



Government of Odisha
Forest and Environment Department

ODISHA CLIMATE CHANGE ACTION PLAN 2021-30

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Forest and Environment Department

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MESSAGE



सत्यमेव जयते

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

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 also has the policy context, with the ratification of important development and climate goals at the International level, such as the Sustainable Development Goals (SDGs) and the Paris Agreement on greenhouse gas emission and adaptation goals. Related all-Indian commitments, such as those in the Nationally Determined Contributions (NDCs) pose the need for an evolving, appropriate climate change action planning process.

In the light of these developments, the second phase of State Action Plan on Climate Change 2021-2030 is developed to reflect the changing context and enhance effective mitigation and adaptation planning and action. I hope, the Action Plan will be implemented in right earnest so that the possible adverse impacts of climate change are minimized and the developmental process is carried out in a sustainable manner.

(NAVEEN PATNAIK)



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Climate Change refers to the long-term changes in the climate that occur over decades, centuries or longer. It is caused by rapidly increasing greenhouse gases in the Earth's atmosphere primarily due to burning of fossil fuels (e.g., coal, oil, and natural gas). Due to the increased emission, the scientists have estimated that, the nations are well below the global goal of keeping average global warming to the 2°C target, let alone the 1.5°C aspiration. This has catastrophic significance for the world.

In 2015, the Conference of Parties signed the Paris Agreement, which announced the desire to limit global average temperature rise to less than two degrees Celsius. This goal forces the acknowledgment of climate change.

The changing patterns of temperature and climate have induced major implications on agricultural (food production) system, water supply system as well as on the health scenario of the state of Odisha. In order to reduce the emission, India has prepared its Nationally Determined Contributions (NDCs) to address this changing scenario for achieving the purpose of the Paris Agreement and its long term goals. The second phase of our State Action Plan on Climate Change (SAPCC) not only takes stock of the implementation of the first SAPCC, it also addresses the NDCs at state level as per the prescribed guideline issued by the Ministry of Environment, Forest and Climate Change (MoEF&CC).

I wish that, implementation of the SAPCC-II will achieve its desired goal and help in addressing the climate goals, both at State as well as National Level. I am sure that with active involvement of all the stake holders, Odisha would be in a position to achieve important milestones in realizing the goal of a climate resilient society.

(BIKRAM KESHARI ARUKHA)

MESSAGE



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MESSAGE



Climate Change has emerged as a matter of immense concern for humanity today. Owing to the urgency of managing climate change, the World Community has set it as a priority SDGs for the present and future. However, Odisha has been a pioneer state in drawing and acting upon a Climate Change Action Plan, SAPCC 2018-23, that was launched by Hon'ble Chief Minister at a time when India hosted the World Environment Day in 2018. It identifies measures to address climate change impact while recognizing the developmental imperatives of the state. The Climate Change Cell instituted in Forest & Environment Department has in the meanwhile come up with a more comprehensive and result oriented revised State Action Plan on Climate Change (SAPCC) for 2021-30.

The revised SAPCC reiterates our tryst with the environment and highlights Government's commitment to the priorities set in the plan. Besides budgetary investments, several Public-Private Partnership Projects have been initiated in the state for improving environmental quality, ecological balance and climate resilience in various sectors of development.

I am sure, this widely consulted and revised action plan will be instrumental in promoting engagements with the people in general and active stake holders in particular, for grounding the concerted efforts to mitigate the adverse impact of climate change.

I compliment the efforts of Forest & Environment Department for their continued endeavor in the matter and urge each and every citizen to think globally while acting locally.


(ASIT TRIPATHY)



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MESSAGE



Odisha is one of the first states to formulate a comprehensive Action Plan to address the climate change issues. Today, climate change is one of the major global environmental challenges faced by the humanity. Addressing climate change requires a good scientific understanding as well as coordinated action at Regional, National and Global level. In the period of Sustainable Development, the world is faced with challenges to meet the needs of present generation without compromising the needs of the future generation.

Climate change has the potential to derail the current growth strategies and deepen poverty. Considering the concern, the state has formulated the second phase of Climate Change Action Plan to strengthen institutional capacities of different stakeholder departments and agencies to integrate environment and climate change issues in development planning, policies and sectoral programmes. This document will serve as a Policy Guide for developmental priorities to adapt and mitigate the adverse impact of climate change.

I hope the State Action Plan on Climate Change will help in programming the resources of the concerned departments so that the adverse impacts of climate change can be minimized.

Mona Sharma

(MONA SHARMA)



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MESSAGE



The State Action Plan on Climate Change (SAPCC) Phase- I was prepared for the operational period 2010-15. The Climate Change Action Plan Phase- II was prepared for the period 2018-23, again a separate report in alignment with Nationally Determined Contributions of India was prepared. Later, Ministry of Environment, Forest and Climate Change (MoEF&CC) issued a new guideline for the preparation of the SAPCC Phase- II.

Under the aegis of Climate Change Cell, Forest and Environment Department, Government of Odisha, the Nodal Department initiated SAPCC revision as per the new guideline with active participation of other departments.

The Nodal Department is indebted to the Hon'ble Chief Minister, Odisha, Hon'ble Minister, Forest and Environment, Chief Secretary, Odisha, Additional Chief Secretaries, Principal Secretaries and Secretaries to Government for their support.

The Nodal Department places on record heartfelt gratitude to Dr. Ashok Kumar Singha, MD, CTRAN Consulting Ltd. and his team of sectoral experts who guided and assisted the SAPCC Phase- II revision with remarkable competence and efficiency.

The credit for completion of SAPCC revision goes to all the Nodal Officers and their team of different departments who tirelessly worked meticulously with remarkable dedication for revision of respective sectoral mission documents.

The revision of Odisha SAPCC Phase- II was initiated under the able guidance of Dr. Mona Sharma, IAS, Additional Chief Secretary, Forest and Environment Department, Govt. of Odisha and coordinated by Dr. Krushna Chandra Pal, Jr. Scientist (EAP) along with Jr. Scientists of Climate Change Cell with various departments which ensure its completion is commendable.

Last, but not the least, the invaluable inputs rendered by officers and staff of the nodal department is hereby gratefully acknowledged.

(K. Murugesan)



ACHIEVEMENTS

under Climate action
with NDCs Linkage

- 1 Odisha is the first state in the country to receive Green Climate Fund (GCF) project. A project on "Groundwater recharge and solar micro irrigation to ensure food security and enhance resilience in vulnerable tribal areas of Odisha" was approved by GCF board. GCF provided a grant of 34 million USD to Odisha Government through NABARD. The project has been granted for six years. The project impacts 5.2 million vulnerable households in 15 priority districts with high level of food insecurity, water scarcity, high climatic stress and high proportion of SC-ST population, which accounts for 12 per cent of the entire population of the state.
- 2 The State Government's initiative granting land rights to thousands of slum dwellers under the Odisha Liveable Habitat Mission (OLHM) or Jaga Mission won the World Habitat Award. The annual award is given by World Habitat in partnership with UN Habitat in recognition of innovative, outstanding and revolutionary ideas, projects and programmes across the world.
- 3 Odisha is the first state in the country to publish Climate Change Budget Coding. The report aims to inform planners in the State Government of the current climate change relevance and sensitivity of public expenditure in sectors outlined in Odisha's SAPCC, through a detailed budget coding exercise. The purpose of this analysis is to assist the Government in first identifying which sectors and schemes to focus on to improve climate resilience, mitigation outcomes, and secondly to support Government in deciding whether programmes need re-designing or additional funding to accommodate changes needed to deliver climate benefits and / or safeguard projects from the impacts of climate change. This would therefore support the State Government in securing broader development benefits of large scale investments being made and would help avoid potential future losses that climate change would exacerbate, thereby helping to achieve Odisha's climate response agenda.
- 4 Odisha has been placed second among states in the 'Fastest Movers' category in the SDG India Index-2019 released by the NITI Aayog in New Delhi. Odisha stands second in overall improvement with an increase of 7 points, from 51 to 58. Goal 9 has contributed mostly to the rise with a jump of 40 points. Goals 6 and 7 follow, with an increase of 39 and 27 points.
- 5 The Odisha Government's effort on emergency response for the distressed people faced with natural disasters has been recognised in a national forum. Odisha has bagged the third prize in poster presentation for "ASHA and Gaon Kalyan Samiti (GKS) led community activities during cyclone Fani at the 6th National Summit on Good & Replicable Practices and Innovations in Public Healthcare System in India.
- 6 Odisha has bagged a prestigious award for evacuating more than a million people which ensured minimum loss of lives during cyclone Phailin in the state.
- 7 The United Nations (UN) appreciated Odisha Government's handling of cyclone Phailin which hit Odisha in October 2013. The international body also announced that it would highlight the state's efforts as a model for disaster management programmes globally.
- 8 Technology-driven, citizen friendly 'Mo bus' service of the Capital Region Urban Transport (CRUT), an Odisha Government initiative, has been awarded as the "Best City Bus Service Project" in the country. This award for CRUT was declared at Urban Mobility India (UMI) Conference and Expo organised by the Urban Development Ministry, Govt. of India.
- 9 For the fifth time in a row Odisha has bagged Krishi Karman Award from the Centre for its overall food grain production in 2016-17.
- 10 Odisha is the first ever state in the country to document a budget booklet on Climate Change. Here the entire state's budget has been coded as per the sensitivity and relevance of the schemes in context of climate change.



Livelihood Mission



Observation of National Disaster Risk Reduction Day



Observation of World Environment Day



Nodal Officer Orientation Programme for revision of SAPCC-II



State Level Steering Committee Meeting



Regional Workshop for Revision of SAPCC-II, Mayurbhanj

297483/2020/CC



Odisha's first Platinum rated Green Building of OSPCB at Paradeep



Geo-Synthetic Tube Installation at Pentha, Kendrapada



Septitized treatment plant at Bankabija, Basuaghai, Khordha



Main entrance of Blue Flag Beach at Puri



Plastic Free Campaign by CES at Chandrabhaga, Puri



Doppler radar installed at Paradeep

Abbreviations

ANR	Assisted Natural Regeneration
ARD	Animal Resources Development
ARS	Fifth Assessment Report
BPL	Below Poverty Line
BRTS	Bus Rapid Transit System
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CARS	Consumer Assistance to Recycle and Save
CBDR	Common But Differential Responsibility
CBDRF	Community-Based Disaster Risk Reduction Framework
CDM	Clean Development Mechanism
CDP	Comprehensive Development Plan/City Development Plan
CER	Certified Emissions Reduction
CESR	Central Electrical Supply Undertaking
CFM	Community Forest Management
CII	Confederation of Indian Industry
CNG	Compressed Natural Gas
CORDEX	Coordinated Regional Climate Downscaling Experiment
CRZ	Coastal Regulation Zone
CSR	Corporate Social Responsibility
CVI	Coastal Vulnerability Index
DFE	Department of Forest & Environment (Odisha)
DFID	Department for International Development (United Kingdom)
DPR	Detailed Project Report
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECBC	Energy Conservation Building Code
ENSO	El Niño Southern Oscillation
ENVIS	Environmental Information System
ETP	Effluent Treatment Plant
GCM	Global Climate Model
GEDCOL	Green Energy Development Corporation of Odisha Limited
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMAC	Green Manufacturing Committee
ICZM	Integrated Coastal Zone Management
IEC	Information, Education and Communication

IFC	International Finance Corporation
IITM	Indian Institute of Tropical Meteorology
IMD	Indian Meteorological Department
INCOIS	Indian National Centre for Ocean Information Services
INDC	Intended Nationally Determined Contribution
IPCC	Inter Governmental Panel on Climate Change
IPICOL	Industrial Promotion and Investment Corporation Limited
ITK	Indigenous Technical Knowledge
IWRM	Integrated Water Resources Management
JFM	Joint Forest Management
JICA	Japan International Cooperation Agency
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KVIC	Khadi and Village Industry Commission
KVK	Krishi Vigyan Kendra
LAC	Livestock Assistance Centre
LIP	Lift Irrigation Project
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land Use Change and Forestry
MCL	Mahanadi Coal Fields Ltd
MCS	Multipurpose Cyclone Shelter
MDG	Millennium Development Goal
MJO	Madden Julian Oscillation
MNRE	Ministry of New and Renewable Energy
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoEF	Ministry of Environment and Forests
MRP	Mixed Recall Period
MRTS	Mass Rapid Transit System
MRV	Monitoring, Reporting and Verification
MSME	Micro, Small and Medium Enterprises
MSW	Municipal Solid Waste
MT	Million Tonnes
NABARD	National Bank for Agriculture and Rural Development
NALCO	National Aluminium Company
NAPCC	National Action Plan on Climate Change
NCRMP	National Cyclone Risk Management Project
NDC	National Development Council
NFHS	National Family Health Survey
NICRA	National Initiative on Climate Resilient Agriculture
NLTA	Non Lending Technical Assistance

NMEE	National Mission on Energy Efficiency
NMSA	National Mission on Sustainable Agriculture
NSSO	National Sample Survey Organisation
OBDA	Odisha Bamboo Development Agency
OCTMP	Odisha Community Tank Management Project
ODRP	Odisha Disaster Recovery Project
OECBC	Odisha Energy Conservation Building Code
OHPC	Odisha Hydropower Corporation
OLIC	Odisha Lift Irrigation Corporation
OMFED	Orissa State Cooperative Milk Producers' Federation
OREDA	Orissa Renewable Energy Development Agency
OSDMA	Odisha State Disaster Mitigation Agency
OSPCB	Odisha State Pollution Control Board
OUAT	Odisha University of Agriculture and Technology
PAT	Perform, Achieve and Trade
PFM	Participatory Forestry Management
PHEO	Public Health Engineering Organisation
PLF	Plant Load Factor
PSU	Public Sector Undertaking
R-APDRP	Redesigned Accelerated Power Development and Reform Programme
RCP	Representative Concentration Pathway
REDD	Reduction in Deforestation and Degradation
RPO	Renewable Power Obligation
RTDAS	Real Time Data Acquisition System
SAAQM	State Ambient Air Quality Monitoring Network
SAPCC	State Action Plan on Climate Change
SDG	Sustainable Development Goal
SME	Small and Medium Enterprise
SPCB	State Pollution Control Board
SRI	System of Rice Intensification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention for Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
VSS	Vana Surakhya Samiti
WUA	Water Users Association

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EXECUTIVE SUMMARY

Background

After the launch of National Action Plan on Climate Change (NAPCC) in 2008, State Governments were also asked to prepare their own State Action Plan on Climate Change (SAPCC) consistent with strategies in the NAPCC. 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. States/UTs have initiated capacity building actions and demonstration projects to implement SAPCCs since the formulation of SAPCCs. Odisha is the first state to formulate the State Action Plan on Climate Change (SAPCC) in 2010. It has also prepared the first monitoring report based on the implementation of the SAPCC. The state has also prepared its second phase of the action plan in 2018 which was released by Hon'ble Chief Minister, Odisha.

India has submitted its Nationally Determined Contributions (NDCs) goal for post-2020 with eight different goals including three major quantifiable goals related to emission reduction, renewable energy and forestry. The scientific and socio-economic understanding and knowledge on climate change have 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. will help identify and prioritize mitigation/ adaptation strategies and refining region specific action plans and strategies.

MoEF & CC requested the states for initiating the revision of the SAPCCs in January 2018 considering the evolving context of climate science, policy and actions.

Odisha Context

Odisha has 480 kilometers of coastline stretching from West Bengal to Andhra Pradesh and it is a hotbed of climatic events. Odisha is India's eighth largest state, comprising 4.7 percent of India's land mass, 3.37 percent of its population (some 42 million people) and over 5 percent of its poor. Although poverty levels fell from 57 percent in 2004/05 to around 33 percent in 2011/12 (Government of Odisha 2014), the proportion of poor in Odisha remains well above the national average of around 22 percent. As clearly stated in every climate change discourse, high poverty level and high percentage of indigenous communities with high natural resource dependency make the state extremely vulnerable to climate change. Its rapidly growing economy (above national average) and rapid urbanization of many agglomerations too pose a challenge for mitigation. The objective of second phase of State Climate Change Action Plan was to address the drivers of climate change, to prepare for its likely impacts in Odisha and to establish goals and timetables for implementation of a sound operational action plan for the next ten years.

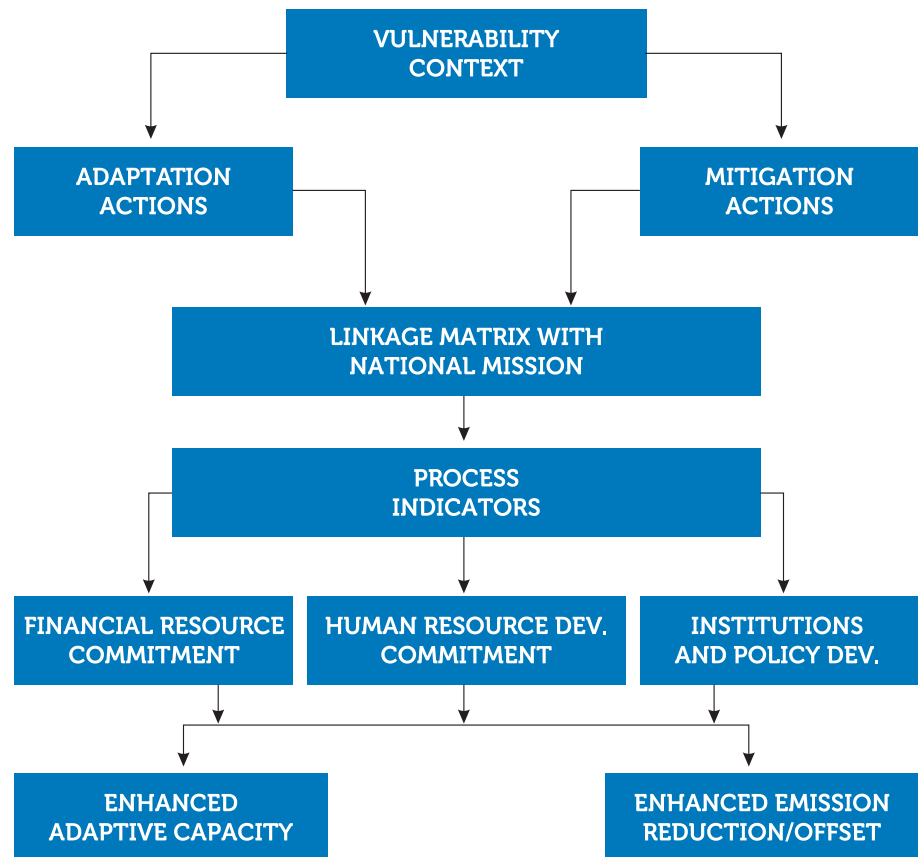
The announcement emphasized Odisha's vulnerability to climate change impacts of sea level rise, increased storm intensity, extreme droughts and

heat waves and increased wind and rainfall events. It once again recognized that human activities such as coastal development, burning of fossil fuels, and increasing greenhouse gas (GHG) emissions are contributing to the causes and consequences of climate change.

The State Climate Change Cell functioning within the Department of Forest and Environment Department was assigned to document the progress made by the State, identify where gaps were from the Phase 1 (2010-2015), and to coordinate the development of a sound operational Action Plan for 2021-30. The SAPCC 2021-30 follows the format specified by the MoEF & CC, Government of India and draws heavily on the second SAPCC for the period 2018-23 progress report and it also refers to various co-benefits (as identified in the NDCs). Therefore, the SAPCC 2021-30 must be viewed in conjunction with the above mentioned reports and not in isolation.

The Structure of SAPCC 2021-30

The report has close linkage with the National Action Plan on Climate Change (NAPCC) and associated missions, an important foundation for the State Action Plan on Climate Change (SAPCC). The report delineates state-level assessment of the likely consequences of the changing global climate on Odisha's agriculture, industry, forest resources, environmental priorities, energy requirements, fisheries resources, freshwater supply, aquatic and terrestrial ecosystems, and human health. The Cell coordinated with a working group of department nodal officers, consultants and experts for peer review, to conduct assessments, extensive literature review and model projections.



State Climate Vulnerabilities

The SAPCC 2021-30 highlights the current and future vulnerabilities of Odisha under different scenarios based on scientific assessments. It also summarizes some major climatic events and their impacts as well as exposure to such events that likely to happen in future.

Rainfall patterns in Odisha have been more erratic since the 1960s, with below-normal rainfall across all districts being recorded for most years. The "normal" 120 days of monsoon rain has shrunk to 60–70 days and unusual spikes in rainfall with torrential rainfall of over 200–250 millimeters/day, are more frequent during the monsoon, frequently resulting in floods. This situation has had a strong influence on agriculture, especially during Rabi season, because of the reduced residual moisture.

By 2100, the mean annual temperature globally is projected to increase by one to five degree Celsius. Future projections as per CORDEX are:

- Mean annual maximum temperature for RCP4.5 scenario is projected to increase by about 0.4 to 1.2 °C in near term and 0.8 to 2.8 °C in mid-century. For RCP 8.5 scenario it is projected to increase by about 0.7 to 1.4 °C in near term and 2.0 to 3.3 °C by mid-century.
- Mean annual minimum temperature for RCP4.5 scenario is projected to increase by about 0.3 to 2.7 °C by near term and 1.6 to 4.2 °C by mid-century. For RCP 8.5 scenario it is projected to increase by about 0.6 to 3.9 °C in near term and 2.0 to 4.9 °C by mid-century.
- Mean annual rainfall for RCP 4.5 scenario is projected to decrease by - 4.6% to an increase of + 25.7 % in the near term and a decrease of - 8.2 to an increase of + 55.7 % towards mid-century in the districts.

As per the Composite Vulnerability Index 2017, the most vulnerable districts are Subarnapur, Balangir, Kalahandi, Dhenkanal, Jajpur and Kendrapara. While Subarnapur continues to be the most vulnerable during the last five years, Jharsuguda continues to be least vulnerable. Bargarh and Boudh have better resilience in terms of reducing their vulnerabilities most in last five years where as Cuttack, Keonjhar, Dhenkanal and Jajpur have become more vulnerable. Kendrapara district tops the list in terms of its risk profile. Districts which rank high in Combined Risk Index are Mayurbhanj, Kendujhar, Bhadrak, Jajpur, Dhenkanal, Jagatsinghpur, Cuttack and Ganjam.

Coastal Odisha will remain relatively less warm than the rest of the state, even though it clearly breaches the 2°C barrier. North-western, western, and south-western Odisha show the highest rise in temperature. This temperature rise is certainly at an unsustainable level, assuming the current challenges of global warming are not mitigated. This factor will have an increasingly larger impact on terrestrial and marine ecosystems.

According to the Coastal Vulnerability Index (CVI) study by the Indian National Centre for Ocean Information Services (INCOIS), vulnerability, loss and damage from sea level rise, coastal geomorphology, tidal range and elevation in the area of Odisha coastline varied from "low" in about 76 kilometers of the coastal stretch of Odisha state, covering parts of Ganjam, Chilika, southern Puri and Kendrapara and to "medium" in about 297

kilometers, covering northern Ganjam, Chilika, central Puri, Jagatsinghpur, Kendrapara, southern Bhadrak and northern Balasore and to "high" in about 107 kilometers, covering northern Puri, parts of Jagatsinghpur, Kendrapara, Northern & Southern Bhadrak and Southern Balasore.

In just about 30 years, a latest study has said, sea level rise may put large parts of coastal Odisha under Ganjam, Puri, Jagatsinghpur, Kendrapara, Bhadrak and Balasore districts at greater risk of deluge and inundation, affecting lakhs of people. The research paper, produced by Climate Central, a science organisation based in New Jersey, revealed that the entire coastline stretching from Ganjam to Balasore is at risk of falling below the elevation of an average annual coastal flood by 2050. The organisation's projection maps show that a number of important coastal ecosystems such as Bhitarkanika National Park, Balukhand-Konark Wildlife Sanctuary, Chandrabhaga beach and areas surrounding Chilika lake may submerge or face permanent inundation due to increasing level of global sea levels, which has been projected to rise between 2 and 7 feet and possibly more, in the next three decades.¹

Greenhouse Gas Inventory – Odisha

A GHG inventory mapping exercise was undertaken by the state during preparation of the SAPCC in 2011 and to review the changes in state's carbon footprint, a second study was conducted in 2014 with support of the Confederation of Indian Industries (CII). This emissions inventory was carried out using IPCC guidelines and it is aligned with the "India Greenhouse Gas Emissions Report 2007."

The carbon footprint study indicates that the state has emissions of 98.525 megatonnes of CO₂ equivalent (baseline year 2012). The per capita emissions of the state are 2.35 metric tonnes, which is higher than the national average of 1.7 metric tonnes (estimated as per 2007) baseline as presented in 2010-15 SAPCC.

Sector	CO ₂ equivalent (megatonnes)		
	2010-2015	2015-2020	Change
Industry, Transport, Energy Sector	82.68	109.77	6.0%
Agriculture	-	25.07	
Waste	0.56	0.66	42.4%
Sub Total (a)	83.24	135.49	
Forest (LULUCF) (b)	-4.56	-36.9	1.8%
Total (a+b)	78.68	98.52	11.4%
Per Capita Emission	1.88	2.35	11.4%

¹ <https://www.newindianexpress.com/states/odisha/2019/oct/31/new-research-says-rising-sea-may-devour-odisha-coast-2054964.html>

Adaptation Measures

With over 480 kilometres of coastline, Odisha is in a precarious position when it comes to the impacts of climate change. Odisha's coast is particularly vulnerable to both episodic storm events, such as cyclones, as well as chronic problems associated with shore erosion, coastal flooding, storm surge and inundation. Odisha also has 10 agro-climatic zones each of which require development of distinct adaptation strategies for various sectors. Adaptation strategies have been formulated keeping in view the state vulnerability, food security and state circumstances. Key sectors for which predominant adaptation strategies have been formulated include Agriculture, Fisheries & Animal Husbandry, Water, Health, Coastal & Disaster Risk Management.

Mitigation Measures

While the Climate Change Cell has assembled a listing of investments that will help the state to mitigate effects of climate change, there is still a need to develop a comprehensive GHG and Carbon Footprint Reduction Strategy. As part of the implementation plan the Cell also analyzes the science-based GHG emission scenarios with different level of mitigation targets and measures in the long term. Key sectors for which predominant mitigation strategies have been formulated include energy, urban development, transport, industries, waste management. Several policies that have low carbon development pathways have been formulated keeping the NDCs and SDGs requirements in view like climate smart agriculture, enhancing water use efficiency, carbon sink enhancement, solar mission etc.

Actions and Budget

There were 110 actions proposed in the SAPCC Phase-II (2018-23). In this Revised SAPCC Phase - II (2021-30), 94 strategies have been proposed out of which 49 are strongly linked to adaptation, 31 linked to mitigation and 14 strategies have linkages to both adaptation and mitigation. The total proposed budget for these activities in 10 years (2021-30) amounts to Rs 245,565 crore. In terms of nature of investment, 73% are for adaptation, 11% for mitigation and 16% for both. It shows that 52% of the adaptation strategy requires 73% of the total public investment. Heavy climate investments are expected in Urban Development, Water and Forestry sector in next 10 years and these are in line with the national priorities.

Implementation

The implementation of the actions will be the responsibility of the various departments. The plan outlines a comprehensive coordination and knowledge management role for the Cell to be provided to departments in a way that ensures quality implementation by using robust monitoring, evaluation and verification systems. As a part of the state's funding strategy, various climate financing options are identified in order to possibly fill the financial gaps in addition to the budgetary sources of the State or Central Sector Schemes. Some of the actions listed in SAPCC 2021-30 will require enabling legislations/policy framework that must be developed and adapted to ensure that climate change related investments are mainstreamed into annual and long-term plans.

The action plans provide opportunity to develop policy/legislations in the following areas:

1. Adopting energy efficiency standards based on performance
2. Amending state building codes and development codes to improve land use, transport and energy efficiencies
3. Strengthening Odisha's Renewable Energy Policy, portfolio and related standards
4. Strengthening multi sector initiatives that cater to challenges related to poverty reduction and enhance adaptive capacity

Perspective Action Plan matrix

Agriculture

Odisha is an agrarian state with 70 percent of the state's population depending on agriculture and allied sectors. Of the total geographical area of the state, about 39.69 percent consists of land under cultivation. Increasing agricultural production and productivity is necessary for ensuring food security, livelihood security and nutritional security to meet the SDGs.

Even though the quantum of rainfall in Odisha is quite high, its distribution during the monsoon period is turning out to be highly uneven and erratic. As a result, flood and drought occur regularly with varying intensity. During extreme weather events, the damage to crops has been significant. The frequent occurrences of natural calamities are impacting the production of kharif rice. In drought years, there is a considerable loss in production of pulses and oilseeds both during kharif and rabi. This in turn is likely to impact the state's food security. The prioritized activities proposed by the Agriculture in Farmers' Empowerment departments are outlined as follows.

Agriculture – Key Priorities
1. Increase Knowledge and Capacity
2. Promotion of SRI
3. Development efficient micro and drip irrigation
4. Promotion of stress tolerant varieties
5. Promotion of organic farming

Fisheries and Animal Resources Development

Fisheries and Animal Resources Development are fully integrated into the agriculture system of the country and more so in several parts of Odisha. Unlike in many other parts of the country, livestock holding in Odisha is equitable; over 80 percent of all livestock are owned by the marginal/small holders and the landless. Small ruminants, poultry birds and aquaculture are highly vulnerable to climate change.

The rise in the surface temperature of the water is likely to result in shifting of species and a smaller catch in traditional areas. It will also boost the operating costs in the ponds for increasing the aeration and desilting the river mouth. Major carp such as rohu, katla and mirgal are likely to show early maturity (before monsoon) and have lower survival rates because of more predators and infestation. For livestock, higher temperatures mean reduced dead storage. And poor water quality means more diseases, reduced milk production and higher mortality in small ruminants and poultry. Floods

and cyclonic weather alter the salinity of the water; damage spawns in the breeding season. High tidal surges in coastal areas are likely to inundate landmass and affect the mangroves. These are likely to damage freshwater, freshwater exchange and several brackish water species. Loss of estuarine areas are likely to affect the quality and quantity of fish. The prioritized activities proposed in the Fishery and Animal Resources Development sector are as follows:

Fisheries & Animal Resources Development – Key Priorities
1. Research on disease early warning system
2. Improved feeding management
3. Upgradation of FH/FLC
4. Assistance to deep sea fishing based on climate induced shift
5. Livelihood support to marine fishers during ban period
6. Upgradation fish seed hatchery for early breeding/seed production

Forestry

Forests are not just about flora and fauna; they also support a large number of forest-dependent communities (especially scheduled tribes) in the states. In Odisha, forests cover about 33.15 percent of the state's geographic area. According to the Forest Survey of India (FSI), there has been an increase in the forest cover in the state. This improvement has been possible because of the enhanced conservation and plantation drive. In view of the high diversity, tree density and low fragmentation of the Odisha forest, if protected properly it is likely to be the resource least vulnerable to climate change under the A1 and B2 scenarios. However, the temperature rise might affect micro-flora and fauna in northern Odisha and the south-western part of Odisha and adversely affect the biodiversity. The prioritised activities proposed in the forestry and environment sector are as follows:

Forestry – Key Priorities
1. Increasing the forest cover of the state by taking up massive plantation programme (including River Rejuvenation & Green Mahanadi Mission)
2. Enhance the density of forest by taking up Assisted Natural Regeneration and protection of existing forest stocks to act as carbon sink with stronger conservation
3. Mangrove cover and coastal biodiversity along the coast
4. Conserve and regenerate bamboo forest

Water Resources

The movement of water in the climate system is essential to life on land because much of the water that falls on land as precipitation and supplies the soil moisture and river flow has been evaporated from the ocean and transported to land by the atmosphere. The world is increasingly confronted with mounting evidence of significant alterations in climate patterns stemming from anthropogenic emissions. They cause frequent extreme events such as floods, droughts and are responsible for a rising sea level, leading to submergence of the coastal area and its erosion, quite apart from other consequences. Indirect evidence from scientific data and sea salinity studies show that the pattern of evaporation-precipitation over the oceans has been enhanced since the 1950s. This is likely to have adverse impacts

on the spatial and temporal scales in several regions, including India and Odisha. Because the monsoon contributes more than three-fourths of the water in the state's water reserve, any change in monsoon behaviour affects the state's flood & drought related vulnerability. The other vulnerability is on the demand side. The bigger problem seems to be the water supply for the rapidly forming urban agglomerations in the state, especially around the industrial clusters. Aquaculture (fresh and brackish) is the other area of the economy affected by the Water Resources sector. As per the Odisha State Water Plan, the total water requirement as estimated in 2011 was in the range of 1,085,158.59 million litres. This requirement is likely to be affected if there is a shortfall in rainfall. In the case of floods, the fish escape and the predatory species damage the aquaculture. The prioritised activities proposed in the Water Resources sector are as follows:

Water Resources – Key Priorities
1. Increase water use efficiency in the irrigation sector
2. Flood protection & anti-erosion works, non-structural works, drainage system improvement (Flood control, Drainage improvement (flood modelling, non-structural work, erosion control, drainage improvement, etc.)

Coastal and Disaster Risk Management

Odisha has a coastline spanning 480 kilometers that covers six districts: Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Puri and Ganjam. The coastal and marine environment plays a critical role in the socioeconomic, cultural and environmental well-being of the state. It has strong linkages to industrial development, agriculture, aquaculture, recreation and port-related transport and commerce.

The loss of land to the sea has become a more recurrent phenomenon. Ocean dynamics and coastal processes have a strong link to climate change. They also have strong links to various disasters that are likely to confront the state quite often. The prioritised activities proposed by the Coast and Disaster Management sector are outlined as follows.

Coastal and Disaster Management – Key Priorities
1. Develop a techno-legal regime for the construction of disaster-resilient public infrastructure (construction of approach roads to MCS buildings under the NCRMP) and include Odisha Disaster Recovery Project (ODRP) for housing etc.
2. Set up an integrated capacity-building protocol covering shelter and a self-help group under the Community-Based Disaster Risk Reduction Framework (CBDRF), including college & school volunteers and officials at the state and district levels.

Health

Natural disasters are common in Odisha because of its specific geo-climatic condition, which makes the state more vulnerable to cyclones, floods, tornados, drought and heat waves. These climate-induced events result in epidemics that have the potential to cause mass casualties and suffering within a short period of time. From March to October, Odisha experiences calamities such as floods, cyclones, droughts or heat waves. Floods were experienced in 2003, 2004, 2007, 2011, 2013 and 2014. Eighteen of the state's 30 districts are prone to flood or flash flood. Experiences with the

super cyclone of 1999, Super cyclone “Phailin” of 2013 and frequent floods in the state have resulted in the prevalence of both water-borne and vector-borne diseases in the immediate aftermath. And between March and June, the recorded temperature is above 45°C in 30–40 percent of districts. All 30 districts of Odisha are prone to experiencing heat stress disorders. The prioritized activities proposed in the Health sector are as follows:

Health – Key Priorities
1. Strengthening approaches to manage vector borne diseases that have worsened due to climate change
2. Capacity building of the Health sector on climate change adaptation and mitigation aspects
3. Strengthening approaches to deal with heat wave conditions exacerbated due to climate change
4. Undertaking measures to manage water borne diseases that have worsened due to climate change

Energy

Odisha has reasonable water resources for hydropower and substantive coal for thermal power. This unique combination has helped the state to remain a balanced and surplus power producer for the nation. The vulnerability here has a dualism. The enhanced demand from within and outside the state for thermal power production would certainly increase emissions. This will in turn increase the state’s contribution to global warming and also result in significant environmental pollution. The sector itself is also vulnerable to climate change. Generation of hydropower will be directly affected by the erratic monsoon seasons and conflict with agricultural and industrial water uses. In the long term, there does not seem to be a major change in the precipitation level at the aggregate level. The temperature increase might affect the Plant Load Factor (PLF) of the power plants. It will also increase the cooling demands of consumers and add stress to the already overloaded distribution network of the state.

Very severe cyclone Phailin and recently Fani exposed the vulnerability of the power network of the state. Immediately after the cyclone, power demand in Odisha dipped to as low as 600 megawatts, 22 percent of the 2,800 megawatts normally registered in the state, bringing the regional grid under stress. Up to seven lines of 400 kilovolts, 17 lines of 220 kilovolts and 19 lines of 132 kilovolts were affected in the state. It also affected several 11-kilovolt lines and 3.8 million consumers.

The state has an ambitious target for the integration of renewable energy. However, wind installations along the coasts are not fully cyclone-proof and the cloud cover and prolonged rainy days may negatively affect the state’s solar power generation. The prioritized activities proposed in the Energy sector are as follows:

Energy – Key Priorities
1. Promotion of grid connected wind power
2. Maximising solar energy generation potential (GEDCOL)
3. Improve energy efficiency

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| 4. Awareness generation on EE |
| 5. CB of energy auditors, strengthening the energy conservation cell |

Urban Development

About 17 percent of Odisha's population resides in urban areas. The state has registered remarkable urban growth (about 26.8 percent) during the last decade. The urbanization trend over the last five decades in the state reveals that the smaller towns (Classes IV, V and VI) are growing at a faster rate than the bigger towns. The urban centers of Odisha experiencing fast growth are also vulnerable to natural hazards.

The urban assets and life are exposed increasingly to the risk of cyclone, heat wave, urban flood, health and earthquake. Urban centers, mainly Class I cities of the state, are also facing the rapid growth of the slum population living in poor building types in environmentally vulnerable pockets. The fast growth of these urban centers leads in turn to the buildup of the surrounding areas, thereby encroaching on low-lying areas and increasing the flood risk. The encroachment of low-lying areas and the clogging of drainage due to the increase in solid waste in the city have led to unhygienic conditions and in turn a high incidence of water and vector-borne diseases. The prioritized activities proposed in the urban sector are as follows:

Urban Development– Key Priorities
1. Augmentation of integrated sewerage project for Bhubaneswar and Cuttack Municipality
2. City Bus Service, Bhubaneswar Municipal Coporation and Puri (BRTS); for City Bus Service in GUTSL, WOUTSL, CUTSL, JKSUTT, SUTT, BBUTT, development of Infrastructure for CBS and development of Bus Terminal
3. Energy efficiency in providing products and services : Street Light
4. Developing urban storm water drainage based on the climate change
5. Housing for all (in-situ slum development for relocation)
6. Development of green space, park (105 ULBs)
7. Smart City Bhubaneswar

Transport

The Transport sector is reliant on oil. Economic growth spurs the sector and consequently both oil consumption and CO₂ emissions. This sector is also responsible for the air pollution contributed by ozone, nitrous oxides and particulates. In 2010, 53 percent of global primary oil consumption was used to meet 94 percent of transport energy demand. In 2007 the Transport Policy of Odisha outlined the following objectives: to increase the competition, efficiency, transparency, accessibility and availability of transport services in the state.

Rising temperatures and extended heat wave periods expedite damage to roads and pavements. In addition, to increase their comfort vehicle users tend to turn on their air conditioning more than before. The use of air-conditioning is further amplified in urban areas as the temperature in those areas is a few degrees higher than in rural areas because of the heat island effects. Higher temperatures also affect rail networks through thermal

expansion. The new rail network expanding to Angul and Kalinganagar (Jajpur) is likely to be affected because of the rise in temperatures in these areas. The prioritized activities proposed in the Transport sector are as follows:

Transport – Key Priorities
1. Encouraging e-rickshaws, electric vehicles & CNG use
2. Policy and implementation of phasing out old vehicles for emission reduction
3. Strengthening enforcement wing for emission level check-up

Industries

The Industry and services sectors have emerged as the main drivers of growth during the past decade. The Industry sector contributes more than one-third of the state's GDP. A climate change-induced rise in temperature reduces industrial activity, increasing down time. Similarly, water scarcity severely affects many industrial processes. Floods and cyclones damage industrial infrastructure and also affect industrial productivity. Industries along the coast such as food processing (aquaculture), chemical and fertiliser are more vulnerable. The prioritized activities proposed in the Industry sector are as follows:

Industries – Key Priorities
1. Devise a mechanism for green belt development and maintenance for industrial clusters
2. Prepare regional environmental management plans for major industrial clusters.

Mining

Out of India's total mineral deposits, Odisha's mineral reserves constitute 28 percent of its iron ore, 24 percent of its coal, 59 percent of its bauxite, and 98 percent of its chromite. The Mining sector contributed an average of 7.4 percent of the Gross State Domestic Product in the 11th plan (2007–12), which declined to 6.67 percent in 2013–14 and is likely to decline to 6.31 percent in 2014–15 (the first two years of the 12th plan period). The high level of precipitation will increase the rainwater infiltration on spoil piles, resulting in aquifer-level contamination in coal-bearing areas. The water quality of nearby streams may be affected. Concentrated rainfall will also increase the risk of mining operations and damage the outbound transport infrastructure. Changes in the frequency and intensity of storm events could affect mining operations (e.g., tailing dams, sediment and erosion control). Similarly, the excessive heat that is likely to prevail in the summer months in the northern and western parts of the state would contribute to workers' heat strokes, cause more mining accidents and shorter working hours and lower productivity. The prioritized activities proposed in the Mining sector are as follows:

Mining – Key Priorities
1. Prepare action plan for sustainable mining
2. Conduct a study to determine the potential of coal bed methane in the coal fields of Odisha

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| 3. Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in Mining sector as suggested by Forest & Environment Department |
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Waste Management

With rapid growth of industrialization, mining as well as urbanization the waste generation in Odisha has also seen a sharp growth. As per Odisha State Pollution Control Board, the average MSW generation in Odisha has been found to be around 2293.3 tonnes per day in all ULB across the state in 2014. If waste generated is not properly managed, especially faecal matters and other liquid and solid waste from households then it may lead to serious health hazard and spread of infectious diseases. Unattended waste lying around attracts flies, rats and other creatures that in turn spread disease. Normally it is the wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby gives rise to health problems. The prioritized activities proposed in the Waste sector are as follows:

Waste Management – Key Priorities

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| 1. Awareness generation for management of various kinds of waste |
| 2. Management Municipal Solid Waste |

Conclusions and Recommendations

The formulation of SAPCC 2021-30 highlighted some of the key lessons learned since formulation of the first SAPCC. Despite the limitation and uncertainty in climate models at state level, it has been clearly understood in the context of Odisha that climate change has both a socio-economic cost and a socio-political cost. A broad vision that factors in sustainable development is pragmatic; factoring climate change concerns into the developmental planning process, has progressed with more understanding and assimilation of the planning process of SAPCC. The action plan is aligning new missions being added at the national level (e.g. Coast and Disaster Risk Management, Health, Waste to Energy; out of which Odisha already highlighted these state specific missions on Health and Disaster Risk Reduction in its first SAPCC). Climate Change Cell is coordinating with departments to meet the mission targets by close monitoring the SAPCC implementation on a regular basis. It will further update the report as per the NDCs requirement for 2018-23 and up to 2030.

It is heartening to note that the state has had consistently higher allocations to climate change in its budget and has reported the progress in a transparent manner. Thus clearly the state has taken the climate change issue seriously and is taking action on it. In contrast, it was also revealed that climate financing should be mobilized more aggressively so that pressure will be reduced on the state budget.

Introduction

1.1 Background

Climate change is one of the most serious global threats to mankind in the modern times. It has far-reaching implications for environment, agriculture, water availability, natural resources, ecosystem, biodiversity, economy and social well-being. After the introduction of National Action Plan on Climate Change (NAPCC) in 2008, 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 converging with the existing policies, 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. States/UTs have initiated capacity building actions and demonstration projects to implement SAPCCs since the formulation of SAPCCs. Odisha is one of the first states in India to prepare a comprehensive State Action Plan on Climate Change.

As per the series of assessment reports released by Inter Governmental Panel on Climate Change (IPCC), the human influence on the climate system is significant and it concludes that the recent anthropogenic emissions of greenhouse gases (GHG) are the highest in history. It also specifically highlights that human induced global warming to 1.5°C can be limited; however, it would require transformative change. IPCC also takes stock of how much higher the risks of a 2°C world is than 1.5°C. India has submitted its Nationally Determined Contributions (NDCs) 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 policies and schemes in areas of 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 have 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 research and technical support 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. will help identify and prioritize

mitigation/ adaptation strategies and refining regional specific action plans and strategies.

In this context, SAPCCs need to be revised and strengthened further considering the evolving context of climate science, policy and actions. Ministry of Environment Forest and Climate Change (MoEF & CC) requested states to initiate the process of revision of the SAPCCs in January 2018.

1.2 National and State Mission Linkage

The sectors/missions identified by the state in the SAPCC and their alignment with National Missions are as follows:

Table 1 National and State Mission Linkages

Sl. No	Missions in the SAPCC	National	Odisha	Remark
1	Agriculture Mission	National Mission on Sustainable Agriculture	Yes	Several components are being implemented
2	Coastal and Disaster Management	For coastal ecosystems, vulnerability analysis is under way	Already formulated	Odisha has formulated this mission since 2010 and has taken a pioneering role
3	Energy	National Mission on Energy Efficiency (NMEE), National Solar Mission	Currently links NMEE and the National Solar Mission	Will link with the National Wind Mission and the Waste to Energy Mission
4	Fishery and Animal Resources development (ARD)	Covered under Sustainable Agriculture Mission	Separate mission considering the nature of the mixed cropping system	Already formulated; Strong linkages to be built up within the framework of the National Mission
5	Forest	Green India Mission (Yes)	Yes	Aligned with National Mission
6	Health	Is now being formulated	Has already been developed	Some implemented since 2010; more detailing will be needed
7	Industry	No specific mission included under National Mission on Energy Efficiency	Has gone beyond energy efficiency and also tries to address other impacts	Odisha Mission is even more broad-based
8	Mining	No specific mission	Specific to state	Requires integration and alignment with some components of other mission
9	Transport	No specific mission linked to sustainable habitat, NDCs has special mention on e-mobility	Specific to state	Requires integration and alignment with some components of the missions, especially the Sustainable Habitat Mission
10	Urban	Sustainable Habitat Mission (Yes)	Yes	Aligned
11	Water	National Water Mission	Yes	Aligned
12	Strategic Knowledge Mission	Yes	Yes	'Strengthening of the State Climate Change Cell' project is under implementation

1.3 Objective

The objective of revision of Climate Change Action Plan is:

- To incorporate the enhanced capacities and improved understanding of sectoral and regional climate variabilities and projections, long-term vulnerabilities, mapping vulnerable regions, social groups, sectors, etc., that will help in identifying and prioritizing mitigation/ adaptation strategies and refining of the region-specific action plans and strategies.
- To assess the achievements made under proposed actions in previous SAPCC. To align & redefine the goals & targets for 2030, in light of the NDCs (Nationally Determined Contributions) & the SDGs (Sustainable Development Goals).

1.4 Scope

The report is having following parts:

- Part A: State Profile
- Part B: Climate Profile and Vulnerability Assessment
- Part C: Climate Change Strategy – Adaptation
- Part D: Climate Change Strategy – Mitigation
- Part E: Financing, Implementation and Monitoring & Evaluation Framework

1.5 Approach and Methodology

This report builds on the developments at the national level, various policies and programmes and the national and international commitments by India on the issues of climate change adaptation and mitigation. The broad guidelines for the revision of SAPCCs as enlisted by MoEF & CC are enlisted below:

PRINCIPLE 1 : To demonstrate the ambition and commitment of the state to address the issue of climate change and state's contribution to NDCs

PRINCIPLE 2 : To assess and show the real progress made by the state in addressing the state specific vulnerability based on the priorities set out in the SAPCC

PRINCIPLE 3 : Develop a long term climate action plan (2030) and policy aligned to NDCs with implementation and M&E framework

PRINCIPLE 4 : SAPCCs should synergise with the goals of NDCs under the Paris Agreement, though the targets under NDCs are national targets. It should also contribute towards achieving other development goals including Sustainable Development Goals (SDGs).

PRINCIPLE 5 : SAPCC should highlight the links with National Missions related to climate change

PRINCIPLE 6 : The SAPCC should also be built on the evolving socio-economic development context and priorities of the state

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 : The 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 programs

PRINCIPLE 10 : The 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

Figure 1 Guiding Principles

The steps taken for the revision of SAPCC are depicted below. Vulnerability assessment is done that provides current and future projections. Key priorities have been outlined both in adaptation and mitigation segments. Synergy has been established with the International climate goals like NDCs and SDGs. Capacity needs in the form of multi stakeholder consultations have been achieved for proper implementation. National policies and programmes for each sector have been in line with the state adaptation and mitigation strategies. Chapter on monitoring and evaluation will help to monitor the progress of the state in coping with climate change. Institutional arrangement has been set up so that the responsibility for various missions will rest under individual departments, which shall strive to attain all listed objectives within stipulated time frames and ensure their vertical integration with the National Missions and objectives of the NAPCC.

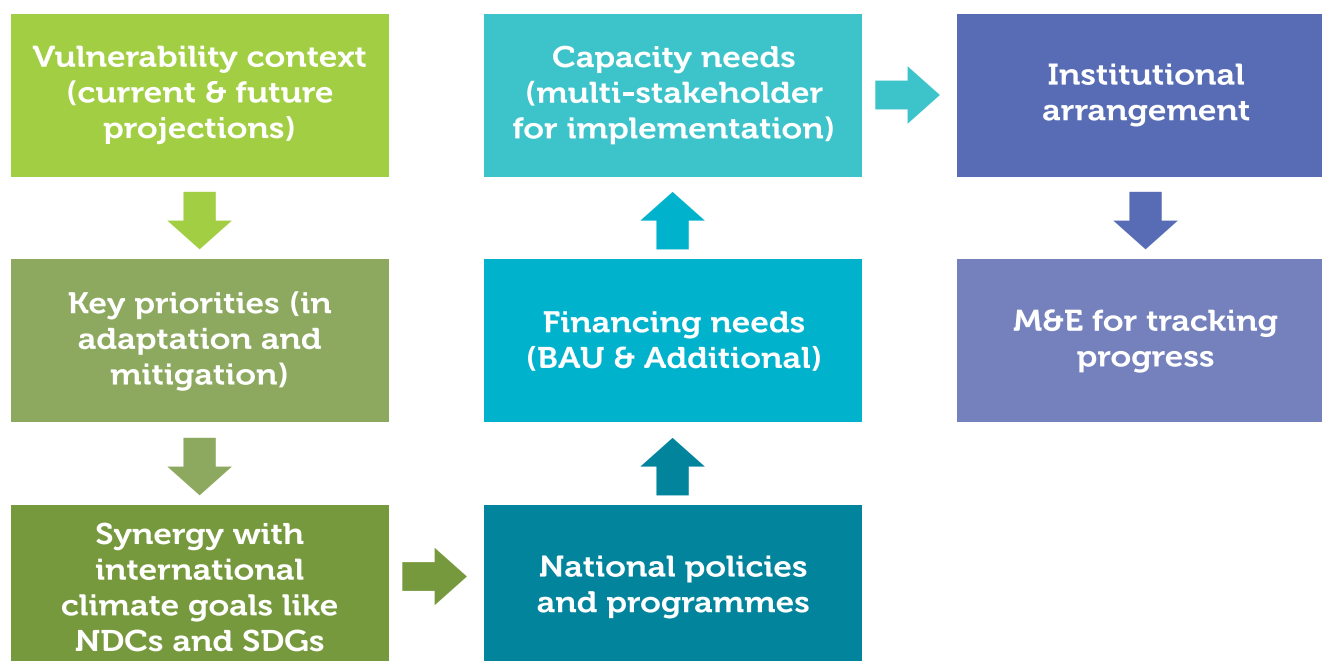


Figure 2 Approach and Methodology

The State's commitment has been measured by the physical achievements of proposed activities in SAPCC-I, financial commitment and alignment with the National Missions, NDCs and SDGs.

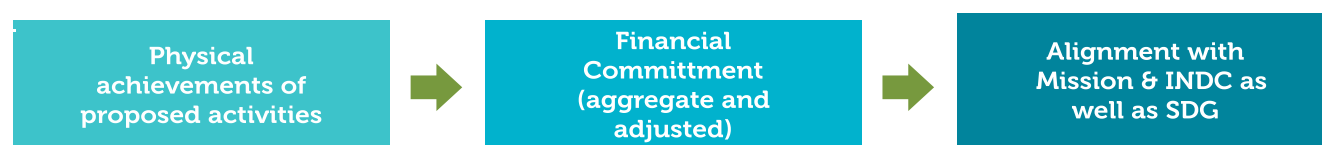


Figure 3 Measuring State's commitments

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-I
4. The activities that are newly proposed by the state nodal departments.

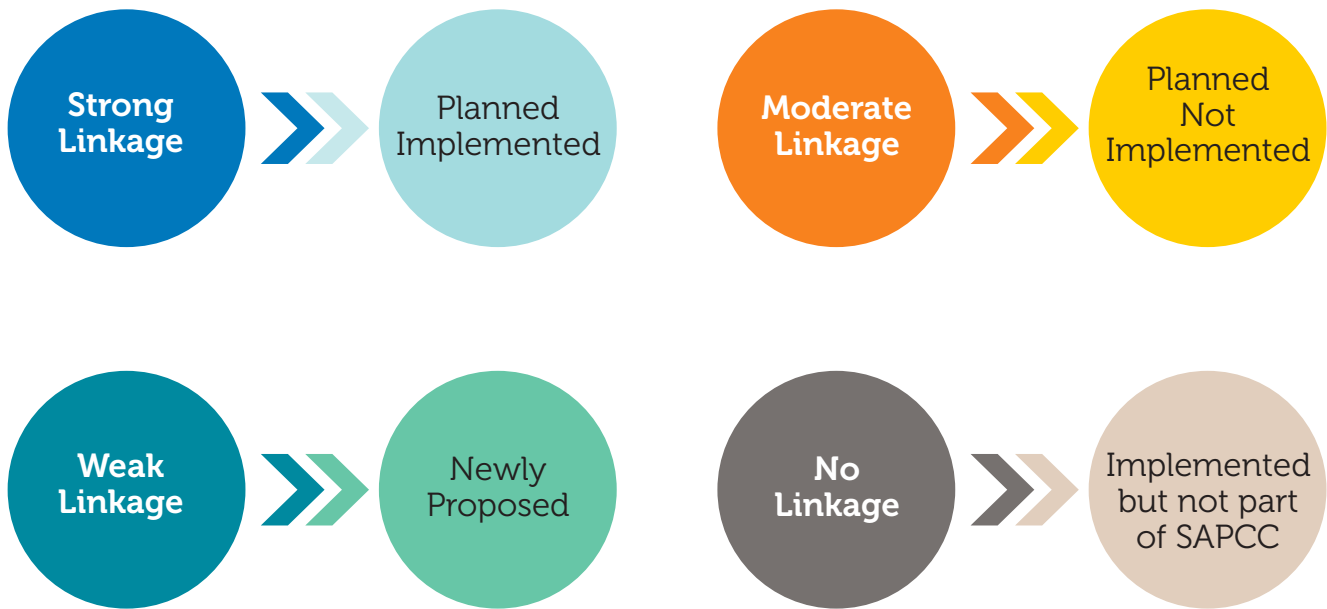


Figure 4 Activity Analysis

The linkages that are established could be Strong/Moderate /Weak / Nil linkages based on the extent to which the proposed activities can be linked with NDCs or SDGs or both.

For the activities that are proposed, the following criteria are used for prioritization:

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

CHAPTER

02

State Circumstances

2.1 State Profile: Location, Demography, Economy

Location, Geography and Size

Odisha is India's eighth largest state by area with a geographical area of 1, 55,707 sq.km which constitutes 4.7 % of the total land mass of India. The state of Odisha stretches between 81°31' E to 87°30' E longitudes and 17°31' N to 22°31' N latitudes. Odisha in the eastern region of India is surrounded by West Bengal in the northeast, Jharkhand in the North andhra Pradesh in the South, Chhattisgarh in the West and open to Bay of Bengal on the East having a coastline of 480 km. The state can be divided into four geographic regions i.e. Northern Plateau, Eastern Ghats, Central Table land and Coastal Plains. A number of important rivers drain through this state like Mahanadi, Brahmani and Baitarani.

Demographic profile

As per the Census of India, 2011, the population of the state is 41.97 millions registering a population density of 270 per sq.km. The population has increased by 51.7 lakh during the decade 2001 to 2011 (decadal growth rate 14.05%) which is slightly lower than the previous decade (1991-2001). The density of population of Odisha as per 2011 census was 270 persons per sq.km as against 236 persons per sq. km. in 2001 census. Out of the 41.97 million populations, 17.1% are Scheduled Caste communities and 22.8 % are Scheduled Tribes. Both caste groups have strong natural resource dependency and are highly vulnerable to climate change. The sex ratio for the state as a whole has improved from 972 females per 1000 males in 2001 to 979 females per 1000 males in 2011. The literacy rate has increased from 63.08 % in 2001 to 72.87% in 2011. Among the males, it has increased from 75.35% in 2001 to 81.60% in 2011, whereas among females, it has increased from 50.51% in 2001 to 64.60 % in 2011.

Table 2 State demographic profile

Particulars	Odisha		India	
	2001	2011	2001	2011
Population (in Crore)	3.68	4.2	10,2.87	12,1.02
Urban Population (%)	14.99	16.69	27.82	31.14
Rural Population (%)	85.01	83.31	72.18	68.86

Population Decadal Growth Rate (%)	15.94	14.05	17.60	21.50
Population Density (person per sq. km)	270	236	324	382
Sex Ratio (Per 1000 Males)	972	979	933	943
Literacy Rate (%)	63.08	72.87	64.83	74.04
Male Literacy Rate (%)	75.35	81.59	75.26	82.14
Female Literacy Rate (%)	50.51	64.01	53.67	65.46

Economic Profile

The state observed high economic growth in the year 2018-19. In 2017-18, the Gross State Domestic Product (GSDP) of the state was Rs 434.67 thousand crore which increased to Rs 486 thousand crore during the financial year 2018-19. The GSDP of the state at constant price during the base year 2011-12 was Rs 230.99 thousand crore which rose to Rs 395.92 thousand crore during 2018-19. The state's real Gross State Domestic Product (GSDP) grew at an impressive 8.4%, higher than the growth witnessed in the preceding year, 2017-18 (7.4%). This was higher than national average where the economy grew at 6.8%. This high rate of growth was basically due to Industry sector. The per capita GSDP of Odisha at constant price during 2018-19 is Rs 87,367.¹

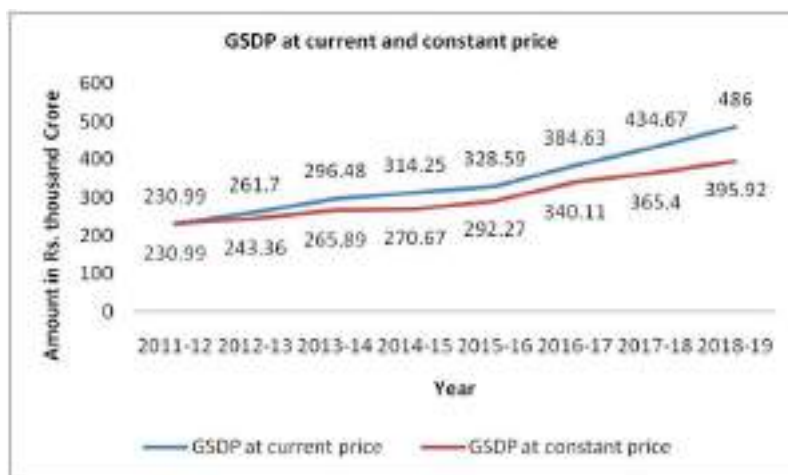


Figure 5 Odisha GSDP at Current and Constant Prices in Rs Crores

(Source: Economic Survey of Odisha 2018-19)

The Agriculture sector in Odisha constituted 18.9% of GSVA in 2018-19. Agriculture sector is highly dependent on monsoon like other states; hence, growth of the sector is also sensitive to weather conditions. The Industry sector has made a significant contribution in the state's GVA, with a 39.5% share and a growth rate of 9.3% in 2018-19 (AE).² Industry sector includes mining and quarrying, manufacturing, electricity, gas, water and construction activities.

2.2 Natural Resources: Availability of Land, Water, Energy, Forestry and Biodiversity Resources

The total geographical area of Odisha is 15571 thousand hectares and the land use pattern for the same is given below:

Table 3 Land Use Pattern Odisha

Sl. No.	Details	Area (Lakh Ha)	% with reference to geographical area
1	Forest	5813	37.33%
2	Net Area Sown	5356	34.40%
3	Area under Misc. Tree Crops	342	2.20%
4	Permanent Pastures	494	3.17%

¹ Odisha Economic Survey 2018-19

² Odisha Economic Survey 2018-19

5	Current fallow	824	5.29%
6	Other fallow	229	1.47%
7	Culturable Waste	375	2.41%
8	Land put to non-agricultural use	1298	8.34%
9	Barren and unculturable land	840	5.39%
10	Total Geographical Area	15571	100.00%

(Source: Odisha Profile 2018, Directorate of Economics and Statistics)

Physiographically, the state is divided into 4 Physiographic Zones namely Coastal Plains, Central Table Land, Northern Plateau and Eastern Ghats. These are further sub-divided into 10 Agro-climatic Zones namely North Western Plateau, North Central Plateau, North Eastern Coastal Plain, East and South Eastern Coastal Plain, North Eastern Ghat, Eastern Ghat High Land, South Eastern Ghat, Western Undulating Zone, Western Central Table Land and Mid Central Table Land. Largest river of the state is Mahanadi and there are several other significant rivers that flow through the state such as Subarnarekha, Brahmani, Baitarani, Vansadhara etc. Chilika Lake, located on the east coast of the state is one of the world's largest brackish water lagoons.

Odisha is an agrarian state and agriculture is considered as the lifeline of state's economy because majority of the population depends on agriculture for their livelihood. During 2017-18, the cropping intensity was 156%, net area sown was 5356 thousand Ha and gross cropped area was 8361 thousand Ha. The state has total livestock population of 207.32 Lakhs and total poultry population of 198.91 Lakhs.

As per the Forest Survey of India Report 2019, the forest cover in Odisha is 51,618.51 sq km of which 6969.71 sq. kms is very dense forest, 21551.93 sq. kms is moderately dense forest whereas 23096.87 sq. kms is open forest. The forest cover in the state constitutes 33.15% of the geographical area. The total Carbon stock of forest in the state is 432.29 million tonnes (1,585.06 million tonnes of CO₂ equivalent) which is 6.07% of total forest carbon stock of the country. The state has 2 National Parks and 21 Wildlife Sanctuaries.

During 2017-18, the state Power Sector has an installed capacity of 5810.82 MW against 5509.14 MW in 2016-17 with an increase of 5.48 percent which includes share from Central generating stations. Among the total installed capacity, hydro power share was 41%, thermal power share was 37% and other power sources share (renewable, independent & CPP) 22%. The present generation capacity of the state is 5737 MW that consists of about 32.49% or 1864 MW from hydro power, 15.34% or 880 MW from thermal power, 25.57% or 1386 MW from Central sector, 2.44% or 140 MW from renewable source and 24.16% or 1467MW from state independent power producers sources.

2.3 Sectoral Highlights

2.3.1 Agriculture

Odisha is an agrarian state and a large portion of the population is dependent on agriculture. Agriculture is an important sector for the economy of Odisha which provides livelihoods, reduces poverty and ensures food security. The Agriculture sector of Odisha broadly comprises agriculture, horticulture and related activities. Agriculture sector is highly vulnerable to climate change. The frequent occurrence of natural calamities badly affects the production of kharif rice. In drought years, there is a considerable loss in production of pulses and oil seeds both during kharif and rabi. Increasing agricultural production and productivity is necessary for ensuring food security, livelihood security and nutritional security. Agricultural production and productivity can be improved through better land and water management, a greater reliance on rain-fed agriculture, expansion of agricultural markets, better technology, higher public and private investments and effective implementation of the ongoing programs in Agriculture and allied sectors better contingency planning and risk transfers with expanded coverage under crop and weather insurance. As on 2017-18, the net sown area in the state is 5356 thousand hectare and gross cropped area is 8361 thousand hectare; and cropping intensity of the state is 156%. The state produced 8482.84 thousand metric tonnes of food grains during 2017-18. According to Agricultural Census 2015-16, the total number of land holders in the state is 48, 65,850.

Table 4 Agriculture Profile of Odisha

Agro Climatic Zones	North Western Plateau, North Central Plateau, North Eastern Coastal Plain, East & South Eastern Coastal Plain, North Eastern Ghat, Eastern Ghat High Land, South Eastern Ghat, Western Undulating Zone, Western Central Table Land, Mid Central Table Land
Soil Profile	Highly acidic to slightly alkaline and from light sandy to stiff clays. Soils are mainly acidic with the degree of acidity varying widely
Gross Cropped Area (2017-18)	8361 thousand Ha
Net Sown Area (2017-18)	5356 thousand Ha
Cropping Intensity (2017-18)	156%
Total food-grain production as on 2017-18 (in '000 MT)	8482.84
Area under food-grain in '000 Ha (2017-18)	6215.16
Productivity of food-grain in Qtls/ha (2017-18)	13.65
Horticulture crops grown in state	Fruits like banana, guava, mango, jackfruit, watermelon Vegetables like potato, sweet potato, onion, brinjal, cabbage, cauliflower, spices like ginger and turmeric
Key Issues and Challenges	<ul style="list-style-type: none"> Increased dependence on the ground water for irrigation and poor management of surface water Excessive use of fertilizers and pesticides which pollute water sources and reduce soil fertility

2.3.2 Fisheries and Animal Resources Development

Fishery and Animal Resources are fully integrated into the agriculture system of the country and more so in several parts of Odisha. Animal husbandry is an integral component of diversified agriculture system as it is a source of employment and livelihood for rural population. As per Livestock Census 2012, the state holds 4.05% share of India's total livestock and 2.73% of the total poultry in India and ranks 11th and 10th respectively out of the 28 states. The total livestock population in the state was over 1.82 lakh whereas poultry population stood at 2.74 lakh. Cattle hold the largest share of livestock population with a share of over 60%. The 480km long coastline and 24,000 sq. kms of shelf area along the Bay of Bengal highlight the potential of the state to produce a variety of marine products and export them within the country as well as to foreign countries. Odisha ranks 10th in fish production and has produced 4.50 percent of the total fish production in the country during 2014-15. During 2016 -17, the state produced 608.10 TMT of fish of which 455.00 TMT were from inland sources and 153.11 TMT from marine sources. The inland fish production included 393.72 TMT from fresh waters and 61.27 TMT from brackish waters.

Table 5 Fisheries and Animal Resource Profile of Odisha

Total Livestock	1,81,70,309
Total Poultry	2,74,39,257
Total Milk production in '000 MT (2017-18)	2087.54
Egg production in lakh number (2017-18)	20, 621.86
Total Meat production in '000 MT (2017-18)	183.42
Total Water Area in Inland Water Sector (in lakh Ha) as on 2017-18	11.02
Total Water Area in Fresh Water Sector (in lakh Ha) as on 2017-18	6.84
Total Fresh Water production (in lakh MT) as on 2017-18	4.54

Total Brackish Water production (in lakh MT) as on 2017-18	0.80
Total Marine production (in lakh MT) as on 2017-18	1.51
Key Issues and Challenges	<ul style="list-style-type: none"> • Reduction in fodder availability • Lack of grazing land • Increased demand for fish has led to over fishing • Fishing malpractices • Water pollution resulting in fish biodiversity loss

2.3.3 Forestry

Forest has an important role not only from the economic perspective but also from the ecological perspective. Climate change threatens forest health and productivity but deforestation and forest degradation significantly contribute to greenhouse gas (GHG) emissions. This makes the sector key for both climate change mitigation and adaptation. There is a need and opportunity for climate adaptation through sustainable forest management, forest restoration and conservation and livelihood security. The state's forest area is classified as reserved forest, protected forest area and other forest area. According to the Forest Survey of India (FSI), which was released in 2019, forest covers about 51,618.51 square kilometres of Odisha or about 33.15 percent of state's geographical area. The state's coverage includes 6969.71 square kilometres of very dense forest, 21,551.93 square kilometres of moderate forest, 23,096.87 square kilometres of open forest and 4,326.91 square kilometres of scrub. The total Carbon Stock of forest in the state is 432.29 million tonnes (1,585.06 million tonnes of CO₂ equivalent) which is 6.07% of total forest carbon of the country³. The forest cover of the state has grown 0.19% as compared to the previous survey in 2017.

Table 6 Forest Profile of Odisha

Total Forest Cover	51,618.51 sq. km
Percentage of State area under forest	33.15%
Area under VDF (Very Dense Forest)	6969.71 sq. km
Area under MDF (Moderately Dense Forest)	21,551.93 sq. km
Area under OF (Open Forest)	23,096.87 sq. km
Scrub	2.78% of total forest cover
Protected forests in the state	40.75% of the recorded forest area
Total tree cover (under forest cover outside recorded forest area)	4648 sq. km
Recorded Forest Area	61,204 sq. km of which 36,049 sq km is Reserved Forest, 25,133 sq km is Protected Forest and 22 sq km is Unclassed Forests
Bamboo bearing area within forest area of state	11,827 sq. km
Total carbon stock of forest	432.29 million tonnes (1,585.06 million tonnes of CO equivalent) which is 6.07% of total forest carbon of the country
Total volume of Growing Stock	394.06 m. cum
Key Issues and Challenges	<ul style="list-style-type: none"> • Increased dependence on forest for fuel wood resulting in forest degradation • Consumption and diversion of forest land for development activities • Frequent forest fires • Unsustainable use of forest resources

³ IFSR Odisha 2019

2.3.4 Water Resources

India faces the challenge of supplying water to a rapidly growing population while promoting water conservation and optimum resource use. Climate change is also critically threatening the Water Resources sector, primarily manifesting itself through changes in the hydrological cycle. Adaptation to climate change is a critical need for the Water Resources sector. Adaptation measures should build on existing water resource management practices that have the potential to create climate resilience, as well as enhance water availability and distribution. The movement of water in the climate system is essential to life on land because much of the water that falls on land as precipitation and supplies the soil moisture and river flow has been evaporated from the ocean and transported to land by the atmosphere. The long-term average rainfall in the state is about 1,452 millimetres. According to a 2009 assessment, the net annual groundwater availability is about 16.69 billion cubic meters. There are eleven principal rivers traversing the entire state that can be grouped under eight major river basins within the state. Most of the major rivers flow in easterly and south-easterly direction with gentle gradient.

Table 7 Water Profile of Odisha

Annual Precipitation per year (in BCM)	230.76
Number of Major River Basins	11
Total Annual Replenishable Ground Water Resource (in BCM)	1778
Net Annual Ground Water Availability (in BCM)	16.69
Annual Ground Water Draft (in BCM)	5.02
Stage of Ground Water Development (in %)	30.07
Total Irrigation Potential (area in '000 Ha)	8803
Key Issues and Challenges	<ul style="list-style-type: none"> • Change in the timing of rainfall and volume of the water can threaten water security and also agricultural productivity • Dependence on groundwater for irrigation • Increasing and competing demands for water • Depleting water resources and their management

2.3.5 Health

Good health is an essential component for wellbeing of people. A healthy populace can contribute productively to the overall economic growth of the country. The state is taking initiatives in building a healthy society by making quality medical facilities available and reachable to the people and by focusing on preventive health care. The state's vision is also aiming to ensure access to safe sanitation including open defecation free and garbage free environment. During 2010, Infant Mortality Rate (IMR) was 61 that reduced to 44 per 1,000 live births during 2016 as per SRS data 2016 against the National IMR of 34. According to SRS data 2014-16, during 2010-12 the Maternal Mortality Ratio (MMR) in the state was 235 that reduced to 180 as per 2014-16 State Health Management Information System Data against the National MMR of 130. The present Total Fertility Rate (TFR) in the state is 2.0 against India's status of 2.3.

Table 8 Health Profile of Odisha

Birth Rate (%)	18.6 (2016-17)	20.5 (2010-11)
Death Rate (%)	7.8 (2016-17)	8.6 (2010-11)
IMR (per 1000 live births)	44 (2016-17)	61 (2010-11)
Life Expectancy at Birth (years)	65.8 (2010-14)	

Maternal Mortality Ratio	180(2014-16)	222 (2011-13)	
Health Infrastructures (2015-16)	6688 Sub-Centers	1305 PHCs	377 CHCs
Key Issues and Challenges	<ul style="list-style-type: none"> • Changes in climate may allow more virulent strains of disease • Natural Disasters like flood, cyclones etc. create conducive environments for numerous health problems • Control of vector borne diseases 		

2.3.6 Coastal and Disaster Risk Management

The coastal and marine environment plays a critical role in the socio economic, cultural and environmental well-being of the state. It has strong linkages to industrial development, agriculture, aquaculture, recreation and port-related transport and commerce. Some of these activities compete for space along the coast and management of the coastal zone is vital for the state's development. Odisha has a coastline spanning 480 kilometres that covers six districts: Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Puri and Ganjam. According to the 2011 census, the total population of these six coastal districts is 10,112,048 and it is distributed over an area of 21,887 square kilometres with a population density of 462 persons per square kilometre. The coastal area and hinterlands along the coast are rich in biodiversity. They include Chilka, Asia's largest brackish water lagoon, which includes a 672-square kilometre of mangrove forest and wetland. Odisha also has a large nesting beach of Olive Ridley turtles along its southern coast.

Table 9 Coastal Profile of Odisha

Coastline (km)	480
Continental Shelf area (km)	24,000
Coastal Districts	Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Puri and Ganjam
Coastal District Population	10,112,048
Coastal District area (sq km)	21,887
Key Issues and Challenges	<ul style="list-style-type: none"> • Commercial fishing • Domestic and Industrial pollution • Unsustainable coastal tourism • Increased number of economic activities in coastal belts by local communities

2.3.7 Energy

Ensuring access to equitable, reliable, affordable and sustainable energy is imperative for achieving economic development, driving social growth; alleviate poverty and ensuring prosperity of any economy. Though access to electricity (100% household electrification) is being ensured till the last mile under Saubhagya scheme, challenge persists towards ensuring affordable and reliable electricity. Odisha is a coal bearing state and has reasonable quantity of water and land. This unique combination has attracted power developers to set up mega thermal power plants in the state. Thus, the state remains a balanced and surplus power producer. State's power sector has an installed capacity of 5810.82 MW during 2017-18 as against 5509.14 MW in 2016-17 with an increase of 5.48 percent which includes share from Central generating stations. The state achieved 100% electrification by the end of 31st March, 2019. 50,359 villages in Odisha have been saturated i.e.100 percent villages have been electrified. Total households electrified as on 31st March, 2019 are 96, 71,853⁴.

⁴ Power Scenario, Economic Survey Odisha 2018-19

Table 10 Energy Profile of Odisha

Total Installed capacity (2017-18)	5810.2 MW
Total Generation of Electricity (2017-18)	5737 MW
Total Demand estimated as on November 2018	3062 MW
Total Consumption (2017-18)	17,729 MW
Share of Hydro Power	38%
Share of Thermal Power	38%
Share of other power sources	24%
Village Electrified by all sources in number as on 31.03.2019	50,359
% of Village electrified from all sources as on 31.03.2019	100%
Total number of Roof Top Solar Power Plants installed	496
Total capacity of Roof Top Solar Power Plants	1050 KWP

2.3.8 Urban Development

The true elucidation of urbanisation lies in the rapid growth of urban population and the expansion of economic activities. Urban regions are most vulnerable to the impacts of climate change because of the rising issues like food insecurity, inequitable water supply, improper sewerage, more accumulation of solid wastes, health issues, vehicular growth, pollution, etc. The most important factor of urbanisation is the migration of people from rural to urban areas. Rapid process of urbanization along with higher concentration of population creates pressure not only on the access but also on the quality of basic amenities. Such expeditious urbanization means that the Government must constantly analyse and upgrade policies and regulations for urban areas to allow them to grow as feasible and vibrant growth regions, while continuing to be liveable and inclusive. About 17 percent of Odisha's population resides in urban areas. The state has registered remarkable urban growth (about 26.8 percent) during the last decade (2001–11) and the urban population has grown from 37 million to 42 million during this period. The urbanisation trend over the last five decades in the state reveals that the smaller towns (Classes IV, V and VI) are growing at a faster rate than the bigger towns.

Table 11 Urban Profile of Odisha

Total Population	41,974,218
Urban Population	7,003,656
Urban Male Population	3,625,933
Urban Female Population	3,377,723
Urban Pop Growth Rate	26.94%
Urban Sex Ratio	932
Urban Literacy Population	5,364,680
Urban Literacy Rate	85.75%
Male Literacy Rate	90.72%
Female Literacy Rate	74.31%
Key Issues and Challenges	<ul style="list-style-type: none"> Increasing rate of urban population sets humongous stress on housing demand and space making living conditions unsustainable Unplanned settlement Unsustainable development practices

2.3.9 Transport

Road transport is the backbone for urban infrastructure development and is needed for economic development and social integration. Roads contribute significantly to economic growth and bring important social benefits. The state has been observing an increasing growth in vehicular population. The major mode of transportation in the state is road transportation. Both transport and non-transport system in the state has seen a boost in the past years. By the end of 2018, the state had 42, 449 kilometres of rural roads and 18, 591 kilometres of urban roads. As on 31 March 2018, the state had 74.32 lakh 'registered' and 70.81 lakh 'on road' vehicles; 8.66 lakh new vehicles were registered during 2017-18 with an annual growth rate of 19.60% over 2016- 17. More than 81% of the MV populations on road are 2-wheelers followed by light motor vehicles (6.9%).⁵ Increase in number of personalised vehicles like two-wheelers, cars, etc. creates problem in terms of traffic congestion in cities, management and auto pollution; parking and road accident problems. Although new cars are fuel-efficient, the auto rickshaw segment requires major regulatory changes to ensure that these new vehicles conform to the emissions standards.

Table 12 Transport Profile of Odisha

Total Road Length (2017-18)	2,64,294 km
Total Registered Motor Vehicles as on 31.03.2018	74,31,815
Total Vehicles on roads (2017-18)	70,81,202
Share of Motor Vehicle	81.25%
Key Issues and Challenges	<ul style="list-style-type: none"> • GHG Emissions • Increase in vehicular population contributes to traffic congestion

2.3.10 Industries

Odisha is industrializing at a rapid pace. The Industry sector constitutes nearly 40% of state's Gross Value Added (GVA) relative to 30% at all-India level. The sector has also experienced strong growth in the recent past. The Industry sector also has significant implication on overall economic growth, given the sector's linkages with services like transportation, storage, trade and tourism. Industry sector in Odisha has emerged as a major driver of state's economy in recent decade. State's industry-oriented policies since 1990s and afterwards created favourable conditions for investments and entry of national and multinational companies into the state. The number of Micro, Small and Medium Enterprises (MSMEs) in the state has been increasing over time. Most of these are set up as ancillary industries near Rourkela and in the Metals Sector, engaged in maintenance and repair. The second most important category is the food processing sector. Both sectors have high potential in energy conservation.

Table 13 Industry Profile of Odisha

Number of MSME Industries (2017-18)	3,22,028
Total Investment in Rs Crores (2017-18)	15,945.25
Employment Generated (number of persons), 2017-18	13,34,693
Number of Industrial Estates and Areas, 2017-18	110
Number of Handicraft and Cottage Industries, 2017-18	3320
Number of Handloom Industries, 2017-18	37,393

5 Transport Section (Economic Survey Odisha 2018-19)

Key Issues and Challenges	<ul style="list-style-type: none"> • Unsustainable industrial practices • GHG Emissions • More demand of water, land and energy
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2.3.11 Mining

Odisha occupies a prominent place in the country as a mineral rich state. Abundant reserves of high-grade iron ore, bauxite, chromite and manganese ore, along with other minerals such as coal, limestone, dolomite, Platinum Group Metals (PGM), nickel, vanadium, graphite, gemstones, diamond, dimension and decorative stones are extensively available in the states of India's total mineral deposits. Odisha's mineral reserves constitute 35 percent of its iron ore, 24 percent if its coal, 53 percent of its bauxite and 98 percent of its chromite. The mining and quarrying sector contributed nearly 10.79% of state GVA in 2018-19. In terms of total value of mineral output, Odisha ranks highest in the country. Iron ore production expanded substantially from 533.29 lakh MT in 2014-15 to 1026.63 lakh MT in 2016-17, bauxite production increased from 91.92 lakh MT in 2014-15 to 119.14 lakh MT in 2016-17 and chromite production also increased from 21.62 lakh MT in 2014-15 to 41.30 lakh MT in 2016-17.⁶

Table 14 Mining Profile of Odisha

Minerals	Iron ore, bauxite, chromite, manganese ore, coal
Total Number of leases (2017-18)	607
Mineral Production in lakh tonnes (2017-18)	2689.89
Value (in Rs Cr) (2017-18)	65,435.73
Share of Chromite deposits	98%
Key Issues and Challenges	<ul style="list-style-type: none"> • Unsustainable mining practices • GHG Emissions • Impact on Environment • More demand of water, land and energy

2.3.12 Waste Management

The main objective of Waste Management is to collect, treat, dispose of wastes produced in a sustainable manner. Solid waste generation and management is an important aspect to enable healthier living condition. Waste management market is expected to be worth US\$ 13.62 billion by 2025. Indian Municipal Solid Waste (MSW) management market is expected to grow at a CAGR of 7.14% by 2025 while e-waste management market is expected to grow at a CAGR of 10.03% during the same period. India has planned to achieve a capacity of 2.9 million hospital beds by 2025 which will help bio medical waste management market to grow at a CAGR of 8.41%. With rapid growth of industrialization, mining as well as urbanization the waste generation in Odisha has also seen a sharp growth. As per Odisha State Pollution Control Board, the total waste generated is 2721 TPD, out of which 1170 TPD(43 %) waste is processed.

Table 15 Waste Management Profile of Odisha

Ward with 100% door to door collection (in numbers) up to October 2019	1923
Ward with 100% Source segregation (in numbers) up to October 2019	1136
Total waste generation (MT/D) up to October 2019	2721
Total waste processing (%) up to October 2019	43%

⁶ Economic Survey Odisha 2018-19

Key Issues and Challenges	<ul style="list-style-type: none"> • Increase in urban population concentration results in more generation of solid waste which affects the environment as well as the public health • Contamination of the groundwater sources • Uncontrolled emission of methane by decomposition of waste • Increased incidence of vector-borne diseases
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2.4 Contribution to NDCs in terms of Key Indicators and Policies

Indicators	Unit	2011-12	2030	Remark
GSDP at current prices	In Rs Lakh	22528348	162175528.4	
Population	In lakh	419.74	526.11	
Urban population	In lakh	70.04	117.03	
Per capita GSDP	In Rs	53672	308254	If we calibrate with a study conducted by McKinsey it is slightly higher at Rs 384948 (market price at 2030)
Electricity demand	In GWh	25430	62160 to 80783	
The status of energy consumption and carbon sink as on 2017				
		Odisha	All India	
Per capita energy consumption	In kWh	1200	1119.37	Per capita consumption of energy is likely to be 1182-1535 KWh which will be higher than all India average at 2030. The emission intensity too will be higher than national average.
Forest carbon sink	In million tonnes	432.29 1585.06 CO ₂ equiv	7082.063 25991.171 CO ₂ equiv	By 2030 the forest carbon sink in the state will grow to 484,826 mn tonnes

2.5 Key development issues and policy triggers

Key Policy Elements	State Performance
National Action Plan on Climate Change	The State has seven missions aligned to NAPCC
State Action Plan on Climate Change	The State has prepared SAPCC and duly endorsed by the State and submitted to MoEF & CC in 2010
Agriculture	<ul style="list-style-type: none"> • KALIA 2018 • Organic Farming Policy, 2018 • Odisha Farmer Producer Organisations (FPOs) Policy, 2018 • Agriculture Production Cluster project, 2018 • State Agriculture Policy, 2013 • Biju Krushaka Kalyan Yojana (BKKY) • Mukhyamantri Krishi Udyog Yojana • Mukhyamantri Abhinav Krishi Yantrapati Samman Yojana • Odisha Watershed Development Mission

	<ul style="list-style-type: none"> Pradhan Mantri Fasal Bima Yojana (PMFBY) Rashtriya Krishi Vikash Yojana (RKVY)
Fisheries and Animal Resources Development	<ul style="list-style-type: none"> Promotion of Dairy Entrepreneurship (PDE) Dairy Entrepreneurship Development Scheme (DEDS) Small Animal Development National Mission for Protein Supplementation Integrated Livestock Development Programme (ILDLP), Kalyani Odisha Fish Pond Yojana Matsyajibi Basagraha Yojana Online Registration of Fishing Vessels and Development of Model Fishermen village Fish Farmers Development Agency (FFDA) Brackish-Water Fisheries Development Agencies (BWFDA)
Forestry	<ul style="list-style-type: none"> State Compensatory Afforestation Fund Management and Planning Authority (State CAMPA), Odisha e- Green Watch Ama Jungle Yojana (AJY) Protection & Conservation of Forest Forest Diversion Plantation & Regeneration Wildlife Resource Protection of Bio Diversion Ecology & Environment Kendu Leaves Operations Eco-tourism Policy
Water Resources	<ul style="list-style-type: none"> State Water Policy Accelerated Irrigation Benefit Programme (AIBP) Odisha Integrated Irrigated Agriculture and Water Management Investment Programme (OIIAWMIP) Dam Rehabilitation and Improvement Project (DRIP) Odisha Community Tank Management Project (OCTMP) Mukhyamantri Adibandha Tiari Yojana (MATY) Deep Borewell Secha Karyakrama Repair, Renovation, Restoration of water bodies. (RR&R) Canal Lining & System Rehabilitation Programme (CLSRP) Buxi Jagabandhu Assured Water Supply to Habitations (BASUDHA) Scheme
Health	<ul style="list-style-type: none"> National Health Mission National Disease Control Programme Immunisation Shishu Abon Matru Mrutyuhara Purna Nirakaran Abhiyan (SAMPURNA) scheme Mamata scheme Biju Shishu Surakshya Yojana Niramaya Scheme Biju Swastya Kalyan Yojana AMA Clinic Yojana Odisha Sahaya Scheme Odisha Nidan Scheme Anmol Yojana Mukhyamantri Swasthya Seva Mission Reproductive Health Care NRHM Initiatives IMR Mission Navajyoti
Coastal and Disaster Risk Management	<ul style="list-style-type: none"> National Mangrove Genetic Resources and Conservation Center (NMGRCC) National River Conservation Programme

	<ul style="list-style-type: none"> • Mangrove for the Future (MFF) and Leaders for Nature (LfN) initiatives by IUCN • Matsyajibi Unnayana Yojana (MUJY) • Integrated Coastal Zone Management (ICZM) Project • Coastal habitat protection as a part of ICZM
Energy	<ul style="list-style-type: none"> • Biju Gram Jyoti Yojana (BGJY) • Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) • Biju Saharanchal Vidyutikaran Yojana (BSVY) • National Biogas and Manure Management Programme • Solar water Pumping Programme for Irrigation • Off-Grid Rooftop Solar Power Plant Programme • Programme of Distribution of Solar Lanterns • Solar Lighting to Tribal Villages • Unnat Chullah Abhiyan • Parishad Chullah Abhiyan • Odisha Power Sector Improvement Projects (OPSIP) • State Capital Region Improvement of Power System (SCRIPS) • Integrated Power Development Scheme (IPDS) • Deendayal Upadhaya Grama Jyoti Yojana (DDUGJY) • Decentralised Distributed Generation (DDG) under DDUGJY • Solar City Programme • Renewable Energy Policy 2016
Urban Development	<ul style="list-style-type: none"> • UNNATI, 2017 (Urban Transformation Initiative for urban infrastructure development) • Smart City Mission • AMRUT • Swachh Bharat Mission • Aahar • Awaas (Odisha Urban Housing Mission) • Hriday • Swachha Sahar Odisha • JAGA Mission (Odisha Liveable Habitat Mission)
Transport	<ul style="list-style-type: none"> • State Transport Policy 2007 • Biju Gaon Gadi Yojana (BGGY) • Biju Gadi Chalak Bima Yojana
Waste Management	<ul style="list-style-type: none"> • Swachha Sahar Odisha • Swachh Bharat Mission
Industries	<ul style="list-style-type: none"> • Industrial Policy Resolution (IPR) 2015 • MSME Development Policy 2015 • Special Economic Zone (SEZ) Policy – 2015 • Odisha Youth Innovation Fund (OYIF) • Odisha Food Processing Policy, 2013 • Ease of doing business like GO-SWIFT, GO-PLUS, GO-SMILE, GO-CARE • Single Window Concept and Public Private Partnership (PPP) • Make-In Odisha Conclave 2018 • Odisha Start-Up Policy 2016 • Craft Village Scheme • Shilpi Unnati Yojana (SUJY)
Mining	<ul style="list-style-type: none"> • Implementation of MMDR (Amendment) Act, 2015 • Odisha Minor Mineral Concession Rules, 2016 • Integrated Mines and Minerals Management System (i3 MS) Project • Odisha District Mineral Foundations Rules, 2015

2.6 Performance under NDCs-SDGs in last 5 years

Several actions proposed in the SAPCC Phase 1 had linkages to NDCs and SDGs outcome. The relative performance of the state has been given in the table .

Table 16 State wise ranking according to the performance

Sector	Unit	Year	Odisha	India	Rank	Year	Odisha	India	Rank
Energy									
	Capacity addition ⁷	2012-13	6946	223344	13	2015-16	9422	298060	13
	Electrification (village electrification) ⁸	2011-12	78.9	93.75	31	2014-15	91.87	96.69	30
Forestry									
	Enhancement of Forest Cover ⁹	2013	50347	697898	5	2017	51345	708273	4
Urban									
	Slum population accommodation (year-wise house completed under PMAY-Gramin) ¹⁰	2013-14	7674	448423	7	2017-18	288476	2505335	18
Health									
	Reduction in vector borne diseases (No. of Malaria cases) ¹¹	2012	262842	1067824	1	2017	352140	842095	1
	Reduction in IMR ¹²	2012	53	42	3	2016	44	34	2
Water Resources									
	Area irrigated/cultivable area (Gross Area Irrigated) ¹³	2010-11	1539	88940	14	2014-15	1485	96457	15
Agriculture									
	Food grain production ¹⁴	2012-13	8008.8	257134.6	12	2016-17	9061.3	251566.3	12
	Horticulture production ¹⁵	2012-13	12245.72	268847.45	10	2017-18	11780.98	311714.22	10
	Livestock ¹⁶	2007	43657000	1178530000	10	2012	45609566	1385178527	13

7 NITI Aayog State Statistics, Installed Capacity

8 NITI Aayog State Statistics, Village Electrification

9 ISFR Report

10 PMAY-Gramin Website

11 NHM Statistics

12 NITI Aayog State Statistics, IMR

13 RBI, Handbook of Statistics on Indian States

14 RBI, Handbook of Statistics on Indian States

15 <http://agricoop.nic.in/statistics/horticulture>

16 Livestock Census

2.7 State Performance on various SDGs

According to NITI Aayog's SDG India Index Baseline Report 2019, the performance of Odisha on several SDGs is shown in table 17. With a composite score of 58, Odisha is marginally below India's average composite score of 60. However, it has out-performed several states on Goal 13 (Climate Action), Goal 15 (Life on land) and Goal 6 (Clean water and sanitation)

Table 17 Performance of Odisha on SDGs for 2019-20

	SDGs	Score	Performance Category
Goal 1	No Poverty	47	Aspirant
Goal 2	Zero Hunger	34	Aspirant
Goal 3	Good Health & Well Being	61	Performer
Goal 4	Quality Education	40	Aspirant
Goal 5	Gender Equality	35	Aspirant
Goal 6	Clean Water & Sanitation	85	Front Runner
Goal 7	Affordable & Clean Energy	50	Performer
Goal 8	Decent Work & Economic Growth	59	Performer
Goal 9	Industry Innovation & Infrastructure	72	Front Runner
Goal 10	Reduced Inequalities	69	Front Runner
Goal 11	Sustainable Cities & Communities	51	Performer
Goal 12	Sustainable Consumption and Production	44	Aspirant
Goal 13	Climate Action	69	Front Runner
Goal 14	Life Below Water	57	Performer
Goal 15	Life on Land	99	Front Runner
Goal 16	Peace, Justice & Strong Institution	61	Performer
	Composite Score	58	Performer

Table 18 Sectors and SDGs

Sectors included in re-vised SAPCC	Sustainable Development Goals being supported
Agriculture	
Livestock	
Fisheries & ARD	

Forestry	
Water Resources	
Health	
Coastal and Disaster Risk Management	
Energy	
Urban Development	
Transport	
Waste Management	
Industries	
Mining	



2.8 Sectoral Schemes and their SDGs and NDCs Linkages

Table 19 Sectoral schemes and funding linkages to SDGs and NDCs

Sector	Schemes	Linkage to SDGs	Linkage to NDCs
Agriculture	National Mission for Sustainable Agriculture	2, 14, 15	<ul style="list-style-type: none"> To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture.
	Annapurna Scheme	2	
	State Food Security Scheme (SFSS)	2	
	Aahaar	2	
	Jalanishi and Soura Jalanidhi	2	
	National Food Security Mission		
	Krushak Assistance for Livelihood and Income Augmentation (KALIA)	2	
	Odisha Millet Mission	2	
	Odisha Integrated Irrigation Project on Climate Resilient Agriculture (OIIPCRA)	6	
	Biju Krushak Vikas Yojana	1, 2, 3	
	Management of Soil Health	2, 15	
Coastal and Disaster Risk Management	Odisha Disaster Recovery Project (EAP)	9, 11, 13,	<ul style="list-style-type: none"> 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 To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030
	Flood protection works under State Plan Schemes	9, 13	
	Integrated Coastal Zone Management Project (ICZMP)	14	
	Flood protection works under State Plan Scheme	1, 14	
	Strengthening SDMA and DDMA	13	
	State Plan for Basin Management	6	
	Conservation and Management of Mangrove	14	
Energy	Biju Gram Jyoti Yojana (BGJY)	7	<ul style="list-style-type: none"> Reduction of Emission intensity by 33-35% by 2030 from 2005 National level target of achieving 40% cumulative electric power installed capacity from non-fossil-based energy resources by 2030
	Biju Saharanchala Vidyutikaran Yojana (BSVY)	7, 11	
	Odisha Distribution System Strengthening Programme	7	
	State Capital Region Improvement of Power System	7	
	Solar Power Plants, GEDCOL	7	
	Grid Interactive Rooftop Solar, GEDCOL	7, 11	
	Solar Park, GEDCOL	7	

	Small Hydro Electric Projects	7	
	Soubagya Yojana	7	
	Biju Grama Jyoti Yojana	7	
	Minor Irrigation Projects (MIPs)	7	
	Lift Irrigation Schemes	7	
Fisheries and Animal Resources Development	Livelihood support to Marine Fishermen	3, 13	<ul style="list-style-type: none"> To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly Agriculture and allied
	Integrated Coastal Zone Management Project (ICZMP)	14	
	Development of Marine Fisheries	14, 1, 2	
	Intensive Aquaculture and Inland Fisheries	1, 2, 14	
	Promotion of Aquaculture and Inland Fisheries	1, 2, 14	
	Development of Brackish water Aquaculture	14	
	Matsyajibi Unnayana Yojana (MUY)	2, 14,	
	Reservoir Fisheries Development	14	
	Maccha Chasa Pain Nua Pokhari Yojana	15	
Forestry	Ama Jungle Yojana	13, 15	<ul style="list-style-type: none"> To create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030 To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change
	Increasing Green cover in the state (IGC)	15	
	Green Mahanadi Mission (GMM)	15	
	Intensive Protection of Critically Endangered Area (IPCEA)	15	
	Forest Conservation, Development & Regeneration	15	
	Survey and Utilisation of Forest Resources	15	
	Wildlife Protection and Conservation measures	15	
	Management of Elephants and Corridor	15	
	Nature Conservation	15	
	Environmental Management	15	
	Development of Eco-tourism	15	
Health	Biju Swasthya Kalyan Yojana (BSKY)	1, 3	<ul style="list-style-type: none"> To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation
	State support for implementation of ICDS in the State	3	
	Mission Shakti	3	
	MAMATA	3	
	National Health Mission	3, 5	
	Abadana	1, 3	
	Sishu Abon Matru Mrutyuhara Puma Nirakarana Abhijana (SAMPURNA)	3	
	Biju Sishu Surakshya Yojana	3	

	Care and Protection of children	3	
	Durgam Anchalare Malaria Nirakaran (DAMAN)	3	
	Mobile Health Units (Swasthya Sanjog)	3	
	Strengthening of Ancillary Services at Public Health Facilities (Nirmal)	3	
Industries	Promotion of Handloom Industries	8	<ul style="list-style-type: none"> Reduction of Emission intensity by 33-35% by 2030 from 2005 level To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development (better energy efficiency and efficient clean production through Make in India)
	Food Processing Policy (MSME)	8	
	Development of IT Parks and Towers	8	
	Assistance for welfare of MSME Workers	11, 5, 1, 8	
	Cluster Development Programme (MSME)	8, 11	
	Organisation of Udyoga Samadhan Sibira (MSME)	8, 11	
	Promotion of Salt Industries	11, 8	
	Promotion of Handicrafts industries	11, 8	
Mining	Odisha Mineral Bearing Areas Development Corporation (OMBADC)	1	<ul style="list-style-type: none"> To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development
	District Mineral Foundation (DMF)	1	
	Pucca Ghar Yojana (Mining)	1	
Transport	Urban Road Transport	11	<ul style="list-style-type: none"> To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development (smart mobility) Reduction of Emission intensity by 33-35% by 2030 from 2005 level
	Enforcement of Road Safety	11	
Urban Development	Odisha Urban Housing Mission- AB-BAAS	11	<ul style="list-style-type: none"> To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development
	Urban Water Supply	11	
	Food Safety Programme	3, 11	
	UNNATI- Urban Transformation Initiative	1, 11	
	Jaga Mission-Odisha Liveable Habitat Mission	11	
	BASUDHA	11	
	Odisha Urban Housing Mission (OUHM)	11	
	Rehabilitation of urban slum in Berhampur City (WB Assisted)-ODRP-EAP	11	
	Odisha Urban Infrastructure Development Fund (assisted by KFW, Germany-EAP)	11	

	Other Urban Development Scheme- Solid Waste Management	11	
	Urban Sewerage & Sanitation- Urban Sewerage Scheme	11	
	Infrastructure for Civic Amenities	11	
Water Resources	Rural Water Supply- BASUDHA	6	<ul style="list-style-type: none"> 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 (better water use efficiency)
	Rural Water Supply, Rural Infrastructure Development Fund (RIDF)	6	
	Buxi Jagabandhu Assured Water Supply to Habitations (BASUDHA)	6	
	Roof top rainwater harvesting programs	6	
	Training of Jal Sathis in Tank areas for operation and maintenance of ground-water recharge shafts, solar pumping system etc	6	
	Canal lining and System Rehabilitation Programme (CLSRP)	6	
	State Plan for Basin Management	6	
	Odisha Integrated Irrigation Project on Climate Resilient Agriculture (OIIPCRA)	6	
Waste Management	UD- Solid Waste Management	12	<ul style="list-style-type: none"> To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation
	Odisha Integrated Sanitation Improvement Project (EAP)	1	
	Other Urban Development Scheme- Solid Waste Management	11	
	Urban Sewerage & Sanitation- Urban Sewerage Scheme	11	
	Bio Medical Waste Management	3	

It is heartening to note that Odisha has outperformed many states in SDGs 13 (climate action).

2.9A Performance under key NDCs areas: Adaptation Strategy

Poverty and Food Security

The major factor which determines the prevalence of poverty is availability and access to food. Odisha has achieved the highest reduction of poverty both in rural as well as urban areas among major states of India. Still the state has high poverty and vulnerability as compared to national level. The social class-wise and region wise poverty is the major concern of this state.

Food grain production in Odisha has shown fluctuating trend since last few years due to uncertainty in climatic conditions. In the year 2015-16 food production declined by 39% from previous year due to severe drought condition. In Odisha, cereals and pulses are the principal crops. High yielding variety (HYV) paddy cultivation is being promoted in this state which in turn also has higher water and fertilizer requirement. During 2017-18, the state had total food grain production of 8482.80 thousand tonnes. Apart from this climatic condition of Odisha is also favorable for horticultural crops like different types of vegetables, spices and fruits. From consumption point of view state specific crops like potato and sugarcane are also important and cotton is considered as a major commercial fiber specifically in KBK districts of Odisha. However, despite of huge potential for agricultural production, the food production in last decade has been largely impacted due to

climate variability as well as many hazards like recurring cyclones, flash floods and droughts. As most of the workers in Odisha are engaged in agricultural works, climate change is a severe threat from livelihood point of view. The yield rate of food grain is below the average yield rate of other major states. Extensive rice cultivation is also contributing to methane emission.

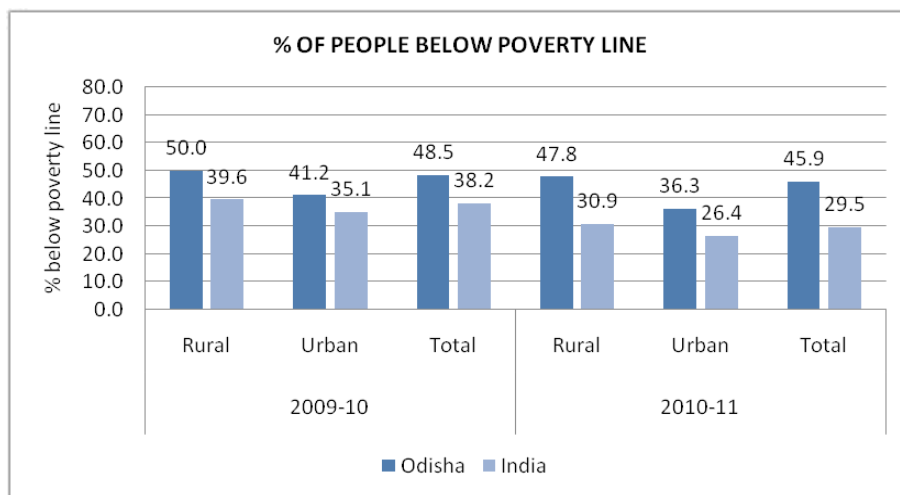


Figure 6 Percentage of people below poverty line as per Expert Group proposed method, Planning Commission, India

(Source: Report of the expert group to review the methodology for measurement of poverty, Government of India Planning Commission June, 2014)

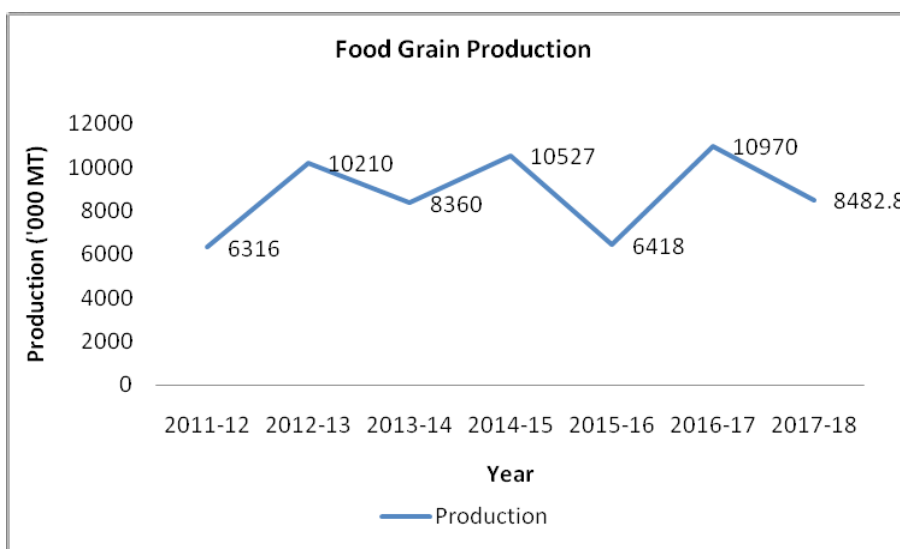


Figure 7 Food Grain Production Odisha

(Source: Agricultural Statistics)

National Food Security Mission (NFSM) aims on improving the adaptive capacity in the vulnerable areas and is being implemented in the state for the paddy, pulses, coarse cereals and sugarcane. It focuses to improve the production by increasing area, productivity enhancement, restoring soil fertility and creation of employment opportunities.

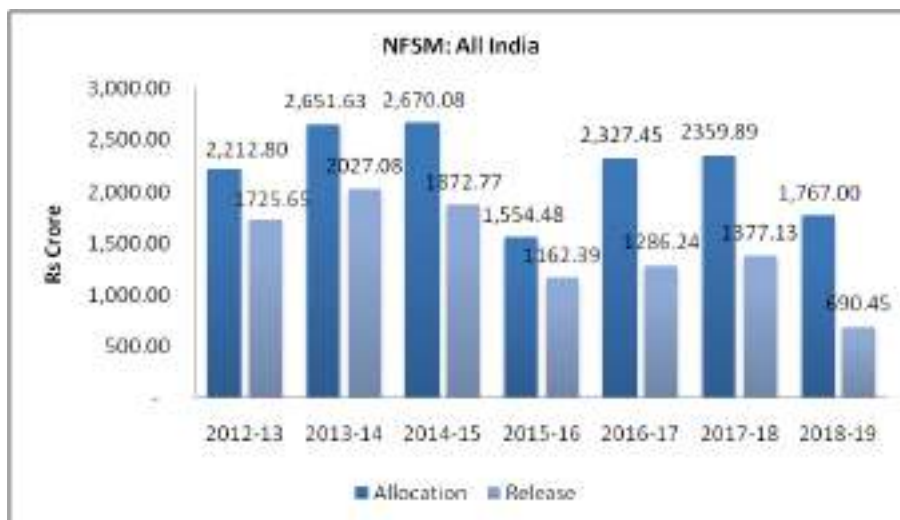


Figure 8 Allocations and Release under National Food Security Mission, India

(Source: Allocation and Release under NFSM)

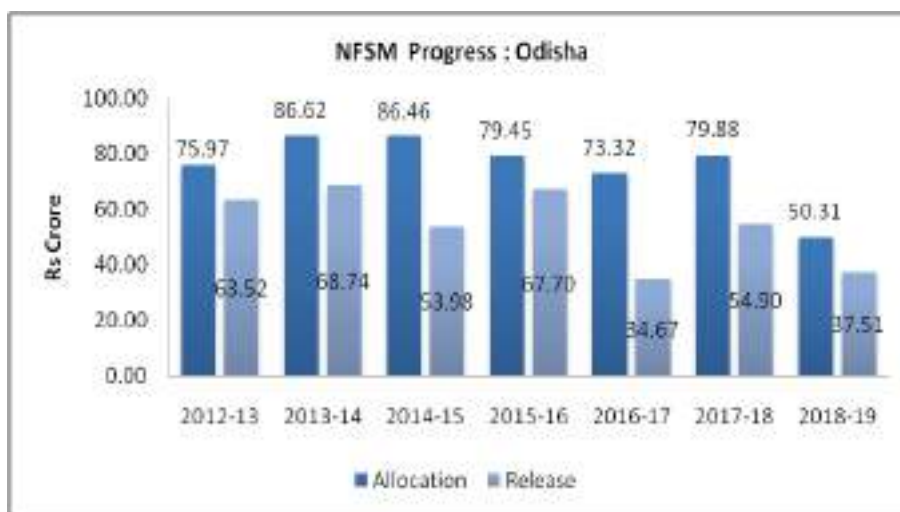


Figure 9 Allocations and Release under National Food Security Mission, Odisha

(Source: Allocation and Release under NFSM)

National Mission for Sustainable Agriculture (NMSA)

Agriculture is the fulcrum of the Odisha economy because it provides livelihood security and food security. Being a productive sector, agriculture helps to provide a pathway out of poverty. Odisha is agrarian state and most of the population depends on it for livelihood. The state produced 8482.8 thousand tonnes of food grains during 2017-18.

The objective of NMSA is to increase the agricultural productivity and to transform agriculture into a sustainable production system. The Mission focuses on soil health management, farmland management and indigenous farming techniques for resource conservation and water use efficiency. As NDCs distinctly defines the appropriate climate resilient farming systems and allied activities for income generation and value addition,

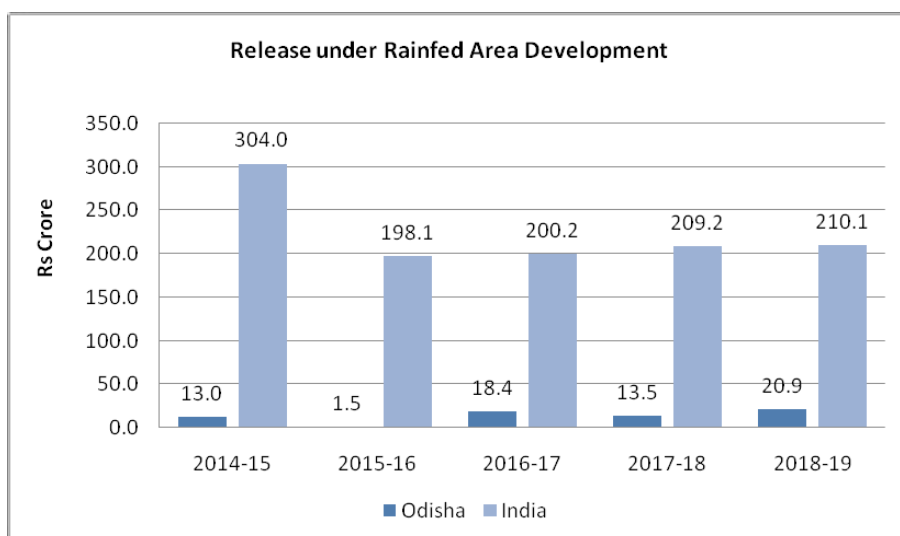


Figure 10 Allocation under Rainfed Area Development

(Source: National Mission on Sustainable Agriculture Website)

it can be said that this component has a strong adaptation linkage to NDCs. Rainfed Area Development and Sub- Mission on Agro forestry are the components implemented under this scheme.

The above chart shows the allocation under rainfed area development in Odisha. The objective of Rainfed Area Development (RAD) is to make rain fed agriculture more productive, sustainable and climate resilient by promoting the Integrated Farming System (IFS) along with the conservation of natural resources.

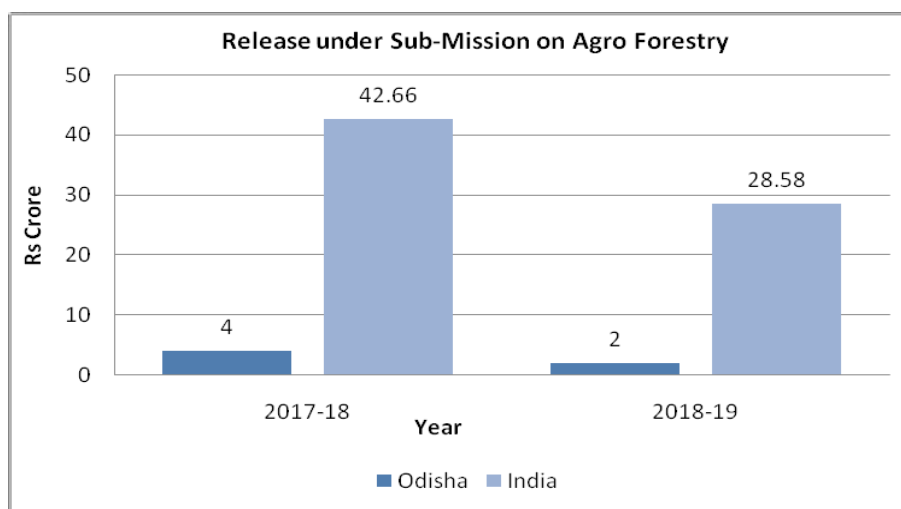


Figure 11 Allocation and Release under National Mission on Sustainable Agriculture, sub-mission on agro forestry

(Source: National Mission on Sustainable Agriculture Website)

The above chart shows the allocation and release under sub-mission on agro forestry in Odisha. The objective of Sub-mission on Agro forestry is to increase the tree coverage in farm areas complementary with agricultural crops. This will provide the farmers additional income opportunities along with enhanced risk management. Odisha had fund allocation for sub-mission on agro forestry during 2016-17 and 2018-19.

Rashtriya Krishi Vikas Yojana (RKVY)

Rashtriya Krishi Vikas Yojana (RKVY) aims to help the states in making agriculture development plans and

The activities of RKVY are linked with agriculture, horticulture and allied sectors which have strong contribution to livelihood and employment generation.

Soil Health

Soil health is an important component for sustainable profitability of the farmers. The objective of Soil Health Management is to promote location as well as crop-specific sustainable soil health management. As far as climate resilient agriculture is concerned, soil testing plays a major role by examining nutrient status of the soils and by giving suggestions on judicious use of fertilizers. In the first cycle, 100% of the target soil samples was collected and tested whereas in the second cycle, 93.1% of the soil samples were collected and 86.7% was tested. In the first cycle, 100% of the SHCs were printed and dispatched whereas in the second cycle, only 40.8% of the SHCs were printed and only 38.6% of the SHCs were dispatched.

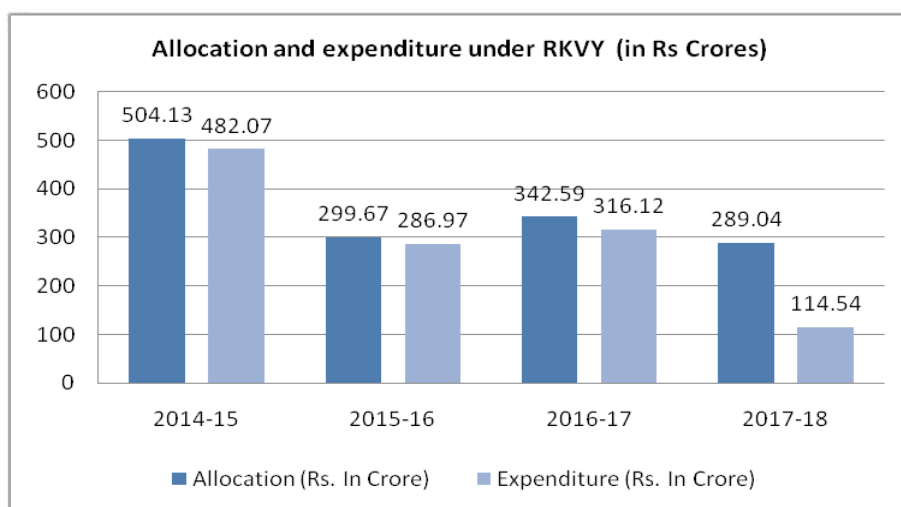


Figure 12 Allocation and Expenditure under RKVY

(Source: Statement Showing allocation release and expenditure of the State under RKVY for different years)

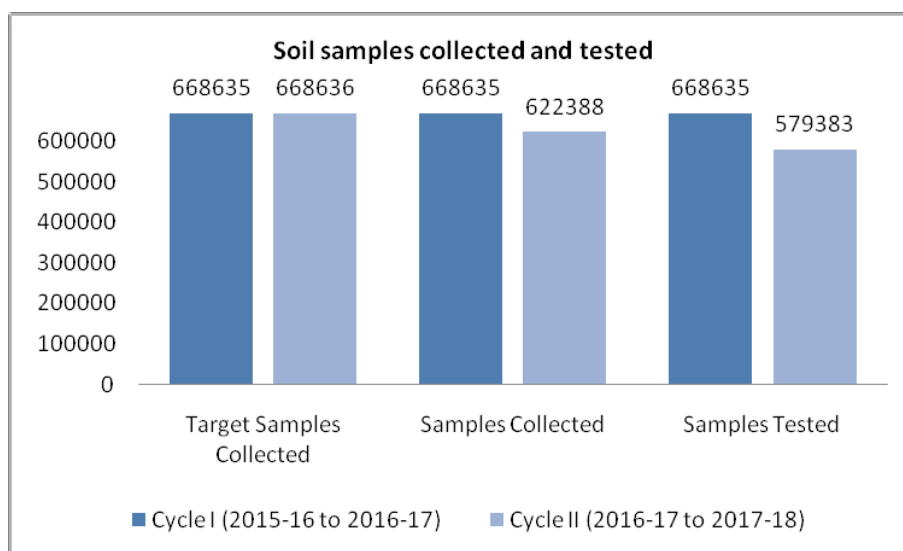


Figure 13 Soil Samples Collected and Tested

(Source: Soil Health Card Website, Scheme Progress)

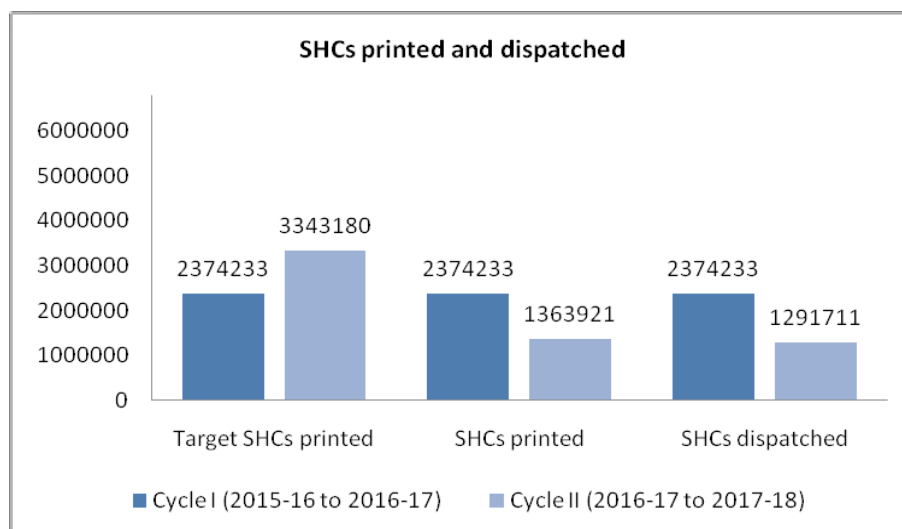


Figure 14 Soil Health Cards Printed and Dispatched

(Source: Soil Health Card Website, Scheme Progress)

attaining sustainable growth in Agriculture sector by ensuring a holistic development of Agriculture and allied sectors. It holds an important share in poverty reduction and food security.

Key policy goals that may have strong contribution to INDCs are as follows:

Key triggers	Key actions taken by state
Poverty reduction	Several welfare activities taken up by the state may see less than a quarter (20-25%) of people below poverty line at the current level of growth by 2030
Shift from paddy to non-paddy field crops	The state is already taking up hardy crops under National Food Security Mission, Millet Mission
Expansion of pulse and vegetable areas	Expansion of pulse areas under RKVY and vegetable areas under NVI will help both in enhancing farmer income as well as emission reduction
Climate resilient agriculture	The state has been changing some of the existing varieties to drought and submergence resistant varieties especially in paddy to address climate variability. Soil health card use will also help in balance use of fertilizer and nutrients

Enhancement of Carbon Sink and Green India Mission

Green India Mission focuses on the protection, restoration and enhancement of forest cover. The Mission involves adoption of adaptation and mitigation measures to respond to climate change. The objective of GIM is to expand the forest and tree cover by 5 Mha, as well as to increase the quality of existing forest and tree cover in another 5 Mha forest/non-forest lands in 10 years. Some other goals of the Mission include development of eco system services like carbon sequestration and storage, biodiversity, hydrological services and provision of fuel, fodder and NTFPs; and to enhance forest-based income.

Table 20 Allocation of funds for Odisha under Green India Mission (Rs lakh)

FY 2015-16		FY 2016-17	
Funds Allocated	Funds Utilized	Funds Allocated	Funds Utilized
398.88	182.92	297.78	138.964

The objective behind the formation of Compensatory Afforestation Management and Planning Authority

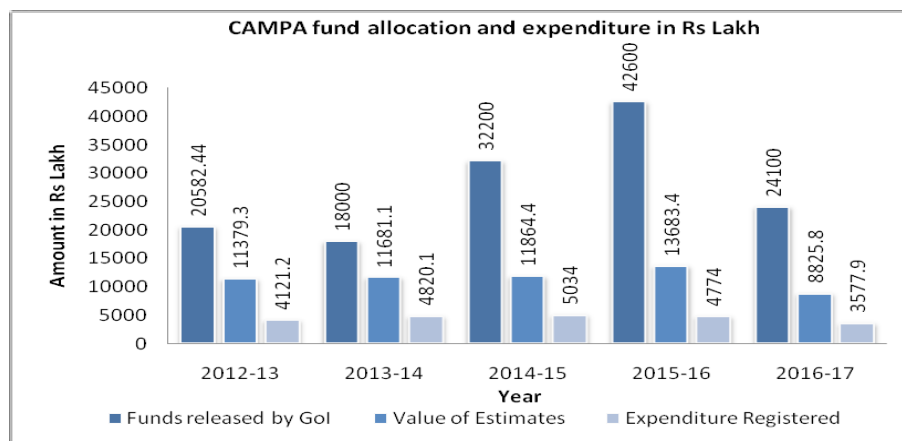


Figure 15 Allocations under CAMPA

(Source: egreenwatch.nic.in)

(CAMPA) is to monitor the effective implementation of the compensatory afforestation efforts in the country. The allocation of funds under CAMPA was to lower the effects of diversion of forest land for non-forest purpose.

As per the Forest Survey of India report, the state has added 885 sq. km forest area due to better conservation and plantation activities. Some districts have shown marginal decrease in forest cover due to developmental activities. The total carbon stock in the forests of Odisha is 452.903 million tons (equivalent to 1660.644 million tons CO₂ equivalent) which is 6.04% of the total forest carbon stock of the country.

The following measures may help in adding to the contribution to carbon sink.

Key triggers	Key actions taken by state
Expansion of carbon sink	The CAMPA program will help in restoring the forest area. The state already has 39% of its total geographical area and by 2030; there may be a possibility to stabilize that by about 40-43% taking other measures listed below.
Planting tree outside forest	The state needs to augment the plantation in major growing cities of the state (industrial and mining buffer zones) and incentivize Panchayats to plant trees in barn lands and even private lands.
Expansion of agroforestry	DoWR has already taken steps to saturate river embankments with such species and agriculture and horticulture departments may augment their effort

Water Mission

Overall goal of **National Water Mission** is to improve water use efficiency by 20%. Several schemes such as more crop per drop (micro-irrigation), **Har Khet ko Pani**, watershed activities, plantation and farm ponds, etc. in convergence with NREGA are expected to contribute to this goal. This mission also has strong adaptation potential with mitigation co-benefits through efficient energy use as well as carbon sequestration. The percentage of irrigated area in Odisha is 1.8% of the net irrigated in India and irrigated as a percentage of gross cropped area has been virtually stagnant at 36-39% as shown in the table below:

Table 21 Irrigation in Odisha (in lakh ha)

Year	Gross Cropped Area	Gross Irrigated Area	Gross Un-Irrigated Area	Irrigated area as a % of Gross Cropped areas
2010-11	85.58	31.06	54.52	36.29%

2011-12	88.01	30.88	57.13	35.09%
2012-13	88.79	33.66	55.13	37.91%
2013-14	90.54	35.21	55.33	38.89%

However, under Command Area Development and Water Management (CADWM) program, Odisha had a target of 11.15 lakh ha to bring under irrigation by March 2017. The state has not made much progress under micro-irrigation so far due to muted demand but there is ample scope for improving the water use efficiency.

Table 22 State-wise ground water resource availability in Odisha

(In BCM)

Annual Replenishable Ground water Resource				Total	Natural Discharge during non-monsoon season	Net Annual Ground Water Availability
Monsoon Season		Non-monsoon				
Recharge from rainfall	Recharge from other source	Recharge from rainfall	Recharge from other source			
11.29	2.53	1.33	2.63	17.78	1.09	16.69

Table 23 State-wise ground water resources utilization and stage of development in Odisha

(In BCM)

Annual Ground Water Draft			Projected Demand for Domestic and Industrial	Ground Water Availability for future irrigation	Stage of Ground Water Development (%)
Irrigation	Domestic and industrial uses	Total			
4.14	0.87	5.02	1.35	11.2	30

As per Central Ground Water Board (CGWB) estimate, the annual replenish-able ground water resource of the state has been estimated as 17.78 bcm and net annual ground water availability is 16.69 bcm. The annual ground water draft is 5.02 bcm and stage of ground water development is 30%.

Integrated Watershed Management Programme

Watershed development programmes aims to optimize rainwater utilization, control soil erosion; promote sustainable land use pattern, cropping and other farming practices that will enhance the production potential in an integrated way by considering all categories of land in a watershed.

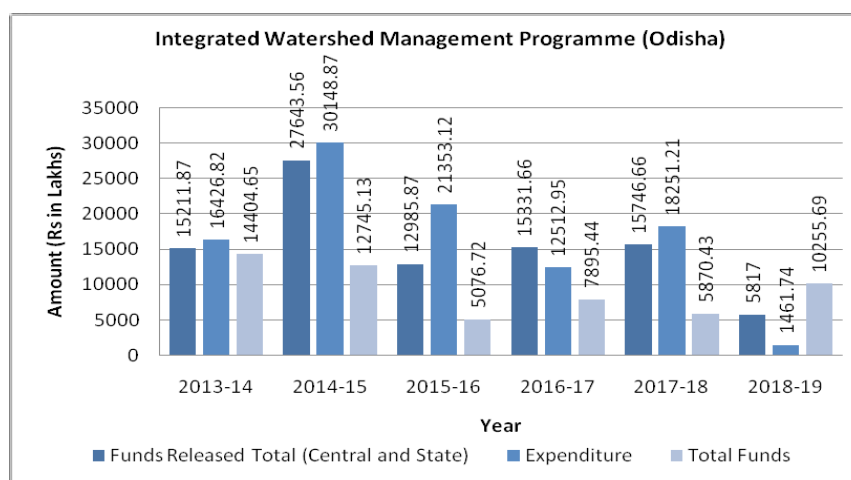


Figure 16 Financial Allocations under Integrated Watershed Management Programme

(Source: IWMP MIS Dashboard)

The watershed structures include farm ponds, nala bund, percolation tanks and some recharge structures.

Drinking Water and Sanitation

The National Government has given a special thrust to improve water and sanitation in India. The launching of **Swatchh Bharat Mission** is a transformational step in this direction. It makes the villages open defecation free; apart from numerous social benefits the mission has potential to reduce emission, disease burden and livelihood improvement. In Odisha, 45,52,605 toilets have been built since the launch of the mission on 2nd October 2014, 1334 Gram Panchayats and 15672 villages (33.05%) have been declared open defecation free (ODF). The progress has been given in the figure.

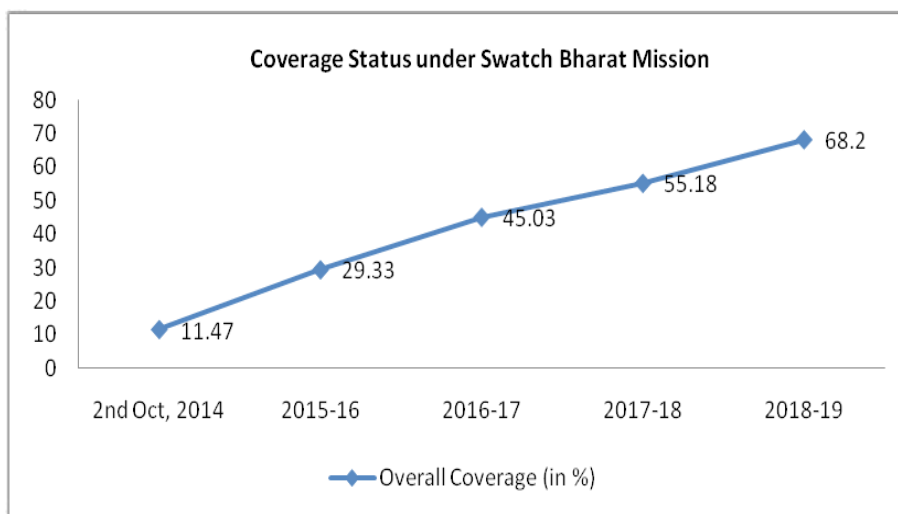


Figure 17 Coverage under Swatchh Bharat Mission as on 2018

Access to safe drinking water has satisfactory performance in the state. As per census 2011 data access to safe drinking water was 75.3% of total household in Odisha. According to Integrated Management Information System (IMIS) reports, only 2.7 percent rural habitations were not covered under drinking water supply.

National Rural Drinking Water Programme

The following measures may help in adding to the resource use efficiency and reduction in vulnerability.

Key triggers	Key actions taken by state
Enhancing water use efficiency	DoWR is making massive effort in improving the water use efficiency taking both technical and nontechnical measures. It has heavily invested in the CADA work to minimize the gap ayacut. It is also making effort to strengthen the Pani Panchayats for crop water budgeting and creating incentives for the PPs who save water. It is also implementing the PMKSY and National Mission on Micro-Irrigation and it is expected that the water use efficiency goals set under the National Water Mission can be achieved by 2030.
Drinking water and sanitation	The state has aimed have 100% coverage of habitations with drinking water supply and this is expected to be achieved before 2030. It has also undertaken massive solarisation of drinking water supply system
Sanitation for all	While the state currently is lagging behind in ODF areas under Swatchh Bharat Mission but it is expected that the state will achieve 100% ODF status much before 2030. It is introducing bio-toilets, sensitization using mobile apps and social media.

NREGA and Climate Benefits

MGNREGA which is considered as one of the largest public benefit program in the world has several climate benefits. It helps in climate change adaptation and builds resilience.

Table 24 Benefits under NREGA activities for reduction in vulnerability

Key activities	Key benefits helping in adaptation and vulnerability reduction
Soil water conservation and harvesting	Groundwater recharge, soil moisture conservation, soil erosion control, soil quality (nutrient cycling), flood control (reduced risk), providing irrigation and drinking water
Plantations	Afforestation, Soil moisture retention, reduction in diurnal variability in temperature, soil quality improvement with increase in soil organic carbon, carbon sequestration, biodiversity (reduced risk), biomass production (fuel wood) and local climate regulation
Land development and restoration of water bodies	Cross bund, deepening and repair of flood channels, desilting diversion channel, check dam, diversion weir, drainage in water logged areas, strengthening of embankment, excavation of pond, renovation of tank, construction of canal, boulder check, construction of control trench, construction of drainage channels, construction of farm bonding, development of waste/fallow land in public land
Overall	Wage employment and social protection for the poor

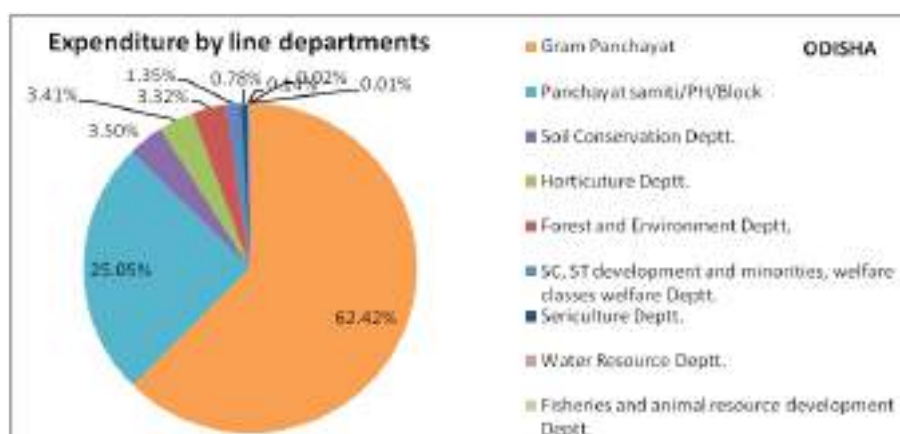


Figure 18 Expenditure work department wise under NREGA

The above analysis shows that maximum expenditure has been by Gram Panchayat and Panchayat Samiti.

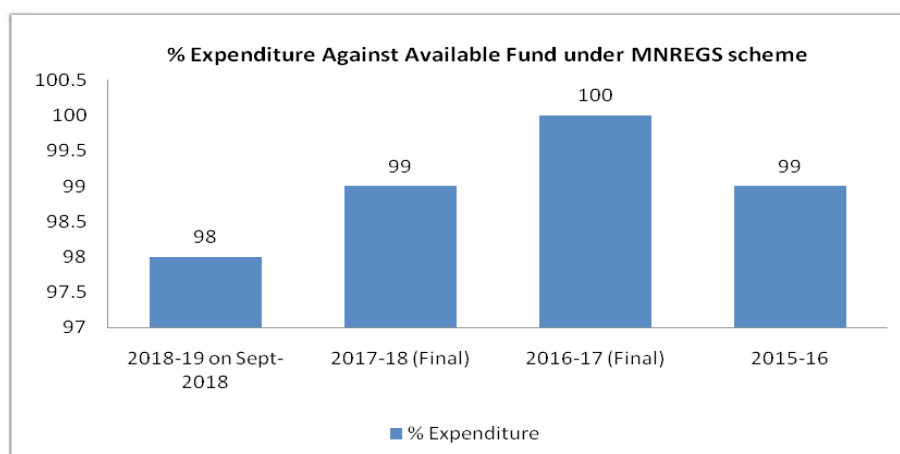


Figure 19 Expenditure against available fund

(Source: MNREGA Website)

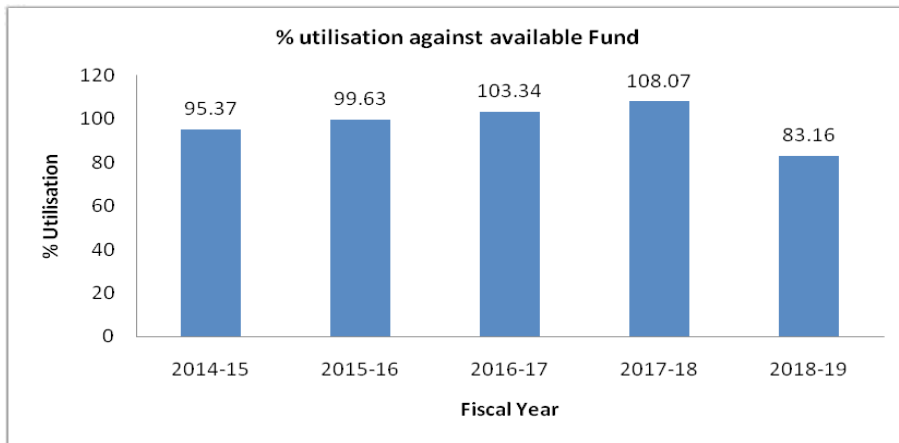


Figure 21 Number of GPs with Nil Expenditure

(Source: MNREGA Website)

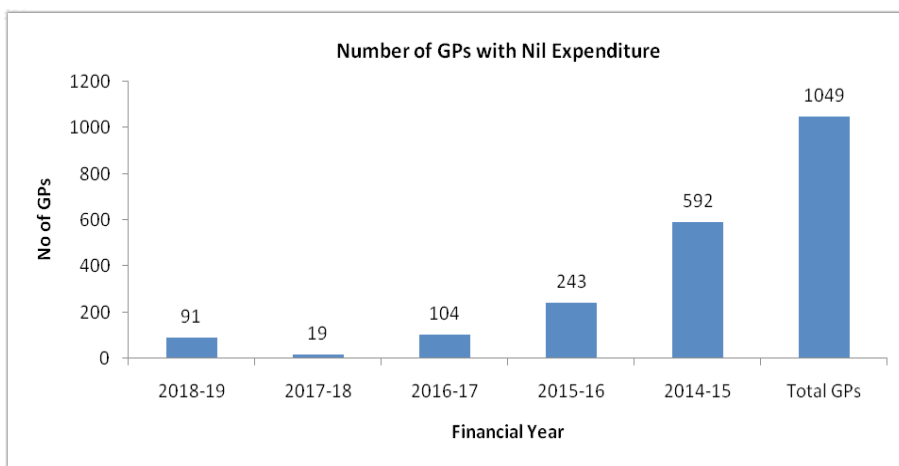


Figure 20 percentage utilisation against available fund

(Source: MNREGA Website)

NREGA activities also make significant contribution to the livelihoods of the vulnerable SC and ST communities in providing social protection.

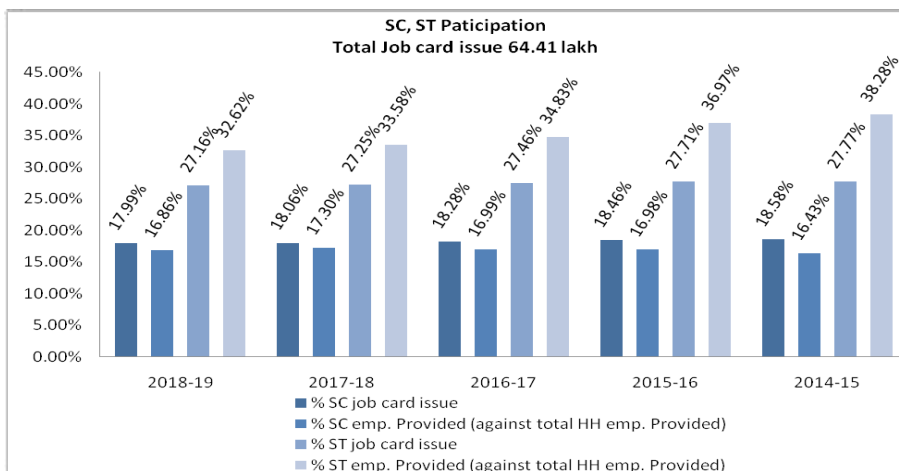


Figure 22 Vulnerability reduction and social protection of SC-STs through NREGA

(Source: MGNREGA Website)



Health Outcomes

The state has roughly 42 beds per Lakh populations but the ratio of caregivers has declined since 2012-13, the number of doctors per thousand populations too has marginally declined. However, the life expectancy for male and female have increased (for male 53.7 to 68.6 and for females from 55.3 to 66.1) between 1990 and 2016. The under-five mortality rate comparison has been given in the figure below:

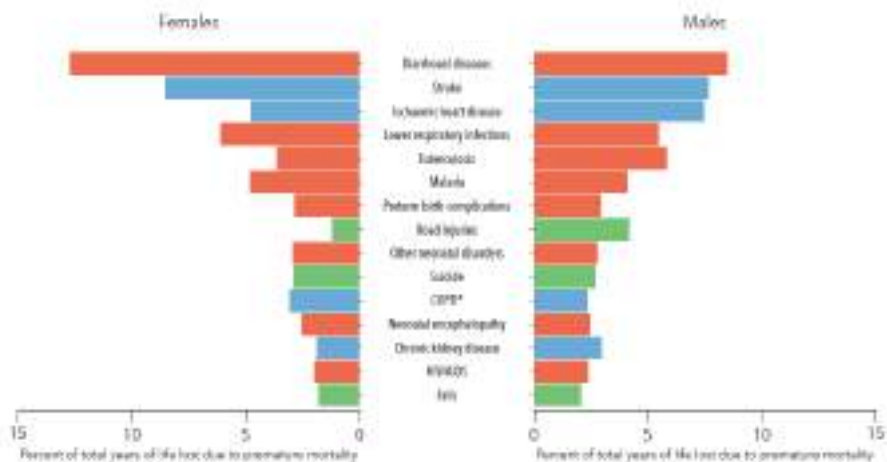


Figure 23 Under five mortality rates from 1990-2016 for Odisha and all-India
(Source: Odisha Disease Burden Profile 2016)

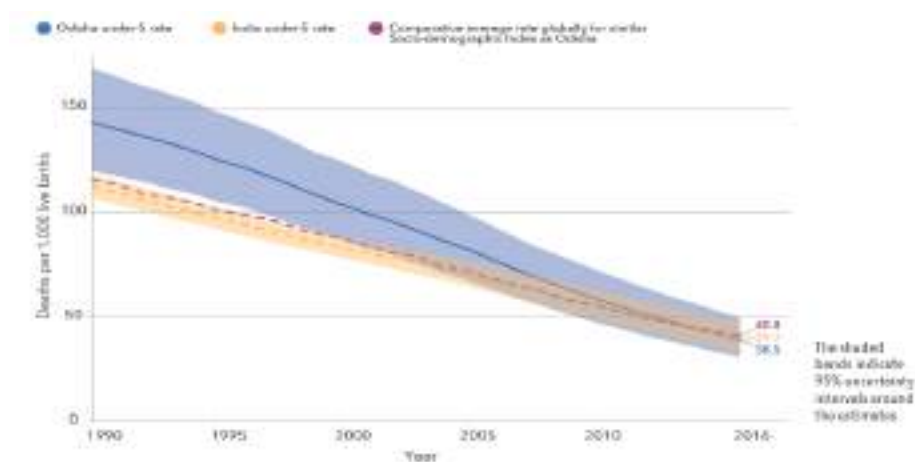


Figure 24 Pattern of disease burden in Odisha
(Source: Odisha Disease Burden Profile 2016)

Various initiatives by Government have brought down the disease burden in the state. Diseases like Leprosy have reduced to less than 1 per 10000 populations and filarial also has been controlled. However, the state has witnessed increase in malaria positive cases from 2.28 lakh in 2013 to 3.95 lakh in 2014. However, it has come down to 3.5 lakh in 2017. HIV cases have been reduced to 3008 in 2016 from 3255 in 2013.

National Rural Health Mission helps reducing health related vulnerability. The objectives of NRHM are as follows:

- To provide accessible, affordable, accountable effective and reliable primary health care facilities, especially, to the poor and vulnerable sections of the population.
- To bridging the gap in Rural Health Care services through creation of a cadre of Accredited Social Health

Activists (ASHA) and improved hospital care, decentralization of programme to district level to improve intra and inter-sectoral convergence and utilisation of resources,

- To provide overarching umbrella to the existing programmes of health and family welfare including Malaria, Blindness, Iodine deficiency, Filaria, Kala Azar, TB, Leprosy and rural Disease Surveillance.

Government is planning a focused mission under NAPCC for climate change and health related issues. The state of Odisha has already planned a mission under SAPCC in 2010 itself. The financial allocation by centre to state of Odisha has been given below. Usually the state share is around 4%.

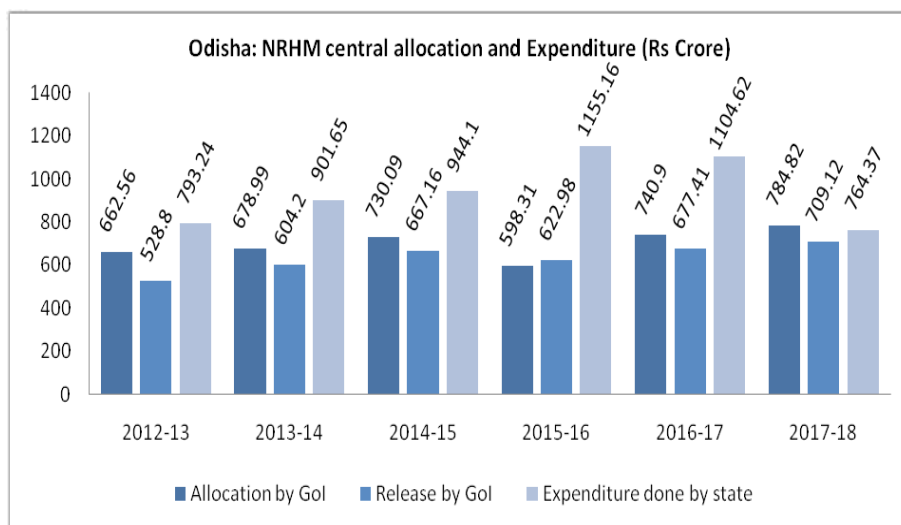


Figure 25 Financial allocation, release and expenditure of the State under NRHM
(Source: Achievements under NRHM and NUHM, Published- 06-February-2018)

There has been reported significant improvement in IMR from 65 in 2005-06 (NFHS-3) to 40 in 2015-16 (NFHS-4). This has been achieved due to improvement in accessibility and delivery system in the state. Institutional delivery has increased to 89% in 2014-15. There is a decline in sex ratio at birth. Measles cases in infants have come down from 2.2% to 0.7%, in Diarrhea a remarkable decline is observed from 96.5% to 4.2% and for fevers (including Malarial cases) there has been an increase from 1.2% to 11.3% (may be due to the aggregation of all fever cases).

Disease prevalence data shows continued raise of vector borne diseases and respiratory diseases.

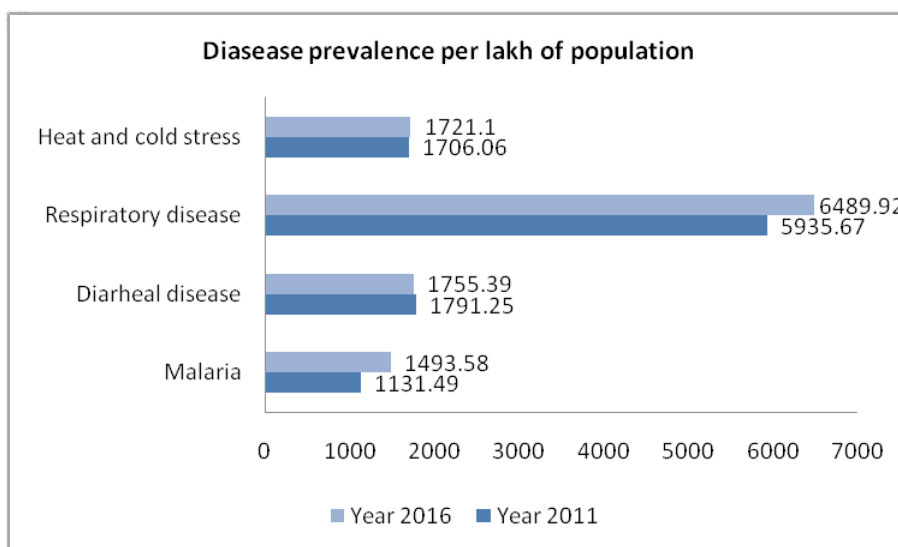


Figure 26 Disease burden trend in the state

Key triggers	Key actions taken by state
Reducing IMR and MMR	<ul style="list-style-type: none"> Odisha Government has targeted to bring down the Maternal Mortality Rate (MMR) and Infant Mortality Rate to 117 and 30 respectively by 2020. This is expected to reduce further to less than 100 for IMR and in single digits for MMR by 2030. For these, incentives are being given to ASHA workers. The training is also being given for skill development of field staff and improvement of the labour rooms is being made to reduce the mortality rate of mother and child.
Reducing the disease burden for respiratory diseases and vector borne diseases	The state has undertaken massive awareness drive for lessening the disease burden in these two areas apart from introducing insurance schemes for the poor. Improved cook stove and Ujjala program is also expected to contribute to improving health outcomes. But the other sources of pollution are rising and it is a matter of concern.

Strategic Knowledge Mission

As the state is sensitive to climate change because of its geographical location and climate change has the potential to affect the economic growth and deepens poverty, the Government has taken early initiatives to formulate Climate Action Plan to address this issue. The action plans are being implemented widely through departments/agencies such as Agriculture, Coastal and Disaster management (OSDMA), Energy, Fisheries and Animal Resources, Forestry, Health, Industries, Mining, Transport, Urban and Water Resources and other agencies.

Climate Change Cell has been set up to closely monitor all the action plans and their alignment to NDCs and resource mobilization for fulfilling action agendas. Forest and Environment Department acts as a nodal department for it to look after day to day activities related to climate change. Its key functions are to coordinate with technical agencies to help departments of the state for the formulation of policies specifically for low carbon emission development, vulnerability reduction and evaluation of progress to adjust sectoral action plans and proactive stakeholder engagement. Micro level vulnerability assessment will help in better adaptation planning. Climate Change Cell is in dialogue with expert agencies for undertaking such activities.



Figure 27 Implementing departments for Climate Change Action Plan

2.9B Performance under key NDCs areas: Mitigation Strategy

Energy & Emission and Solar Mission

The total energy demand in the system is expected to be 33224 GWh by 2018-19. This is because of declining poverty, higher economic activity and level of electrification. The per capita energy consumption has increased from 665 kWh in FY 2007 to 1146 kWh in FY 2012 which is mainly led by growth in consumer purchase power in the state. The State Government has envisaged in achieving following renewable energy capacity by the year 2022.

Table 25 Renewable Energy capacity by the year 2022

Technology	Solar	Wind	Small Hydro	Biomass	WTE	Total
Target (MW)	2378	350	150	180	20	3078

The share of renewable in Odisha has not changed much when it comes to grid interactive renewable energy. Even in decentralized systems there has not been any significant progress.

Table 26 Change in share of renewable energy

Parameters	2015-16		2011-12	
	Odisha	India	Odisha	India
Total Installed Capacity (GW)	7.66	302.08	4.38	199.96
Renewable source	0.18	42.85	0.1	24.49
Share of renewable	2.35%	14%	2.28%	12%

Source: Energy Statistics, 2017



The activities proposed in the last action plan had a focus on energy conservation and energy efficiency. Therefore, more directed focus on renewable energy generation from possible sources needs to be given for significant contribution to the INDCs.

Solar Mission: The state has divided solar power capacity into four segments: 328MW would be in the form of normal utility-scale projects, 50 MW on water bodies, 1 GW for roof top projects in commercial and domestic consumers segments and 1 GW through large scale solar parks by end of the year 2022.

Table 27 Solar Mission Target for Odisha

Solar Mission target by 2022	Grid-connected solar power	Remark
India	100 GW	May achieve it by 2022
Odisha	2378 MW Demand for solar: Roof top solar capacity to be achieved 1000 MW	To achieve this target, Odisha Government plans to create a separate Odisha Renewable Energy Development Fund.

Urbanization and development of climate resilient urban centers, Sustainable Urban Habitat Mission

In 2001 only 14.99% population was in urban areas in Odisha, which increased to 16.70% in 2011. During these decades from 2001-2011, this percentage has increased by approximately 26.90%. This shows that urbanization is accelerating. However, Odisha still ranks 31st in the list of most urbanized states of the country at 16.68% according to census 2011, while in terms of actual urban population Odisha ranks 11th in the list of states with the largest urban population. In Odisha the largest increase in urban population percentage in 2011 w.r.t 2001 has taken place in the Nayagarh district which had 115.1% decadal growth rate of urban population due to infrastructure development and civic amenities. However, Jagatsinghpur and Deogarh district in Odisha recorded low growths which is due to lack of expansion of economic activities. The urban population in Odisha is higher in the two districts- Khordha at 10, 84,405 in 2011 and Ganjam where the corresponding figure was relatively lower at 767,917. In Khordha the percentage of urbanization is high because of the presence of large metropolitan center. The urbanization and spread of urban sprawl result in resource congestion, waste accumulation, congestion and emission.

The state capital Bhubaneswar has been covered under AMRUT as well as smart city program. Under State Annual Action Plan 2017-18 the projects have been approved under AMRUT for provision of water supply, septage and park spaces in Bhubaneswar which cost around 123.98 Crores.

Table 28 Envisaged changes in service levels with project under SAAP (2017-18)

Sl No	City name	Projects (Sectors)	Estimated cost and share (INR crores)				Change in service levels		
			GoI	State	ULB/Others	Total	Indicator	Existing	On project completion
1	Bhubaneswar	Water Supply	58.87	58.87	-	117.74	Coverage	35.00%	95%
		Septage	0.85	0.85	-	1.7	Coverage	-	100%
		Parks	2.27	2.27	-	4.54	Sq.m./P	16	-

Also the Smart City Proposal of Bhubaneswar got selected and stood first in round 1 of the Smart City challenge of Ministry of Housing and Urban Affairs, Government of India. The city proposed developments in two major components namely,

- Area Based Development in a selected area called "Bhubaneswar Town Centre District (BTCD)" comprising

primary projects like integrated development of water supply, energy infrastructure, multilevel car parking, green parks and lakes development

- Pan City development of technological projects named as “Smart Solutions” comprises of city wide technological interventions in the field of traffic, transit, parking, emergency response & incidence management systems, common payment card, enterprise resource planning, e-governance and a Command Control Centre for the city

Apart from this Odisha has given top priority to “AWAAS – Odisha Urban Housing Mission” for achieving the objectives of “Housing for All” in Urban areas. It aims to create shelter for every identified homeless including temporary migrants. The State Government has launched Aahaar program to provide cooked hot meals to the poor and needy people at places of public congregations in urban areas. Currently 110 centres are operational across 30 districts of Odisha.

Overall Mitigation Scenario

Energy consumption constitutes the major source of GHG emission in the state¹⁷. In line with the NDCs commitment of reducing the emission intensity, the section intends to assess the current (2016-17) emission intensity and variation in emission intensity of 2016-17 from 2011-12 level. The synopsis of the sector wise estimation is presented in the table below:

Table 29 GHG emission from energy consumption

S. No.	Emission Source	GHG Emission (tCO ₂ Eq)	
		2016-17	2011-12 ¹⁸
1	Electricity generation and usage	5,68,65,127	5,07,70,105
2	Transportation (Vehicular, freight, rail and aviation)	84,63,875	60,77,759
Note: Emission form electricity consumption (57,28,86,792 kWh) for railway operation and its equivalent emission of 5,27,056 tCO ₂ is not accounted as the total electricity consumed is accounted under S. No. 1			
3	Residential and commercial	21,24,121	15,73,317
4	Agriculture	4,98,215	-
5	Other source	38,96,199	9,07,641
Note: Emission from consumption of petroleum products viz petrol, diesel, bitumen, LDO and FO (other than for the purpose of transportation, agriculture and residential sector)			
Emission from consumption of coal (other than for power generation) equivalent to 7,60,14,200 tCO ₂ is not accounted for estimation of emission intensity since the same was not considered under 2011-12 estimation. However, the same was calculated to present an overview of the degree of emission.			
6	Fugitive Emission	33,57,678	19,78,598
Total Emission (tCO ₂)		7,52,05,215	6,13,07,420
CAGR of GHG emission		4.32%	

The emission intensity is estimated below:

Table 30 Emission intensity of energy consumption

Factors	(2016-17)	(2011-12)
Total Emission (tCO ₂)	7,52,05,215	6,13,07,420
CAGR of GHG emission	4.32%	
GSDP (in Lakh Rs.)	3,77,20,178	2,30,98,708

¹⁷ State Action Plan on Climate Change (62% of the total GHG emission is from energy consumption, section 3.1)

¹⁸ CII Report

CAGR of GSDP	10.31%	
Emission intensity (kg CO ₂ eq/Rs. 1,000)	19.94	26.54

The above estimation reveals a reduction in the emission intensity during 2016-17 from 2011-12 level. The reduction of emission intensity owes to comparatively higher growth in GSDP (CAGR of 10.31%) in comparison to sectoral growth of GHG emission (CAGR of 4.32%) and adoption of number of energy conservation and clean energy measures in due course.

Assessing impact of mitigation initiative (2015-18) on NDCs commitment

The NDCs commitment pertaining to Energy sector includes

1. Reduce the emission intensity of its GDP by 33% to 35% by 2030 from 2005 level.
2. Achieve about 40% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.

Addition of on-grid renewable energy project (2015-18)

As against the cumulative coal-based electricity generation capacity of 4992.90 MW (including state's own generation unit, share of joint and Central sector power project, IPP and CPP); the cumulative installed capacity of renewable energy project is only 232.78 MW¹⁹. The share of renewable energy as on date is only 4.66%.

Table 31 RE based capacity in the State

Description	Installed Capacity (MW)
Installed capacity -Solar (stand alone, park etc)	201 ²⁰
Note: Of the 201 MW installed solar power project, 148 MW is accounted as state share for utility supply. However, the entire capacity of 201 MW is considered for the purpose of assessing the emission intensity reduction from mitigation intervention.	
Installed capacity -Solar (Rooftop)	20 ²¹
Note: Rooftop is not considered under utility scale supply. However, the entire capacity of 20 MW is considered for the purpose of assessing the emission intensity reduction from mitigation intervention.	
Installed capacity -SHP	64.625 ²²
Installed capacity -Biomass	20

Of the above-mentioned three-renewable energy-based power generation options, capacity addition of utility scale solar and rooftop solar is carried out during 2015-18. Therefore, the impact is estimated for generation from solar power unit only.

Contribution of RE capacity addition on NDCs commitment 2

Table 32 Contribution of RE capacity addition on NDCs commitment for increase in share of RE

Description	2015	2018
Installed capacity of fossil fuel-based power generation (MW)	6753.04 ²³	4992.90
Installed capacity of RE units (MW)	116.39	232.78
Share of renewable	1.72%	4.66%

¹⁹ CEA

²⁰ <https://bridgetoindia.com/wp-content/uploads/2018/11/BRIDGE-TO-INDIA-India-RE-Map-September-2018.pdf>

²¹ Bridge to India rooftop map March 2018

²² MNRE Annual Report

²³ http://www.cea.nic.in/reports/monthly/executivesummary/2015/exe_summary-05.pdf

Contribution of RE capacity addition on NDCs commitment 1

Table 33 Contribution of RE capacity addition on NDCs commitment of emission intensity reduction

Description	Unit	Value
Capacity addition of solar power generation during 2015-18	MW	196.24
Note: Cumulative Solar installed capacity by 2015 was 38.76 MW and by 2018 it is 221 MW. So, capacity addition during 2015-18 is 196.24 MW.		
Estimated annual generation @17% PLF	MWh	292,240
Emission for sourcing equivalent quantum of power from grid (@ grid emission factor of 0.92 tCO ₂ /MWh)	tCO ₂	268,861
Emission intensity ²⁴	kg CO ₂ eq/Rs. 1,000	0.07
Equivalent reduction of emission intensity	%	0.36%

Uptake of energy efficiency initiative

UJALA Scheme

UJALA scheme launched in May 2015 involves dissemination of energy efficient light and energy efficient fan to domestic consumer towards ensuring energy efficiency in domestic sector.

Table 34 Dissemination of EE light and fan under UJALA

Description	No. of units disseminated	Annual Energy saving (MWh)	Annual Emission Reduction (tCO ₂)
Dissemination of LED	1,85,74,764	24,12,249	19,53,922
Dissemination of EE fan	35,322	3,284.95	2,694
Dissemination of LED tube light	1,33,787	5,859.87	4,805
Cumulative saving		24,21,394	19,61,421

The impact of implementation of UJALA scheme on reduction of energy intensity (2017 GSDP base) is estimated below:

Table 35 Estimation of impact of UJALA on reduction of emission intensity

Description	Unit	Value
Emission for sourcing equivalent quantum of power from grid ²⁵	tCO ₂	19,61,421
Emission intensity ²⁶	kg CO ₂ eq/Rs. 1,000	0.52
Equivalent reduction of emission intensity	%	3%

Initiatives by SDA

The energy conservation initiatives by SDA includes (a) implementation of energy efficient measures in Drinking Water Pumping Station (DWPS), (b) EE implementation across Govt. buildings, (c) LED village campaign and (d) implementation of EC measures at OMFED.

²⁴ GSDP for 2017 is considered for estimation

²⁵ Estimated at UJALA dashboard

²⁶ GSDP for 2017 is considered for estimation

Table 36 EE initiatives by SDA

Initiatives	Capacity Avoidance (MW)	Equivalent Energy (MWh)
Implementation of DWPS	3.03	18,580
EE implementation at Govt. buildings	2.36	14,472
LED village campaign	0.142	871
OMFED initiatives		3,000
Total		36,922

Note: equivalent energy is estimated @70% CUF

Table 37 Estimation of impact of EE on reduction of emission intensity

Description	Unit	Value
Net energy saving	MWh	36,922
Emission for sourcing equivalent quantum of power from grid ²⁷	tCO ₂	33,968
Emission intensity ²⁸	kg CO ₂ eq/Rs 1,000	0.01
Equivalent reduction of emission intensity	%	0.05%

²⁷ Grid emission factor of 0.92 tCO₂/MWh

²⁸ GSDP for 2017 is considered for estimation

Odisha Climate Profile

3.1 Climate Profile

The state is having a tropical climate which is characterized by high temperature, high humidity, medium to high rainfall and short and mild winters. The south west monsoon covers the entire state by June second week and the state receives heavy rainfall from June to September. The winter season settles in the state from the month of November. The state of Odisha is highly vulnerable to climate change as described for each sector in the SAPCC.

The following climate trends are available for the state as a whole.

Table 38 Summary of Climate Analysis

Observed Climate Data ²⁹ (1951-2013) IMD Gridded Data		
Temperature	Precipitation	Climate Extremes
Increasing trends observed for both maximum temperatures (Medium to high confidence). In contrast minimum temperature showed a decreasing trend (Low confidence).	Annual average precipitation showed a decreasing trend. The average total rainfall from 1871-1990 baseline period was 1166.4 mm and the observed trend from 1871-2016 was (-0.24 mm/year)	Frequency of one day maximum precipitation, warm nights and hot days increased (Medium confidence)
Projected Climate Data ³⁰ (2020-39): RCP 4.5 and RCP 8.5		

²⁹ Based on IMD Gridded data for 63 years

³⁰ Based on 29 GCMCMIP simulated for before Mid Century Scenario (near term to our INDCs 2030) under RCP 4.5 and RCP 8.5 scenarios

Projected change in Temperature Under RCP 4.5 Tmax; 0.4°C to 1.2°C TMin: 0.3 to 2.7 °C	Projected annual precipitation changes Under RCP 4.5: - 4.6 to + 25.7 %	Increase in frequency of extreme rainfall events such as droughts, floods. Intermittent dry spells and unseasonal rainfall will become a big issue. The heat index (exceeding 35 °C will be 17.4 in near term (by 2039) and would increase to 42.8 by 2059. Largest single day rainfall is expected to be less by -5.37 mm. However, annual consecutive days for dry spell are expected to reduce by 9.4 days in the near-term. The annual wet spell days are also expected to reduce by 8.71 days.
Under RCP 8.5 Tmax; 0.7 to 1.4°C TMin: 0.6 to 3.9 °C	Under RCP 8.5 - 5 to + 30.9 %	

3.2 Temperature

Based on the historical IMD Gridded data on daily temperature (maximum and minimum) and rainfall from 1951-2013 for the state has been analyzed. This has been given in the table below.

Table 39 Past Observed temperature pattern

District	Average max Temp	Average min Temp
Angul	32.04	21.46
Bolangir	31.96	19.97
Balasore	32.05	20.22
Bargarh	32.34	21.02
Baudh	32.34	21.02
Bhadrak	31.32	22.04
Cuttack	32.34	21.02
Debagarh	32.05	20.22
Dhenkanal	31.35	21.40
Gajapati	31.02	21.53
Ganjam	31.80	21.69
Jagatsinghpur	31.18	21.49
Jajpur	31.35	21.40
Jharsuguda	31.94	19.87
Kalahandi	31.61	20.84
Kandhamal	31.65	21.58
Kendrapara	31.32	22.02
Kendujhar	32.04	21.15
Khordha	31.18	21.49
Koraput	31.39	21.86
Malkangiri	31.82	20.54
Mayurbhanj	31.96	18.62
Nabarangpur	31.80	21.69
Nayagarh	32.17	20.73
Nuapada	32.04	21.15
Puri	31.18	21.49
Rayagada	31.02	21.53
Sambalpur	32.34	21.02

Subarnapur	31.94	19.87
Sundergarh	32.05	20.22

From the above table it shows that, the maximum average temperature in the past was observed in undivided Sambalpur (Sambalpur and Bargarh) and Boudh districts. Lowest average minimum temperature was recorded in Mayurbhanj district.

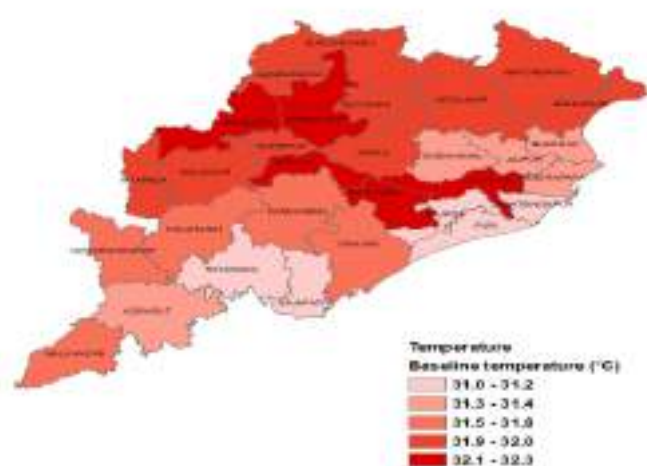


Figure 28 Odisha temperature trend baseline scenario for Maximum Temperature

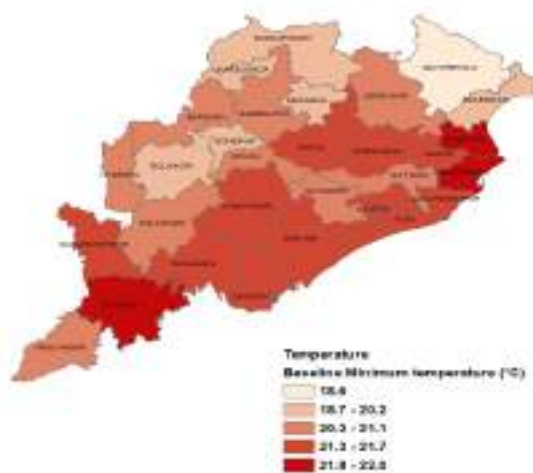


Figure 29 Odisha temperature trend baseline scenario (Minimum Temperature)

The projected temperature for near-century (2020-2039) under RCP 4.5 is given below:

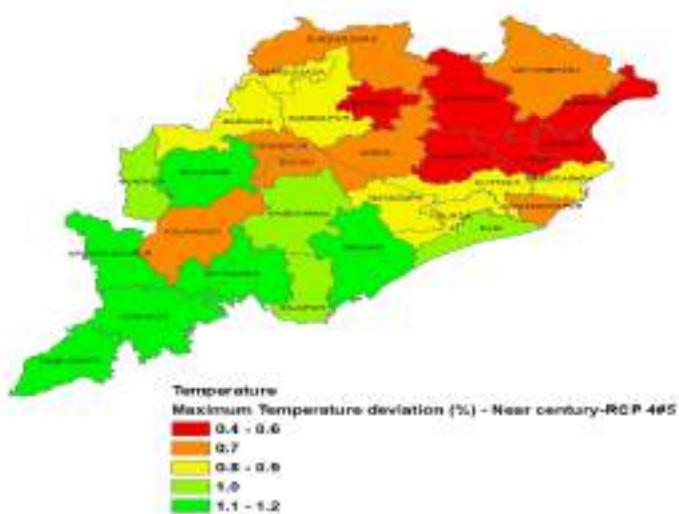


Figure 30 Maximum temperature deviation in near century under RCP 4.5 scenario

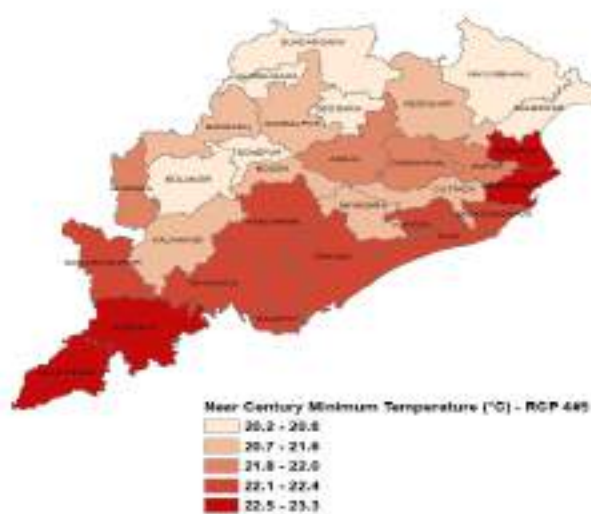


Figure 31 Minimum temperature deviation in near century under RCP 4.5 scenario



The analysis³¹ of the projected daily temperature under climate change scenarios shows that:

- Mean annual maximum temperature for RCP4.5 scenario is projected to increase by about 0.4 to 1.2 °C in near term and 0.8 to 2.8 °C in mid-century. For RCP 8.5 scenario it is projected to increase by about 0.7 to 1.4 °C in near term and 2.0 to 3.3 °C by mid-century.
- Mean annual minimum temperature for RCP4.5 scenario is projected to increase by about 0.3 to 2.7 °C by near term and 1.6 to 4.2 °C by mid-century. For RCP 8.5 scenario it is projected to increase by about 0.6 to 3.9 °C 2.0 to 4.9 °C by mid-century.

3.3 Rainfall

The analysis of annual rainfall reveals a negative trend indicating that the total amount of rainfall received has been decreasing for some parts of the states. Even in the baseline scenario, the trend shows a decline from 1871-2016 (-0.24 mm). There are however, 25 excess rainfall years and 26 deficit rainfall years.

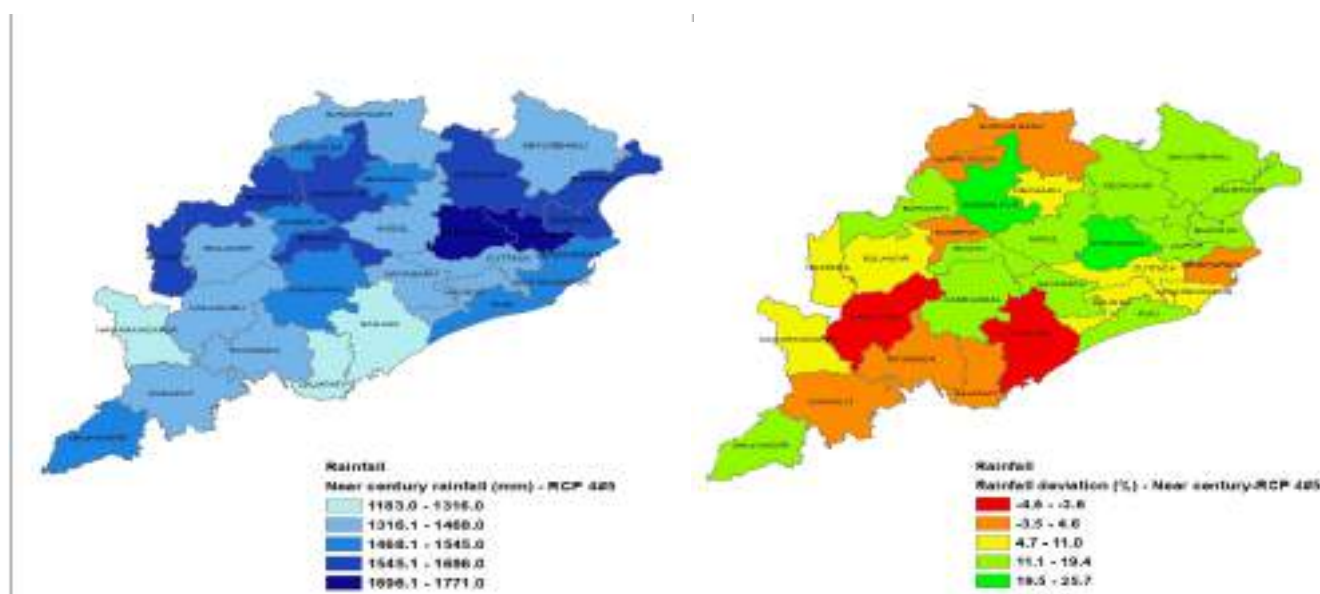


Figure 32 Odisha near century rainfall pattern under RCP 4.5 scenario Figure 33 Odisha near century rainfall deviation from baseline under RCP 4.5 scenario

Mean annual rainfall for RCP 4.5 scenario is projected to decrease by - 4.6% to an increase of + 25.7 % in the near term and a decrease of - 8.2 to an increase of + 55.7% towards mid-century in the districts. This has been spatially shown in the figure above. This shows a very wide variation and will impact irrigation and flood control in the state. For RCP 8.5 scenario rainfall is projected to decrease by- 5 to + 30.9 % and increase to + 1.7 to + 65.1 % mid-century scenario.

General implications of temperature increase may include heat stress related health impacts, increase in energy demand for cooling, additional evaporation and evapotranspiration 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. As per the monitoring report by the climate change cell, Government of Odisha, the climate investment commitment by the state has increased to 4% (in 2014-15) of the total budget up from 3.3% in 2012-13. Based on the investments made some changes have been noticed in the vulnerability between 2012 and 2017, however due to paucity of data, only some critical indicators for which data points are available for projection have been chosen.

³¹ Climate Impacts and Vulnerability Assessment by CTRAN consortium

Vulnerability Assessment

A vulnerability assessment is the process of recognizing, measuring and prioritizing the vulnerabilities in a system. Vulnerability assessment helps in:

- Understanding present vulnerability as well as likely vulnerability in the future
- Recognizing the factors that make some areas more vulnerable than others
- Inform and encourage the decision-making process
- Selection of adaptation strategies and practices

4.1 Methodology

The risk and vulnerability assessment have been done broadly as per the IPCC-AR5 methodology. The hazard due to temperature and precipitations for the mid-century scenario (under RCP 4.5) remains same during the period 2012-17. Change in Drought Proneness (2021-2050 over 1961-1990) and Change in Incidence of Dry Spells of ≥ 14 days (2021-2050 over 1961-1990) change in mean maximum rainfall in three consecutive days as % to annual normal (2021 -2050 to 1961-1990) are other parameters considered. The two periods considered for this analysis are: First period from 2009-10, 2010-11 and 2011-12 (when the first SAPCC was formulated); second period is 2013-17. Some of the data variables that are 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.

A set of 36 indicators for which data were available at the district level were collected for computation of the index. In essence, the data shows the change in vulnerability as well as the change in risk over the last five years.

Table 40 Example of some of the Indicators for the computation of the Combined Vulnerability Index

Indicators	Interpretation with respect to risk and hazard due to their exposure, sensitivity and adaptive capacity
Projected increase in temp in °C by 2050	higher temperature means higher risk of drought hazard, water scarcity and yield loss to the exposed

Projected increase in precipitation in % by 2050	higher precipitation means higher risk of flood hazard yield loss due to submergence of the exposed
Multi-hazard score	Higher the score, higher is the risk to the exposed population
Sex Ratio (2011)	A better sex ratio ensures gender equity and work division and better ability to cope with the risk
Urban population growth decadal	Higher exposed urban population affects the capacity of the exposed to cope to hazards and they will have less ability to cope with the risk due to resource congestion
Literacy rate (2011)	Higher the literacy of the exposed population they have better ability to cope with the risk due to climate change
% of Forest area to Geographical area (2011)	Positive change in forest area helps in carbon sequestration and reduction in local climate variability
Share of agriculture workers (2011)	Agricultural workers especially with monoculture of paddy, least diversification and low value addition are sensitive to climate variability adversely
Cropping Intensity (2011-12)	Positive change in cropping intensity shows the instances of diversification, availability of residual moisture and irrigation and lesser vulnerability
Livestock Population (2012)	Livestock population especially considering the food habits of the region is likely to enhance methane emission due to enteric fermentation and has adverse relationship with climate sensitivity
Electricity access% to total household (2011)	People having better access to electricity have better adaptive capacity
Access to toilets (2011)	Access to toilets will reduce open defecation, reduce water pollution, reduce disease burden and improve adaptive capacity
Share of household using firewood for cooking (2011)	People having more usage of firewood for cooking would affect forest biomass, increase indoor air pollution, pulmonary diseases and affect adaptive capacity in the long run
Share of household using crop residue for cooking (2011)	-same as above
Share of household using electricity for cooking (2011)	Usage of electricity for cooking will enhance adaptive capacity
Access to Mobile Phone Only % (2011)	Access to mobile phones will help in dissemination of information like early warning system, pest and disease, market information, etc. and would improve the adaptive capacity
Households having access to banking services (2011)	Household having access to banking will help in improving their livelihood and improved adaptive capacity
Road density (2011)	Better road density is linked to reduction in congestion, livelihood options and thus enhances adaptive capacity

The baseline period was chosen when the state Climate Change Action Plan was prepared and the 2-3 years prior to that for which data from census and other official sources were available for the districts. This was compared with either the data after 2015 or projected for the period in 2017 wherever feasible. Principal component analysis method was used to compute the index after necessary normalization. For the projected figures only RCP 4.5 and near-century scenario has been considered.

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

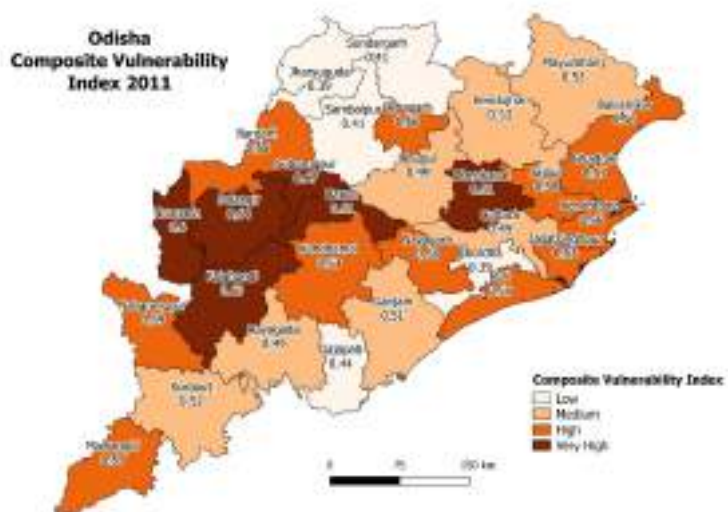


Figure 34 Baseline Composite Vulnerability Index, 2011

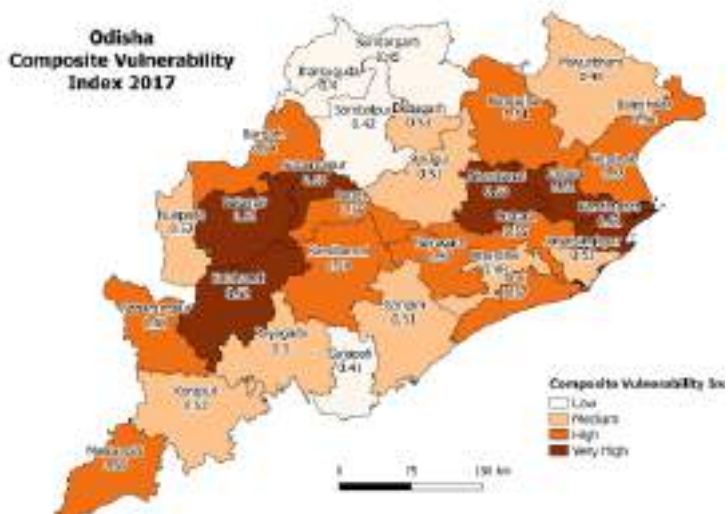


Figure 35 Composite Vulnerability Index, 2017

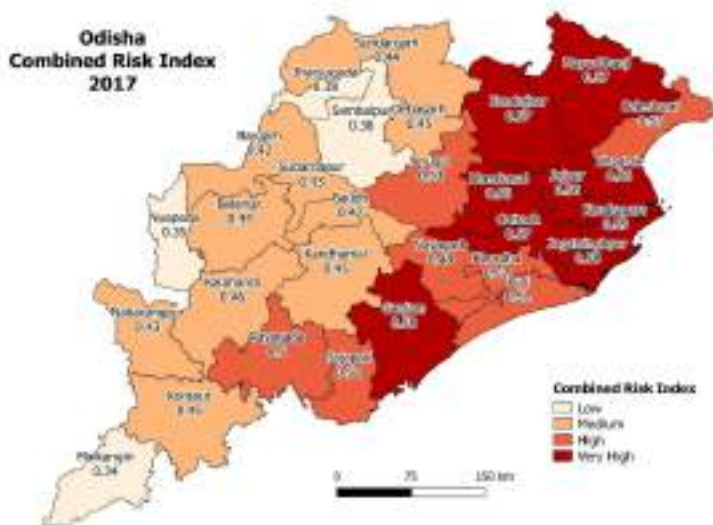


Figure 36 Combined Risk Index, 2017



The table below shows, there has been marginal change in vulnerability in last five years with KBK region remaining vulnerable. Vulnerability in northern Odisha (esp. Keonjhar) has worsened.

Table 41 Composite Vulnerability Index and Risk Index (2017)

Districts	Hazard Index	Exposure Index	Composite Vulnerability Index	Combined Risk Index	Composite Vulnerability Rank (2017)	Combined Risk Rank (2017)
Angul	0.562	0.534	0.505	0.534	23	10
Bolangir	0.392	0.328	0.607	0.442	5	21
Balasore	0.525	0.496	0.559	0.527	11	11
Bargarh	0.235	0.482	0.536	0.418	16	25
Baudh	0.252	0.435	0.562	0.416	10	26
Bhadrak	0.637	0.503	0.551	0.563	12	8
Cuttack	0.631	0.53	0.549	0.57	13	6
Debagarh	0.388	0.445	0.529	0.454	18	18
Dhenkanal	0.558	0.559	0.629	0.582	2	3
Gajapati	0.589	0.569	0.414	0.524	29	12
Ganjam	0.701	0.528	0.514	0.581	22	4
Jagatsinghpur	0.623	0.598	0.528	0.583	19	2
Jajpur	0.571	0.485	0.619	0.558	3	9
Jharsuguda	0.341	0.385	0.399	0.375	30	28
Kalahandi	0.359	0.407	0.618	0.461	4	17
Kandhamal	0.264	0.536	0.542	0.447	15	19
Kendrapara	0.561	0.61	0.606	0.592	6	1
Kendujhar	0.688	0.494	0.536	0.573	17	5
Khordha	0.615	0.464	0.478	0.519	26	14
Koraput	0.412	0.413	0.516	0.447	21	20
Malkangiri	0.163	0.306	0.549	0.339	14	30
Mayurbhanj	0.651	0.563	0.482	0.566	25	7
Nabarangpur	0.349	0.362	0.578	0.429	7	23
Nayagarh	0.375	0.506	0.572	0.485	8	16
Nuapada	0.052	0.479	0.524	0.352	20	29
Puri	0.492	0.501	0.569	0.521	9	13
Rayagada	0.544	0.456	0.504	0.501	24	15
Sambalpur	0.237	0.468	0.423	0.376	28	27
Subarnapur	0.255	0.378	0.653	0.429	1	24
Sundargarh	0.392	0.484	0.445	0.441	27	22

The change in risk and vulnerability of the state has been given in the table below:

Table 42 Change in risk and vulnerability 2011-12 to 2016-17

Districts	Composite Vulnerability Rank (2011)	Composite Vulnerability Rank (2017)	Combined Risk Rank (2011)	Combined Risk Rank (2017)
Angul	25	23	13	10
Bolangir	2	5	17	21
Balasore	14	11	12	11
Bargarh	9	16	23	25
Boudh	4	10	24	26
Bhadrak	11	12	7	8
Cuttack	24	13	10	6
Debagarh	15	18	22	18
Dhenkanal	5	2	4	3
Gajapati	26	29	6	12
Ganjam	22	22	1	4
Jagatsinghpur	17	19	5	2
Jajpur	8	3	9	9
Jharsuguda	30	30	30	28
Kalahandi	3	4	21	17
Kandhamal	18	15	20	19
Kendrapara	13	6	3	1
Kendujhar	19	17	8	5
Khordha	29	26	16	14
Koraput	21	21	18	20
Malkangiri	12	14	28	30
Mayurbhanj	20	25	2	7
Nabarangpur	7	7	19	23
Nayagarh	10	8	15	16
Nuapada	6	20	29	29
Puri	16	9	11	13
Rayagada	23	24	14	15
Sambalpur	27	28	27	27
Subarnapur	1	1	25	24
Sundargarh	28	27	26	22

The above table shows the changes in the risk and vulnerability spatially in last five years since the SAPCC was implemented. It shows by and large most districts have had significant changes in their risk profile except for Sambalpur, Nuapada. While Subarnapur continues to be the most vulnerable during the last five years, Jharsuguda continues to be least vulnerable. Bargarh and Boudh have better resilience in terms of reducing their vulnerabilities most in last five years where as Cuttack, Keonjhar, Dhenkanal and Jajpur have become more vulnerable. Kendrapara district tops the list in terms of its risk profile. Maximum improvement is noticed in case of Gajapati in better managing the risk in last five years. However, more granular and sector specific data will be needed to have sector specific targeting and planning. Considering that, the data is aggregated; this gives an idea about the climate hotspots in the state for integrated planning.

4.2 Other Sectoral Vulnerability & Hazards

4.2.1 Sea Level Rise and Coastal Vulnerability

According to the IPCC's Fifth Assessment Report, future rates of sea level rise are expected to exceed those of recent decades, thereby increasing coastal flooding, erosion and saltwater intrusion into surface and groundwater. The report predicts cyclone frequency, intensity and sea level rise. In turn, these would increase coastal flooding and the loss of coral reefs and mangrove forests and would exacerbate wave damage. Individual fish species are projected to shift their ranges northward in response to rising sea surface temperatures and the body size of certain marine fish is likely to shrink, which will affect the fishing community.

A study by the Indian National Centre for Ocean Information Services (INCOIS) estimated the Coastal Vulnerability Index (CVI) of Odisha by dividing the entire coastline into grids of 1 kilometre by 1 kilometre. Eight risk variables such as sea level rise, coastal geomorphology, tidal range and elevation were assigned appropriate risk classes (1, 2, 3) based on their ability to cause low, medium and high damage, respectively, for the area of the coastline. The vulnerable points along the coastline identified by the study appear in Figure 37.

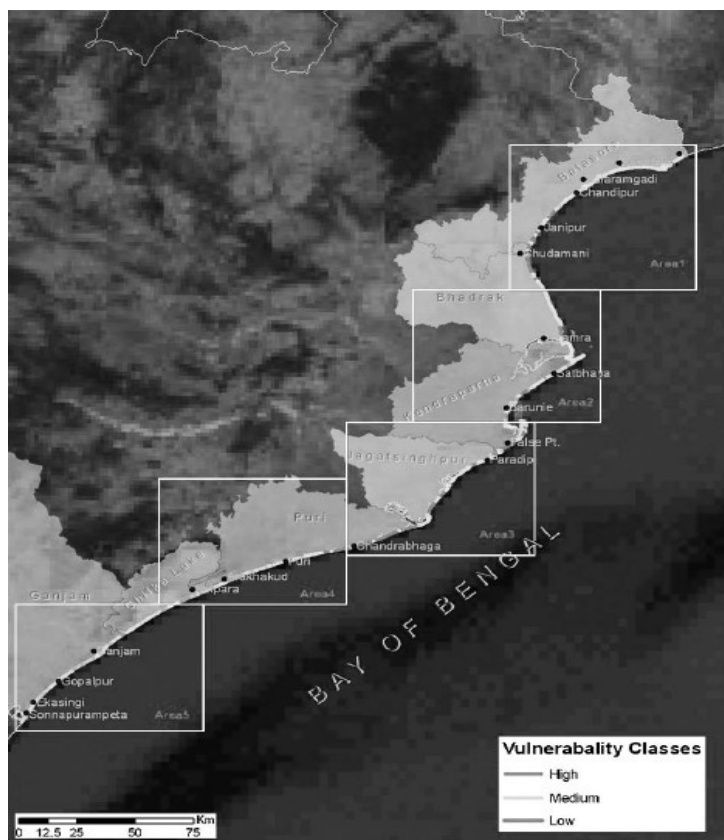


Figure 37 Coastal Vulnerability Odisha

Source: Kumar et al. 2010.

The CVI value in the study area of Odisha coastline varied from 2.1 to 1.9 (Kumar et al. 2010). The 25th and 50th percentiles of CVI value are 4.75 and 9.5, respectively. In vulnerability to damage, those parts of the coastline having CVI values ranging from 2.1 to 4.75 are considered to be in the low class; those ranges from 4.75 to 9.5 in the medium class; and the remaining parts with CVI values of over 9.5 in the high class. Accordingly, in vulnerability to damage, about 76 kilometres of the coastal stretch of Odisha state, covering parts of Ganjam, Chilika, southern Puri and Kendrapara, are in the low class; about 297 kilometres, covering northern Ganjam, Chilika, Central Puri, Jagatsinghpur, Kendrapara, southern Bhadrak and northern Balasore, are in the medium class; and about 107 kilometres, covering northern Puri, parts of Jagatsinghpur, Kendrapara, northern and southern Bhadrak and southern Balasore, are in the high class. A detailed study on Shoreline Management of Odisha coast has been conducted by ICZMP with the support of World Bank. A brief summary of the said study is annexed at **Annexure-3** for information.

4.2.2 Flood

With a flood-prone area of 33,400 square kilometres, Odisha is the fifth most flood-prone state in India after Uttar Pradesh, Bihar, Assam and West Bengal. Odisha's entire coastline of 480 kilometres is exposed to frequent floods and water logging. In addition to heavy rainfall, cyclonic winds and tidal flows also cause flooding in coastal areas. Flooding lasts for 5–15 days along the coastal belt. It causes loss of life and damage to property and crops, thereby affecting food security and livelihoods (Mishra et al. 2010). Agriculturally, the fertile coastal

regions with paddy fields are vulnerable to inundation and salinization. Experts warn that Odisha should brace itself for more severe flooding in the future due to deforestation, faulty flood control planning and climate change. Such conditions are likely to displace large numbers of people, leading to rapid urbanisation and pressure on civic amenities and resources. The flood-affected area in 2013 is depicted in Figure 38. One of the interesting observations in Figure 38 is that new areas are being affected by flood and cyclone, beyond the traditional flood zone of the state.



Figure 38 Areas affected by Flood and Cyclone: Odisha 2013

Source: OSDMA

In Odisha, normal flood damage occurs mainly in areas surround the Mahanadi, Brahmani and Baitarani Rivers. These rivers have a common delta where flood waters intermingle and when they are in spate simultaneously, they wreak considerable havoc. This problem becomes even more acute when floods coincide with high tide. The water level rises because of the deposits of silt on the riverbed. The floods of 1980, 1982, 2001, 2003, 2011 and 2013 in the state were particularly severe; property worth tens of millions of rupees was destroyed in the floods.

4.2.3 Drought

Recent studies show that drought-prone areas over the world have more than doubled since 1970s. It has been established that drought severity has increased along with the enhanced warming of both the sea surface and land mass. Evidence exists of a climatic link between the El Niño Southern Oscillation (ENSO)³² and India's rainfall (Maity and Nagesh Kumar 2006). The impact is thus more severe in India, especially in the Odisha region because of its coastal position. Therefore, global warming with high surface warming in Odisha, the sensitivity of its precipitation to ENSO and the coastal position are the possible reasons for the greater probability of drought in this region.

³² The Madden Julian Oscillation is recognised in both excess and deficit rainfall scenarios, whereas it is associated solely with deficit or drought scenarios in the Indian context

Downscaled from the Global Circulation Model, the probability of occurrence of various categories of drought in Odisha is presented in the Figure 39:

According to the methodology adopted by Ghosh and Majumdar (2007), there is an increasing trend in the probability of severe and extreme droughts for Odisha toward the end of the 21st century, with a modest decrease in the probability of near-normal conditions.

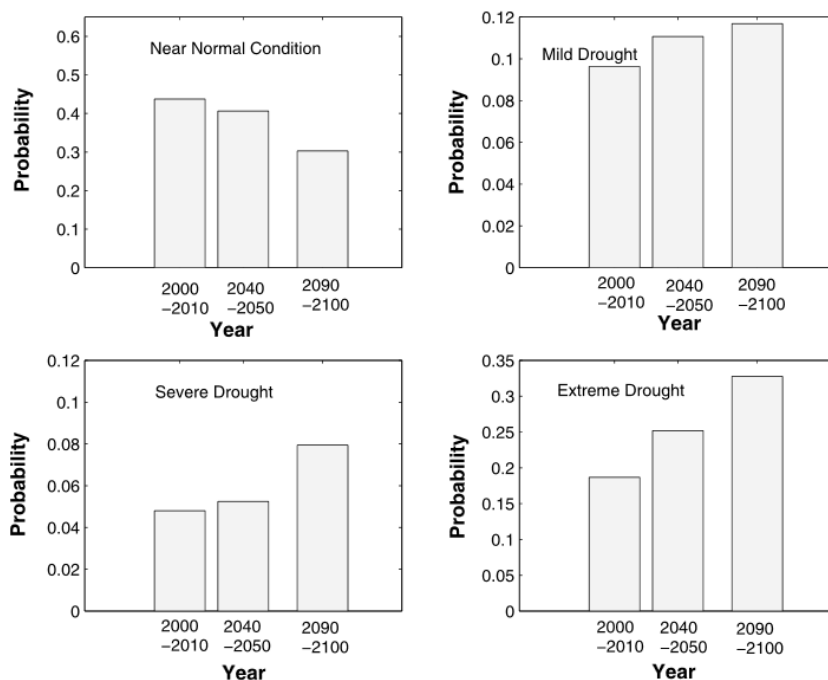


Figure 39 Probability of Occurrence of Drought: Odisha, 2000–2100

Source: Ghosh and Majumdar 2007



Figure 40 Wind & Cyclone Prone Areas, Odisha

Source: OSDMA



4.2.4 Cyclone

According to the Fifth Assessment Report, the frequency and intensity of tropical cyclones in Odisha are likely to rise. Even past data compiled by the United Nations Office for Disaster Risk Reduction (UNISDR) reveal that from 1970 to 2010, the Asia-Pacific population living in cyclone-prone areas increased from 71.8 million to 120.7 million, expanding the magnitude of vulnerability to disasters. Odisha did improve its disaster preparedness based on the lessons learned from the Super Cyclone episode in 1999. The cyclone-prone areas of the state are shown in Figure 38 and Figure 40.

The local area resilience plan prepared for Cuttack, Puri and Bhubaneswar under the World Bank's NLTA programme estimates that the Probable Maximum Loss (PML) from cyclonic wind is highest for the residential sector on the order of Rs 223 crore with substantial increases in the climate change scenarios for the 2040s and 2080s. The losses in the commercial and industrial sectors would be about Rs 115 crore and Rs 11 crore, respectively, with substantial increases in the 2040s and 2080s in Bhubaneswar. The estimated PML in Cuttack for the residential sector would be Rs 215 crore, with projected losses of Rs 322 crore and Rs 430 crore in the scenarios for the 2040s and 2080s, respectively. Losses for the commercial sector, also significant, are on the order of Rs 39 crore, which would double in 2080s scenario.

4.2.5 Heat Island Effect

Urban Heat Island (UHI) is a situation with elevated air or surface temperatures in urban areas in contrast to their non-urban rural vicinities. The phenomenon is present in all big and small cities around the world with varying intensity. UHI has adverse effect on human health can also significantly affect the economic productivity. Higher surface air temperature, particularly during summer months, is associated with increase in electricity demand, air pollution and heat stress related mortality and morbidity. The industrial agglomeration of Ib-valley in Jharsuguda faces the problem of Heat Island Effect which may be attributed to changes in land cover, energy intensive

MANAGING DISASTER

In October 2013, cyclone Phailin, with a wind speed of more than 200 kilometres per hour, lashed out at the coastal region of the state of Odisha. The cyclone affected 13.2 million people in five districts. The Indian Meteorology Department, four days ahead of the cyclone, cautioned the state administration to evacuate nearly 1.2 million people. In the largest single-day evacuation on October 11 (the day before landfall), 0.5 million people were shifted to safe locations. Only 21 lives were lost. Later, however, another 22 lives were lost due to flash floods, snake bite and mud wall collapse. The fact that in a 1999 cyclone 10,000 lives were lost shows the resilience attained in the structure and processes of disaster management in the state.

In 2014 cyclone Hudhud headed towards the Odisha coast. Landfall was expected to be on October 11. This time, too, the state remained alert and cancelled the leaves of officers and kept officers available in the non-affected areas to meet any eventuality. Meanwhile, the cyclone changed its course, largely affecting the southern districts of Odisha. However, not taking any chances, the state evacuated close to 0.4 million people from the vulnerable areas. Six teams of the National Disaster Response Force (NDRF) and 10 teams of the Odisha Disaster Rapid Action Force (ODRAF) were engaged in rescue operations and 17 satellite phones provided by the Central Government were used for uninterrupted communication. Two thousand shelter homes were erected in the districts of Gajapati, Ganjam, Koraput, Malkangiri, Puri, Rayagada, Nabarangpur, Kendrapara, Kalahandi and Khordha.

Recent cyclone Fani, through took a huge toll on power infrastructure, the loss of life was minimal. Though, the early warning systems and heightened preparedness was demonstrated, it is now required to update the SOP of critical sectors such as power, water supply, sanitation, agriculture and allied sectors.

industrial activities, mining, etc. Based on the time-series analysis it was found that the locations 'Bhushan Steel', 'Municipality Office' and 'Market Road' were hotspots for UHI during the summer period and 'OPGC', 'Market Road' and 'Municipality Office' were hotspots in the monsoon period. The effect of UHI is amplified in the summer months when the temperature reaches ~ 50 °C. The sectoral contribution of different sources and sinks to heat islands has been analysed to determine where actions can be targeted. Sector specific measures to reduce the Heat Island Effect over the Ib-valley region in Jharsuguda have been recommended on the basis of analysis of the contribution of each measure to the reduction in heat release.³³

Suggestions and Recommendation

Coal Mining

Key measures recommended for the five open cast coal mining projects viz. Samleshwari, Lakhanpur, Lajkura, Lilari and Belpahar include: a) Improved management of de-coaled areas through creation of water bodies in void spaces to reduce self-oxidation as well as act as a heat sink as well as through increased bio-reclamation area within the mine boundary; b) Setting up of more coal washeries which would reduce the ash content of coal, thereby reducing its self-oxidation potential – an exothermic process which releases heat into the ambient atmosphere; c) Moving from 95% to 100% surface miner technology for coal removal which would completely replace the conventional blasting operations, thereby improving the stability of benches and high-walls. This would consequently result in reduced self-combustion of loose coal due to the limited presence of oxygen; and d) Large-scale afforestation of the diverted forest area.

Industries

Key measures recommended in Industries include: a) Stockpile inventory management which would enable optimizing coal purchase and keeping the stockpile inventory at an optimum level, thereby not only resulting in cost savings but also environmental benefits; b) Stockpile design changes from cuboidal to dome-shaped so that lesser surface area is exposed to environment, consequently resulting in lower heat radiation.

Urban Planning

Traffic congestion in certain parts of the district has been identified as a key issue to be addressed. Some of the measures that can be taken in this regard include shifting the bus terminus away from the market road, construction of flyover at strategic points, construction of new approach road to SH10 (Sambalpur-Jharsuguda bypass road), etc. In addition, plantation of trees with higher LAI (Leaf Area Index) bordering along the pavements of national highways, state highways and newly proposed roads, have also been included under the urban planning section. Species specific recommendations have been provided for national and state highways, city artillery roads and the municipal areas. Jharsuguda airport has been identified as a priority area for undertaking plantation activities due to extreme barrenness of the area. In the buildings sector, green roofing has been recommended as a voluntary measure to reduce ambient air temperature as well as cooling demand of air conditioners. Adopting higher albedo road surface materials such as concrete, where possible, can also go a long way to mitigate the rise in temperature.

Agriculture

In the Agriculture sector, the key recommendation includes moving towards conservation tillage, which not only improves the productivity of land but also increases the surface albedo of the land mainly during the fallow period, thereby reflecting most of the incoming solar radiation back into the atmosphere

³³ Heat Island Effect in an Industrial Cluster (Identification, Mitigation and Adaptation), published by Climate Change Cell Odisha

4.2.6 Heat Wave

Heat wave is a condition of atmospheric temperature that leads to physiological stress, which sometimes can claim human life. Heat-wave is defined as the condition where maximum temperature at a grid point is 3°C or more than the normal temperature, consecutively for 3 days or more. World Meteorological Organization defines a heat wave as five or more consecutive days during which the daily maximum temperature exceeds the average maximum temperature by five degree Celsius. If the maximum temperature of any place continues to be more than 45°C consecutively for two days, it is called a heat wave condition.

There will be no harm to the human body if the environmental temperature remains at 37°C. Whenever the environmental temperature increases above 37°C, the human body starts gaining heat from the atmosphere. If humidity is high, a person can suffer from heat stress disorders even with the temperature at 37°C or 38°C. The extreme temperatures combined with high humidity and resultant atmospheric conditions adversely affect people living in these regions leading to physiological stress, sometimes even death. This unusual and uncomfortable hot weather can impact human and animal health and also cause major disruption in community infrastructure such as power supply, public transport and other essential services.

To calculate the effect of humidity we can use Heat Index Values. The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. As an example, if the air temperature is 34°C and the relative humidity is 75%, the heat index--how hot it feels--is 49°C. The same effect is reached at just 31°C when the relative humidity is 100%. The temperature vs humidity chart is placed and the temperature actually felt is placed below:

Relative Humidity %	Temperature °C																
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	54	57	
50	27	28	30	31	33	35	36	38	41	43	46	49	52	55	58		
55	28	29	30	32	34	36	38	40	43	46	48	52	54	58			
60	28	29	31	33	35	37	40	42	45	48	51	55	59				
65	28	30	32	34	36	39	41	44	48	51	55	59					
70	29	31	33	35	38	40	43	47	50	54	58						
75	29	31	34	36	39	42	46	49	53	58							
80	30	32	35	38	41	44	48	52	57								
85	30	33	36	39	43	47	51	55									
90	31	34	37	41	45	49	54										
95	31	35	38	42	47	51	57										
100	32	36	40	44	49	56											

Source : Calculated °F to °C from NOAA's National Weather Service

Caution
 Extreme Caution
 Danger
 Extreme Danger

Heat wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the pre-monsoon (April to June) summer season. Heat –waves typically occur between March to June and in some rare cases even extend till July. Heat waves are more frequent over the Indo-Gangetic plains of India. On an average, 5-6 heat wave events occur every year over the northern parts of the country. The most notable amongst the recent ones are Hyderabad (Andhra Pradesh) 46°C, Khammam 48 °C , Jharsuguda (Odisha) 45.4°C, Bhubaneswar (Odisha) 44°C, Allahabad (Uttar Pradesh) 47.8°C , Delhi 46.4°C, Jashpur (Chattisgarh) 44.5°C, Kolkata (West Bengal) 44.5°C, Gaya (Bihar) 46.3°C, Nagpur (Vidarbha region in Maharashtra) 47.1°C, Kalburgi (Karnataka) 44.1°C and Churu (Rajasthan) 48.0°C in 2015.

4.2.7 Socio-Economic Vulnerabilities

Odisha is India's eighth largest state, comprising 4.7 percent of India's land mass, 3.37 percent of its population (some 42 million people) and over 5 percent of its poor. Although poverty levels fell from 57 percent in 2004/05

to around 33 percent in 2011/12 (Government of Odisha 2014), the proportion of poor in Odisha remains well above the national average of around 22 percent. As clearly stated in every climate change discourse, high poverty level and high percentage of indigenous communities with high natural resource dependency make the state extremely vulnerable to climate change. Its rapidly growing economy (above national average) and rapid urbanisation of many agglomerations too pose a challenge for mitigation.

Odisha is particularly vulnerable to sea level rise, increased storm intensity, extreme droughts and heat waves and increased wind and rainfall events. It once again recognized that human activities such as coastal development, burning of fossil fuels and increasing greenhouse gas (GHG) emissions are contributing to the causes of heat wave events more frequent in urban areas. The trend shows that the number of persons living in urban areas will continue to grow at a faster rate than the population in the rural areas due to migration and increasing urbanization.

The World Meteorological Organization (WMO) statements on global climate during 2011 and 2012 indicate that, the global temperatures are continuing to increase. Heat-waves are projected to increase in number, intensity and duration over the most of the land area in the 21st century. This is directly affecting the communities, undermining their livelihoods through gradual, insidious changes in temperature and rainfall patterns and resulting in increased frequency and intensity of hazards such as floods, cyclones, droughts, unseasonal rains and hailstorms, causing extensive damage to crops and agro-rural economy.

4.3 Hydro-Met Challenges: Key Sectoral Measures Taken

Table 43 summarises the measures Odisha has taken to meet the hydro-meteorological challenges described in the preceding sections.

Table 43 Key Sectoral Measures Taken to Meet Hydro-Meteorological Challenges, Odisha

Event	Sector	Adaptation measures adopted by the state
Flood and cyclone	Agriculture Water Resources Coastal and Disaster Management	<ul style="list-style-type: none"> • Early warning • Flood-tolerant varieties, Structural modification, Insurance • Construction of artificial reefs, rif-raf structures Water regulation in basin, main delta • River mouth dredging • Shelterbelt plantation • Mangrove restoration
Flash Flood management	Agriculture Water Resources	<ul style="list-style-type: none"> • Investment in Flash Flood Modeling • Landslide protection • Investment in minor, sub-minor and check dams in the hilly terrain • Watershed based approach
Drought	Agriculture Water Resources Fishery and animal resources development	<ul style="list-style-type: none"> • Drought-resistant varieties • Tank desilting • Runoff management • Rainwater harvesting • Watershed management
		<ul style="list-style-type: none"> • Crop insurance • Livestock management with forage stock and dead water storage for wildlife • Establish wooded riparian areas/buffer strips along water bodies
Heat wave	Health Agriculture Housing and urban development Industries Energy	<ul style="list-style-type: none"> • Health advisory • Water fountains • Electricity and water supply • Timing of work for labourers, especially construction labourers

Climate Change Strategy – Adaptation

According to UNFCCC, “Climate change adaptation is a response to global warming (also known as ‘climate change’ or ‘anthropogenic climate change’), that seeks to reduce the vulnerability of social and biological systems to relatively sudden change and thus offset the effects of global warming.”

Chapters covered under Adaptation Strategy are:

5A: AGRICULTURE

5B: FISHERIES AND ANIMAL RESOURCES DEVELOPMENT

5C: FORESTRY

5D: WATER RESOURCES

5E: HEALTH

5F: COASTAL AND DISASTER RISK MANAGEMENT

5A: Agriculture

5A.1 Overview

Agriculture is the key to food security of millions in India. The sector is highly vulnerable to climate change. Odisha is an agrarian state in which about 70 percent of the population is dependent on agriculture. The Agriculture sector of Odisha broadly comprises agriculture, horticulture and related activities. Of the total geographical area of the state, about 39.69 percent consists of land under cultivation. Increasing agricultural production and productivity is necessary for ensuring food security, livelihood security and nutritional security. Agricultural production and productivity can be improved through better land and water management, a greater reliance on rain-fed agriculture, expansion of agricultural markets, better technology, higher public & private investments and effective implementation of the ongoing programs in Agriculture and allied sectors such as for crop and weather insurance.

The state's key agricultural output trend is shown in Figure 41. According to the figure; mostly output has been relatively stable over the last five years without any major fluctuations. However, the frequent occurrence of natural calamities badly affects the production of kharif rice. In drought years; there is a considerable loss in production of pulses and oilseeds both during kharif and rabi.

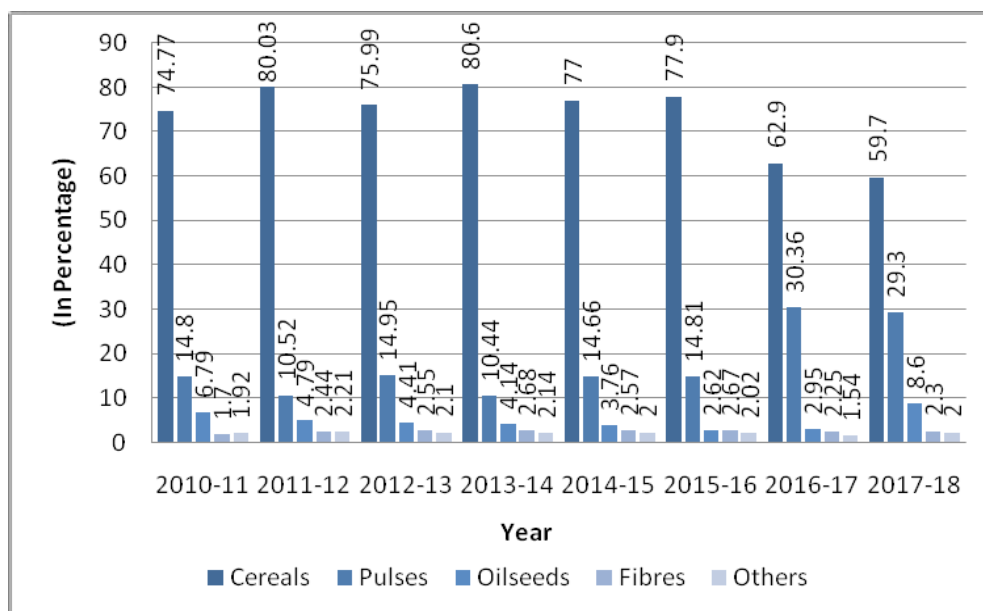


Figure 41 Key Agricultural Outputs, Odisha

(Source: Odisha Economic Survey)

The agro-climatic diversity in the state, with its high rainfall distributed over a four-month monsoon period and a reasonably moderate winter, allows cultivation of a variety of horticultural crops. The normal rainfall from June to September from the southwest monsoon is suitable for growing perennial fruit crops such as mango, litchi, guava, orange and lime; annual fruit crops such as banana, pineapple and papaya; spices such as ginger, turmeric and chilli; a variety of roots and tubers; and a whole range of vegetables. Among all states, Odisha is ranked fourth in the production of vegetables. The total production of vegetables was 9,433.65 thousand tonnes in 2013–14, compared with 9,913 thousand tonnes in 2012–13. From 2010–11 to 2013–14, the production of major fruit crops increased: mango from 33.78 thousand tonnes to 38.02 thousand tonnes; papaya from 214.36 thousand tonnes to 220.06 thousand tonnes; and banana from 181.93 thousand tonnes to 190.18 thousand tonnes. The production of ginger and turmeric has increased significantly. Odisha also accounts for about 3 percent of India's total flower production and 4 percent of spice production.

5A.2 Impact of Climate Change

Even though the quantum of rainfall in Odisha is quite high, its distribution during the monsoon period is highly uneven and erratic. As a result, flood and drought occur regularly with varying intensity. During extreme weather events, the damage to crops has been significant. The Agriculture sector is also a major contributor of methane emissions. Rapid mechanisation of agriculture and fossil fuel use lead to CO₂ emissions. Increases in the number of ruminants and food wastes as well as expansion of the rice-growing area are the major sources of methane emissions. According to the IPCC AR5, there is scientific evidence that the CH₄ concentration in the atmosphere began growing after 2007. Odisha, as a major rice-growing area, is also a contributor to this phenomenon.

Farmers in developing countries, such as in India, are little able to cope with climate change. Various climate events such as drought, cyclone and flood have significantly affected Odisha's agriculture. About 70 percent of the total cultivated area in the state is drought-prone. Historically, Bolangir and Boudh were the most drought-affected districts. The Government has, however, identified contiguous patches comprising 47 blocks as a chronic drought-prone zone. Even though human casualties were minimal because of the deft handling of cyclones Phailin and Hudhud, the damage to crops and livestock could not be prevented. Severe cyclonic storm and post cyclonic floods damaged standing crops in 6.71 lakh hectares in the state. Heavy rains and surging seawater destroyed more than 500,000 hectares (1.23 million acres) of crops worth an estimated Rs 24 billion (US\$395 million), according to official sources (Revenue and Disaster Management Department).

Beyond the temperature rise of two degree Celsius, yields of cereals and even coarse grains and maize are likely to be adversely affected, affecting in turn the state's food security. Finally, the pest problem is likely to worsen because of climate change, although strong causality has not yet been established in Odisha.

5A.3 Gap/ Barrier Analysis

Type	Gap
Financial	<ul style="list-style-type: none"> Fund Requirement for implementation of activities having strong climate relevance
Institutional	<ul style="list-style-type: none"> Sustainability of adaptation programs Need of more climate experts advising on departmental programs Scheme convergence within departments to lead to adaptation e.g. Agriculture, Water Resources, Forest
Technical	<ul style="list-style-type: none"> Accessing relevant climate and sectoral data Technical capacity on designing more adaptation actions High dependency on rain for agriculture Market opportunities
Socio-Economic	<ul style="list-style-type: none"> Alternate livelihood creation Storage facilities, transportation facilities, better rural connectivity
Policy	<ul style="list-style-type: none"> Requirement of systematic and quantified evidence of impacts of various policies and aspects on long term sustainability

5A.4 Key activities taken up

Table 44 Key Climate Change Activities in Agriculture Sector

SN	Activity	Linkage	Progress in 2010–15
1	Expand 25,954 hectare area under perennial fruit crops.	Adaptation and mitigation	Implemented as a key priority (KP)
2	Promote SRI (system of rice intensification) rice cultivation for methane management.	Mitigation	Implemented but not a KP
3	E-pest surveillance in all districts	Adaptation	Implemented as a KP
4	Water use efficiency through micro-irrigation	Mitigation	Implemented as a KP

5	Undertake livelihood-focused, people-centric integrated watershed development programmes in rainfed areas.	Adaptation and mitigation	Implemented as a KP
6	Conduct research on climate resilience and cropping system adaptation.	Adaptation	Initiated pilots as a KP
7	Promote organic agriculture and nutrient management	Adaptation	Implemented but not a KP
8	Identify suitable varieties for flood and drought (Crop contingency planning).	Adaptation	Implemented but not a KP
9	Build capacity of extension personnel and farmers in aspects of climate change (vulnerability and adaptation).	Adaptation	Implemented as a KP
10	Build community capacity for disaster preparedness.	Adaptation	Implemented as a KP
11	Emphasise polyhouses, net houses and mulching.	Adaptation	Implemented but not a KP

5A.5 Plan to meet NDCs and SDGs

Table 45: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 6: To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture.	<ul style="list-style-type: none"> • Odisha Integrated Irrigation Project on Climate Resilient Agriculture (OIIPCRA) • Focusing on soil health management • Accelerated Irrigation Benefit Programme (AIBP) • Agriculture projects under Rural Infrastructure Development Fund (RIDF) • Odisha Integrated Irrigated Agriculture and Water Management Investment Programme (OIIAWMIP) • Command Area Development and Water Management Programme (CAD&WM)

Table 46: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	<ul style="list-style-type: none"> • Annapurna Scheme • Krushak Assistance for Livelihood and Income Augmentation (KALIA) • Odisha Millet Mission • Biju Krushak Vikas Yojana • Promotion of System Rice Intensification (SRI) • Providing better market • Insurance coverage for crops • Improved storage facilities • Focus on soil health management • Agriculture and Livelihood support through OCTMP
SDG 6: Ensure availability and sustainable management of water and sanitation for all	<ul style="list-style-type: none"> • Odisha Integrated Irrigation Project on Climate Resilient Agriculture (OIIPCRA) • Jananidhi and Soura Jananidhi • Odisha Integrated Irrigated Agriculture and Water Management Investment Programme (OIIAWMIP) • Increase in water use efficiency for irrigation • Upgrading water harvesting structures

SDG 13: Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy

- Promoting use of renewable energy in irrigation
- Management of Soil Health

5A.6 Description of Activities and their implementation

AG/KP/13- Increased knowledge and capacity

Increasing agricultural productivity requires building the knowledge base and capacity of the farmers to innovate and adopt new technologies to cope with climate change. Local knowledge is crucial for survival. Especially revising ITK is also essential.

AG/KP/3- Capacity building of extension personnel

It is important to train extension personnel on climate smart agricultural practices so that they can motivate the farmers. Around 500 numbers of trainings are planned to be conducted for 2021-30 and about 9000 extension personnel across all grades (A, B and C) are planned to be trained.

AG/KP/6- Create awareness among farmers of climate change adaptation

This initiative would sensitise farmers to climate change adaptation in rural areas. The initiative is being supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

AG/KP/2- Establish an institutional delivery mechanism to promote best practices on climate change

This is a new activity and a network of centres of excellence will be established in the state based on the climate-smart principles.

AG/KP/7- Establish an automated weather station

Establishment of such a weather station and linking it to KVK network would yield better microclimate data. It will also help in modelling and risk management and will deepen the weather insurance in the state.

AG/KP/ 8- Establish a seed bank at the village level

This initiative enhances adaptability by managing climate variability and seeding at the local level.

AG/KP/9- Promote SRI

The System of Rice Intensification (SRI) can help to reduce methane emissions by use of an alternate wetting and drying method, can reduce water use and can lead to higher outputs. SRI has been successfully incorporated into production in Odisha and will be continued during 2021-30.

AG/KP/15- Promote crop diversification

Diversification of crop from field crop to high value fruit crop and vegetable crop for enhancing the farming and livelihood

AG/KP/5- Develop water-efficient micro-irrigation methods: individual and community farm ponds

This activity will enhance both demand-side and supply-side efficiency and aid in the mitigation effort. It will





also help in water use efficiency and reduce the risk of crop failure, especially in the rabi crops. Total outlay is expected to be Rs 430 crore in 1, 50,000 hectares over ten years.

AG/KP/4- Increase the area under fruit crops to help cope with uncertain weather patterns

This proposal will help in crop diversification and provide nutrition. Also, fruit crops, when planted in degraded areas, would help in carbon sequestration. The state has already developed an AR-CDM ³⁴project, which is under validation. The total area to be covered under this phase (2021-30) is 2, 00,000 hectares, with an outlay of about Rs 3000 crore.

AG/KP/12- Green energy efficient models for farmers

More widespread use of this model will help in carbon sequestration as well as enhance productivity. Use of solar pumps and other efficient pump sets can be used for this.

AG/N/8- Promotion of stress tolerant varieties

The stresses that are anticipated to worsen as the consequences of climate change include high temperature, drought, flooding etc. Incorporating stress tolerance into high-yielding varieties has proven to be a very effective approach to developing varieties that can cope with these situations

AG/N/9- Promotion of organic farming

The Odisha Organic Farming Policy has been formulated to make farming climate- resilient, reduce the risk of farmers and enhance farm income. It has been planned to promote healthier soils with eco-friendly approaches, reduce input costs and provide market for the organic products. It was prepared in consultation with all the stakeholders.

AG/N/10- Promote Integrated farming system approach

Integrated farming is a farming system with simultaneous activities involving crop and animal. The main purpose of integrated farming is so that the farming components support one another; hence, reducing external inputs.

AG/N/11- Conservation Agriculture

It focuses on the maintenance of a permanent soil cover, minimum soil disturbance and diversification of plant species. This will help to improve crop yields, while improving the long-term environmental and financial sustainability of farming with increased mechanization, especially use of combined harvesters, there is a potential risk of air quality deterioration due to stubble burning and this need to be managed.

AG/N/12- Rainfed Area Development

The objective of Rainfed Area Development (RAD) is to make rain fed agriculture more productive, sustainable and climate resilient by promoting the Integrated Farming System (IFS) along with the conservation of natural resources. The total area to be covered under RAD is 1500 hectares, with an outlay of about Rs 500crore.

5A.7 Co-benefits

Resilience-related: In Odisha; about 70 percent of the total population is dependent on agriculture and allied activities. Therefore, any activity that would improve the resilience of agriculture will positively affect this population.

Mitigation-related: Initiatives such as SRI will help to reduce methane emissions while the agro-forestry system helps in carbon sequestration. Planting fruit trees in degraded areas has provided this benefit as well as livelihood diversification and nutrition.

³⁴ A methodology under the clean development mechanism in the forestry sector

5A.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	AG/KP/13	Increase knowledge & capacity	2,800.00	10	1,270.00	1,530.00	External aid	State-wide, Number of training= 50, 31 Climate Change Cell, 80000 number (horticulture)	AD
2	AG/KP/3	Capacity building of Extensional personnel(Gr.A/B/C) & farmers	500.00	10	500.00	-	State Plan	Number of Training =500	AD
3	AG/KP/6	Creation of Awareness among farmers on climate change adaptation	3,140.00	10	3,140.00	-	State Plan	Number of Campaigns= 3140	AD
4	AG/KP/2	Establish an institutional delivery mechanism to promote best practices on climate change.	6,280.00	5	6,280.00	-	State Plan	Number of model villages (CSV)= 314	AD
5	AG/KP/7	Establishment of Automated Weather Station (AWS)	510.00	5		510.00	Central Scheme	Number of AWS =170	AD
6	AG/KP/8	Establishment of Seed bank at village level	15,000.00	10	15,000.00	-	Central Scheme	5000 numbers	AD
7	AG/KP/9	Promotion of SRI	2,000.00	10	800.00	1,200.00	RKVV, NFSM, BGREI	20000 Ha	MI
8	AG/KP/15	Promote Crop Diversification	20,000.00	10	12,000.00	8,000.00	State Plan, NFS, RKVV	5 lakh Ha	AD

9	AG/KP/5	Development efficient micro and drip irrigation	43,000.00	10	17,000.00	26,000.00	PMKSY, National Mission and other sources	150000 Ha	MI
10	AG/KP/4	Increasing the area under perennial fruit plantation	300,000.00	10	120,000.00	180,000.00	MGNREGA,MIDH, RKVY	200000 Ha	Both
11	AG/KP/12	Green Energy Efficient Models for farmers	18,000.00	10	18,000.00	-	NMSA	50000 numbers	MI
12	AG/N8	Promotion of stress tolerant varieties	20,000.00	10	8,000.00	12,000.00	NFSM, N+BGREI	2 lakh Ha	AD
13	AG/N9	Promotion of organic farming	30,000.00	10	12,000.00	18,000.00	PKVY	4 lakh Ha	AD
14	AG/N10	Integrated farming system approach	500.00	5	500.00	-	State plan	500 numbers	AD
15	AG/N11	Conservation agriculture	3,500.00	10	3,500.00	-	State plan	Organic waste decomposer- 500 numbers, Zero till seed drill- 350 numbers, Agriculture residue management in 50000 Ha	AD
16	AG/N12	Rainfed area development	50,000.00	1	20,000.00	30,000.00	NMSA		AD
		Total (In Rs Crore)	5,152.30		2,379.90	2,772.40			

5B: Fisheries and Animal Resources Development

5B.1 Overview

Fisheries and Animal Resources are fully integrated into the agriculture system of the country and more so in several parts of Odisha. The predominant farming system in Odisha is the mixed crop-livestock farming system and over 90 percent of farms of all categories conform to this farming system. Unlike in many other parts of the country, livestock holding in Odisha is equitable; over 80 percent of all livestock are owned by the marginal/small holders and the landless. Some 80 percent of all rural households own livestock of one species or the other, or a combination of some of them, cattle being the most popular. The state has an ambitious target of having 20 lakh of cross-breed cows by 2020. One million breedable goats and 0.2 million sheep will be upgraded through the supply of an improved variety of buck/ram by 2020. Poultry has also grown in several parts of southern and central Odisha in recent years, whereas indigenous species are predominant in northern and western Odisha. By means of poultry breeding programme, a target of 2,000 broiler units (bird capacity of 1,000–10,000 birds per week) has been set up in the state. On 1,000 hectares, green fodder will be developed.

As per Livestock Census 2019, the state holds 3.39% share of India's total livestock and 3.22% of the total poultry in India. The total livestock population in the state was over 1.82 lakhs whereas poultry population stood at 2.74 lakhs. Cattle hold the largest share of livestock population with a share of over 60%.

Odisha ranks 10th in fish production and has produced 4.50 percent of the total fish production in the country during 2014-15. During 2016 -17, the state produced 608.10 TMT of fish of which 455.00 TMT were from inland sources and 153.11 TMT from marine sources. The inland fish production included 393.72 TMT from fresh waters and 61.27 TMT from brackish waters.

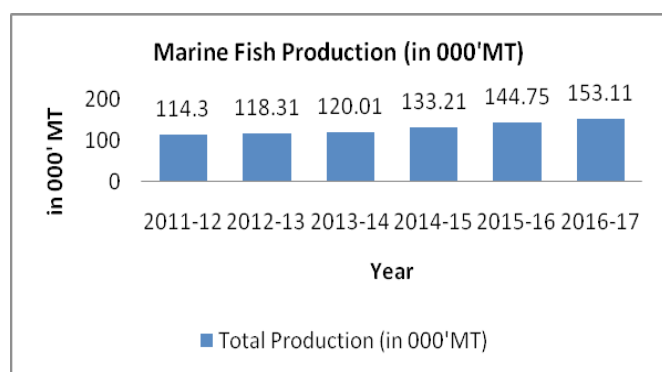


Figure 42 Marine Fish Production Odisha
(Source: Economic Survey Odisha 2018-19)

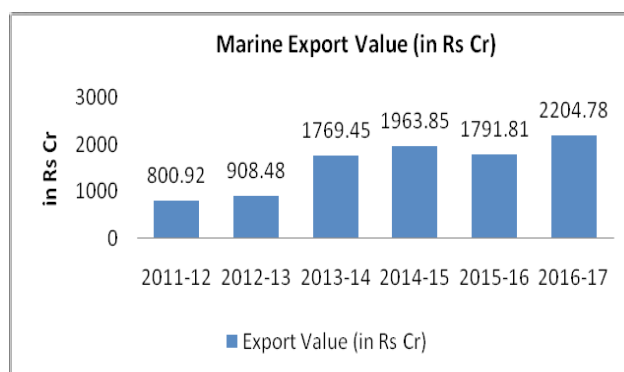


Figure 43 Marine Export Value Odisha
(Source: Economic Survey Odisha 2017-18)

5B.2 Impact of Climate Change

Large ruminants and poultry birds are highly vulnerable to climate change. Some of the vulnerabilities are described below:

Impacts of temperature rise

Several parts of coastal Odisha are likely to breach the two degree Celsius temperature rise barrier, while hinterlands are likely to be warmer. The rise in the surface temperature of the water will result in shifting of species.

Livestock are homeothermals, which means, that they must regulate their body temperature within a relatively narrow range to remain healthy and productive. The ambient temperature below or above the thermo-neutral range creates stress conditions in animals.

Hot and humid environmental conditions cause heat stress in cows. Heat stress induces behavioural and metabolic changes which include reduced feed intake and metabolic activity and thereby a decline in their productivity and reproductive performance.

Impacts of monsoon variability and flooding

Every year thousands of livestock are lost due to heavy rains, floods and cyclones in various parts of the state. The significance of impacts related to climate variability was visible during recent events such as severe cyclonic storm "Fani" in Odisha.

According to the IMD, Odisha is receiving the same quantity of rainfall in fewer days during the monsoon. This has resulted in several flood events in the state. For livestock, damage from floods and cyclones is estimated to be quite high because of mud wall collapse, water logging in pastureland, etc.

Drought incidence

Decline in rainfall would lead to drought situation and water shortage for livestock. Decline in agriculture production would lead to feed shortage for livestock and poultry birds. Drought affects water quality and fodder availability, reducing the efficiency of the livestock and their productivity

5B.3 Gap/ Barrier Analysis

Type	Gap
Financial	<ul style="list-style-type: none"> Execution of activities is largely dependent on Central assistance for grants
Institutional	<ul style="list-style-type: none"> Dearth of technical experts advising on departmental programs Understanding the sustainability of adaptation programs
Technical	<ul style="list-style-type: none"> Understanding of vulnerability assessment findings and what it means for the sector Technical capacity on designing adaptation actions Understanding relevant climate and sectoral data and their relationship with the sector
Socio-Economic	<ul style="list-style-type: none"> Creation of alternate livelihood Fodder Availability
Policy	<ul style="list-style-type: none"> Need for an integrated approach for livestock and fishery management related to climate change

5B.4 Key activities taken up

The activities listed in Table 47 were undertaken in the state's Fishery and Animal Resources Development sector.

Table 47 Key Climate Change Activities in Fishery and Animal Resources Development Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Provide routine de-worming and vaccination tasks in a planned manner to minimise the mortality of small animals.	Adaptation	Implemented as a key priority (KP)
2	Conserve and selectively breed native species of cattle, buffalo, small ruminants and poultry.	Adaptation	Implemented as a KP
3	Utilise all departmental fodder farms optimally to produce quality planting materials for fodder development.	Adaptation	Implemented as a KP

4	Revive genetic up-gradation of small animals.	Adaptation	Implemented but not a KP
5	Promote insurance in the livestock sector.	Adaptation	Implemented but not a KP

5B.5 Plan to meet NDCs and SDGs

Table 48: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 6: To better adapt to climate change by enhancing investments in development programme in sectors vulnerable to climate change, particularly Agriculture, Water Resources, Himalayan region, Coastal regions, Health and Disaster Management.	<ul style="list-style-type: none"> • Conservation and improvement of native breeds • Artificial insemination in cattle and Buffalo and frozen Semen Bank established in Cuttack • Information Network for Animal Productivity and Health (INAPH) • Controlled breeding Programme • Cattle and goat development under Integrated Livestock Development Program- Kalyani • National Animal Disease Reporting System (NADRS) • Assistance to State for Control of Animal Diseases (ASCAD) • Innovative Poultry Productivity Project (IPPP)- Broiler and Low Input Technology (LIT) birds • Natural Breeding Programme • Promotion of fuel-efficient environment friendly fishing practice and promotion of CNG/LPG driven engine • Basundhara for fishermen • MO KUDIA scheme for fishermen • Financial assistance to fisher women SHGs

Table 49: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	<ul style="list-style-type: none"> • Strengthening of Dairy Organization • Dairy Entrepreneurship Development Scheme • Small Animal Development • Support to farmers for small scale goat/sheep farming, conservation of local germplasm • Poultry Development, under the financial assistance of SGSY infrastructure fund • Fodder Seed production programme, Fodder Production and Demonstration Programme • National Livestock Mission, Fodder Development Programme
SDG 13: Climate Action	<ul style="list-style-type: none"> • Integrated Coastal Zone Management Project (ICZMP)
SDG 14: Life below Water	<ul style="list-style-type: none"> • Development of freshwater aquaculture through FFDA • Development of brackish water aquaculture through FFDA • Reservoir Fisheries Development • Development of Marine Fisheries • Machha Chasa Pain Nua Pokhari Yojana

5B.6 Description of Activities and their implementation

ARD/KP/1- Engage in scientific animal health management

Climate change may bring about substantial shifts in disease distribution and outbreaks of severe disease could occur in previously unexposed animal populations. Hot and humid weather conditions were found to aggravate the infestation of vector borne diseases. Therefore, it has been proposed to take up preventive vaccination of livestock and poultry birds. Focus will be given to vaccinate all the eligible livestock against contagious disease like Foot & Mouth Disease and Brucellosis in the state under National Animal Disease Control Program (NADCP). Preventive vaccination against other contagious diseases will also be taken up. Under free range system animals are very prone to parasitic infestations. Therefore, routine de-worming of livestock will be taken up.

ARD/KP/2- Pursue capacity building of livestock keepers

Livestock owners are to be sensitized to better equip themselves to guard against immediate livestock loss from disasters like flood, droughts and extreme heat. In the existing skill upgradation training programme, a module of climate change concerns will be used to sensitize livestock keepers to those concerns. Around 2 lakh farmers will be covered under this programme over 10 years.

ARD/KP/3- Improve fodder management

More legumes and less carbohydrate food can reduce methane emission from cattle. Raising forage at the farm level to address the increasing difficulty on obtaining green feeds especially during the dry months is essential. Growing fodder and feeding animal also helps to reduce parasite infection (under free range) and ensures the livestock manure is retained in the farm to support the farming system. The area under fodder production from existing 2000Ha to 20000Ha will be increased by involving different collaborating partners such as ILRI, BAIF, OM FED & the Department will be taken up in the state.

ARD/KP/4- Undertake breeding management

Increasing productivity through breeding and better management practices, such as a reduction in the number of replacement heifers, often reduces methane output per unit of animal product. Therefore, advanced technology such as Sex Sorted Semen will be used extensively for genetic improvement of cattle.

Around 20 lakh Artificial Inseminations in cattle and buffalo will be undertaken every year and the Frozen Semen Bank, Infrastructure at Cuttack will be strengthened to produce quality semen. Frozen Semen from recognized indigenous breeds like Binjharpurl, Sahlwal, Gir will be produced for genetic improvement of local cattle based on different agro-climatic zones.

Odisha possesses four recognized cattle and two buffalo breeds. Steps will be taken to improve and conserve these breeds in the state. Improvement of native breeds will help to develop capacity to withstand extreme environmental conditions and better resistance to diseases.

ARD/KP/6- Setup Epidemiological Cell and disease early warning system

The direct effects of climate change on livestock include the increase of existing vector-borne diseases and the emergence and spread of new diseases. A serious constraint to livestock production is the high animal mortality caused by widespread incidence of animal diseases. In order to keep pace with the future intricacies accompanied by changing pathologies of causative organisms due to gradual change in environment followed in turn by change in manifestation of various diseases, there is an emergent need to establish a completely new modernized Epidemiology Cell and diseases early warning system.

FISH/CAP/1- Up gradation of FH/FLC

Upgradation of infrastructures in 4 numbers of selected fish seed hatcheries for early fish seed production (in the month of March-April). This will facilitate fish farmers to grow fish within short culture period.



Scientific animal health management



Livelihood support to marine fisher communities



Disease early warning system



Up gradation of FH/FLC



Vaccination



Capacity building of livestock keepers



Undertake breeding management



Adoption of better Fishing methods



FISH/CAP/2- Assistance to deep sea fishing based on climate induced shift

State has proposed to build 4 deep sea fishing vessels at a cost of Rs. 3.20 crore with an unit cost of Rs. 0.80 Lakh and subsidy assistance for General Category 40% and SC/ST/Women 60% under Blue Revolution. India has a resource potential of Indian EEZ estimated to be 2.13 lakh MT of Tuna, comprising of Yellow fin 54%, Skipjack Tuna 40% & Big Eye Tuna 6% and Odisha is working towards exploiting these resources optimally.

FISH/CAP/3- Livelihood support to marine fishers during ban period

Under the State Plan Scheme "Livelihood Support to Marine Fishermen during Fishing Ban Period", Rs 7500 are being provided to 5000 nos. of fisherman families towards turtle conservation.

FISH/CAP/4- Saving cum Relief

Under the Blue Revolution schemes around 10000 fishermen are covered under "Saving-cum-Relief" with a financial assistance of Rs. 1500 as Central Assistance and Rs 1500 as State Share and Rs 1500 as Beneficiary contribution.

FISH/CAP/5- Fishing methods and gears for safety of fisherman

Under the State Plan Scheme as well as in Blue Revolution, DAT and Safety kits comprising Lifebuoy, Life jackets, solar lantern, GPS, etc. are being provided.

FISH/CAP/6- Upgradation fish seed hatchery for early breeding/seed production

- 4 number of fishing harbours and 24 nos. of Fish landing centres has been upgraded/constructed at a cost of Rs. 93.68 crore through different State Plan schemes of Govt. of Odisha
- Increasing fish production and fish farming area for rural livelihood through Inland fisheries- FFDA, Reservoir fisheries development, fish culture in pens and cages, establishment of hatcheries
- Undertaking Repair and renovation of Government fish seed farms/ hatchery to increase fish seed production for fish farming
- To increase per hectare production and encourage new species advocating culture of SPF L vannamei

5B.7 Co-benefits

The key co-benefits of these proposals for the Fishery and Animal Resources Development sector include the diversification of livelihoods through animal husbandry and fisheries, which leads to more resilient livelihoods. Initiatives such as biogas and manure management enrich soil health and help in reducing methane emissions.

5B.8 Synopsis of Proposed Activities

Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
ARD/KP/1	Scientific Animal Health Management	112,800.00	10	-	112,800.00	CSS	State Wide	AD
ARD/KP/3	Improved feeding management	16,000.00	10	16,000.00	-	State plan	State Wide	AD
ARD/KP/2	Capacity building of live-stock keepers	3,000.00	10	3,000.00	-	State plan	State Wide	AD
ARD/KP/4	Breeding Management	26,500.00	10	-	26,500.00	CSS	State Wide	AD
ARD/KP/6	Research on Disease Early Warning System	1,178.00	10	1,178.00	-	State plan	State Wide	AD
FISH/CAP/1	Upgradation of FH/FLC	50,000.00	10	25,000.00	25,000.00	State +CSS	4 FH and 20 FLC	AD
FISH/CAP/2	Assistance to deep sea fishing based on climate induced shift	1,440.00	10	576.00	864.00	State +CSS	50 units	AD
FISH/CAP/3	Livelihood support to marine fishers during ban period	10,000.00	10	10,000.00	-		10000 fisher family	AD
FISH/CAP/4	Saving cum relief	3,000.00	10	1,500.00	1,500.00	State +CSS	10000 active fishermen	AD
FISH/CAP/5	Safety of fisherman	1,000.00	10	700.00	300.00	State +CSS	10000 fisher family	AD
FISH/CAP/6	Upgradation fish seed hatchery for early breeding/seed production	2,000.00	5	1,000.00	1,000.00	State +CSS	15 fish seed hatchery	AD
	Total (in Rs Crore)	2,269.18		589.54	1,679.64			

5C: Forestry

5C.1 Overview

Forests are not just about flora and fauna; they also support a large number of forest- dependent communities (especially scheduled tribes). It is estimated that a little less than one-third of the increase in CO₂ in the atmosphere is a result of the deforestation over the last 150 years. Currently, India has a dominant forest cover of the tropical dry forest type (37.2 percent), followed by dry savannah type (33 percent) and moist savannah type (32.5 percent). This mix is projected to change, with tropical dry forest and tropical seasonal forest (28.4 percent) becoming dominant. Xeric scrubland, to a smaller extent, is set to decrease in area and xeric woodland is expected to increase in the drier regions.

According to the Forest Survey of India (FSI), which was released in 2019, forest covers about 51,618.51 square kilometres of Odisha or about 33.15 percent of state’s geographical area. The state’s coverage includes 6969.71 square kilometres of very dense forest, 21,551.93 square kilometres of moderate forest, 23,096.87 square kilometres of open forest and 4,326.91 square kilometres of scrub. The

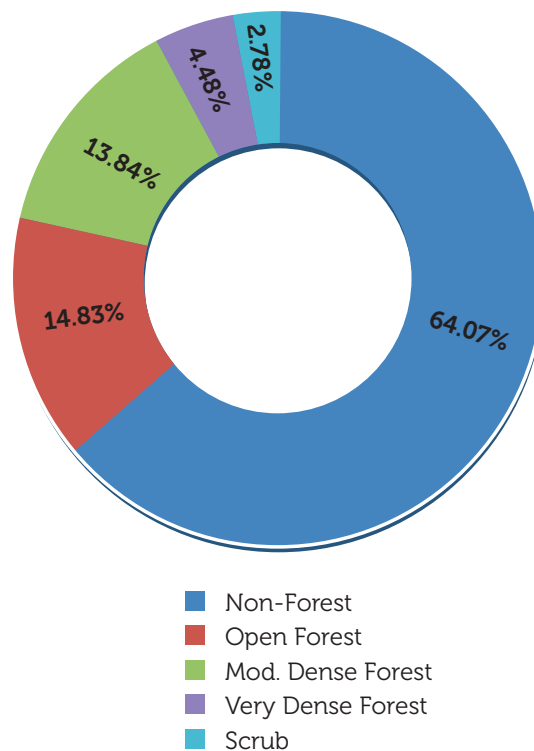


Figure 44 Forest Cover of Odisha
(Source: ISFR Odisha 2019)

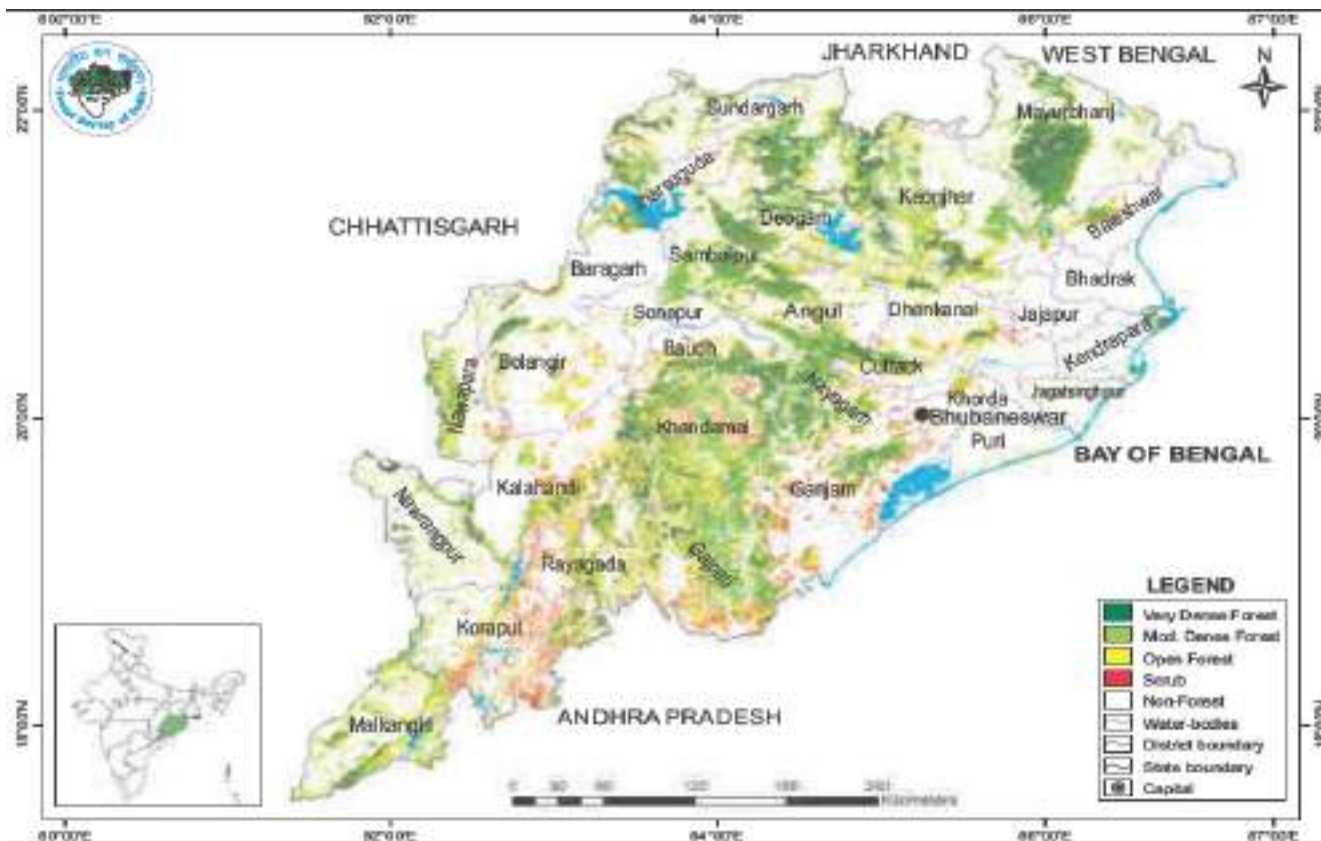


Figure 45 Forest Mix Odisha 2019
(Source: ISFR Odisha 2019)



state has reported extent of Recorded Forest Area (RFA) 61,204 sq km which is 39.31% of its geographical area. The Reserved, Protected and Unclassed forests are 58.90%, 40.75% and 0.35% of the Recorded Forest Area in the state respectively. The latest survey data on forest cover of Odisha is shown in Figure 44 and a map of the forest mix appears in Figure 45.

The changes in the state's forest cover are presented in Table 50. The table shows a net increase in forest cover in the state and expansion of the forest carbon sink. This improvement has been possible because of the enhanced conservation and plantation drive.

Table 50 Change in Forest Cover: Odisha, 2017 and 2019

	VDF	MDF	Open	Scrub	Total Forest	% of Forest	% Change	Trend
2017	6967	21370	23008	4306	55651	35.74	0.19	Increasing
2019	6970	21552	23097	4327	55946	35.93		

(Source: ISFR Odisha 2019)

Note: VDF = very dense forest; MDF = moderately dense forest.

5C.2 Impact of Climate Change

In view of the high diversity, tree density and low fragmentation of the Odisha forest, if protected properly it is likely to be the resource, least vulnerable to climate change. The early intervention in community-based forest management and robust implementation of the Forest Right Act are likely to maintain the carbon sink in the 21st century for the state. Some of the major species such as teak in the forest grids are not likely to be much affected and might even gain under both emissions scenarios. However, even within this overall scenario, of the 2,564 (2.5 x 2.5 minutes) forest grids that fall within Odisha state, 9.71 percent are projected to undergo change by 2035 and 13.53 percent by 2085 (Gopalakrishnan et al. 2011). This will affect the carbon flux and may affect the sink.

However, the temperature rise, as projected under the A2 scenario in IPCC AR4, would affect microflora and fauna in northern Odisha and the south-western part of Odisha and adversely affect the biodiversity. There is a likelihood of an increase in forest area because of the higher temperature and the dry deciduous nature of the state's forest.

Mining and industrial activity beyond the carrying capacity, if affected during this period, would cause irreversible damage to the ecosystem. There is also likely to be an intensification of the conflict between humans and wild animals (elephants, monkeys) in the adjacent areas.

5C.3 Gap/ Barrier Analysis

Area	Issues Faced	Gaps
Technical	<ul style="list-style-type: none"> Rising biotic pressure on forest Growing incidences of forest fires 	<ul style="list-style-type: none"> Because of decreasing pasture lands, forest has become major source of grazing and fodder Requirement of technological measures to control forest fires Understanding of vulnerability assessment findings and what it means for the sector Understanding of climate data, both historical and projections Accessing relevant climate and sectoral data

Policy& Regulatory	<ul style="list-style-type: none"> • People living in forest are directly dependent on fuel wood for lighting, cooking and heating • Land Diversions for development activities and agriculture expansion • Loss of habitat and increasing fragmentation of forest ecosystems • More cases of human wildlife conflict 	<ul style="list-style-type: none"> • Lack of alternate resources for cooking and lighting with the forest dependent communities • Unplanned development activities like construction of highways and railway lines
Institutional	Encroachment, Poaching and Illicit felling	<ul style="list-style-type: none"> • Strict monitoring to avoid encroachment, poaching and illicit felling • Need of effective planning of research into forest resources and their management • Capacity development of all stakeholders for awareness related to forest management

5C.4 Key activities taken up

The activities listed in Table 51 were undertaken in the state's Forest and Environment sector

Table 51 Key Climate Change Activities in Forestry Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Increase reforestation/ afforestation activities in degraded forest areas (392,759 hectares) and avenue planting (8,382 route kilometres).	Both	Implemented as a key priority (KP)
2	Protect existing forest stocks to act as carbon sink with stronger conservation.	Both	Implemented as a KP
3	Cover bald hills with suitable species mix.	Both	Implemented as a KP
4	Increase and protect existing mangrove cover and coastal biodiversity.	Both	Implemented as a KP
7	Assess fire management strategies.	Adaptation	Implemented as a KP
8	Improve tree planting and forest management to integrate with watershed and water resource management.	Both	Implemented as a KP
9	Work to establish new systems to support Community Forest Management (CFM), Joint Forestry Management (JFM) and REDD+ activities.	Adaptation	Implemented as a KP
10	Undertake studies on indigenous tree species to assess their vulnerability to climate change.	Adaptation	Implemented as a KP
11	Assess additional threats to biodiversity and wildlife.	Adaptation	Implemented as a KP
12	Obtain access to updated knowledge on climate change science and policy development.	Adaptation	Implemented as a KP
13	Build capacity of CFM committees and Panchayati Raj institutions to adapt to climate change.	Adaptation	Implemented as a KP
14	Monitor carbon stock and biodiversity at regular intervals.	Adaptation	Implemented as a KP

5C.5 Plan to Meet NDCs and SDGs

Table 52: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 5: To create an additional carbon sink of 2.5 to 3 billion tonnes of CO ₂ equivalent through additional forest and tree cover by 2030.	<ul style="list-style-type: none"> • Forest Conservation, Development and Regeneration • Increasing Green cover in the State (IGC) • Green Mahanadi Mission • Ama Jungle Yojana
NDC 6: To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change.	<ul style="list-style-type: none"> • Wildlife Protection and Conservation measures • Intensive protection of Critically Endangered Area (IPCEA)

Table 53: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 13: Climate Action	<ul style="list-style-type: none"> • Ama Jungle Yojana • Nature Conservation • Environmental Management • Climate Action Planning and Systematic Monitoring • Climate Finance and Budget Coding
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss.	<ul style="list-style-type: none"> • Increasing green cover in the forest • Survey and Utilisation of Forest Resources • Green Mahanadi Mission • Forest Conservation, Development and Regeneration

5C.6 Description of Activities and their implementation plan

FOR/KP/1- Increase the forest cover of the state by undertaking afforestation and reforestation measures (including River Rejuvenation & Green Mahanadi Mission)

There is tremendous potential to increase the carbon stock within the state. The canopy density of open and degraded forest can be increased through Assisted Natural Regeneration. Such land can be identified and brought under forest cover. Reforestation and afforestation can be achieved through economic plantations (2,300 hectares per year) and plantations under the Green India Mission and MNREGA convergence (20,000 hectares per year). Plantations under compensatory afforestation (1,000 hectares per year) have been targeted for coverage under this programme. Economic planting will be undertaken in designated and notified forest areas in suitable pockets to convert the lower-value growing stock to forest stand of higher value.

Under River Rejuvenation, a green belt will be created within one km width from riverbank to rejuvenate Mahanadi, Tel and IB rivers. Under Green Mahanadi Mission, two crore saplings will be planted along the Mahanadi river and its tributaries. The main objective of the mission is to stop soil erosion on riverbanks and recharge the groundwater reserve. It also aims to protect the Mahanadi River and keep it alive.

FOR/KP/2- Enhance the density of forests by undertaking Assisted Natural Regeneration (ANR) and protecting existing forest stocks to act as a carbon sink with stronger conservation

Assisted Natural Regeneration plantation under the National Afforestation Programme (5,080 hectares per year), MNREGA (30,000 hectares per year), the Compensatory Afforestation Programme, CAMPA (9,700 hectares per year) and the Odisha Forestry Sector Development Project (OFSDP) under Ama Jungala Yojana (22,000 hectares per year) will be undertaken in the state. Protecting existing forest cover and carbon stocks is as important as undertaking reforestation and afforestation. Recent Forest Survey of India statistics reveal an increase of 295 square kilometres of forest cover from 2017 to 2019 (55946 square kilometres in 2019 and 55651 square kilometres in 2017). This is the result of stronger protection measures and people's participation

in forest conservation. These activities are to be continued with renewed vigour. Planting inside and outside of working plan areas (5,500 hectares per year) will be undertaken (about 2 lakh ha and 32 crore saplings). Emphasis will be put on mixed and qualitative forest, so that it will be a carbon sink and not a carbon source. Procedures for stronger protection measures and community participation will be formulated.

FOR/KP/3- Increase planting on non-forest land

There is vast scope for increasing the carbon stock by increasing planting on non-forest land such as orchards, trees on farm lands, roadside plantations, canal banks and irrigation projects. Urban and peri-urban plantation programmes will be undertaken to reduce the adverse impact of climate change in urban areas. Planting about 17, 00,000 seedlings a year have been proposed under these initiatives. To increase the green cover outside forests in both urban and rural areas, including on the premises of public institutions in the state, seedlings will be distributed free of charge to the beneficiaries. Furthermore, to create a green belt along roads (national highways, state highways, express ways, district roads and Panchayat roads) and to provide environmental services and shelters, avenue plantation of 4,000 route kilometres per year (about 25,000 routes KM) will be undertaken. In summary, under this initiative trees will be planted on these non-forest lands.

FOR/KP/4- Cover bald hills with suitable species mix

Scrublands across Odisha are mostly bald hills devoid of any appreciable forest growth. Such lands can be found in the districts of Ganjam, Koraput, Rayagada, Kalahandi, Kandhamal, Gajapati, Nayagarh, Bolangir and Khordha, among others. These are very difficult sites for plantations. The scrub forest of 4,326.91 square kilometres in the state is mainly in the form of bald hills, which can be used for planting at the rate of 1,000 hectares per year after filling the pits with external soil. However, mixed species instead of a monoculture will be used for normal and compensatory planting in order to increase green cover.

FOR/KP/5- Increase and protect existing mangrove cover and coastal biodiversity along the coast

Mangroves can serve as excellent barriers against climate-induced extreme weather events such as cyclonic storms. They also can act as a blue carbon stock and they have proven to be most effective for carbon sequestration. Odisha has 221 square kilometres of mangroves in the districts of Kendrapara, Bhadrak, Jagatsinghpur, Balasore and Puri. Under this initiative, the area under plantation will be increased and potential mangrove areas will be protected. Rs 5.65 crore has been proposed for this activity.

FOR/KP/7- Conserve and regenerate bamboo forest

The State Government has constituted the Odisha Bamboo Development Agency (OBDA) to address all aspects of bamboo development in the state. Planting under the Odisha Bamboo Development Project (1,000 hectares per year) and under the National Bamboo Mission (700 hectares per year) and regeneration under CAMPA (1, 00,000 hectares per year) will be undertaken.

FOR/KP/8- Undertake sustainable management of forests and maximisation of forest productivity, preparation of management plans and scientific forest management through annual coupe working

Climate change will make weather more uncertain and less predictable. Soil and water conservation measures in watersheds will be undertaken to control runoff, to conserve water and to harvest (excess) water. This activity will be undertaken by Odisha Forest Development Corporation.

FOR/KP/11- Implement joint forest management so that people can participate in conservation, management and regeneration

Climate change will exacerbate the pressures on the forest. In that context, the pressures must be reduced through formation of Vana Surakhya Samitis (VSS) and Eco Development Committees (EDCs). Under this initiative, it is proposed that the capacity of communities to manage through the sustainable forest management plan be enhanced. VSS committees will be convened under the Ama Jungala Programme. An Eco Development Committee will be mobilised for protection and management of the forests.



FOR/KP/10- Conserve wildlife and its habitat, assessing the threats to biodiversity and wildlife

Effective implementation of management plans is needed to conserve and improve the status of wildlife and biodiversity in the state. Steps will be taken to develop meadows in interior forest areas to meet the food requirement of herbivores and delimit their movement in forest areas. To augment the water available to wild animals, more water bodies will be created in forest and protected areas. The existing water bodies will also be renovated regularly. The fragmented forest landscapes will be linked through corridor development measures in order to maintain their connectivity to facilitate movement of long-ranging wild animals. An improved communication network through equipment such as VHF radios /mobiles, vehicles, as well as camp sheds and watchtowers are needed to facilitate the protection and conservation of forests and wildlife. Amphibian wild life and threat due to climate change and anthropogenic pressure will be duly assessed. Example-Irrawaddi dolphins, sharks, crocodiles, Olive Ridley turtles.

FOR/KP/12- Build the capacity of the department staff in the field to tackle climate change related issues

Staffs of the department especially at all levels in the field will be sensitised through various capacity-building programmes related to the Climate Change Action Plan. The capacity building of the staff will also be carried out to develop a strategy for adapting to climate change as part of sustainable forest and wildlife management. Sensitising and building the capacity of the JFM/Eco Development Committees and Panchayati Raj institutions is also needed through training and awareness generation programmes.

FOR/KP/9- Undertake research studies on indigenous flora and fauna and their vulnerability to climate change

Climate change is expected to have a significant impact on the forest ecosystem, thereby affecting wildlife because many species may be unable to tolerate the weather changes. Study of the long-term effects of climate change on plant species and wildlife is needed. Ex-situ conservation of threatened/endangered species will be undertaken through captive breeding programmes.

FOR/CAP/N3- Forest Protection (Procurement of Equipment & Communication Infrastructure)

For effective communication both within and outside department, as per the CAMPA APOs provisions have been created for the establishment of control rooms. These control rooms are provided with various equipments which are used in forest management. An improved communication network through equipment such as VHF radios /mobiles, vehicles, as well as camp sheds and watchtowers are needed to facilitate the protection and conservation of forests and wildlife. For improving the performances of wildlife protection squads, fire squads and anti-depredation squads, it is essential that they should have better communication facilities for which they are supported with VHF/GPS sets, new mobile sets and recharging and maintenance of mobile sets.

FOR/KP/6- Forest Fire Protection

Forest fire is a major cause of degradation of forests. With the change in climate, forest fires will increase because a warmer climate means more fires. Thus a strategy of fire forecasting, fire prevention and fire fighting will be developed. Modern technologies will be used to locate fires and forecast fires. Based on satellite images, fire-prone zones will be prioritised and monitored. Community participation in fire prevention and fire fighting will be encouraged through incentives. An improved communication network through equipment such as VHF radios /mobiles, vehicles, as well as camp sheds and watchtowers are needed to facilitate the protection and conservation of forests and wildlife.

FOR/CAP/N1 (MIN/KP/2 & MIN/CAP/22) - Green Belt Development and maintenance in mining clusters

Green belt development helps to reduce emissions and also helps to lower the ambient temperature in the region and improve biodiversity. Creation and maintenance of green zones in major mining clusters is a regular activity that will be further enhanced. These green zones will serve as additional carbon sinks and also contribute towards building local environmental benefits.



Olive Ridley turtle mating & mass nesting

5C.7 Co-benefits

Forestry sector has both adaptation and mitigation co-benefit. Promoting plantation activity in large scale facilitates the creation of an economic alternative (both for the state) and also for private owners of degraded land, mainly small and marginal farmers, which in turn will result in a new impetus to the forestry activity in the state. This would increase rates of afforestation and restoration of natural forests and make the livelihood of forest dependent communities resilient. It will also enhance bio-diversity and eco-system balance. At the same time, the establishment and enhancement of forest cover in the state will result in the generation of an environmental asset that will be a key part of the national strategies of mitigation of GHG emissions.



Forest Fire fighting squad





Forest fire management



5C.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	FOR/KP/1	Increasing the forest cover of the state by taking up massive plantation programme (including River Rejuvenation & Green Mahanadi Mission)	500,000.00	10.00	500,000.00	-	IGC, GMM, OF-SDP, NAP, AJY, GJM, CAMPA & Deposit scheme	2.5 lakh ha	MI
2	FOR/KP/2	Enhance the density of forest by taking up Assisted Natural Regeneration and Protecting existing forest stocks to act as carbon sink with stronger conservation	780,000.00	10.00	780,000.00	-	CAMPA, GMM & Deposit scheme	20 lakh ha	MI
3	FOR/KP/3	Increasing planting on non-forest land	28,000.00	10.00	28,000.00	-	OBDA, CSR	0.2 lakh ha	MI
4	FOR/KP/4	Covering bald-hills with suitable species mix	151,250.00	10.00	151,250.00	-	IGC, GMM, OF-SDP, NAP, AJY, GJM, CAMPA & Deposit scheme	0.50 lakh ha	Both
5	FOR/KP/5	Mangrove cover and coastal biodiversity along the coast	4,953.96	10.00	2,158.74	2,795.22	State, CSS, ICZMP, CAMPA	Area specific	Both
6	FOR/KP/7	Conserve and regenerate bamboo forest	47,680.00	10.00	47,680.00	-	CAMPA	16 lakh ha SSO timber	AD
7	FOR/KP/8	Sustainable management of forest and maximising forest productivity, preparation of management plans and scientific forest management through annual coupe working	38,740.00	10.00	38,740.00	-	IGC	10 lakh ha SSO Timber, research and production of QPM	AD

8	FOR/KP/11	Implementation of Joint Forest Management for people participation in conservation, management and regeneration	14,000.00	10.00	14,000.00	-	NAP, GJM, IGC	14000 VSS & EDC	AD
9	FOR/KP/10	Conserve wildlife and its habitat	398,614.93	10.00	164,653.99	233,960.94	State, CSS, CAMPA, ICZMP	Area specific/state wide	AD
10	FOR/KP/12	Capacity building	55,127.00	10.00	55,127.00	-	IGC, GJM, NAP	8500 forest field staff and 4500 squad personnel	AD
11	FOR/KP/9	Research activities	1,050.00	10.00	1,050.00	-	CAMPA	Silviculture research on tree improvement, nursery and plantation	AD
12	FOR/CAP/N3	Forest protection (Procurement of equipment & Communication infra-structures)	8,000.00	10.00	8,000.00	-	CAMPA	Fire blowe, GPS, Walky talky, VHF set	AD
13	FOR/KP/6	Forest protection	200,000.00	10.00	200,000.00	-	CAMPA	Forest protection squad, construction of watch tower, hiring of vehicle	AD
14	FOR/CAP/N1 (MIN/KP/2 & MIN/CAP/22)	Green Belt Development and maintenance in mining clusters	6,100.00	10.00	1,525.00	4,575.00	Forest & Environment Department, Mining Companies		MI
		Total in (Rs Crore)	22,335.16		19,921.85	2,413.31			

5D: Water Resources

5D.1 Overview

The movement of water in the climate system is essential to life on land because much of the water that falls on land as precipitation and supplies the soil moisture and river flow has been evaporated from the ocean and transported to land by the atmosphere. The world is increasingly confronted with mounting evidence of significant alterations in climate patterns stemming from anthropogenic emissions. They cause frequent extreme events such as floods and droughts and are responsible for a rising sea level, leading to submergence of the coastal area and its erosion, quite apart from other consequences. The present agricultural practices are also having uncertain and adverse effects linked to the changing climatic conditions. Many of these effects are due to the direct or indirect impacts of climate change on hydro-met systems, leading to excesses or shortages of water. The IPCC's Fifth Assessment Report also shows widespread decreases in relative humidity near the surface of the land in recent years. Indirect evidence from scientific data and sea salinity studies show that the pattern of evaporation-precipitation over the oceans has been enhanced since the 1950s. This is likely to have adverse impacts on the spatial and temporal scales in several regions, including India and Odisha. The long-term average rainfall in the state is about 1,452 millimetres. According to a 2009 assessment, the net annual groundwater availability is about 16.69 billion cubic meters. The 2005 and current annual groundwater draft for Odisha is shown in Table 54.

Table 54 Annual Groundwater Draft, Current and Projected: Odisha

Usage level	Current level (in bcm)	2025 level (in bcm)
Irrigation	4.14	Available 11.94
Domestic and industrial uses	0.87	1.27

(Source: State Water Policy)

There are eleven principal rivers traversing the entire state that can be grouped under eight major river basins within the state, whereas the Indravati, Kolab, Machkund sub-basins in the south forms part of Godavari river basin. Most of the major rivers flow in easterly and south-easterly direction with gentle gradient. In general, the drainage pattern is of both dendrite and radial types. The availability of water in the future from basins is presented in Table 55.

Table 55 Basin Water Availability, Odisha

Basin Name	Average annual flow (in BCM)			75% dependable flow (in BCM)		
	Own	Outside State	Total	Own	Outside State	Total
Mahanadi	29.9	21.039	50.939	25.508	16.702	42.21
Brahmani	11.391	3.118	14.509	8.849	2.395	10.884
Baitarani	7.568	-	7.568	5.434	-	5.434
Rushikulya	3.949	-	3.949	2.782	-	2.782
Vansadhara	5.083	-	5.083	3.881	-	3.881
Budhabalanga	3.111	-	3.111	2.521	-	2.521
Kolab	11.089	-	11.089	8.885	-	8.885
Indravati	6.265	-	6.265	4.451	-	4.451
Bahuda	0.438	-	0.438	0.213	-	0.213
Nagavali	2.853	-	2.853	2.322	-	2.322
Subarnarekha	1.193	1.115	2.308	1.193	1.115	2.308
Total	82.841	25.272	108.11	65.679	20.212	85.891

Source: Odisha State Water Plan, 2007

5D.2 Impact of Climate Change

In Odisha, the per capita water availability is about 3,359 cubic meters per year. However, this might be drastically less in some areas, especially in southern and south-western Odisha. It is likely to fall to 2,218 cubic meters by 2051 (this is still more than 1,700 cubic meters, which is a water-stressed condition). Because the monsoon contributes more than three-fourths of the water in the state's water reserve, any change in monsoon behaviour affects the state's flood & drought related vulnerability. Groundwater levels in Odisha, pre-monsoon in 2014, are shown in Figure 46:

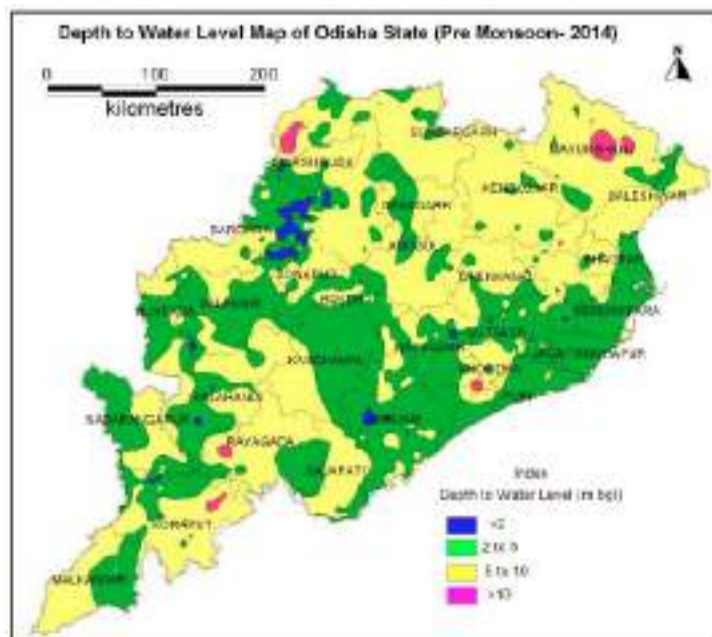


Figure 46 Groundwater Level: Odisha, Pre-monsoon, 2014
(Source: Central Ground Water Book)

The pre & post monsoon assessment by the Central Ground Water Board in 2014 observed that in 8 percent of wells, water level ranges were 0–2 meters below ground level; about 45 percent of the wells analysed had water levels in the range of 2–5 meters below ground level; and about 45 percent of monitoring stations showed a depth to water level range of 5–10 meters below ground level. Less than 2 percent of the wells analysed had a water level in the range of 10–(–0) meters below ground level. It was also observed that the decadal mean (pre-monsoon 2004–13) fluctuation of water level in about 62 percent of the analysed wells showed a rise in water level and of those, 51 percent of wells showed a rise in the range of 0–2 meters, 9 percent in the range of 2–4 meters and 2 percent in the range of more than 4 meters. About 37 percent of wells showed a fall in water level, mostly in the range of 0–2 meters (34 percent of the wells). About 1 percent of wells showed no change. Therefore, water is still not a strong vulnerability from an availability point of view. Rather, it is a management challenge in view of the spatial variability.

The hydro-met vulnerability is discussed in vulnerability chapter. The other vulnerability is on the demand side. The bigger problem seems to be the water supply for the rapidly forming urban agglomerations in the state, especially around the industrial clusters. For Class I towns, the domestic water demand is about 291.333 cubic meters at the 2051 level; for Class II towns, 92.733 cubic meters; and for Class III towns, 51.115 cubic meters. The contamination of groundwater and the increased turbidity due to the temperature rise has raised the disease burden in some areas, largely because of the poor drainage or the release of wastewater to rivers without adequate treatment.

The state is power surplus (with a demand in excess of 3,500 megawatts) because of the normal monsoon. If there is below-normal rainfall, hydropower generation falls below 400 megawatts. This, coupled with the poor supply of coal to thermal power plants, puts enormous pressure on the demand-supply power situation in the state.

Aquaculture (fresh and brackish) is the other area of the economy affected by the water sector. As per the Odisha State Water Plan, the total water requirement as estimated in 2011 was in the range of 1,085,158.59 million litres. This requirement is likely to be affected if there is a shortfall in rainfall. In the case of floods, the fish escape and the predatory species damage the aquaculture.

Flood & drought-related vulnerability are discussed in Chapter-4. Management of flood and water are critical task of the Water Resources Department in its effort to achieve the balanced growth of Agriculture and its allied sector, Energy as well as make quality water available to each citizen of the state in an adequate quantity.

5D.3 Gap/ Barrier Analysis

Work Vertical	Observed Gap
Institutional	<ul style="list-style-type: none"> • More planning for conservation and judicious use of the surface as well as ground water resource for different purpose • Lack of expertise in Integrated Water Resource Management as an adaptation option • Lack of proper maintenance of micro-level data that affects the micro-level planning, especially systematic ground water monitoring and management of runoff and conjunctive use • Need of interdepartmental coordination mechanism for specific sectoral outcome impacted by climate change
Technical	<ul style="list-style-type: none"> • Understanding of vulnerability assessment findings and what it means for the sector • Understanding of climate data both historical & projections and use in resilience infrastructure planning • Accessing relevant climate and sectoral data from different sources (technical institutions) and use in the planning process & Disaster Risk Reduction • Inadequacy of up-to date technical and scientific studies at the state level • Identified irrigation potential is not being tapped as per requirement • Requirement of scientific approach in streamlining and sequencing water management structures
Financial	<ul style="list-style-type: none"> • Inadequacy of fund for implementation of activities
Regulatory/ Policy	<ul style="list-style-type: none"> • Scheme convergence achieving similar objective • Need for an integrated approach for water management in meso scale • Revision of State Water Policy from time to time • Need of more effective policies for proper monitoring and enhancing water use efficiency

5D.4 Key activities taken up

The activities listed in Table 56 were undertaken in the state's Water Resources Sector.

Table 56 Key Climate Change Activities in Water Resources Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Expand the hydrometry network at 107 stations across the state.	Adaptation	Implemented as a key priority (KP)
2	Increase water use efficiency in irrigation projects. Includes water audit, benchmarking, monitoring and pricing (pilot study).	Adaptation and mitigation	Implemented as a KP

3	Construct and protect water harvesting structures through 6,000 check dams and restoration of 1,121 ponds.	Adaptation	Implemented as a KP
4	Improve the drainage system through desilting and expanding the network.	Adaptation	Implemented as a KP
5	Raise awareness with Pani Panchayat through farmers' training programme.	Adaptation	Implemented as a KP

5D.5 Plan to meet NDCs and SDGs

Table 57: Key Initiatives under NDCs for the Sector

NDCs	State Level Initiative
Strategy 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	<ul style="list-style-type: none"> • Buxi Jagabandhu Assured Water Supply to Habitations (BASUDHA) • Odisha Integrated Irrigated Agriculture and Water Management Investment Programme (OIIAWMIP) • Expansion and upgradation of water resources through National Hydrology Project • River bathymetric surveys for critical areas, Groundwater Survey and Investigation (GWS&I) • Rooftop rainwater harvesting and groundwater recharge in rural and urban areas • Transmission of hydro-met data to National Water Resources Information System • Command Area Development and Water Management Programme (CAD&WM)

Table 58: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 6- Ensure availability and sustainable management of water and sanitation for all	<ul style="list-style-type: none"> • National Rural Drinking water and National Urban Drinking Water Programme is being implemented • 1433 Community Lift Irrigation Projects (LIPs) installed, 1052 LIPs through Biju Krushak Vikash Yojana (BKVY) • Training of Jal Sathis in Tank areas for operation and maintenance of groundwater recharge shafts, solar pumping system etc • Tank system improvement through Odisha Community Tank Management Project (OCTMP) • Implementation of flood control projects • Deep Borewell Construction Programme • Strengthening of Odisha Pani Panchayats • Water Supply and Water Supply Improvement Schemes (WSIS) • Canal Lining and System Rehabilitation Programme (CLSRP) • State Plan for Basin Management
SDG 14- Conserve and sustainably use the oceans, seas and marine resources for sustainable development	<ul style="list-style-type: none"> • Revival of 1406 number of LIPs • Rehabilitation of 3 dams, Kalo, Nesa, Dhanei under Dam Rehabilitation and Improvement Project (DRIP) • Mukhyamantri Adibandha Tiari Yojana (MATY), Check dam construction programme • Repair, renovation and restoration of water bodies with domestic support for improvement of catchment areas of tank and groundwater recharge

5D.6 Description of Activities

WR/N1- Increase water use efficiency in the irrigation sector

The National Water Mission on Climate Change proposes enhancing water use efficiency in the irrigation command area by 20 percent. The State Government has proposed lining canals and undertaking canal rehabilitation work under the rehabilitation of canal networks, including lining/construction of the field channel. Bore wells, community lift irrigation projects (LIPs), Micro River lifts and shallow tube wells, a mega lift scheme and Indravati lift scheme under the priority area would enhance the availability of water and reduce the agricultural vulnerability stemming from climate change.

A good capacity-building effort would be to undertake climate-linked crop planning based on water availability and efficient distribution. Systematic collection and analysis of data will help water auditing and benchmarking of irrigation projects. All these activities will contribute to increased water use efficiency that can later be verified against the investments made.

WR/N2- Conserve water resources

The rivers in Odisha are seasonal. There is little flow in them during the non-monsoon period. It is essential to conserve the surplus monsoon water for utilisation during the dry period. Thus, the following projects are under consideration for pursuit over the next ten years under conservation of water resources: expediting completion of major and medium reservoir projects; constructing check dams; desilting minor irrigation tanks; Odisha Community Tank Management Project (OCTMP); and pursuing Repair, Renovation and Restoration (RRR) as well as rooftop rainwater harvesting and artificial recharge of groundwater. A new project OIIPCRA has been operationalised with World Bank support.

WR/N3- Improve flood control and drainage

One of the major climate change impacts is flooding. For the real time, flood forecasting models are needed to assist in preparedness. Expansion of the hydrometry network is essential for a better flood forecasting model. It is necessary to facilitate measurement and to process, store and disseminate hydrological and meteorological data both qualitatively and quantitatively. A Real-Time Data Acquisition System (RTDAS) was set up during phase 2 of the World Bank-supported River Hydrology Project. During this phase, 107 hydro- metrological stations were installed. In the priority area of flood management, the following projects are under consideration for the next five years: river and saline embankments (raising and strengthening), embankment construction, renovation or construction of spurs/ launching aprons, identification of a flood hazard zonation map, extension of the flood forecasting network, real-time operation of the Rengali and Hirakud reservoir, preparation of a basin flood control master plan, excavation and resectioning of drainage channels and construction of field drains in the command area of irrigation projects.

WR/N4- Assess the impact of climate change on the state's water resources

A detailed assessment of the impact of climate change on water resources is needed to take the necessary preventive measures. For this, development of a water database for the state through the Integrated Water Resources Management (IWRM) study is being contemplated. The basic principle of IWRM is that the river basin should be recognised as a basic unit in water planning. Increasing demands on water, leading to scarcity, have forced the state to adopt IWRM as the basic approach to water resource management. All water related activities in the basin are to be planned, managed and overseen by a single multidisciplinary organisation, the River Basin Organisation (RBO), in partnership with the Department of Water Resources. Thus there is a need for reassessment of the basin water situation, review of the network of hydrological observation stations and the establishment of additional stations, development of a state water resources information system and implementation of advance technology for the collection and analysis of data. This information will be used to develop climate-sensitive groundwater legislation, including the development of a groundwater data system for monitoring the consumptive use of groundwater.



Conserve water resources



Improve flood protection



Institutional Capacity Building Programme



Conserve water resources



Improve flood control and drainage



5D.7 Co-benefits

Some of the major co-benefits include increasing water availability for crops (especially rabi and summer crops) in a climate-stressed situation and improving water use efficiency. Fewer crop failures enhance livelihood security and food security. The mitigation co-benefits include more clean power through enhanced hydrogeneration, reduced energy demand from more efficient use of groundwater and pumping systems and the integration of solar pump sets and generation along canals.

The livelihood resilience co-benefits are indirect and linked to the investment in the development and conservation of water resources. Finally, improving water quality by means of less turbidity, managing salinity and improving drainage and sewerage has environmental co-benefits.

5D.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	WR/N1	To increase water use efficiency in Irrigation sector (CAP-4) Old (rehab of network incld lining, water audit and benchmarking, use of sprinkler and drip, Command Area Development)	2194308.8	10				State Wide	Both
2	WR/N2	Conservation of Water Resources (Expediting completion major & medium reservoir projects , Construction of check dams, De-silting of minor irrigation tanks, roof top rain water harvesting & artificial recharge of ground water Generating community awareness for water conservation)	5922393	10				State Wide	AD
3	WR/N3	Flood protection & anti-erosion works, non-structural works, drainage system improvement (Flood Control , River Training & Drainage Improvement (flood modelling, non-structural work, erosion control, drainage improvement etc.)	2134255	10				State Wide	AD
4	WR/N4	Assessment of Impact of Climate Change on water resources of the state (old CAP 1, CAP 10, 12, 13, 18)	7500	10				State Wide	AD
		Total (in Rs Crore)	102584.57		102584.57				

5E. Health

5E.1 Overview

The Health and Family Welfare Department of the Government of Odisha has been making an ongoing, concentrated effort to formulate and implement schemes to ensure that the people of the state have adequate health care services in line with National Health Policy. Special care is also being taken to meet the needs of people living in the tribal area and backward region.

The objectives are as follows:

- To provide the people of the state with affordable health care and adequate curative and preventive facilities
- To eliminate diseases such as Polio and Leprosy and to prevent as well as to control communicable diseases
- To reduce maternal, infant and Neonatal Mortality Rates
- To improve hospital services at the primary and secondary levels

5E.2 Impact of Climate Change

Natural disasters are common in Odisha because of its specific geo-climatic condition, which makes the state more vulnerable to cyclones, floods, tornados, drought and heat waves. These climate-induced events result in epidemics that have the potential to cause mass casualties and suffering within a short period of time. From March to October, Odisha experiences calamities such as floods, cyclones, droughts or heat waves. Floods were experienced in 2003, 2004, 2007, 2011, 2013 and 2014. Eighteen of the state's 30 districts are prone to flood or flash flood. Experiences with the Super Cyclone of 1999, Super Cyclone "Phailin" of 2013, Hudhud in 2014, Fani in 2019 and frequent floods in the state have resulted in the prevalence of both water-borne and vector-borne diseases in the immediate aftermath. And between March and June, the recorded temperature is above 45°C in 30–40 percent of districts. All 30 districts of Odisha are prone to experiencing heat stress disorders.

The following are the impacts of extreme climate-induced changes on air, water and food:

- Heat waves lead directly to heat stress disorders such as heat stroke, heat exhaustion, heat cramps and heat syncope.
- Heavy rainfall (flood and cyclone) leads directly and indirectly to mass casualty incidents, population displacement or migration and water & vector borne diseases.
- Food scarcity during a drought leads to malnutrition and psychosocial disorders.
- Air pollution leads directly to respiratory diseases and other health consequences.

5E.3 Gap/Barrier Analysis

Work Vertical	Observed Gap
Institutional	<ul style="list-style-type: none"> • Strong surveillance system • Early warning system • Need of climate experts advising on departmental programs on the basis of climate stress • Proper integration of health and climate change issues in the planning process (e.g. heat stress, preventive action for vector control) • Sustainability of different departmental programmes
Technical	<ul style="list-style-type: none"> • Need of adequate healthcare staff in remote villages • More awareness about the control measures for vectors • Understanding of vulnerability assessment findings and what it means for the sector

Financial	<ul style="list-style-type: none"> Financial assistance to provide multi-speciality health care facilities Paucity of funds delay in implementation of activities
Regulatory/ Policy	<ul style="list-style-type: none"> Scheme convergence achieving similar objective Need of inter departmental co-ordination for better clarity of goals Need of effective policies related to health and climate change

5E.4 Key activities taken up

The activities listed in Table 59 were undertaken during in the state's Health sector.

Table 59 Key Climate Change Activities in Health Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Strengthen approaches (e.g., integrated vector management; information, education and communication (IEC); behaviour change communication; and capacity building) to manage vector-borne diseases that have worsened because of climate change impacts	Adaptation	Implemented as a key priority (KP)
2	Strengthen approaches to deal with heat wave conditions exacerbated by climate change	Adaptation	Implemented as a KP
3	Undertake measures (e.g., improved disease surveillance and IEC) to manage water-borne diseases that have worsened because of climate change impacts (to be carried out by the Public Health Engineering Organisation, PHEO)	Adaptation	Implemented as a KP

5E. 5 Plan to meet NDCs and SDGs

Table 60: Key Initiatives under NDCs for the Sector

NDCs Commitment - Health Sector	Key State level initiative to comply with NDCs Statements
NDC 1: To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	<ul style="list-style-type: none"> National Health Mission Mission Shakti MAMATA State support for implementation of ICDS in the State Strengthening of Ancillary Services at Public Health Facilities (Nirmal) National Disease Control Programme (NDCP) National Vector Borne Disease Control Programme (NVBDCP) under NHM and NDCCP National Leprosy Eradication Programme (NLEP) under NHM Health service development for Disaster Management Public Private Partnership in Malaria Control Urban Health Centers for Slum Population

Table 61: Key Initiatives under SDGs for the Sector

SDGs	Key Initiatives by the State
SDG 3: Ensure healthy lives and promote well-being for all at all ages	<ul style="list-style-type: none"> National Health Mission, Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+A) and Health System Strengthening

	<ul style="list-style-type: none"> • Sishu Abon Matru Mrutyuhara Purna Nirakarana Abhijana (SAMPURNA) • Supplementary Nutrition Programme (SNP) • Sishu Abon Matru Mrutyuhara Abhijana (SAMPURNNA) • MAMATA scheme • Durgama Anchalara Malaria Nirakaran (DAMAN) • Mobile Health Units • Mukhyamantri Swasthya Seva Mission • Biju Swasthya Kalyan Yojana (BSKY) • Food Safety Programme • Niramaya- Free drug Scheme • Nidan- Free Diagnostic and Dialysis Services • Free OPD IPD services • Infant Mortality Rate Mission
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5E.6 Description of Activities and their implementation

H/KP/1- Build the capacity of Health sector personnel on issues relating to climate change

Plans are under way to sensitise hospital staff, rapid response teams and the five-member quick reaction team from each village to the issue of disaster response and climate change. Plans are also under way to train staff in the use of renewable energy such as solar water heating, rainwater harvesting and energy efficiency measures to reduce the carbon footprint of hospitals.

H/KP/2- Integrate climate change concerns into the State Health Policy

This activity includes a comprehensive review of State Health Policy and assessment of climate stressed areas to make provisions of a dedicated trained staff and labs, as well as the placement of buffer resources. The policy would ensure to have judicious placement of the staff needed for diagnostic, referral and transport services in the climate stressed areas. They must be equipped with adequate consumables to enable them to undertake early detection, prevention and recovery measures.

H/KP/3- Strengthen approaches to manage the vector- borne diseases that worsen because of climate change

This activity would expedite disease surveillance, entomological study, vector control measures and environmental engineering. Eleven interventions are proposed to reduce vector density and parasite loads in endemic communities.

H/KP/4- Strengthen approaches to deal with heat wave conditions in the state

This activity would continuously sensitise the staff of control rooms on treatment protocols from March to June to deal with heat stress and provide sufficient drugs, consumable and facilities to deal with heat stress. It is also proposed that the targeted communication effort be supplemented. A proposed Rs 10 crore would be spent in ten years.

H/KP/5- Undertake measures to manage water-borne diseases that have worsened because of climate change impacts

This approach would strengthen disease surveillance units for early detection and control of water-borne diseases and periodic monitoring of water quality and it would include a review and feedback mechanism. Provision would be made for separate Diarrhoea and Herpetology units, dedicated wards, free drugs and isolation wards. Case management and referral units should be strengthened to deal with the large-scale epidemiological situations aggravated by climate change. An intensive IEC campaign also should be mounted. The budget for this activity will be Rs 30 crore.



Managing water-borne diseases



Managing vector- borne diseases

ସ୍ୱାସ୍ଥ୍ୟ ପୁନଃ

ପ୍ରତି ସତର୍କ ରୁହନ୍ତୁ ।



ଭୁମ, କାଶ, ଗହାବରଣ, ମୁଣ୍ଡବିନ୍ଧା,
ଦେହ ଘୋଡ଼ାବିନ୍ଧା, ଚରକଦାହ, ଦାନ୍ତି ହେବା,
ନିଶ୍ୱାସ ପ୍ରଣାଳୀରେ କଷ୍ଟହେବା ଏବଂ ଆଖି ଲାଲ୍ ପଡ଼ିବା ।

ସ୍ୱାସ୍ଥ୍ୟ ପୁନଃ ର ଲକ୍ଷଣ ହୋଇପାରେ

ଉପରୋକ୍ତ ଲକ୍ଷଣ

ପୁରାଣ ପାଇଲେ ବିକଳ ନକରି ନିବେଶୁ ଡାକରଖାନାକୁ
ଯାଇ ଚିକିତ୍ସା ଓ ପରାମର୍ଶ କରନ୍ତୁ ।

ଏହି ଘୋଷଣା ବିକଳ ନକର ନିମ୍ନ ମୁଖ୍ୟ ବିକଳଗୋଷ୍ଠୀ ଉପରେ ଉପଯୁକ୍ତ ଉପାଦାନ ଉପରେ କରାଯାଏ ।



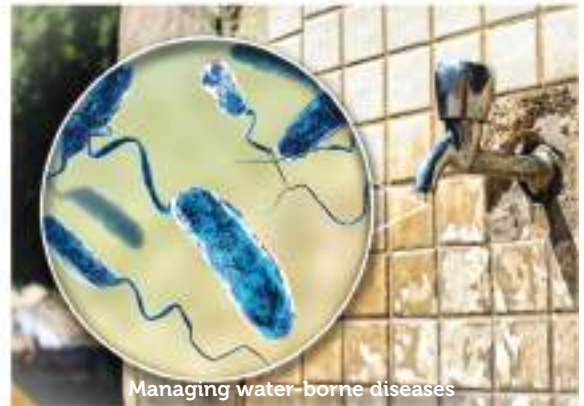
Odisha State Health and Family Welfare Department



Managing vector- borne diseases



Strengthen approaches to deal with heat wave conditions



Managing water-borne diseases



5E.7 Co-benefits

One of the co-benefits of these Health sector activities is enhanced life expectancy. The improved air and water quality needed to boost health would have environmental benefits as well. Mitigation co-benefits would result when renewable energy (such as solar water heaters) is integrated into hospital infrastructure and energy efficiency measures are undertaken.

5E.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	H/KP/1	Capacity building of the Health Sector on climate change on adaptation and mitigation aspects	36,200.00	10.00	36,200.00		State Health Society	30 districts over 10 years	AD
2	H/KP/2	Integrating climate change considerations in the State Health Policy	6,000.00	10.00	6,000.00		State-Health Society	30 districts over 10 years	AD
3	H/KP/3	Strengthening approaches to manage vector borne diseases with worsening that have worsened due to climate changes impact.	18,000.00	10.00	18,000.00		State Health Society	30 districts over 10 years	AD
4	H/KP/4	Strengthening approaches to deal with Heat wave conditions exacerbated due to climate change impacts	1,000.00	10.00	1,000.00		State Health Society	30 districts over 10 years	AD
5	H/KP/5	Undertaking measures to manage waterborne diseases that have worsened due to climate change impacts.	3,000.00	10.00	3,000.00		State Health Society	30 districts over 10 years	AD
		Total (in Rs Crore)	642.00		642.00	-			

State's Strategy for battle against COVID-19 pandemic

Armed with 'zero transmission' target against COVID-19 coupled with a proactive approach and multi-pronged strategy, Odisha slowed down the Coronavirus spread and making itself ready for a long battle against the menace. Odisha was the first state to have declared COVID-19 as a disaster and imposed lockdown and drew appreciation from the Govt. of India for being among the top two states in containing and combating the COVID-19 pandemic efficiently.

5F: Coastal and Disaster Risk Management

5F.1 Overview

Odisha has a coastline spanning 480 kilometers that covers six districts: Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Puri and Ganjam. According to the 2011 census, the total population of these six coastal districts is 10,112,048 and it is distributed over an area of 21,887 square kilometers with a population density of 462 persons per square kilometer. The coastal area and hinterlands along the coast are rich in biodiversity. They include Chilika, Asia's largest brackish water lagoon, which includes a 672-square kilometer mangrove forest and wetland. Odisha also has a large nesting beach of Olive Ridley turtles along its southern coast.

The coastal and marine environment plays a critical role in the socioeconomic, cultural and environmental well-being of the state. It has strong linkages to industrial development, agriculture, aquaculture, recreation and port-related transport and commerce. Some of these activities compete for space along the coast and management of the coastal zone is vital for the state's development. The loss of land to the sea has become a more recurrent phenomenon. Ocean dynamics and coastal processes have a strong link to climate change. They also have strong links to various disasters that confront the state quite often.

5F.2 Impact of Climate Change

According to the IPCC Fifth Assessment Report's Representative Concentration Pathway (RCP), the 2.6 scenario coincides with global warming of 1.5 degree Celsius and in this scenario the sea level is projected to rise by 0.36 meters (range of 0.20 meters to 0.60 meters). And for the four degree Celsius world, by 2100, the sea level is projected to rise by 0.58 meters (range of 0.40 meters to 1.01 meters).

Coastal vulnerability is strongly correlated with elevation and the exposure. Regional coastal process modelling undertaken by the Integrated Coastal Zone Management (ICZM) project supported by the World Bank has identified the vulnerable areas along the coast. Structural and non-structural measures have been undertaken to mitigate the risks. Of the coast length of 480 kilometers, nearly 187 kilometers are exposed to erosion and are considered accreting or stable; 39.3 kilometers are a high erosion zone; and 51.96 kilometers have been designated at medium erosion zone. Coasts subjected to accretion are considered less vulnerable areas as they move toward the ocean and result in the addition of land areas, whereas areas of coastal erosion are considered more vulnerable because of the resultant loss of private and public property and important natural habitats such as beaches, dunes and marshes.

Global warming is also likely to affect the brackish water fishery, which is a major revenue earner in the state. This type of fishery is expected to undergo significant physiological change during the larval stage because of higher acidification.

Saline water ingress and poor water discharge due to high tide would affect the crop productivity and food security in this region. Coastal cities such as Paradeep, Gopalpur and Dhamara have ports and are also highly populated. Enhanced storm surge will inundate the coastal infrastructure and affect the lives and livelihoods of people in these cities. The disaster proneness of the coastal areas from storm surge, erosion and periodic cyclones raises the overall disaster risk for the state. A multi hazard analysis of Odisha is shown in Figure 47

In just about 30 years, a latest study has said, sea level rise may put large parts of coastal Odisha under Ganjam, Puri, Jagatsinghpur, Kendrapara, Bhadrak and Balasore districts at greater risk of deluge and inundation, affecting lakhs of people. The research paper, produced by Climate Central, a science organisation based in New Jersey, revealed that the entire coastline stretching from Ganjam to Balasore is at risk of falling below the elevation of an average annual coastal flood by 2050. The organization's projection maps show that a number of important coastal eco-systems such as Bhitarkanika National Park, Balukhand-Konark Wildlife Sanctuary,

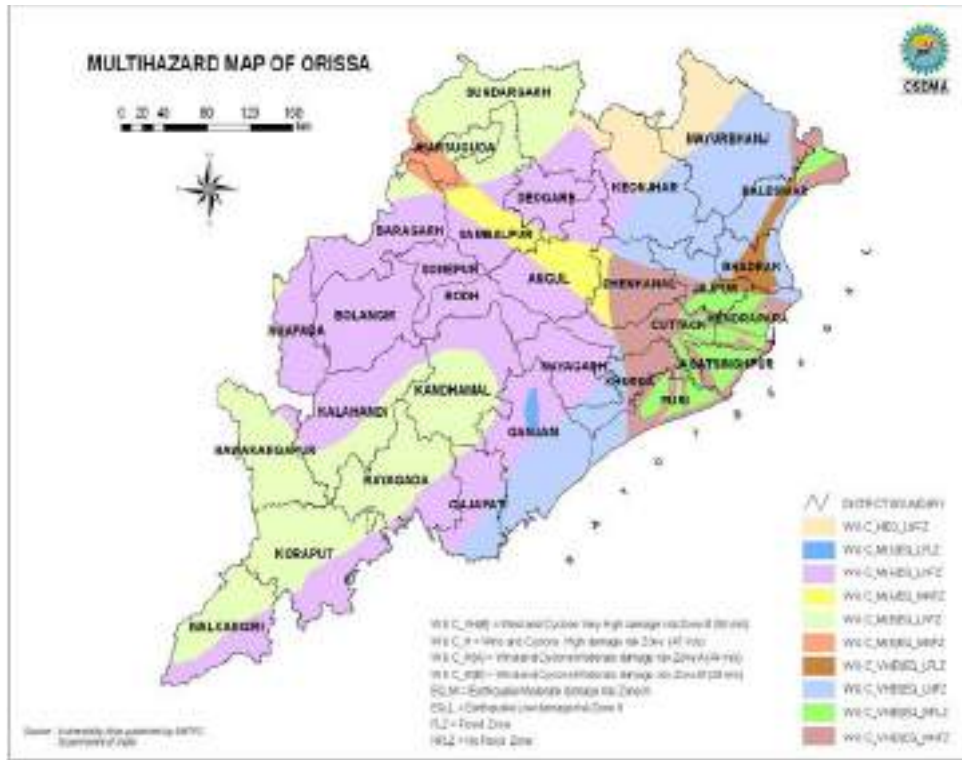


Figure 47 Multi-hazard Analysis, Odisha

Chandrabhaga beach and areas surrounding Chilika lake may face permanent inundation due to increasing level of global sea levels, which has been projected to rise between 2 and 7 feet and possibly more, in the next three decades.³⁵

Table 62 indicates the types of disasters to which the state has been vulnerable

Table 62 Types of Disasters, Odisha

Sl. No.	Type of disaster	Frequency	Intensity
1	Flood	Regular feature	High
2	Cyclone	2-3 year interval	High
3	Tsunami	Rare	High
4	Drought	3-5 years	Moderate
5	Heat wave	Regular	High
6	Earthquake	Low	Moderate

Source: OSDMA

5F.3 Gap/ Barrier Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> Clarity on adaptation strategies – mainly at community level Capacity Building of local communities to formulate their own contingency plan and respond to the emerging disasters/risks Requirement of adequate climate experts advising on departmental programs Co-ordination with other departments

³⁵ <https://www.newindianexpress.com/states/odisha/2019/oct/31/new-research-says-rising-sea-may-devour-odisha-coast-2054964.html>



Financial	<ul style="list-style-type: none"> • Availability of finance for implementation of activities
Technical	<ul style="list-style-type: none"> • Focus to find technical solution to adopt/prevent sea erosion • Technical capacity on designing adaptation actions • Understanding the relationship between adaptation actions in sectoral activities and other sectors
Regulatory/ Policy	<ul style="list-style-type: none"> • Need of inter departmental co-ordination for better convergence • More focused conservation and management programmes to each ecosystem in CRZ (CZMP) • More effective policies for coastal management and resources

5F.4 Key activities taken up

Table 63 is a snapshot of climate change activities undertaken by the state for Disaster Risk Reduction.

Table 63 Key Climate Change Activities in Coast and Disaster Risk Management Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Coastal biodiversity conservation and livelihood security	Adaptation	Implemented but not a key priority (KP)
2	Mangrove restoration	Mitigation	Implemented as a KP
3	Multipurpose Cyclone Shelter construction	Adaptation	Implemented as a KP
4	Solid Waste Management in Paradeep	Mitigation	Implemented but not a KP in this sector; done in association with Housing and Urban Development (H&UD)
5	Coastal protection measures in a high erosion zone (Pentha, Kendrapara), including saline embankment construction under National Cyclone Risk Management Project (NCRMP)	Adaptation	Implemented a pilot under a generic KP
6	Construction and restoration of climate-resilient public infrastructure under Odisha Disaster Recovery Project	Adaptation	Implemented as a KP (started after Cyclone Phailin)
7	Regional Coastal Process Study ³⁶	Adaptation	Implemented as a KP for better scientific assessment of coastal vulnerability spatially
8	Hydrological intervention for lake restoration in Chilika	Adaptation	Implemented but not a KP
9	Research study on bioprospecting, water bird movement, macrophyte biodiversity	Adaptation	Implemented but not a KP
10	Hazard mapping zones for flood and cyclone	Adaptation	Implemented as a KP
11	Community capacity building for disaster preparedness	Adaptation	Implemented as a KP
12	Multipurpose Cyclone Shelter building and food assistance	Adaptation	Implemented as a KP
13	Streamlining the Standard Operating Procedure (SOP) based on the Early Warning System	Adaptation	Implemented as a KP

³⁶ Study undertaken by Indian National Centre for Ocean Information Services (INCOIS) under the Integrated Coastal Zone Management (ICZM) programme at the World Bank



5F.5 Plan to meet NDCs and SDGs

Table 64: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 1: To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.	<ul style="list-style-type: none"> • Conservation of turtles • Kalibhanjdia island in Bhitarkanika designated as the National Mangrove Genetic Resources and Conservation Center (NMGRCC) • Strengthening of research infrastructure development wing of Chilika Development Authority (CDA) at Wetlands Research and Training Centre (WRTC) • National River Conservation Programme • River mouth dredging and water hyacinth removal under State Plan Scheme • Research and Development and Implementation of National Water Misison
NDC 5: To create an additional carbon sink of 2.5 to 3 billion tonnes of CO ₂ equivalent through additional forest and tree cover by 2030.	<ul style="list-style-type: none"> • 94.12 ha of land in Arakhakuda village, Puri district, 8.32 ha in Tarapada village and 3 ha in Itakandia village in Kendrapada district are identified for mangrove plantation under ICZMP
NDC 6: To better adapt to climate change by enhancing investments in development programme in sectors vulnerable to climate change, particularly Agriculture, Water Resources, Himalayan region, Coastal regions, Health and Disaster Management.	<ul style="list-style-type: none"> • Implementation of Integrated Coastal Zone Management project on pilot basis in 2 coastal stretches, Paradeep to Dhamra and Gopalpur to Chilika • Development and enhancement of rural industries and promotion of eco-tourism industry • Real time flood forecasting model for Budhabalanga river basin and Tel sub-basin under NHP • Flood control under RIDF and water resource department

Table 65: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 2: Zero Hunger	<ul style="list-style-type: none"> • Recreation of Mangrove covers by Chilika coastal communities to safeguard their livelihoods in support of ICZMP. • Enhancement of inland fish production through NMPS under RKVY
SDG 3: Good Health and well-being	<ul style="list-style-type: none"> • Capacity building programmes for fisheries and rural industries by Chilika Development Authority, contributing towards sustainable livelihood of the rural people • Livelihood support to marine fishermen by fisheries and Animal Resources Department under RKVY • National scheme for welfare of fishermen • Matsyajibi Unnayana Yojana (MUJY)
SDG 14: Conserve and Sustainably use the oceans, seas and marine resources for sustainable development	<ul style="list-style-type: none"> • Integrated Coastal Zone Management Project (ICZMP) • Mangrove For the Future (MFF) and Leaders for Nature (Lfn) initiatives by IUCN are taken up in Odisha for nature conservation and ensure equitable and ecologically sustainable use of natural resources • Fisheries training and extension under national scheme for welfare for fishermen

	<ul style="list-style-type: none"> • Intensive aquaculture in tanks and ponds under RKVY • Aquaculture development through integrated approach in Rayagada district under NMPS under RKVY
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss	<ul style="list-style-type: none"> • Coastal habitat protection as a part of ICZM • Development of marine fisheries • Implementation of Fishery Policy • Development of Brackish Water Aquaculture • Reservoir fisheries development through cage culture
SDG 13: Take urgent action to combat climate change and its impacts	<ul style="list-style-type: none"> • Conservation and management of mangroves and other marine resources under ICZMP • Development of water logged areas through FFDA • Integrated Development of Inland capture resources (Reservoir/Rivers) • Odisha Disaster Recovery Project (EAP) • Flood protection works under State Plan Schemes • Strengthening SDMA and DDMA

5F.6 Description of Activities

CD/KP/10- Develop a techno-legal regime for the construction of disaster-resilient public infrastructure (construction of approach roads to MCS buildings under the NCRMP) and include Odisha Disaster Recovery Project (ODRP) project for housing, etc.

Several approach roads to cyclone and flood shelters have been completed. Shelter level social mobilization and capacity building training of ongoing projects, 149 MCS of National Cyclone Risk Mitigation Project (NCRMP) & 162 MCS of NCRMP (Additional Financing) started from 2016-17. As per the practice of OSDMA 32 types standardized shelter level equipment were provided to all 316 shelter under NCRMP & NCRMP (AF) during 2017-18. Similarly, 256 shelter buildings are being constructed during post 'Phailin' period were provided with these shelter level equipment during 2017-18. 16899 houses have been taken up under ODRP in Ganjam and Khordha districts (Ganjam-16621, Khordha-278). As on 31.10.2016, 12251 Houses have been completed out of which approximately 12,000 houses have been occupied by the beneficiaries in almost 141 relocated sites. 4648 houses are at different stages of construction. Infrastructure works like Internal Roads, Drains, Electrification, Piped Water Supply and Community Buildings are presently under process. Climate Proofing Telecom and Energy Infrastructure; strengthening alternative communication system (VHF), HAM radio during disaster.

CD/KP/4- Set up an integrated capacity-building protocol covering shelter and a self-help group under the Community-Based Disaster Risk Reduction Framework (CBDRF), including college and school volunteers and officials at the state and district levels.

The role of capacity development in Disaster Risk Reduction has been well proven in the context of Odisha. The investment in institutions and processes to manage disasters has helped reduce casualties and aided in quick recovery. Therefore, plans are under way to build the capacity of the community from the shelter level to the decision-making members of the Panchayats, teachers and students in schools and colleges and district and state officials through an integrated framework. The capacity building will be attempted in areas such as early warning, precautions related to health and hygiene and livelihood restoration. Provision has been made for an allocation of Rs 93 Cr.

5F.7 Co-benefits

Coastal zone management has several co-benefits that protect the life and livelihood of fishermen. Mangroves and coastal vegetation, referred to as "blue carbon," sequester carbon far more effectively (up to 100 times faster) and more permanently than terrestrial forests. There is strong evidence of water balance allowing the

proper exchange of water between land and sea. Investment in climate-smart disaster management has helped create resilient community, institutions and networks. This in turn has helped reduce climate risk and protect livelihoods.

5F.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2015-20	Type
1	CD/ KP/10	Developing a techno-legal regime for construction of disaster resilient public infrastructure (Construction of Approach Road to MCS building under NCRMP) + ODRP project for housing etc.	15,300.00	2	-	15,300.00	World Bank	State Wide, ODRP for Ganjam and Puri	AD
2	CD/ KP/12	Setting up an integrated capacity building protocol covering shelter, SHG, CBDRF, college and school volunteers, officials at state and district level etc.)	9,300.00	2	-	9,300.00	World Bank	Bhubaneswar	AD
		Total (in Rs Crore)	246.00		-	246.00			



UNITED NATIONS RESIDENT COORDINATOR INDIA

7 May, 2019

Honourable Chief Secretary,

Please allow me to take this opportunity to present our compliments to the Government of Odisha, and our expression of solidarity, on behalf of the United Nations in India, with the people of Odisha in the context of the devastating Cyclone Fani.

We extend our condolences for the loss of 38 lives and express our deep concern for the impact the cyclone has had on 10 million people. We would also like to take this opportunity to commend the efforts of the Government of Odisha in evacuating 1.2 million people and reaching out to affected populations to address their immediate lifesaving needs. Your preparedness and pace of response have been critical in saving lives.

The United Nations in India stands ready to offer assistance and support to the Government of Odisha in post disaster response, needs assessment and recovery planning. The UN team in Odisha is closely coordinating with the State Emergency Operation Centre and Odisha State Disaster Management Authority to extend support across the sectors.

The UN focal point in the state of Odisha is Ms. Monika Nielsen, the Chief of Odisha Field Office, UNICEF. Please find her contact details below:

Chief, Odisha Field Office
 United Nations Children's Fund
 44 Surya Nagar, Bhubaneswar, 751 003, Odisha, India
 Phone: +91 674 2397978/79/80
 Email: monnielsen@unicef.org

Please accept assurances of our highest consideration.

Yours sincerely,

Yasmin Ali Haque
 UN Resident Coordinator a.i.

Mr. Aditya Prasad Padhi, IAS
 Chief Secretary,
 General Administration Department
 Odisha Secretariat
 Bhubaneswar - 751001
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CHAPTER

06

Climate Change Strategy – Mitigation

Mitigation strategy is critical to meet the climate goals under the Paris Agreement and NDCs. Several initiatives need to be fast tracked at the state level. Mitigation strategy as planned in the state involves pushing for higher share of renewable in the state especially hydro, solar and biomass-based energy including energy from the waste. It also has integrated several energy and waste management solutions in Smart City Plan and AMRUT to mitigate the emissions. Sectoral plans under Agriculture, Forestry and Water Resources sector have investments that are likely to have several mitigation co-benefits.

Chapters covered under Mitigation Strategy are:

6A. Energy Sector

6B. Urban Development

6C. Transport

6D. Industries

6E. Mining

6F. Waste Management

6A: Energy

6A.1 Overview

Odisha is a coal bearing state and has reasonable quantity of water and land. This unique combination has attracted power developers to set up mega thermal power plants in the state. Thus, the state remains a balanced and surplus power producer. State's Power Sector has an installed capacity of 5810.82 MW during 2017-18 as against 5509.14MW in 2016-17 with an increase of 5.48 percent which includes share from Central generating stations. The Installed capacity of the state has doubled in a decade. The growth of consumer numbers, peak demand and average energy demand along with AT&C Loss of the state is given in Table 66

Table 66 Projected Energy Demand

Particulars	Unit	FY 2000-01	FY 2014-15	Projected for FY 2019-20
Consumers	Lakh	16	58	96
Peak Demand	MVA	1,679	3,958	5,641
Energy	MU	9,997	23,555	32,847
AT & C Loss	(%)	57	38	26

The power requirement of the state for the last three years and source of power is given in Table 67

Table 67 Sources of Power

Sl. No.	Description	2013-14 (MW)	2014-15 (MW)	2015-16 (MW)
1	State Requirement	2581	2689	2831
2	State Hydro	801	726	671
3	State Thermal	681	671	630
4	NTPC	730	777	517
5	NHPC	102	103	104
6	Power Banking & Trading	15	22	0
7	Central Sector UI	52	43	0
8	IPPs	380	486	758
9	CGP/Cogen	89	75	140
10	Renewable(Solar+SHEP)	50	51	51

Even though the state has surplus power, it experiences shortages during peak demand. The peak demand and the average power demand of the state has reached up to 4111 MW and 3529 MW respectively.

Out of the total share of sources of power in 2018-19, 38% was from thermal sources, 38% was from hydro sources and the balance, 24% was from other sources. As of 2018-19, the state had availed power from seven State Hydropower Projects, three Central Sector Hydro allocations, eight Thermal Power Projects (both State and Central), one Biomass Project, two Small Hydroelectric Projects, 28 State Solar Photo Voltaic (SPV) Projects out of which 5 SPV Projects are located outside the State and 36 Captive Power Plants. Power is also supplied to Odisha through other

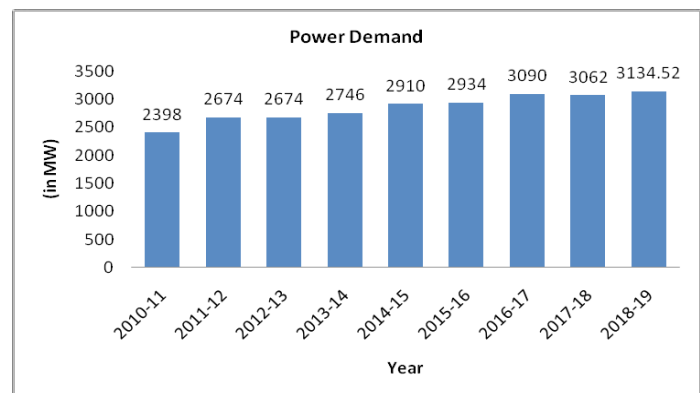


Figure 48 Power Demand
(Source: Economic Survey, Odisha)

sources like ER UI pool, trading companies like PTC, APPCPL, NVVN, GMRETL, MPPL & MPL and through two power exchanges IEX & PXIL.³⁷ The state achieved 100% electrification by the end of 31st March, 2019. 50,359 villages in Odisha have been saturated i.e.100 percent villages have been electrified. Total households electrified as on 31st March, 2019 are 96, 71,853 ³⁸.

6A.2 Impact of Climate Change

The enhanced power demand from within and outside state for thermal power production would certainly increase the emission. This will increase both warming and environmental pollution.

Generation of hydro power will be directly impacted due to erratic monsoon and conflict between agricultural and industrial water use. In the long term however, there does not seem to be a major change in precipitation level at aggregate level.

The temperature increase might impact the PLF of the power plants; it will also enhance the cooling demand of consumers and stress the already overloaded distribution network of the state.

Very severe cyclone Phailin exposed the vulnerability of the power network of the state. Post cyclone, power demand in Odisha dipped to as low as 600 MW bringing the regional grid under stress. Seven lines of 400 KV, 17 lines of 220 KV and 19 lines of 132 KV were affected in the state. It also affected several 11 KV lines impacting 3.8 million consumers.

The state has an ambitious target for renewable energy integration, wind installations along the coastal area; the cloud cover during prolonged rainy days and cyclone prone coastal area may negatively impact the renewable power generation in the state.

6A.3 Gap/ Barrier Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> • Need of more technical experts advising on departmental programs related to climate change especially multi-agency coordination to tackle climate related impacts (frequent cyclones, fluctuations in hydro power, etc.) • Integration of climate change concerns in the planning process and updating the sector SOP • Institutional memory on what has been done, what has worked, what has not and why
Technical	<ul style="list-style-type: none"> • Understanding of relevant climate and sectoral data for power systems planning (climate proofing) • Understanding of vulnerability assessment findings and what it means for the sector • Technical capacity on designing different strategies for resilient infrastructure • Harnessing renewable potential with convergence
Financial	<ul style="list-style-type: none"> • Delay in enactment of activities due to paucity of funds
Regulatory/ Policy	<ul style="list-style-type: none"> • Policies and regulations related to climate change • More emphasis on GHG Emissions • Need of more effective policies for proper monitoring

³⁷ Economic Survey Odisha, 2018-19

³⁸ Power Scenario, Economic Survey Odisha 2018-19

6A.4 Key activities taken up

Table 68 lists the key climate change activities implemented in Odisha in Energy sector

Table 68 Key Climate Change Activities in Energy sector

SL No.	Activity	Linkage	Progress in 2010–15
1	Institutional development and policy (GEDCOL was formed for on- grid renewable); integrate renewable energy policy for the state has been formulated	Adaptation	KP and covered
2	Ambitious CAPEX programme was launched to improve distribution infrastructure and reduce T&D loss in CESU areas	Mitigation	KP and covered
3	Energy efficiency measures in Government building, PSUs and water supply system	Mitigation	KP and covered
4	Area based programmes in upgrading 33/11 KV substation to improve system efficiency, reduce transformer over	Mitigation	Not a KP but taken up
5	Underground cabling to make power lines disaster-proof (Puri and now in Ganjam)	Adaptation	Not a KP but taken up
6	Commissioning of 13 megawatts of solar power	Mitigation	KP and covered
7	Bio-gas and bio-mass power generation enhancement through OREDA	Mitigation	KP and covered

6A.5 Plan to meet NDCs and SDGs

Table 69: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 3: To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.	<ul style="list-style-type: none"> • Odisha Transmission System Improvement Project by JICA for 2016-20 through OPTCL • State Capital Region Improvement of Power System (SCRIPS) • Adoption of Smart Grid Technology in power sector • Solar Power Plants, GEDCOL • Grid Interactive Roof Top Solar, GEDCOL • Small Hydro Electric Projects

Table 70: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all	<ul style="list-style-type: none"> • Biju Gram Jyoti Yojana (BGJY) • Biju Saharanchala Vidyutikaran Yojana • Odisha Distribution System Strengthening Programme • State Capital Region Improvement of Power System • Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) • DeenDayal Upadhyaya Gram Jyoti Yojana (DDUGJY) • Sahaj Bijli Harghar Yojana (Urban)- SAUBHAGYA • Integrated Power Development Scheme (IPDS) • Jawarharlal Nehru National Solar Mission (JNNSM) • Minor Irrigation Projects by Water Resources Department • Lift Irrigation Schemes • Satyabhamapur (Cuttack) and Raghurajpur (Puri) was covered under the LED Village campaign in first phase during 2010-14 and 4 villages from Keonjhar and Jajpur district covered in 2nd phase • Disaster Resilient Power System

6A.6 Description of Activities

The Energy sector has an ambitious plan to harness the potential in the state. It aims to shed its image as a generator of dirty power and invest in clean coal, clean generation and renewables in a big way.

Energy/KP/3- Reduce T&D losses and distribution system improvement

Reductions in T&D loss are a top priority of the Energy Department after the franchisees failed to control the losses and did not invest in the distribution infrastructure. The

department has undertaken a CAPEX programme of about Rs 135 crore for this purpose. The state after large-scale damage to the power infrastructure during cyclone Phailin has planned to invest in a disaster-resilient power system along the coastal area in which transformers and towers can withstand wind speeds of 300 Km/hr.



To manage the increasing load in the state capital region Rs 50 crore has been invested. Rs 20 crore has been proposed for the ambitious SMART Grid project. There are also Rs 67 crore provisions for improving power infrastructure during Nabakalebar festival in Puri. State has also made token provision for R-APDRP project in anticipation of Central Government funding.

Energy/KP/12- DSM and EE (utility level)

Utility DSM guideline will be prepared by Energy department of the state to be followed by disforms.

Energy/KP/4- Improve energy efficiency (Energy/CAP 23, 29, 30, 31)

Energy efficiency measures are a reflection of avoided generation. The state wants to strengthen the designated agency through capacity building of energy auditors, working with utilities in promotion of the energy-efficient use, working with the Public Health Engineering Organisation (PHEO) and the Odisha Lift Irrigation Corporation (OLIC) to improve the efficiency of the water pumping system. It also works toward operationalizing the Odisha Energy Conservation Building Code.

Energy/CAP/28- Awareness Generation

Generation of awareness on energy conservation, management and promotion of renewable and rooftop power generation will help in reducing the carbon footprint of the state.

Energy/KP/14- Build capacity of energy auditors, strengthen the Energy Conservation Cell

For proper energy monitoring, capacity building of energy auditors, strengthening of existing Energy Conservation Cell under the Energy Department supported with manpower and infrastructure.

Energy/KP/15- Increase energy efficiency in drinking water pumping system and lift irrigation system

The deficit in electricity and high diesel costs affects the pumping requirements of community water supplies and irrigation; so using energy efficiency for water pumping is a promising alternative to conventional electricity and diesel based pumping systems.

Energy/KP/5- Utilise fly ash

Because of a large number of power plants, fly ash generation in highland is about to touch 100 million

tonnes per year. The state has constituted a Fly Ash Mission for effective coordination with various agencies and industries on improving its utilisation in various areas like road construction, brick making, cement manufacturing etc. The amount of annual fly ash generation is expected to touch 100 MT due to a large number of power plants. OPGC has modified its dry ash collection and disposal system and has commissioned 100 % ash water recycling system at the Ib Thermal Power Station

Energy/KP/6- Promote small and medium hydel (hydroelectric) plants

Pre-feasibility report and DPR are under preparation for more than 20 sites in the state to boost hydel generation. This is spearheaded by OHPC & GEDCOL. The Department of Energy, Government of Odisha has identified 42 sites for the development of Small Hydro Electric Plants (SHEPs). The three units of the Lower Baitarani SHEP with total capacity of 24 MW are expected to be completed by March, 2020. The sub-station work for the Saptadhara SHEP (18 MW) is expected to be finished by June, 2020. Detailed Project Reports (DPRs) have been prepared for 3 MW (2 X 1.5MW) at Jambhira SHEP in Mayurbhanj district and 4.2 MW (2 X 2.1 MW) at Kanupur SHEP in Keonjhar District and MoUs have been signed. Pre-Feasibility Reports (PFR) for 13 numbers of SHEPs with approximate capacity of 168 MW have been prepared by GEDCOL. Out of these 13 SHEPs, GEDCOL has requested State Technical Committee (STC) for allotment of 4 numbers of SHEPs namely, Kharagpur - I, II, IIA



and III in Kandhamal District of combined capacity 96 MW in favour of GEDCOL for development. GEDCOL and Steel Authority of India Limited, Rourkela have agreed to develop 15 MW, Mandira SHEP in Sundargarh District in Joint Venture mode. Preliminary survey has been completed by M/s MECON and site for installation of Power House has been finalized. DPR for the same is under preparation by M/s MECON.

Energy/KP/7&8- Promote biomass and wind generation

The Orissa Renewable Development Agency (OREDA) acts as the technical agency for promoting these two

renewable energy technologies in the state. So far, a few demonstration wind energy plants have come up in the state and more sites are being identified with C-WET. Bio-mass generation has started in Nimidha in Dhenkanal district and rice husk-based power generation also has started in some of the rice mills.

Energy/KP/9- Maximise solar energy generation potential (GEDCOL)

The solar energy generation initiative has got a boost after an infusion of Rs 35 crore equity into GEDCOL. The DPR of 1MW capacity solar plant at Mukhiguda is under progress, 500 acre land is being identified by IDCO to



start a solar park. In Manmunda a 20 MW solar plant is being commissioned with viability gap funding coming from Solar Energy Corporation of India (SECI). Enhance solar energy integration through roof top solar in public buildings, schools, eco-tourism sites and forest beat houses.

The Ministry of New and Renewable Energy (MNRE), GoI has sanctioned 4 MW Solar Rooftop project on the non-residential Government buildings in twin city of Cuttack-Bhubaneswar through PPP mode. 199 numbers of buildings have been identified (126 in Bhubaneswar and 73 in Cuttack) for taking up Roof Top installations. The final phase of the project implementation was completed on 31.03.2019. Besides above, GEDCOL is contemplating to replicate the Bhubaneswar-Cuttack Rooftop project to other cities in the state. The towns and cities of Sambalpur, Burla, Hirkud, Rourkela, Puri, Khordha, Berhampur, Chhattrapur, Jeypore, Sunabeda, Balasore, Bhadrak and Baripada towns are to be taken up for the project. GEDCOL is also looking forward to extend the Scheme to the Central Government buildings and State Government Residential Quarters in Bhubaneswar and Cuttack. The total Rooftop Project capacity is expected to be around 10 MW. GEDCOL is to develop Solar Plants on the unutilized lands available inside OPTCL Grid Sub-stations at Duburi, Baripada, Bolangir, Koraput & Rairangpur including OHPC Power House at Mukhiguda. Preparation of Tender for selection of EPC contractor is under process. The Ministry of New and Renewable Energy (MNRE), GoI has allocated 1000MW Solar Park to Odisha for development under the Ultra Mega Solar Power Park (UMSPP) Scheme. About 4000 acres of land has been identified at Bhograi and Bahanaga in Balasore district and Land identification across the other districts is also under progress for this purpose.

Energy/KP/10- Promote biogas and manure management

OREDA is taking up an ambitious plan to work with the OMFED and others to promote a large-scale biogas programme in the state. They have already installed more than 2.25 lakh of domestic biogas systems.

Other Initiatives

Exploring the Potential of Floating Solar Power in the state

The Department of Energy, Government of Odisha is planning to develop floating solar projects in the artificial water reservoirs across the state in the upcoming years. Possibilities of destruction of forests, use of agricultural lands for land solar projects in a state like Odisha where agriculture is the prime source of livelihood of majority of population, have led way to the idea of development of floating solar projects. Various international organisations like the European Union Consortium and International Finance Corporation (World Bank Group) have conducted feasibility studies in Odisha in this regard.



Reduction in Energy Consumption

The Government of Odisha had launched the Ama Ghare LED Programme in the Financial Year 2018-19. About 5 lakh LEDs were distributed across the state and 1358 MW power is reported to have been saved due to the use of LED bulbs.

NTPC

NTPC has implemented the Super Critical Technology with higher boiler efficiency in its Darlipalli STPP units (2x800 MW) in Sundargarh to reduce CO₂ emission. NTPC is awaiting the investment approval of Government of Odisha for its Stage- III (2x660 MW) units based on Ultra Super Critical Technology aimed at higher boiler efficiency and reduced CO₂ emission. NTPC is also upgrading its boilers with De-SO_x and De-NO_x technologies to meet the new emission norms in all the plants in Odisha.

6A.7 Co-benefits

Renewable energy generation will help to improve the energy mix in the state and also create green jobs in the sector. Reducing GHG emissions in the Energy sector yields a global impact, but the co-benefits are going to be experienced in the state too. Mitigation policies relating to the energy efficiency of plants, fuel switching from coal to biomass/ other renewable energy may have several objectives of co-benefits like reduction in air pollution (an environmental co-benefit), energy-supply security (by increased energy diversity) that enhances productivity and also has livelihood benefit. Investment in hydel will also help in some flood control measures as well as efficient use of water especially in the run off the river project. Capital intensive projects in wind and mega solar projects especially in areas like Manmunda (Boudh District) a backward district will spur growth and reduce disparity.

6A.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2015-20	Type
1	Energy/ KP/3	Reduction of T&D Losses (CAPEX, Disaster Resilient Power System, Radial to ring conversion)	517,240.00	3	46,125.00	471,115.00	State budget, Central support, Loan	Statewide	MI
2	Energy/ KP/12	DSM and EE (utility level),	680.00	2	680.00	-	Mission and own source	Statewide	MI
3	Energy/ KP/4	Improve energy efficiency	415.00	2	415.00	-	State budget		
4	Energy/ CAP/28	Awareness generation on EE	75.00	9	75.00	-	BEE and GoO	Statewide	MI
5	Energy/ KP/14	CB of energy auditors, strengthening the Energy Conservation Cell	417.00	9	417.00	-	BEE and GoO	Statewide	MI
6	Energy/ KP/15	Increase energy efficiency in drinking water pumping system and Lift Irrigation system	8420.00	5		8420.00	BEE	Statewide	MI
8	Energy/ KP/6	Promotion of small and medium hydel plants	1570.00	5		1570.00	OHPC, PSU	Area Specific	MI
11	Energy/ KP/9	Maximising solar energy generation potential (GEDCOL)	4445.00	5		4445.00	GEDCOL, PSU	Area Specific	MI
		Total (in Rs Crore)	5,332.62		477.12	4,855.50			

6B. Urban Development

6B.1 Overview

About 17 percent of Odisha's population resides in urban areas. The state has registered remarkable urban growth (about 26.8 percent) during the last decade (2001–11) and the urban population has grown from 37 million to 42 million during this period. Considering the pace of the economic growth in the urban centres in the state, even these growth figures appear to be high and pose challenges in terms of services and secure living conditions for the urban community.

There is significant inter district variation in the urban-rural composition in the state, with Khordha district reporting an urbanisation rate of 48 percent (highest), whereas Boudh in south central Odisha has an urbanisation rate of only 5 percent. Khordha district has the highest urbanisation in terms of both the spatial extent and growth in urban population.

The urbanisation trend over the last five decades in the state reveals that the smaller towns (Classes IV, V and VI) are growing at a faster rate than the bigger towns (see Figure 49). Also, these small towns are more in number and spread over different parts of the state, whereas the larger cities are fewer in number and concentrated in specific advantageous locations attracting more urban population with a higher grade of opportunities.

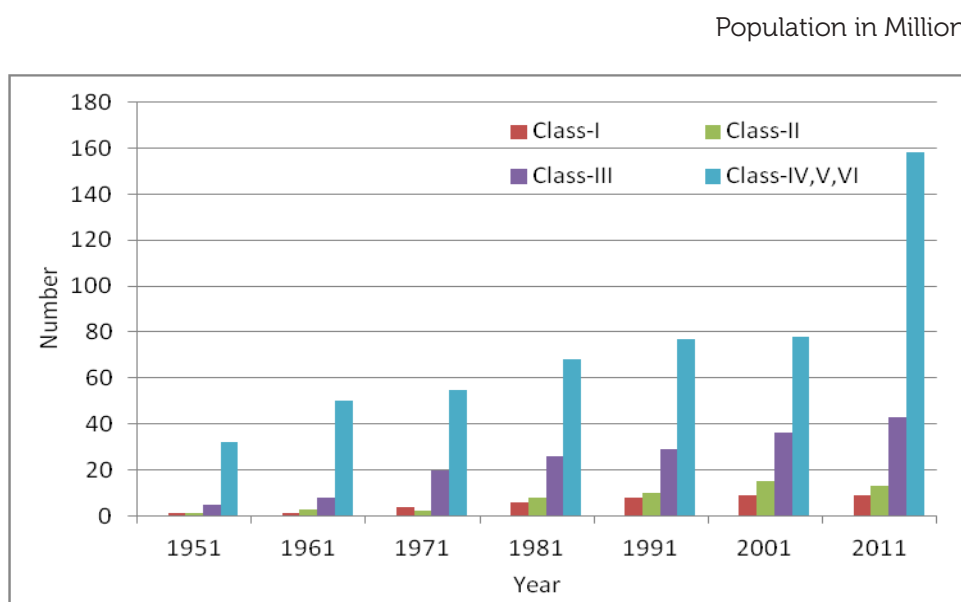


Figure 49 Trends in Urban Growth: Odisha, 1951–2011

(Source: Economic Survey Odisha 2014)

6B.2 Impact of Climate Change

The urban centres of Odisha experiencing fast growth are also vulnerable to natural hazards. The urban assets and life are exposed increasingly to the risk of cyclone, heat wave, urban flood, health and earthquake. Urban centres, mainly Class I cities of the state, are also facing the rapid growth of the slum population living in poor building types in environmentally vulnerable pockets.

The fast growth of these urban centres leads in turn to the build-up of the surrounding areas, thereby encroaching on low-lying areas and increasing the flood risk. The encroachment of low-lying areas and the clogging of drainage due to the increase in solid waste in the city have led to unhygienic conditions and in turn a high incidence of water & vector borne diseases.

6B.3 Gap/ Barrier Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> • More awareness programmes to engage the communities in mitigating climate change as well as adapting to its effects • More technical experts advising on departmental programs related to climate change • Need of inter-departmental synergy • Need of proper integration in the departmental planning process
Technical	<ul style="list-style-type: none"> • Understanding of vulnerability assessment findings and what it means for the sector • Accessing relevant climate and sectoral data
Financial	<ul style="list-style-type: none"> • Requirement of more funds • Delay of funds result in cost overrun • Need for appropriate long term financial management and guidance to build governance capacity
Regulatory/ Policy	<ul style="list-style-type: none"> • Co-ordination between regulating body and policy makers • Lack of convergence with the schemes attaining similar goal • Need for an integrated approach for urban development

6B.4 Key activities taken up

The activities listed in Table 71 were taken up in the state's Urban Development sector.

Table 71 Key Climate Change Activities in Urban Development Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Conduct training programmes for the staff covering aspects of the challenges and combating the issues in climate change and their respective roles and responsibilities.	Adaptation	Implemented as a key priority (KP)
2	To sensitise city dwellers on non-revenue water loss and orient them towards water conservation measures. To introduce water metering system and ensure water assessment and audit.	Both	Implemented as a KP
3	Develop and implement an ideal Municipal Solid Waste (MSW) management plan in a selected city and prepare such plans for state-wide implementation.	Mitigation	Implemented as a KP
4	Orient city dwellers to energy-efficient street lighting and pilot the same through a Clean Development Mechanism (CDM) proposal.	Mitigation	Implemented as a KP
5	Develop models of urban storm water flows and based on assessment of the capacities of existing drainage systems in a selected city with climate change	Adaptation	Implemented as a KP
6	Strengthen the existing guidelines for preparation of a Master Plan/ Comprehensive Development Plan (CDP) by incorporating measures to combat climate change and CDP for a selected city. The activity will be outsourced through a technical organisation. prepare and implement such a master plan	Adaptation	Implemented as a KP
7	Improve urban infrastructure by making non-motorised transport feasible throughout the city. The activity will involve survey of the transport network of the city and development of a plan for improvement along with policy-level decisions for incentivising.	Mitigation	Implemented as a KP
8	Rejuvenate ponds and tanks.	Adaptation	Implemented but not a KP

6B.5 Plan to meet NDCs and SDGs

Table 72: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 3: Reduce emission intensity by 33-35% by 2030 compared to 2005 levels	<ul style="list-style-type: none"> • AMRUT • Aahaar • Awaas • HRIDAY • PMAY
NDC 4: Produce 40% of electricity from non-fossil based energy resources by 2030	<ul style="list-style-type: none"> • SMART City Mission • Greenfield Energy efficient street lightning in 113 ULBs in PPP Mode
NDC 5: Create additional carbon sink of 2.5 to 3 billion tonnes of carbon dioxide equivalent by 2030	<ul style="list-style-type: none"> • Plantation of trees by State Government • Improved recreation and public green spaces

Table 73: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 3: Ensure healthy lives and promote well-being for all at all ages	<ul style="list-style-type: none"> • Odisha Urban Infrastructure Development Fund (OUIDF) • Urban infrastructure planning and development • Urban poverty alleviation • Slum Rehabilitation through Affordable Housing
SDG 6: Ensure availability and sustainable management of water and sanitation for all	<ul style="list-style-type: none"> • Municipal solid waste management • Swachh Sahar Odisha • Swachh Bharat Mission • Urban Water Supply
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable	<ul style="list-style-type: none"> • UNNATI- Urban Transformation Initiative • Jaga Mission-Odisha Liveable Habitat Mission • BASUDHA • LED street lightning Project • Energy efficient street lightning in streets across ULBs • Construction of rural roads for enhanced connectivity

6B.6 Description of Activities

HUD/CAP/2a –Augmentation of integrated sewerage project for Bhubaneswar and Cuttack Municipality

The Integrated Sewerage Project for Bhubaneswar and Cuttack is being implemented by the Odisha Water Supply and Sanitation Board (OWSSB) with the support of JICA to cover all the sewerage districts in Bhubaneswar and Cuttack

HUD/CAP/N4a- Update building byelaws and development control regulations to incorporate CC and DRR considerations

The rules and regulations of the building byelaws under Bhubaneswar Development Agency (BDA) is planned to be updated in accordance to the Climate Change and Disaster Risk Reduction factor.

HUD/CAP/N4b- Update and incorporate risk-sensitive land use planning in city's Master Plan

Urban and Regional Development Plan Formulation and Implementation (URDPFI) guidelines 2015, National Building Code (NBC) 2005 and model building bye laws by MoUD, 2016, GoI are referred for preparation

of master plan and development regulation in urban areas. Odisha Development Authorities (Common Application Form) Rules, 2016 and Development Authority (Planning and Building Standards) Regulations, 2017 have been prepared to address the challenges arising from climate change and natural disasters. The regulation also provides incentives for promotion of green buildings in urban areas with the purpose of energy and water conservation and reduction of Green House Gas Emission.

HUD/CAP/8- Urban Transport and Transit Oriented Development (TOD)

Draft Odisha Urban Parking Policy 2013, prioritises for an efficient parking policy, mass transit system and non-motorized transport infrastructure with a dynamic city land use plan focussing on transit oriented development that can address issues relating to parking and long travel time. Further, Bhubaneswar Municipal Corporation is preparing bye-laws for formulation of TOD supportive zonal development plans.

Government is focussing on improving the public transportation so that more number of people can use these facilities, thereby reducing carbon foot print. Eight Special Purpose Vehicles (SPVs) have been formed for provision of city bus services that has resulted in increase of ridership to about 1.5 lakh per day, out of which seven are functional and one is added recently.

Preparation of Detailed Project Report (DPR) for a Mass Rapid Transit System (MRTS) is in process and the DPR for Bus Rapid Transit System (BRTS) is being prepared and may be taken up in future. Bhubaneswar Puri Transport Services (BPTS) is also planning for Bhubaneswar City Bus Modernization Plan (BCBMP) through Gross Cost Contract (GCC). Focus of Government is on promotion of Non-Motorised Transport through creation of cycle tracks and pedestrian pathways. Under Smart City scheme the Government is also planning to introduce Public Bi-cycle Sharing (PBS) scheme. The State Government is also planning to introduce electric vehicles under smart city mission.



Development of Dedicated Parking in Janpath



Environmental Monitoring System



Dedicated corridor for Pedestrian, Cyclist, bus stop and Public Bicycle Sharing



Smart LED Lighting System

HUD/KP/8- Restoration of urban water bodies, Berhampur, Bindusagar and others

Water bodies are lifelines of urban local bodies and where development is faster they needed to be restored as they provide a cooling effect to the local environment and also act as a catalyst in restring water-based ecosystem comprising floral and faunal diversities. Focus of Government is on holistic development of water bodies to ensure that there is no encroachment and the water feeder channels are intact. This will help in increasing the water-holding capacities of urban areas, thereby reducing the impact of urban flooding.

HUD/CAP/10 (a & b) - Energy efficiency in providing products and services

A number of policy decisions have been taken for use of energy efficient devices in the Urban sector such energy efficient pumps in water supply & sewerage, energy efficient LED street lights and energy efficient buildings, etc. It also includes promotion of green buildings and sustainability provisions, installation of rooftop solar energy and solar assisted water heating systems etc.

The energy efficiency investments will reduce the energy consumption of retrofitted public and social facilities and reduce the CO₂ emissions. Additionally, these investments will generate substantial economic and social benefits including better environment and improved health.

For optimisation of energy consumption, in first phase 20,000 streets light have been replaced in Bhubaneswar Municipal Corporation on a PPP mode by A/s Super Wealth Finance Enterprise. In the second phase agreement has been signed with Consortium of Hesalight A/S and New Energy LLP for Supply, Installation, Operation and Maintenance (SIOM) for energy efficiency street lighting in all 5 Municipal Corporations. The work of installation and replacement has already been started in all 5 MC by Nieve Energy. Energy Efficiency Services Limited is supporting to extent energy efficient street lighting in rest 105 ULBs. Survey work of the streetlight is completed in all ULBs. It is planned to convert existing streetlights in all ULBs to LED streetlights by March, 2018 through PPP/EPC mode.

Agreement between EESL and Housing and Urban Development Department, Government of Odisha has been done on 30th January, 2017, for undertaking projects for replacement of inefficient pump sets in 9 AMRUT cities; and preparation and submission of Investment Grade Energy Audit (IGEA) Report. IGEA report has been submitted by EESL and commencement will be started soon.

HUD/KP/9 - Promote urban storm-water and drainage management for urban flood control

The construction and improvement of drains and storm water drains will help in reducing flooding. Proper drainage system is being installed at all water stagnant or flooding points up to the end discharge point. Rejuvenation of existing primary drains including covering and installation of filter is being in nine cities of Odisha which shall be replicated in all other cities in a time bound manner.

Under JNNURM storm water drainage work was initiated in two JNNURM cities i.e. Bhubaneswar and Puri. After closure of the project with effect from 31st march 2014, both the projects work are being executed through State Plan. Further as mandated under AMRUT a Service Level Improvement Plan (SLIP) was submitted to Ministry of Housing and Urban affairs (MoHUA) for consideration. Storm Water Drainage has got a priority and project has been submitted for all 9 AMRUT cities.

HUD/CAP/N1- Housing for all, including in-situ slum development or relocation

Upgrading of informal settlements, redevelopment and resettlement of slums wherever required, are essential for inclusive development and restricting the growth of slums and informal settlements. As per policy for housing for all in urban areas of Odisha, 2015, different models of affordable housing with all basic services (water, toilets, roads, pathways, electricity and waste management) for EWS and LIG has been developed for implementation.

The Mission seeks to address the housing requirements of urban poor including slum dwellers through four programme verticals giving option to the beneficiaries: 1. Slum rehabilitation of slum dwellers with participation of private developers using land as a resource; 2. Promotion of affordable housing for weaker section through credit linked subsidy; 3. Affordable housing in partnership with public and private sectors and 4. Subsidy for beneficiary-led individual house construction or enhancement

The Pradhan Mantri Awas Yojana (PMAY) or Housing for All (Urban) Mission, targets construction over 6.77 lakhs houses (housing shortage in urban Odisha as per Socio Economic Caste Census, 2011) across the state within a span of next seven years to conclude successfully by year 2022. Out of 6.77 lakh houses, about 90,000 houses shall be constructed by beneficiaries and remaining 5.8 lakh houses shall be constructed under In-situ model and through Affordable Housing in Partnership (AHP).

AWAAS (Odisha Urban Housing Mission) was launched on 11th Oct 2015 by recognising the need for an efficient institutional mechanism for achieving the objectives for Housing for all in urban areas. Odisha Urban Mission Directorate for AWAAS has been registered along with 30 District Housing Society (DHS). OUHM functions as the State Level Nodal Agency (SLNA) for implementation of Central Government housing schemes. It aims to create surplus housing stock through different strategic development models. The state has won accolades for the **Jaaga Mission**.

Housing and Urban Development Department along with Construction Worker Welfare Board has taken the initiatives for rental housing for construction workers to help these workers in moving to slums. Land Rights to Slum Dwellers Act, 2017 is a historic step taken by Govt. of Odisha to grant land rights to the slum dwellers which is 1st of this kind in the country. Implementation of this act will benefit all 109 Municipalities and Notified Area Councils covering 30 districts. The urban poor in slums will get land rights for residential use that is heritable, mortgageable and non-transferable. The settlement will be made for land in actual occupation by the slum dwellers, up to a maximum limit of 646 sq. ft in NACs and 484 sq.ft in Municipalities in case of in situ settlement. In case of relocation of untenable slums, the maximum area of the land allocation will be 323sq.ft for each household. Relocation will be done on voluntary basis only if the slum dwellers agree to do so.

HUD/CAP/N2 (a & b)-Development of green space, park

Parks are being developed in a holistic manner with more green coverage. Cities are in the process of developing action plan to progressively increase green cover in cities. Many parks have been developed and some are planned to develop/renovate over the next 10 years. The parks are being developed in a people friendly manner and being made accessible to all. All the parks being developed under AMRUT have been graded and are being developed to include compound wall, walking track, furniture, public toilets, energy efficient lights and open gyms.



Smart Parks Project

The redevelopment of neighborhood parks are part of Smart City program. To create activated green spaces having various benefits for the citizen like: pathway for public walking, play equipment for children, open gym for citizens, screen wall for graphic presentation, yoga areas for all, splash pool to spend some leisure time during evening. Three parks are completed; those include redevelopment of existing infrastructure like pathways, drinking water taps, children's play equipment, splash pool, watch tower, open gym, portable e-toilet, organized shrubs/trees in a decorative manner to suit the overall theme.

HUD/CAP/N3-Smart Cities- Bhubaneswar and Rourkela

Bhubaneswar and Rourkela have been selected under Smart Cities Mission of Ministry of Urban Development, Government of India. The objective is to develop these 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.

Bhubaneswar ranked one in the first phase of Smart City Challenge and Rourkela got selected in the phase 2 of the smart city selection. Bhubaneswar Smart City proposal envisions retrofitting and redevelopment of 985 acres centered around main Railway Station. The intervention aims to convert area to be a walkable, well connected mixed –use area with public spaces and buildings. Area shall be developed on low-impact carbon neutral development using innovations in transport and green infrastructure.

Smart Janpath Project

Redevelopment of Janpath commercial corridor into People's street with dedicated Pedestrian walking pathway, Public Realm and Plazas. The scope of the project includes streetscape design, beautification, landscaping, intersection redesign and infrastructure upgradation. Integrated approach was adopted for implementation of different elements with focus on promotion of pedestrian movement and dedicated corridor for Non-motorized Transportation (NMT) such as Cycle and Bus lanes. Drainage management plan of Janpath also integrated overall flood management requirement of catchment areas with capacity upgradation of Drain No.5 and redevelopment of Drain 10 into Lake Neutral.

State Government constituted a Special Purpose Vehicle (SPV) named Bhubaneswar Smart City Limited, as a limited company, incorporated under the Companies Act (2013), for implementation of the Smart City Proposal of Bhubaneswar.

Rourkela Smart City, area based development will focus on the main road area with 1241 acres and approximately serve 19 % of City Population along Birsa Chowk to Panpose Chowk (BCPC) through retrofitting model. Rourkela Smart City project include : Gateway to Rourkela Project with multi utility transit node, market area rejuvenation and slum rehabilitation, connected residential neighbourhoods along with pedestrian friendly roads and smart infrastructure, one-stop Rourkela for seamless service delivery along with skill & entrepreneurship hub and Brahmani Riverfront Development promoting local identity and culture.



HUD/KP3 - Ensuring access to tap water for all

Government of Odisha is making all efforts to ensure that every household has access to tap water with assured supply and quality. Water supply includes augmentation of existing water supply, replacement of age old pipelines, development of water treatment plants, Automatic Water Reading (AWR) compatible water metering and installation of SCADA (Supervisory Control and Data acquisition) at water treatment plants for water conservation. Special provision is made for water supply arrangement for difficult areas (hills and coastal cities) and areas having water quality problem, e.g. arsenic, fluoride (hot spot).

Under the national flagship programme of Atal Mission for Rejuvenation and Urban Transformation (AMRUT), the department has identified about 130 water supply projects, across nine mission cities & have been taken up with 50% Government of India and 50% State Share to be completed by 2019-20. Under urban water supply from State Plan over 300 urban water supply projects have been completed/ commissioned during 2017-18 and another 200 water supply projects are planned to be completed by the end of FY 17-18.

Out of the 2014 number of municipal wards across 113 ULBs, 1181 municipal wards are fully covered, 710 wards are partly covered and remaining 137 wards are uncovered, so far as urban water supply is concerned.

HUD/CAP/2b - Making urban Odisha open defecation free and management of sewerage, Faecal Sludge and Sewage

Universal sanitation coverage and elimination of open defecation is essential for improving cleanliness and ensuring healthy living for all citizens. Equally important is the management of liquid waste to keep cities and towns clean, contain the adverse impact on public health and reduce environmental pollution.

Currently, all ULBs have prepared City Sanitation Plan with the objective of universal coverage and making the cities open defecation free. Community and public toilets are being established near slums and public places for ensuring access to toilet facilities. Construction of hybrid toilets are in progress in 9 AMRUT towns which will cater to both public and community needs.

Various social mobilisation activities are being undertaken under **Swachh Bharat Mission** for ensuring the use of toilets and making cities and towns open defecation free.

The Government has also put in place a number of policies and strategies to ensure 100 % ODF, strengthening the sanitation value chain, faecal sludge and sewage management including (i) Odisha Urban Sanitation Policy and Strategy, (ii) Odisha Septate Management Guidelines and (iii) Solid Waste Management bye-laws. These policy initiatives are helping in making urban areas progress towards their goal with respect to ODF, faecal sludge, septage and sewerage management through scientific containment in toilets, regulation in collection, transport, treatment and disposal of liquid waste.

To ensure proper transportation and disposal of faecal sludge, 86 numbers of modern cesspool emptier machines at a cost of Rs 13.47 Crore have been purchased and placed at all 57 ULBs. Currently, the state has 203 cesspool emptiers operating in the 113 ULBs. In addition, a River Pollution Abatement scheme for Brahmani at Talcher and sewerage project at Puri is currently under execution.

Septage Treatment Plants (SeTPs) at a cost of Rs 17.86 Crores are under construction in the 9 AMRUT cities for treatment and safe disposal of faecal sludge and septage, which will cover 50 % of the urban population of the state and public institutions like schools, colleges, universities, hospitals, offices, private hostels, market complexes, etc. in the cities. In addition, three other Faecal Sludge & Septage Treatment Plants (FSTPs) are

also under progress in Angul, Dhenkanal and Chowdwar, which will benefit 1,53,998 urban population. System strengthening has been initiated at the ULB level through training and orientation of ULB officials and private operators engaged in FSSM. Community mobilisation to motivate citizens to practices desired behaviours are also among other interventions being undertaken to build capacities and strengthen the sanitation value chain in the state. A scale-up plan covering 113 ULBs in the state is also being worked out which will be implemented in a time bound manner.

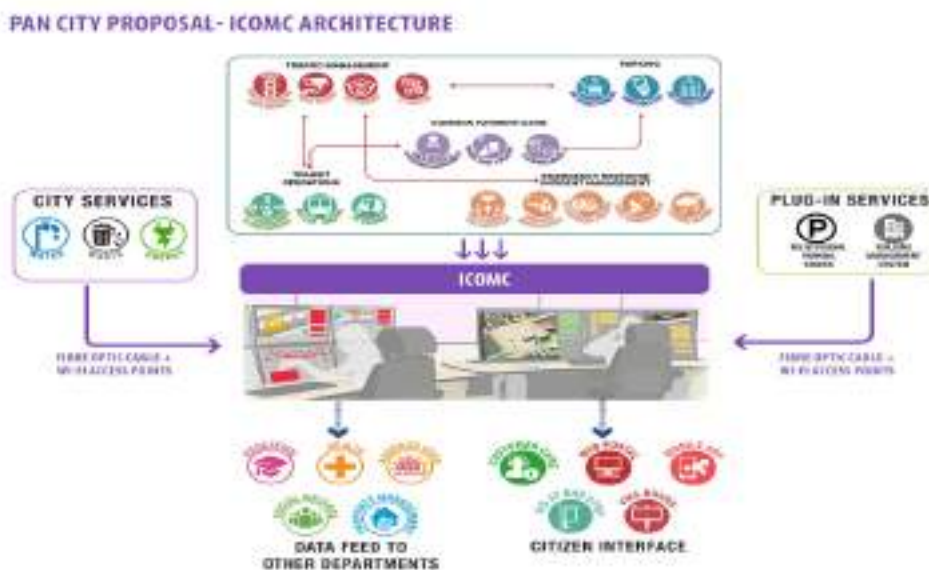
HUD/CAP/N6 - 1-Drink from Tap and 24x7 water supply

As per the State Urban Water Supply Policy, all individuals must get at least 70 litres per capita per day (LPCD) of water which should be subsequently increased to 135 LPCD. The continuity in supply has to be progressively increased to attain 24/7. The policy also aims to ensure 100% household level coverage by direct piped house connection.

HUD/CAP/N7 - Water testing laboratories (District level in 22 districts)

Provision of safe drinking water is essential to promote public health and ensure prevention and control of water borne diseases. For this purpose, water testing laboratories will be established.

Pan City Projects



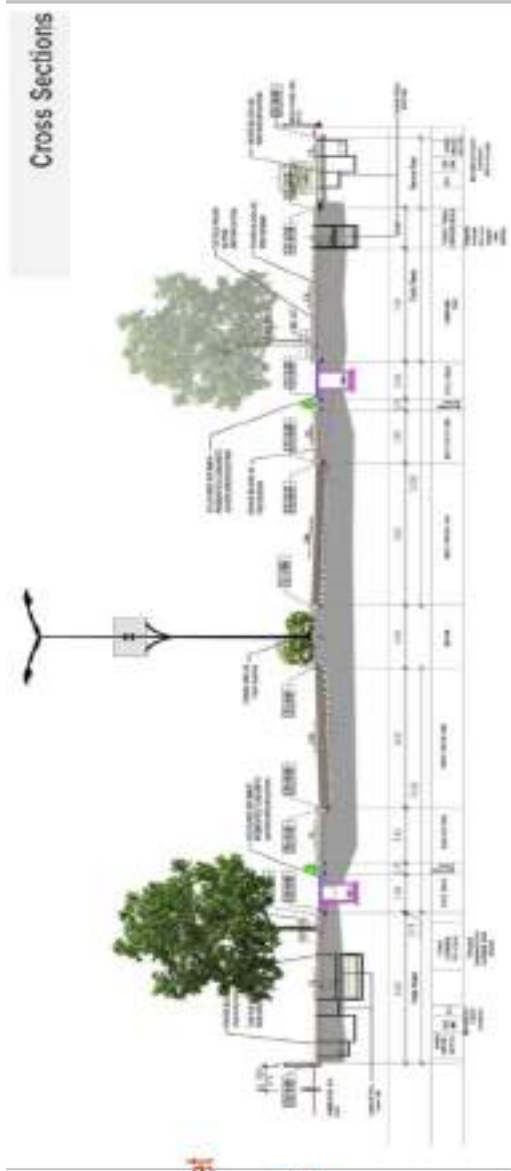
The Pan City projects are technological intervention for city management of traffic system, transit system, parking system, emergency response & incidence management system, digital payment system, Enterprise Resource Planning and e-Governance for the four city level organizations i.e. Bhubaneswar Development Authority, Bhubaneswar Municipal Corporation, Bhubaneswar Puri Transport Services and Bhubaneswar Smart City Limited. It also includes setting up an Intelligent City Operations and Management Centre (ICOMC) for managing these services on a common platform involving participation of different stakeholder organizations.

6B.7 Co-benefits

Many of the city development projects that are part of city's regular services have co-benefits in terms of climate and urban resilience. Solid Waste Management will help reduce contamination of ground water and toxic particles, amendment of building bylaws shall reduce the hazard and risk and it will also help in reduction of energy consumption, increase use of public transport and promotion of non-motorised transport will reduce air pollution, provision of drinking water to all will help in water security as well as conservation of ground water, use of energy efficient lights and pumps will help in reducing the carbon foot print.

INTEGRATED APPROACH

- Transforming auto orientated street to pedestrian oriented street
- Integration of underground utilities and Smart elements
- Child-friendly and safe street



6B.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2015-20	Type
1	HUD/CAP/2a	Augmentation of integrated sewerage project for Bhubaneswar and Cuttack municipality	470,336.00	10.00	470,336.00	-	State plan	Bhubaneswar, Cuttack, Berhampur, Puri & Sambalpur	MI
2	HUD/CAP/N4a	Update building byelaws and development control regulations to incorporate CC and DRR considerations	1,000.00	6.00	1,000.00	-	External TA	Statewide	AD
3	HUD/CAP/N4b	Update and Incorporate risk-sensitive land use planning in city's Master Plan	3,000.00	6.00	3,000.00	-		Statewide	AD
4	HUD/CAP/8	City Bus Service, Bhubaneswar Municipal Corporation and Puri (BRTS); For City Bus Service in GUTSL, WOUTSL, CUTSL, JKSL, SUTT, BBUTT, development of Infrastructure for CBS and development of Bus Terminal	63,010.00	10.00	63,010.00	-	State plan	Statewide	MI
5	HUD/KP/8	Restoration of Urban Water Bodies, Behrampur, Bindusagar and others	44,361.00	10.00	15,361.00	29,000.00	Loan and external aid	42 ULBS in 23 districts	AD
6	HUD/CAP/10a	Energy efficiency in providing products and services : Street Light	75,393.00	7.00	61,950.00	13,443.00		Statewide	MI
7	HUD/CAP/10b	Energy efficiency in providing products and services : Water Pumps	1,000.00	1.00	1,000.00	-	State plan	Statewide	MI
8	HUD/KP/9	Developing urban storm water drainage based on the climate change	6,410,441.00	10.00	6,410,441.00	-		Statewide	AD

9	HUD/CAP/N1	Housing for all (in-situ slum development for relocation)	2,100,000.00	10.00	1,800,000.00	300,000.00	Statewide	AD
10	HUD/CAP/N2a	Development of green space, park (105 ULB)	102,100.00	10.00	102,100.00	-	State plan	Both
	HUD/CAP/N2b	Development of green space, park (9 Amrut Cities)	21,100.00	1.00	4,000.00	17,100.00	In 9 AMRUT Cities	Both
11	HUD/CAP/N3a	Smart City Bhubaneswar	580,000.00	10.00	530,000.00	50,000.00	Central Assistance	BBSR & RKL
12	HUD/CAP/N3b	Smart City Rourkela						
13	HUD/KP/3	Ensuring tap water for all	15,000.00	1.00	15,000.00		State plan	AD
15	HUD/CAP/2b	Making urban Odisha open defecation free and management of sewerage, Faecal Sludge and Sewage	75,802.00	10.00	75,802.00	-	State plan	AD
16	HUD/CAP/N6	1-Drink from Tap and 24x7 water supply	500,000.00	5.00	500,000.00		State plan	Both
17	HUD/CAP/N7	Water testing laboratories (District level in 22 districts)	18,000.00	3.00	18,000.00		State plan	AD
		Total (in Rs Crore)	104,785.43		100,690.00	4,095.43		

6C: Transport

6C.1 Overview

The Transport sector is reliant on oil. Economic growth spurs the sector and consequently both oil consumption and CO₂ emissions. This sector is also responsible for the air pollution contributed by ozone, nitrous oxides and particulates. In 2010, 53 percent of global primary oil consumption was used to meet 94 percent of transport energy demand.

As early as 2007 the Transport Policy of Odisha outlined the following objectives: to increase the competition, efficiency, transparency, accessibility and availability of transport services in the state. An ultramodern and well-designed transport network enhances the productivity and profitability of various socioeconomic activities. The State Government has placed much emphasis on infrastructure development in roads and transport in both urban and rural areas for the effective utilisation of resources. However, from the climate change perspective there is a need to understand the impact of transportation on GHGs and other emissions. The Transport sector therefore has two main aspects that must be analysed to develop measures that address climate change adaptation and mitigation: (1) roads and related infrastructure and (2) vehicular modes of transportation.

Transportation: roads and related infrastructure- By the end of 2018, the state had 42, 449 kilometres of rural roads and 18, 591 kilometres of urban roads. The quality of a roadway affects commuting time. The amount of time spent on the road is as important as the distance travelled. The quality and optimal design of roads play a key role in achieving travel efficiencies and in reducing maintenance costs.

Traffic smoothing studies have shown that reductions in constant acceleration and deceleration result in fuel efficiencies. Such studies have also demonstrated that smoothing of traffic flow has been accomplished through controlled traffic signals and with modified lanes as a part of traffic flow management.

Composition of the vehicular mode of transport- As on 31 March 2018, the state had 74.32 lakh 'registered' and 70.81 lakh 'on road' vehicles; 8.66 lakh new vehicles were registered during 2017-18 with an annual growth rate of 19.60% over 2016- 17. More than 81% of the MV populations on road are 2-wheelers followed by light motor vehicles (6.9%).³⁹ Increase in number of personalised vehicles like two-wheelers, cars,

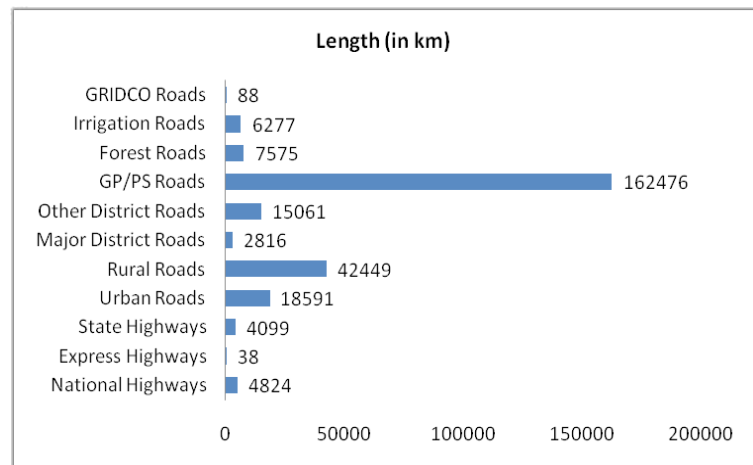


Figure 50 Types of Roads in 2018, Odisha

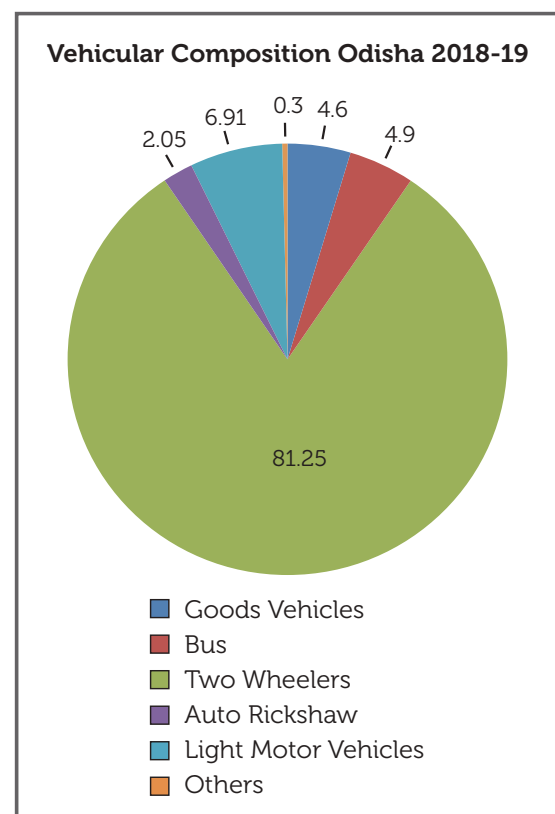


Figure 51 Vehicular Composition Odisha
(Source: Transport Section, Economic Survey 2018-19)

³⁹ Transport Section (Economic Survey Odisha 2018-19)

etc. creates problem in terms of traffic congestion in cities, management and auto pollution; parking and road accident problems. Although new cars are fuel-efficient, the auto rickshaw segment requires major regulatory changes to ensure that these new vehicles conform to the emissions standards.

6C.2 Impact of Climate Change

The Transport sector is itself a major contributor of emissions that contribute to climate change and global warming. Globally, the Transport sector produced 7.0 gigatonnes of CO₂ equivalent of direct emissions in 2010 (or, including non-CO₂ gases, about 20 percent of the total). Emissions from transport are projected to reach 46 percent of global emissions by 2035.

The number of vehicle miles travelled by passenger cars and light-duty trucks increased 35 percent from 1990 to 2013. The increase in travel miles is attributed to several factors, including population growth, economic growth, urban sprawl and low fuel prices during the beginning of this period.

Rising temperatures and extended heat wave periods expedite damage to roads and pavements. In addition, to increase their comfort vehicle users tend to turn on their air conditioning more than before. The use of air-conditioning is further amplified in urban areas as the temperature in those areas is a few degrees higher than in rural areas because of the Heat Island Effects.

Higher temperature also affects rail networks through thermal expansion. The new rail network expanding to Angul and Kalinganagar (Jajpur) is likely to be affected because of the rise in temperatures in these areas. Movement of dirty cargo, especially from mining areas and constant road congestion, increase emissions and cause air pollution. Floods damage roads in rural areas and increased precipitation and storm water weaken the road infrastructure. Cyclones and hurricanes also damage roads and the avenue plantations.

Roads and rail near the coast will become more vulnerable to flooding and erosion as a result of the rise in sea level and extreme weather events. Ports such as Gopalpur, Dhamra and Paradeep are in cyclone paths and repeatedly suffer from extreme weather events.

Older vehicles and overloaded vehicles emit more CO₂ than newly arrived modern vehicles or lightly loaded vehicles.

6C.3 Gap/ Barrier Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> Focusing climate change concerns in the planning process Need of climate change experts advising on departmental programs related to climate change Sustainability of different programmes
Technical	<ul style="list-style-type: none"> Understanding relevant climate and sectoral data Technical capacity on designing different strategies
Financial	<ul style="list-style-type: none"> Execution of activities is dependent on financial assistance
Regulatory/ Policy	<ul style="list-style-type: none"> More emphasis on GHG Emissions Need of sustainable policies and regulations related to climate change Revision of Transport Policy from time to time

6C.4 Key activities taken up

Table 74: Lists of the key climate change activities implemented in Transport Sector

Table 74 Key Climate Change Activities in Transport Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Expand road network, fly overs and bypasses in major cities for decongestion	Mitigation	Implemented but not a Key Priority (KP)
2	Develop plan for Inland Waterways	Mitigation	Implemented as a KP
3	Introduce Mass Rapid Transport System (MRTS)	Mitigation	Implemented as a KP

6C.5 Plan to meet NDCs and SDGs

Table 75: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 2: To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development	<ul style="list-style-type: none"> • Initiatives towards Odisha Electric Vehicles Policy • E-Mobility plan under SMART city plan
NDC 3: To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.	<ul style="list-style-type: none"> • Introduction to cycle lanes • Procurement of e-buses

Table 76: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable	<ul style="list-style-type: none"> • Urban Road Transport • Enforcement of Road Safety • Odisha Urban Infrastructure Development Fund Assisted by KFW, Germany • Heritage City Development and Augmentation Yojana (HRIDAY) • Construction and renovation of bus stands • Prime Minister Gram Sadak Yojana • Mukhya Mantri Sadak yojana • SCA for KBK Districts • State Highway Development Project • Biju Express Way • Odisha State Road Project-EAP • RIDF • Road Development project • Gopabandhu Grameen Yojana • Establishment of Rural Road Connectivity

6C.6 Description of Activities

Good opportunities exist for both structural and technological changes around low carbon transport. Policy changes in the Transport sector have the potential to institute practices that can improve the prospects for mitigation through reductions in carbon.

C&T/KP/1- Policy of phasing out old vehicles in order to reduce emissions

Several global best practices such as a scrappage programme and vehicle emissions standards are available in this sector both incentive programmes and regulations. Such practices will entail changes in Transport Policy

and regulations. A draft Policy has been formulated by MoRT&H, GoI. Once this policy is finalized, old vehicles would be phased out from the road resulting in drastic emission reduction. It is estimated that nearly 35 Lakhs vehicles will be phased out with a cost of 60 crores for 10 years once the scrapping policy is implemented. This is a tentative figure only. The share of the state will be decided once the Scrapping Policy is formulated by Govt. of India.

C&T/KP/2- Ensure fuel efficiency through driver training
Training drivers to better manage vehicle control and road and traffic signage will enhance fuel efficiency in the Transport sector. Steps would be taken to train the existing as well as upcoming drivers to educate them regarding fuel efficiency along with other aspects of Road Safety. It is estimated that, nearly 3,00,000 Nos. of drivers will be trained in LMV & HMV Driving Training Programs through empanelled Pvt. LMV DTIs and HMV Chhatia under funding from both OSDA & Transport Dept for a cost of Rs. 45 crores in 10 years.

C&T /KP/3- Strengthen the enforcement wing for emission level check-up system

High security number plates will be installed on cars and emission standards will be included in the Transport Policy and regulations. Nearly 1236 numbers of Private Pollution Testing Units are operating across the state which includes both static and mobile who are authorized to conduct emission test of vehicles and issue Pollution Under Control Certificate (PUCC) through online. Pollution testing of all types of vehicles is being conducted by the Enforcement Officials of all RTOs in the state of Odisha during course of checking. Besides PUC Certificates are also being verified of commercial vehicles (HGV/LGV/Passenger/Stage Carriage/ Contract Carriage etc.) before consideration of fitness certificate and permit. As Private Pollution Testing Units have been established, Govt. has to spend only on enforcement with a total cost of Rs 100 cores towards the remuneration of the officials.

C&T/KP/5- Encouraging e-rickshaws, electric vehicles & Compressed Natural Gas (CNG) use

The Central Government is enacting legislation that prescribes the standards for battery- powered e-rickshaws. They will reduce the ever-increasing growth of CO₂ emitting normal autos. So far, 35 numbers of cars, 3447 numbers of motor cycles, 609 numbers of e-Rickshaws and 109 numbers of e-carts have already been registered at different RTOs in the state of Odisha. For encouraging the public, specially the auto drivers to use of electric vehicles, the Govt. of Odisha is taking a lot of initiatives and also in the process of reducing the tax from existing 3% to 0%. These electric vehicles can be seen in numbers once the basic facilities like quality of batteries, battery swapping and charging stations are to be developed at appropriate locations. A cost of Rs.40 crores nearly is estimated towards the reduction of tax, registration, permit etc. for the electric vehicles. The use of CNG would certainly reduce CO₂ emission levels. CNG is cheaper and cleaner and it can be combusted without releasing too much carbon into the atmosphere. This makes CNG a much more environment friendly fuel alternative to petroleum and gasoline.

CASH FOR CLUNKERS

The U.S. Consumer Assistance to Recycle and Save (CARS) Act of 2009, more commonly known as "Cash for Clunkers," was intended to improve the fuel efficiency of the U.S. vehicle fleet by removing old and inefficient vehicles from use. As a result, CARS had a one-time effect of preventing 4.4 mega tones of CO₂ equivalent emissions.



Encouraging e-rickshaws/ electric vehicles



Strengthen the enforcement wing for emission level check-up system



Strengthen the enforcement wing for emission level check-up system

6C.7 Co-benefits

A low-carbon transport system with trained drivers not only provides such drivers (about 1 lakh) with a livelihood, but also provides the poor who earn their livelihoods in different parts of the state with mobility services. It also aids in the movement of goods and services. An efficient transport system saves time, reduces particulate emissions and ensures long- term energy security.

6C.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	C & T/ KP/1	Policy and implementation of phasing out old vehicles for emission reduction	6,000.00	10.00		6,000.00	-	Nearly 35 lakhs vehicles is expected	AD
2	C & T/ KP/2	Ensuring fuel efficiency through Driver training	4,500.00	10.00	-	4,500.00	State Govt.	300000 number of drivers	AD
3	C & T/ KP/3	Strengthening enforcement wing for emission level check-up	10,000.00	10.00	-	10,000.00	State Govt.	State wide	MI
4	C & T/ KP/5	Encouraging e-rickshaws, electric vehicles and CNG use	4,000.00	10.00		4,000.00	State Govt.	State wide	MI
		Total (in Rs crore)	245.00		-	245.00			

6D: Industries

6D.1 Overview

The National Goal of India is described in its National Manufacturing Policy (2011). This policy seeks to increase the contribution of manufacturing to GDP to 25 percent (from the current 15 percent) within the next decade and help create 100 million jobs. Among the priorities outlined in the policy is its focus on “greener and cleaner” technologies. The policy recommends that a Green Manufacturing Committee (GMAC) be established to work with industries in developing low emissions strategies for production and supply chains. The Industrial Policy Resolution of Odisha also emphasises cleaner production. The major industries in Odisha are steel, aluminium (covered by the Steel and Mines Department), power (Energy Department), food processing and ancillary industries, including the clean Khadi and Village Industry Commission (KVIC) pattern industries under the Micro, Small and Medium Enterprises (MSME) Department.

The Industry and services sectors have emerged as the main drivers of growth during the past decade. In real terms at 2004–05 constant prices, Odisha’s economy exhibited an average annual growth rate of 8.82 percent during the 10th Plan (2002–07), exceeding the target of 6.20 percent. The Industry sector contributes more than one-third of the state’s GDP. In Odisha, aluminium occupies first place in the country in terms of production capacity and actual output. For several mineral-based industries, forests must be diverted to production, which sometimes has a negative effect on the environment if not mitigated. According to the Odisha Economic Survey 2016–17, about 47660.52 ha of land have been diverted for 448 projects under the Forest Act 1980. Figure 52 shows some examples of how forest land is diverted to industrial uses.

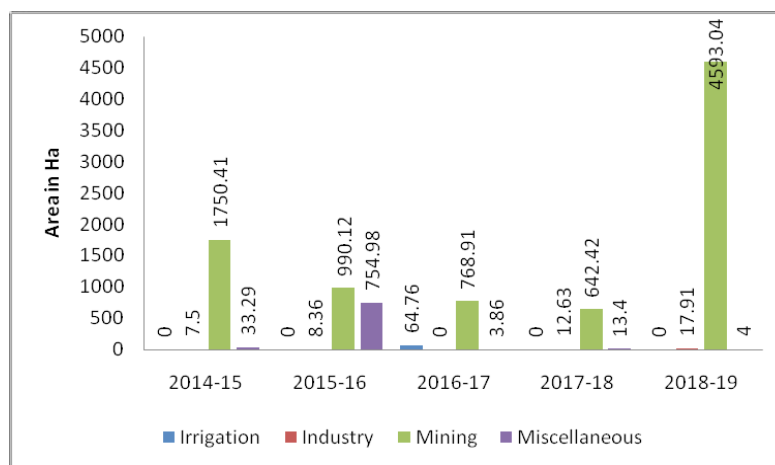


Figure 52 Forest Area Diversion by Category: Odisha, 2014–19 (hectares)

Table 77 Forest Area Diverted to Non-forest Use (2010-11 to 2016-17)

Year	Number of Projects	Area diverted to non-forest use (in hectare)
2010-11	13	915.95
2011-12	13	831.18
2012-13	10	2813.74
2013-14	18	925.407
2014-15	21	2867.588
2015-16	7	756.001
2016-17	14	297.872

(Source: Economic Survey Odisha 2017-18)

The number of Micro, Small and Medium Enterprises (MSMEs) in the state has been increasing over time. Most of these are set up as ancillary industries near Rourkela and in the Metals Sector, engaged in maintenance and repair. The second most important category is the food processing sector. Both sectors have high potential in energy conservation.

6D.2 Impact of Climate Change

The vulnerability in the Industrial sector, especially in manufacturing, can be analysed in two different ways. First, many thermal power industries contribute to emissions. Aluminium, paper and cement are power-intensive industries that place demands on thermal generation. As described in the Mining sector study, most of these industries use world-class technologies and are almost on a par with developed countries in energy consumption. Having additional such industries in the state would contribute to emissions and to climate vulnerability.

Most of the MSME sector in metals and food processing has far to go in reducing emissions by improving energy use and reducing waste. Thus clean production is necessary to reduce vulnerability.

A climate change-induced rise in temperature reduces industrial activity, increasing down time. Similarly, water scarcity severely affects many industrial processes.

Floods and cyclones damage industrial infrastructure and also affect industrial productivity. Industries along the coast such as food processing (aquaculture), chemical and fertiliser are more vulnerable.

6D.3 Gap/ Barrier Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> Understanding on what has been done, what has worked, what has not and why Requirement of more technical experts advising on departmental programs related to climate change Sustainability of different programmes related to climate change
Technical	<ul style="list-style-type: none"> Technical capacity on designing different strategies to promote clean and efficient technology in the industries, especially the SMEs Understanding of vulnerability assessment findings and what it means for the sector Accessing relevant climate and sectoral data
Financial	<ul style="list-style-type: none"> Requirement of more funds for implementation of activities
Regulatory/ Policy	<ul style="list-style-type: none"> Need of sustainable policies and regulations Revision of industrial policy from time to time Co-ordination between regulating body and policy makers Need of more effective policies for proper monitoring

6D.4 Key activities taken up

The activities listed in Table 78 were undertaken in the Industrial sector

Table 78 Key Climate Change Activities in Industry Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Integrate climate concerns in policies and plans for industrial development and related areas.	Mitigation	Implemented as a Key Priority (KP)
2	Prepare GHG profile of major industrial cluster.	Mitigation	Implemented as a KP
3	Undertake a Heat Island study for Talcher and Jharsuguda areas.	Mitigation	Implemented as a KP
4	Train various stakeholders on climate change issues.	Both	Implemented as a KP

5	Implement a system of compensatory water harvesting.	Adaptation	Implemented as a KP
6	Streamline an institutional arrangement and strengthen OSDMA to tackle extreme climate events in coastal areas.	Adaptation	Implemented as a KP
7	Carry out an energy efficiency study of the iron, steel, thermal power, cement and aluminum sectors.	Mitigation	Implemented as a KP
8	Promote use of bulk waste material such as fly ash, dolo char, slag, etc.	Mitigation	Implemented as a KP

6D.5 Plan to meet NDCs and SDGs

Table 79: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 2: To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development	<ul style="list-style-type: none"> • Popularization of science and technology and support to scientific institutions
NDC 3: To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.	<ul style="list-style-type: none"> • Implementation of National Air Quality Monitoring Programme • UNNATI Initiative

Table 80: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 5: Achieve Gender Equality and Empower All women and girls	<ul style="list-style-type: none"> • Promotion of Handloom Industry and enhance women participation • Assistance for welfare of MSME workers • Financial assistance to WSHGs and their federations under Mission Shakti
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	<ul style="list-style-type: none"> • Cluster Development Programme (MSME) • Promotion of Handloom Industries • Food Processing Policy (MSME) • Development of IT Parks and Towers • Assistance for Welfare of MSME Workers • Organisation of Udyoga Samadhan Sibira (MSME) • Promotion of Salt Industries • Promotion of Handicrafts industries

6D.6 Description of Activities

IND/KP/1- Devise a mechanism for green belt development and maintenance for industrial clusters

The purpose of this activity is to internalise green belt development and maintenance in all industrial clusters within the state. This initiative should move away from being funded and maintained through Government funds. Industrial clusters and their organisations need to develop a mechanism to define green belts and expand and maintain them on a continual basis.

IND/KP/4- Prepare regional environmental management plans for major industrial clusters

Regional environmental management plans are required to identify the priority environmental actions needed in each of the major industrial clusters. Resources, both financial and human are scarce. Thus regional environmental plans can be used to determine where the focus should be to maximise effectiveness.

IND/CAP/N1- Fly ash utilization by industries

Fly ash, being treated as waste and a source of air and water pollution till recent past, is in fact a resource material and has also proven its worth over a period of time. It is the action of human beings that determines the worth of any material. Materials having potential for gainful utilization remain in the category of waste till its potential is understood and is put to right use. Fly ash is one such example, which has been treated as waste materials. The fly ash generated at industries is ideal for use in the manufacture of cement, concrete, concrete products, cellular concrete products, bricks/blocks/ tiles etc. The important areas for this utilization are cement industry, bricks industry road embankment and mine filling.

6D.7 Co-benefits

Green manufacturing using renewable (covered under energy sector), Perform, Achieve, Trade (PAT)–compliant industries and industries using recycling and reuse processes for waste beyond the legal requirements are strong environmental co-benefits of the proposed climate change activities in the Industry sector. The other co-benefits include the employment that MSME generates. Table 81 shows employment in the various categories of industry.

Although power sector co-benefits in employment would be provided by thermal sources, the growing investment in renewable power will also add to employment, especially in terms of the human resources required for solar installations and the trade and commerce in solar devices.

The environmental and emissions co-benefits are as follows:

- Creation of a green belt will improve the environmental aesthetics of industrial clusters, reducing the local heat and expanding the carbon sinks within the state.
- Treatment of food waste will result in ways to convert waste, reducing a local environmental

Table 81 Employment generated in Odisha by the end of 2017-18

Category	Employment generated (in numbers)
Food & Allied	189915
Chemical & Allied	28249
Electrical & Electronics	10456
Engineering & Metal Based	115427
Forest & Wood Based	67385
Glass & Ceramic	149842
Livestock & Leather	3252
Paper & Paper Products	20567
Rubber & Plastic	12828
Textiles	78193
Misc. Manufacturing	83755
Repairing and Services	574824
Total	1334693



Devise mechanisms for green belt development

- Centralised solar heating will reduce heating needs for conventional power and thus reduce carbon emissions.
- Water harvesting will include better climate adaptation and reduced groundwater/ surface water use as the stored runoff water is gainfully utilised.
- Implementation of pollution prevention plans will bring about a reduction in energy and water consumption, which will translate into emissions reduction as well.

6D.8 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR Lakh during (2021-30)	Duration in years	Source: State budget in INR Lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	IND/KP/1	Devise a mechanism for green belt development and maintenance for industrial clusters	10,000.00	10.00	10,000.00			Area specific	Both
2	IND/KP/2	Preparation of Regional Environmental Management Plans for major industrial clusters	1,500.00	10.00	1,500.00			Area specific	AD
3	IND/CAP/N1	Fly ash utilisation by industries						Area specific	MI
		Total (in Rs crore)	115.00		115.00	-			

6E: Mining

6E.1 Overview

Of India’s total mineral deposits, Odisha’s mineral reserves constitute 35 percent of its iron ore, 24 percent of its coal, 53 percent of its bauxite and 98 percent of its chromite. The mining and quarrying sector contributed nearly 10.79% of state GVA in 2018-19. In terms of total value of mineral output, Odisha ranks highest in the country. Iron ore production expanded substantially from 533.29 lakh MT in 2014-15 to 1026.63 lakh MT in 2016-17, bauxite production increased from 91.92 lakh MT in 2014-15 to 119.14 lakh MT in 2016-17 and chromite production also increased from 21.62 lakh MT in 2014-15 to 41.30 lakh MT in 2016-17⁴⁰. Figure 53 shows total value of mineral production in Odisha from 2009 to 2017.

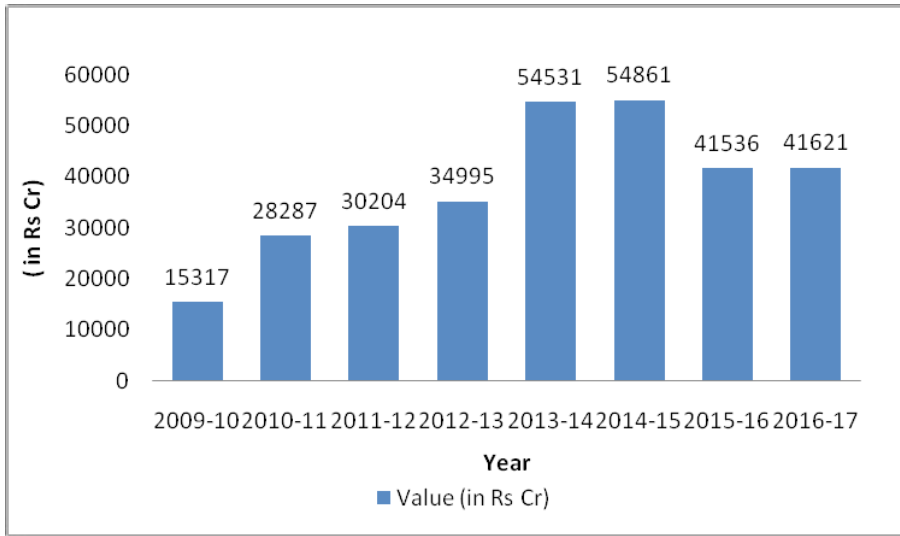


Figure 53 Value of Mineral Production: Odisha, 2009-2017

(Source: Economic Survey Odisha)

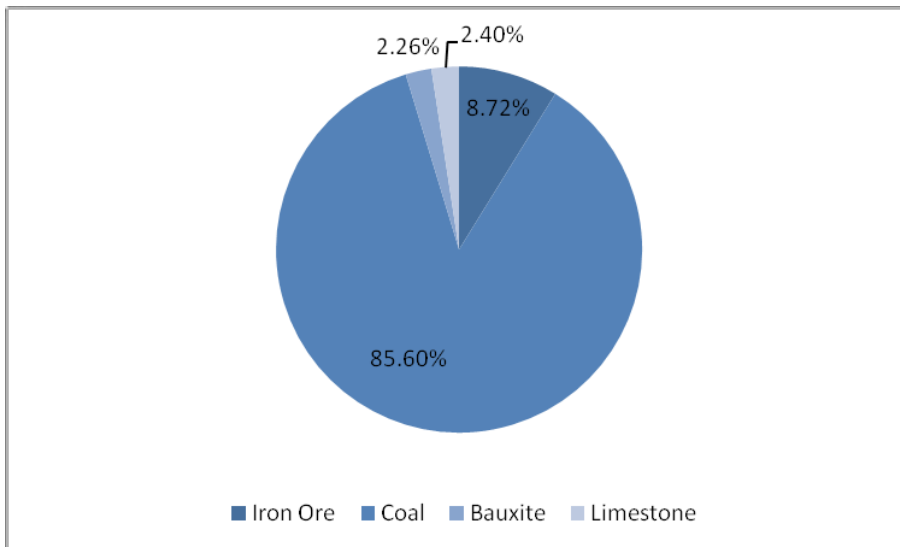


Figure 54 Shares of Mineral Reserve Odisha 2017-18

(Source: Economic Survey Odisha)

⁴⁰ Economic Survey Odisha 2018-19



The state succeeded in expansion of the quantum of identified reserves for major minerals. With continuous research, reserves size for majority of key minerals such as iron ore, chromite, coal, bauxite has increased since 2010-11. The State Government of Odisha aims at achieving optimal utilization of state's mineral resources for its industrial growth and socio-economic development through scientific exploration, sustainable mining practices and geo-scientific research.

6E.2 Impact of Climate Change

According to IPCC's Fifth Assessment Report and subsequent observations of the climate change network in the country, the following events may affect mining activity in the state.

The high level of precipitation will increase the rain water infiltration on spoil piles, resulting in aquifer-level contamination in coal-bearing areas. The water quality of nearby streams may be affected. Concentrated rainfall will also increase the risk of mining operations and damage the outbound transport infrastructure.

Changes in the frequency and intensity of storm events could affect mining operations (e.g., tailing dams, sediment and erosion control). However, these impacts must be addressed as a part of a mine's water management plan in a changing climate scenario.

The atmospheric pollutants from primary aluminium production also produce acid rain when they mix with water vapour. Aluminium poses no danger of environmental toxicity when the soil pH remains at or above 5.0. However, acid rain lowers the pH of soil and forces aluminium into solution. This causes it to leach into the water supply where it can damage root systems.

Similarly, the excessive heat that is likely to prevail in the summer months in the northern and western parts of the state would contribute to workers' heat strokes, cause more mining accidents and shorter working hours and lower productivity.

The greenhouse gases resulting from primary production include per-fluorocarbons (PFCs), polycyclic aromatic hydrocarbons (PAHs), fluoride, sulphur dioxide (SO₂) and carbon dioxide (CO₂). Of these gases, PFCs resulting from the smelting process are the most potent. PFC emissions from primary aluminium smelting can be reduced by controlling the frequency and duration of anode effects (AEs). It is possible to reduce AEs by as much as 70 percent. The reduction can be achieved by computerised process controls, but also by increasing employee awareness and training. The major aluminium plants in the state already have state-of-the-art technology.

CARBON FOOTPRINT REDUCTION IN MCL

In Odisha, 68.44 percent of Mahandi Coal Field Limited (MCL) production (73.84 MT) is conducted using surface mining technology. This eco- friendly, blastless mining technology completely eliminates the dust- generating operations such as drilling, blasting and crushing while sprinkling water at the same time. The total CO₂ reduction by using this technology in 27 surface mines is about 619,410.5 MT.

6E.3 Gap/ Barrier Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> Understanding of how to include climate change concerns in mining plans In house technical experts advising on departmental programs related to climate change Capacity to advise and implement different activities
Technical	<ul style="list-style-type: none"> Understanding of vulnerability assessment findings and what it means for the sector Technical capacity on designing different strategies

Financial	<ul style="list-style-type: none"> Requirement of more funds for implementation of activities
Regulatory/ Policy	<ul style="list-style-type: none"> Need of sustainable policies and regulations Co-ordination between regulating body and policy makers

6E.4 Key activities taken up

Table 82 Key Climate Change Activities in Mining Sector

Sl. No.	Activity	Linkage	Progress in 2010–15
1	Institute robust system of environmental monitoring and disclosure for mines	Adaptation	Implemented as a key priority (KP)
2	Create and maintain green zones	Adaptation	Implemented as a KP
3	Offer training on Clean Development Mechanisms and climate change awareness programmes	Mitigation and adaptation	Implemented as a KP
4	Conduct Heat Island study	Adaptation	Implemented but not a KP

6E.5 Plan to meet NDCs and SDGs

Table 83: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 2: To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development	<ul style="list-style-type: none"> Integrated Mines and Minerals Management System (i3MS) Government laboratories for Research on Mines and minerals in the state Development in Mineral exploration technologies

Table 84: Key Initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 1: No Poverty	<ul style="list-style-type: none"> Odisha Mineral Bearing Areas Development Corporation (OMBADC) District Mineral Foundation (DMF) Pucca Ghar Yojana (Mining)

6E.6 Description of Activities

Adaptation Measures

MIN/KP/1- Prepare an action plan for sustainable mining

The regional management plan for Joda-Barbil (iron and manganese) area, Mayurbhanj (iron ore zone), the Talcher-Angul-Ib valley area and Sukinda (chromite belt), Sundergarh (lime stone and dolomite belt) and the eastern Ghats (bauxite zone) will help in estimating the carrying capacity and sustainable extraction of minerals from the region, along with the proper mine closure plans. This measure will also have a mitigation co-benefit.

Mitigation measures

Some of the following mitigation measures can reduce emissions by 40–50 percent if integrated into some of the existing mines:

- New pollution control devices such as advanced scrubbers that clean pollutants from flue gases before they exit a plant's smokestack (mandated by OSPCB)
- Chemical looping combustion technology to concentrate CO₂ levels in the exhaust
- Production of ultraclean coal, which reduces ash from the coal, allowing it to be directly fired in gas turbines at higher efficiency and lower emissions
- Efficiency upgrades and co-firing with fewer greenhouse-intensive fuels in coal-fired power stations
- Low-NOx burners, which allow coal-fired plants to reduce nitrogen oxide emissions
- High-temperature solar thermal applications integrated into coal-fired power generation
- Stack gas treatment, applied to gaseous emissions from pulverised fuel combustion.

The PFC reduction and energy efficiency issues remain a challenge in the aluminium industry. Mitigation measures have been implemented. Some companies operating in the state are using slotted anodes. This technology is useful in expelling gas bubbles out of the pot easily and reduces the ohmic voltage drop to the tune of 50–100 mega volts, thereby reducing direct current (DC) energy consumption. The Indian Aluminium Industry is among the lowest users of electricity in aluminium smelters in the world. By adopting prebaked Anode technology, it also has one of the lowest perfluoro carbon emissions in the world (0.14 MT of CO₂ equivalents per MT of aluminium). But because of the very low efficiency of coal-based captive power production, the sector's carbon intensity is well above the global average.

Energy efficiency opportunities for the iron and steel sectors include improved heat and energy recovery from process gases and waste streams. Improved fuel delivery through coal injection is also a possibility. Emission-related efficiency gains are possible through beneficiation of coal ash and the substitution of a cleaner fuel such as natural gas or waste plastics for coal injection. The Paradip region is likely to have a plastic park and can therefore enhance the waste plastic supply. The Perform, Achieve and Trade (PAT) target (a domestic energy efficiency trading measure) covers most of the iron and steel industry in the state.



MIN/CAP/8- Conduct a study to determine the potential of coal bed methane in the coal fields of Odisha

A detailed study is needed to estimate the state's coal bed methane potential and the commercial viability of such exploration. The exploration rights will be granted following the due procedures and this effort will help enhance the energy security of the state and nation.

MIN/CAP/34- Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in the Mining sector as suggested by the Forest & Environment Department

It is important to track the carbon stock in mining areas where planting has been undertaken on a massive scale. A transparent methodology will be developed for this purpose and routinely made available at various sites. This budget may be transferred to the Forest & Environment Department for uniform methodology.

6E.7 Co-benefits

The workers directly employed in this sector are shown in Figure 55. However, the direct employment in this sector is almost stagnant because most mines now operate with capital- intensive and labour-saving technology to compete on a global scale. The indirect employment benefits in this sector are huge.



Figure 55 Workers Directly Employed in Mining Sector: Odisha, 2010–18
(Economic Survey Odisha 2018-19)

Many mines (coal, iron ore and bauxite) in the state operate with the same global environmental standards as followed by developed countries. The violators are penalised through the regulatory mechanism and notices have been issued. Recycling of aluminium (as practiced by the National Aluminium Company (NALCO) and thereby closing the supply chain loop will reduce energy consumption and minimise waste.

With globally available technologies, the manufacturing and mining processes are almost comparable and their products are competitive. This situation helps create jobs and improve livelihoods. The mandatory CSR expenditure also enables companies to invest in social infrastructure (health, education and skill development)

6E.8 Synopsis of Proposed Activities

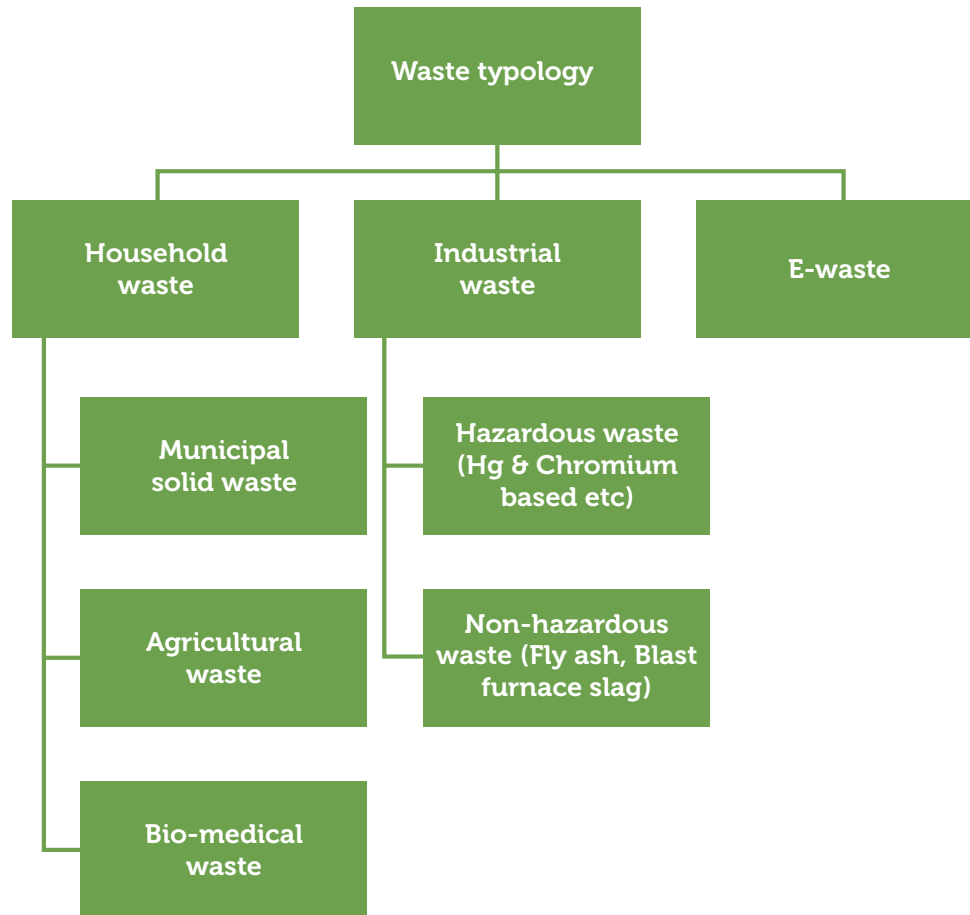
Sl. No	Code	Name of the activity	Proposed budget in INR lakh during (2021-30)	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for the period 2021-30	Type
1	MIN/KP/1	Prepare an action plan for sustainable mining for Joda-Barbil, iron and manganese area, Mayurbhanj iron ore zone, Talcher-Angul Area, Ib-valley area, Sukinda chromite belt, Sundergarh lime stone and dolomite belt, eastern ghats bauxite zone.	200.00	10.00	200.00		Mining companies	Area specific/148 units	Both
2	MIN/CAP/8	Conduct a study to determine the potential of coal bed methane in the coal fields of Odisha.	200.00	10.00	50.00	150.00	Bi/multilateral	State wise/ 30 units	MI
3	MIN/CAP/34	Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in mining sector as suggested by the Forest & Environment Department	70.00	5.00	-	70.00	Bi/multilateral	Area specific/ 148 units	MI
		Total (in Rs crore)	4.70		2.50	2.20			

6F: Waste Management

6F.1 Overview

Indian Government has launched “Swachh Bharat Mission” or “Clean India Mission” which aims to mobilize masses and seeks to create a clean India. The aim of this mission is to motivate Indian citizens to devote at least hundred hours every year i.e. two hours every week to keep their homes and neighbourhood clean. Waste management market is expected to be worth US\$ 13.62 billion by 2025. Indian Municipal Solid Waste (MSW) management market is expected to grow at a CAGR of 7.14% by 2025 while e-waste management market is expected to grow at a CAGR of 10.03% during the same period. India has planned to achieve a capacity of 2.9 million hospital beds by 2025 which will help bio medical waste management market to grow at a CAGR of 8.41%.

The characterisation of waste has been given below:



With rapid growth of industrialization, mining as well as urbanization the waste generation in Odisha has also seen a sharp growth. As per Odisha State Pollution Control Board, the total waste generated is 2721 TPD, out of which 1170 TPD (43 %) waste is processed.

6F.2 Impact of Climate Change

If waste generated is not properly managed, especially faecal matters and other liquid and solid waste from households then it may lead to serious health hazard and spread of infectious diseases. Unattended waste lying around attracts flies, rats and other creatures that in turn spread disease. Normally it is the wet waste that

decomposes and releases a bad odour. This leads to unhygienic conditions and thereby gives rise to health problems.

The group at risk from the unscientific disposal of solid waste include – the population in areas where there is no proper waste disposal method, especially the pre-school children; waste workers; and workers in facilities producing toxic and infectious material. Other high- risk group include population living close to a waste dump and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites. Uncollected solid waste also increases risk of injury and infection. In particular, organic domestic waste poses a serious threat, since they ferment, creating conditions favourable to the survival and growth of microbial pathogens. Direct handling of solid waste can result in various types of infectious and chronic diseases with the waste workers and the rag pickers being the most vulnerable. Occupational hazards associated with waste handling infections, skin and blood infections resulting from direct contact with waste and from infected wounds. Eye and respiratory infections resulting from exposure to infected dust, especially during landfill operations. Different diseases results from the bites of animals feeding on the waste. Intestinal infections are transmitted by flies feeding on the waste.

Disposal of hospital and other bio-medical waste requires special attention since this can create major health hazards. This waste generated from the hospitals, health care centres, medical laboratories and research centres such as discarded syringe needles, bandages, swabs, plasters and other types of infectious waste are often disposed with the regular non- infectious waste.

Waste treatment and disposal sites can also create health hazards for the neighbourhood. Improperly operated incineration plants cause air pollution and improperly managed and designed landfills attract all types of insects and rodents that spread disease. Ideally these sites should be located at a safe distance from all human settlement. Landfill sites should be well lined and walled to ensure that there is no leakage into the nearby ground water sources.

Recycling too carries health risks if proper precautions are not taken. Workers working with waste containing chemical and metals may experience toxic exposure. Disposal of health- care wastes require special attention since it can create major health hazards, such as Hepatitis B and C, through wounds caused by discarded syringes. Rag pickers and others who are involved in scavenging in the waste dumps for items that can be recycled, may sustain injuries and come into direct contact with these infectious items.

6F.3 Gap Analysis

Area	Gaps
Institutional	<ul style="list-style-type: none"> • Proper action plan for implementation of the MSW Rules • Awareness programmes to engage the communities
Technical	<ul style="list-style-type: none"> • Gap between solid waste generation and collection • Gap between waste collection and processing • Need of solid waste treatment plant and proper waste disposal system
Financial	<ul style="list-style-type: none"> • Availability of funds for implementation of activities • Delay of funds result in cost overrun
Regulatory/ Policy	<ul style="list-style-type: none"> • Strict follow of SWM Rules • Lack of convergence with the schemes attaining similar goal • Need for an integrated approach for waste management

6F.4 Plan to Meet NDCs and SDGs

Table 85: Key Initiatives under NDCs for the Sector

NDCs Commitment	Key initiatives by the state
NDC 1: To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and modernisation	<ul style="list-style-type: none"> • Odisha Integrated Sanitation Improvement Project (EAP) • Climate Adaptation Measures through storm water and flood drains structure development • Comprehensive Sewerage Systems • Solid Waste Management • Underground Sewerage Schemes (UGSS)

Table 86: Key initiatives under SDGs for the Sector

SDGs	Key initiatives by the state
SDG 6: Ensure availability and sustainable management of water and sanitation for all	<ul style="list-style-type: none"> • Location and Geo coordinates identified by ULBs for Deposition of Construction and Demolition waste • Pilot project on 'Toilets on Wheels' at Bhubaneswar • 5 TPD capacity compost plant at a Temporary Transfer Station (TTS), Bhubaneswar • Integrated Municipal Solid Waste Management Project, Berhampur • Bio Medical Waste Management • Urban Sewerage & Sanitation- Urban Sewerage Scheme

6F.5 Description of Activities

This is a new mission mainly aimed at sanitary land fill of solid waste and wherever possible to attempt Waste to Wealth projects.

WS/KP/1- Awareness generation for management of various kinds of waste

Considering the food habit and culture, massive effort is needed to create awareness about waste segregation at the household level. This has to be done in urban areas with housing societies and also schools and slum committees. OSPCB would also work with relevant industry associations through workshops and seminars about handling of hazardous waste and E-waste.





Awareness generation for management of various kinds of waste

WS/KP/2- Waste to Wealth projects in PPP mode

The Principle of "decentralized processing" has been adopted by the H&UD Dept. and dispersed facilities have been established for maximizing the process of biodegradable waste by setting up of Micro Composting Centres (MCCs) and for recovery of recyclables, the Materials Recovery Facilities (MRFs) closest to the sources of generation. These projects are intended to be managed in PPP mode where in the ULBs shall partner with the WSHG/ Area or City Level Federation/ transgender groups & other community based groups and assign operation & maintenance responsibility of the MCCs and MRFs to them.

WS/KP/3- Management Municipal Solid Waste

Government of Odisha would work with Urban Local Bodies and private sector for the management of Municipal Solid Waste. The ULBs will identify landfill sites and sign concession agreement with private sector. A viability gap funding mechanism has been proposed for this. The activity would include effective source segregation, transfer station management and quality landfill and compaction wherever possible.

6F.6 Synopsis of Proposed Activities

Sl. No	Code	Name of the activity	Proposed budget in INR lakh for 2021-30	Duration in years	Source: State budget in INR lakh	Source from (National Missions, from external aid, etc.) in INR Lakh	Source (specify)	Whether state wise or area specific indicate physical coverage with unit for 2021-30	Type
1	WS/KP/1	Awareness generation for management of various kinds of waste	282.00	10.00	282.00	-	External TA	Statewide	MI
2	WS/KP/2	Waste to Wealth in PPP mode		10.00			PPP mode	Area specific	MI
3	WS/KP/3	Management of Municipal Solid Waste	185,000.00	10.00	185,000.00	-	Ongoing work	Statewide	MI
		Total (in Rs Crore)	1,852.82		1,852.82	-			

Gender and Climate Change

7.1 Overview

It is important to integrate and address gender concerns in the context of climate change. Gender is a crosscutting issue and it is well known that women suffer adverse climate impacts relatively more than men because they have less opportunities, authority and resources which enable them to adapt to the unavoidable impacts of climate change. Effective participation of women is critical for adaptation planning to address climate change as they can provide solutions required in enhancing their resilience. Hence for effective action on all aspects of climate change, the effective participation of women is necessary.

It has been widely recognized that the climate change challenges cannot be tackled with half of the population. We need to have both men and women come together, joining hands to address this challenge. It is also unfair to say that mainstream climate adaptation/mitigation programmes are not women friendly. 65 of 162 INDCs including India [40%] mention "women" and /or "gender" in the context of their national priorities and ambitions for reducing emissions. But in many cases they are not tightly focused on gender issues and sometimes insensitive to the changing role of women in the modern society. Therefore, gender mainstreaming requires a contextual analysis of the needs, priorities, roles and experiences of women and men as well as the integration of specific actions proposed under SAPCC to address any gender related inequalities.

Table 87 Work Participation Rate

Work Participation Rate	Odisha	India
Male	56.11	53.26
Female	27.16	25.51
Total	41.79	39.79

Source: Census Odisha 2011

The female work participation rate in Odisha is marginally higher than the national average. However, it is also important to note that climate change disproportionately affects female employment as well as makes them

more vulnerable. Traditionally, in the state females suffer more drudgery and suffer more in fetching water, collecting bio-mass for cooking and have relatively higher disease burden under similar circumstances due to poor nutrition.

Table 88 Share of Women in Odisha

% Share of Women			Sex Ratio		
Rural	Urban	Total	Rural	Urban	Total
49.71	48.23	49.46	989	932	979

Source: Census Odisha 2011

The state observed growth in female literacy rate from 50.51 (in 2001) to 64.01 (in 2011). Women are considered to be as change agents when executing climate impact solutions. The long-established knowledge which they hold helps to adapt to impacts of climate change. Women have important impact on consumption patterns and lifestyle choices also.

Table 89 Comparison of Literacy Rates in Odisha

2001			2011		
Female	Male	Total	Female	Male	Total
50.51	75.35	63.08	64.01	81.59	72.87

Source: Census Odisha 2011 and 2001

The state has observed decrease in Maternal Mortality Rate (MMR) from 2004 to 2016. Women are more prone to the increased occurrence of vector-borne and water-borne diseases as a result of climate change. Improper health diet as well as lack of access to good health services results in weakness, maternal mortality, reduced physical and mental capacity, etc. It is important to monitor health inequalities while gender mainstreaming through proper coverage of health services.

Table 90 Maternal Mortality Rate (MMR) in Odisha

2004-06	2007-09	2010-12	2012-13	2014-16
303	258	235	222	180

Source: NITI Aayog Statistics

Gender Policy Framework⁴¹

1. Create productive assets – land titles, livestock ownership, CPR/forest land lease, water harvested tanks, micro-enterprises traditional knowledge thought leaders
2. Reduce drudgery and workload - pro-women technology transfer across sectors. e.g. in farm tasks, shorter distances transport
3. Invest in new livelihoods e.g. transport, renewable electrification (e.g. solar systems), waste, housing, health, climate science
4. Ensure women's fair representation in mainstream decision-making institutions and governance platforms to help them shape laws, policies and programmes that affect their lives.
5. Dedicate fair proportion of financial resources for women, mandating gender budgeting and ensuring impact assessment.

⁴¹ Gender and Climate Change Presentation, Aditi Kapoor

6. Promote integrated risk management - address DRR, CCA and ecosystem regeneration together in village upwards development plans to safeguard natural resources.

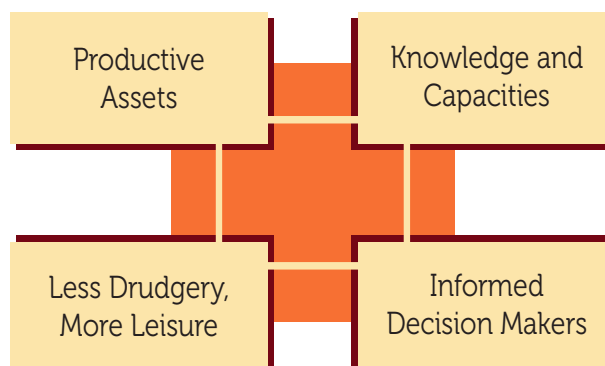


Figure 56 Four Cornerstones of Gender Mainstreaming and Gender Empowerment

(Source: Mainstreaming Gender in the Implementation of State Action Plan on Climate Change)

Gender Mainstreaming Checklist

It is important to integrate gender concerns in adaptation and mitigation strategies and the following checklist can help in the integration process.

- Assess the different implications of policy and programme interventions suggested in the SAPCC for women and men from the outset.
- Assess women & men's technology choices, uses and needs.
- Assess women & men's knowledge concerning the climate change risks, changes in local environment, weather, strategies and coping mechanisms in response.
- Ensure that these assessments are informed by a gender expert to support in developing a gender analysis and by consultations with women and men on priorities, strategic needs and options for action.
- Based on this analysis, refine targeted objectives for incorporating gender equality and women empowerment into policies' and programmes' plans and budgets.
- Use female project implementers, extension agents and trainers to ensure that women participate equally in knowledge access and training.
- Set targets for female participation in activities.
- Make women's equality, access to information, economic resources and education a priority.
- Monitor and evaluate changes in gender relations using gender-sensitive indicators.
- Monitor beneficiaries and results of projects using sex-disaggregated data.
- Proactively seek out and engage with appropriate women's rights organizations and female community leaders when selecting partner.

7.2 Gendered Impact of Climate Change

Climate Change impacts	Women's Vulnerabilities
Lower food production	<ul style="list-style-type: none"> • Least to eat; sleep on an empty stomach • Need to take on additional work as wage labor which also led to more feminization of agricultural labor
More natural disasters: cyclones, floods, water logging and droughts, infrequent rains, intense rains	<ul style="list-style-type: none"> • Longer distances to walk to get water and fuel-wood • Loss of fodder and livestock • Drought/infrequent spells of rains – harder ground to do agricultural work on • Intense rains – more weeds and weeding is a woman's job

Higher summer temperatures, longer summers	<ul style="list-style-type: none"> • Lower milk production among animals • More tiring work in fields • Longer waking hours to work in the field early morning and late evening to beat the heat
Social Impacts	<ul style="list-style-type: none"> • Higher indebtedness– women go to take loans and have the responsibility to pay off loans • Greater poverty and frustration among men leads to increase in domestic abuse/ violence

Source: Engendering the Climate for Change, Policies and practices for gender-just adaptation by Aditi Kapoor

The state will adopt the following approaches to integrate gender concerns in the various sectors under the Climate Change Action Plan.

- Catalyzing actions that recognize and address the different vulnerabilities associated with gender roles due to climate change

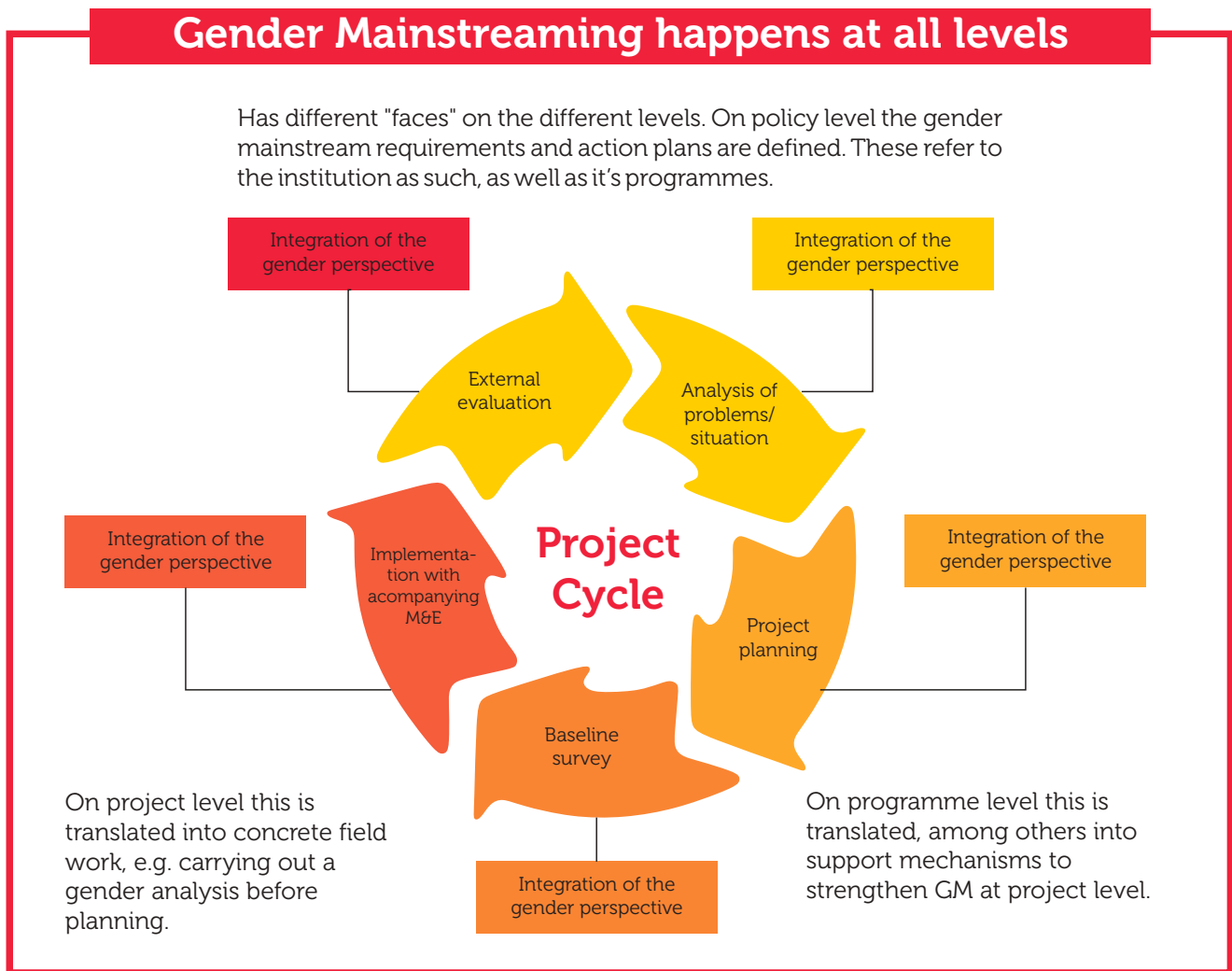


Figure 57 Gender Mainstreaming Process⁴²

⁴² GiZ gender checklist

- Empowering women as agents of change and innovation and not to depict them only as the victims of climate change
- Build the capacity of women and gender-focused community-based organizations (common interest groups, SHG groups, women PRI members)
- Earmark funding for integrating gender considerations into adaptation/mitigation programmes
- Systematically documenting and widely sharing case studies that demonstrate the benefits of applying gender-sensitive approaches

7.3 Gap/ Barrier Analysis

- Huge knowledge gap regarding climate change
- Need of awareness and more capacity building
- Need of gender-based research and participatory planning to design the policies and programmes
- Proper collection and mapping of gender disaggregated data
- Lack of accepting the contributions of women as decision makers, stakeholders and experts across sectors and at all levels that can lead to long-term solutions to climate change
- Women hold the knowledge and understanding of what is required to adapt to changing climate conditions and to arise with practical solutions but still their knowledge are not made use of.

7.4 Key priorities where gender concerns can be integrated

Agriculture

KP No	Priority actions	Category	Linkages
AG/KP/3	Capacity building of extension personnel	AD	At least x% of the extension personnel should be women
AG/KP/5	Develop water-efficient micro-irrigation methods: individual and community farm ponds	MI	Linkages with kitchen gardening, vegetable cultivation
AG/KP/6	Create awareness among farmers of climate change adaptation.	AD	Special focus on women farmers
AG/KP/8	Establish a seed bank at the village level.	AD	Involvement of women SHG groups
AG/KP/9	Promote SRI	Both	Involvement of women farmers

Coast and disaster management

KP No	Priority actions	Category	Linkages
CD/KP/10	Develop a techno-legal regime for the construction of disaster-resilient public infrastructure (construction of approach roads to MCS buildings under the NCRMP) and include Odisha Disaster Recovery Project (ODRP) project for housing, etc.	AD	A specific Gender Action Plan to be integrated in the social safeguard section and implementation be monitored
CD/KP/12	Set up an integrated capacity-building protocol covering shelter and a self-help group under the Community-Based Disaster Risk Reduction Framework (CBDRF), including college and school volunteers and officials at the state and district levels	AD	Women self-help group members to be fully oriented

Energy

Energy sector: Women are important positive change agents through their role as key energy managers and their participation in the renewable energy sector and value chain, including the design, production, servicing and marketing of these technologies. They can bring out changes from household level enterprises to larger units at scale with proper incentives.

KP No	Priority actions	Category	Linkages
Energy/ KP/9	Maximize solar energy generation potential (GEDCOL).	Mitigation	Linking women in the decentralized solar generation value chain
Energy/ KP/10	Promote biogas and manure management	Mitigation	Involvement of women in converting traditional cook stoves to bio-gas based cook stoves
Energy/ KP/7	Maximizing and harnessing bio-mass potential	Mitigation	Possible involvement of women in bio-mass generation (small scale) and incentive to women entrepreneurs

Fisheries

Women play a major role in fish processing and trading, especially dry fish. Therefore, proper awareness about climate change issues, alternate healthy fish drying mechanisms using solar dryers should be introduced in the fishery clusters. Risk management through self help groups during extreme weather events should be integrated in the planning framework.

Forestry

The role of women in forestry sector is significant, especially in Odisha where there is a huge tribal population that is directly dependent on forest. As women constitute the most important user group collecting forest produce for meeting the family's subsistence needs, sustainable forest management is not possible without their active involvement. Awareness about trees, shrubs and grasses is higher amongst women and they are more concerned with biodiversity conservation and multiple products-based management which ensures fuel wood, fodder, water and other NTFPs. Women participation needs to be improved and they should be made aware of the current scenario. Gender equity in benefit sharing and land holding should also be ensured. The policy provisions regarding women participation should be clear and mandatory.

Health

Women play a key role in health management in family. They must be fully aware about events like heat stress, vector borne diseases especially not to have stagnant water in house and proper management practices. Women health workers, Anganwadi workers should be made aware about various mitigation measures prescribed by public health specialists to manage climate stress. They need proper training and re-orientation for this. Targeted communication needs to be provided to women on these areas. They also need to be trained on proper drinking water management due to the falling water quality due to higher temperature.

Transport

Young women should, be sensitized to use clean fuel, bi-cycles and electric bikes and should be sensitized to protect plantation and greenery.

Water Resources Sector

Women representation in Pani Panchayat, water management and also off-farm livelihood initiatives should be given priority. Women PRI members should also be trained about various mitigation measures and mandatory mitigation provisions required to be met by urban and rural local bodies on waste management, water management and land use change under different regulatory framework.

Financing the SAPCC

8.1 Financing Strategy

India's climate adaptation gap by 2030 is around 1 trillion USD⁴³. Therefore, creative financing strategy by the states is the need of the hour. It has become apparent since the last SAPCC, that additional finance is hard to come by. Therefore, high impact areas have to be identified from the state's ongoing sectoral activities for mainstreaming and tagged. In addition, more and more private sector involvement should be pooled in for high priority activities in a systematic way including Public-Private Partnership mechanism. In addition there will be 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 facility (loan and grant projects through WB, ADB, UNDP, etc.), National Climate Fund (National Adaptation Fund for Climate Change, Small Grants programme, mission-specific allocation, regular schematic allocation having climate relevance).

8.2 Approach

The following sources can provide climate additional finance for certain proposed strategies.

Table 91 Available climate finance options

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 upto 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

⁴³ CEEW

	Adaptation Fund	Grant, But Loan as co-finance (by NIE or MIE) maximum upto 50% of the project cost	Natural resource systems (addressing climate risks), eco-system, 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)
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
INGOs	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

Typical process to be followed for climate finance area as follows:

Table 92 Generic processes for developing climate finance proposals

Step 1a: Identify high impact/high priority activity/strategy having linkage to SDGs/ NDCs	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.
Step 1b: identify activities linked to national missions	Draw down resources from relevant mission based on the demand/target
Step 2: 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 INGO sources
Step 3: There is correspondence or availability of funds from special climate funds available nationally	<ul style="list-style-type: none"> 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
Step 4: There is correspondence or availability of funds from special climate funds available internationally	<ul style="list-style-type: none"> Assess the concept based on the result/impact areas and investment criteria (for GCF) <ol style="list-style-type: none"> 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.

1. Green Climate Fund

The first Green Climate Fund (GCF) project from India on groundwater recharge and solar micro irrigation to ensure food security and enhance resilience in vulnerable tribal areas of Odisha was approved by GCF board. GCF provided a grant of 34 million USD to Odisha Government through NABARD. The project has been granted for six years. The project impacts 5.2 million vulnerable households in 15 priority districts with high level of food insecurity, water scarcity, high climatic stress and high proportion of SC-ST population, which accounts for 12 percent of the entire population of the state.

2. National Adaptation Fund on Climate Change

“Conserve water through the management of run-off in the river basin to reduce vulnerability and enhance resilience for traditional livelihood in Nuapada” aims at conservation of water through the management of run-off in the river basin to reduce vulnerability and enhance resilience for traditional livelihood in Nuapada. Department of Water Resources, Government of Odisha is executing the project with a total outlay of Rs. 20 Crores and the project would benefit the inhabitants along the River basin of Jonk River (a tributary of Mahanadi) in Nuapada district, affected by both drought and flood.

8.3 Synthesis

There has been thorough analysis of climate strategies in the context of NDCs-SDGs alignment through several deliberations. There were 110 actions proposed in the SAPCC-II (2018-23). In this revised SAPCC-II (2021-30) 94 strategies have been proposed out of which 49 are strongly linked to adaptation, 31 linked to mitigation and 14 strategies have linkages to both adaptation and mitigation. The total proposed budget for these activities in 10 years (2021-30) amounts to Rs 245,565 crore. The distribution of these climate strategies has been presented in the figure below:

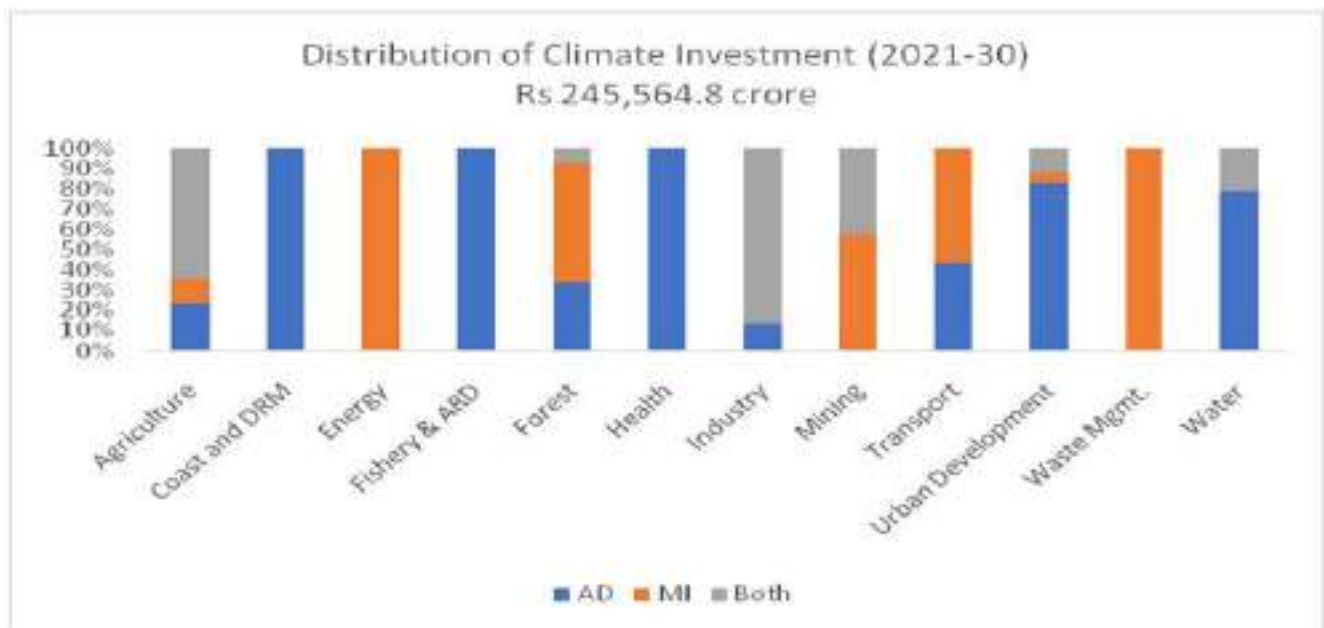


Figure 58 Overall distribution of climate strategy

52% of the activities are linked to adaptation. 33% are linked to mitigation and 15% are linked to both. In the Energy sector, which has a strong linkage with NDCs targets focusses entirely on mitigation. Similarly, Coast and Disaster Risk Management and Fishery, ARD and Health sector entirely focus on adaptation strategy. Urban, Waste Management and Transport sector have strong mitigation focus with adaptation co-benefit. Similarly, Agriculture and Forestry sectors have strong adaptation focus with mitigation co-benefit.



The sectoral distributions of climate investment in 10 years (2021-30) have been given in the table below:

Table 93 Summary of sectoral climate investment (2021-30)

Sl No	Sector	Budget for 2021-30 in INR Crore	Source: State Budget In INR Crore	Source from (National Missions, from external aid, etc.) in INR Crore
1	Agriculture	5,152.30	2,379.90	2,772.40
2	Coast and DRM	246.00	-	246.00
3	Energy	5,332.62	477.12	4,855.50
4	Fisheries & ARD	2,269.18	589.54	1,679.64
5	Forestry	22,335.16	19,921.85	2,413.31
6	Health	642.00	642.00	-
7	Industries	115.00	115.00	-
8	Mining	4.7	2.5	2.20
9	Transport	245.00	-	245.00
10	Urban Development	104,785.43	100,690.00	4,095.43
11	Waste Management	1,852.82	1,852.82	-
11	Water Resources	102,584.56	102,584.56	-
	TOTAL	245,564.77	229,255.29	16,309.48

In terms of nature of investment, 73% are for adaptation, 11% for mitigation and 16% for both. It shows that 52% of the adaptation strategy requires 73% of the total public investment. Heavy climate investments are expected in Urban Development, Water Resources and Forestry sector in next 10 years and these are in line with the national priorities. However, disaster linked investment are linked to climate proofing and the actual investments are reactive based on the nature, frequency and intensity of the disaster. In mitigation, especially in the Energy, Industry and Mining sectors, the quantum of private investments is likely to be much more and there the public investment component has been mostly reflected. The following figures give the distribution of proposed climate investment for next 10 years.

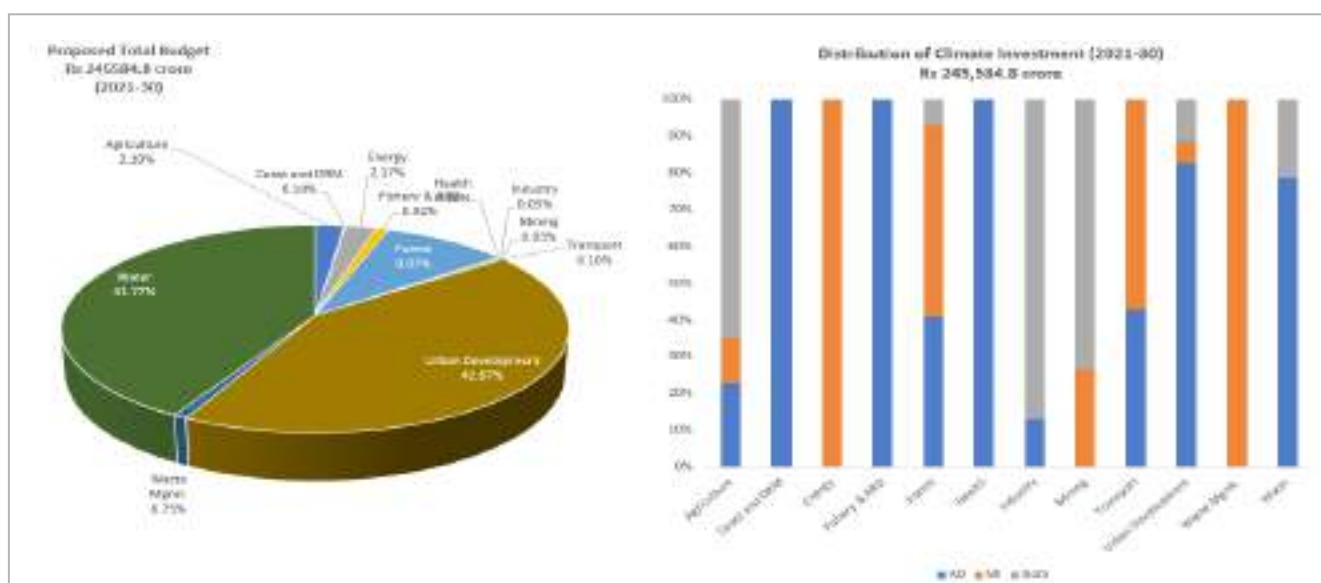


Figure 59 Distribution of climate investment (2021-30)

It also shows that Agriculture, Industries, Mining sectors are expected to have both adaptation and mitigation co-benefits through these investments.

8.4 Summary of Prioritized Interventions

After the discussion with all relevant stakeholders and departments, 94 planned activities have been identified in 12 sectors. This has been examined based on its linkages to SDGs-NDCs, funding linkage and implementation potential.

Of the 94 planned activities that have been identified in 12 sectors for prioritization, the financial allocation has been proposed merging similar activities. The key method of prioritization is driven by the following:

- ✓ The adaptation activities that address high vulnerability and fits into the impact chain (as relevant to sector)
- ✓ Low carbon development linked to mitigation activities
- ✓ There are some activities where both adaptation and mitigation are possible, the co-benefit approach has been taken.

Further sharpening has been done based on their linkages to SDGs-NDCs, funding linkage and implementation potential. The details have been given in Annexure 2.

Though 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 low carbon development processes. Thereafter, NDCs-SDGs linkage was assigned highest weight of 50%. Implementation potential based on low barriers was assigned 30% weight and funding linkage was assigned 20% weight (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) no linkage (2) meagre (3) reasonable (4) significant. The weighted averages were used for ranking and prioritization.

Table 94 SDGs-NDCs linkage of proposed activities

Sector	NDC-SDG Linkage				Total
	None	Meagre	Reasonable	Significant	
Agriculture	0	2	8	6	16
Coastal and DRM	0	0	0	2	2
Energy	0	2	5	5	12
Fisheries and ARD	0	5	4	2	11
Forestry	0	3	5	6	14
Health	0	0	1	4	5
Industries	1	1	1	0	3
Mining	0	2	1	0	3
Transport	0	1	1	2	4
Urban	0	1	3	13	17
Water Resources	0	1	2	1	4
Waste	0	0	0	3	3
Total	1	18	31	44	94

Sectorwise NDC-SDG Linkage						
Sector		NDC-SDC Linkage				Total
		None	Meagre	Reasonable	Significant	
Agriculture	Nos.	0	2	8	6	16
	% of Total	0.0%	2.1%	8.5%	6.4%	17.0%
Coastal and DRM	Nos.	0	0	0	2	2
	% of Total	0.0%	0.0%	0.0%	2.1%	2.1%
Energy	Nos.	0	2	5	5	12
	% of Total	0.0%	2.1%	5.3%	5.3%	12.8%
Fisheries and ARD	Nos.	0	5	4	2	11
	% of Total	0.0%	5.3%	4.3%	2.1%	11.7%
Forestry	Nos.	0	3	5	6	14
	% of Total	0.0%	3.2%	5.3%	6.4%	14.9%
Health	Nos.	0	0	1	4	5
	% of Total	0.0%	0.0%	1.1%	4.3%	5.3%
Industries	Nos.	1	1	1	0	3
	% of Total	1.1%	1.1%	1.1%	0.0%	3.2%
Mining	Nos.	0	2	1	0	3
	% of Total	0.0%	2.1%	1.1%	0.0%	3.2%
Transport	Nos.	0	1	1	2	4
	% of Total	0.0%	1.1%	1.1%	2.1%	4.3%
Urban	Nos.	0	1	3	13	17
	% of Total	0.0%	1.1%	3.2%	13.8%	18.1%
Water Resources	Nos.	0	1	2	1	4
	% of Total	0.0%	1.1%	2.1%	1.1%	4.3%
Waste	Nos.	0	0	0	3	3
	% of Total	0.0%	0.0%	0.0%	3.2%	3.2%
Total	Nos.	1	18	31	44	94
	% of Total	1.1%	19.1%	33.0%	46.8%	100.0%

From the above table it is seen that, overall 79.8% of the activities have either reasonable or significant NDC-SDG linkage, while only 19.1% have feeble linkage. Industries, Mining and Fisheries & ARD sectors have low level of linkages to NDCs-SDGs because of their potential emission. In future, more work needed in these sectors to align with NDCs-SDGs with better technology and additional finance, especially mobilised from private sector.

SDGs-NDCs and funding linkages

Since majority of the activities are having significant linkages to SDGs and NDCs, a further analysis was done to see their sectoral distribution and identify funding linkage.

Table 95 Funding linkages for SDGs-NDCs

			NDC-SDG Linkage				Total
			None	Meagre	Reasonable	Significant	
Funding	None	Nos.	1	9	6	3	19
		% of Total	1.1%	9.6%	6.4%	3.2%	20.2%
	Meagre	Nos.	0	9	21	17	47
		% of Total	0.0%	9.6%	22.3%	18.1%	50.0%
	Reasonable	Nos.	0	0	4	23	27
		% of Total	0.0%	0.0%	4.3%	24.5%	28.7%
	Significant	Nos.	0	0	0	1	1
		% of Total	0.0%	0.0%	0.0%	1.1%	1.1%
Total		Nos.	1	18	31	44	94
		% of Total	1.1%	19.1%	33.0%	46.8%	100.0%

From the above analysis it is seen that 9 activities have meagre NDCs and SDGs linkage and no current funding. Hence these activities need either better targeting or exploring possibility of additional financing making it more NDCs-SDGs linked. 24.5% of the activities those have significant NDCs-SDGs linkages too have reasonable funding linkage. This is a good sign of budgetary mainstreaming.

Further analysis was done to explore the funding and implementation linkages (from the barrier analysis).

Table 96 Funding and implementation linkage

			Implementation			Total
			None	Meagre	Reasonable	
Funding	None	Nos.	17	2	0	19
		% of Total	18.1%	2.1%	0.0%	20.2%
	Meagre	Nos.	4	41	2	47
		% of Total	4.3%	43.6%	2.1%	50.0%
	Reasonable	Nos.	0	7	20	27
		% of Total	0.0%	7.4%	21.3%	28.7%
	Significant	Nos.	0	0	1	1
		% of Total	0.0%	0.0%	1.1%	1.1%
Total		Nos.	21	50	23	94
		% of Total	22.3%	53.2%	24.5%	100.0%

17 activities have no funding linkages and no implementation which accounts for 18.1%. This is natural because without a proper funding linkage climate linked activity are difficult to implement both from technical and institutional reasons. Most funds are tied to schemes and not necessarily have indicators under NDCs-SDGs; if at all, the linkage is too indirect.

8.5 Priority Adaptation Actions

The top activities in **Agriculture** are as follows:

1. Increase knowledge and capacity
2. Promotion of Organic farming
3. Promotion of SRI
4. Development of efficient micro and drip irrigation
5. Promotion of stress tolerant varieties
6. Creation of Awareness among farmers on climate change adaptation

The top activities in **Fisheries and Animal Resource Development** are as follows:

1. Research on Disease Early Warning System
2. Improved feeding management
3. Upgradation of FH/FLC
4. Assistance to deep sea fishing based on climate induced shift
5. Livelihood support to marine fishers during ban period
6. Upgradation of fish seed hatchery for early breeding/seed production

The top activities in **Forestry Sector** are as follows:

1. Increasing the forest cover of the state by taking up massive plantation programme (including River Rejuvenation and Green Mahanadi Mission)
2. Enhance the density of forest by taking up Assisted Natural Regeneration and Protecting existing forest stocks to act as carbon sink with stronger conservation
3. Mangrove cover and coastal biodiversity along the coast
4. Conserve and regenerate bamboo forest
5. Green Belt Development and Maintenance in mining clusters

The top activities in the **Water Resources Sector** are as follows:

1. To increase water use efficiency in Irrigation sector (CAP-4) Old (rehab of network include lining, water audit and benchmarking, use of sprinkler and drip, Command Area Development)
2. Flood protection & anti-erosion works, non-structural works, drainage system improvement (Flood Control, River Training & Drainage Improvement (flood modelling, non-structural work, erosion control, drainage improvement, etc.)

The top activities in the **Health Sector** are as follows:

1. Strengthening approaches to manage Vector borne diseases that have worsened due to climate change impact.
2. Capacity building of the Health Sector on climate change on adaptation and mitigation aspects
3. Strengthening approaches to deal with Heat Wave Conditions exacerbated due to climate change impacts
4. Undertaking measures to manage waterborne diseases that have worsened due to climate change impacts.

The top activities in **Coastal and Disaster Risk Management Sector** are as follows:

1. Developing a techno-legal regime for construction of disaster resilient public infrastructure (Construction of Approach Road to MCS building under NCRMP) + ODRP project for housing etc.
2. Setting up an integrated capacity building protocol covering shelter, SHG, CBDRF, college and school volunteers, officials at state and district level etc.)

8.6 Priority Mitigation Actions

Since little investment in the previous plan has gone to mitigation, related actions most of the actions need to be covered considering the NDCs goals.

The following are the key priorities in the **Energy Sector**:

1. Promotion of grid connected wind power
2. Maximising solar energy generation potential (GEDCOL)
3. Improve energy efficiency
4. Awareness generation on EE
5. CB of energy auditors, strengthening the energy conservation cell

The following are the key priorities in the **Urban Development Sector**

1. Augmentation of integrated sewerage project for Bhubaneswar and Cuttack municipality
2. City Bus Service, Bhubaneswar Municipal Coporation and Puri (BRTS); For City Bus Service in GUTSL, WOUT-SL, CUTSL, JKSUTT, SUTT, BBUTT, development of Infrastructure for CBS and development of Bus Terminal
3. Energy efficiency in providing products and services : Street Light
4. Developing urban storm water drainage based on the climate change
5. Housing for all (in-situ slum development for relocation)
6. Development of green space, park (105 ULB)
7. Smart City Bhubaneswar

The following are the key priorities in the **Transport Sector**

1. Encouraging e-rickshaw, electric vehicles & CNG use
2. Policy and implementation of phasing out old vehicles for emission reduction
3. Strengthening enforcement wing for emission level check-up

The following are the key priorities in the **Industries Sector**

1. Devise a mechanism for green belt development and maintenance for industrial clusters
2. Preparation of Regional Environmental Management Plans for major industrial clusters.

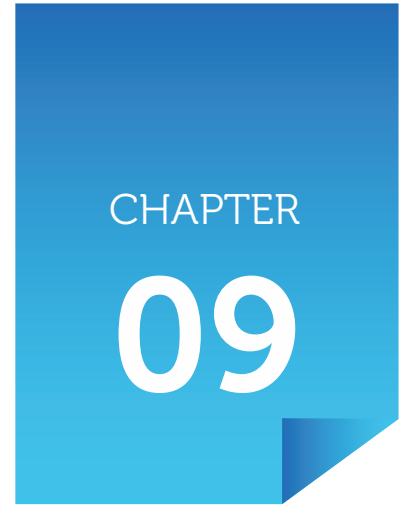
The following are the key priorities in the **Mining Sector**

1. Prepare an action plan for sustainable mining
2. Conduct a study to determine the potential of coal bed methane in the coal fields of Odisha
3. Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in Mining sector as suggested by Forest & Environment Department

The following are the key priorities in the **Waste Management Sector**

1. Awareness generation for management of various kinds of waste.
2. Management of Municipal Solid Waste

A detailed score card of activities has been presented in Annexure 2 of the report.



Implementation Mechanism

9.1 Overview

The Climate Change Action Plan implementation in Odisha follows the National Action Plan on Climate Change and is based on a long-term strategy. SAPCC is a kind of strategic document to contribute to climate goal of the state and in turn that of the nation. The following are the key guiding principles for the implementation of the strategies under SAPCC.

The SAPCC implementation must be supplemented by a mechanism for not only as a mode of ensuring that the detailed activities are implemented as planned, but also, as a method for systematic review and programme improvement. The interdepartmental coordination has an important role when it comes to effectively implementing the climate relevant strategies for getting the desired results. A systematic and synchronized approach along with a sincere effort is required for the proposed strategies. For every strategy proposed in the SAPCC, the principal implementing department along with collaborative departments has been identified. Moreover, if required, further association with other departments as well as agencies is also possible depending on the planned intervention.

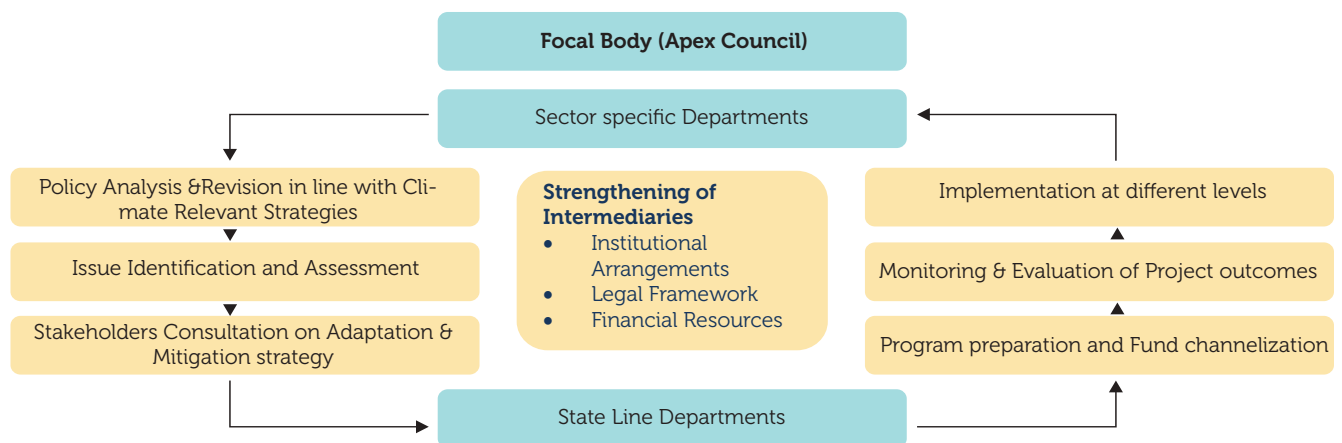


Figure 60 Implementation Mechanism



9.2 Implementation process

The Odisha State Action Plan on Climate Change is anchored by the Forest and Environment Department as a nodal department. It interfaces with 11 partner departments and implementing agencies to coordinate the implementation. It is also the focal point for stakeholder interface.

The implementation process is guided by the following principles:

- National policy and the state level of alignment of national policy/state specific policy
- Adaptation policy to take a longer term view of climate impacts, slow onset as well as extreme events
- Adaptation actions should have scaling up plan unless it is location specific
- Mitigation policy should follow low carbon development process and necessary, fiscal incentive and regulatory instruments as necessary to achieve targets
- Both adaptation and mitigation actions should have a funding strategy
- Convergence to leverage the resources to be actively planned across partner departments
- Systematic monitoring and review of planned actions and targets

9.3 Climate Change Cell and the implementation modalities

The state has been proactive in the creation of a Climate Change Cell and an interim budget was approved for FY 2013 to enable the Forest and Environment Department to take the first steps towards instituting the cell. Based on the state notification, the department has appointed the Director, Environment-cum-Special Secretary to head this Cell. The Climate Change Cell is adequately empowered by the Government of Odisha to spearhead actions on climate change. The Cell is mandated to closely coordinate all the recommended actions and work towards resource mobilization to implement different components of the Action Plan in a systematic and time bound manner to track the progress on various climate change related issues.

The objectives of the Climate Change Cell are as follows:

- Design and implement policies. The Climate Change Cell will coordinate with the technical agencies to assist departments in developing design-specific policies and establishing implementation pathways.
- Monitor, measure and evaluate. The Climate Change Cell will assist in developing mechanisms to evaluate progress toward the state's goals in order to adjust strategies and action plans accordingly. Planning for monitoring, measurement and evaluation will be included in the design of policy implementation.
- Communication, citizens and stakeholders have important roles in implementation of the SAPCC. Communicating the benefits of programmes to mitigate climate change can help gain continued support for state policies and programmes.

A High-Level Coordination Committee headed by the Chief Secretary of the state with the Chairmanship of concerned departmental Secretaries (Eleven Departments) of this committee, has continuously monitored and deliberated the implementation of climate change activities. A nodal officer in each department and state agencies have appointed to review and monitor the Departmental Action Plans and its improvement. Climate Change Cell is coordinating with departments to meet the mission targets of OCCAP implementation on a regular basis. The Cell has also come up with a second phase of Climate Change Action Plan with the limited data available. Thus, it can be said that the Cell has the intent, empowerment and capability to take the leading role in implementing Climate Action in Odisha.

There are also local as well as national technical resources available from which the Cell can obtain technical support if necessary. Under the guidance of the Climate Change Cell, independent Government authorities,

agencies and research institutes are well capable to implement the proposed activities. Further, to strengthen the functions of the Climate Change Cell and to aid in departmental planning for climate actions, Nodal Officers has been identified and trained from each of the departments.

The Cell has the clear objective to create and maintain a Climate Change Knowledge Repository, to provide a forum for climate change knowledge access and transfer, to manage climate change related knowledge as an asset, to promote research on policies, plans and programmes in key sectors that has relevance to climate change to mainstream climate agenda, to promote regional research on climate change specific to agro-climatic zones, which can help in identifying regional adaptation options

The State Climate Change Cell will periodically report the outcomes of Key Priorities. Some of the process indicators such as pre-investment and policy actions are tracked as well by the Cell. Financial allocations to key activities in the OCCAP will also be monitored by the Cell. This will gradually be replicated in other departments to achieve project outcomes with minimal intervention of the Cell. It will also endeavor to tap into the external knowledge resources available nationally and internationally and provide links to such contents and data.

Although the current Climate Change Action Plan has developed a sector-based classification of actions, the long-term plan is to develop technical aspects and guidelines that address the following:

- Regional and local climate risks and vulnerabilities
- Baseline emissions
- Goals and targets for each department
- Alternative policy options and recommendations for their development
- Identification and screening of mitigation/adaptation actions
- Documentation and forecasting of the impacts of mitigation/adaptation actions
- Recommendations and strategy for implementation

The institutional arrangement of the Climate Change Cell is based on the following assumptions:

- Odisha will undertake reforms aimed at mainstreaming investments related to climate change adaptation/mitigation within each department. This includes mandating departments to structure budgetary allocations and to maintain optimal expenditure rates based on the detailed actions outlined in the SAPCC.
- Odisha will develop governance and implementation mechanisms to incentivise the departments to scale up implementation and their internal capacities for successful implementation of the Climate Change Actions.
- Odisha will oversee the functioning and growth of the Climate Change Cell so that it serves as a centre in the medium term and perhaps a stand-alone department in the long term.

9.4 Technology-assisted progress on monitoring and knowledge management

The Climate Change Cell will act as the interface and repository of the state's climate change-related activities. It already has a website. It plans to regularly issue knowledge products and progress reports. The IT-enabled framework appears in Figure 61.

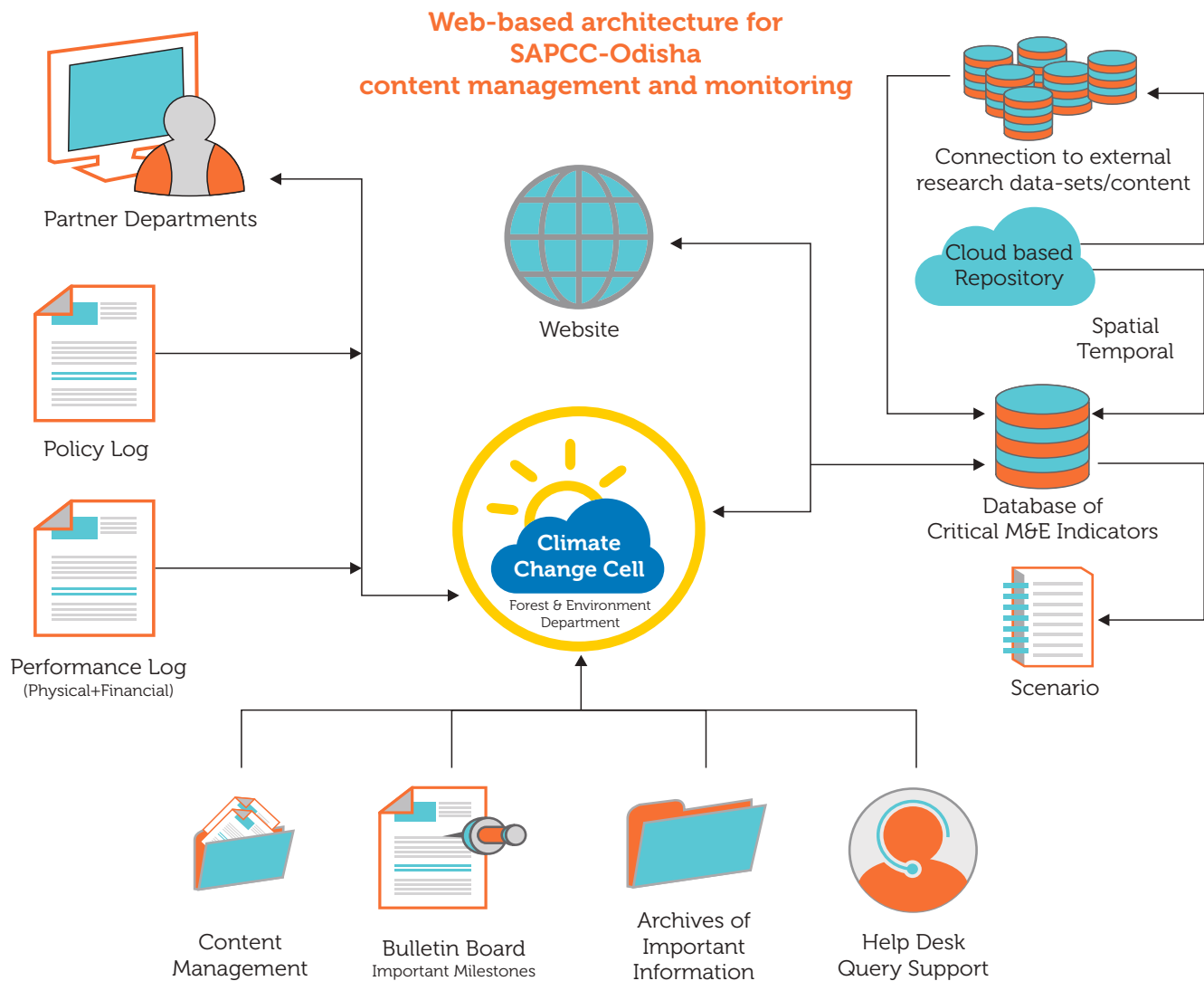


Figure 61 Proposed Information Technology–Enabled Knowledge Management Platform for Climate Change Cell

The Climate Change Cell will draw inputs primarily from the various state agencies implementing the climate change–related activities as well as inputs from the departments. It will also endeavour to tap into the external knowledge resources available nationally and internationally and provide links to such contents and data. It will access the cloud (data) from the Indian Meteorological Department and other relevant departments for conducting analysis.

Eventually, various standardised environment indicators from OSPCB, climate indicators, hydro-met indicators from IMD, Disaster Risk Reduction indicators from the Odisha State Disaster Management Authority (OSDMA), socioeconomic indicators from Planning and Convergence (P&C) Department and forest-related indicators from MoEF & CC (ENVIS) will be integrated.

Content management will include categorisation, analysis and policy briefs/logs. The Climate Change Cell will also have a help desk for resolving queries and accessing the archives of important documents related to climate change.

Table 97 Activities and Implementing Department

Code	Activity	Implementing Department
Agriculture		
AG/KP/13	Increase knowledge & capacity	DoA, OUAT
AG/KP/3	Capacity building of Extension personnel (Gr.A/B/C) & farmers	DoA, IMAGE
AG/KP/6	Creation of Awareness among farmers on climate change adaptation	DoA
AG/KP/2	Establish an institutional delivery mechanism to promote best practices on climate change.	DoA
AG/KP/7	Establishment of Automated Weather Station (AWS)	DoA/OSDMA
AG/KP/8	Establishment of seed bank at village level	DoA
AG/KP/9	Promotion of SRI	DoA
AG/KP/15	Crop Diversification	DoA
AG/KP/5	Development efficient micro and drip irrigation	DoH, DoA
AG/KP/4	Increasing the area under perennial fruit plantation	DoH
AG/KP/12	Green Energy Efficient Models for farmers	DoA
AG/N8	Promotion of stress tolerant varieties	DoA/ICAR/OUAT
AG/N9	Promotion of organic farming	DoA
AG/N10	Integrated farming system approach	DoA
AG/N11	Conservation agriculture	DoA
AG/N12	Rainfed area development	DoA
Fisheries and Animal Resources Development		
ARD/KP/1	Scientific Animal Health Management	ARD
ARD/KP/3	Improved feeding management	ARD
ARD/KP/2	Capacity building of livestock keepers	ARD
ARD/KP/4	Breeding Management	ARD
ARD/KP/6	Research on Disease Early Warning System	ARD
FISH/CAP/1	Upgradation of FH/FLC	FD
FISH/CAP/2	Assistance to deep sea fishing based on climate induced shift	FD
FISH/CAP/3	Livelihood support to marine fishers during ban period	FD
FISH/CAP/4	Saving cum relief	FD
FISH/CAP/5	Fishing methods and gears for safety of fisherman	
FISH/CAP/6	Upgradation fish seed hatchery for early breeding/seed production	
Forest		
FOR/KP/1	Increasing the forest cover of the state by taking up massive plantation programme (including River Rejuvenation and Green Mahanadi Mission)	FED
FOR/KP/2	Enhance the density of forest by taking up Assisted Natural Regeneration and Protecting existing forest stocks to act as carbon sink with stronger conservation	FED
FOR/KP/3	Increasing planting on non-forest land	FED
FOR/KP/4	Covering bald-hills with suitable species mix	FED
FOR/KP/5	Mangrove cover and coastal biodiversity along the coast	FED
FOR/KP/7	Conserve and regenerate bamboo forest	FED

FOR/KP/8	Sustainable management of forest and maximizing forest productivity, preparation of management plans and scientific forest management through annual coupe working	FED
FOR/KP/11	Implementation of Joint Forest Management for people participation in conservation, management and regeneration	FED
FOR/KP/10	Conserve wildlife and its habitat	FED
FOR/KP/12	Capacity building	FED
FOR/KP/9	Research Activities	FED
FOR/CAP/N3	Forest Protection (including Procurement of equipment and Communication infrastructures)	FED
FOR/KP/6	Forest Fire Protection	FED
FOR/CAP/N1 (MIN/KP/2 & MIM/CAP/22)	Green Belt Development and Maintenance in Mining clusters	FED, Mining Companies
Water Resources		
WR/N1	To increase water use efficiency in Irrigation sector (CAP-4) old (rehab of network including lining, water audit and benchmarking, use of sprinkler and drip, Command Area Development)	WR, DOA
WR/N2	Conservation of Water Resources (Expediting completion major & medium reservoir projects, construction of check dams, de-silting of minor irrigation tanks, roof top rain water harvesting & artificial recharge of ground water generating community awareness for water conservation)	WR
WR/N3	Flood protection & anti-erosion works, non-structural works, drainage system improvement (flood control, river training & drainage improvement, flood modeling, non-structural work, erosion control, drainage improvement etc.	WR
WR/N4	Assessment of Impact of Climate Change on water resources of the state (old CAP 1, 10, 12, 13, 18)	WR
Health		
H/KP/1	Capacity building of the Health sector on climate change on adaptation and mitigation aspects	DoHFW
H/KP/2	Integrating climate change considerations in the State Health Policy	DoHFW
H/KP/3	Strengthening approaches to manage vector borne diseases that have worsened due to climate changes impact.	DoHFW
H/KP/4	Strengthening approaches to deal with Heat wave conditions exacerbated due to climate change impacts	DoHFW
H/KP/5	Undertaking measures to manage waterborne diseases that have worsened due to climate change impacts.	DoHFW
Coastal and Disaster Risk Management		
CD/KP/10	Developing a techno-legal regime for construction of disaster resilient public infrastructure (Construction of Approach Road to MCS building under NCRMP) + ODRP project for housing etc.	OSDMA
CD/KP/12	Setting up an integrated Capacity building protocol covering shelter, SHG, CBDRF, college and school volunteers, officials at state and district level etc.)	OSDMA
Energy		
Energy/KP/1	Generation of power through clean coal approaches (where coal consumption will be reduced from 1 MT to 0.88 MT/MWh)	Energy Department
	Some activities like coal washery, improved boiler efficiency (OPGC plant) contributes to low emission	Energy Department

Energy/CAP/23	Develop state level energy efficiency standard through ECBC, PAT etc. through SDA	Energy Department
Energy/KP/2	Institutional development (capacity building and restructuring of Energy department, formation of GEDCOL, capacity development of OREDA, operationalisation of RPO and feasibility studies on clean technology in generation and T&D)	Energy Department, OREDA
Energy/KP/3	Reduction of T&D Losses (CAPEX, ODSSP, Disaster Resilient Power System, SCRIPS, Radial to ring conversion, Smart Grid, Nabakalebar in Puri, R-APDRP urban)	Energy Department
Energy/KP/4	DSM and EE (utility level),	Energy Department
Energy/CAP/28	Awareness generation on EE	Energy Department
Energy/CAP/29	OECBC Implementation	Energy Department
Energy/CAP/30	CB of energy auditors, strengthening the Energy Conservation Cell	Energy Department
Energy/CAP/31	Increase energy efficiency in drinking water pumping system and Lift Irrigation system	Energy Department
Energy/KP/5	Effective Fly-ash utilization	Energy Department
Energy/KP/6	Promotion of small and medium hydel plants	Energy Department
Energy/KP/7	Maximizing and harnessing bio-mass potential	Energy Department
Energy/KP/8	Promotion of grid connected wind power	Energy Department
Energy/KP/9	Maximizing solar energy generation potential (GEDCOL)	Energy Department
Urban Development		
HUD/CAP/2a	Augmentation of integrated sewerage project for Bhubaneswar and Cuttack municipality	H&UD
HUD/CAP/N4a	Update building by laws and development control regulations to incorporate CC and DRR considerations	H&UD
HUD/CAP/N4b	Incorporate risk-sensitive land use planning in city's Master Plan	H&UD
HUD/CAP/8	City Bus Service, Bhubaneswar Municipal Corporation and Puri (BRTS); For City Bus Service in GUTSL, WOUTSL, CUTSL, JKSUTT, SUTT, BBUTT, development of infrastructure for CBS and development of Bus Terminal	H&UD
HUD/KP/8	Restoration of Urban Water Bodies, Behrampur, Bindusagar and others	H&UD, WR
HUD/CAP/10a	Energy efficiency in providing products and services : Street Light	H&UD, Energy Department
HUD/CAP/10b	Energy efficiency in providing products and services : Water Pumps	H&UD, Energy Department
HUD/KP/9	Developing urban storm water drainage based on the climate change	H&UD
HUD/CAP/N1	Housing for all (in-situ slum development for relocation)	H&UD
HUD/CAP/N2a	Development of green space, park (105 ULB)	H&UD
HUD/CAP/N2b	Development of green space, park (9 Amrut cities)	H&UD

HUD/CAP/N3a	Smart city Bhubaneswar	H&UD
HUD/CAP/N3b	Smart city Rourkela	H&UD
HUD/KP/3	Ensuring tap water for all	WR, H&UD
HUD/CAP/2b	Making urban Odisha open defecation free and management of sewerage, faecal sludge and sewage	H&UD
HUD/CAP/N6	1-Drink from Tap and 24x7 water supply	H&UD
HUD/CAP/N7	Water testing laboratories (District level in 22 districts)	H&UD
Transport		
C & T/KP/1	Policy of phasing out old vehicles for emission reduction	C&T
C & T/KP/2	Ensuring fuel efficiency through driver training	C&T
C & T/KP/3	Strengthening enforcement wing for emission level check-up	C&T
C & T/KP/5	Encouraging e-rickshaws, electric vehicles and CNG use	C&T
Industries		
IND/CAP/5	Devise a mechanism for green belt development and maintenance for industrial clusters.	IDCO, Industries Department
IND/CAP/12	Preparation of Regional Environmental Management Plans for major industrial clusters.	Industries Department, SPCB
IND/CAP/N1	Fly ash utilisation by Industries	Industries Department
Mining		
MIN/KP/1	Prepare an action plan for sustainable mining	S&M Department
MIN/CAP/8	Conduct a study to determine the potential of coal bed methane in the coal fields of Odisha	S&M Department
MIN/CAP/34	Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in Mining sector as suggested by Forest & Environment Dept.	FED, S&M Department
Waste Management		
WS/KP/1	Awareness generation for management of various kinds of waste	H&UD
WS/KP/2	Waste to Wealth Projects in PPP Mode	H&UD
WS/KP/3	Management Municipal Solid Waste	H&UD

Monitoring & Evaluation

Key objective of monitoring of SAPCC is to include elements related to NDCs that has implication on GHG effects, sustainable development impacts and implementation progress of various actions relating to vulnerability reduction. Our GHG emission inventory is national in nature and reported as part of BUR process. Various mitigation actions that has impact on our GHG emissions (e.g. enhanced share of renewable, better energy efficiency, etc.) needs to be captured at state level (if already implemented or even if it is planned). At the national level of course, 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 SDGs at the national/state level, reduction in vulnerability in specific sectors/projects are possible. The Paris Agreement has necessitated countries to have harmonized measurement and reporting systems for the countries as per their NDCs mitigation commitments. Indian NDCs also has several areas in adaptation that needs systematic monitoring and assessing the change in vulnerability due to the investments made. Some of these investments are through the budget and some others are off-budget supported through bi-lateral and multilateral agencies, philanthropic bodies and national and international climate funds. All these information have to be consolidated nationally and a seamless harmonization of measurement and reporting is also required at state level.

In the SAPCC the attempt has been made to follow a structured process of monitoring which is given as follows.

- Analysis of state circumstances (various, policy targets/achievements)
- Change in vulnerability and risk (as compared to the last SAPCC baseline)
- Stock Taking (both for adaptation and mitigation sectors as per the last SAPCC)
- Analysis of climate relevant investment (on and off budget)
- Category of support as per their climate relevance
- Linkages to SDGs and NDCs goals
- A score card for prioritisation of planned actions based on the linkages to both the goals

There is an **institutional mechanism** to be followed for uniform reporting to MoEF & CC. The following diagram shows such a process.

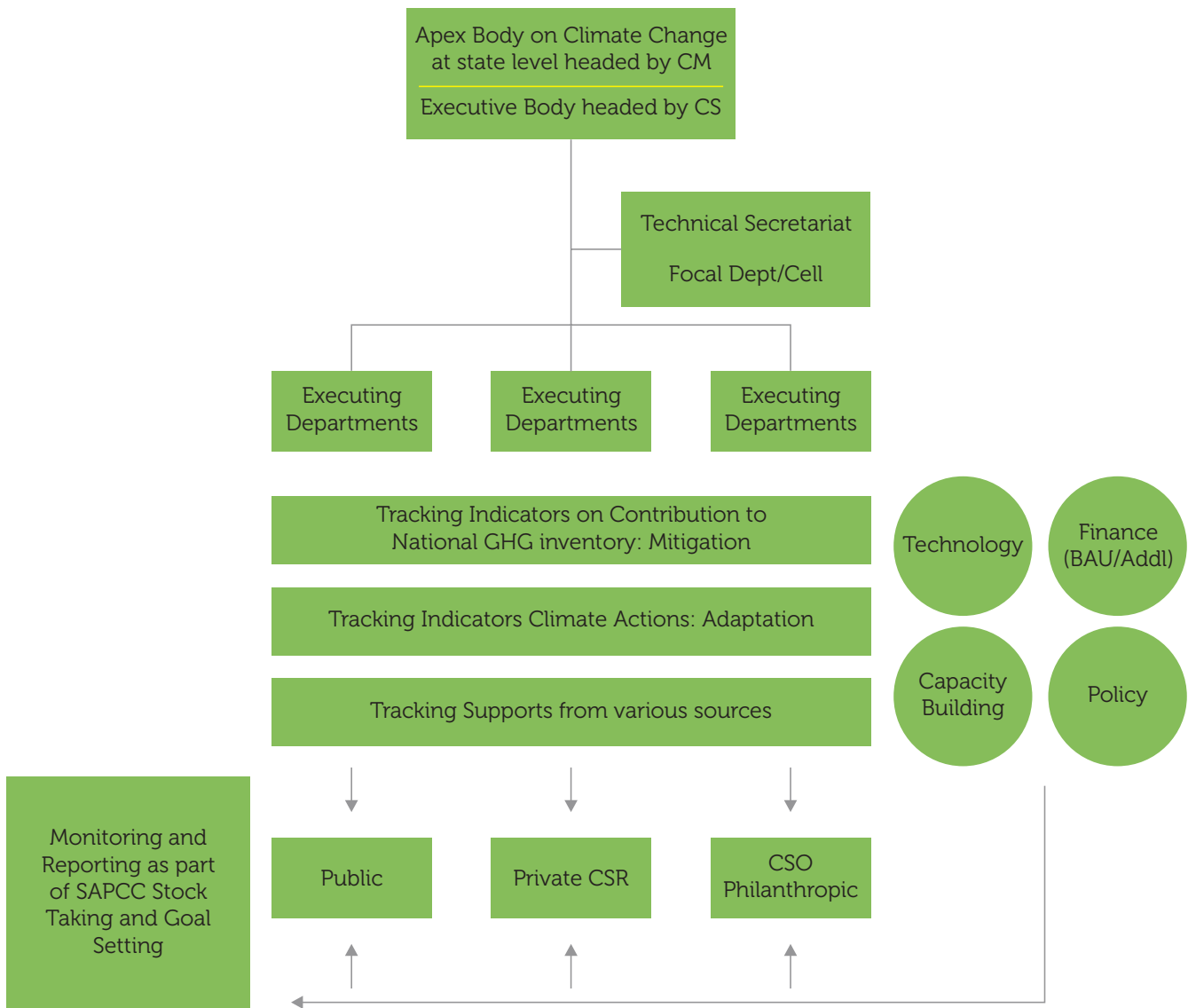


Figure 62 Institutional Mechanism for M&E

Key to M&E system is the proper institutional arrangement. The M&E system will be grounded in the existing institutional framework driven by the Focal Department/Climate Change Cell within the Focal Department with higher level political and executive bodies providing policy guidance and governance. The Cell/Focal department will act as the Technical Secretariat and will interface with executing departments/line departments for data collection. Each department may constitute a small working group with at least one member in the working group dealing with departmental finance. The working group can be headed by a nodal officer who will interface with the Cell/Focal Department for Data/MIS updation.

The working group members and nodal officers must be trained by the Focal Department on kind of data requirement and their frequency. In addition to the line department officials, members drawn from the finance, statistics and planning should 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 this protocol have been given below:

M&E Dashboard

Sl #	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												

Illustration

Based on the above approach, the state had

- 31 nos. of mitigation actions
- 49 nos. of adaptation actions
- 14 nos. 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

Indicator system

The indicators can be classified broadly in to 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 to classifying the indicators can be as follows:

Table 98 Indicator system for monitoring and reporting

Category	Explanation	Remark
Climate Impact ⁴⁴	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 adaptive measures undertaken	This can be easily tracked in form of relevant activities leading to adaptation
Adaptation Outcome	Indicators that depict the outcomes of the adaptive measures	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

⁴⁴ Based on a GiZ report on monitoring adaptation projects

Process Indicators	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 mal-adaptation another sector
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Some of the examples of indicators are given below:

Table 99 Indicators and their monitoring and reporting cycle

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 attribution of rise in income, sometimes direct cash transfer an adaptive policy may result in temporary rise in income
Water Resources	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 (pre-monsoon post monsoon reporting possible)
	State water policy addressing climate risks specific to the state	Process	Presence of the policy
Forestry	Increased ecosystem resilience in response to climate variability and change	Outcome	Aggregate indicator, impact indicator- long-term periodicity can be combined from various provisioning services
	Increase in plantation area	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
Health	Reduction in vector borne and water borne diseases	Outcome	Aggregate indicator, impact indicator-medium to long-term periodicity
	Improvement in dealing with heat wave conditions	Outcome	Aggregate indicator, impact indicator-medium to long-term periodicity
	Health Policy addressing climate risks specific to the state	Process	Presence of the policy
Coastal and Disaster Risk Management	Increase in mangrove plantation	Output	Easy to report, annual
	EWS integration and contingency	Output	Medium term
	Reduced key risks and adverse impacts of climate change	Outcome	Medium to long term, aggregate or event specific
	Increase in Multipurpose Cyclone Shelter	Output	Event specific

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 car pooling	Process	Short term, presence of policy
Industries and Mining	Green Zone Development in industrial and mining clusters	Output	Easy to report
	Number of personnel trained on climate change issues	Output	Short term to medium term (based on number of trainings)
	Policy addressing climate risks for industrial and mining development	Process	Presence of policy, medium term

The above list is only indicative and the process of indicator selections should be possible after wider consultation with departments. First priority is climate relevant scheme specific indicators (mostly output indicators) that the department report as routine. The second is project level indicators as defined in the result framework. The third is sector/mission level indicators as defined under mission document or state/national priority (e.g. doubling farm income, reduction of energy intensity of GDP). The following diagram⁴⁵ captures the aggregation process



Tools and methods for harmonization

- Key aspects in this is to choose indicators/proxy that has relevance to SDGs/NDCs
- IPCC defined methods on emission inventory (since the state level inventory is not available, proxies on share of renewable, energy efficiency, etc. can be reported)
- For project level emission reduction, Co-benefit tracking tools, sustainable development potentials can be tracked and consolidated. If required, state share reflected in NAMAs can be reflected.
- For adaptation investments, change in vulnerability (mostly the change in adaptive capacity and sensitivity) to be tracked. Those should follow 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, without that the nodal department can discuss with technical working groups to fix climate relevance percentage based on scheme components.

⁴⁵ GiZ

Data management System

- Collect a 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 output and outcome
- 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
- Work with industry associations/ NGOs for collecting relevant data having impact on NDCs/SDGs

Capacity Building

Generally, awareness and capacity to plan and deliver on climate change strategies is low at cutting edge. Therefore, efforts should be made to de-mystify the climate strategies proposed by the departments at regular interval. The process will be facilitated by the Focal Department and technical working group members (both department and inter-department) will take part in it. This process should be a quarterly affair each year.

Data frequency

The data sets should be divided in to two categories (a) static e.g. GDP data (b) dynamic data. In essence nothing is static, but some statistics are annual or more. The dynamic data sets change more frequently. However, for such data sets monthly or quarterly cycle of updation will be adequate.

Data consolidation and validation

The data will be validated by the Focal 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 updation. The climate strategy and action plans should be revised every five years as is the process now. The monitoring of results will be part of that stock taking.



Annexure-1
Training and Consultation details on Climate Change (Regional & State Level)

DISTRICT LEVEL									
Sl. No.	State	Title of the Training Programme	Theme and objectives	Date & Duration	Venue	Total No. of Participants	No. of Female participants	Level of participants(student/officials /Civil society bodies	
1	Odisha- Puri	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	29.01.19, One Day	Sanskruiti Bhawan	133	36	Students/All Line Departments of District/Media personnel/Teachers	
2	Odisha- Balasore	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	30.01.19, One Day	DRDA Balasore	125	76	Students/All Line Departments of District/Media personnel/Teachers	
3	Odisha- Kendrapara	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	01.02.19, One Day	DRDA Conference Hall	141	54	Students/All Line Departments of District/Media personnel/Teachers	
4	Odisha- Berhampur	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	14.05.19, One Day	RCCF Conference Hall	153	36	Students/All Line Departments of District/Media personnel/Teachers	
5	Odisha- Dhenkanal	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	17.05.19, One Day	Dhenkanal Science Centre	141	57	Students/All Line Departments of District/Media personnel/Teachers	
6	Odisha- Jagatsinghpur	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	03.07.19, One Day	Collectorate conference hall	118	33	Students/All Line Departments of District/Media personnel/Teachers	
7	Odisha- Keonjhar	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	10.07.19, One Day	Darbar hall-Collectorate	120	40	Students/All Line Departments of District/Media personnel/Teachers	
STATE LEVEL									
1	Odisha- Bhubaneswar	Emerging Climate change Scenarios in Agro Climatic Zones of Odisha	Climate change Vulnerability Assessment in Agro Climatic Zones of Odisha	01.03.19, One Day	Hotel The New Marriot	91	10	Officers from line dept./ Research Scholar/Scientists	

Annexure- 2 Score Card

Sl. No	Code	Proposed Activities	Sector	Funding		Implementation		SDG_ NDC	Marks	Overall rank	Sub Rank
				20%	30%	30%	50%				
1	AG/KP/13	Increase knowledge & capacity	Agriculture	4	3	4	4	3.7	1	1	
2	AG/KP/3	Capacity building of Extension Personnel (Gr.A/B/C) & farmers	Agriculture	2	2	3	3	2.5	47	6	
3	AG/KP/6	Creation of Awareness among farmers on climate change adaptation	Agriculture	2	2	3	3	2.5	47	6	
4	AG/KP/2	Establish an institutional delivery mechanism to promote best practices on climate change.	Agriculture	1	1	3	3	2	70	12	
5	AG/KP/7	Establishment of Automated Weather Station (AWS)	Agriculture	1	1	3	3	2	70	12	
6	AG/KP/8	Establishment of seed bank at village level	Agriculture	2	2	2	2	2	70	12	
7	AG/KP/9	Promotion of SRI	Agriculture	2	2	4	4	3	28	3	
8	AG/KP/15	Crop Diversification	Agriculture	2	2	3	3	2.5	47	6	
9	AG/KP/5	Development efficient micro and drip irrigation	Agriculture	2	2	4	4	3	28	3	
10	AG/KP/4	Increasing the area under perennial fruit plantation	Agriculture	2	2	3	3	2.5	47	6	
11	AG/KP/12	Green Energy Efficient Models for farmers	Agriculture	1	1	2	2	1.5	87	16	
12	AG/N8	Promotion of stress tolerant varieties	Agriculture	2	2	4	4	3	28	3	
13	AG/N9	Promotion of organic farming	Agriculture	3	3	4	4	3.5	2	2	
14	AG/N10	Integrated farming system approach	Agriculture	1	1	4	4	2.5	47	6	
15	AG/N11	Conservation agriculture	Agriculture	1	1	3	3	2	70	12	
16	AG/N12	Rainfed area development	Agriculture	2	2	3	3	2.5	47	6	
17	CD/KP/10	Developing a techno-legal regime for construction of disaster resilient public infrastructure (Construction of Approach Road to MCS building under NCRMP) + ODRP project for housing, etc.	Coastal and DRM	3	3	4	4	3.5	2	1	

18	CD/KP/12	Setting up an an integrated Capacity building protocol covering shelter, SHG, CBDRF, college and school volunteers, officials at state and district level, etc.)	Coastal and DRM	2	3	4	3.3	18	2
19	Energy/KP/3	Reduction of T&D Losses (CAPEX, Disaster Resilient Power System, Radial to ring conversion)	Energy	2	2	3	2.5	47	7
20	Energy/KP/12	DSM and EE (utility level),	Energy	2	2	2	2	70	10
21	Energy/KP/4	Improve energy efficiency	Energy	2	2	4	3	28	2
22	Energy/ CAP/28	Awareness generation on EE	Energy	2	2	4	3	28	2
23	Energy/KP/14	CB of energy auditors, strengthening the energy conservation cell	Energy	3	3	3	3	28	2
24	Energy/KP/15	Increase energy efficiency in drinking water pumping system and Lift Irrigation system	Energy	2	2	3	2.5	47	7
25	Energy/KP/5	Effective Fly-ash utilisation	Energy	2	2	3	2.5	47	7
26	Energy/KP/6	Promotion of small and medium hydel plants	Energy	1	1	3	2	70	10
27	Energy/KP/7	Maximising and harnessing bio-mass potential	Energy	1	1	2	1.5	87	12
28	Energy/KP/8	Promotion of grid connected wind power	Energy	2	3	4	3.3	18	1
29	Energy/KP/9	Maximising solar energy generation potential (GEDCOL)	Energy	2	2	4	3	28	2
30	Energy/KP/10	Bio- gas and manure management	Energy	2	1	4	2.7	45	6
31	ARD/KP/1	Scientific Animal Health Management	Fisheries & ARD	2	2	2	2	70	6
32	ARD/KP/3	Improved feeding management	Fisheries & ARD	2	2	3	2.5	47	2
33	ARD/KP/2	Capacity building of livestock keepers	Fisheries & ARD	2	2	2	2	70	6
34	ARD/KP/4	Breeding Management	Fisheries & ARD	2	2	2	2	70	6
35	ARD/KP/6	Research on Disease Early Warning System	Fisheries & ARD	2	2	4	3	28	1
36	FISH/CAP/1	Upgradation of FH/FLC	Fisheries & ARD	2	2	2	2	70	6
37	FISH/CAP/2	Assistance to deep sea fishing based on climate induced shift	Fisheries & ARD	1	1	4	2.5	47	2

38	FISH/CAP/3	Livelihood support to marine fishers during ban period	Fisheries & ARD	2	2	3	2.5	47	2
39	FISH/CAP/4	Saving cum relief	Fisheries & ARD	1	1	2	1.5	87	11
40	FISH/CAP/5	Fishing methods and gears for safety of fisherman	Fisheries & ARD	1	1	3	2	70	6
41	FISH/CAP/6	Upgradation fish seed hatchery for early breeding/seed production	Fisheries & ARD	2	2	3	2.5	47	2
42	FOR/KP/1	Increasing the forest cover of the state by taking up massive plantation programme (including River Rejuvenation and Green Mahanadi Mission)	Forestry	3	3	4	3.5	2	1
43	FOR/KP/2	Enhance the density of forest by taking up Assisted Natural Regeneration and Protecting existing forest stocks to act as carbon sink with stronger conservation	Forestry	3	3	4	3.5	2	1
44	FOR/KP/3	Increasing planting on non-forest land	Forestry	2	2	4	3	28	6
45	FOR/KP/4	Covering bald-hills with suitable species mix	Forestry	3	2	4	3.2	20	5
46	FOR/KP/5	Mangrove cover and coastal biodiversity along the coast	Forestry	3	3	4	3.5	2	1
47	FOR/KP/7	Conserve and regenerate bamboo forest	Forestry	3	3	4	3.5	2	1
48	FOR/KP/8	Sustainable management of forest and maximizing forest productivity, preparation of management plans and scientific forest management through annual coupe working	Forestry	3	3	3	3	28	6
49	FOR/KP/11	Implementation of Joint Forest Management for people participation in conservation, management and regeneration	Forestry	3	3	3	3	28	6
50	FOR/KP/10	Conserve wildlife and its habitat	Forestry	3	3	3	3	28	6
51	FOR/KP/12	Capacity building	Forestry	2	2	2	2	70	12
52	FOR/KP/9	Research Activities	Forestry	2	2	3	2.5	47	10
54	FOR/CAP/N3	Forest Protection (Procurement of Equipments and Communication Infrastructures)	Forestry	1	2	2	1.8	85	13

55	FOR/KP/6	Forest Fire Protection	Forestry	2	2	2	3	2.5	47	10
53	FOR/CAP/N1 (MIN/KP/2 & MIN/CAP/22)	Green Belt Development and Maintenance in Mining clusters	Forestry	1	2	2	2	1.8	85	13
56	H/KP/1	Capacity building of the Health sector on climate change adaptation and mitigation aspects	Health	2	2	2	4	3	28	2
57	H/KP/2	Integrating climate change considerations in the State Health Policy	Health	2	2	2	3	2.5	47	5
58	H/KP/3	Strengthening approaches to manage vector borne diseases that have worsened due to climate changes impact.	Health	3	3	4	4	3.5	2	1
59	H/KP/4	Strengthening approaches to deal with Heat wave Conditions exacerbated due to climate change impacts	Health	2	2	2	4	3	28	2
60	H/KP/5	Undertaking measures to manage waterborne diseases that have worsened due to climate change impacts.	Health	2	2	2	4	3	28	2
61	IND/KP/1	Devise a mechanism for green belt development and maintenance for industrial clusters.	Industries	1	1	1	3	2	70	1
62	IND/CAP/N1	Fly ash utilisation by Industries	Industries	1	1	1	1	1	94	3
63	IND/KP/4	Preparation of Regional Environmental Management Plans for major industrial clusters.	Industries	2	2	2	2	2	70	1
64	MIN/KP/1	Prepare Action plan for sustainable mining for Joda-Barbil, iron and manganese area, Mayurbhanj iron ore zone, Talcher-Anugul Area, Ib-valley area, Sukinda chromite belt, Sundergarh lime stone and dolomite belt, eastern ghats bauxite zone.	Mining	1	1	1	2	1.5	87	2
65	MIN/CAP/8	Conduct a study to determine the potential of coal bed methane in the coal fields of Odisha.	Mining	2	2	2	3	2.5	47	1

66	MIN/CAP/34	Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in Mining sector as suggested by F&E Dept	Mining	1	1	2	1.5	87	2
67	C&T/KP/1	Policy and implementation of phasing out old vehicles for emission reduction	Transport	2	1	4	2.7	45	2
68	C&T/KP/2	Ensuring fuel efficiency through driver training	Transport	2	2	2	2	70	4
69	C&T/KP/3	Strengthening enforcement wing for emission level check-up	Transport	2	2	3	2.5	47	3
70	C&T/KP/4	Encouraging e-rickshaws, electric vehicles and CNG use	Transport	3	2	4	3.2	20	1
71	HUD/CAP/2a	Augmentation of integrated sewerage project for Bhubaneswar and Cuttack municipality	Urban	3	3	4	3.5	2	1
72	HUD/CAP/N4a	Update building byelaws and development control regulations to incorporate CC and DRR considerations	Urban	1	1	4	2.5	47	13
73	HUD/CAP/N4b	Update and Incorporate risk-sensitive land use planning in city's Master Plan	Urban	1	1	2	1.5	87	17
74	HUD/CAP/8	City Bus Service, Bhubaneswar Municipal Corporation and Puri (BRTS); For City Bus Service in GUTSL, WOUTSL, CUTSL, JKSL, SUTL, BBUTT, development of infrastructure for CBS and development of Bus Terminal	Urban	3	3	4	3.5	2	1
75	HUD/KP/8	Restoration of Urban Water Bodies, Behrampur, Bindusagar and others	Urban	2	2	3	2.5	47	13
76	HUD/CAP/10a	Energy efficiency in providing products and services : Street Light	Urban	3	3	4	3.5	2	1
77	HUD/CAP/10b	Energy efficiency in providing products and services : Water Pumps	Urban	3	2	4	3.2	20	8
78	HUD/KP/9	Developing urban storm water drainage based on the climate change	Urban	3	3	4	3.5	2	1
79	HUD/CAP/N1	Housing for all (in-situ slum development for relocation)	Urban	3	3	4	3.5	2	1

80	HUD/CAP/N2a	Development of green space, park (105 ULB)	Urban	3	3	4	3.5	2	1
81	HUD/CAP/N2b	Development of green space, park (9 Amrut Cities)	Urban	3	2	4	3.2	20	8
82	HUD/CAP/N3a	Smart City Bhubaneswar	Urban	3	3	4	3.5	2	1
83	HUD/CAP/N3b	Smart City Rourkela	Urban	3	2	4	3.2	20	8
84	HUD/KP/3	Ensuring tap water for all	Urban	3	2	4	3.2	20	8
85	HUD/CAP/2b	Making urban Odisha open defecation free and management of sewerage, Faecal Sludge and Sewage	Urban	3	2	4	3.2	20	8
86	HUD/CAP/N6	1-Drink from Tap and 24x7 water supply	Urban	2	2	3	2.5	47	13
87	HUD/CAP/N7	Water testing laboratories (District level in 22 districts)	Urban	2	2	3	2.5	47	13
88	WS/KP/1	Awareness generation for management of various kinds of waste	Waste	2	1	3	2.2	69	6
89	WS/KP/2	Waste to Wealth in PPP Mode	Waste	1	1	2	1.5	87	7
90	WS/KP/3	Management Municipal Solid Waste	Waste	2	2	4	3	28	4
91	WR/N1	To increase water use efficiency in Irrigation sector (CAP-4) Old (rehab of network incld lining, water audit and benchmarking, use of sprinkler and drip, Command Area Development)	Water Resources	3	3	4	3.5	2	1
92	WR/N2	Conservation of Water Resources (Expediting completion major & medium reservoir projects , construction of check dams, desilting MI tanks, rooftop RWH, Artificial recharge for GW and community awareness on water conservation)	Water Resources	3	2	4	3.2	20	3
93	WR/N3	Flood protection & anti-erosion works, non-structural works, drainage system improvement (Flood Control, River Training & Drainage Improvement (flood modelling, non-structural work, erosion control, drainage improvement, etc.)	Water Resources	3	3	4	3.5	2	1
94	WR/N4	Assessment of Impact of Climate Change on water resources of the state (old CAP 1, CAP 10, 12, 13, 18)	Water Resources	2	2	4	3	28	4

Annexure- 3

Shoreline Management Sub-Plan for Odisha Coast

The World Bank and Government of Odisha have established an initiative to formulate an Integrated Coastal Zone Management Plan which involves an integrated approach to coordinate activities of various Government agencies & departments for the sustainable management and usages of coastal resources maintaining the natural environment.

The present assignment under this umbrella of ICZMP initiative of Odisha has broadly two major components i.e.

- A shoreline management plan: For the sediments cells in Odisha Coast
- An integrated coastal zone management plan (for the two stretches: Gopalpur to Chilika and Paradip to Dhamra)

IPE Global was awarded the assignment by Government of Odisha to provide Services for "Consultancy for Facilitating Preparation of Integrated Coastal Zone Management (ICZM) Plan and Shoreline Management Plan for Odisha". The following documents therefore provide the Shoreline Management Plan for the entire coastal stretch of Odisha with recommendations of policy options and technical solutions.

Coastal Hazard Assessment

- 1. Erosion and Accretion Hazard :** Overall statistics and assessments indicate that the coast of Odisha is largely accreting (52.7%) and about 10.4% of the coast is stable. Erosion accounts for 36.9% of the coast. District-wise statistics indicate that erosion is dominant in the district of Kendrapara while accretion is dominant in districts like Bhadrak. The stretch of Paradip to Dhamra – is highly eroding making the region highly prone to hazard. In addition to this, region near Rushikulya River is also prone to erosion. Also, as mentioned, in Kendrapra, the region from Mahanadi River to Gahirmatha also witnesses a high erosion rate. Similarly, the north of Paradip Port and near Hukitola bay accretion is predominantly high, making the region hazard prone.
- 2. Sea Water Inundation Hazard :** Out of the entire coastal stretch around 30% of the area has a less than 5m elevation profile which is resulting in about 18% of the coastal zone in the area highly prone to sea water inundation. It can be observed that Bhadrak and Kendrapara are having comparatively more area which is prone to inundation due to frequent occurrence of high tides and the low elevation profile. Puri and Ganjam districts comparatively show a high elevation profile resulting in a region less prone to sea water inundation hazard.

Coastal Vulnerability Assessment

Land Use and Land Cover Vulnerability : The northern region of Balasore has rural settlements situated near the coast and as rural areas dominantly have temporary unstable structures, this area is highly vulnerable to hazards. In addition to this, huge portion of Bhadrak and Balasore lie under agriculture and aquaculture making the coast vulnerable to hazards in terms of loss of property. Areas of heavy economic activities like Paradip, Dhamra Port and Gopalpur are vulnerable due to their location and associated economic loss in occurrence of hazard. Therefore, Jagatsinghpur, Bhadrak and Ganjam district are coming up as highly vulnerable. In addition to this, due to availability of mangroves, a strong prevalence of aquaculture can be seen in the areas of Kendrapara and Jagatsinghpur making the area near coast more vulnerable to hazards. In addition to this, due to Balukhand Wildlife Sanctuary and Chilika Lake, about 35% of the region is non-vulnerable. Altogether, LVI contributes significantly to the outcome of risk as 73% of the area lies in medium and high vulnerability zone.

Population Vulnerability : Out of the six coastal districts under ICZMP, Balasore has the highest number of villages that fall in the high population vulnerability zone, followed by Kendrapara and Puri. More than 20% of the villages in Balasore district are vulnerable due to their high population concentration.

Heritage Vulnerability : Heritage Vulnerability analysis shows that the maximum numbers of vulnerable sites is in Puri district. More than 50 sites are falling in the range of moderate to high vulnerable areas as most of the monuments are of state and local importance.

Composite Risk Assessment

Composite risk assessment includes the impacts of hazards on the areas closest to the coastline. This section mainly emphasizes on assessing the risk in coastal villages and provides a methodology to identify priority areas that will contribute in further deliverables. Since areas adjacent to the coastline have to bear the highest level of impacts of hazards, villages falling within 1 km of the coastline have been considered for a detailed analysis of distribution of risk. A comparative risk analysis between the coastal and the inland villages has been done, where, the relative level of risk in coastal villages been compared to the inland villages. Finally, high risk prone coastal villages have been prioritized with the help of three scenarios to substantiate the findings. The assessment reveals that 28% and 27% of the total coastal villages fall under 'very high' and 'high' risk areas, whereas only 4% and 24% of the villages are under 'very low' and 'low' risk areas. District wise distribution of risk is given in the table below:

District	Very Low	Low	Medium	High	Very High
Balasore	0	0	15	33	18
Bhadrak	0	0	1	22	18
Kendrapara	2	0	6	24	49
Jagatsinghpur	0	10	11	5	1
Puri	8	43	8	1	1
Ganjam	2	24	12	0	4

ICZMP Stretch I – Gopalpur to Chilika has a very low percentage of high risk zones. Presence of Chilika Lagoon and Balukhand Wildlife Sanctuary are dominant ecological features in the area resulting into a low risk zone. ICZMP Stretch II – Paradip to Dhamra has comparatively a high percentage of risk zones. This is mainly because of the likelihood of sea water inundation in the area with an added hazard of accretion on the coast. Also, districts of Bhadrak and Kendrapara have most of the region rural which has less resilient structures. In addition to this, the heavy population density makes the region highly vulnerable to hazards.

Comparison between coastal and inland villages reveals that percentage of 'very high risk' areas is more in coastal stretch than in inland. The coastal villages in districts of Bhadrak and Jagatsinghpur are falling under 'very high risk' prone areas whereas most of the inland villages are falling under 'medium' or 'low risk' areas. southern districts such as Puri and Ganjam altogether lie in a comparatively low risk zone but high risk prone villages of these districts lie only in the coastal area. District-wise predominant index is given as:

Indices	Balasore	Bhadrak	Jagatsinghpur	Kendrapara	Ganjam	Puri
LVI						
PVI						
HVI						
AHI						
EHI						
SHI						
Note						
	High Influence					
	Moderate Influence					
	Low Influence					

Shoreline Management Plan

The Shoreline Management Plan considers sustainable solutions involving environmental, social, economic and technical elements while recognizing that these elements may pose conflicting demands. The Shoreline Management Plan for Odisha is based on adaptation to the shoreline changes from natural and/or human factors, where the aim is to moderate the losses due to shoreline change while also aiming to derive benefits that the coastal resources have to offer. In this plan, the strategic policy options for shoreline management that have been considered in five classifications.

1. The first classification is "Do-nothing" - With no active intervention, the coast is to be monitored and allowed to take adapt to the natural forces. This is generally applicable where there are no significant inhabitations, developments or assets requiring protection.
2. The second classification is "managed realignment". This policy targets creation of an additional buffer between a settlement / asset and the hazards of the coast. This policy recommends moving settlements landwards.
3. The third option is "hold the line" where attempts to retain the position of the shoreline by preventing further erosion, by building protection to preserve assets considered to be valuable to the community.
4. The fourth option is move seaward by advancing the coastline seawards by the construction of new defenses seaward of the original defenses.
5. The fifth policy option is limited intervention and differs from the hold the line option by not attempting to fix the shoreline in position rigidly but reducing the rate of erosion, preferably to negligible quantities.

The key recommendations of the shoreline management plan are:

1. Relocation of villages such as Ramayyapatnam, Bada NoliaNuagaon and Kantigada (Pudampetta) further landwards is the preferred solution. Resistance to relocation may lead to the second preference of short groynes located over a 700m stretch along the shoreline at Ramayyapatnam. At Bada NoliaNuagaon and Kantigada (Pudampetta), hard solutions with groynes and seawalls are not recommended as they lie within the Rushikulya turtle nesting beaches
2. Protection is recommended in the form of groynes for the town of Gopalpur on Sea as buildings are located very close to the shoreline. The groynes design needs to consider the potential benefit of eroding the Haripur River, allowing shelter to fish landing crafts in the river.
3. Arjyapalli and shoreline north of Gopalpur requires beach nourishment, while groynes are not recommended. With groynes, erosion will continue northwards approaching Rushikulya mouth, where reduction of spit formation across the mouth has adverse effects on turtle nesting
4. At Rushikulya, it is recommended that the spit formations and dynamic morphological changes be allowed to adapt naturally with minor dredging where required for navigational access for fishing boats. Engineering structures are not recommended at Rushikulya.
5. Chilika lake mouth requires monitoring and dredging such that a mouth with cross sectional area of 1500 sqmetres above the low tide level is available for exchange of tidal waters into the lake. Engineering structures are not recommended.
6. Shamuka beach resort is a prominent tourist resort planned south of Puri. Conservation and protection of the existing sand dunes at this location as per the CRZ notification is recommended such that no modification physically and ecologically is permitted.
7. The Devi river mouth is influenced by tidal and freshwater flows and has complex morphology. Limited development is recommended in the form of fisheries jetty. The jetty needs to be located preferably in stable channels where adequate depth has been observed over the past and where future morphological changes do not result in channels with siltation.
8. Paradip Port has had a significant impact of the longshore sediment transport and sedimentary regime. The blocking of sediments from south of Paradip is suggested to be a key cause for erosion and shoreline change at Pentha – Gahirmatha coast. While erosion of the seawall north of Paradip is recommended to

be arrested by beach nourishment of 0.4 Mm³/ year and dredging of the approach channel to the Paradip fishing harbour located at the mouth of Mahandi river, this nourishment is not likely to be a solution for Gahirmatha.

9. For Pentha – Gahrimatha, beach nourishment is recommended using sediments from the spit / shifting sands/ islands of Hukitola Bay. Hard engineering structures are not recommended as they may hinder turtle nesting and also reduce sediment inputs to Ekatula spit and the Dhamra – Brahmani – Baitarini estuarine complex
10. Dredge spoil disposal from the Dhamra port channel at locations north of Dhamra at shallow water locations in Balasore need to be considered after confirmatory studies, including impacts on mangroves. Erosion along the coast of Balasore may be a result of settling of sediments in the Dhamra dredged approach channel, reducing sediment inputs to the shoreline.
11. Dredging is recommended at several river mouths such as Markandi, Hansua, Jathardarmuhan, Haripur to allow exchange of tidal waters, reduce flooding, improve water quality and allow access for fishing boats
12. Protection of the Puri Beach is suggested in the form of groynes or detached breakwaters

Following generalized approaches towards coastal defenses and ecosystem diversity need to be adopted.

1. In areas with low elevation that are prone to inundation during storms, the existing sea defense structures in the form of luna bunds need to be evaluated and strengthened. Areas that do not have such structures also need to have similar protection after consideration of the hydraulic regime such that inundation from the storm surges and waves are prevented, yet drainage of flood waters from extreme rainfall events is not hindered.
2. Mangrove afforestation needs to be considered in suitable areas where the soil and hydraulic regimes are suitable. Mangroves can be considered at estuarine and river mouths. Mangrove afforestation along open sandy beaches is generally not sustainable.
3. Gap filling of the coastal plantations seen along much of the coast of Odisha needs to be considered by the Forest and Environment Department to reduce damage due to high winds during cyclones.
4. Proper planning is required to enhance biodiversity in these afforested areas, with special focus on avoiding monoculture. In turtle rookery areas, plantations can also be harmful if predators such as canine populations increase in numbers.

It is also recommended that, there has to be Comprehensive Social Vulnerability Analysis and Livelihood Analysis for developing a Coastal Adaptation Plan And Strategy.

Annexure- 4

Issues Addressed

Sl. No	Issues	Addressed
1	Vulnerability Assessment	Issue is addressed under Strategic Knowledge Mission
2	Flash Flood Management	Issue is addressed under Hydro-Met Challenges: Key Sectoral Measures Taken
3	Weather Station	Issue is addressed under AG/KP/7- Establish an automated weather station
4	Stubble Burning	Issue is addressed under AG/N/11- Conservation Agriculture
5	Threat to wildlife, amphibian	Issue is addressed under FOR/KP/10- Conserve wildlife and its habitat, assessing the threats to biodiversity and wildlife
6	Telecom, Infrastructure	Issue is addressed under CD/KP/10- Develop a techno-legal regime for the construction of disaster-resilient public infrastructure
7	Converging with Solar	Issue is addressed under Energy/KP/9- Maximize solar energy generation potential (GEDCOL)
8	Fire Protection	Issue is addressed under FOR/KP/6- Forest Fire protection Strategy under the Forestry Sector
9	Forest Protection	Converging of FOR/CAP/N3- Procurement of Equipment, FOR/CAP/N4- Communication Infrastructure and FOR/CAP/N5- Forest Protection under FOR/CAP/N3- Forest Protection in Forestry sector.
10	FOR/KP/1	Converging of FOR/CAP/N6- Green Mahanadi Mission and FOR/CAP/N7-River Rejuvenation with FOR/KP/1- Increase the forest cover of the state by undertaking afforestation and reforestation measures in the Forestry sector
11	MIN/KP/1	Renaming of MIN/KP/1- 'Preparing regional sustainable mining plans' as 'Prepare an action Plan for sustainable mining'
12	FOR/CAP/N1 (MIN/CAP/22 & MIN/KP/2)	Converging of MIN/CAP/22- Creation and maintenance of green zones in major mining clusters' with MIN/KP/2- Devise a mechanisms for green belt development and maintenance in mining clusters under FOR/CAP/N1- Green Belt Development and Maintenance in mining clusters in Forestry Sector
13	MIN/CAP/6	MIN/CAP/6- Explore cleaner technologies and best practices in coal mining will be dropped out
14	Compressed Natural Gas (CNG)	Encouraging the use of Compressed Natural Gas (CNG) is addressed under C&T/KP/5 of Transport sector
15	Fly ash utilization	Fly ash utilization, incorporated in Industries sector, is addressed under IND/CAP/N1
16	Waste to Wealth Projects	The activity WS/KP/2- Waste to Wealth projects in PPP mode is addressed in the Waste Management Sector under Housing & Urban Development Department
17	Calculation of Carbon Sequestration	The activity MIN/CAP/34- Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in Mining sector as suggested by the Forest & Environment Department

