulnerability is concerned. Climate data from RCP 4.5 and RCP 8.5 indicates an increase in extreme events: heavy rainfall, heat waves, floods and droughts in the state. These extreme events might lead to fluctuations in agricultural and horticulture production in the state. Vulnerability ofagriculture dependent communities, farmers, workers especially with monoculture of wheat/maize, least diversification and low value addition are sensitive to climate variability negatively.

5.3.3 Key Issues and Challenges of the Sector

Table 5.8 : Key Issues and challenges of Himachal Pradesh

Key Policy Elements	State Performance
Technical	• Farming on tiny and terraced holdings • Changing agricultural landscape due to extreme climatic events • Lack of modern irrigation systems and infrastructure for moisture management. • Lack of climate resilient crop varieties • Agriculture machinery utilization is low • Lack of road infrastructure in inaccessible villages, lack of cold storage.
Institutional/Regulatory	• Missing region perspective in macro-level policies; policy focus in mountainous areas on resource extraction, revenue maximization • Product pricing and compensation mechanism guided by conventional measures rather than sustainability implication of pace and pattern of resource use
Financial	• Lack of marketing channels for marketable surplus of agri and horticulture crops • Lack of financial support (subsidy/ incentives) • Poor yield of animal husbandry products due to lack of fodder and poor breed of animals.
Capacity building	• Lack of adequate training on climate resilient technology and practices in the sector
Socio-Economic	• Low income of farmers due to insufficient irrigation facilities

5.3.4 Progress Mapping (In last 5 years)

The stocktaking exercise for the sustainable agriculture sector has been highlighted in Table 5.9. The SAPCC 1.0 activities have been proposed, out of these some activities have been undertaken by the Department of Agriculture:

Table 5.9 : Physical Progress achieved with respect to the action proposed

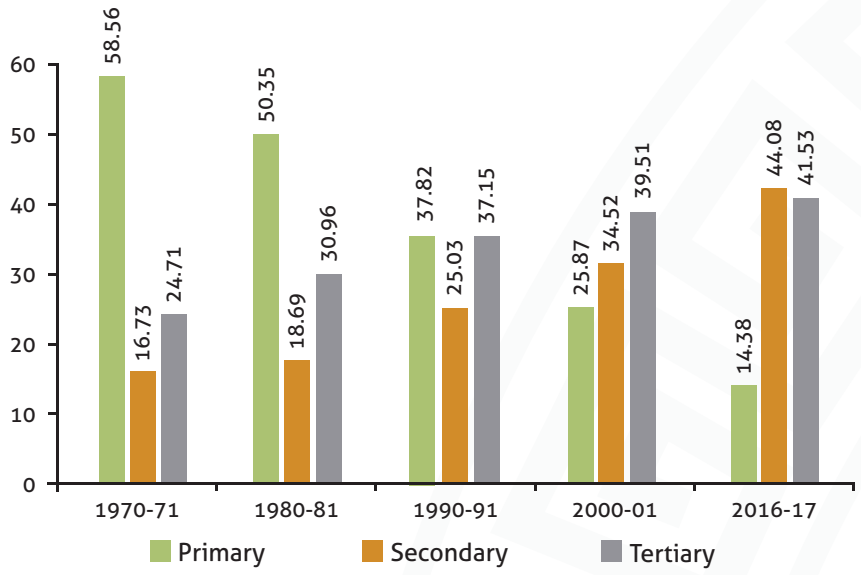
Action Code	Action Proposed	Physical Progress
AG/4	Develop a system to manage agro-climatic risks and agricultural emergencies	About 4,36,280 farmers got insured in 2013-17 under Weather. Based Crop Insurance Scheme by Department of Horticulture. About 185325 farmers covered under RKBY & PMFBY from Rabi 2012 to Kharif 2016 ensuring area ~ 97845 hectares for which about s 578.5 Crores was insured during this period. 3760 polyhouses have been set up since 2014 under Dr. Y.S. Parmar Kisan Swarojgar Yojna (RIDF 19XIX). 412696 Sq. m. area covered under poly houses benefitting 554 farmers from MIDH in year 2013-18.
AG/5	Foster and promote the efficient use of water in agriculture.	1819.69 ha. Area covered under Micro Irrigation scheme under National Mission for Micro Irrigation by Department of Horticulture during 2014-17. 231.38 Ha is converted to irrigated land under PMKSY in 1 year 2554 ha. area covered under Micro-Irrigation under Rajiv Gandhi Micro-Irrigation Scheme funded by NABARD under RIDF –XIV during 2015-2018.
AG/6	Reduce use of chemicals for agri-horti productions and to promote organic farming in the state.	In 2014-15 micronutrients promotion was carried out on 700 hectares land.
AG/8	Increase the State's irrigated surface area by 50% through a new water shed - dam construction program.	377 Ha area was developed under Rainfed Area Development of National Mission for Sustainable Agriculture from 2014-18; Integrated Harvesting System under NMSA covered 4579.5 Ha; Under Value Addition and Resource Conservation Greenhouse were 23668 sq m, WHS in command area of 51.7 Ha; 248.3320 ha. area has been brought under irrigation under Per Drop More Crop component of Pradhan Mantri Krishi Vikas Yojana by constructing water harvesting / water conservation structures.
AG/9	Expand irrigation and water policies to include small reservoirs, artificial groundwater replenishment, relining of canals, to promote organic farming in state	Bore wells and Lift Irrigation schemes are being implemented in the state Jal Se Krishi Ko Bal scheme is initiated. Saur Sinchayee Yojna is being implemented in the state. Flow Irrigation Scheme Per Drop More Crop-Pradhan Mantri Krishi Sinchayee Yojana are being implemented successfully in the state.

5.3.5 Gap/barrier Analysis

This agrarian state has witnessed a decline in share of agriculture, horticulture and animal husbandry in GSDP from 26.86% in 1990-91 to 9.68% in 2016-17 as shown in figure 5.4. The economy of the state has also witnessed a shift away from agriculture sector and towards industries and services. Share of primary sectors (including agriculture and allied sectors) in State. Domestic Product has declined from 58.56% in 1970-71 to 14.38% in 2016-17.[7]

Changes in occupational profile of Himachal Pradesh also indicate an increase in interest in non agriculture occupations. As per the census data, of the total workers 57.93% are cultivators and 4.92% agricultural laborers in 2011 as compared to 65.33% cultivators and 3.15% agricultural laborers in 2001. These shifts may be due to a lesser dependence on agriculture derived livelihood options

Figure 5.4 : Sectoral contribution in GSDP of Himachal Pradesh



Major gaps identified are as follows

- Lack of incorporation of indigenous knowledge to manage scarce land and water resources in mainstreaming agricultural system and practices.
- Increasingly small land holdings may lead to non-cultivable land for which promotion of high value crops, precision farming, bringing more area under efficient irrigation, consolidation of holdings should be promoted by the department.
- Inadequate soil and water conservation measures causing soil and water erosion lead to low agricultural and allied sector productivity. State schemes need to give more emphasis on soil conservation measures, increasing vegetative conservation and watershed development approach.
- Low income of small & marginal farmers is attributable to inadequate marketing and post-harvest infrastructure. Addressing this problem requires sensitization of farmers on efficient marketing, better marketing infrastructure like marketing yards, storage and transportation facilities, better rural connectivity etc.

Reference

7. Economic Survey of Himachal Pradesh, 2017 Source: Economic survey 2019-20, HP

- State schemes/programmes also need to support the development of bio input enterprises and provisions need to be included in the support programmes.
- Absence of systematic and quantified evidence of impacts of various policies and aspects on long term sustainability.

5.3.6 Sector Priorities/Strategies

5.3.6.1 Future Plan to Meet NDC and SDG

Specific Targets under INDC for Agriculture and Allied Sector

The NDC aims at achieving the vision of a sustainable lifestyle and climate justice to protect the poor and vulnerable from adverse impacts of climate change. In order to achieve the goals, the central government has developed some commitments for different sectors. The key commitment under INDC pertaining to agriculture and allied sector are outlined in the Table 5.10

Table 5.10 : INDC commitment & key State Level Initiatives

Key Policy Elements	Key initiatives by the State
To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture.	• Reducing emission from agriculture by adopting climate resilient best agricultural practices and sustainable cropland and nutrient management. • Increasing income and generation of livelihood by increasing dependence on high value crops. • Better preparedness towards climate induced hazards

Table 5.11 : Specific Targets under SDGs for agriculture and Allied Sector

SDG Goals	Key initiatives by the State
Goal 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	• Increasing production of agriculture and horticulture crops, improved resilient crop varieties, providing better market • Improved storage facilities to address climate variability
Goal 6: Ensure availability and sustainable management of water and sanitation for all	• Increasing efficiency in water usage for irrigation. • Adoption of water harvesting and soil conservation techniques
Goal 12: Ensure sustainable consumption and production patterns	• Sustainable production through Cropland and plant management and cropland nutrient management • Meeting required demands

High Impact opportunities in Agriculture and allied sector of Himachal Pradesh are:

AG/N/1: Sustainable land use management

Himachal Pradesh is a hilly state and the enhancement of cropping intensity is a challenge. Farming on small land holdings in the state and altered land use pattern has resulted in productivity losses. Development and integration of land use policies will support effective use of resources to prevent degradation of agricultural

land. The state needs to promote high input carbon cropland management practices like improved crop zzvarieties, crop rotation, use of cover crops, perennial cropping system, agricultural biotechnology. Cropland nutrient management also needs to be promoted by use of fertilizer input to increase yields and residual inputs, changing nitrogen fertilizer application rate, fertilizer type, timing, precision application, inhibitors etc.

Direct and Co-benefits:

- Enhanced crop Production and enhancement in yield
- Enhanced carbon sink

AG/N/2: Adequate promotion and development of resilient high value crops including fruits and off-season vegetables which are suitable for the seasonal variations to promote a viable solution for farmers facing the impacts of climate change on cereal based agriculture

Majority of farmer population is completely dependent on cereal based agriculture for livelihoods. Dependence on rain fed crops increases their vulnerability. Hence there is a need to shift to high value fruits and vegetables. Extensive research on new crops including fruits and vegetables needs to be carried out by academic and research institutions at the state level.The state will try to minimize the impacts of climate change on horticulture products by increasing the area under perennial fruits and vegetables which will also help in enhancing carbon sinks, promoting low volume – high value crops like medicinal plants, fruits like kiwi, avocado etc. and multi-cropping.

Direct and Co-benefits:

- High farm/farmer income
- Reduced vulnerability to climate induced hazards

AG/N/3: Analysis of the impact of climate change on crop yield change, demand and supply.

Research needs to be undertaken to better understand the impact of climate change on crop yields as well as demand and supply chains. Gaps in available markets needs to be analysed for changes during different seasons. After identification, necessary planning can be done to increase the resilience. The linkages should be built on micro-weather station data; soil health based nutrient management system and organic cultivation.

Direct and Co-benefits:

- Better market linkages would help farmers to get correct price for their produce.
- High resilience

AG/N/4: Introduction of people centric watershed development and soil conservation.

The state has already undertaken watershed development and soil conservation activities in projects like Mid Himalayan Watershed Development Programme and Rainfed Area Development Programmes under NMSA. Water harvesting structures like ponds, dams, de-silting structures, rain water structures, farm ponds, dugout ponds etc. for multiple purposes like irrigation, animal husbandry need to be cared for by the local community after construction. NGOs/ civil organizations can be appointed by government for handholding the farmers for implementation of above-mentioned activities.

Direct and Co-benefits:

- Employment generation
- Better water availability throughout the year for irrigation and other activities

AG/N/5: Revision and implementation of Contingency plans

State needs to revise and upgrade its agriculture contingency plans and impart training to agriculture officers for rigorous implementation of the plan ensuring reduced crop failure in the state due to unfavourable climate conditions.

Direct and Co-benefits:

- Increased adaptive capacity
- Reduce chances of failure
- Reduction in farmer distress

AG/N/6: Use of information and communication technologies including mobile telephony for dissemination of weather-related information

In order to ensure preparedness towards the changing weather like delay or early onset of monsoon, early warning systems including announcements, sharing of information through mobile apps/ messages

Direct and Co-benefits:

- Increased preparedness
- Reduce cases of crop failure
- Increased awareness among people

AG/N/7: Foster and promote the efficient use of water in agriculture

Several works were undertaken in this context in the last five years under schemes like Rajiv Gandhi Micro Irrigation Scheme, PMKSY, Pandit Deen Dayal Kisan Bhawan Samriti Yojna and MIDH. The activities should be promoted again as there is scope for enhancing water efficiency in agriculture sector of the state. Initiatives like use of solar powered pumps and economical need to be undertaken.

Direct and Co-benefits:

- Micro-irrigation can result in increased irrigation and fertilizer use efficiency.
- High water use efficiency for irrigation and lower fossil fuel consumption
- Reduction in water shortage and enhanced future availability

AG/N/8: To promote development of eco villages/ bio villages in order to improve livelihood resilience amongst villages in high-altitude regions.

It aims the Integration of natural resources with the local community to focus on the qualitative and quantitative, social, economic and environmental benefits of implementation of an effective framework. Some proposed projects in the villages can be

I. Creation of pond for rainwater harvesting and rooftop rainwater harvesting
II. Electrification of the village by solar panel system

The project is proposed in Jawari village with an area of 133 ha and a total population of approximately 384 individuals accommodated in 64 households.

Direct and Co-benefits:

- Farm forestry, community forestry and other afforestation programme
- Groundwater recharge, water storage and rainwater harvesting
- Encouragement of renewable source of energy

AG/N/9: To promote crop diversification through protected cultivation and promotion of solar fencing in state

Installing solar fencing around the entire perimeter of the field acts as an effective barrier that uses safe electric shocks to deter animals from entering the farm boundary

Direct and Co-benefits:

- About 24,429.45 tCO_2 emissions saved for 25 years for all 2300 solar fencing systems.
- Improving resilience of local communities against crop loss.

AG/N/10: To promote balanced use of pesticides and fertilizers in state and improvement of market linkages for agro-horticulture and herb-culture products

Better use of pesticides and fertilizers should be promoted in state. Construction of a local level storage unit for storing excess products by different small farmers is required. It will also help in adapting to climate variability.

Direct and Co-benefits:

- Rural Development, livelihood generation and increased climate adaptability.
- Sustainable agricultural practices.
- Food security.

5.3.6.1 Future Plan to Meet NDC and SDG

Table 5.12 : Implementation schedule of the state

Code	Activity	Scheme	Proposed budget (2021-30) in Rs.Crore	Duration in years	Amount likely from existing central scheme (2021-2030) in Rs. Crore	Amount likely from existing state govt. scheme (2021-2030) in Rs. Crore	Gap funding	Implementing department
AG/N/1	Sustainable land use management	Himachal Pradesh Crop Diversification Promotion Project–Phase -II	1608.0	10	-	342	-	Department of Agriculture (HPADS)
AG/N/2	Adequate research for development of high value crops including fruits and off season vegetables which are suitable for the seasonal variations to promote a viable solution for farmers facing the impacts of climate change on cereal based agriculture.		300.0	10	-	-	-	Universities, Research Institutions
AG/N/3	Analysis of the impact of climate change on crop yield change, demand and supply		75.0	10	-	-	-	Universities, Research Institutions
AG/N/4	Introduction of people centric watershed development and soil conservation	National Mission on Sustainable Agriculture (NMSA), IFS (Integrated Farming System)	300.0	10	100	-	-	Department of Agriculture ,Department of Soil conservation
AG/N/5	Revision and implementation of Contingency plans	Calamity Relief Fund	150	10	80.0	-	-	Department of Agriculture
AG/N/6	Use of information and communication technologies including mobile telephony for dissemination of weather related information	ATMA, NeGP (National e governance Programme)	120.0	10	-	-	-	Department of Agriculture , Department of Horticulture, IMD

AG/N/7	Foster and promote the efficient use of water in agriculture and improvement of livelihood resilience	Efficient Irrigation through Micro-Irrigation Systems, Saur Sinchayee Yojna, Jal Se Krishi Ko Bal, Flow Irrigation Scheme, Per Drop More Crop –Supplementary Water Management Activities under PMKSY	1592.0	10.0	500.0	1000.0	-	Departm-entnof Agriculture , Departm-ent of Irrigation and Public Health
AG/N/8	To promote development of eco village/ bio village in order to improve livelihood resilience amongst villages in high-altitude regions	Eco Village Scheme	300.0	-	300.0	-	-	Departm-ent of Agriculture
AG/N/9	To promote crop diversification through protected cultivation and promotion of solar fencing in state	Mukhya Mantri Nutan Poly house Project	100.0	10	-	-	-	Departm-ent of Agriculture
AG/N/10	To promote balanced use of pesticides and fertilizers in state and iimprovement of market linkages for agro-horticulture and herbiculture products	National Mission on Sustainable Agriculture (NMSA). (Soil Health Management and Soil Health Card), PKVY (Paramparagat Krishi Vikas Yojna)	200.0	10	100.0	-	-	Departm-ent of Agriculture
	Total		4895.0					

5.4 STATE MISSION ON WATER

5.4.1 Overview of the Water Sector

As a part of Himalayan mountain ecosystem, Himacha Pradesh is endowed with a wide range of natural fresh water sources. Water resources in state are primarily in the form of glaciers and rivers. Total live water source storage in Northern States is of 18.01 BCM while the available storage is ~ 20% of the capacity of reservoirs[8]. Glaciers and glacial lakes are the source of north Indian rivers during critical summer months. The cascading effects of rise in temperature, glacial melt in Himalayan ranges shows an effect on water availability, biodiversity, ecosystem

The production of agricultural and horticultural crops in state depends on snowfed gravity channels and fresh snowfall. Any changes in rainfall patterns impacts hydrological cycle. The climate change has social and environmental impacts that are likely to exacerbate uncertainty in water supplies and fluctuations in agricultural production. Shimla, the state capital faces an acute water crisis due to deficits in precipitation during winters and drying up of most of the water sources like streams, springs, rivulets and other natural sources during summers.

Reference
9. South Asia Network on Dams, Rivers and People, Himachal Pradesh
10. Ground Water Year Book Himachal Pradesh 2016-17, CGWB Source: https://himachalpradesh.pscnotes.com/
11. Climate Change adaptation in Himachal Pradesh: Sustainable strategies of water resources Source: https://www.adb. org/sites/default/files/publication/27999/cca himachal-pradesh.pdf

Drinking water supply and sanitation for all households in the state is a commitment of the government for which effective adaptation measures and investment options must be taken to augment water supply and decrease the impact of climate change.

There are five major river systems of the state i.e. Satluj, Beas, Ravi, Yamuna and Chenab. These rivers receive water from about 800 glaciers located in upper reaches covering 3124.713 km^2 areas. All five river basins cover almost 55,000 sq. km of area with catchment area of 53311 sq. km[9].

HYDROGEOLOGY

Himachal Pradesh is a hilly and mountainous region with fissured tertiary formations dating back to Proterozoic to Mesozoic ages. The valleys cover only 15% of the state's area which is formed of alluvial deposits having porous formations. The porous rock formations from boulder, cobble, pebble, sand, silt and clay show high yield characterestics from 30- 75 m3/ hr. These rocks are found in districts like Kangra, Una, Solan, Sirmaur, Mandi and Kullu. The fissured formations show moderate to low yield. Parts of districts like Sirmaur, Solan, Bilaspur, Una, Mandi, Hamirpur, Lahaul & Spiti, Kangra, Kullu and Chamba show these formations[10]

GROUND WATER SCENARIO OF STATE

Most of the areas of state are hilly and inter mountainous. Traditional ground water structures like dug wells are presently observed for monitoring in valleys. Currently 128 National Hydrograph Stations have ben established in 7 districts of the state by CGWB. Rainfall in the state varies from 600 mm to 2400 mm with northern districts of the state receiving higher share of rainfall. Decadal water level fluctuations in the state show fall in an average of 60% of the stations analyzed. The rise is observed between 0-2m only in all the stations.

Table 5.13 : Decadal Water Level Fluctuations in Himachal Pradesh

Year	No. of Stations analyzed	% of stations showing rise	% of stations showing Rise			% of stations showing Fall
			0-2 m	2-4m	>4m	
>4mMay (2006-15)	95	37.89	83.33	8.33	8.33	62.1
August (2006-15)	99	38	86.84	7.89	5.26	61
November (2006-15)	99	39.39	82.05	12.82	5.1	60.6
January (2007-16)	86	43.02	78.37	8.1	13.5	56.97

Himachal Pradesh has no fluoride, arsenic, iron, nitrate, salinity & heavy metals affected habitations as reported by the state for Integrated Management Information System of Ministry of Water Resources.

IMPACT OF CLIMATE CHANGE ON WATER RESOURCES

The mountain Himalayan ecosystem has wide range of natural resources and is particularly highly vulnerable to climate change. Climate analysis has shown that temperature increases are greater in uplands than the lowlands.[11] Climate change impact assessment on water sector was carried out by GIZ using biophysical models. Under RCP 4.5 and 8.5 scenarios for southwest monsoon, an increase in precipitation is projected up to 23% towards mid-century and up to 41% towards end century. It also projected an increase in run off in districts like Kullu, and Lahaul Spiti and increase in evapo-transpiration in districts like Shimla and Sirmaur

The analysis also predicted an increase in flood discharges in districts like Chamba, Hamirpur, Kangra, and Lahaul & Spiti and they are likely to experience high magnitude of floods in future. District wise vulnerability analysis based on adaptive capacity, sensitivity and exposure is done by identification of specific indicators of sector. Vulnerability indices for water sector were generated for each district. All districts except Una, Hamirpur and Lahaul & Spiti showed high

and very high vulnerability under both scenarios. Table 5.14 highlights current and projected vulnerability of Himachal Pradesh for water sector.

Table 5.14 : Himachal Pradesh Current and Projected Variability in water sector

Water Resources VI (WRVI)						
			RCP 4.5		RCP 8.5	
Districts	BL_Rank	BL	MC	EC	MC	EC
Lahaul &Spiti	1	VL	VL	VL	VL	VL
Kinnaur	10	VH	VH	EH	VH	EH
Solan	9	VH	VH	VH	H	H
Kullu	4	M	H	H	H	VH
Shimla	8	H	H	H	H	H
Hamirpur	2	L	L	L	L	L
Mandi	11	VH	VH	VH	VH	H
Kangra	5	H	H	H	H	H
Una	3	L	M	L	L	L
Bilaspur	12	VH	EH	VH	VH	VH
Sirmaur	6	H	H	H	H	H
Chamba	7	H	VH	VH	H	EH

VL: Very Low, L: Low, M: Moderate, H: High, VH: Very High, EH: Extremely High, BL: Baseline, MC: Mid Century, EC: End CenturySource: Climate Impacts and Vulnerability Assessment of the Water Sector in the state of Himachal Pradesh, GIZ

Large rivers and tributaries, locally known as seasonal rivulets, nallahs and khads are important part of riverine system. Local communities are dependent on these resources for their household needs and drinking water. Hence any impact on these resources will affect the lives of local communities. Threat from floods and climate change projected are critical for Satluj, Ravi and Chenab.

Figure 5.5 : Source: South Asian Network on Dams, Rivers and People.

5.4.3 Key Issues and Challenges of the Sector

Technical Issues

- The state specific agro-climatic zoning-based cultivation and contingency plan need to be formalised.
- Huge leakages in water supply and distribution systems in most of the towns of the state.
- There is limited micro irrigation coverage in the state.
- Despite heavy rainfall in the state, many areas are water stressed leading to rise in groundwater usage in state. Data has shown that depletion rate between pre and post monsoon period is about 40-80% depending on landscape.
- Contamination of drinking water is still a major issue in the state.
- Lack of irrigation facilities for major part of cutilvated area is a serious problem. Dependence on rain water makes the rural population highly vulnerable.

Institutional /Regulatory Issues

- Poor groundwater management regulation in the state.
- State is prone to hazards like flash floods, however the state has no defined line department for climate and flood risk with no climate adaptation activities undertaken by existing departments.
- All major water sources in the state are currently under climate stress and to cater to that preparation of action plans needs to be done with respect to the quality and quantity of water available in the state.
- Inter-departmental coordination needs to be promoted to ensure convergence of sustainable solutions and minimize inter-sectoral conflicts

Financial and Socio-Economic Issues

- Funds proposed for field channels/river lift should be optimized.
- Water Users Associations cover only 15% of net command area for observations and maintenance in the field.
- Schemes implemented by Department of Jal Shakti lack a convergence of activities contributing to other sectors like agriculture and horticulture based on crop water budgeting.

5.4.4 Progress mapping (in last 5 years)

Large rivers and tributaries, locally known as seasonal rivulets, nallahs and khads are important part of riverine system. Local communities are dependent on these resources for their household needs and drinking water.

PHYSICAL PROGRESS

» Table 5.15 : Progress mapping of Himachal Pradesh

Action Code	Action Proposed	Physical Progress
WR/3	Updating of hydrological balances in the most critical area	1. Under Swan River Channelization Project 2884 Ha. land brought under flood protection 2. Under Seer Khadd Stabilization 120 Ha. Land brought under flood protection 3. 584.6 Ha land was protected under floods and DPR for Bata river stabilization was prepared.

WR/5	Forecasting of hydrological trends (flows) based on climate evolution predictions.	Hydrology project involves integration and comprehensive hydrological data collection and information system
WR/7	Progress toward commitments set out in the state strategy for Integrated Watershed Resources Management and development	Swan River Integrated Watershed Management Project restores degraded forests; protect agricultural land, and increase agricultural and forestry products. Swan River watershed in the Una district of the state of Himachal Pradesh in northern India, thereby improving living standards of 2 local residents including the poor. Under Integrated Watershed Management Programme 249916 Ha of land was treated under all the projects sanctioned in all districts of state.
WR/11	Encourage the construction of rain water harvesting structures	Water and Sanitation Support Organization disseminates information, education and communication of water conservation & water harvesting through letters, radio channels. In last five years Water and Sanitation Support Organization communicated 1919 advertisements and audio messages, conducted Awareness programmes, arrangement of plays for spreading awareness on water conservation at GP level, Poster/Pamphlet distribution on related topics.
WR/13	Carry out a multidisciplinary study of glaciology and meteorological aspects of rich biodiversity in remote geographical regions, through research.	Hydrology Project–II improved the existing system and developed an integrated and comprehensive hydrological data collection and information system in the State. Hydrology Project -II completed in 2014. Project involved compilation of information of surface water, ground water and weather related statistics through development of a physical model and its verification. Measurement of Groundwater through 80 piezometers. Borewell with Digital Water Level recorder, measurement of surface water through 35 observatories, 101 rainfall measurement instruments, 85 automatic rainfall measurement instruments 8 Weather observatories, 16 snowfall measurement instruments.
WR/15	Enhance rain water harvesting installations coverage in timebound manner	806 rain water harvesting structures with capacity of about 3443553.1 cum were constructed under MNREGA, Sustainability Component of NRDWP, NABARD, AIBP and other funds like DC's fund, CRF.

5.4.5 Gap/barrier Analysis

- State has to improve its water policy by incorporating clear directives for effective surface water restoration. Irrigation potential is not fully restored for identified water bodies as the state has converted only 8% of the irrigation potential.
- Limited emphasis on participatory irrigation practices.
- Structural maintenance is inadequate under the schemes due to lack of funds and community participation.
- Irrigation potential identified for water-bodies is not being tapped as per requirements due to fund scarcity.
- Himachal Pradesh has been classified as medium performer in the composite water index ranking and its performance has deteriorated in past two years. There is, hence, a high scope of improvement in water resource management practices.

5.4.6 Sector- Priority/ Strategies

5.4.6.1 Future Plan to Meet NDC and SDG

Specific Commitments under NDC for water Sector

India's NDC document has outlined its commitment to UNFCC on climate related action strategies and timelines. At the same time, SDG has also set goals and indicators. Water sector activities in Himachal Pradesh have been planned to align the activities to meet NDC commitments and SDG goals.

NDC document estimates indicate that India would need around USD 206 billion (at 2014-15 prices) between the year 2015 and 2030 for implementing adaptation actions in agriculture, forestry, fisheries infrastructure, water resources and ecosystems under the section Means for Implementation. Himachal Pradesh's plan for water sector is accordingly formulated with estimated financial requirement which when added will help in adding additional area under irrigation, hydro power, stream and river rejuvenation and aid to meeting NDC strategies and goals.

» Table 5.16 : NDC Commitment and Key State Level Initiatives to comply national pledge

NDC statement as adaption strategy- Water Sector	Key State level initiative to comply with NDC Statements
The adaptation strategies for the water sector focus on enhancing efficient use of water, ensuring access and tackling the adverse impact of climate change.	• Ensure Water Security. • Integrated water resource management. • Improve water use efficiency. • Improve defence from climate induced hazards.

» Table 5.17 : SDG target and key initiatives at state level

SDG Target	Key Initiatives at State Level to Comply SDG Commitments
By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	• State will reduce water losses and ensure efficient water distribution in all regions. • Better supply and distribution system to meet all the demands.
By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	• mprove water use efficiency, through crop water budgeting and microirrigation.
By 2030, implement integrated water resources management at all levels, including through trans-boundary cooperation as appropriate	• Implement Integrated Water Harvesting System.

High Impact Opportunities in Water Sector

Water sector, and the range of services it provides, underpins poverty reduction, economic growth and environmental sustainability. Access to water and sanitation facilities matters to every aspect of human development: from food and energy security to human and environmental health,water contributes to improvements in social well-being and inclusive growth, affecting the livelihoods of billions of people. Himachal Pradesh's water sector programmes need to be strongly aligned with SDG 6 for ensuring water availability and sustainable management of

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Himachal Pradesh's water sector programmes need to be strongly aligned with SDG 6 for ensuring water availability and sustainable management of water resources and sanitation for all. Activities planned for implementation by 2023 in water sector in Himachal Pradesh are briefly described below.

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Himachal Pradesh's water sector programmes need to be strongly aligned with SDG 6 for ensuring water availability and sustainable management of water resources and sanitation for all. Activities planned for implementation by 2023 in water sector in Himachal Pradesh are briefly described below.

WR/N/1-Reduce demand in the state by controlling leaks, implementing water-saving programs, cascading and reusing water.

Review of supply and distribution system in the state to identify and resolve water leakage issues in the urban areas of state. There is need for renovation, upgradation and expansion of water supply and distribution systems. The state capital itself faces major water loss in distribution during the water crisis. In order to increase the resilience during water shortage in the future there is need to decrease the losses.

WR/N/2: Integrated water resources management should be promoted. Expansion and maintenance of STPs in the State to promote recycling of water leading to reduced groundwater extraction.

There is a need to create a workable plan for integrated water resource management so that projects could be identified, planned and incorporated in the desired sectors. Water resource management can be promoted through groundwater recharge, rainwater harvesting, reuse of water for domestic/ or industrial sectors. Himachal Pradesh has shown good progress in construction of water harvesting structures. Integrated management of land considering specifically negative and positive impacts of climate change is however, necessary.

Himachal Pradesh aims to reduce ground water contamination through recycling and reuse of treated waste water primarily for the hotel industry in order to address the gap between sewage generation and treatment capacity.

WR/N/3: Promotion of Spring-Shed Management

Assisting ground water recharge through the principles of watershed management and encouraging aquifer recharge by, drainage line treatment, brush-wood check-dams, loose boulder check dams, fodder and fruit species and live hedge-rows. Proposed activities under this component will include protection and augmentation of water recharge at micro levels, community engagement for discharge monitoring and sustenance, capacity building of local institutions. Climate benefits include revival of natural spring sources and reforestation, enhanced availability of water to meet irrigation and drinking requirements, improvement of ground water quality due to effect of dilution and enhanced levels of water resource literacy amongst local stakeholders.

WR/N/4: Development of contingency plans for water sector/ Improve defence during hazards

In order to reduce the impact of climate related hazards like droughts, cloud bursts, hailstorms and flash floods contingency planning needs to be done at sectoral level taking into account possible future hazards. Preparedness and response plan for water related climate hazards should be suggested in the plan. Other defensive measures like shifting of harvesting structures during floods should be promoted.

WR/N/5: Participatory Irrigation Management through Water User Association with emphasis on crop-water budgeting

After new construction of canal systems and on-farm development work, Water User Associations should be formed so that the irrigation systems remain in good condition.

5.4.7 Synopsis of Activities and Implementation Schedule

Table 5.18 : Activities implementation schedule of the state

S.No.	Code	Activity	Name of ongoing/ new schemes from which funds can be accessed.	Proposed budget (2021-30) in Rs.Crore	Amount likely from existing central scheme (2021-30) in Rs Crore as in Col D	From state budget (2021-30) in Rs Crore	Gap funding	Implementing Agency
A	B	C	D	E	F	G	H=E-F-G	
1.	WR/1	Reduce demand in the state by controlling leaks, implementing water-saving programs, cascading and reusing water.	No central scheme	100.00			-	Department of Irrigation and Public Health
2.	WR/2	Integrated water resources management should be promoted. Expansion and maintenance of STPs in the State to promote recycling of water leading to reduced groundwater extraction	No central scheme	550.00			-	Department of Irrigation and Public Health
3.	WR/3	Promotion of Spring-Shed Management leading to increase in irrigation efficiency	PMKSY				-	Department of Irrigation / Department of Agriculture
4.	WR/4	Development of contingency plans in water sector / Improve defence during hazards	No central scheme	300.00	-	10	-	Department of Irrigation and Public Health

5.	WR/5	Developing communication strategies targeted at schools,public and private sector	Himachal Pradesh Forest Ecosystems Climate Proofing Project (KfW supported)	100.00	-	10	-	Department of Irrigation and Public Health
		Total		2000.00				

5.5 STATE MISSION FOR HEALTH

5.5.1 Overview

Himachal Pradesh has 12 districts with a total population of 68, 64,602, out of this only about 10.03% of this population is urban and majority still lives in rural areas of the state. Due to the locational disadvantages there is a huge difference between regions regarding the availability of the health services. The service delivery of health care centres varies depending upon the population and terrain of the area The number of sub-centres, Primary Health Centres and Community Health Centres as on 31st March'2017 are given in table 5.19.

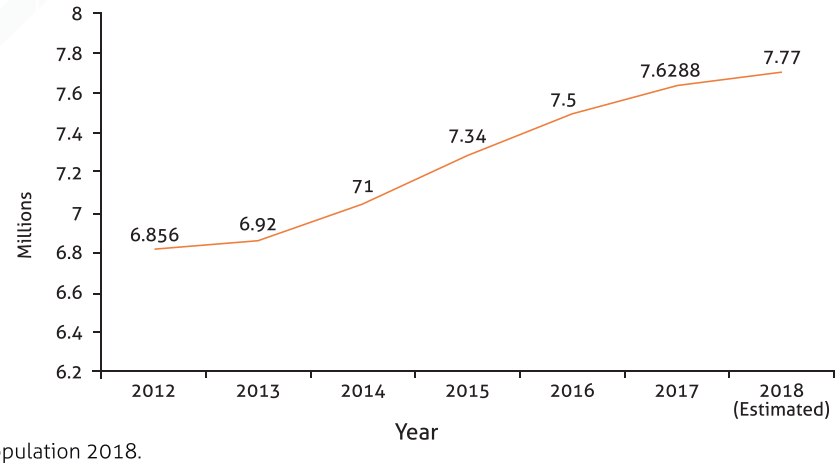
Table 5.19 : No. of Health Centres in State

Centre	No. of Centres
Sub-centres	2085
Primary Health Centres	576
Community Health Centres	90

Sources: Department of Economics & Statistics, Govt. of Himachal Pradesh

The ratio of hospitals for per lakh people is 2.81 which was more than national average of 2.20 (National Health Profile, 2011). In as many as five districts including Kinnaur, Lahaul & Spiti, Shimla, Sirmaur and Solan, the number of hospitals per one lakh persons was higher than the state average by 0.79 hospitals per 1 lakh persons. In the districts of Hamirpur, Bilaspur, Una, Kangra, Mandi, Kullu and Chamba the number of hospitals per 1 lakh persons was much less than the state average.

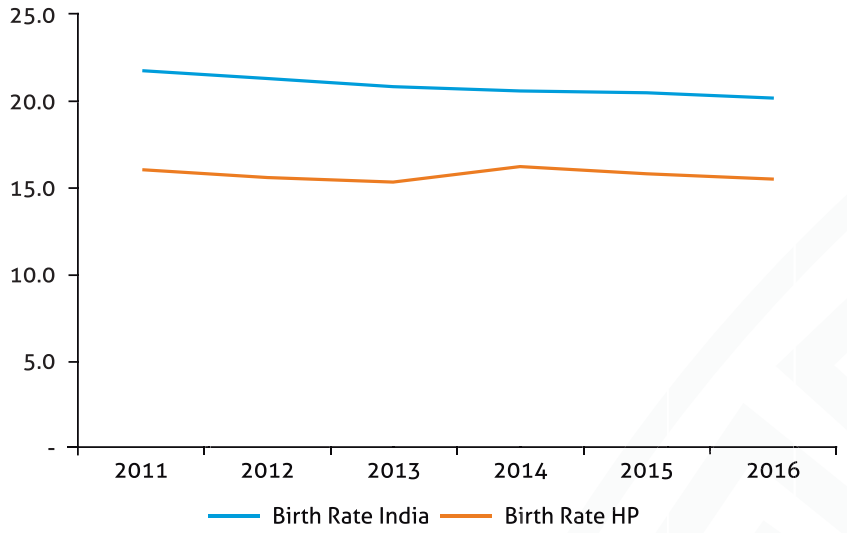
Figure 5.6 : Population Trend in Himachal Pradesh



Source: India Population 2018.

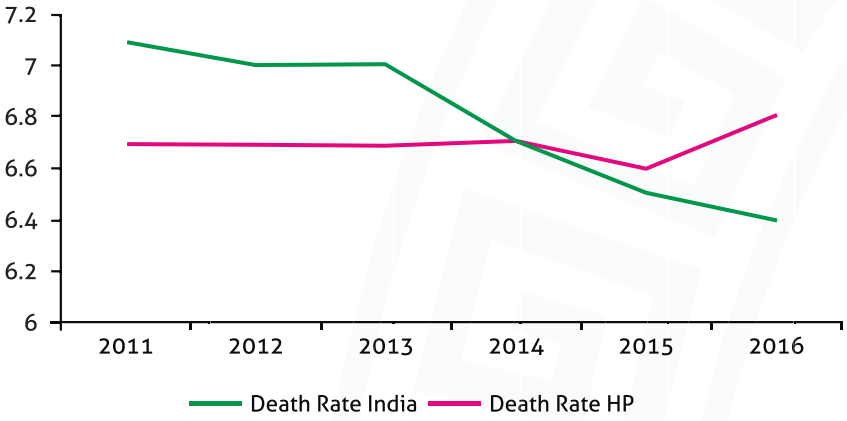
The population trends in Himachal Pradesh show an annual increase of 0.14176 million with which population in year 2018 is estimated at 7.77076 million.

Figure 5.7 : Birth Rate in India and Himachal Pradesh



Source: Niti Aayog, Govt. of India

Figure 5.8 : Death Rate in India and Himachal Pradesh

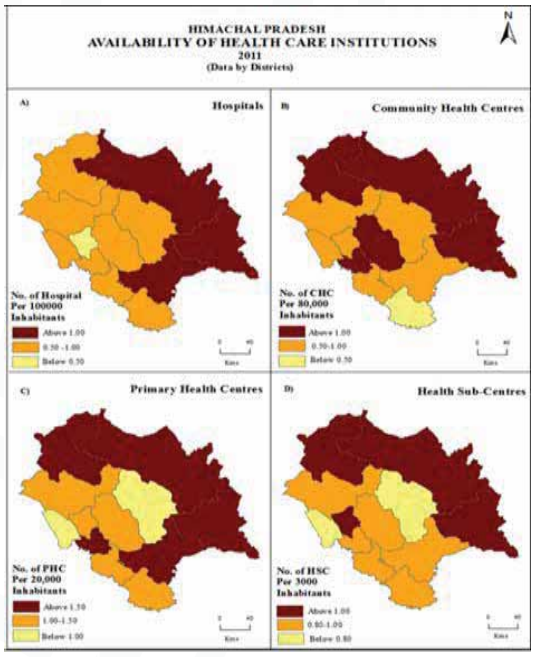


Source: Niti Aayog, Govt. of India

Overall child birth rate (CBR) of India was 20.4 in year 2016 and Himachal Pradesh's CBR was 16. However, Himachal's Urban Birth rate was noted to be amongst the lowest in the country i.e. 10.6.

The average life expectancy in the state is 72 years for both (male & female) as per the census report on mortality for 2011-15.

Figure 5.9 : Health institutions in Himachal Pradesh



COMMUNITY HEALTH CENTRES

The state had 0.91 community health centres per 80,000 persons as compared to other hilly states of India which had 0.45 community health centres per 80,000 persons (NHP, 2011). The districts of Kullu, Bilaspur, Chamba, Mandi, Kinnaur and Lahaul & Spiti possessed a higher number of community health centres per 80,000 persons. The remaining districts had a lesser number of community health centres per 80,000 persons than the state average. In year 2018, the state had 1.04 Community Health Centres per 80,000 populations which is better than national average.

PRIMARY HEALTH CENTRES

There were 1.39 primary health centres per 20,000 persons in Himachal Pradesh in 2011. This ratio is comparatively lower in other hill states of India; where 1.64 primary health centres operate per 20,000 persons. Chamba, Bilaspur, Shimla, Kinnaur and Lahaul & Spiti districts had a higher number of primary health centre per 20,000 persons than the state average. In all the remaining districts with the exception of Kullu and Una the number of primary health centre ranged between 1.00 and 1.50 primary health centre per 20,000 persons. The two extremes i.e. Lahaul & Spiti and Una have small proportion of population and so they have lesser Primary Health Centres. As the primary health centres form the backbone of rural health care system,the districts with a large percentage of rural population require more number of primary health centres. On the other hand, Kullu and Una are on the extreme opposite side, witnessing less number of primary health centres than the state average. In year 2018 the state had 1.68 Primary Health Centres per 20,000 populations which is better than national average.

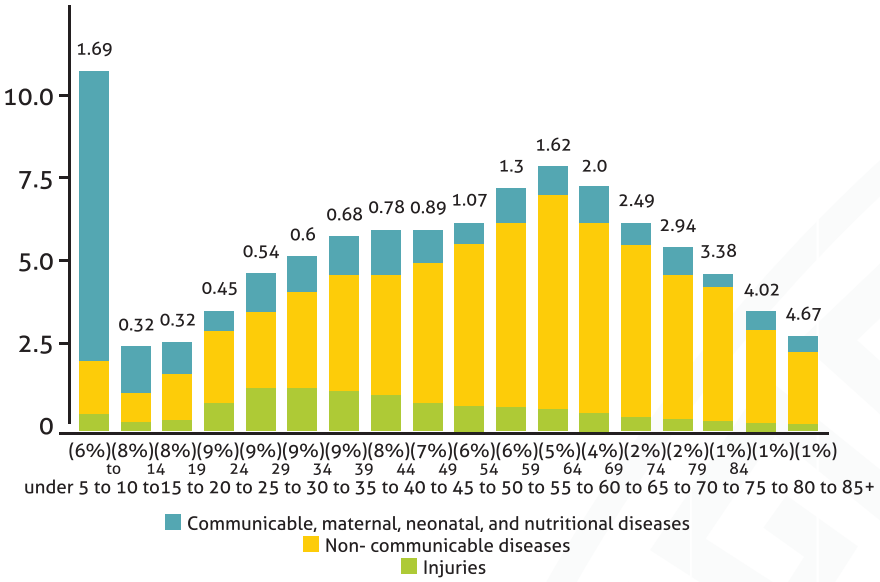
HEALTH SUB-CENTRES (HSCs)

In Himachal Pradesh health sub-centre-population ratio was 0.90 health sub-centre per 3000 persons, which was higher than other hill states in India where this ratio was 0.48 health sub-centre per 3000 persons in 2011 (NHP, 2011). In Bilaspur, Shimla, Solan, Mandi, Hamirpur, Chamba, Kinnaur and Lahaul & Spiti, the number of health sub-centre per 3000 persons was higher than the state average.

In Kangra, Kullu, Sirmaur and Una the number of health subcentre was however less than the state average of health sub-centre per 3000 persons.

Now, in year 2018 the state has 0.91 Health Sub-Centres per 3,000 populations which is lesser than the national standards.

Figure 5.10 : Age wise disease burden for the state of Himachal Pradesh



The number in the bracket on top of each vertical bar is the ratio of percent DALYs to population for that age group.
The number in parentheses after each age group on the x-axis is the percent of population in that age group.

HEALTH CARE STATUS

Figure 5.10 gives the age wise disease burden for the state of Himachal Pradesh as per ICMR reports. Under 5 years of age category, the disease burden is very high in Communicable, Maternal, Neo-natal and Nutritional Diseases (CMNNDs). The incidence trend for Non Communicable Diseases (NCDs) increases from 30 years and peaks at 60 years. From the above data, it is seen that the CMNNDs and NCDs are the biggest challenges for the state of Himachal Pradesh.

5.5.2 Impact of Climate change on Health Sector

As per the climate impact and vulnerability assessments of the state, it is observed that as per present trends, the heat is likely to increase in the months after May and up to September in most of the districts (analysed under two scenarios namely – RCP 8.5 and RCP 4.5). Since physical activities and exposure are more likely in the state, it is important to take precautions under high vulnerability phase which varies in mid-century and end-century. Lahaul & Spiti and Kinnaur are constant throughout. The temperature humidity index of Kangra and Mandi districts is very high with risk to animals and livestock.

Table 5.20 : Himachal Pradesh Current and Projected Variability

Himachal Pradesh Current and Projected Variability				
			Health/Extreme Climate VI (CLVI)	
			RCP 4.5	RCP 8.5

Districts	BL_Rank	BL	MC	EC	MC	EC
Lahaul &Spiti	1	VL	VL	VL	VL	VL
Kinnaur	3	VL	VL	VL	VL	VL
Solan	8	H	H	H	H	VH
Kullu	2	VL	VL	VL	VL	L
Shimla	4	L	L	L	L	M
Hamirpur	11	H	VH	VH	VH	VH
Mandi	6	L	M	M	M	H
Kangra	7	M	H	H	H	H
Una	12	VH	VH	VH	EH	EH
Bilaspur	9	H	H	H	H	VH
Sirmaur	10	H	H	VH	VH	VH
Chamba	5	L	M	M	M	M

Source: Climate Impact and Vulnerability assessment report, GIZ

Districts such as Una, Hamirpur, Solan and Sirmaur seem to face increased stress levels under both the scenarios. Climatic variations result in enhancement of vector-borne diseases such as malaria, bartonellosis, tick –borne and other infectious diseases. Many studies derived from empirical weather data have concluded that climate change causes the spread of vector-borne disease, as Ross Virus Fever in Australia (Woodruff & Guest 2002). The global temperature is likely to increase by 1.0 - 3.5 ºC (Watson et al. 1997). With the rising temperature, the rainfall pattern is also changing which is going to create preferred living conditions for vector-borne diseases.

Climate change and variability are likely to have a direct impact on vector-borne diseases epidemiology. With a rise in surface temperature and abrupt changes in rainfall patterns, the mosquito species may have favourable climatic conditions to grow (Patz & Martens 1996; Reiter 1998). Malaria mosquitoes have recently been observed at high altitudes in the region (Eriksson et al. 2008). Different temperatures can directly enhance the breeding of malaria protozoa and suitable climatic conditions can intensify the invasiveness of mosquitoes (Tong & Ying 2000).

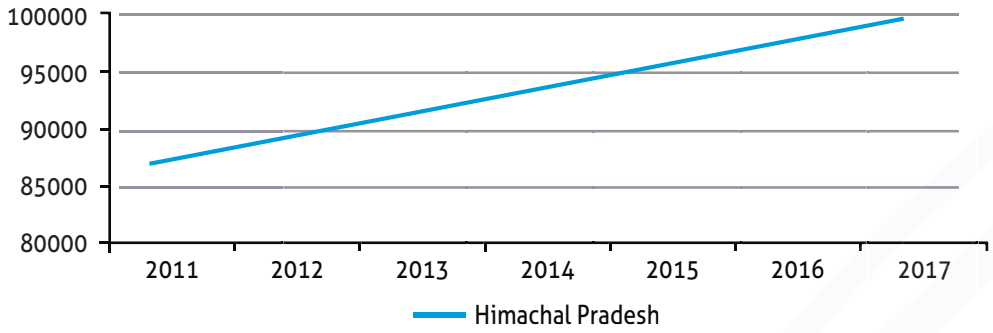
In Himachal Pradesh, aerosols optical depth (AOD), obtained through Multi Wavelength Radiometer (MWR) has shown highest ever AOD at 500 nm as 0.55 ± 0.03 in May 2009 which was 104 % more than mean AOD value from April 2006 to December 2009 (Kuniyal et al. 2009). This value of AOD was found to be 0.056 ± 0.037 at Nainital (Pant et al. 2006), that is, far less to the values obtained at Kullu, indicating inter-regional variations in Climate Change within the Himalayan region. The amount of aerosols present in the air leading to pulmonary complications. Temperature rise due to radiative forcing from aerosols in the atmosphere based on per unit AOD increase at Kullu (HP) was calculated as high as 0.95 kelvin (K) day-1 during summer (April-July) and as low as 0.51 K day-1 during winter season (December, January March) (Guleria et al. 2010). Climate change will have a wide range of health impacts across the Himalayas.

5.5.3 Key Issues and Challenges

The impact of climate change on human health is going to be big. 'The Lancet- Britain's premier health journal' has called it the "biggest global health threat of the 21st century." The key challenges not only include the heat related diseases but also psychological pressure each farmer under goes adding to higher stress levels and mental disorders. It will have health consequences that will disproportionately affect the most vulnerable and marginalized farmers, populations and increase in intensity over time. The residents of the slum areas are furthermore

closer to be affected by water borne and vector borne diseases. Unfortunately, the number which should have decreased with the enhanced development in the state talks otherwise.

Figure 5.11 : Slum Population in Himachal Pradesh



The key challenges are observed in the health sector of Himachal Pradesh are listed below.

- Direct impacts, such as propagation of vector borne disease (such as malaria, dengue, Japanese encephalitis, etc.), increased due to heat, drought, flooding and heavy storms, and enhanced mass migration of climate change victims.
- Climate change is causing scarcity of water thereby leading to an increased consumption of contaminated water. This in turn is responsible for increased incidence of Hepatitis A and E in the state.
- Floods create conducive environments for numerous health implications resulting from disease transmission e.g. if flood water gets contaminated with human or animal waste, the rate of faecal-oral disease transmission increases to many fold allowing spread of water borne diseases in the region.
- Fossil-fuel combustion causes major health problems by enhancing air-pollution which had lead to six million deaths reported globally each year (twice of Human immunodeficiency virus infection, Malaria & Tuberculosis together).
- Impacts on labour productivity can lead to economic consequences.
- Changes in climate may allow more virulent strains of disease or more efficient vectors to emerge or be introduced to new areas (Sharma et al. 2009).
- Increase in malnutrition due to the failure of food supply, disease and injury due to extreme weather events, Low productivity can furthermore lead to economic loss
- Increase in infectious diseases and cardiorespiratory diseases from the build-up of high concentrations of air pollutants such as nitrogen dioxide (No2),
- Increase in diarrheal diseases from deteriorating water quality.
- Increased concentration of ground-level ozone, and air-borne particles in large urban areas.
- Huge quantities of municipal waste produced in the western Himalayan Mountain towns are further compounding the problem of emission, sanitation and associated health hazards (Kuniyal 2002).

5.5.4 Progress Mapping (In Last 5 years)

Physical Progress: Out of the 9 activities proposed, work was undertaken for all activities shown in Table 5.21.

Table 5.21 : Activities proposed and physical progress in health sector of the state

Action Code	Action Proposed	Physical Progress
	Health Adaptation Measures	
H/4	Strengthen the capabilities of healthy personnel to address prevention and care of adverse effects caused by climate change.	IEC organized for Information, Education and Awareness Campaigns communicates with localites to give away lectures, organize quizzes and webcast of programmes in Shimla, Dharamshala, Kasauli and Hamirpur.
H/5	Identify vulnerable areas or those with the greatest health risks due to different factors. the affected population should also be considered	Vulnerability analysis on health sector for the state by GIZ as given in Table 19
H/6	Improve monitoring of environmental health indicators. Trends in these indicators as well as any stark changes can reveal effects of climate change	Surveillance of vector borne diseases is being done on weekly basis and data is shared with Govt. of India. State government is doing daily surveillance of five diseases namely ScrubTyphus, Hepatitis A and E & Dengue.
H/7	Interact with other sectors in order to identify the current or future effects of climate change on the health of the population.	No activity undertaken
H/8	Create and develop capacities to address the potential introduction of yellow fever, dengue fever, malaria and vectors such as mosquitoes	1. Strategies of national vector borne disease programme are implemented for vector surveillance & control upto 2018. A total of 4, 21,429 blood slides were examined out of which 97 slides were found positive 2. Capacity building of clinicians on new "National Guidelines of Clinical Management of Dengue Fever"
H/9	Adapt monitoring systems and emergency plans by including in risk management practices, any climate change related health effects.	RashtriyaSwasthyaBeemaYojna ensures social security and healthcare assurance. The premium cost for enrolled beneficiaries under the scheme is shared by Government of India and the State Governments. The program has the target to cover 70 million households by the end of the Twelfth Five Year Plan (2012-17). Out of total targeted families i.e. 877763, around480588 families are enrolled with 21 private and 155 Public Hospitals empaneled. About 116000 smart card holders in last five years receiving all the benefits.

5.5.5 Sector- Priority/ Strategies

5.5.5.1 Future Plan to meet INDC/SDG

Specific Targets under SDG for Health Sector

Specific goals under SDG 3 are to ensure healthy lives and promote wellbeing of all at all ages. It has 9 targets which are described in table 5.22 along with key initiatives at the state level to achieve these targets.

Table 5.22 : SDG target and key initiatives at state level

SDG Target	Key Initiatives at State Level to achieve SDG targets	Indicator
By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	• Increased number of CHCs , sub-centres and primary health centres. • Establishment of enhanced infrastructure. • Creation of awareness regarding symptoms of dengue and ensuring of no deaths occurs in the state. • Counselling to people suffering from depression to minimise suicidal • Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders • Improved health services available (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, new-born and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population) and 24X7 availability of ambulances in most of the districts. Above 2,50,000 people registered and given health cards till 2016 who have availed services of above one billion rupees worth of services have been provided	% of reduction of MMR
By 2030, end preventable deaths of new-borns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births.		
By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases		Prevalence of vector borne diseases will be reduced to half from the current level eventually to have zero mortality.
By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and wellbeing		
By 2020, halve the number of global deaths and injuries from road traffic accidents		% reduction in road accidents
By 2030, ensure universal access to sexual and reproductive healthcare services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes		
Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all		
By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination		

Himachal is one of the few states in the country where, there is no shortfall of Sub Centres, PHCs or CHCs relative to the population of the state. The expansion of public primary health care infrastructure in the state has undergone a rapid expansion. Himachal Pradesh, with nearly half of one percent (0.58% approximately) of India's population, has more subdivisional hospitals than Bihar, a state with 8.58% of India's total population. Despite the great infrastructure and resources at its disposal, Himachal Pradesh is short of skilled doctors and medical staff. There are absolutely no female health workers/ Auxiliary nurse midwife in Primary Health

Centres, and male health workers at Sub Centre are less than half of what is required. Out of the total 1951 sub centres functioning in the state, 214 work without a female health worker/ Auxiliary nurse midwife, 1,129 works without a male health worker, and 121 work without both.

High Impact opportunities in Health sector

HS/1- Adapt monitoring systems and emergency plans by including in risk management practices, any climate change related health effects

Health sector schemes need to incorporate risk management practices and adaptation to any climate related risks. It would enable more preparedness from climate change induced health risks.

HS/2- Improve monitoring of environmental health indicators. Trends in these indicators as well as any stark changes can reveal effects of climate change

Health surveys need to include more climate change risk related indicators for assessment of vulnerability from the sector.

HS/N/1- Strengthening health care in Himachal Pradesh to reduce deaths of new-borns and children under 5 years of age

Health surveys need to include more climate change risk related indicators for assessment of

HS/N/2- Strengthen the prevention and treatment of Vector-borne diseases such as malaria and dengue.

Considering the fact that, there will be more prevalence of vector borne diseases due to climate change, awareness levels of people and preventive health care infrastructure needs to be strengthened.

HS/N/3- Training and awareness programmes for identifying early signs of extreme climatic events on the population and their remedy

- Capacity building of all CMS/CMO/medical specialists, IDSP members, ASHA for identification of early climatic effects on communities and its remedies.
- Capacity building of hospital staff for providing necessary equipment, services.

HS/N/4: To understand the impact for the operational research for climate change in all districts of state

The state is considered to have high impacts in health sector due to climate change. Operational research on environmental causes of vector and water borne diseases is required at district level

5.5.6 Synopsis of activities and implementation schedule

Table 5.23 : Activities implementation schedule of the state

S.No.	Code	Activity	Name of ongoing/ new schemes from which funds can be accessed.	Proposed budget (2021-30) in Rs.Crore	Amount likely from existing central scheme (2021-30) in Rs Crore as in Col D	From state budget (2021-30) in Rs Crore	Gap funding	Implementing Agency
A	B	C	D	E	F	G	H=E-F-G	
1.	HS/1	Adapt monitoring systems and emergency plans by including in risk management practices, any climate change related health effects	IDSP IHIP	140.00	20.00	Nil	-	Department of Health
2.	HS/2	Improve monitoring of environmental health indicators.	Climate Change Anti Microbial Assistance Programme	20.00	2.00	Nil	-	Department of Health
3.	HS/N/1	Strengthen health care in the state to reduce fatalities of children under 5 years of age	National Health Mission	500.00	500.00	Nil	-	Department of Irrigation / Department of Agriculture
4.	HS/N/2	Strengthen prevention and treatment of Vectorborne diseases	National Health Mission	100.00	600.00	Nil	-	Department of Irrigation and Public Health
5.	HS/N/3	Training & awareness programmes for identifying early signs of extreme climatic events on the population and their remedy	National Health Mission	100.00	10.00	Nil	-	Department of Irrigation and Public Health
6.	HS/N/4	To understand the impact for the operational research for climate change in all districts of state	Directorate of Health Services	20.00	5.00		-	Department of Irrigation and Public Health
		Total		1780.00				

5.6 STATE MISSION ON TOURISM- ECO TOURISM

The policy related to tourism was formulated for the first time in 1991 in Himachal Pradesh. It has since been revised twice. In 2005 ecotourism component has added where eco-tourism was considered as an income generation strategy. Several measures have been taken up to promote ecotourism in the state, besides several seminars, capacity building and training are conducted in several forms. There is a huge potential of ecotourism in Himachal Pradesh. However, with the changing climatic conditions it is important to keep in mind the developments in ecotourism should by no means disturb the environmental balance. Ecotourism is directly related to other sectors i.e. Forest, Biodiversity and Urban Development. Improved infrastructure, roads and maintenance of biodiversity and forests helps in the promotion of ecotourism. With the involvement of local population, ecotourism can be beneficial to all.

5.6.1 Progress Mapping (In Last 5 Years)

Out of the proposed 8 activities in previous State Action Plan of Climate Change, progress has been observed in activities shown in table 5.24:

PHYSICAL PROGRESS

» Table 5.24 : Activities proposed and physical progress in Eco-Tourism sector of the state

Code	Activities	Physical Progress
ET/1	Incorporate the results of climate change impact studies into tourism plans to avoid the expansion of urban areas into rural and riverside areas that are already susceptible to climate change risk	Govt. level governing body (Chief Minister is the head)
ET/2	Check infrastructure development related to tourism activities in areas prone to disasters.	Eco-tourism 5 locations identified - Public-private Partnership mode Income generated – Avg 19,75,000/-p.a
ET/3	Assess the economic impact of preventive measures to prepare for extreme events and of repairs or reconstruction that could result necessary from such events.	Trainings for FRM Chokidars
ET/4 ET/5	Promote program related to traditional culture based tourism Eco tourism expansion.	1. Formation of Eco-club (2018), 2. Formation of Trademark, 3. Seminar (2018) Eco-Tourism in H.P (Tentative) The way forward 4. Seminar (2017) conducted for Eco-Tourism promotion 5. Eco-tourism promotion website 6. Capacity Building and Training
ET/8	Strategic Environment Assessment of Sustainable Tourism Practices	Conduct - Climate Change assessment report (Assessment study for social & Environment impacts of eco-Tourism projects Under Public-private Partnership mode

5.6.2 Key issues and challenges of the sector

Loss of biodiversity is one of the major problems in Himachal Pradesh.The major causes of biodiversity loss are as follows:

1. Deforestation and forest degradation: Due to urbanization and infrastructure building in the state, deforestation and forest degradation is observed in many districts. It has also led to loss of habitat for several species.

2. Forest Fires: Forest fires in valleys as well as mountains are very frequent in the state. This is also a major reason for loss of biodiversity loss in the state. The villagers often play a role in setting up forest fires to get firewood and grass as fodder for their cattle. Due to forest fires, the new recruitment in forests is wiped out laying ground for damage to the ecology of the region.

3. Encroachment in forest areas: Due to increase in human population, villager encroach the forest areas. Often the encroachment are made on

   the premise that the same may be regularised in the future leading to legal ownership.

4. Overexploitation of forest resources and lack of alternative sources of livelihood: The majority of the population in the hill districts are directly or indirectly dependent upon the local forests for their livelihood and subsistence. The unscientific and unsustainable harvesting

   of the forest resources has eroded the quality of the forests over the years leading to variety of ecological imbalances.

5.7 STATE MISSION FOR CLIMATE CHANGE STRATEGIC KNOWLEDGE AND INFORMATION

The mission mode actions are required to form well designed knowledge networks, enhance the research capability in climate science for bridging the existing knowledge gap, and, leverage the development of suitable technologies for climate change adaptation and mitigation under various missions that will help the community, and also contribute to the INDC. It is important to systematically track the natural forcing arising in the Himalayan ecosystem due to climate change as well as changes due to other anthropogenic pressures. The Department of Environment, Science and Technology (DEST) is the nodal department to deal with all climate change rules and business. Under DEST a State Knowledge Cell on Climate Change (Himachal Pradesh State Knowledge Cell on Climate Change) has been set up under National Mission on Sustaining Himalayan Ecosystem. The knowledge cell is working effectively amongst scientific, academic and research institutions and NGOs inside and outside the state for pursuing research in the field of climate change and its impact on the Himalayan Ecosystem. It is expected that activities of the cell will help evolve adaptation plans and polices relevant to the state. Vulnerability analysis based on hydrological models have been carried out for all major river basins in this state. This information however, has to be mainstreamed into adaptation planning in sectors where life and livelihoods of the local communities are likely to be impacted in future. The state is first in the country to have conducted an inventory of GHG Emissions in 2008-09 and 2012-13 with analysis of GHGs emitted from range of sectors and sub sectors as well as carbon sequestered forests and grasslands in the state. Specialised Knowledge Cell on Climate Change under National Mission for Sustaining the Himalayan Ecosystem has also been set up for ensuring cooperative actions on climate change and building a strong knowledge platform with primary focus to disseminate the knowledge in state. Under the climate change cell, project concept note of climate smart projects, capacity building and several climate proofing projects have been approved for funding under National Adaptation

Fund for Climate Change (NAFCC).The state is also running a multi Sectoral Programme On Green Growth And Sustainable Development. The State Has Set Up An Integrated information system for climate modelling, GIS lab for spatial planning and information documentation under the climate change cell which acts as the focal interface. The model gives predictions for near future (2030s: 2020-2050) to arrive at future climate variability. The cell also provides a platform for research and development in locally relevant thematic areas impacted by climate change. State is also coordinating with line departments to mobilise climate finance from different sources. There is a need to understand the impact of climate change risk on major sectors like agriculture, animal husbandry, horticulture, water, forest, urban and energy systems in order to develop capability to deal with it. It is required to bring together scientific knowledge from research studies for improved planning. This would call for partnership with national and international institutions, universities and scientific networks.

5.7.1 Key Issues and Challenges

The key challenges include the following:

- There exists a considerable primary knowledge gap in understanding micro climate data on climate change.
- Networking with universities and researchers is not adequately maintained for climate change research in the state.
- There is need to build capacity in area of climate modelling at micro level.
- There is a need to assess and document timely progress of the actions proposed under the mission.

5.7.2 Progress Mapping (In last 5 years)

Out of the proposed 6 activities for capacity building in previous SAPCC, progress has been recorded in following activities:

PHYSICAL PROGRESS

» Table 5.25 : Activities proposed and physical progress in strategic knowledge of the state

Code	Strategy	Physical Progress
SK/1	Creation of a State Level Program for Climate Change Education and Awareness	Knowledge on Climate Change is being built through various studies, awareness programmes, assessments.
SK/2	Creation of a State Fund for Research on Climate Change and Biodiversity	About 3000 Biodiversity Management Committees have been formed in the state.
SK/4	Creation of a State Level Glacier Registry.	State Remote Sensing is actively working on this component
SK/5	Strengthening the Institutional Framework in Himachal Pradesh for Addressing Climate Change.	The Knowledge Cell on Climate Change has been set up to coordinate, disseminate, develop and implement various Climate Change actions in State with all stakeholder organizations. The Climate research policy and plans are being maintained through this cell.

SK/6	Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation.	1. River Basin based Hydrological modelling done for two river basins covering five Districts in Kullu, Mandi, Hamirpur, Kangra & Sirmaur. 2. Micro Watershed Vulnerability Assessment has been carried out for Kullu, Mandi, Hamirpur, Kangra and Sirmaur Districts. 3. Risk and Hazard Assessment in Kullu district under bilateral cooperation. 4. River basin wise hydrological modelling is being carried out for Satluj basin covering six districts in the state.

5.7.3 Sector- Priority /Strategies

5.7.3.1 Future Plan to Meet NDC and SDG

Specific Targets under NDC for Strategic Knowledge

The NDC aims to realise the vision of a sustainable lifestyle and climate justice to protect the poor and vulnerable from adverse impacts of climate change. In order to achieve this goal, the central government has outlined: commitments for different sectors. The key commitment under NDC pertaining to Strategic Knowledge and Information sector is outlined in Table 5.26

» Table 5.26 : INDC commitments & key State level Initiatives

NDC Commitment	Key State level initiative to comply with NDC Target
To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.	• Strengthening of institutional framework of state dealing with climate change adapation and mitigation actions. • Providing institutional support for formation of Climate Change knowledge network in the state. • Initiatives on mapping of the Climate Change knowledgebase and data resources.

Specific targets under SDG for strategic knowledge and information

» Table 5.27 : SDG Goals and key State level Initiatives

SDG Goals	Key Initiatives by the State
Strengthen the means of implementation and revitalize the global partnership for sustainable development.	Himachal Pradesh has collaborated with several institutions for Himalayan Ecosystem related research. It has also partnered with World Bank for Sustainable Development programme, second phase of SAPCC preparation through GIZ and also tied up with GIZ/ Kreditanstalt für Wiederaufbau and ADF for climate finance.

5.7.4 Description of Activities

SK/1-Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation

These instruments need to complement measures included in the respective regional and sectoral plans.

There is a need for advancing sustainable development and poverty reduction through transfer of technologies that mitigate greenhouse gas emissions and enable adaptation

to their expected impacts. Implement the Integrated Climate Change Adaptation Project, which seeks to create technologies for climate change mitigation and/or adaptation in the major sectors.

SK/2 Strengthening the Institutional Framework in Himachal Pradesh for Addressing Climate Change

Review the institutional arrangements in different sectors for combating climate change together, and implement recommendations of the institutional assessment to be put together in a guideline for seamless implementation. There is need to incorporate other important sectors such as health, public works, tourism, industry-mining and transport for developing coherent adaptation planning.

SK/N/3 Mapping of the knowledge base and data resources relevant to climate change for the mobilization of state specific strategic knowledge

The state should plan to participate in national level programmes on climate change issues and collaborate with other states in order to tap their best practices advance technology and also share the state's knowledge in adapting to climate change under different stressed scenarios.

SK/N/4- Study the climate data and project the climate changes for vulnerability assessment at the regional and local level

The installation of weather monitoring station with different sensors to track critical climate parameters will help in better climate analysis and modelling capability at the state level. This will help in pinpointing hotspots and develop area specific planning and contingencies.

SK/N/5- Identification of research gap in each sectors with review of existing sectoral policies and strategies

Climate change is a multi-disciplinary subject. Interdepartmental Co-ordination is the major requirement in order to access climate sensitive data from each department. The National Data Sharing Policy can facilitate research and analysis of the data which would further help the planners and policy makers to interpret and make informed decisions. One or two centres of excellence can be established in the state for addressing regional and state specific climate change knowledge gap. Partnership for this can be established with National and International institutions, agencies.

5.7.5 Synopsis of Key Priorities & implementation arrangement

Table 5.28 : Activities implementation schedule of the state

A	B	C	D	E	F	G	H=E-F-G	
S.No.	**Code**	**Activity**	**Scheme**	**Proposed Budget (2021-2030) in Rs Cr.**	**Amount likely from existing central scheme (2018-22) in Rs Crore as in Col D**	**From state budget (2018-22) in Rs Crore**	**Gap in Rs lakh (2018-22)**	**Imple-menting Agency**
1.	SK/1	Design of Instruments to Promote the Development, Transfer and Adoption of		100	4	2		DEST KCCC,

		Technologies for Climate Change Mitigation and Adaptation. Design of Instruments to Promote the Development,Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation.						Agriculture, Horticulture, Water sector
2.	SK/2	Strengthening the Institutional Framework in Himachal Pradesh for Addressing Climate Change and strengthening of Himachal Pradesh State Knowledge Cell on Climate Change.		20	1	0.5		DEST KCCC
3.	SK/N/3	Mapping of the knowledge base and data resources relevant to climate change for the mobilization of state specific strategic knowledge		10	1	0.5		DEST KCCC
4.	SK/N/4	Study the climate data and project the climate changes for vulnerability assessment at the regional and local level		10	0.1	0.5		DEST KCCC
5.	SK/N/5	Identification of research gap in each sectors with review of existing sectoral policies and strategies		10	1	1		DEST KCCC
		Total		150.0				

CLIMATE CHANGE STRATEGY - MITIGATION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6 CLIMATE CHANGE STRATEGY - MITIGATION

Climate change mitigation encompasses "human interventions to reduce emissions or enhance the sinks of greenhouse gases"[1] and is urgently required to meet the climate goals such as those under the Paris Agreement. While the previous chapter focused on adaptation strategies, several of the proposed strategies and activities imply substantial mitigation co-benefits. This chapter, in turn, focuses on mitigation strategies, which due to their intertwined nature may also yield important adaptation co-benefits.

Mitigation strategy is critical to meet the climate change goals under the Paris agreement and NDC. Several initiatives need to be fast tracked at the state level. Mitigation strategy as planned in the state involves enhancing share of renewable in the state especially hydro, solar and biomass-based energy including energy from the waste. The state is also strengthening the State Designated Agency (State Designated Agency) to implement the Comprehensive Energy Efficiency Plan for the state. It also has integrated several energy and waste management solutions in Smart City Plan and Atal Mission for Rejuvenation and Urban Transformation to mitigate the emissions. Sectoral plans under agriculture, forestry and water sectors have investments that are likely to have several mitigation co-benefits such as solar fencing, solar water pumping etc. have been prioritized in the state.

1.1 STATE MISSION FOR ENHANCED ENERGY EFFICIENCY AND CONSERVATION

1.1.1 Stocktaking

Access to modern and affordable energy services is rare in driving economic growth and empowering human development. Inequalities in availability of energy influences developmental prospects of a society, productivity, health and education have a long-term implication on the livelihood of the poor's. The per capita electricity consumption in Himachal Pradesh was 1339 Kilo watt per hour (during year 2015-16) in comparison to the national average of 1,075 Kilo watt per hour.

The energy scenario in the Himachal Pradesh is elaborated upon as under:

ELECTRICITY

The electrical supply position of Himachal Pradesh from April 2017 to February 2018 is outlined in Table 6.1:

» Table 6.1 : Electricity demand - supply scenarios from April 2017 to February2018

Energy Requirement (MU)	Energy Supplied (MU)	Unmet demand (MU)	Unmet demand (%)	Peak Demand (MW)	Peak Met (MW)	Unmet Peak Demand (MW)	Unmet Peak Demand (%)
8626	8578	48	0.6%	1594	1594	0	0.0%

(**Source:** Government of India, Ministry of Power, Central electricity Authority, New Delhi, Power sector March- 2018 Report)

RENEWABLE ENERGY

The source-wise estimated potential of Renewable Power in HP and India, as on 31-03-2017, is indicated in the Table 6.2

Reference
1.https://unfccc.int/files/press/backgrounders/application/pdf/press_factsh_mitigation.pdf

Table 6.2: Estimated renewable potential of Himachal Pradesh

	Wind Power (MW)	Small hydro power (MW)	Biomass Power (MW)	Cogeneration bagasse (MW)	Waste to Energy (MW)	Solar Energy (MW)	Total Estimated Reserves (MW)	Total Distribution (%)
Himachal Pradesh	-	3460	142	-	2	33840	37444	3.74
All India Total	302251	21134	18601	7260	2554	649342	1001132	100

(**Source:** Energy Statistics 2018 (Twenty Fifth issue))

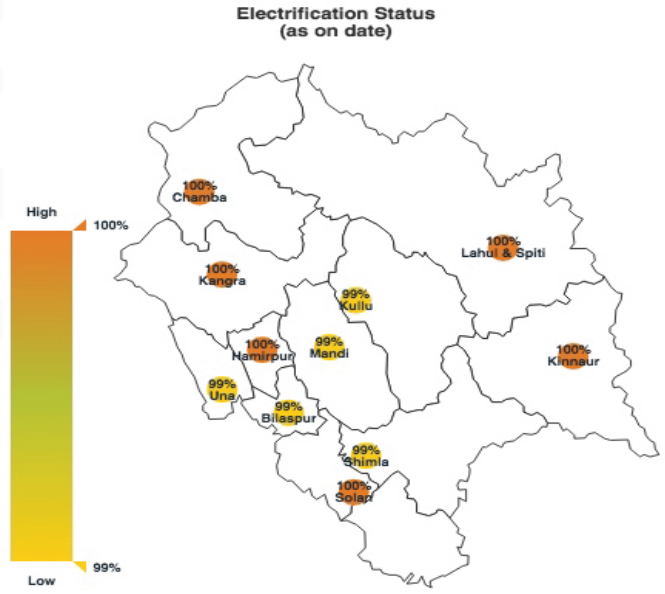
The state has a cumulative installed capacity of grid interactive renewable power of 793.51 MW and 832.54 MW as on 30-03-2016 and on 30-03-2017 respectively. The state has added 4.92 MW between(2015-16 and 2016-17).

All India total values for cumulative installed capacity of grid interactive renewable ower was 42849.38 MW and 57244.23 MW as on 30-03-2016 and on 30-03-2017 respectively.

HOUSEHOLD ELECTRIFICATION

Ninety percent of total households in the state are electrified through grid outreach with maximum electrification, for instance at district Lahaul and Spiti (100%) and minimum at district Una (98.67%), also refer Figure 6.1.

Figure 6.1 : Household electrification status (as on date) of Himachal Pradesh (in %)



Source: Saubhagya Dashboard, Ministry of Power, Government of India)

PETROLEUM AND PETROLEUM PRODUCTS

The allocation and usage of different petroleum products during April to September 2017 is summarised in Table 6.3.

Table 6.3 : Consumption of petroleum and petroleum products

PDS SKO Allocation	Sales figures (In thousand metric tonnes)			
	LPG	MS	SKO	HSD
7248	**75**	**105.1**	**6.5**	**319.2**
Per-capita sales of petroleum products in Himachal Pradesh (kg)		104.4	Per-capita sales of petroleum products at National level (kg)	

(**Source:** Ready Reckoner, Oil Industry Information at a Glance, Petroleum Planning & Analysis Cell (PPAC), Ministry of Petroleum & Natural gas, November 2017)

COAL

The installed capacity of power utilities in the state is mostly dominated by Hydro (2910.4 MW) as on 31-03-18. Coal accounts for a share of 183.40 MW (entirely owned by central public sector undertaking) in the installed capacity of power utilities for HP.

FIRE-WOOD

A total of 56.8% households depend upon firewood for cooking. Per capita fuel consumption (Per capita fuel consumption) varies seasonally and region wise, for instance the Per capita fuel consumption is 0.48-1.32 kg/person/day in Solan, 1.9-2.68 kg/person/day in Shimla and 0.89–2.91 kg/person/day in Lahaul & Spiti.

Table 6.4 : GHG Emissions from different sources in Himachal Pradesh

S.No.	Type	GHG in CO2 -eqv (Gg) in 2009	(Gg)	GHG in CO2-eqv in 2012	(Gg)
1.	Electricity/ Energy		6065.49		5122
2.	Captive generation and consumption	358.67		244	
3.	Transport	667.28		716	
4.	Residential	1809.72		1405	
5.	Industrial/Commercial	3213.98		2757	
6.	Agriculture	15.84		-	
7.	Industry		5485.22		5512
8.	Agriculture		164.84		248
9.	LULUCF		(-) 1632.70		(-) 1685
10.	Waste		0.0061		0.003
	Total		10082.87		9197

(**Source:** Government of India, Ministry of Power, Central electricity Authority, New Delhi, Power sector March- 2018 Report)

Note: Emissions/removals due to hydro power generation in the state (6.4 GW) as its contribution to clean energy is not taken into account in GHG estimation. If this is taken into consideration, the state is carbon neutral. Himachal Pradesh has observed an overall decline in emissions. The agricultural emissions of the state have also shown a reduction (it was not estimated in 2012)

1.1.1 Impact of Climate Change on the Sector

INCREASED CLIMATIC VARIABILITY

A long-term change in water flow rate across the river basins in Himachal Pradesh may have deeper implications on the hydro power projects. Climate change can cause long-term changes in the water flow regime of the river basins in the state. Precipitation is likely to vary from -8% to 12% over different regions of Himachal Pradesh. It is also observed that15-40% of total rainfall

will be concentrated within short durations. As a result of climate variability, the average flow rate observed in the base period (2.98- 3.92 m3/sec) will increase to 3.06-4.71 m3/sec in the near future (2030s). The range of discharge is widened and as a result the duration of high flow will be reduced.

INCREASED INCIDENCE OF CLIMATE EXTREME EVENTS

Climate extreme events might cause damage to the power sector infrastructure. Increased weather variability (summer or winter) might stress the existing energy demand-supply gap due to increase in heating and cooling load.

6.1.1.2 Key Issues and challenges of the sector

» Table: 6.5 : Key issues and challenges in mitigation sector

SDG Goals	Key Initiatives by the State
Gaps in understanding Climate data	Gap in knowledge of climate change, lack of systemic climate parameters, monitoring, documentation and research in this field and how it impacts hydropower sector. There is no clear roadmap to update greenhouse gas emissions inventory for the state periodically as well as scenarios on mitigation assessment studies and implementable actions.
Institutional and Regulatory	A rapid building up of capacities is essential to enhance the level of climate change research in HP mainly in the areas of climate modelling, impact assessment, mitigation potential and research.
Financial	Climate finance beyond the targeted budgetary sources is low if the state wants to meet its carbon neutral goal by 2020.
Technical (including infrastructural)	Transfer of technologies that mitigate GHG emissions and enable adaptation to their expected impacts for advancing sustainable development and eliminating. Participation in international carbon markets for accelerating the introduction of environmentally friendly technologies in the state is very limited low. Infrastructure and manpower is not available in the State Designated Agency to look after the projects of Bureau of energy efficiency in the state.
Sensitisation	Lack of accessible information and sensitisation about the quality, cost and benefit of adopting renewable energy technology and energy efficiency measures forbids widespread adoption of the technology options. Lack of cost recovery by state owned distribution companies as they are unable to guarantee payment for power generated by independent power producers (independent power producers).

6.1.1.2 Key Issues and challenges of the sector

PHYSICAL PROGRESS

Out of the proposed 22 mitigation activities in HP SAPCC 1..0, the progress made has been shown in table 6.6.

Table 6.6 : Progress of Himachal Pradesh State Action Plan on Climate Change

<table>
<tr><th>Code</th><th>Activity</th><th>Physical Progress</th></tr>
<tr><td>EEC/1</td><td>Improve estimates of potential savings and energy efficiency on a State and regional scale, by consumption sector. To achieve this, the potential for reducing greenhouse gas emissions through implementation of the 2009-2014 Action Plan of the National Energy Efficiency Mission will be quantified. The objective of this plan is to limit increases in energy consumption in sectors such as transport, industrial, cement mining, public and residential. In addition, this programmes potential for reducing baseline emissions will be established.</td><td>• Implementation of Rooftop SPV plants on residential buildings in accordance with the grid-connecting Rooftop Solar Scheme.
• 56 Rooftop SPV plants have been installed so far of 1600 KW capacity and potential of 33 GW.
• 56 beneficiaries from grid-connected system.
• Off-grid systems include installation of solar street lights which is a total of around 1 lakh lights from 2011 to July 2018
• Number of solar street lights installed (under National Emission Fund) year-wise as indicated in table below:
<table>
<tr><th>Year</th><th>No. of solar street lights installed</th></tr>
<tr><td>2010-11</td><td>776</td></tr>
<tr><td>2011-12</td><td>8204</td></tr>
<tr><td>2012-14</td><td>24, 552</td></tr>
<tr><td>2014-15</td><td>19, 600</td></tr>
<tr><td>2015-16</td><td>10, 110</td></tr>
<tr><td>2016-17</td><td>15, 000; 3044 (in tribal areas); 350 (in Manali)</td></tr>
<tr><td>2017-18</td><td>0</td></tr>
</table></td></tr>
<tr><td></td><td></td><td>• DEMONSTRATION PROJECT: The project has been finalised for the street lighting at Municipal Council, Dharamshala, under which 244 no. of inefficient street lights will be retrofitted. (completed project).
• ECBC Cell has been established in Directorate of Energy, Shimla, H.P. The cell has started functioning w.e.f. 11-04-2017
• Himachal Pradesh Energy Conservation Building Code (Himachal Pradesh Energy Conservation Building Code 2018) and Himachal Pradesh Energy Conservation Building Code rules 2018. were approved by the Council of Cabinet Ministers to the Govt. of H.P. on 06-06-2018 for its notification in the state. The Himachal Pradesh Energy Conservation Building Code code and Rules have been notified in State on 5th January 2019.
• A capacity building scheme through the creation of ECBC cells was developed by BEE with the support from UNDP- GEF project.</td></tr>
<tr><td>EEC/2</td><td>Strengthen the National Energy Efficiency mission based on results of the potential for savings and energy efficiency. The purpose of this is to intensify energy efficiency initiatives in sectors such as construction, commercial, residential, industrial and transport and to evaluate their potential for future mitigation.</td><td>• Implementation of off-grid and on-grid SPV plants.
• Solar Power policy of Himachal Pradesh was notified by the Govt. of H.P. on 23-01-2016 and regulations for gridconnected RTS programme was notified by HPERC.
• Funds have been provided to Govt. of H.P. for implementation of demonstration project in rural drinking water pumping systems under Agriculture Demand Side Management (Agriculture Demand Side Management) scheme. Detail Project report of 4 no. of projects has been prepared and the details are below:
1. Lift Water Supply scheme (Lift Water Supply scheme) from Behna Khad to Baragaonin GP Bhaeri Shalouta & Banahar, Behna Khad nearuhri, District Shimla.
2. Lift Water Supply scheme (Lift Water Supply scheme) Chawla Bhuint, Ghanahatti, Distt. Shimla
3. Lift Water Supply scheme (Lift Water Supply scheme),Totu Mayhtai, Totu, Distt. Shimla
4. Lift Water Supply scheme (Lift Water Supply scheme), Dagoli Dhar, Shilaroo Matiana, Distt. Shimla</td></tr>
</table>

		• The project no. 4 above has been selected as first demonstration project. State Level Agriculture Demand Side Management Committee is constituted for the implementation of this project consisting members of State Designated Agency, BEE and I & PH Dept. • Two rural panchayats- Grogra in Basantpur block and Banthmana-Jabri in Mashobra Block in Distt. Shimla have been finalized for this project. The project has been completed. Total 4315 no. of light-emitting diode lamps were distributed among all 863 cno. Of consumers. Free 5 nos. of 9 MW light-emitting diode lamps have been distributed to each household in Himri and Chalahal Villages under Basantpur Block under 'light-emitting diode Village campaign Scheme' of BEE, MoP, Government of India. There were total 821 consumers and 4105 no. of free lightemitting diodehave been distributed under this programme.
EEC/2	Study the potential for renewable energy generation. To do this, the potential for limiting the increase of greenhouse gas emissions will be calculated and quantified. This potential is a result of new investments being made in this field that have resulted from actions taken to promote the development of nonconventional renewable energies in the State and also of regulatory modifications.	• National level Training/ workshops/ meetings to promote the development of non- conventional renewable energies have been organised in the state and attended by state in other states. • Awareness campaign through Radio Jingles, Newspapers, Magazines, Annual Functions at IIT Mandi, ECBC awareness, NIT Hamirpur, etc. • An independent State Designated Agency website is proposed to be launched to showcase all the ongoing activities / projects relevant to energy conservation and efficiency. State Designated Agency will create this website.
EEC/5	To undertake Cumulative Environmental Impact Assessment (CEIA) studies	• Earlier in 2011 initiated by Govt. of H.P., later in 2015 the process of CEIAs studies were handed over to MoEF& CC GoI on as and where basis as per the decision of MoEF& CC. • CEIA Study of Satluj Basin was completed up to 10MW HEPs. On the direction of EAC of MoEF& CC Government of India now study below 5 MW HEP has also been completed and pending for approval of EAC of MoEF& CC Government of India. • CEIA Study of Chenab Basin completed- approved by MoEF& CC. Recommendations are under consideration. • CEIA Study of Beas Basin completed- approved by MoEF& CC. Recommendations are under consideration. • CEIA Study of Ravi Basin is to be taken up by MoEF& CC soon. • Yamuna Basin study to be taken up by MoEF& CC in participation with Government of Himachal Pradesh and Uttarakhand Go • Wide stakeholders consultation process was taken up during the course of studies. Various Village/ Panchayat/ Basin level stakeholders public consultation meetings were being organised. • Preparation of basin wise GIS based digital hydro power potential maps for the state.
EEC/6	Establish the Centre for Renewable Energies to create policies that guide and create incentives for investors. Implement a government backed fund for investments in renewable energies and energy efficiency.	• Possibilities are being explored to open a centre for Renewable energy in H.P. • Proposals are under consideration by the Govt. to have a corpus for Renewable energy projects like RTS.

<table>
<tr><td>EEC/7</td><td>Encourage the installation of solar systems for heating water or generating electricity in the public, commercial, residential and industrial sectors, to make maximum use of yHimachal Pradesh's solar resources.</td><td>

The programme is being implemented by HIMURJA in H.P.
Proposal to provide 30% subsidy for installation of SWHS in residential building is under consideration.

**PHYSICAL PROGRESS SAME AS THAT OF ACTIVITY EEC/ 17
</td></tr>
<tr><td>EEC/13</td><td>Evaluate the potential energy generation scenarios in Himachal that take into account the expected impacts of climate change on water resources. This information will be central to any assessment of different alternatives and opportunities that, in the future, could allow for the establishment of a more diverse and sustainable energy matrix</td><td>
Pertains to Department of Energy.
Status of Hydro Power Potential in Himachal Pradesh
<table>
<tr><th></th><th>Description</th><th>Total Projects</th><th>Capacity (MW)</th></tr>
<tr><td>1.</td><td>Projects Commissioned</td><td>153</td><td>10571.17</td></tr>
<tr><td>2.</td><td>Projects under Construction</td><td>64</td><td>2389.14</td></tr>
<tr><td>3.</td><td>Projects at different stages of obtaining clearances</td><td>776</td><td>8901.85</td></tr>
<tr><td></td><td>A. Total (1 to 3)</td><td>993</td><td>21862.16</td></tr>
</table>
</td></tr>
<tr><td>EEC/14</td><td>Assessment of the Power sector's hydrological vulnerability and its effect on Himachal Pradesh energy security. This will be carried out by developing future hydroelectricgeneration scenarios.</td><td>

Comprehensive Study of Glacial reserve and impacts of global warming on glacial deposits needs to be taken up. This is important in a way that this glacial reserves are the primary source of discharge for many of HEPs in the State.
Effective Hydro Power Communication Strategy implementation in the basin needs to be taken up. The Communication Strategy is under preparation at Department of Energy. We need to have communication centres at Key location in all the river basin for addressing the social, environmental and other related aspects of Hydro Power development through regular consultations among all the stakeholders.
The need of the hour is to associate Hydro Power Projects with tourism. This in turn will provide livelihood opportunities to project affected families and local habitants and will sensitize the masses about myths and reality of the good and adverse impacts of Hydro Generation on climate change and environment.

</td></tr>
<tr><td>EEC/16</td><td>Target energy conservation through market-based instruments</td><td>
Under PAT cycle-1 (2012-15), details of 9 no. of Designated Consumers (DCs) of HP and their target, achieved and Escerts data is given below:
<table>
<tr><th>S.No.</th><th>Designated Consumer</th><th>Baseline SEC (ToE/ ton of product) Average of year 2007-10</th><th>Target SEC (ToE/ ton of product) Year 2015</th><th>Achieved SEC (ToE/ ton of product) Year 2015</th><th>Escerts issued by MoP, GoI</th></tr>
<tr><td>1.</td><td>Ambuja Cement Ltd.</td><td>0.0712</td><td>0.0684</td><td>0.0675</td><td>3439</td></tr>
<tr><td>2.</td><td>ACC Limited, Unit-1</td><td>0.0788</td><td>0.0753</td><td>0.0716</td><td>7804</td></tr>
<tr><td>3.</td><td>ACC Limited, Unit-2</td><td>0.484</td><td>0.0760</td><td>0.0727</td><td>7623</td></tr>
<tr><td>4.</td><td>Auro Spinning Mills</td><td>993</td><td>0.459</td><td>0.458</td><td>-418</td></tr>
<tr><td>5.</td><td>Arshit Spinning Mills</td><td>0.440</td><td>0.420</td><td>0.414</td><td>100</td></tr>
<tr><td>6.</td><td>Birla Textile Mill</td><td>0.489</td><td>0.464</td><td>0.4368</td><td>-1170</td></tr>
<tr><td>7.</td><td>Deepak Spinners Ltd.</td><td>1.863</td><td>1.778</td><td>1.69</td><td>1807</td></tr>
<tr><td>8.</td><td>G.P.I Textile Ltd.</td><td>0.349</td><td>0.336</td><td>0.275</td><td>1266</td></tr>
<tr><td>9.</td><td>Winsome Textile Industries Ltd.</td><td>0.394</td><td>0.377</td><td>0.334</td><td>206</td></tr>
<tr><td></td><td>Total</td><td></td><td></td><td>993</td><td>20657</td></tr>
</table>
</td></tr>
</table>

Out of these 9 DCs, 2 no. of DCs haven't achieved their targets set by GoI and will be penalized under Energy Conservation Act, 2001. With this initiative, the state has saved 20, 657 Tonne of Oil equivalent (ToE) (240.24 MU) energy in two energy intensive sectors i.e. cement and textile.

Under PAT cycle 2 (2016-2019), BEE has notified 5 new DCs and currently there are total 14 no. of DCs along with their targets are follows:

S.No.	Designated Consumer	Baseline SEC (ToE/ ton of product) Average of year 2007-10	Target SEC (ToE/ ton of product) Year 2015
1.	Ambuja, Dharlaghat	0.0933	0.0886
2.	Ambuja, Suli	0.0734	0.0699
3.	ACC Limited, Unit-1	0.0716	0.0682
4.	ACC Limited,Unit-2	0.0727	0.0692
5.	JP Himachal Cement	0.1074	0.1018
6.	Auro Spinning Mills	0.4819	0.4535
7.	Birla Textile Mill	0.5031	0.4722
8.	Deepak Spinners Ltd.	0.3695	0.3528
9.	G.P.I Textile Ltd.	0.5255	0.4918
10.	Winsome Textile Industries Ltd.	0.6298	0.5814
11.	Ruchira Paper Ltd.	0.5314	0.5065
12.	Arshit Spinning Mills	0.4561	0.4307
13.	Vardhaman Spinning	0.5316	0.4844
14.	HPSEBL	11.19	10.87

EEC/17 — Target solar energy coverage in urban rural areas.

S.No.	Period	Activity Undertaken	Funds utilized towards this activity (INR)	Progress
1.	2016-17	Installation of Solar Water Heaters at Govt. buildings	28, 73, 378	Project completed. Solar water heaters have already been installed at all the 6 (no.) of Govt. building which were finalized for this project. The total cost of the project is 28 Lacs approximately
2.	2017- till date	Incentive scheme for small and medium scale enterprises (MSME) to conduct energy audit in their premises (Ongoing)	77, 625	8 no. of SMEs have approached this office under this scheme, out of which 6 no. of industries have conducted the energy audit in their premises. The total cost of the project is 50 lacs approx. Scheme will be applicable to first 10 no. of industries on first come first serve basis.

EEC/18	Bio energy- waste to energy pilotmodel projects.	Biomass power plant • 7.2 MW biomass co-gen (Non-bagasse) Plant installed by the IPP M/ Ruchira Papers Ltd. At Kala Amb in District Sirmour, H.P. The biomass plant was commissioned on 9th March, 2009 and power generated from this plant is being used by the company for their captive use in the paper industries. • 1.5 MW biomass power plant installed by M/s Premier AlcobevPvt. Ltd. At Plot No. 1 Sansarpur Terrace, Industrial area, Phase- III, Distt. Kangra, H.P. The plant was commissioned on 1st June, 2016.
EEC/19	Discourage energy intensive industrial development.	
EEC/20	Regulating diversion of river flows, courses for power generation.	** Physical progress same as that of EEC/5
EEC/21	Target to achieve minimum discharge required for downstream floral-faunal sustenance.	Maintenance of 15% & (minimum lean season downstream, diversion dams etc. introduced and maintained online in the state.
EEC/22	Target revival of water mills. Design of economic instruments to address priority pollutant and incentives for cleaner production based on economic efficiency criteria	41 No. improved watermills (electrical output and both electrical and mechanical output) of various beneficiaries have already been developed/ upgraded till date. A target of 50 (Nos.) more watermills have been proposed to be installed/ upgraded beyond 2022.

6.1.3 Mapping of Indicator

The electrification status of urban as well as rural areas has improved due to various climate change related initiatives in the past 5 years. Overall electrification has improved from 96.7% to 98.9%.

Table 6.7: Proportion of Population with access to electricity in Himachal Pradesh (Baseline 2010-11)

Urban Area			Rural Area			Total (Rural + Urban)		
No. of Household	No. of Household electrified	% of Household electrified	No. of Household	No. of Household electrified	% of Household electrified	No. of Household	No. of Household electrified	% of Household electrified
1,66,043	1,62,886	98.1%	13,10,538	12,65,897	96.6%	14,76,581	14,28,783	96.7%
As per Census 2010-11								
Current (as on March 2018)								
Urban Area			**Rural Area**			**Total (Rural + Urban)**		
No. of Household	No. of Household electrified	% of Household electrified	No. of Household	No. of Household electrified	% of Household electrified	No. of Household	No. of Household electrified	% of Household electrified
3,69,244	3,68,352	99.7%	14,77,019	14,58,046	98.7%	18,46,263	18,26,398	98.9%
As per Saubhagya dashboard the percentage of electrification as on date across18,46,263 households is 98.9%								

Source: ??

6.1.4 Gap/barrier Analysis

The major gaps identified in implementation of the SAPCC actions are as under: -

» Table 6.8 : Major gaps identified in implementation of SAPCC

Institutional	• Absence of lack of integration of the proposed climate action in planning and budgeting especially hydro-power, agriculture and forestry departments. • Lack of convergence (1) amongst the responsible departments (2) schemes aimed at attaining similar goals. • No clarity amongst the nodal department and limited top-down enforcement of implementing the proposed actions.
Finance	• Although the access to finance is the major challenge in implementation of the climate actions, but limited endeavour has been made in identifying the source of special funds and tapping them.
Capacity	• Lack of skilled resources across the state and amongst the implementing departments in operationalisation of renewable energy project or augmenting advanced technology. • Insufficient infrastructural capacity of the DISCOMS and intent (concern over revenue loss under net metering) for large scale market adoption of solar (specifically the rooftop)

6.1.5 Future Plan to Meet NDC and SDG

6.1.5.1 Specific Targets under NDC for Energy Sector

NDC embodies the national efforts to reduce emission and adapt to the impact of climate change. The key commitment under NDC pertaining to energy sectorand state level clean energy target to comply with the NDC commitment is outlined in Table 6.9.

» Table 6.9: NDC Commitment and Key State Level Initiatives to Comply with National Pledge

NDC Commitment -Energy Sector	Key State level initiative to comply with NDC target	
Reduce the emission intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.	Almost 80-85% of reductions in CO2 intensity are due to decrease in energy use and increase in use of low GHG emitting sources of energy per unit of GDP.	Energy conservation programmes are in place for reducing emission intensity such as increasing solar energy usage, efficiency in residential and commercial sectors and energy savings from space heating.
Achieve about 40% of cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030	Under Solar photovoltaic programme, 66,967 Solar photo Voltaic street lights, 23,386 SPV domestic lights, 39,246 SPV lanterns and 1,222.5 kWp SPV power plants were installed by mid-2016.	Total renewable Power target is 776 MW (solar power) and 1500 MW (SHP) that must be achieved by 2022.

6.1.5.2 Situational Analysis - NDC Perspective

Himachal Pradesh is amongst the few states in the country that have conducted state level inventory of Green House Gases. The first report was released in 2012 using 2008-09 activity data. The salient features of the second report prepared using year 2012-13 activity data are presented in Table 6.10.

Table 6.10 (a) : Annual GHG emission from the state

	Annual CO_2 emissions (eqv) (in thousands of metric tonnes) Giga Gram	Percentage of Global total
India	17,27,706.10 (2007 levels)	<5% of global
Himachal Pradesh*	9196.4748* ~0.00134 per capita 000'tones* (2012 levels)	~0.53% of India*
* Without taking into consideration emission/ removals due to hydro power generation 7957.29 MW contributed to grid as clean energy. ~ (-) 17094.74000'tons CO_2 eq @ ~45% operational capacity.		

Over the period 2008- 2012, CO_2 emissions from energy use have decreased on an average by 3% although the economic activity (GDP), at constant prices, based on 2004-05 year has shown an average growth of 7.05% during the same period. GDP has increased steadily by 0.57% per year on an average until 2010-11 and then further decreased slowly again by about 1.02% during the year 2012. The total CO_2 emissions per capita have decreased from 1.47 tons in year 2008-09 to 1.34 tons in 2012 a decrease of about 8.84%. Almost 80-85 % of reduction in CO_2 intensity is due to the decrease in energy use or increase in use of low GHG emitting sources of energy per unit of GDP. The CO_2 intensity decreased more rapidly than that of the energy intensity.

Table 6.10 (b) : A comparison of CO_2 emissions by sector from Himachal Pradesh with National estimates for 2007 (in million tons)

Analysed source of emission	GHGs at National (2007, INCAA Report)	2009		2012	
		GHGs HP estimates	Percentage of nation (%)	GHGs HP estimates	Percentage of nation (%)
Electricity Generation (Other than Hydro)	719.30	0.359	0.1	0.244	0.034
Transportation	142.04	0.667	0.47	0.716	0.50
Residential	137.84	1.81	1.31	1.405	1.02
(Industrial, Commercial, mics.) Other Energy (2007-16)	100.87	3.23	3.20	2.757	2.73
Cement	129.92	5.17	3.98	5.311	4.09
Iron & Steel	117.32	0.281	0.24	0.167	0.14
Other Industries	165.31	0.034	0.021	0.034	0.021
Agriculture	334.41	0.165	0.049	0.248	0.074
Waste	57.73	0.00001	0.00002	0.000003	0.0000052
Total without Land use, land-use change, and forestry	1904.73	11.716	0.615	10.882	0.57
Land use, land-use change, and forestry	(-)177.03	(-) 1.633	-	(-)1.685	-
Total with Land use, land-use change, and forestry	1727.71	10.083	0.584*	9.197	0.53

* Estimates are without the Emissions/ Removals from Hydro Power generation

In Himachal Pradesh, during the year 2012-13, the energy sector emitted 5.147 million tons of CO2 equivalents as compared to 6.0655 million tons in 2008-09. Of the above, about 53.56% (2756.84 Gg) of the total CO2 equivalent emissions from the Energy sector were due to electricity consumption by industry, commercial, institutions and tourism. The residential sector has a rural and urban spread, and therefore it combusts both fossil fuels as well as biomass together emitted 27.30% (1405.213 Gg) of the total GHG emitted from the energy sector. The transport sector emitted 13.91% (716.002 Gg) of the total CO2 equivalent emissions. Emissions due to captive power generation by various industries contributed 4.74% (244.024 Gg). Rest of the 0.483% (24.84 Gg) GHG emissions were from energy consumption for agriculture.

Table 6.11 : Emission scenario of Himachal Pradesh

S.No.	Type	GHG Emission 000' tones (or Giga Gram)			
		CH_4	N_2O	49	26
1.	**Electricity**				
	Captive Generation and Consumption	243.484	0.01246	0.000505	244.024
2.	**Transport**	387	0.39	285	128
	Road	714.505	0.0131	0.003488	716.002
	Railways	0.0012	-	-	0.0014
	Aviation	0.0011	-	-	0.0012
3.	**Others**				
	Residential	1129.554	4.4053	0.5908	1405.213
	Industrial/ Commercial/ Institutional/ Bulk misc. /Tourism	2730.185	0.2968	0.06587	2756.838
	Agriculture	24.552	0.00088	0.00087	24.840
	Total	4842.2823	4.72854	0.661533	5146.9196

SPECIFIC TARGETS UNDER SDG FOR ENERGY SECTOR

Specific goals under SDG 7 are to ensure affordable, reliable, sustainable and modern energy for all. Himachal Pradesh is yet to formulate and submit the state's goals under SDG 7. Infact, the broader national goals have been descaled as state level targets under the SAPCC.

Table 6.12: SDG target and key initiatives at state level

SDG Target	Key Initiatives at State Level to Comply SDG Commitments
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services.	• 100% household electrification (both rural and urban) with improved daily average supply hours to 24 hrs. - Saubhagya, Deen Dayal Upadhyaya Gram Jyoti Yojana. • Increase per capita consumption and access to clean and affordable energy - National Solar Mission, Pradhan Mantri Ujjwala Yojana, Individualized education program. • Operational and financial efficiency improvement of energy supply and its consumption – Ujjwal DISCOM Assurance Yojana, Demand Side Management, National Electricity Policy/Plan. • Leading innovation in power sector – ANTP, National Electricity Policy/Plan, GCP.
7.2 By 2030, increase substantially the share of renewable energy.	
7.3 By 2030, double the global rate of improvement in energy efficiency	
7.4 By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services.	

HIGH IMPACT OPPORTUNITIES

EN/N/1: Conducting a study to reduce the cost of major financing components impacting the tariff of HEP with the view of making them financially viable.

The Directorate of Energy will explore the possibilities for arranging international funds for financing the HEPs for revival of Hydro sector in Himachal Pradesh and take up the matter with various funding agencies.

Direct Benefits and Co-benefits:

- Viability of investment is increased.
- This is our point number one in a paragraph and this is it.

EN/N/2: Facilitate Deployment of Identified Hydro Power Project

Tapping of hydro power potential will help in meeting the current/projected energy gap in the state along with reducing energy dependency and reduction of financial burden of DISCOM against short/medium term power procurement.

Direct Benefits and Co-benefits:

- Reducing GHG emissions.
- Employment generation during construction and post commissioning operation and maintenance phase.

EN/N/3: Improve energy intensity through adoption of energy conservation and DSM measures

This activity has already been pursued in the last action plan and it is essential to continue with the same to achieve the targets. The following are included in it:

- Promoting the use of energy-efficient pumps and motors in the state.
- Employment generation during construction and post commissioning operation and maintenance phase.
- Investing in building consumer awareness about energy-efficient equipment and energy conservation measures.

Direct Benefits and Co-benefits:

- Increase the share of renewable energy mix.
- Reduce GHG emissions.
- Employment generation at supply chain level.

EN/N/4: Reduction in energy-use intensities in income generating activities through structural adjustments of activity typology and ensuring linkages along value addition chain and optimal use of resource endowment

The prioritised energy management options in the state would be to:

- Adopt power conservation practices in agriculture, shift to LPG in domestic sector.
- Adoption of concentrated solar thermal in industrial process heating, cooking and cooling applications.
- Adoption of industrial waste to energy on a wider scale that would decrease the fuel requirements in process heating.
- Adoption of energy efficiency measures in industrial clusters viz. rice milling, pharma & bulk drugs.
- Plan for co-generation and captive power plants for industrial sector and augmentation of projected supply-demand gap by 60%.
- Selection of industry typology with minimization of energy intensity in region.

Direct Benefits and Co-benefits:

- Reduce GHG emissions.
- Reduction in energy intensity of the nation's overall economy.

EN/N/5: Study for proper analysis, assessment of hydro power development as it stands today in the state, and, the future prospects in view of the current power scenario, balancing, energy Mmx requirements, social and environmental obligations and most importantly, on the allotted HEPs and stressed HPEs (on account of financial and other reasons) so as to take up sustainable development in a phased manner.

EN/N/6: Capacity Building of the technical manpower of the power sector to upgrade with the latest state of art technologies currently in practice internationally which are more economical, environment friendly, efficient and adaptable to climate change.

EN/N/7: Comprehensive study of glacial reserves and impacts of climate change/global warming on glacial reserves in Himachal Pradesh and its impact on hydro power development in the state.

EN/N/8: Implementation of communication strategy with respect to Hydro Power development in the state of Himachal Pradesh for having better coordination amongst all relevant stakeholders.

EN/N/9: Comprehensive study for proper dam regulations, reservoir management, silt management and disposal due the anticipated impacts of climate change.

EN/N/10: Promotion and awareness of solar roof top programme through awareness activities/exhibitions.

EN/N/11: Development of safety and quality of hydro projects upto 5MW capacity.

EN/N/12: Reduction in energy use intensity by using solar equipment viz solar water heater, solar lantern, solar light, solar coolers (box and dish type).

EN/N/13: Repair and maintenance of reserved energy systems.

6.1.6 Synopsis of activities and implementation schedule

Table 6.13: Synopsis of activities and implementation schedule of Himachal Pradesh

A	B	C	D	E	F	Duration in years	G	H=E-F-G	I
S.No.	Code	Activity	Scheme	Proposed Budget (2021-2030) in Rs crore	Amount likely from existing central scheme (2021-30) (in Rs crore)		From state budget (2021-30) in Rs Crore	Gap in Rs lakh (2021-30)	Imple-menting Agency
1.	EN/N/1	Conducting a study to reduce the cost of major financing components impacting the tariff of HEP with the view of making them financially viable		5.0					Directo-rate of Energy
2.	EN/N/2	Facilitate development of identified solar power projects/ other reserved energy projects		206.52					HIMU-RJA
3.	EN/N/3	Improve energy intensity through adoption of energy conservation and DSM measures		33					HIMU-RJA, MNRE

4.	EN/N/4	4 Reduction in energy-use intensities in income generating activities through structural adjustments of activity typology and ensuring linkages along value addition chain and optimal use of resource endowment		273.62				-	HIMU-RJA, MNRE
5.	EN/N/5	Study for proper analysis, assessment of hydro power development as it stands today in the state and the future prospects in view of the current Power Scenario, balancing Energy Mix require-ments, Social and Environmental obligations and most importantly on the allotted HEPs and stressed HPEs on account of financial and other reasons so as to take up sustainable development in a phased manner.		5.0				-	Direct-orate of Energy
6.	EN/N/6	Capacity Building of the Technical manpower of Power Sector to upgrade with the latest state of art technologies, internationally in practice these days which are more environment friendly, adaptable to Climate Change, economical and at the same time efficient also.		10.0					Directo-rate of Energy
7.	EN/N/7	Comprehensive Study of Glacial deposits and impacts of Climate Change, Global Warming on Glacial deposit in Himachal Pradesh and its impact on Hydro Power development in the state		50.0					HIMU-RJA
8.	EN/N/8	Implementation of Communication Strategy with respect to hydro Power development in the state of Himachal Pradesh for having better coordination amongst all relevant stakeholders.		10.0					HIMU-RJA, MNRE

9.	EN/N/9	Comprehensive Study for proper Dam regulations, Reservoir management and Silt management and disposal due the future anticipated impact of Climate Change.		25.0					HIMURJA, MNRE
10.	EN/N/10	Promotion and awareness of Solar Roof Top programme through awareness activities/exhibitions		3.0					Directorate of Energy
11.	EN/N/11	Development of Safety and quality of hydro projects upto 5MW capacity.		10.0					Directorate of Energy
12.	EN/N/12	Reduction in energy use intensity by using solar system viz solar water heater, solar lantern, solar light, solar coolers (box and dish type)		317.04					Directorate of Energy
13.	EN/N/13	Repair and maintenance of reserved energy systems		10.0					Directorate of Energy
		Total		958.14					

6.2: STATE MISION ON URBAN PLANNING AND SUSTAINABLE HABITAT

6.2.1 Stocktaking

Just about 10.03% of the total population of Himachal Pradesh live in habitations classified as urban. The total population of the state has increased by approximately 7 lakhs annually. Himachal Pradesh is the least urbanized state in India with only growth of 1.45% in urban population which is recorded to be the lowest from year 2001 to 2011. The main cause behind the low growth is attributed to inability main cause behind the low growth is attributed to inability to achieve national standards at maximum places, like population density of 400 people per square feet is required whereas it is only about 123 people per square feet in the entire state. Sex ratio in urba regions is 853 females for every 1000 males. Child Ratio figure is also very close at 881 girls for every 1000 boys.

» Table 6.14 : Extent of Demographic Change

Description	Rural	Urban
Population (%)	89.87	10.03
Total Population	6,176,050	688,552
Male Population	3,110,345	371,528
Female Population	3,065,705	317,024
Population Growth	12.65%	15.61%
Sex Ratio	986	986
Child Sex Ratio (0-6)	912	881

Child Population (0-6)	777,898	65,076
Literates	4,471,736	568,000
Average Literacy	81.85%	91.10%

TRENDS IN URBAN GROWTH OF HIMACHAL

The urban growth trend is not very expansive; as the growth every decade is very marginal.

» Table 6.15 : Urban Population in UA

Year	Total No. of Urban Agglomerations	Total No. of Urban Towns	Total Population		% of Urban Population to the State
			State	Urban	
1961		29	28,12,463		6.34
1971		35	34,60,434	5.26	6.99
1981		46	42,80,818	5.1	7.61
1991	1	57	51,03,900	13.5	8.81
2001	1	55	60,77,900	5.1	9.8
2011	3	55	68,64,602	13.5	10.03

6.2.1.1 Impact of Climate Change on Sector

According to the provisional census – 2011, 24.74% of the urban population resides in Shimla followed by 17.60% in Solan. Population growth in urban areas results in increased stress on infrastructure and from there resource congestion, emission and exploitation which results in imbalance in supply chain.

» Table 6.16: Impact of climate change on sector

Increased climatic variability	The average annual temperature has gradually increased by 1.2°C from 1985 to 2009 and it is projected to increase 2.2°C by 2030 (Urban Climate Change Research Network,2015). These projected changes may affect the ecosystem services. The increase in urban area contributes to the increase in carbon emission which leads to drastic change in climate. The over-exploitation of water is leading to Ground water table depletion especially in urban cities like Shimla, Baddi,Kangra.
Increased incidence of climate extreme events	With the current scenario of the Climatic trends of the country and intensity of extreme weather events, changes in precipitation patterns and water cycle has increased the problems related to water supply and quality in urban areas, the rise in temperature due to global warming can magnify environment-related diseases by providing suitable conditions for mosquito-borne diseases, which is directly linked to improper sanitation facilities, warmer climates can lead to droughts which can further contribute to increased migration.
Resource congestion due to migration	Migration from village to cities, the cities fail to address the additional demand which is beyond their carrying capacity. This creates pressure on land use, waste, drinking water supply, road and electricity network.

6.2.1.2 Key Issues and Challenges of the Sector

» Table 6.17 (a): Key Issues and challenges of the sector

Financial	90% dependence on Central financial assistance and grants for funding urban projects. Investments are required for better and wide road constructions to avoid traffic hazards or reduce traffic through promotion of public vehicles, as the volume of traffic on roads is much higher than its capacity.

Technical	State requires extensive training on water resource management and drainage system in urban areas. It is an agrarian state and has high dependency on water resources which is causing depletion in groundwater table and municipal corporation like Shimla is under severe stress. Enhanced corrective measures to be taken up for purification of the water to be made drinkable.The water quality of the khads has deteriorated and needs improvement. Air Pollution is required to lower down by promotion of environment friendly vehicle as well as with proper regulation for fresh and retrofit constructions in the city.
Social-political	The Department has everything such as adequate legislative support, head office with field networks, increasing responsibilities and mandate, growing manpower except town planners (barring few, who are at retiring age). Planners in Shimla appear to have taken the back seat.Data analyzed through free data sources are estimates only, which may change with accurate assessments.
Institutional and Regulatory	Unauthorized Constructions, land degradation and mixed land use are to be tackled. There is a need for integration of regulatory framework for efficient use of energy in buildings and better mobility that would help in lower emission intensity

6.2.2 Progress Mapping (In last 5 years)

Out of the proposed 13 mitigation activities in the initial SAPCC, progress has been recorded in the following activities.

PHYSICAL PROGRESS

» Table 6.17 (b): Progress recorded under SAPCC

Code	Activities	Physical Progress
USH/1	Determination of Impacts and Climate Change Adaptation Measures	No sector specific activity performed
USH/2	Assess the economic impact of preventive measures to prepare for extreme events and of repairs or reconstruction that could result necessary from such events.	Total 14052 beneficiaries under three components namely Self-Employment Programme (Self-Employment Programme), Social Mobilization and Institutional Development (Social Mobilization and Institutional Development) and EST (Employment through skilled training and placement). Support Urban Street Vendors (Support Urban Street Vendors) was initiated in 2016-17 which included survey training; it has benefited 5040 individuals and is still on-going. Shelter for Urban Homeless has also been added to NULM and new constructions are undergoing.
USH/7	Incorporate the results of climate change impact studies into zoning plans to avoid the expansion of urban areas into rural and riverside areas that are already susceptZible to climate change risk.	Water supply schemes carried out in 8 Urban local Bodies namely – Dharamshala, Ramput, Nagrota, Kangra, Mandi, Kullu, Parwanoo. Urban renewal carried out in Dharamshala and Rewlsar. Sewerage schemes in Baddi and Nalagarh
USH/8	Smart City Mission	The mission was started in year 2015, in two districts – Shimla and Dharamshala, no physical progress has been documented.
USH/9	In 2016 Climate Change assessment report (Assessment study for social & Environment of eco-Tourism Projects Under PPP mode.)	Trainings are being conducted based on the assessment for FRM chokidars. Govt. level governing body (Chief Minister is the head) is being formed – it is still at its initial phase.

USH/12	Swachh Bharat Mission (Urban)	Project timeline is 2014-22, with target of 11266 IHHL are to be constructed in the Urban local Bodies of State, Overall applications received as on 31.05.2018 were 5093 from which, 3040 were verified and 2428 approved and 1584 were constructed (equates to 14% progress against overall target). Up to March'2018, total 51 Urban local Bodies of the state have submitted the claim of their city to be Open Defecation Free. Total of 24 Urban local Bodies have been certified as Open Defecation Free after third party inspection. Inspection of rest 13 of the Urban local Bodies are being carried out by Quality Council of India one by one. 220 Community toilets and 652 Public Toilets are built. Dharamshala: Set of bins for 70 locations have been installed by the firm. Two tipper truck fitted with crane for bin lifting has been supplied. Sundernagar: Set of bins for 40 locations have been supplied by the firm at Sundernagar, bin installation is complete in 37 locations as on March'2018. One tipper truck filled with crane supplied by firm. Paonta Sahib: Set of bins for 40 locations have been supplied by the firm at Paonta Sahib. 2 Locations completed. Civil Work is under progress at 8 locations.
USH/13	Others	MAY launched on 25th June' 2015 and its mission is to provide 20 million houses by 31st March'2022 – 7914 beneficiaries so far.

6.2.3 Gap/Barrier Analysis:

There is a need for a better documentation of tasks carried out under the aegis of the Smart City Mission. There are no mechanisms proposed to tackle the rising river levels which may cause hydrological emergencies. New adaption mechanisms are to be introduced to regularize the use of water resources; lack of training in integrated water resource management may lead to severe water scarcity in the cities in the future. The capacity of the roads is not enough to handle the traffic and avoid congestion. Rules and regulations are followed in urban areas like Shimla but better enforcement of laws and policies are required in other regions.

There is also an urgent need for including policies to stop unauthorized constructions. There is already a policy that restricts residents of other states to own properties in the state. However, there are no policies for construction where it is causing concentrated pressure on specific areas. Although, Himachal Pradesh Town and Country Planning Act, 1977 is there but it needs to be updated as the scenario has extensively changed from then to now. Social defence programmes need to be designed to protect the lives of citizens and safeguard public and private property in remote areas.

6.2.4 Future Plan to meet INDC/SDG

6.2.4.1 Specific Targets under NDC for Urban Sector

The NDC aims at achieving the vision of a sustainable lifestyle and climate justice to protect the poor and vulnerable from adverse impacts of climate change. In order to achieve the goals, the central government has developed a set of commitments for different sectors. The key commitments under NDC pertaining to the urban sector is outlined in the table below:

Table 6.18: NDC Commitment and Key State Level Initiatives to comply with national pledge

NDC Commitment - Urban Sector	Key State level initiative to comply with NDC Target
To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	• Reduce emission and traffic of transportation through promotion of public transport. • Promotion of Rain water harvesting techniques to reduce water scarcity. • Usage of unconventional fuel in order to have a sustainable way of living.
To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.	Enhance the water quality in nearby rivulets, khads and measures be taken to improve the ground water table. Efficient Road, Vehicles to reduce the air pollution.

6.2.4.2 Specific target under SDG for Urban Sector

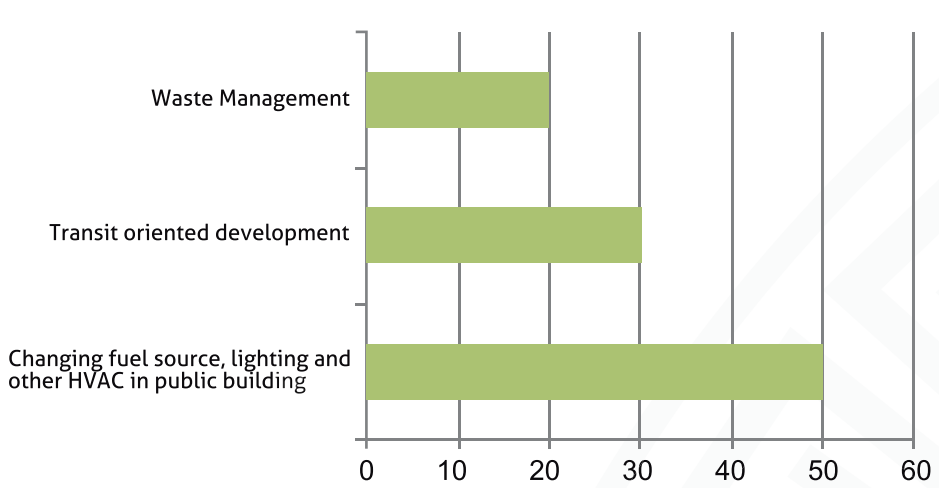
» Table 6.19 : SDG target and key initiatives at state level

<table>
<tr><th>SDG Goals</th><th>Key Initiatives by the State</th></tr>
<tr><td>Goal 6: Ensure the availability and sustainable management of water and sanitation for all</td><td>The Swachh Bharat Mission-Urban is being implemented in state for duration of 5 years i.e. from 2nd Oct, 2014 to 2nd Oct, 2019
Objectives of Mission are:
• Elimination of open defecation.
• Eradication of Manual Scavenging.
• Modern and Scientific Municipal Solid Waste Management.
• To effect behavioral change regarding healthy sanitation practices.
• Generate awareness about sanitation and its linkage with public health.
• Capacity Augmentation for ULBs to create an enabling environment for private sector
<table>
<tr><th>Component</th><th>Target</th><th>% target achievement</th><th>Tentative date for 100% target achievement</th></tr>
<tr><td>Individual Household Latrines (IHHL)</td><td>7818</td><td>34</td><td>31.03.2019</td></tr>
<tr><td>Community Toilet (CT) (No. of Wcs)</td><td>348</td><td>81</td><td>31.03.2019</td></tr>
<tr><td>Public Toilet (PT) (No. of Wcs)</td><td>528</td><td>100</td><td>achieved</td></tr>
<tr><td>Solid Waste Management (processing)</td><td>370</td><td>45</td><td>31.08.2019</td></tr>
</table></td></tr>
<tr><td>Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</td><td>The state is supporting Self- Employment Programme (SEP), Social Mobilization and Institutional Development (SMID) and Employment through skilled training and placement (ESTP) which has 14052 beneficiaries so far.
Smart City Mission is launched which will enable develop cities in a holistic and environmentally sustainable manner with core infrastructure. The comprehensive development will improve quality of life, create employment and enhance incomes for all, especially for the poor and disadvantaged, leading to inclusive cities.</td></tr>
<tr><td>Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable</td><td>PMAY launched on 25th June’ 2015 and its mission is to provide 20 million houses by 31st March’2022 – 7914 beneficiaries so far.</td></tr>
</table>

HIGH IMPACT OPPORTUNITIES

Broadly there are three to four high impact opportunities in urban sector that may contribute to climate goals of the Nation.

Figure 6.2 : Planned urban sector high impact opportunities



USH/ 1- Improvement of Waste management

Solid waste management is a component under the Swatch Bharat Mission. However, the waste produced can be converted into energy through technologies that convert waste matter into fuel (in various forms) that can be used for meeting energy needs. It can address two sets of environmental issues by a single stroke, namely – land-use for, and pollution from, landfills, and environmental side-effects s of fossil fuels. Himachal Pradesh produces about 63 metric ton of Municipal Solid Waste every year which can generate 0.5 MW of power.

Direct Benefits and Co-benefits:

- Generation of energy from waste abates associated carbon-dioxide emissions associated with generation of equivalent amount of energy from fossil fuels.
- Judicious management of waste results in abatement of methane emissions from landfill besides preventing land degradation.
- Job creation for building construction and post commissioning.

USH/2- Implementation of Rain water harvesting as part of building by-laws

Though Himachal Pradesh receives a good amount of annual rainfall, several regions of the state still face water scarcity, some even in the rainy season. This is primarily due to unsustainable management of water as a natural resource. Rain water harvesting is a vital strategy to provide safe drinking water in the urban areas. The government needs to explore the possibilities of installing rain water harvesting systems in every new building, along with wherever possible, in old structures.

Direct Benefits and Co-benefits:

- Reduces water stress and municipal water demand on the state.
- Reduces run-off thereby reducing chances of flood.
- Reduction in energy consumption.

Changes in the building byes laws is needed to facilitate rain water harvesting as a mandatory requirement.

- Reduced tax.

USH/N/1- Recycling and reuse of treated water from sewerage:

With decreasing freshwater availability and increasing costs fo delivering water of acceptable quality, recycling and reuse of treated wastewater becomes an important part of the sanitation cycle and critical for robust management of the environment. According to ENVIS Centre on Hygiene, Sanitation, Sewage Treatment Systems and Technology, Himachal Pradesh generates about 110 million litres per day (MLD) of sewerage in the urban areas alone. The capacity installed for its sewerage treatment is approximately 11472 million litres per day, the numbers are right in place as of now but it is required to ensure its maintenance.

Direct Benefits and Co-benefits:

- Reduction of toxic contamination with the natural resources.
- Reduces stress on water demand.
- Reduction of GHG emission due to organic waste deposition.
- Generation of employment.
- Enhancing the eco-balance of the water balance.

USH/N/2- Green highway (Plantation and Maintenance) - tree linealongside of Nationalv Highways

Green Highway Policy was formulated in 2015 by the Ministry of Road transport & Highways. Plantations along the highways can act as natural sinks for air pollutants and also arrest soil erosion on the embankment slopes. Plants along highway median strips and along the edges reduce the glare of headlights of reciprocal traffic which is often a cause of fatal accidents. The vision is to develop eco-friendly National Highways with participation of the local communities, farmers, NGOs, private sector, institutions, government agencies and Forest Department while also providing new employment opportunities for local people. Dust-fall due to bad road management is a serious issue in Himachal Pradesh. Plantations along the highways would also help swift settling down of these dust plumes.

Direct Benefits and Co-benefits:

- Safety of human lives by reduction in accidents.
- Control over highway pollution.
- Increased biodiversity.
- Income generation of the local people through employment and NTFP collection.

USH/N/3- Faster Adoption and Manufacturing of Hybrid & Electric vehicle

Council of Scientific and Industrial Research (CSIR) has successfully fixed electric vehicle (EV) kits to convert vehicles run on fossil fuel into electric vehicles in order to reduce pollution. CSIR is carrying out successful trials of installing the EV kits into fossil fuel vehicles under the National Electronic Mobility Mission 2020. The EV kit is supported by a 48V and 100AH lithium ion battery. The vehicles covers a distance of 30 KM at a speed of 45km/ hr approximately. The main advantage of this kit is that it can convert a conventional fuel vehicle into a pollution free vehicle at a very reasonable cost.

local people. Dust-fall due to bad road management is a serious issue in Himachal Pradesh. Plantations along the highways would also help swift settling down of these dust plumes.

Direct Benefits and Co-benefits:

- Abating GHG emission by reducing fossil fuel based vehicles.
- Reduced dependency on imported fossil fuels.

USH/N/4- Consideration of 25% tax on diesel run vehicles at the time of registration- Fuel efficiency programme

Automobile pollution is one of the major sources of pollution in Himachal Pradesh. Diesel run auto-rickshaws are a major component of public transport and also a major source of pollution in the cities. Government's initiative to ban diesel run auto-rickshaws without providing any alternative livelihood support has strongly been condemned by the community. Despite there being rules to declare 15-year old fossil fuel vehicles unfit for use, there is no policy in the country to convert such vehicles into scrap. Therefore, no effective results have been observed. Increase in tax on diesel vehicles might discourage the usage of such vehicles providing some relief from the pollution.

Direct Benefits and Co-benefits:

- Reduced use of diesel directly affects the air quality of the area.
- GHG reduction.

USH/N/5- Alteration of Conventional fuel and blending of bio-fuel in automobile

Capitalizing untapped potential in biofuels and other alternate fuels is one of the major components of the road map to reduce import of crude oil. The purpose of the activity is to provide greater access to clean liquid fuels while helping to optimise energy costs, energy security and global warming concerns associated with petroleum fuel. The state can take initiatives on using/ blending biofuels with conventional fuelto cope with the fuel crisis of the state which usually occurs due to blockage of the national highways. Himachal Pradesh being an agriculture state, production of raw material for bio-fuel is largely viable.

Direct Benefits and Co-benefits:

- Reduced dependency on fossil fuel.
- Adopting a cleaner and renewable source of energy.

6.2.5 Synopsis of activities and implementation schedule

A	B	C	D	E	F	G	H=E-F-G	
S.No.	**Code**	**Activity**	**Scheme**	**Proposed Budget (2021-2030 in Rs Crore**	**Amount likely from existing central scheme (2021-30) (In Rs crore)**	**From state budget (2021-30) in Rs Crore**	**Gap in Rs lakh (2021-30)**	**Imple-menting Agency**
1.	USH/1	Improvement of Waste management	Swachh Bharat Mission	90.00	90.00	0	-	Depart ment of Urban Develop ment
2.	USH/2	Implementation of Rain water harvesting as part of building by-laws		40.00			-	Depart ment of Urban Develop ment
3.	USH/N/1	Recycling and reuse of treated water from sewerage	AMRUT	200.00			-	Depart ment of Urban Develop ment

		Green highway (Plantation and Maintenance)- tree line alongside of National Highways						Department of Urban Development
5.	USH/N/3	Research on Faster Adoption and Manufacturing of Hybrid & Electric vehicle		40.0			-	Department of Transport
6.	USH/N/4	Consideration of tax on diesel run vehicles by 25% at the time of registration- Fuel efficiency program		15.0			-	Department of Transport
7.	USH/N/5	Alteration of Conventional fuel and blending of bio-fuel in automobile		20.0			-	Department of Transport
		Total		445.00				

FINANCING SAPCC

7 FINANCING SAPCC

India's climate adaptation financing gap is estimated at around 2.5 trillion US $ by 2030[1] (CEEW). Therefore, development of a creative financing strategy by the states is the need of the hour. High impact areas have to be identified from the state's ongoing sectoral activities for main streaming and tagging. Further, more private sector financing needs to be pooled in for high priority activities in a systematic way including public-private partnership (PPP). In addition, there are possibilities of securing additional climate finance from international climate funds, (Green Climate Fund, Global Environment Facility, Adaptation Fund) bilateral cooperation (additional financial and technical support for climate change outcomes like SDC, GIZ, JICA, DFID), multilateral facilities (loans and grant through WB, ADB, UNDP, etc.) and National Climate Fund (National Adaptation Fund for Climate Change, Small Grants Programme, Mission-Specific Allocations, regular schematic allocation having climate relevance).

The approach taken for climate financing is explained in the Table 7.1. Various types of financing windows are listed along with source of funds against each of them. A variety of instruments can be used to access funds. The key sectors in which the funds can be used are also mentioned along with the modalities and challenges faced in the process.

» Table 7.1 : Financial mechanism approach adopted by Himachal Pradesh during SAPCC 1.0

Financing Window	Source of Fund	Instrument	Key sectors	Access modalities and challenges
International Climate Fund (Budget Additional)	Green Climate Fund	Loan and grant, guarantee, equity	Food and water, health, Livelihood, infrastructure and built environment, ecosystem (for both adaptation and mitigation.	Micro up to 10 million USD Small (10-50) Medium (50-250) Large (>250) National Designated Authority (MoEF&CC) as focal point Through (Direct Access Entity and multilateral access entities) approved as NIE or MIE by NDA (MoEF&CC) 1-2 years, elaborate process
	Adaptation Fund	Grant, but loan as co-finance (by NIE or MIE) maximum up to 50% of the project cost	Natural resource systems (addressing climate risks), ecosystem, hazard	Regular project size >1 million USD Small <1 million USD Through NDA through NIE and MIE 8-12 months Maximum cap for country 10 mn USD (India exhausted)

Reference

1. CEEW (Complete source should be cited) Source: https://www.iamrenew.com/green-energy/india-needs-2- -trillionin-climate-financing-by-2030-ceew/

National Fund	GEF	Grant	Based on the sectors under the star allocation both for adaptation and mitigation. 1) Food systems, Land Use and Restoration; 2) Sustainable Cities; and 3) Sustainable Forest Management (under GEF 7 series)	Full sized project > 2 million USD. Medium size (upto 2million USD). Enabling activity (strategy development under a convention) Minimum 12 months
	NAFCC	Grant, Co-finance, convergence fund from state	Agriculture, horticulture, agro-forestry, environment, allied activities, water, forestry, urban, coastal and low-lying system, disaster management, human health, marine system, tourism, habitat sector and other rural livelihood sectors to address climate change related issues. Climate scenarios, capacity building, consultation, monitoring	Though no upper limit specified typical maximum for a state is about Rs 25 crore. Through NIE Typically 6 months for preparation and sanction. Maximum preparation cost is Rs 10 lakh, NIE fee capped at 3% of the project cost.
Bilateral and Multilateral projects/ programmes	Programs/ Projects linked to clear climate outcomes	Loan, Grant	Sectoral (both for adaptation and mitigation)	On state partnership basis and through the concurrence of national government.
NGOs	Programs/ Projects linked to clear climate outcomes	Grant	Sectoral (both for adaptation and mitigation)	On state partnership basis and through the concurrence of national government.
CSR	Programs/ Projects linked to clear climate outcomes	Grant	Sectoral (both for adaptation and mitigation)	As per statutory requirement under Company Act for the eligible companies, private foundations with voluntary pledge with programmatic convergence.
Budgetary (National and State)	Regular schematic (may not be additional)	Budget (grant in aid) state, central and centrally sponsored schemes	Sectoral (both for adaptation and mitigation)	Some of the schemes are listed in the report, not all required/ proposed strategies/priorities are covered under the scheme guideline. This needs to be classified as climate relevant and possible have a climate tag for reporting. Currently, there is no standard approach available.
Budgetary (Mission specific)	As per mission guideline	Both demand driven and also as per target	Sectoral (both for adaptation and mitigation)	Some of these have been specified in the report

» Table 7.2 : Process to be followed for climate finance in Himachal Pradesh state

Step1	Identify high impact/high priority activity/strategy having linkage to SDG/NDC having linkage to SDG/NDC	Identify relevant schemes in the state budget and put in the right demand (some examples have been given in the report). The expenditures can be treated a climate relevant expenditure based on how many components of the project activities have been covered.
	identify activities linked to national missions	Draw down resources form relevant mission based on the demand/target
Step2	There is no correspondence or availability of funds from state budget/national missions	Map to CSP, external aided projects or sources under bi-lateral or multilateral cooperation. Prepare proposal under the formats/processes given by the agency. The lead department/agency can initiate the process.
		Look for grants from CSR and NGO sources
Step3	There is correspondence or availability of funds from special climate funds available nationally	For NAFCC, prepare project concept note, do a preliminary go-no go check with NIE. If agreed go ahead with the detailed project report and submit through NIE to National Designated Authority. Executing agency signs the grant agreement and project cycle operation starts. Baseline and end line assessment conducted by external agencies track outcomes as per the project result framework.
Step4	There is correspondence or availability of funds from special climate funds available internationally	Assess the concept based on the result/impact areas and investment criteria (for GCF): 1. Impact potential, 2. paradigm shift potential, 3. sustainable development potential, 4. needs of the recipient, 5. country/state ownership, 6. efficiency and effectiveness, Submit proposal to NDA through NIE or MIE as per the format. Once approved by relevant board sign subsidiary agreement with NIE/MIE. Executing agency starts the project cycle operation.

7.1 FINANCIAL ALLOCATION UNDER SAPCC -1.0

This section highlights the sector-wise allocations for the activities that were proposed in the initial SAPCC State Mission for Ecosystem, Biodiversity and Livelihood Sustainability

» Table 7.3 : Financial allocation for each key strategy under State Mission for Ecosystem, Biodiversity and Livelihood Sustainability

Action Code	Action Proposed	Proposed Budget (as in SAPCC 2012-16) in INR crore	Amount Allocated in INR during 2013-2018 in INR crore	Amount Expenditure (2013-18) in INR crore	Type	Nature
	Proposed Budget for sector (as in SAPCC 2012-16)	55 crore				

A/B/1	Evaluation of the effects of climate change on areas of high environmental value/ eco sensitive areas.		1.00	1.00	AD	Research and Assessment
A/B/2	Analysis of the effects of climate change on species in conservation categories.		Nil	Nil	AD	Research
A/B/3	Undertake out climate change impact studies using existing information on public land of significant patrimonial value such as glaciers that encompass entire watersheds, glaciers or those that form an oasis in absolute desert ecosystems		Nil	Nil	AD	Research
A/B/4	Develop the Integrated Observatory Project in order to precisely measure terrestrial factors that influence climate change.		Nil	Nil	AD	Research
A/B/5	Wetland conservation, restoration programs.	1.5	Nil	Nil	AD	Investment
A/B/6	Protection of glaciers		Nil	Nil	AD	Investment
A/B/7	Develop a State Plan for Climate Change Education and Awareness, by incorporating the subject into curriculum at all educational levels.		0.15	0.15	AD	CB
A/B/8	Creation of the State Fund for Research on Climate Change and Biodiversity.		Nil	Nil	AD	Policy

7.1.1 State Mission for Green India

Table 7.4 : Financial allocation for each key strategy in State Mission for Green India

Action Code	Action Proposed	Proposed Budget (as in SAPCC 2012-16) in INR crore	Amount Allocated in INR during 2013-2018 in INR crore	Amount Expenditure (2013-18) in INR crore	Type	Nature
	Forest adaptation measures	140				

A/F/1	Perform an analysis of the vulnerability and adaptation potential of the Forest sector resources.		Nil	Nil	AD	Research
A/F/2	Assess and summarize national policies and strategies for adaptation in the Forest sectors and water resources.		Nil	Nil	AD	Policy
A/F/3	Conduct a socioeconomic assessment of the impact of climate change on the Forestry sector and studies to identify climate change adaptation measures and projects in Forest sector of Himachal Pradesh.		308.45	50.65	AD	Investment
A/F/4	Perform studies to identify climate change adaptation measures and projects in Forest sector of Himachal Pradesh, especially in alpine areas, reserves.		Nil	Nil	AD	Research
A/F/5	Perform studies to identify climate change adaptation measures and projects in Forest sector of Himachal Pradesh, especially in alpine areas, reserves.		Nil	Nil	AD	Investment
A/F/6	Foster and promote the efficient use of rain water in forests.		26.29	26.29	AD	Investment
A/F/7	Forest fire management and control.		Nil	Nil		Policy
A/F/8	Target annual basis forest area enhancement-community participation		657	Nil	Both	CB
A/F/9	Target CAT plan implementation and physical achievement.		157.31	106.84	AD	Investment
A/F/10	Target to create nurseries with new varieties.		5.56	5.55	AD	Policy
Mitigation measures – Total proposed budget (as given in previous SAPCC) – INR 55 crores						
M/F/11	Promote native forest management and recovery		Nil	Nil	MI	Investment
M/F/12	Promote afforestation		109.32	105.92	MI	Investment
M/F/13	Promote a program to calculate the carbon footprint		Nil	Nil	MI	Policy
M/F/14	Estimate carbon capture by plantations		Nil	Nil	MI	Research

M/F/15	Sustainable management of forests as per agreed upon methodology on REDD+	Nil	Nil	MI	Policy
	TOTAL	195	1263.93	295.25	

7.1.2 State Mission on Sustainable Agriculture

Table 7.5 : Financial Allocation for each key strategy under State Mission of Sustainable Agriculture

Action Code	Action Proposed	Scheme	Proposed Budget (as in SAPCC 2013-18) in INR crore	Amount Allocated in INR during 2013-18 in INR crore	Expenditure (2013-18) in INR crore	Type	Nature
	Agriculture Adaptation Practices		1,100				
AG/4	Develop a system to manage agro-climatic risks and agricultural emergencies	WBCIS by Department of Horticulture (2012-17), Pt. Deen Dayal Kisan Bhawan Samriti Yojna for Polyhouses, MIDH (Polyhouses)		88.98	85.7	AD	Investment
AG/6	Foster and promote the efficient use of water in agriculture	Rajiv Gandhi Micro Irrigation Scheme, PMKSY, Dr. Y.S. Parmar Kisan Swarojgar Yojna (RIDF 19XIX), MI under NMMI/NMSA/ PMKSY Dept. of Horticulture, PMKSY Per drop more crop		166.47	165.89	Both	Investment
AG/7	Reduce use of chemicals for agri-horti productions and to promote organic farming in the State	NMSA (Soil Health Management, Soil Health Card)		10.14	7.84	Both	Investment
AG/8	Increase the State's irrigated surface area by 50% through a new water shed - dam construction program	National Mission on Sustainable Agriculture 2014-18 (Rainfed Area Development, OFWM, Paramparagat Krishi Vikas Yojna)		45.04	43.52	AD	Investment
AG/9	Expand irrigation and water policies to include small reservoirs, artificial groundwater replenishment, relining of canals	Subsidies on Borewell and Lift Irrigation Schemes (2015-18)		40	40	AD	Investment

7.1.3 State Mission on Water

Table 7.6 : Financial Allocation of each key strategy under State Mission of Water

Action Code	Action Proposed	Proposed Budget (as in SAPCC 2013-18) in INR crore	Amount Allocated in INR during 2013-18 in INR crore	Expenditure (2013-18) in INR crore	Type	Nature
	Water Resources Adaptation Measures	110				
WR/1	Evaluation of the effects of climate change on different phases of the water cycle		Nil	Nil	AD	Research
WR/2	Perform an analysis of the vulnerability and adaptation potential of water resources				AD	Research
WR/3	Updating of hydrological balances in the most critical area (Flood control works: Channelization and Stabilization)			4.72	AD	Investment
WR/4	Determination of the availability of water in the future for consumption by humans, agriculture and electricity generation, considering the effects of climate change and demand forecasts				AD	Research
WR/5	Forecasting of hydrological trends (flows) based on climate evolution predictions		Nil	Nil	AD	Research
WR/6	Design of a state level aquifer monitoring program		Nil	Nil	AD	Policy
WR/7	Progress toward commitments set out in the State Strategy for Integrated Watershed Resources Management and development		479.01	479.01	AD	Investment
WR/8	Study of water resources and how efficiently they are used, in order to adapt them to climate change in Himachal Pradesh		Nil	Nil	AD	Research
WR/9	Application of calibrated hydrologic balance models to various unregulated watersheds		Nil	Nil	AD	Research
WR/10	Creation of the Environmental Research Centre, which will focus on the study of the region's water resources		Nil	Nil	AD	Policy
WR/11	Encourage the construction of rainwater harvesting structures				AD	Policy
WR/12	Implement the processes for technical improvements for the effective irrigation		Nil	Nil	AD	Policy
WR/13	Carry out a multidisciplinary study of glaciology and meteorological aspects of rich biodiversity in remote geographical regions, through research		0.18	0.18	AD	Research
WR/14	Set up a multipurpose centre equipped for researching water resources and biodiversity in order to advance research in the State		Nil	Nil	AD	Policy

WR/15	Enhance rain water harvesting installations coverage in time bound manner		0.91	0.91	AD	Investment
WR/16	Regulate and target to reduce water storage systems in industrial, commercial activities		Nil	Nil	AD	Policy

7.1.4 State Mission for Health

Table 7.7 : Financial Allocation of each key strategy under State mission for Health

Action Code	Action Proposed	Scheme/ Activity	Amount Budgeted (2012-18) in Rs crore	Amount Allocated (in cr) (2012-18)	Amount released (in cr) (2012-18)	Amount spent (in cr) (2012-18)	Type	Nature
	Health Adaptation Measures		105					
H/4	Strengthen the capabilities of healthy personnel to address prevention and care of adverse effects caused by climate change	NRHM includes RCH Flexi pool and NRHM Flexipool		839.28	976.79	1030.64	AD	CB
H/5	Identify vulnerable areas or those with the greatest health risks due to different factors the affected population should also be considered			-	-	-	AD	Research
H/6	Improve monitoring of environmental health indicators. Trends in these indicators as well as any stark changes can reveal effects of climate change			-	-	-	AD	Policy
H/7	Interact with other sectors in order to identify the current or future effects of climate change on the health of the population			-	-	-	AD	Policy

H/8	Create and develop capacities to address the potential introduction of yellow fever, dengue fever, malaria and vectors such as mosquitoes	National Disease Control Programme (NDCP)		100.99	82.49	45.3	AD	Investment
H/9	Adapt monitoring systems and emergency plans by including in risk management practices, any climate change related health effects				49	-	AD	Policy
	Total		105	940.27	1075.94			

7.1.5 State Mission for Eco Tourism

» Table 7.8 : Financial Allocation of each key strategy under State Mission for Eco Tourism

Strategies	Code	Actions	Amount Allocated during 2013-2018) in INR Crore	Amount spent in INR during 2013-2018) in INR Crore	Proposed budget in INR lakh during (2018-23)	Type	Nature
Determination of Impacts and Climate Change Adaptation Measures	ET/1	Incorporate the results of climate change impact studies into tourism plans to avoid the expansion of urban areas into rural and riverside areas that are already susceptible to climate change risk	NA		-	Adaptation	Research
	ET/2	Check infrastructure development related to tourism activities in areas prone to disaster	NA		-	Adaptation	Research
	ET/3	Assess the economic impact of preventive measures to prepare for extreme events and of repairs or reconstruction that could result necessary from such events	0.08	0.09	-	Adaptation	Research
	ET/4	Promote program related to traditional culture-based tourism	0.30	0.31	NA	Adaptation	Investment
	ET/5	Eco tourism expansion					

Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation	ET/8	Strategic Environment Assessment of Sustainable Tourism Practices	0.07	0.07	-	Mitigation	Policy
Total			0.46	0.47	-		

7.1.6 State Mission on Strategic Knowledge of Climate Change

» Table 7.9 : Financial Allocation of each key strategy under State Mission on Strategic Knowledge of Climate Change

S.No.	Strategy	Code	Activities	Proposed Budget in SAPCC 2013-18 in INR crore	Expenditure in 2013-18 (in INR crore)	Type	Nature
1	Creation of a State Level Program for Climate Change Education and Awareness	SK/1	Develop a State Plan for Climate Change Education and Awareness, by incorporating the subject into curriculum at all educational evels	100	0.20	Adaptation	Research
2	Creation of a State Fund for Research on Climate Change and Biodiversity	SK/2	Creation of the State Fund for Research on Climate Change and Biodiversity	50	0.010	Adaptation	Research
3	Evaluation of the Technical and Economic Feasibility of Establishing a Basic Comprehensive Regional Network (Atmospheric and Terrestrial) for Monitoring and Studying Climate Change	SK/3	Assess current capacities for meteorological monitoring - Carry out a technical and economic assessment of the potential improvement and expansion of existing meteorological networks in Himachal Pradesh	65	0.039	Adaptation	Research
			Upgrade the existing meteorological network in order to allow for real time monitoring of climate behaviour. Create and install a network of stations to record environmental parameters, for the purpose of expanding the database of glaciology information and monitoring of the El Nino Southern Oscillation phenomenon				

4	Strengthening the Institutional Framework in Himachal Pradesh for Addressing Climate Change	SK/4	Prepare a State Level Glacier Inventory - Identify actions or measures to minimize or mitigate the effect of climate change on Glaciers - Identify situations or risk-factors associated with anthropogenic impacts Glaciers that could affect urban areas, industrial developments	55	1.6	Adaptation	Investment
5	Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation	SK/4	Review the current membership of the State Steering Committee on climate change, with the aim of incorporating other important sectors such as health, public works, industry, mining and transport, among others - Review the institutional arrangements in different sectors for combating climate change, and implement recommendations of the institutional assessment as per outcomes of Environment Master Plan	95	0.10	Adaptation	Research
6	Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation	SK/6	Design instruments to promote the development, transfer and adoption of technologies for climate change mitigation and adaptation -These instruments should complement measures included in the respective regional and sectoral plans -Provide incentives for the development of alternative energy projects and evaluate mechanisms to facilitate their implementation -Implement the Integrated Climate Change Project, which seeks to create technologies for climate change mitigation and/or adaptation in the agriculture and forestry sectors	100	0.20	Adaptation	Research
			Implement an environmental labeling system to inform consumers about the performance and emission levels of new vehicles, including CO2 emissions -Develop incentives for the promotion of more energy-efficient transportation, such as hybrid or electric vehicles -Support the Mechanism, an instrument that supports the development and transfer of technology and sustainable development -Proposed Studies -South - South Exchange on sub national environmental and climate change management				

7.1.7 State Mission on Enhanced Energy Efficiency

Table 7.10 : Financial Allocation of each key strategy under State Mission on Enhanced Energy Efficiency

Name of the activity	Code	Strategies	Proposed Budget in SAPCC 2013-18 in INR crore	Allocated Money in INR Crore	Expenditure in 2013-18 (in INR crore)	Type	Nature
Energy Efficiency and renewable energies	EEC/1	Improve estimates of potential savings and energy efficiency on a State and regional scale, by consumption sector. To achieve this, the potential for reducing greenhouse gas emissions through implementation of the 2009-2014 Action Plan of the National Energy Efficiency Mission will be quantified. The objective of this plan is to limit increases in energy consumption in sectors such as transport, industrial, cement mining, public and residential. In addition, this program's potential for reducing baseline emissions will be established	75	On yearly basis corresponding to physical targets (allocated) 5 crores upto 30-06- 2018 was received 50 lakhs for streetlight demonstration project	5.75	MI	Investment
	EEC/2	Strengthen the National Energy Efficiency mission based on results of the potential for savings and energy efficiency. The purpose of this is to intensify energy efficiency initiatives in sectors such as construction, commercial, residential, industrial and transport and to evaluate their potential for future mitigation		68 Plus 25 for LED Village Campaign		MI	CB
	EEC/3	Study the potential for renewable energy generation. To do this, the potential for limiting the increase of greenhouse gas emissions will be calculated and quantified. This potential is a result of new investments being made in this field that have resulted from actions taken to promote the development of non- conventional renewable energies in the State and of regulatory modifications.		0.67		MI	Research
	EEC/4	To undertake Cumulative Environmental Impact Assessment (CEIA) studies				MI	Research

	EEC/5	Ongoing monitoring of the evolution of the current and projected baseline, for the purpose of tracking the natural evolutiin demand, as well as the new energy supply options that are available.on of growth				MI	Policy
	EEC/6	Establish the Centre for Renewable Energies to create policies that guide and create incentives for investors. Implement a government-backed fund for investments in renewable energies and energy efficiency				MI	Pilocy
	EEC/7	Encourage the installation of solar systems for heating water or generating electricity in the public, commercial, residential and industrial sectors, to make maximum use of Himachal Pradesh's solar resources			**FINANCIAL PROGRESS SAME AS THAT OF ACTIVITY EEC/17	MI	Policy
	EEC/8	Provide the necessary infrastructure and safety features for the large-scale use of bicycles, pooled transport as an everyday means of transport				MI	Policy
Generation of Mitigation Scenarios in Himachal Pradesh	EEC/9	Development of mitigation scenarios for the next 15 or 20 years, which includes creating scenarios up to 2025 or 2030 for those sectors making significant contributions to State's GHG emissions	25			MI	Research
Formulation of a Regional Plan for Mitigation and Related Sectoral Plans	EEC/10	Creation of the 2015-2025 Regional Action Plan for Mitigation of GHG Emissions and its related Sectoral Plans	15			MI	Policy
Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation	EEC/11	Provide incentives for the development of alternative energy projects and evaluate mechanisms to facilitate their implementation	120			MI	Policy

	EEC/12	Develop incentives for the promotion of more energy-efficient transportation, such as hybrid or electric vehicles				MI	Pilocy
Energy, Hydro, power, Industry Sector	EEC/13	Evaluate the potential energy generation scenarios in Himachal that take into account the expected impacts of climate change on water resources. This information will be central to any assessment of different alternatives and opportunities that, in the future, could allow for the establishment of a more diverse and sustainable energy matrix			Approx. 850 lakh per MW	MI	Investment
	EEC/14	Assessment of the Power sector's hydrological vulnerability and its effect on Himachal Pradesh energy security. This will be carried out by developing future hydroelectric generation scenarios				MI	Research
	EEC/15	Transmission and evacuation plan				MI	Policy
	EEC/16	Target energy conservation through market-based instruments		0.07		MI	Pilot
	EEC/17	Target solar energy coverage in urban rural areas				MI	Pilot
	EEC/18	Bio energy- waste to energy pilot-model projects		0.09 commissioned on 6th Jan 2016		MI	Pilot
	EEC/19	Discourage energy intensive industrial development				MI	Policy
	EEC/20	Regulating diversion of river flows, courses for power generation				MI	Policy
	EEC/21	Target to achieve minimum discharge required for downstream floral-faunal sustenance		N/A		MI	Policy
	EEC/22	Target revival of water mills. Design of economic instruments to address of one priority pollutant and incentives for cleane production based on economic efficiency criteria		1.37		MI	Pilot
Total Budget			280	164.76	5.78		

7.1.8 State Mission on Sustainable Urban Habitat

Table 7.11 : Financial Allocation of each key strategy under State mission on Urban habitat

Activity	Code	Strategies	Proposed Budget (as in SAPCC 2013-18) in INR Crore	Allocation (as in SAPCC 2013-18) in INR Crore	Expend-iture (as in SAPCC 2013-18) in INR Crore)	Type	Nature
Urban Adaptation and Mitigation Measures			210				
Determination of Impacts and Climate Change Adaptation Measures	USH/1	Develop scenarios to model the impacts of climate change on major infrastructure in lowlying and river bed areas susceptible to climate related damage.				AD	Research
	USH/2	Assess the economic impact of preventive measures to prepare for extreme events and of repairs or reconstruction that could result necessary from such events.	26.24	21.47	16.53	AD	Research
	USH/3	Develop criteria for adapting regional emergency plans to prepare for the potential destruction of major infrastructure.	NA			AD	Policy
	USH/4	Adapt the design for new bridges and hydraulic infrastructure so that these would account for changes to Himachal Pradesh's hydrology caused by climate change.				AD	Policy
	USH/5	Expand the infrastructure and defence program designed to protect the lives of citizens and safeguard public and private property in remote areas and riverside areas.				AD	Policy
	USH/6	Improve the capacity to predict and respond to Hydrological emergencies caused by destructiverises in river levels due to the new hydrologycaused by climate change.				AD	Research

	USH/7	Incorporate the results of climate change impact studies into zoning plans to avoid the expansion of urban areas into rural and riverside areas that are already susceptible to climate change risk.	279.96	279.96	259.57	AD	Investment
Green Urban Infrastructure	USH/8	Improve the link between the process for developing urban planning instruments and the incorporation of background information from available studies on rural areas and watersheds.				Both	Investment
	USH/9	Check infrastructure development related to tourism activities in areas prone to disasters.	26.24	21.47	16.53	AD	Investment
	USH/10	Develop building energy efficiency design guidelines- (retrofitting as well as new constructions)	NA			MI	Policy
	USH/11	Implement and environmental labelling system to inform consumers about the performance and emission levels of new vehicles, including CO_2emissions.				MI	Policy
	USH/12	Assessment of economic instruments to promote cleaner sources of growth and to reduce pollution from existing industrial plants including Swatch Bharat Mission	34.95	18.74	15.33	MI	Policy
	USH/13	Other		127.43	12.1	Both	Investment

7.2 ANALYSIS OF CLIMATE EXPENDITURE

There has been significant change in the state's attention to climate related investments. In fact, several flagship schemes have strong linkages to NDC and have strong climate relevance. This has been evidenced in almost all the sectors. While the initial SAPCC focused mostly on research and studies, there has been evidence of many full-scale investment programmes, in agriculture, water, urban and forestry drawing central and externally aided funds. This has been clearly seen activities that have got major allocations. Many actions were proposed in 2012-13 as policy actions have now got full scale investment. Overall there were 82 activities under different missions of which 54 relates to adaptation, 30 for mitigation and 4 under both adaptation and mitigation

Overall allocation of financial resources under different missions has been given in table 7.12.

Table 7.12 : Summary allocation of climate relevant budget in different missions

S.No.	Sector	Proposed Budget in Rs Crore (2012-16)	Allocation in Rs Crore (2012-16)	Estimated Expenditure in Rs Crore (2012-16)
1.	Agriculture-Horticulture	1,100	350.63	342.97
2.	Energy	280	164.74	5.78
3.	Water	110	480.1	484.82
4.	Health	105	940.27	1075.94
5.	Urban	551.15	447.56	303.5
6.	Ecotourism	65	0.46	0.47
7.	Forest	195	1263.93	295.25
8.	Strategic Knowledge/ Capacity Building	485	2.53	2.529
	Total	**2,891**	**3,650.53**	**2,511.53**

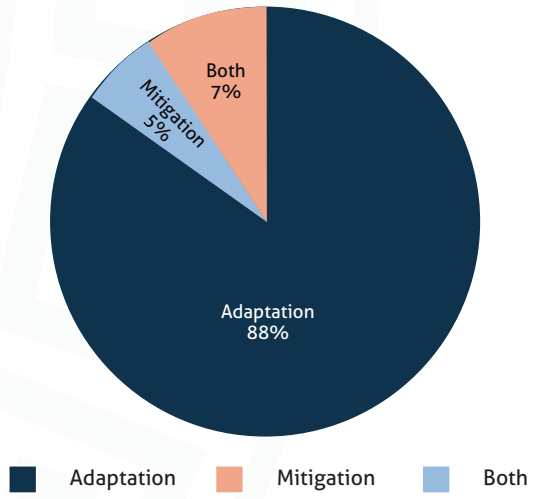
The following observations are important while interpreting Table 7.12.

- The figures relate to allocations and are a proxy for state's ambition.
- The activities often do not have one to one correspondence with budget components. Therefore, wherever, such likelihood of duplication or anomaly is likely, suitable adjustment has been made and that is subjective.
- Allocations in agriculture include the comprehensive flagship scheme RKVY which has many overlaps with activities in other components. Similarly, NRHM, the flagship health scheme is extremely comprehensive and it has been taken in totality as NDC is all encompassing while the climate relevance may be limited to vector borne diseases, etc. Similar situations emerge for urban sector where large investments have been made under JNNURM and subsequent smart city and AMRUT programmes.

In forestry sector, a large externally aided climate proofing program has been taken in full. Therefore, overall it looks all the proposed amount has been funded. However, if we go strictly by climate relevance figures, the amount may be lower. The fact that 60 percent of the activities having high climate relevance proposed in the initial SAPCChave not got any funding linkage yet is a pointer in this context. Moreover, three critical sectors with high linkages to NDC and country climate goals i.e. energy, water and forest sectors have many important climate relevant activities without any proper funding linkage. However, it is difficult to assess this in the absence of budget coding.

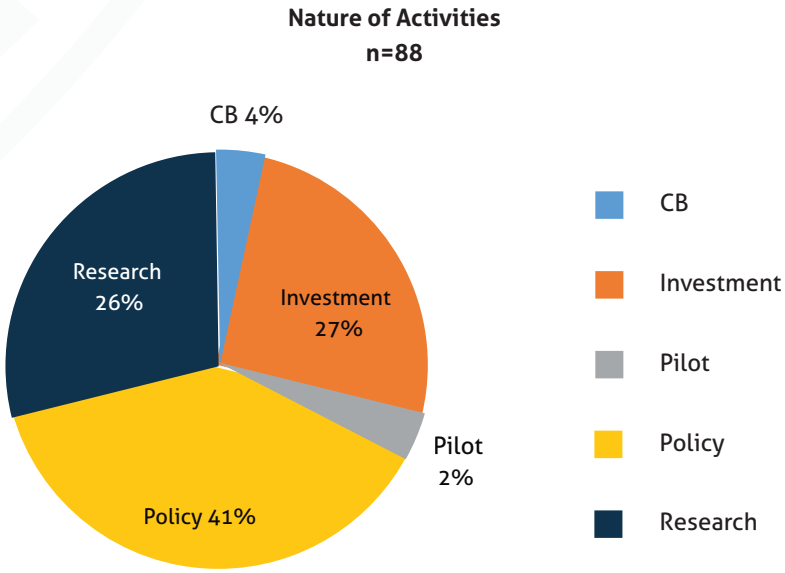
In terms of expenditure patterns, of the total expenditure of Rs 2509 crore during 2012-17, 88% relates to adaptation and 5% relates to mitigation, 7 percent have linkages to both adaptation and mitigation.

Figure 7.1 : Type of activities and allocation



In terms of nature of activities it is interesting to note that out of the 88 activities little more than a quarter are investment projects. The highest share of activities is related to policies (41%) followed by 26% to research related actions, 2 % are for demonstration or pilot and 4% for capacity building. However, the capacity building components are part of many flagship schemes now and the actual share may be close to 8-10 percent of the total scheme value. This reflects in allocation numbers, as almost 41% of the allocation goes to capacity building and extension related activities dominated by sectors like agriculture and health.

Figure 7.2 : Breakup by the nature of activities



It is also observed that, about 30-40% of activities having strong relevance to INDC have not got any allocation which makes it important that their relevance is re-assessed during the planning process. Table 7.13 gives the sector wise break up of proposed budget, allocation and expenditure from initial SAPCC.

Table7.13 : Sector wise proposed budget, allocation and expenditure

S.No.	Sector	Proposed Budget in Rs Crore (2012-16)	Allocation in Rs Crore (2012-16)	Estimated Expenditure in Rs Crore (2012-16)
1.	Agriculture-Horticulture	1,100	350.63	342.97
2.	Energy	280	164.74	5.78
3.	Water	110	480.1	484.82
4.	Health	105	940.27	1075.94
5.	Urban	551.15	447.56	303.5
6.	Ecotourism	65	0.46	0.47
7.	Forest	195	1263.93	295.25
8.	Strategic Knowledge/ Capacity Building	485	2.53	2.529
	Total	**2,891**	**3,650.53**	**2,511.53**

7.3 SYNTHESIS

After the consultations with concerned stakeholders and relevant departments, 53 planned activities have been identified in eight sectors in the state. These have been examined based on their linkages to SDGNDC, funding linkages and implementation potential. Most of these activities have their genesis in state specific vulnerability (for adaptation) as well as their relevance to low carbon development (for mitigation strategies). For prioritization of activities, a multi criteria- analysis-based score card was used. First, the activities were screened based on vulnerability/ impact as well as lowcarbon development process. Therefore NDC-SDG linkage was assigned the highest weightage of 50%. Implementation potential based on low barriers was assigned 30% weightage and funding linkage was assigned 20% weightage (since our funding is mostly schematic and climate relevance for proposed activities is still not standardized). The activities based on this were scaled as :

1. meagre
2. reasonable
3. significant.

The weighted averages were used for ranking and prioritization.

Table 7.14 : SDG-NDC linkage of proposed activities

Sector/Mission Meagre Reasonable		SDG_NDC			Total
		Meagre	Reasonable	Significant	
Agriculture	No	1	4	5	10
	% of Total	1.9%	7.5%	9.4%	18.9%
Energy	No	1	8	4	13
	% of Total	1.9%	15.1%	7.5%	24.5%

Forestry	No	0	1	6	7
	% of Total	0.0%	1.9%	11.3%	13.2%
Health	No	0	1	5	6
	% of Total	0.0%	1.9%	9.4%	11.3%
Strategic Knowledge	No	0	3	2	5
	% of Total	00.0%	5.7%	3.8%	9.4
Urban	No	0	1	6	7
	% of Total	0.0%	1.9%	11.3%	13.2%
Water	No	0	1	4	5
	% of Total	0.0%	1.9%	7.5%	9.4%
Total	No	2	19	32	53
	% of Total	3.8%	35.8%	60.4%	100.0%

From the table 7.14 one can infer that more than 96% of the planned activities across eight sectors have reasonable and significant linkages to SDG and/or NDC. Agriculture, Energy, Urban and Forestry sectors have such linkages. These sectors significantly can contribute to climate goals under NDC as well as have reasonable co-benefits

Since majority of the activities are having significant linkages to SDG and NDC, a further analysis has been carried out to identify funding linkage.

» Table 7.15 : SDG-NDC linkage of proposed activities with available funding

			Funding				Total
			None	Meagre	Reasonable	Significant	
SDG_NDC	Meagre	No	1	1	0	0	2
		% of Total	1.9%	1.9%	0.0%	0.0%	3.8%
	Reasonable	No	5	11	2	1	19
		% of Total	9.4%	20.8%	3.8%	1.9%	35.8%
	Significant	No	1	5	15	11	32
		% of Total	1.9%	9.4%	28.3%	20.8%	60.4%
Total		No	7	17	17	12	53
		% of Total	13.2%	32.1%	32.1%	22.6%	100.0%

From the above table it is observed that only 1.9% of the activities have either meagre or no SDG_NDC linkage or funding linkage. Overall 45.3 percent activities did not have any significant funding linkage. 20.8% of the activities have significant linkages to SDG-NDC as well as funding.

Table 7.16 : Implementation and Funding Linkage

			Implementation				Total
			None	Meagre	Reasonable	Significant	
SDG_NDC	None	No	6	1	0	0	7
		% of Total	11.3%	1.9%	0.0%	0.0%	13.2%
	Meagre	No	4	12	1	0	17
		% of Total	7.5%	22.6%	1.9%	0.0%	32.1%
	Reasonable	No	0	4	13	0	17
		% of Total	0.0%	7.5%	24.5%	0.0%	32.1%
	Significant	No	0	1	6	5	12
		% of Total	0.0%	1.9%	11.3%	9.4%	22.6%
Total		No	10	18	20	5	53
		% of Total	18.9%	34.0%	37.7%	9.4%	100.0%

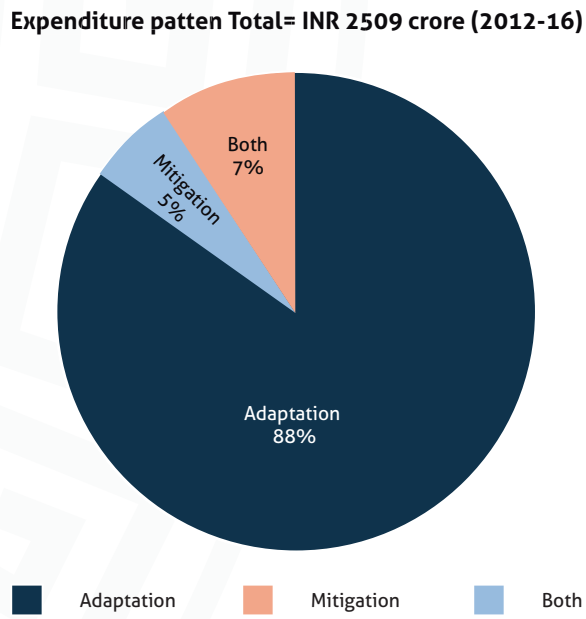
Only 11.3% of the proposed activities have no funding and no implementation linkage. It is also validated that without any funding linkage no implementation takes place. Only 9.4% activities had significant funding and implementation linkage. Summary of prioritised actions have been given in the section below. A detailed score card of activities has been presented in **Annexure 3** of the report. The proposed budget for next 10 years is given in the below table with the probable linkages to funding and gaps.

Table 7.17 : Proposed Budget for next 10 years

Sector	Proposed Budget (as in SAPCC 2021-30) in Rs crore	Sources	Funding gap in Rs Crore
Forest Resource	688.6	Central Schemes	653.90
Agriculture	4895.0	Central and State Schemes	2473.00
Water	4895.0	Central and State Schemes	1800.00
Health	1780.0	Central and State Schemes	643.00
Strategic Knowledge	150.0	Central and State Schemes	137.50
Enhanced Energy Efficiency and Solar Mission	958.1	Central and State Schemes	958.14
Urban	445.0	Central and State Schemes	338.47
Total	**10916.7**		**7004.0**

Out of the proposed 53 activities, 65% are adaptation activities, 13% are mitigation activities while 22% of the activities comprises both adaptation and mitigation options, see Figure 7.3

Figure 7.3 : Budget of proposed adaptation and mitigation activities from 2021-2030



The nature of proposed activities shows thatmajor portion of the proposed activities belong to investment section i.e. 55% and 26% of the proposed actions are research based.

A total budget of Rs 10,917 crore is allotted to all activities for 10 years. The segregation of nature of activities is given in the figure 7.4 below.

Figure 7.4 : Nature of proposed activities from 2021-30

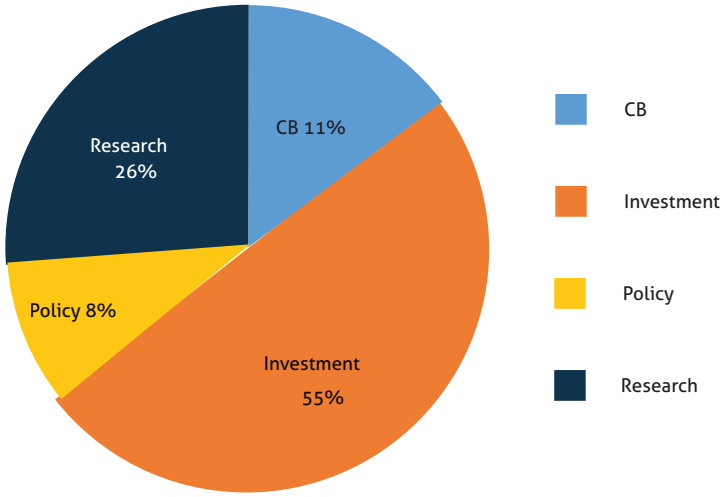
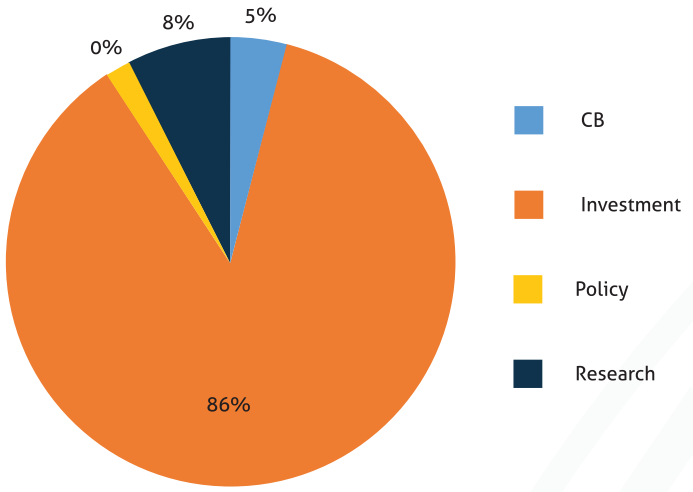


Figure 7.5 : Allocated Budget from 2021-30



7.4 PRIORITY ADAPTATION ACTIONS

a. The top activities in Agriculture sector are as follows:

- Foster and promote the efficient use of water in agriculture
- Sustainable land use management
- Adequate promotion and development of resilient high value crops including fruits and off-season vegetables which are suitable for the seasonal variations to promote a viable solution for farmers
- facing the impacts of climate change on cereal based agriculture
- To promote development of eco village/ bio village in order to improve livelihood resilience amongst villages in high-altitude regions.
- Revision and implementation of Contingency plans.

b. The top five activities in Water sector are as follows:

- Reduce demand in state by controlling leaks implementing water saving programs through reusing water.
- Integrated water resources management and preparation of state specific action
- plan on water sector.
- Improve water use efficiency in the state/ Promotion of Spring-Shed Management.
- Management of irrigation through WUA and Command area development.

c. The top activities in forest sector are as follows:

- Identification of key impacts, vulnerabilities and research priorities – Support research priorities to fill gap inclimate change and forestry
- researchneeds.
- Developing strategies in collaborating with hydro industry.

- Developing communication strategies targeted at schools, public and private sector.
- Strengthening of State Wetland Authority and preparation and implementation of Action Plans at micro level for conservation and restoration of wetlands.
- Enhancement of livelihood options of state through agro-forestry/farm forestry.
- Biodiversity Conservation through habitat management and strengthening of Biodiversity committee.
- Expansion of Eco Tourism landscape

d. The top activities in health area as follows:

- Strengthening health care in HP to reduce deaths of new-borns and children under 5 years of age,
- Strengthen the prevention, control and treatment of vector borne diseases
- Training and awareness programs for identifying early signs of extreme climatic events on the population and the remedy.
- To understand the impact of operational research for climate change in all districts of the state.
- Adapt monitoring system and emergency plan in risk management practices on climate change related health aspects.

e. The top activities in the Strategic Knowledge sector are as follows:

- Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation.
- Study the climate data and project the climate changes for vulnerability assessment at the regional and local level.
- Strengthening the Institutional knowledge network in Himachal Pradesh for Addressing Climate Change.
- Mapping of the knowledge base and data resources relevant to climate change for the mobilization of state specific strategic knowledge
- Identification of research gap in each sector with review of existing sectoral policies and strategies

7.5 Priority Mitigation Actions

There are several mitigation-oriented strategies proposed as key priorities and are summarised as under:

The top activities in energy sector are as follows:

- Facilitate Deployment of Identified Hydro Power Project.
- Improve energy intensity through adoption of energy conservation and DSM measures.
- Reduction in energy-use intensities in income generating activities through structural adjustments of activity typology and ensuring linkages along value addition chain and optimal use of resource endowment.
- Study for proper analysis and hydropower development.
- Capacity building of technical manpower of power sector on energy conservation and management.
- Promotion and awareness of solar rooftop programme through awareness development and exhibition.
- Development of safety and quality of hydro projects upto 5 MW capacity.
- Implementation of communication strategy with respect to hydro power development in the state.

- Comprehensive study for dam regulation and silt management, disposal due to future climate change impact.
- Reduction in energy use intensity by solar systems like solar water heater, coolers, lights, etc.

Key priorities in the Urban and Waste Management sector:

- Improvement of Waste management including waste to energy to bioenergy like domestic waste to bio-gas, electricity.
- Implementation of Rainwater harvesting as part of building by-laws.
- Green highway (Plantation and Maintenance)- tree line alongside of National Highways.
- Faster Adoption and Manufacturing of Hybrid & Electric vehicle
- Alteration of Conventional fuel and blending of bio-fuel in automobile.
- Foster waste to energy programme.

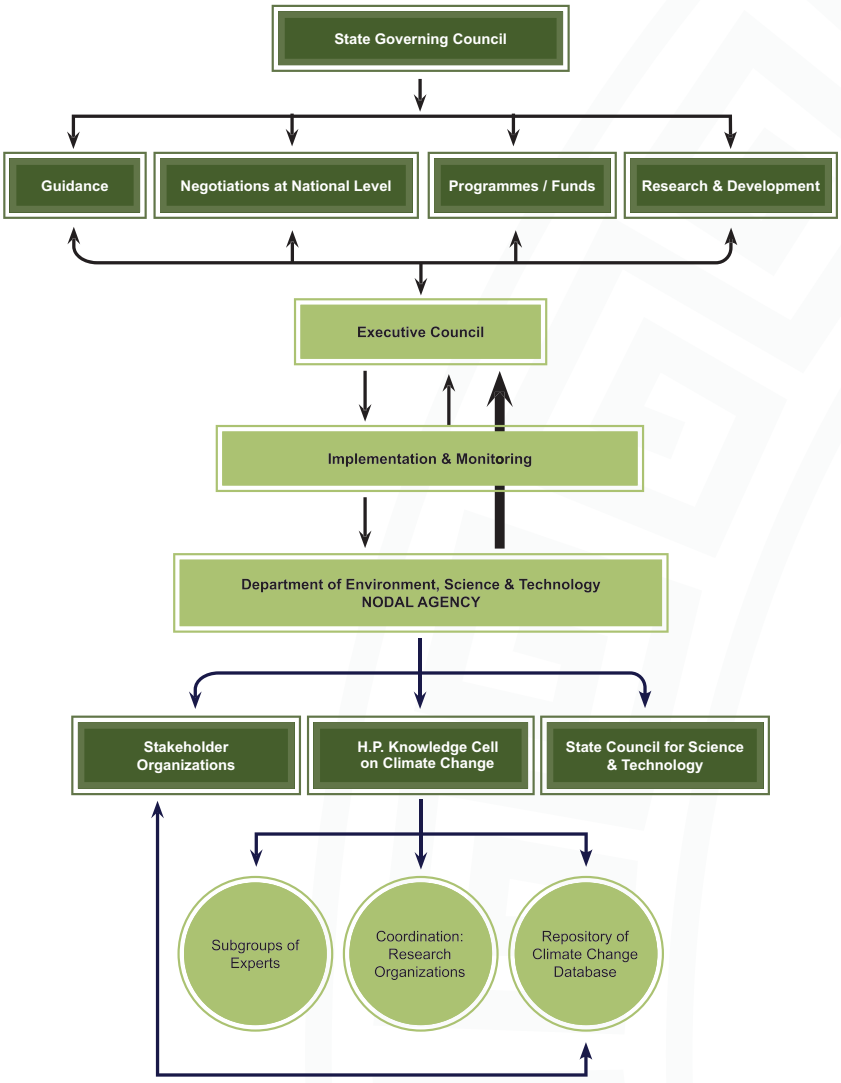
IMPLEMENTATION MECHANISM

8 IMPLEMENTATION MECHANISM

8.1 IMPLEMENTATION ARRANGEMENT OF THE SAPCC

A state level Climate Change Governing Council has been set up for taking all the strategic decisions on climate change. The council is headed by Chief Minister of the state. The operating arm of the Climate Change Governing Council is to advice the Executive Council chaired by the Chief Secretary, Govt. of Himachal Pradesh (GoHP). Department ofEnvironment, Science and Technology (DEST) is designated as the nodal

Figure 8.1: Implementation Arrangement of SAPCC

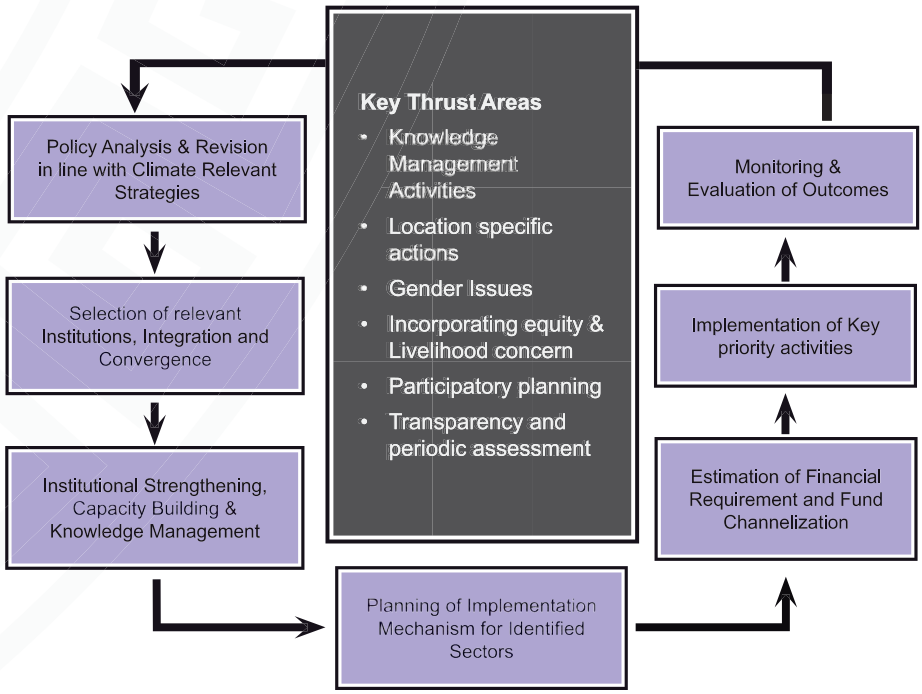


agency for overseeing the implementation the SAPCC. Additionally, Himachal Pradesh Knowledge Cell on Climate Change has also been set up in the state under the DEST. The Knowledge Cell is mandated to provide the knowledge management components envisaged in the SAPCC. DEST is responsible for evolving new programmes and strategies based on scientific and technical knowledge and shall assess the state's progress in addressing climate change issues in order to increase climate change related awareness. The AGiSAC (Aryabhatta Geo-Informatics & Space Application Centre) shall assist in the field of GIS applications.

8.2 IMPLEMENTATION FRAMEWORK OF THE SAPCC

The State is committed to implement the SAPCC. It is supported by a robust framework and mechanisms not only as operational plans but more importantly, as tool for systematic review and programme improvement based on the need of state.

Figure 8.2: Implementation framework of SAPCC



In order to implement effectively the climate relevant strategies for achieving the desired outcomes, the interdepartmental coordination is going to play a critical role. The proposed strategies will require a sincere effort along with a systematic and synchronised approach. The implementation framework outlined in Fig. 8.2 broadly highlights the approach that the line departments will undertake. With every proposed activity, the Principal Implementing Agency (PIA) along with supporting departments have also been identified and indicated in the framework. However, if required, further alliance with other departments as well as agencies is also possible depending on the scale and or planned intervention.

8.3 Proposed Activities & Implementing Agencies

Climate policy-making requires integrated thinking. For example, anticipated changes in water availability driven by climate change will spill over decisions about urban development, agriculture, and forest and broader land use considerations. To address these linkages, climate policymaking must aim at integration, where different sectoral perspectives and priorities will need to be brought into conversation within the scientific evidences of climate impacts.[1] This will enable a shifting in an administrative incentive to reward integration rather than defending of the existing perspectives. If climate adaptation policy is to be informed by a multiple stressor and multiple objective approach and if it is to take seriously the challenge of integrative and transformative change, then the institutional framework for climate policy have to cater these objectives. However, the optimal design of climate-focused institutions is not obvious. Governance in India (and its states including Himachal Pradesh) is organized around sectors, while climate change is, by definition, a cross-sectoral challenge.

This section attempts to mainstream climate change within existing departments by pointing out the activities that are cross departmental in each of the sectors listed in SAPCC. Strengthening of the coordinating body is essential which will happen if it is consistent with internal administrative norms.

STATE MISSION FOR GREEN INDIA

Code	Activity	Implementing Agency
F-EB/1	Identification of key impacts, vulnerabilities and research priorities – Support research priorities to fill gap in climate change and forestry research needs.	Forest Department
F-EB/2	Developing strategies in collaboration with hydro power industry.	Forest Department, Energy Department, Private sector
F-EB/3	Developing communication strategies targeted at schools, public and private sector for afforestation progress.	Forest Department, Media, Private sector, PSUs, Education Department
F-EB/4	Strengthening of State Wetland Authority and preparation and implementation of Action Plans at micro level for conservation and restoration of wetlands.	DEST, Forest State Wetland Authority, Fisheries, Tourism, District Administration
F-EB/5	Enhancement of livelihood options of state through community Agro forestry/farm forestry.	Department of Forest
F-EB/6	Biodiversity Conservation through habitat management and strengthening of Biodiversity management committees.	Biodiversity Board
F-EB/7	Eco Tourism landscape Expansion.	Department of Forest

STATE MISSION ON SUSTAINABLE AGRICULTURE

Code	Activity	Implementing Agency
AG/N/1	Sustainable land use management.	Department of Agriculture (Himachal Pradesh Agriculture Development Society)
AG/N/2	Adequate research for development of high value crops including fruits and off season vegetables which are suitable for the seasonal variations to promote a viable solution for farmers facing the impacts of climate change on cereal based agriculture.	Universities, Research Institutions
AG/N/3	Analysis of the impact of climate change on crop yield change, demand and supply	Universities, Research Institutions.

Reference

1. Based on a GiZ report on Monitoring adaptation projects

AG/N/4	Introduce cummunity centric watershed development and soil conservation.	Department of Agriculture, Department of Soil conservation, Horticulture
AG/N/5	Revision and implementation of Contingency plans .	Department of Agriculture
AG/N/6	Use of information and communication technologies including mobile apps for dissemination of weather related information.	Department of Agriculture, Horticulture, IMDBoard
AG/N/7	Foster and promote the efficient use of water in agriculture and improvement of livelihood resilience.	Department of Agriculture, Department of Irrigation and Public Health
AG/N/8	To promote development of eco village/ bio village in order to improve livelihood resilience amongst villages in high-altitude regions.	Department of Agriculture, Horticulture
AG/N/9	To promote crop diversification through protected cultivation and promotion of solar fencing in state.	Department of Agriculture, Horticulture
AG/N/10	To promote balanced use of pesticides and fertilizers in state strengthen FPOS market linkages for agro-horticulture and herbiculture produce.	Department of Agriculture, Horticulture
AG/N/11	Development of micro cold chain circuits.	Department of Agriculture, Horticulture

STATE MISSION ON WATER

Code	Activity	Implementing Agency
WR/N/1	Reduce water demand in the state by controlling leaks, implementing water-saving programs, cascading and reusing water.	Department of Jal Shakti
WR/N/2	Integrated water resources management should be promoted. Expansion and maintenance of STPs in the State to promote recycling of water leading to reduced groundwater extraction.	Department of Jal Shakti
WR/N/3	Promotion of Spring-Shed Management leading to increase in irrigation efficiency.	Department of Jal Shakti / Department of Agriculture
WR/N/4	Development of contingency plans in water sector / Improve defence during hazards.	Department of Jal Shakti
WR/N/5	Management of Irrigation through Water User Agencies.	Department of Jal Shakti

STATE MISSION FOR HEALTH

Code	Activity	Implementing Agency
HS/1	Monitoring systems and emergency plans by including risk management practices, any climate change related health impacts.	Department of Health
HS/2	Improve monitoring of environmental health indicators.	Department of Health
HS/N/1	Strengthening health care in Himachal Pradesh to reduce deaths of new-borns and children under 5 years of age.	Department of Health
HS/N/2	Strengthen the prevention and treatment of Vector-borne diseases such as malaria and dengue.	Department of Health
HS/N/3	Training and awareness programmes for identifying early signs of extreme climatic events on the population and their remedy.	Department of Health, NHM
HS/N/4	To understand the impact for the operational research for climate change in all districts of state.	Medical Colleges (Medical University H.P.), Universities

STATE MISSION FOR CLIMATE CHANGE STRATEGIC KNOWLEDGE AND INFORMATION

Code	Activity	Implementing Agency
SK/1	Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation.	DEST Knowledge Cell on Climate Change, Agriculture, Horticulture, Water, Health sectors.
SK/2	Strengthening the Institutional Framework in Himachal Pradesh for Addressing Climate Change and strengthening of HPKCCC.	DEST Knowledge Cell on Climate Change
SK/N/3	Mapping of the knowledge base and data resources relevant to climate change for the mobilization of state specific strategic knowledge networks.	DEST Knowledge Cell on Climate Change
SK/N/4	Study the climate data and project the climate changes for vulnerability assessment at the regional and local level.	DEST Knowledge Cell on Climate Change
SK/N/5	Identification of research gap in each sector with review of existing sectoral policies and strategies.	DEST Knowledge Cell on Climate Change
SK/N/6	Vulnerability Assessment with latest technology, at micro level with river basin approach. .	DEST Knowledge Cell on Climate Change

STATE MISSION FOR ENHANCED ENERGY EFFICIENCY AND CONSERVATION

Code	Activity	Implementing Agency
EN/N/1	Undertake feasibility assessment study to reduce the cost of major financing components impacting the tariff of HEP with the view to make it financially viable.	Directorate of Energy
EN/N/2	Facilitate development of identified solar power projects/ other reserved energy projects.	HIMURJA, DOE
EN/N/3	Improve energy intensity through adoption of energy conservation and DSM measures.	HIMURJA, MNRE, DOE
EN/N/4	Reduction in energy-use intensities in income generating activities through structural adjustments of activity typology and ensuring linkages along value addition chain and optimal use of resource endowment.	HIMURJA, MNRE, DOE
EN/N/5	Feasibility study to analyse, assess hydro power development in phased manner. Identify the future prospects in view of connect power scenario, balance energy mix requirement. Assess social and environmental obligations of HED.	Directorate of Energy
EN/N/6	Capacity Building of the Technical manpower of Power Sector to upgrade with the latest state of art technologies, internationally in practice these days which are more environment friendly, adaptable to Climate Change, economical and at the same time efficient also.	Directorate of Energy
EN/N/7	Comprehensive Study of Glacial deposits and impacts of Climate Change, Global Warming on Glacial deposit in Himachal Pradesh and its impact on Hydro Power development in the state.	Directorate of Energy
EN/N/8	Implementation of Communication Strategy with respect to hydro Power development in the state of Himachal Pradesh for having better coordination amongst all relevant stakeholders.	Directorate of Energy
EN/N/9	Comprehensive Study for proper Dam regulations, Reservoir management and Silt management and disposal due the future anticipated impact of Climate Change.	Directorate of Energy

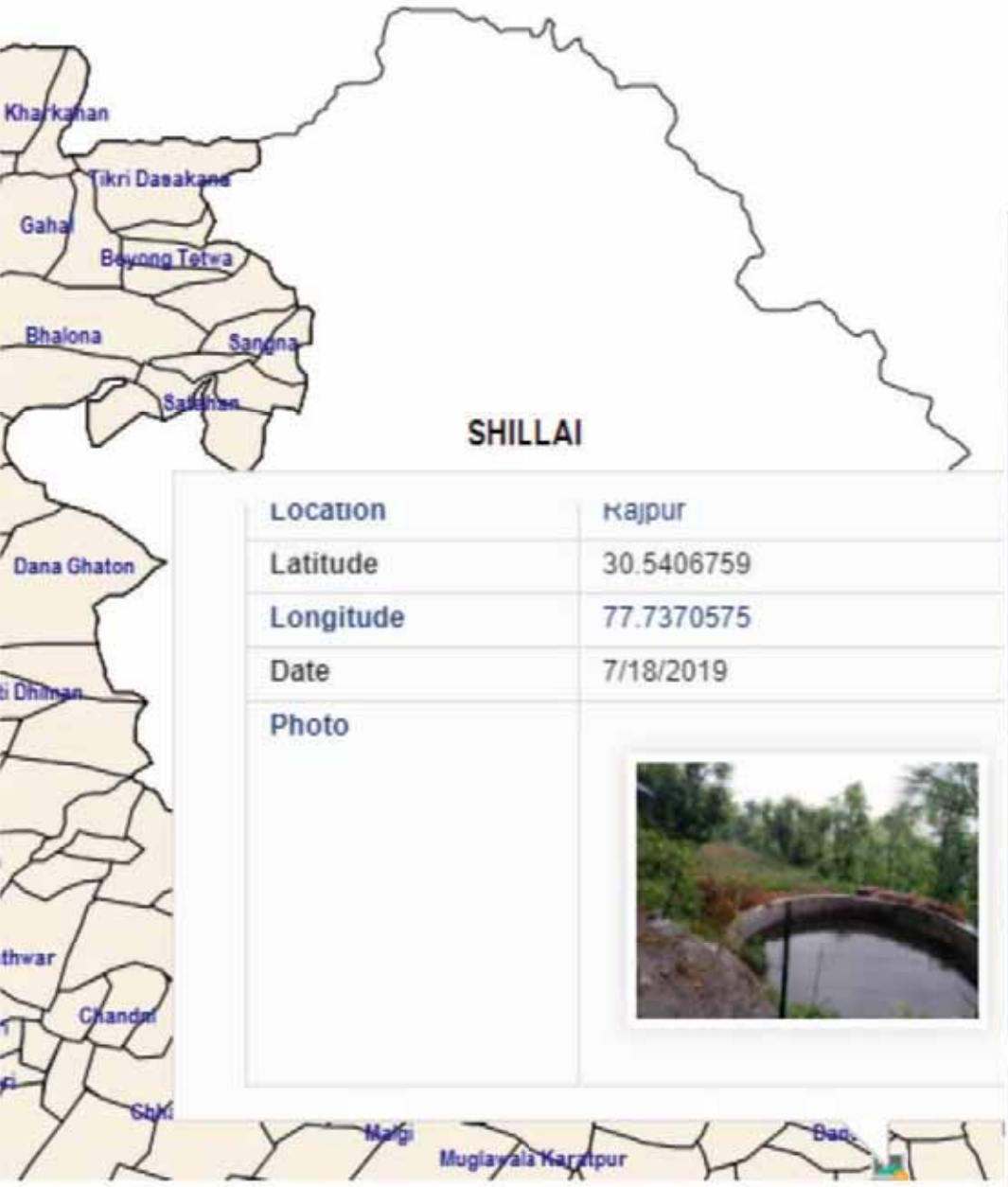
EN/N/10	Promotion and awareness of Solar Roof Top programme through awareness activities/exhibitions.	HIMURJA
EN/N/11	Development of Safety and quality of hydro projects up to 5 MW capacity.	HIMURJA, MNRE
EN/N/12	Reduction in energy use intensity by using solar system viz solar water heater, solar lantern, solar light, solar coolers (box and dish type).	HIMURJA
EN/N/13	Repair and maintenance of reserved energy systems.	HIMURJA
EN/N/14	Assess stress on Hydro Power plants on account of CC and financial aspects.	DOE
EN/N/15	Implementation of commutative Environment Impact Assessment Studies	DOE
EN/N/16	Assessment of minimum water discharge requirement on the face of CC	DOE

» STATE MISSION ON URBAN PLANNING AND SUSTAINABLE HABITAT

Code	Activity	Implementing Agency
USH/1	Strengthen Waste management practices.	Department of Urban Development
USH/2	Adoption of rain water harvesting as part of building by-laws.	Department of Urban Development
USH/N/1	Recycling and reuse of treated waste water.	Department of Urban Development
USH/N/2	Green highway in all ULBs (Plantation and Maintenance) - tree line alongside of National Highways.	Department of Urban Development
USH/N/3	Adoption of electrical vehicles for mass transportation in urban local bodies.	Department of Urban Development
USH/N/4	Consideration of tax on diesel run vehicles at the time of registration imposing optimum Fuel efficiency program.	Department of Transport
USH/N/5	Alteration of Conventional fuel and adopt blending of bio-fuel in automobile.	Department of Transport
USH/N/6	Adoption of rope ways transportation in urban local bodies.	Department of Transport, UDD

MONITORING AND EVALUATION

ONLINE MONITORING MECHANISM



SHILLAI

Location	Rajpur
Latitude	30.5406759
Longitude	77.7370575
Date	7/18/2019
Photo	

Project Executing Agency (PEA) | Field Implement

9 MONITORING & EVALUATION

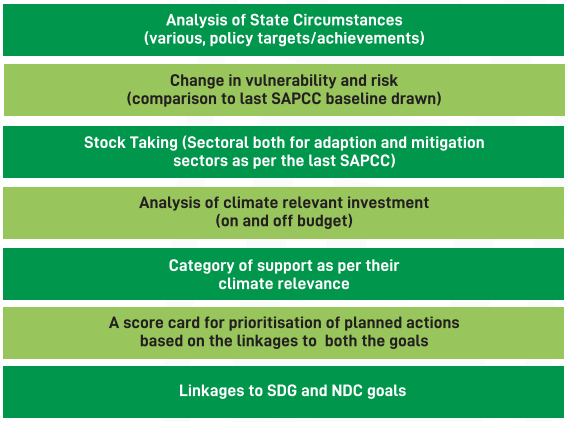
Department of Environment, Science and Technology (DEST), Govt. of Himachal Pradesh (GoHP),being the nodal department on climate change, will be responsible for monitoring andevaluating the activities envisaged under HPSAPCC with the overall support from multiple implementing departments. The monitoring & evaluation mechanism needed for operationlizing the HPSAPCC are defined as under.

9.1 INTRODUCTION

Key objective of monitoring of SAPCC implementation is to include elements related to NDC that have implications for GHG effects, sustainable development impacts, and implementation progress of various actions relating to vulnerability reduction. Our GHGemission inventory is national in nature and reported as a part of Biennial Update Report (BUR) process. Various mitigation actions that have an impact on our GHG emissions (e.g. enhanced share of renewable, better energy efficiency, etc.) need to be captured at the state level (already implemented or planned). At the national level energy intensity, NAMA, etc. can be measured for project level aggregation. NCDMA registry, international climate finance (mitigation) tracking tools can be used. For adaptation, possible tracking for SDG at the national /state level, reduction in vulnerability in specific sectors /projects are possible. The Paris Agreement has mandated countries to have harmonized measurement and reporting systems for the countries as per their NDC mitigation commitments. Indian NDC also has several areas in adaptation that need a systematic monitoring and assessment of change in vulnerabilities due to the investments made. Some of these investments are through the budget while some are supported through bi-lateral and multilateral agencies, philanthropic bodies, and national and international climate funds. All this information must be consolidated nationally and a seamless harmonization of measurement and reporting is also required at state level.

In the SAPCC, an attempt has been made to follow a structured process of monitoring as given in Figure 9.1.

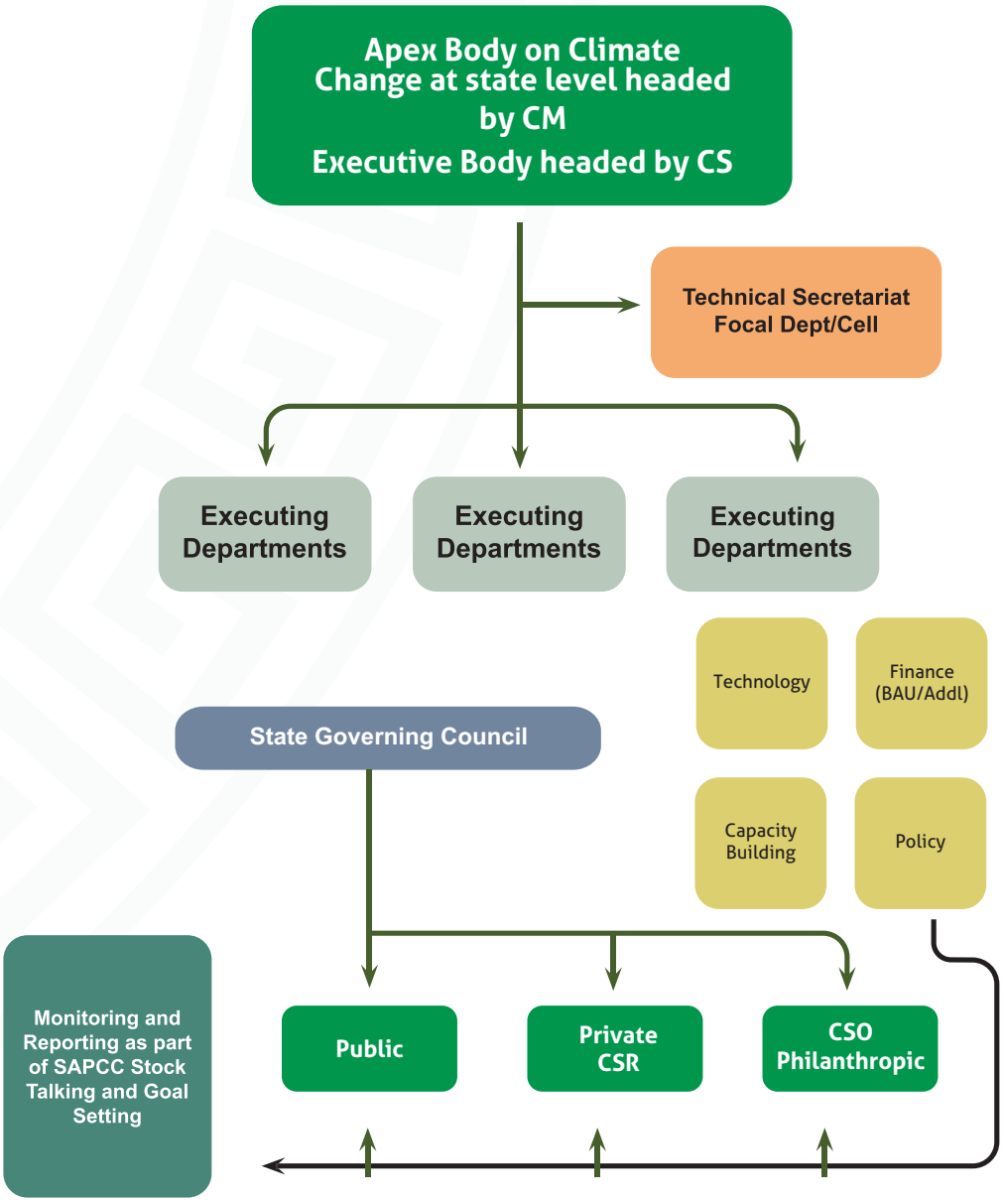
Figure 9.1 SAPCC monitoring & evaluation (M&E) structure for Himachal Pradesh



9.2 INSTITUTIONAL MECHANISM

An institutional mechanism proposed to be followed for uniform reporting to Monitoring & Evaluation Forests and Climate Change. The process is elaborated in following figure.

Figure 9.2: Institutional Mechanism for M&E



Key to an effective M&E system is appropriate institutional arrangement. The M&E system will be grounded in the existing institutional framework driven by the focal departments or climate change cell with policy guidance and governance. The climate change knowledge cell of nodal department will act as the technical secretariat and will interface with executing departments for data collection. Each department shall constitute small working group with at least one member in the working group dealing with departmental budget. The working group shall be headed by a nodal officer who will interface with the climate change knowledge cell/focal department for data/MIS updating. The working group members and nodal officers shall be trained by the nodal department on aspects of data requirement and their frequency. In addition to the line department officials, members drawn from the finance, statistics and planning shall also be part of the training process.

The M&E protocol will be activity/strategy based and indicators (both categorical and outcome wise) that should fit the protocol are shown in Figure 9.3.

Figure 9.3 : M&E reporting dashboard for Himachal Pradesh

M&E Dashboard

S.No.	Activity Code	Sector	Activity	Climate relevance (A= Adaptation; M= Mitigation; B=Both*	Category (e.g. Policy, Tech Demo/ Pilot, Investment, CB, R&D)	Linked to SDG (if yes number)	Linked to NDC (if yes category key word)	Allocation in INR	Climate relevance (%)	Adjusted allocation in INR	Source (On Budget, Off Budget)	If Off Budget (Category, Bilateral, Multilateral, CSR, INGO)
1.												
2.												
3.												

ILLUSTRATION

The SAPCC revision is thus intended to-

- 19 mitigation actions,
- 27 adaptation actions,
- 7 of both adaptation actions and mitigation actions,
- Climate relevant budget for adaptation and allocation and their breakup. However, in the absence of budget coding, the climate relevance % can be subjective.

9.3 BROAD INDICATORS FOR MONITORING AND EVALUATING CLIMATE CHANGE INTERVENTIONS

The indicators can be classified broadly into the following categories (a) output indicator – as outlined in the physical progress (b) process indicators (c) outcome indicators (aggregation of a and b). The other ways of classifying the indicators can be as follows:

Table 9.1 (a): Broad indicators for evaluating climate change interventions

Category	Explanation	Remark
Climate Impact [1]	Indicators that depict a particular climate change risk/impact.	Only after ex-ante and ex-post assessment, periodicity as per the project, may be very long term in case of adaptation.
Adaptation Measure	Indicators that depict the outcomes of the adaptive measures.	This can be easily tracked in form of relevant activities leading to adaptation.
Adaptation Outcome	Indicators that depict a particular climate change risk/impact.	Aggregate indicator as defined in the project logical framework/result framework.
Mitigation Measure	Indicators that depict the mitigation measures undertaken.	This can be easily tracked in form of relevant activities leading to mitigation.
Mitigation Outcome	Indicators that depict the outcomes of the mitigation measures.	Aggregate indicator as defined in the project logical framework/result framework.
Mitigation Outcome	Indicators that depict the policies/ processes in place that facilitate implementation of adaptation/mitigation measures	Can be reported in form of presence and absence of certain polices or activities that may lead to outcome but not necessarily always leads to a positive outcome, in case of adaptation sometimes may lead to maladaptation another sector.

Some of the examples of indicators are given below:

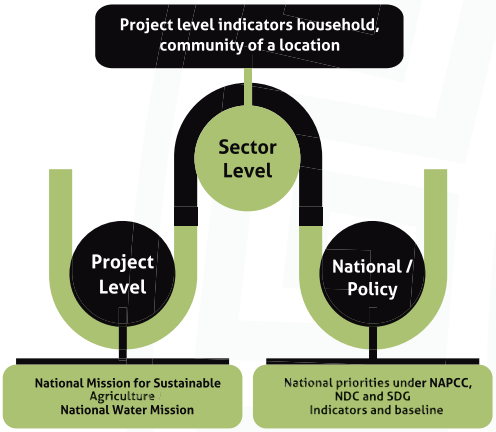
Table 9.1 (b): Broad indicators for evaluating climate change interventions

Sector	Indicators	Level	Remarks (periodicity and challenges)
Agriculture and allied	Reduced key risks and adverse impacts of climate change.	Outcome	Aggregate indicator, impact indicator medium to long-term periodicity.
	Irrigation Intensity or % of area under irrigation.	Output	May be annual, easy to report.
	Cropping intensity.	Outcome	Annual easy to report.
	Agricultural insurance policy including new crops.	Process	Presence of the policy will reduce the risk.
	Crop diversification (areas under different crops) .	Both output and process	Paddy to Non-paddy may reduce the risk due to climate .
	% of individuals who have diversified sources of income.	Outcome	Challenges in Zof rise in income, sometimes direct cash transfer an adaptive policy may result in temporary rise inincome.
	No. of FPO's created, strengthed	Outcome	Financial and operationalization of FPO
	No. of cold store chains created	Output & process	Presence of cold stores will save losses to farmers
Water	Enhanced food and water security.	Outcome	Aggregate indicator, impact indicator medium to long-term periodicity.
	Rise in ground water level.	Output	May be short to medium term (premonsoon post monsoon reporting possible).
	State water policy addressing climate risks specific to the state.	Process	Presence of the policy .

Forest	Increased ecosystem resilience in response to climate variability and change.	Outcome	Aggregate indicator, impact indicator-longterm periodicity can be combined from various provisioning services.
	Increase in forest area, quality forests, dense forests	Output	Short term (if area) to medium term (if based on survival percentage).
	Incentive or Policies on tree outside forest, urban forestry.	Process	Presence of the policy.
Energy	Reduction in energy intensity of state GDP.	Outcome	Short to medium term considering all factors and leakage.
	Share of renewable energy in the energy mix of the state	Output	Easy to report.
	Implementation of energy conservation building code in public building.	Process	Easy to report from compliance.
Urban habitat	% Reduction in Migration of local population directly and indirectly dependent on concerned sectors for their livelihoods.	Outcome	Aggregate indicator (short to medium term reporting possible after survey) .
	Open defecation free status.	Output/ Process	Short term
	Amount of solid-waste converted to energy.	Output	Short term
	Smart city policy on bi-cycle tracks or carpooling, electric vehicles.	Process	Short term, policy presence

The above list is only indicative, and the process of indicator selection will be possible only after wider consultation with departments. Priority is climate relevant scheme specific indicators (mostly output indicators) that the department reports in routine. The second is project level indicators as defined in the result framework. The third is the sector/mission level indicators as defined in the mission document or state/national priorities (e.g. doubling farm income, reduction of energy intensity of GDP). Figure 9.3 captures the aggregation process.

Figure 9.3 : Aggregation process for climate change interventions in Himachal Pradesh



TOOLS AND METHODS FOR HARMONIZATION

Key aspect in harmonization is to select indicators/ proxy variables that have relevance to SDG/INDC

IPCC has defined methods on emission inventory (since the state level inventory is not available, proxies on share of renewables, energy efficiency, etc. can be reported)

For project level emission reduction, co-benefit tracking tools and sustainable development potential can be tracked and consolidated. If required, state's share reflected in NAMAs can be reflected.

For adaptation investments, change in vulnerability (mostly the change in adaptive capacity and sensitivity) needs to be tracked. This should be based on IPCC AR5 methods and tools (presented in the vulnerability section). This tracking can be spatial, or temporal.

The project level vulnerability reduction can be tracked against committed targets based on the project level assessment reports.

Policy level assessment can be done by tracking policy goals and targets for various sectors.

Finance data for effective harmonization requires budget coding. In the absence of that the nodal department can discuss with technical working groups and fix climate relevance % based on scheme components.

DATA MANAGEMENT SYSTEM

- Collect relevant economic and social data to develop the state circumstances (macro).
- Collect departmental level data based on the proposed strategies by the departments and their outputs and outcomes.
- Work with industry associations/ NGOs for collecting relevant data having impact on NDC/SDG.
- Collect project level data from project MIS (may be externally aided and off budget projects).
- Delegate responsibility for the collection of particular data sets to authorized individuals and agencies of the government.

AWARENESS & CAPACITY

Awareness and capacity to plan and deliver on climate change strategies is low at the cutting edge. Therefore, efforts are required to be made to clarify the climate strategies proposed by the departments at regular intervals. The process will be facilitated by the nodal department while technical working group members (both department and inter-department) will take part in it. This process should be a repeated once every quarter.

The data sets need to be divided into two categories (a) Static (like GDP data) (b) Dynamic. In essence nothing is static, but some statistics are annual in reporting. The dynamic data sets change more frequently. However, for such datasets monthly or quarterly cycle of updating will be adequate.

DATA CONSOLIDATION AND VALIDATION

The data will be validated by the nodal department/ cell in assistance with experts and also the nodal officers who in turn will provide clarification if any after due consultation with sectoral working group members.

REPORTING

The dashboards for key indicators will have regular updating. The climate strategy and action plans are dynamic in nature and should be revised every 5 years as per the process. The monitoring of results will be part of stocktaking.

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