

Orissa Climate Change Action Plan 2010-2015

Draft Copy



Government of Orissa





Orissa Climate Change Action Plan



Government of Orissa



Summary

Why Climate Change is a Serious Issue for Orissa?

Orissa is most vulnerable to climate change. It has a 480 km coast line that is subject to climate-mediated cyclones and coastal erosion. Its water resources depend on the monsoons, which is exposed to the vagaries of weather. Water-consuming rice is its main crop and therefore its agriculture is vulnerable to the vagaries of climate-induced weather changes. Though 38% of the state's geographical area is forests, much of these forests are degraded. Vector-borne diseases, particularly malaria, are fairly rampant and climate change may make the prevalence of the disease even more widespread.

Indeed, climate change has the potential to derail the current growth strategy and deepen poverty in Orissa. Continuing climate change variation is predicted to alter the sectoral origins of growth, including the ability of the poor to engage in the farm and non-farm sector, as well as increase inequality, and therefore to reduce the poverty elasticity of growth. The direct impacts of extreme climate-induced events could be the loss of life, livelihoods, assets and infrastructure. All of these will affect the state's economic growth and nullify the effectiveness of pro-poor macroeconomic policies, trade and private sector investment being pursued.

Climate Risks in Orissa

High variability of rainfall, leaving people with two peak periods of food shortage
Drought and dry spells at an interval of every two years in Western Orissa with a major drought every 5-6 years
Flash floods during rainy season
Heat waves in summer
Intense coastal flooding and cyclones

What the Government of Orissa (GoO) is doing?

Context

Orissa has recently transformed itself in economic and fiscal terms. The Gross State Domestic Product (GSDP) during the 10th five year period (2002-2007) has increased by 8.5% which is slightly more than the national level. Private investment of funds in the state has increased, employment opportunities have grown and development is leading to poverty reduction. A remarkable fiscal turnaround was achieved through the state's own efforts and complemented by performance-linked support from the central government. The state's 11th Five Year Plan focuses on addressing the challenges in achieving sustainable, shared economic growth and accelerating human development. GoO recognizes that climate change should not undermine the economic development underway.

Process

Orissa is a leader in formulating the State Climate Change Action Plan (CAP). The Chief Minister appointed a High Level Coordination Committee headed by the Chief Secretary to steer its preparation. Eleven sectoral missions have been identified and an inter-departmental representation ensured to address integration and co-ordination issues. Chaired by the respective High Level Coordination Committee member, individual working groups deliberated on the eleven sectors. Supported and facilitated by the World Bank and DFID, these Working Groups interacted with renowned experts in the various sectors. Key priorities consistent with those of the National Action Plan on Climate Change (NAPCC) were identified (Agriculture, Coastal Zones and Disasters, Energy, Fisheries and Animal Resources, Forestry, Health, Industry, Mining, Transport, Urban Planning and Water Resources). These key priorities were vetted through a series of stakeholder consultations held in Bhubaneswar, Berhampur, Anugul and Balasore. Both the business sector as well as civil society institutions participated. A synthesis workshop in Bhubaneswar collated and discussed the civil stakeholder feedback. Rich inputs were considered and incorporated in the CAP.

Agriculture

Agriculture holds a predominant position in the state's economy. About 80-85% of the state's population is rural and virtually all depend on agriculture and the agriculture sector contributes about 26 per cent of the GSDP. With almost 60% of land devoted to rain fed agriculture and with a water-dependent crop, rice, as its main crop, the agriculture sector is vulnerable to the vagaries of climate-induced weather changes. Further, rice and grain grown in the flood prone coastal areas are prone to frequent erosion, salinisation and inundation. Climate projections indicate that drier areas will become drier and flood prone areas will be subject to more flooding. Other problems such

High-Level Coordination Committee

Chief Secretary, Chairman
Development Commissioner
Principal Secretary, Fisheries and ARD, Member
Principal Secretary, Steel and Mines Department, Member
Commissioner-cum-Secretary, Agriculture Department, Member
Commissioner-cum-Secretary, Commerce & Transport Department, Member
Commissioner-cum-Secretary, Health and Family Welfare Department, Member
Commissioner-cum-Secretary, Revenue & Disaster Management Department, Member
Commissioner-cum-Secretary, Energy Department, Member
Commissioner-cum-Secretary, Industry Department, Member
Commissioner-cum-Secretary, Water Resources Department, Member
Principal Secretary, Forests & Environment Department, Member-Convenor

Key priorities Agriculture

Climate-friendly State Agriculture policy
Institutional delivery mechanisms to promote best climate change adaptation practices
Capacity Building to cope with climate change
Continuing the livelihood-focused, people-centric integrated watershed development programmes
Increasing the area under perennial fruit plantation to help cope with uncertain weather patterns
Developing water-efficient micro irrigation methods and individual / community farm ponds
Improving monitoring and surveillance techniques
Developing sustainable soil, water and crop management practices
Breeding studies on major crops for tolerance
More research on agricultural implications

as pest and disease outbreaks are also likely due to climate variability.

Coastal Zones and Disasters

Orissa has long been prone to disasters: recurring droughts, flood and cyclones are regular features in the state and have had a crippling effect on the economy. In 1999 a severe cyclone followed by a super severe cyclone lashed the entire coast of Orissa causing large scale loss of life. Whilst the extent to which climate change will exacerbate floods and droughts is not yet fully understood, it is clear that their frequency and intensity will increase. While Orissa has pioneered disaster management in the country through the creation of Orissa State Disaster Management Authority (OSDMA), the first of its kind in the country, there is a considerable need to better understand the climatic impacts on coasts and disasters and to build capacity of communities to adopt, manage and mitigate these adverse impacts.

Energy

The State of Orissa is poised for rapid industrial development. To meet the growing needs, GoO has treaded on an aggressive path to generate more power. Orissa is on the way to becoming a major energy supplier to the grid and this could come at a high cost in terms of both local environmental quality and contributing to global emissions. The State has had the distinction of being the first state in the country for ushering in sweeping reforms in power sector, which had the objective to provide consumers with reasonable cheap,

Key priorities

- Downscaled climate change projections modelling pertaining to floods
- Assessing coastal erosion prone areas
- Strengthening delivery and monitoring system and preparedness
- Appropriate modeling on the impact of sea level rise
- Research on coastal biodiversity impacts

reliable and quality supply of power. There are already several initiatives to promote renewable energy, reduce Transmission & Distribution (T&D) losses and to promote energy efficiency in the state. All of these need to be given a further boost as these efforts become that much more important in the climate change context.

Key priorities

- Generating cleaner energy through clean coal approaches
- Institutional development (Capacity building/ restructuring) of Energy Department
- Reduction of Transmission & Distribution losses
- Promoting demand side management & energy efficiency
- Fly ash utilization and emission reduction from power plants
- Promotion of Small and Medium Hydel plants
- Harnessing biomass potential
- Promotion of Grid based wind power generation
- Maximize solar power generation
- Development of Biogas and manure management

Fisheries and Animal Resources

Being water dependent, the fisheries sector in Orissa will be impacted by climate change. Erratic rainfall is relevant in the context of open reservoirs and ponds/tanks, rise in sea level and the climate-mediated hazards is relevant in the context of coastal fishing will influence the reservoirs and impact fisheries livelihoods. Animal resources - supports a large part of rural livelihoods - will be impacted by heat stress and other climatic impacts. Methane emission from the livestock is a key concern.

Forests

Forests provide important livelihoods to the rural poor combined with the substantial tribal populations and sustenance. The forests

Key priorities

- Biotechnology and skilled animal breeding for developing better adapted species
- Capacity building on climate change adaptation of livestock keepers
- Research on early warning system for livestock diseases
- Understanding implications on inland and coastal aquaculture
- Developing infrastructure early warning systems for coastal fishermen

also have important ecological functions, checking soil erosion and reducing the impact of droughts, floods and cyclones (mangroves). Unfortunately, mining and other industrial projects are threatening forests, livelihood of people dependent on forest based economy and creating conflicts between wild animals and local inhabitants due to loss of forest. Forestry sector is also particularly important both from climate mitigation as well as adaptation perspectives. While no assessment of the impact of climate changes on Orissa's forests has yet been undertaken, the forestry community nonetheless needs to evaluate the

Key priorities

- Increasing reforestation/afforestation in degraded areas
- Protecting existing forest stocks as carbon sinks
- Increasing planting on non-forest land
- Covering bald-hills with suitable species mix
- Expanding existing mangrove cover along the coast
- Assessing fire management strategies
- Establishing new systems for community forest users
- Research on indigenous trees species and their vulnerability to climate change
- Assessing threats to biodiversity and wildlife
- Obtaining access to updated climate change knowledge
- Capacity building of Panchayati Raj Institutions/communities on climate change adaptation
- New agency for monitoring carbon stock

long-term effects of climate change on forests and determine what the community might do now in response.

Health

In Orissa, increased health risks will arise from climate change. The prevalence of malaria and vector-borne diseases, are already rampant in particular areas. With the expected erratic nature of rainfall and extending seasons, this may become more widespread. Climate change has the potential to aggravate vector-borne, water-borne and food-borne diseases as well. The intensity and frequency of extreme events such as heat waves and increase the intensity of cyclones could further expose the vulnerable population to health risks.

Key priorities

- Capacity Building on climate change mitigation and adaptation
- Climate-friendly State Health policy
- Undertaking measures to manage vector borne and water borne diseases
- Strengthening vector borne disease management
- Better approaches to deal with heat wave conditions
- Deal with the physical and psychological impacts post-extreme weather events
- Addressing drought, nutrition & food security issues
- Addressing food safety arising due to increased ambient temperatures and extreme events

Industry

The industrial sector in Orissa mainly comprises mineral-based industries. Since these industries are energy-intensive, the acceleration of industrialization is closely linked to carbon emission. There is substantive potential for improving energy efficiency through the use of cleaner production technologies, methods and practices. The

workers in mineral-based industries have to work in extremely hot conditions and with the likely increase in the average temperatures due to climate change; this will also become an occupational health issue in the future. With a prediction of increased intensity and frequency, protection of coastal industrial assets will have to be considered.

Key priorities

- Integrating climate concerns in industrial development policies
- Assessing GHG profile of industrial clusters
- Studying heat-island at Talcher and Jharsuguda
- Training various stakeholders on climate change issues
- Implementing compensatory water harvesting
- Streamlining institutional arrangement between industry and OSDMA
- Conducting energy efficiency studies in energy intensive sectors
- Promoting recovery, recycle and reuse of waste material
- Setting emission standards for thermal power plants

Mining

Mining is a mainstay activity in Orissa and contributes significantly to the state's economic development. These deposits of certain minerals constitute a significant portion of the total deposits of the country. Mining in Orissa has serious local environmental impacts. This includes the air pollution impacts (particulates), water pollution (mine water discharges), social impacts (displacement and rehabilitation) and forest impacts (part of the mining area is in the forests or in the vicinity). Mining being energy intensive is also a big contributor to global greenhouse gas emissions.

Transport

Inadequate public transport and an increasing motorization with greater availability of low cost vehicles has resulted in a commensurate increase in the emissions from the transport

Key priorities

- Climate-friendly State Mineral Policy
- Appropriate policies to promote energy efficiency in mining clusters and mineral transport
- Identifying the potential of beneficiation of low grade minerals.
- Strengthening environmental monitoring in major mining clusters
- Protecting water harvesting structures, reservoirs and weirs
- Creating and maintaining green zones in major mining clusters
- Training on Clean Development Mechanism

sector. Orissa is also largely dependent on the road network that is the least carbon friendly among different modes of transport. This has local pollution implications as well. No alternative, less carbon-emitting fuel such as CNG exists in the state and effort to move to a more carbon-friendly mass rapid transport system is also only at a very early stage.

Urban Planning

Key priorities

- Climate-friendly State Transport Policy & Boat Policy
- Integrating urban and land use planning with transport planning
- Introducing MRTS in suburban areas
- Encouraging transportation of bulk dirty cargo through rail
- Using alternate fuel to conventional fuel & blending of bio fuel in automobiles
- Green low carbon foot-print highway
- Capacity building of drivers on fuel efficiency & strengthening enforcement for emission level checks
- Promoting non-motorized transport
- Sequestering carbon through avenue plantation
- Estimating carbon emission from transport sector
- Developing inland waterways

The continuous exodus of rural population to urban areas in Orissa has contributed to its

Key priorities

Capacity building of ULBs on climate change
Developing climate-friendly designs for urban water supply and sewerage
Sensitizing city dwellers on water conservation measures
Preparing an ideal MSW management plan
Orienting city dwellers on energy efficient street lighting
Strengthening Master Plans / CDPs guidelines to address climate change
Improving urban infrastructure by promoting non motorized transport

Key priorities

Expanding hydrometry network
Developing flood forecasting models
Downscaling Global climate prediction models
Increasing the water use efficiency
Construction of Water Harvesting Structures
Improving drainage system
Strengthening river health and ecosystem monitoring
Generating awareness with Pani Panchayat on climate change & creation of agro-climatic stations

exponential growth. There is already a severe strain on the existing urban infrastructure. However, as the population living in urban areas in Orissa is significantly lower than the national average, GoO is in a unique position to chart out a urban development path that learns from the mistakes / experiences of other Indian cities (particularly the metropolitan cities). Given the climate change dimension, Orissa can go further by defining a climate-responsible urban development path.

Water

Impact of climate change on water resources in Orissa is likely to be due to the vagaries monsoons creating variability in river flows and increased frequency/intensity in extreme events such as floods, droughts and cyclones. Heavy flood or drought occurs every alternate year due to disproportionate distribution of rainfall. In recent years, wide fluctuation in climate has been observed and irregular rainfall causing both floods and droughts is a major concern. The impact of drought on farmers has been deleterious in some areas.

Way Forward

The CAP will lead Orissa to move towards a carbon-conscious, climate resilient development path. This move will be ushered with an estimated budget of about Rs. 17,000 crores over a 5-year period. This includes the existing budgets for current activities that are identified as climate-friendly. Additional financing will have to be raised from both Gol and international funding sources. Efforts will be made to take advantage of global carbon markets and special global funds available for both adaptation and mitigation. The monitoring and evaluation framework will be in place to supervise progress and effectiveness. A new Orissa Climate Change Agency will be established during the first year of implementation. This will have an information advisory, supervisory and co-ordinating role on climate change issues. This Agency will be a single-window contact for dealing with the Gol and other external funding agencies in issues pertaining to climate change. GoO will show leadership in dealing with climate change.

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Abbreviations and Acronyms

BCM	Billion Cubic Metres
CEA	Central Electricity Authority
CAP	Climate Change Action Plan
CBO	Community Based Organization
CDM	Clean Development Mechanism
CDP	Comprehensive Development Plan
CNG	Compressed Natural Gas
CO ₂	Carbon Dioxide
CPP	Captive Power Plant
DFID	Department for International Development, UK
DPR	Detailed Project Report
DSM	Demand Side Management
ECBC	Energy Conservation Building Code
FSI	Forest Survey of India
GHG	Green House Gas
GoI	Government of India
GoO	Government of Orissa
GSDP	Gross State Domestic Product
ICZMP	Integrated Coastal Zone Management Project
IPCC	Inter-Government Panel on Climate Change
IPP	Independent Power Producer
IPR	Industrial Policy Regime
JFM	Joint Forest Management
Km	Kilometre

LPG	Liquefied Petroleum Gas
Mm	Millimetre
MoEF	Ministry of Environment & Forests
MRTS	Mass Rapid Transport Systems
MSME	Micro, Small & Medium Enterprise
MT	Metric Tons
MW	Mega Watt
MSW	Municipal Solid Waste
NAPCC	National Action Plan on Climate Change
NTFP	Non-timber Forest Produce
NTPC	National Thermal Power Corporation
OERC	Orissa Electricity Regulation Commission
OREDA	Orissa Renewable Energy Development Agency
OSDMA	Orissa State Disaster Management Agency
OWDM	Orissa Watershed Development Mission
PV	Photovoltaic
Rs.	Rupees
SEZ	Special Economic Zones
T & D	Transmission and Distribution
ULB	Urban Local Bodies

Background

1.1 Introduction

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) indicates that the Earth's climate is changing at an unprecedented pace with potentially serious economic impacts and implications for sustainable development. Climate model projections indicate that global average temperature will increase, with disproportionately higher temperatures in the tropics and at the poles. South Asia is especially vulnerable to climate change due to its high levels of population density, prevalent poverty and a high dependence on natural resources.

India is already the fifth largest emitter of greenhouse gases. From the viewpoint of per capita emissions, India's contribution is very low but it is substantial in a cumulative sense. Climate projections for India suggest that impacts are likely to be varied and heterogeneous, with some regions experiencing more intense rainfall and flood risks, while others will encounter sparser rainfall and prolonged droughts. Among the more substantial effects is a projected spatial shift in the pattern of rainfall towards the already flood-prone coastal areas, while water-scarce regions become even more drought-prone and unproductive. India will also suffer from higher tides, more intense storms fueled by warmer oceans and further erosion along its coastline due to sea level rise. For India, climate variability and climate change pose huge risks to human life and threaten to endanger the sustainability of the country's

fast growing economy. India's immense geographic diversity adds to the complexity of developing and implementing an adaptation strategy. The impacts will vary across states, sectors, locations and populations. Consequently, there can be no one-size-fits-all climate change strategy. Approaches will need to be tailored to fit state and local vulnerabilities and conditions.

In June 2008, Government of India's (GoI) National Action Plan on Climate Change (NAPCC) was announced. The objective is to adapt and to enhance ecological sustainability of India's development path. The vision is to create a prosperous (not wasteful) self-sustaining economy. The principle is to maintain a high growth rate and reduce vulnerability. There are 8 national missions that are to be developed in greater detail (Refer Chapter 3 for a further elaboration). These include the following subjects: solar, energy efficiency, water, sustainable habitat, water, Himalayan eco-system, forests, sustainable agriculture and strategic knowledge. In August 2009, the Indian Prime Minister urged each state Government to create their own state level action plan consistent with the strategies in the National plan. This was re-emphasized by the Union Minister of State, Environment & Forests (MoEF), at the meeting of the Chief Secretaries in February 2010. Simultaneously the Honb'le Chief Minister of Orissa, while expressing his concern on climate change issues instructed for constitution of High Level Co-ordination committee for formulation of State Climate Change Action Plan for Orissa.

Orissa is a state that is endowed with coal and a variety of mineral resources. It has the potential to generate coal-based thermal power not only for the state's needs but also to for the region. Being mineral-rich, the state has mineral-based industries that are both energy and water intensive. The energy, mining and industry sector also contribute to the local environmental and social problems. About 38% of the state's geographical areas are forests, and therefore offer it very well in terms of providing for carbon sinks. The state also has 10% of the country's water resources for just 4% of the population. There is sufficient water in the state as a whole but still there are water shortages in certain parts of the state. Agriculture is largely rainfed as the irrigation network is not spread across the state. The main crop in agriculture is rice, which is a highly water-intensive crop. It has a 480 km vulnerable coast line, which is a periodic recipient of climate risks such as cyclones and coastal erosion. In terms of health, the vector-borne disease - malaria - is fairly rampant in many parts of the state. Given its profile, climate change is an important subject for the state as it is presently on a carbon-oriented development path and at the same time, it is vulnerable to climate-mediated risks.

Government of Orissa (GoO) will be one of the first Indian states to develop a state Climate Change Action Plan (CAP). GoO recognizes that the climate change has the potential to erode the progress achieved and to be achieved through economic growth. Given its importance, GoO aims to demonstrate continued leadership in this new and important environmental concern.

1.2 Methodology

GoO initiated the climate change scoping study with a view to understand the range of issues that need to be addressed. GoO provided information on possible issues and the Orissa context to consultants who put together a short, focused report on the issues that GoO needs to be addressed. Most of the GoO Departments that contribute

High-Level Coordination Committee
 Chief Secretary, Chairman
 Principal Secretary, Fisheries and ARD, Member
 Principal Secretary, Steel and Mines Department, Member
 Commissioner-cum-Secretary, Agriculture Department, Member
 Commissioner-cum-Secretary, Commerce & Transport Department, Member
 Commissioner-cum-Secretary, Health and Family Welfare Department, Member
 Commissioner-cum-Secretary, Revenue & Disaster Management Department, Member
 Commissioner-cum-Secretary, Energy Department, Member
 Commissioner-cum-Secretary, Industry Department, Member
 Commissioner-cum-Secretary, Water Resources Department, Member
 Principal Secretary, Forests & Environment Department, Member-Convenor

carbon dioxide emissions or will need to adapt to climate change were consulted during the scoping study. This scoping study was done between November 2009 and February 2010.

When the findings of the scoping study were presented, GoO proposed the establishment of a High Level Co-ordination Committee headed by the Chief Secretary to steer the preparation of the CAP. This was done recognizing the need for the top and senior bureaucracy within the GoO to be involved in the context of the list of climate change issues that the scoping study revealed. The Chief Minister approved and appointed this High Level Coordination Committee. The composition of the Committee is provided in the adjoining text box. At the same time, the GoO established 11 working groups to cover issues in 11 different sectors that are relevant to climate change. The list of the working groups formed and sectors addressed are in the text box below. GoO ensured that the membership was drawn not only from the primary department but also from the

different associated departments. Chaired by the Principal Secretary/Secretary of the primary Department, meetings were held by these working groups to deliberate the relevance of climate change pertaining to the sectors in the Orissa context. A convenor was appointed to co-ordinate the regular conduct of meetings, to collect/collate the required information and to develop/draft the plans pertaining to each of the sectors. Annex 1 provides the composition of all the working groups - chairpersons, convenors and the individual members.

Templates were prepared for listing the various activities relevant to climate change, prioritizing the activities as high, medium and low priorities, and developing an outline of the sub-activities to be done in the high priority activities along with estimating the budget and sources of funding. These templates are included in Annex 2. Each Working Group completed these templates and the high priority activities were reviewed. In the deliberations of the high priorities during the meeting of the High-Level Co-ordination Committee, it was agreed that each Working Group will rationalize and determine about 10-12 key priorities which will be focus of the first period of the CAP [2010-2015].

To provide technical advice to these working groups, climate change specialists as well as national / international sector experts were invited for interactions on the different subjects. This ensured that the working groups were on track, were addressing issues that are important in the Orissa context and were in line with the responses both at the national/ international context. A list of climate change specialists and sector experts, who advised the different working groups, is provided in the Acknowledgements.

Using the scoping study findings as the first-cut, the different working groups expanded to all the possible activities that are relevant in the climate change context in their respective sectors. Recognizing that all activities are equally significant, the working groups

Working Groups

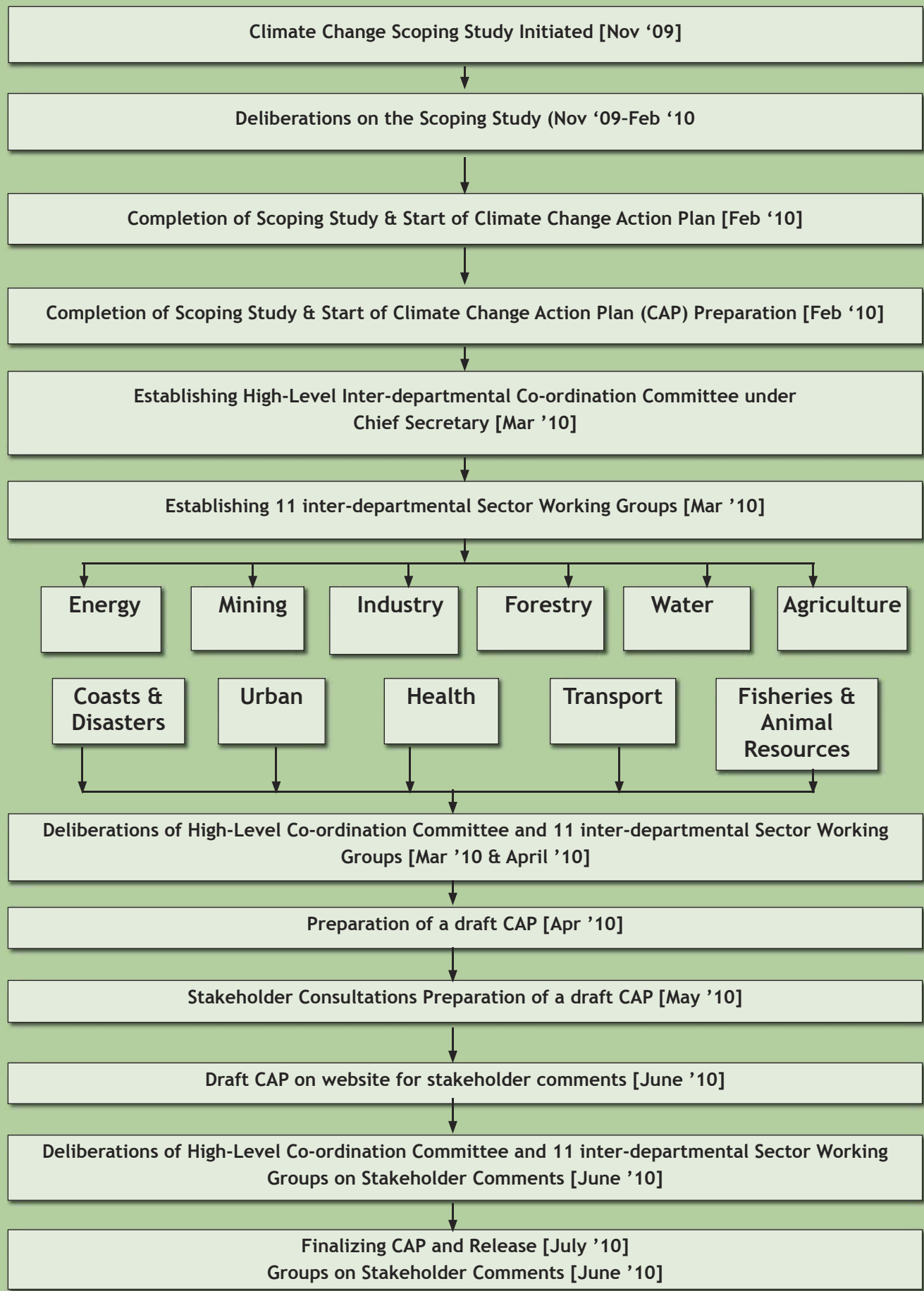
1. Agriculture
2. Coastal Zones and Disasters
3. Energy
4. Fisheries and Animal Resources
5. Forestry
6. Health
7. Industry
8. Mining
9. Transport
10. Urban Planning
11. Water Resources

developed a prioritization approach to divide the comprehensive list of activities into high, medium and low priority activities. Once this was done, the working groups went ahead and defined key priorities in order to get a further focus. Finally, each working group identified 10-12 key priorities in the five year period between 2010 and 2015. Description of the key priorities was developed, organizations to be involved with the implementation were identified and budgets to implement these activities were estimated.

The process adopted and the key priorities identified were then shared with the external stakeholders. With a view to collect feedback from across the state, GoO arranged the stakeholder consultation workshops at Bhubaneswar, Berhampur, Angul and Balasore. In each of these consultation workshops, specific sectors were discussed in detail. These stakeholder consultations concluded with a synthesis stakeholder workshop that covered all the 11 sectors. The feedback obtained from these stakeholder workshops were considered by the different working groups - DFID-UK.

The scoping study was done with technical and financial support from the Department for International Development (DFID), UK. The World Bank provided both technical and financial assistance in providing the climate change experts, sourcing the sector experts to the different working groups and in supporting the external stakeholder consultations. DFID-UK assisted as well in

Table: Methodology & Timeframe



sourcing a couple of sector experts and also provided support for the first printing of this CAP document.

1.3 Structure of the CAP document

The CAP document begins with this background chapter, which introduces the context, provides the methodology and outlines the structure of the document. The second chapter includes a detailed overview of the Orissa scenario and the third chapter draws relevance of the eight National Missions to Orissa. The next chapter includes a sector analysis and

describes the key priorities identified. This covers all the 11 sectors and also includes a section that identifies the issues that are cross cutting. The subsequent chapter analyses and synthesizes the sector information to arrive at the key findings. The last chapter provides the conclusions and recommendations. The Annexes include the composition of the working groups (Chairpersons, Convenors and Members), list of external stakeholder consultations held, summary of stakeholder consultations, sectorwise table of key priorities, comprehensive list of activities considered and list of references.



National Action Plan on Climate Change

2.1 Introduction

India released its National Action Plan on Climate Change (NAPCC) on 30th June 2008 to outline its strategy to meet the challenge of Climate Change. The National Action Plan advocates a strategy that promotes, firstly, the adaptation to Climate Change and secondly, further enhancement of the ecological sustainability of India's development path.

2.2 Approach to Climate Change

The National Action Plan recognises that climate change is a global challenge and, that it should be successfully overcome through a globally collaborative and cooperative effort based on the basis of the principle of equity. The Action Plan expresses India's willingness to play its role as a responsible member of the international community and to make its contribution. However, it emphasises that, this requires not only sustainable production processes, but also sustainable life styles across the globe. In this effort, every citizen of the planet should have an equal share of the planetary atmospheric space. The Action Plan suggests that the long-term convergence of per capita GHG emissions is the only equitable basis for a global agreement to tackle climate change. The Action Plan assures the international community that India's per capita GHG emissions would not exceed the per capita GHG emissions of developed countries, despite India's developmental imperatives.

2.3 Domestic Action

India's National Action Plan stresses that maintaining a high growth rate is essential for increasing living standards of the vast majority of people of India and reducing their vulnerability of the impacts of climate change. Accordingly, the Action Plan identifies measures that promote the objectives of sustainable development of India while also yielding co-benefits for addressing climate change. Eight National Missions which form the core of the National Action Plan represent multi-pronged, long term and integrate strategies for achieving key goals in the context of climate change. The focus is on promoting understanding of Climate Change, adaptation and mitigation, energy efficiency and natural resource conservation. While, several of these programmes are already a part of the current actions, the Action Plan seeks to enhance them in scope, and effectiveness and implement them in an accelerated manner through time bound plans.

2.3.1 Solar Mission

This mission aims to promote the development and use of solar energy for power generation and other uses, as well as to render solar energy competitive with fossil-based energy options in urban areas, industry, and commercial establishments. Its goal is to generate at least 10,000 megawatts of solar thermal power and to create a solar research center, among other things.

2.3.2 Mission for Enhanced Energy Efficiency

This mission seeks to yield savings of 10,000 megawatts by 2012 through the implementation of certain initiatives, such as energy incentives (including differential taxation on energy-efficient appliances); setting up financing platforms for public-private partnerships to reduce energy consumption through demand-side management programs; and establishing a system for large energy-intensive industries and facilities to trade energy-savings certificates so that they can meet government-mandated reductions in energy consumption, as per the Energy Conservation Act.

2.3.3 Mission on Sustainable Habitat

This mission seeks to promote energy efficiency in urban planning through measures such as putting more emphasis on urban waste management and recycling, strengthening the enforcement of automotive fuel economy standards, using pricing measures to encourage the purchase of fuel-efficient vehicles, and providing incentives for people to make greater use of public transportation.

2.3.4 Water Mission

This mission aims to increase water use efficiency by 20 percent through pricing and regulatory measures, including the recycling of wastewater, increases in irrigation efficiency, and incentives to promote water-neutral or water-positive technologies and groundwater recharge.

2.3.5 Mission for Sustaining the Himalayan Ecosystem

This mission seeks to promote the conservation of biodiversity, forest cover, and other ecological values in the Himalayan region to help stop the retreat of glaciers, as they constitute a major source of India's water supply.

2.3.6 Mission for a "Green India"

The mission plans to expand forest cover in India by 10 percent through afforestation of 6 million hectares of degraded forest lands.

2.3.7 Mission for Sustainable Agriculture

The mission will foster adaptation in the agricultural sector by supporting the development of climate-resilient crops and the expansion of weather insurance mechanisms, among other measures.

2.3.8 Mission on Strategic Knowledge for Climate Change

This mission will promote "a better understanding of climate science, impacts and challenges." It calls for the establishment of a new Climate Science Research Fund, improved climate modeling, and increased international collaboration. It will also foster private sector initiatives aimed at developing adaptation and mitigation technologies through venture capital funds.

2.4 Other Initiatives

Apart from the eight National Missions, the National Action Plan also envisages other initiatives aimed at enhancing mitigation and adaptation. These include research & development in the area of ultra super critical boilers in coal-based thermal plants; integrated gasification combined cycle technology to make coal based power generation efficient; setting up more combined cycle natural gas plants; promotion of nuclear energy through adoption of fast breeder and thorium-based thermal reactor technology in nuclear power generation; adoption of high-voltage AC and high-voltage DC transmission to reduce technical losses during transmission and distribution; small and large scale hydro power; promotion of renewable energy technologies such as bio-mass combustion and gasification-based power generation; enhancements in the regulatory/tariff regimes to help mainstream renewable-based sources

¹ As many as 21 thermal power projects are in different stages of implementation in the state

in the national power system; and renewable energy technologies for transportation and industrial fuels. In addition, the Action Plan envisages effective disaster management strategies that include mainstreaming disaster risk reduction into infrastructure project design, strengthening communication networks and disaster management facilities at all levels; protection of coastal areas, provision of enhanced public health care services, and assessment of increased burden of disease due to climate change. The Action Plan also highlights the role of Central Government, State Governments and local Bodies in putting in place appropriate delivery mechanisms and building adequate capacity and knowledge in the relevant institutions for effective adaptation and mitigation actions.

2.5 Institutional Mechanism

The National Missions are to be institutionalized by the respective Ministries and will be organized through inter-sectoral groups. Appropriate mechanisms including public-private partnership and civil society actions, will be devised, as suited, for effective delivery of each individual Mission's objectives. Comprehensive Mission documents detailing objectives, strategies, plan of action, timelines and monitoring and evaluation criteria of all eight Missions and Other Initiatives are to be developed by December 2008 and submitted to the Prime Minister's Council on Climate Change. The work is to be coordinated by the Ministry of Environment & Forests.



Climate change issues relevant to Orissa

3.1 Introduction

Climate projections for India suggest that impacts are likely to be varied and heterogeneous, with some regions experiencing more intense rainfall and flood risks, while others will encounter sparser rainfall and prolonged droughts. Among the more substantial effects is a projected spatial shift in the pattern of rainfall towards the already flood-prone coastal areas, while water-scarce regions become even more drought-prone and unproductive. India will also suffer from higher tides, more intense storms fueled by warmer oceans and further erosion along its coastline due to sea level rise. For India, climate variability and climate change pose huge risks to human life and threaten to endanger the sustainability of the country's fast growing economy. India's immense geographic diversity adds to the complexity of developing and implementing an adaptation strategy. The impacts will vary across States, sectors, locations and populations. Consequently, there can be no one-size-fits-all approach to developing a climate risk management strategy: approaches will need to be tailored to fit state and local vulnerabilities and conditions.

Among the Indian states, Orissa is one of the most vulnerable to climate change. It has a 480 km vulnerable coast line, which is a periodic recipient of climate risks such as cyclones and coastal erosion. Orissa is rainfall dependent as its irrigation network does not cover the entire state. With a water-dependent crop, rice, as its main crop, the

agriculture sector is vulnerable to the vagaries of climate-induced weather changes. In terms of health, the vector-borne disease - Malaria - is fairly rampant in many parts of the state. Although 38% of the state's geographical areas are forests, however, much these forests are degraded.

Orissa also remains one of India's poorest states. The estimates from the Planning Commission reflected in indices such as the percentage of population below the poverty line both in rural and urban areas, and the overall incidence of poverty in Orissa viz-a-viz rest of India reveal that Orissa remains one of the poorest among all the major states of India. The high poverty in Orissa is closely tied to low productivity in agriculture, which is in turn linked to the prevalence of small and marginal holdings. The GoO has realized that poverty reducing economic growth would need acceleration in both agriculture and non-agricultural sectors.

Climate change is predicted to deepen poverty in Orissa both directly and indirectly compromising the current growth strategy. The direct impacts could include the loss of life, livelihoods, assets, infrastructure, etc. from climatic extreme events. The indirect effects could be the effect on economic growth; continuing climate change variation is predicted to alter the sectoral origins of growth, including the ability of the poor to engage in the non-farm sector, as well as increase inequality, and therefore to reduce the poverty elasticity of growth. This could nullify the pro-poor potential of

macroeconomic policies, trade and private sector investment.

Climatic variations could further multiply the vulnerability of poor people by adversely affecting their health and livelihoods and jeopardizing growth opportunities vital for poverty reduction. Climate change in Orissa has the potential to tremendously aggravate water stress and enhanced food insecurity.

GoO wants to ensure that climate change does not undermine the economic development which is now underway. Orissa has recently transformed itself in economic and fiscal terms. Double-digit growth for the past five years has had a multiplier effect throughout the economy. A remarkable fiscal turnaround, achieved through the state's own efforts and complemented by performance-linked support from the central government and external donors has released funds for development and greater public investments more generally. The state finances, which were in critical stage have improved. The GSDP during the 10th five year period (2002-2007) has increased by 8.5% which is slightly more than the national level. Private investment of funds in the state has increased as a result of this, employment opportunities have increased in private sector leading to Poverty reduction.

The state's 11th Five Year Plan focuses on addressing the challenges in achieving sustainable, shared economic growth and accelerating human development. This includes measures to tackle problems in the agriculture and rural non-farm sectors; enhanced social protection and tribal empowerment; further improvement of the business climate and the regulatory framework for managing environmental and social impacts of resource-intensive investments in the State; greater attention to financial management and modernization of procurement systems for converting outlays to outputs and outcomes; and continuing tax reforms for transition to Goods and Services Tax.

Orissa is also a state that is endowed with coal and a variety of mineral resources. It has the potential to generate coal-based thermal power not only for the state's needs but also to cater to the neighboring states in the region. The current development trends point to increased emphasis on power, mining, energy-intensive industries and infrastructure. It is anticipated that thermal power generation capacity will increase to 55-60,000 MW in the coming decade from the current about 4,000 MW¹. While climate adaptation remains a key issue, the state's role in mitigation in the broader national context could not be ignored.

Being mineral-rich, the state has mineral-based industries that are both energy and water intensive. The energy, mining and industry sector also contribute to the local environmental and social problems. Mining projects are threatening forests, livelihood of people dependent on forest based economy and creating conflicts between wild animals and local inhabitants due to loss of forest. All these developments will have a high carbon and environmental footprint. On the other hand, sustained management of the state's forests also offers it very well in terms of providing for carbon sinks and protection of watersheds.

Given its profile, climate change is a very important subject for the state as it is presently on a carbon-oriented development path and, at the same time, it is vulnerable to climate-mediated risks. We describe below some key issues pertaining to climate change adaptation and mitigation.

3.2 Key Issues

3.2.1 Adaptation

Coastal/disasters

Orissa has long been prone to disasters: recurring droughts, flood and cyclones are regular features in the state and have had a crippling effect on the economy. In 1999

¹ As many as 21 thermal power projects are in different stages of implementation in the state.

a severe cyclone followed by a super severe cyclone lashed the entire coast of Orissa causing large scale loss of life. Whilst the extent to which climate change will exacerbate floods and droughts is not yet fully understood- one thing is clear- their frequency and intensity will increase, not diminish. Cyclones may further intensify with climate change.

Water Resources

In Orissa, over 80% of annual rainfall occurs during the monsoon period average 1400 mm, with an average of 70 rainy days. The state experiences either heavy flood or drought every alternate year due to disproportionate distribution of rainfall. In recent years, wide fluctuation in climate has been observed and irregular rainfall causing both floods and droughts is a major concern. The impact of drought on farmers has been deleterious in some areas. Floods in 1980, 1982, 2001 and 2003 were particularly severe but there have been notable flood events in each of the past 4 years. Saline water ingress has been observed in some coastal districts. With the large demand for water coming primarily from the energy, industry and agriculture sectors and rainfall / precipitation levels turning erratic, the state will be challenged for water resources in various locations within the state.

Agriculture

Almost 85 per cent population of the State is dependent on agriculture and the agriculture sector contributes only about 26 per cent of the GSDP. With almost 60% of land is devoted to rain fed agriculture and with a water-dependent crop, rice, as its main crop, the agriculture sector is vulnerable to the vagaries of climate-induced weather changes.

Health

The prevalence of the Malaria, the vector-borne disease, is already rampant. With the expected erratic nature of rainfall and extending seasons, there is a possibility that the prevalence of these diseases become more rampant. Climate change has the potential to aggravate these malarial outbreaks as well as other vector-borne, water-borne and food-borne diseases.

3.2.2 Mitigation

Energy

The State of Orissa is poised for rapid industrial development and large use of electricity for industrial purpose for which the demand for electrical power is continuously increasing. To meet the growing needs, GoO has treaded on an aggressive path to generate more power. Orissa is on the way to becoming an energy supplier to the grid. In the next 10 years, Orissa expects to be generating about 60,000 MW of power, most of which are based on coal (a multiple increase from the current 4,000 MW). On the demand side, there is potential for reducing T&D losses, energy-efficiency promotion / DSM and also tapping the unrealized potential for renewable energy particularly bio-mass and solar.

Mining

Being endowed with mineral resources, this sector will continue to form an important part of the state's economy. Many of the mineral resources are found on forest land and these also have tribal / indigenous populations. Therefore, mining is already fraught with situations of conflict that are constantly being resolved. In the climate context these forests could serve as carbon sinks, but the state will have to overcome these conflicting challenges. In addition, there are a number of small mining companies that do not adopt sustainable practices. Combined with the poor infrastructure, there is a serious concern pertaining to local sustainable development issues in this sector.

Industry

Industries in Orissa belong to the energy-intensive and highly polluting sectors. Being energy-intensive, there is potential for improving energy efficiency through the use of cleaner production technologies, methods and practices. This will contribute towards mitigating green house gases. As most mineral-based industries have their own coal-based captive power plants, there are direct emissions from the industry sector as well. Therefore, making the captive power plants more energy-efficient on the supply side is also

a key issue in the Orissa context. As Orissa has substantial coal resources, the industry sector will be a direct emitter of carbon dioxide in the foreseeable future.

Transport

The state is solely dependent on petrol and diesel to meet its growing fuel needs. Strengthening motor vehicle enforcements, introducing mass transport and/or switching to fuel that will reduce both local and global emissions.

3.2.3 Cross cutting Issues

Forestry

No assessment of the impact of climate changes on Orissa's forests has yet been undertaken using the latest range of climate scenario- further there are the uncertainties about the future of the monsoon in all the models. At a national level past studies have indicated that whilst Orissa's forest areas are not the most vulnerable, within 50 years,

most of India's forest biomes seem to be highly vulnerable to the change in climate. The forestry community nonetheless needs to evaluate the long-term effects of climate change on forests and determine what the community might do now and in the future to respond to this threat. A large fraction of these forests in Orissa are degraded and offer itself well for large scale afforestation/ reforestation.

Urban

Creation of sustainable habitats is a big challenge in urban areas. This will bring down emission levels substantively. Also, energy use by the urban local bodies for applications such as water/sewerage pumping and street-lighting is considerable. Large scale energy savings are possible and will contribute towards mitigating carbon emissions. At the same time, intense, heavy precipitation in cities and towns can cause flash floods for which the urban local bodies (ULBs) need to be prepared.

Sectoral Issues & Programme of Key Priorities

4.1 Agriculture

4.1.1 Introduction

Agriculture holds a predominant position in the state's economy. About 80-85% of the state's population is rural and virtually all depend on agriculture. Rice dominates the crop area (about 75%) and is also the main kharif crop. Farmers diversify the cropping pattern from up land paddy to pulses and oilseeds during Kharif. Predominantly farmers cultivate vegetables and low duty crops in Rabi. Having 10 different agro-climatic zones due to large variations in physiographic and topographic conditions, there are differences in agricultural practices across the state.

About 60% of land is devoted to rain fed agriculture, which is characterized by low productivity, low income, low employment

Table 4.1: Agriculture Key Statistics

S.No.	Title/Description	Particular Data/ Information
1	Agriculture's & Animal Husbandry sectors' contribution to the economy	21.11% of the Net State Domestic Product (NSDP)
2	Employment	70% of state's population
3	Topography, climate and soil types	10 different agroclimatic zones
4	Total rainfall	1,451.20 mm (Monsoon rainfall is 1144.30 mm, i.e. 79% of total rainfall between June & September)
5	Main crop	Rice or paddy (Kharif)
6	Dependence on rainfall	High

Source: Agricultural Statistics, 2006-2007 and 2008-09.



with high incidence of poverty. Rainfall pattern in these areas is highly variable leading to moisture stress during critical state of crop production. These are hotspots of poverty, malnutrition, food insecurity and prone to severe land degradation.

Given that the agriculture is largely rain fed, the behavior of the monsoon has the potential to impact the prevailing systems and practices in a negative way. Climate projections indicate that there will be a change in the intensity and frequency of rainfall across the country. This will impact agriculture in Orissa adversely. From the grassroots, there have been reports of problems, e.g. germination, due to the variability in rainfall. Other problems such as pest and disease outbreaks are also likely due to climate variability. The agriculture sector needs to adapt and cope to the impending climate change implications.

Under the NAPC, there is a separate National Mission on Sustainable Agriculture. This Mission aims to make Indian agriculture more resilient to climate change. The focus is on rain-fed agricultural zones. The suggested approaches include (i) Development of drought and pest resistant crop varieties, (ii) alternative cropping patterns and on specific aspects that include, (iii) Improving methods to conserve soil and water, (iv) capacity building and support to farmers, and (v) safeguarding farmers against increased climate change risks.

The key priorities identified in the Orissa context fall in line with these national policy directions. The rest of this section outlines the various key priorities pertaining to agriculture. Fisheries and Animal Resources are identified as an independent sector and addressed in a separate section.

4.1.2 Rapid screening and strategy assessment of State Agriculture Policy

Agriculture is one of the key sectors that will be affected due to climate change. While that is clear, there is still a lot of uncertainty regarding the nature of the impacts as these are dependent on different climate scenarios of rainfall and temperature. Empirical weather data will also be used to provide the

bottoms-up perspective and that will lead to substantiate the possible climate scenarios for Orissa. It is in this context of these scenarios that a rapid screening and strategic assessment of the State Agriculture Policy and associated implementation approaches will be done. This will lead to identifying modifications that will be required to cope with climate change.

4.1.3 Establishing an effective institutional delivery mechanism to promote best practices on climate change

In the years to come, the agriculture sector in Orissa needs to constantly cope with implications of climate change. The location, nature and scale of the impacts cannot be accurately predicted. At the same time, when these impacts occur, there is a need to respond. Therefore, an institutional delivery mechanism will be established to promote climate change adaptation measures. This will be in the nature of strengthening existing delivery mechanisms through the different executive wings, i.e. Directorates of Agriculture, Horticulture, Soil

Agriculture - Key Priorities

1. Rapid screening and strategy assessment of State Agriculture Policy
2. Establishing an effective institutional delivery mechanism to promote best practices on climate change
3. Undertaking capacity building
4. Continuing the livelihood-focused, people-centric integrated watershed development in rain fed areas
5. Increasing the area under perennial fruit plantation
6. Developing water use-efficient micro irrigation methods and individual / community farm ponds
7. Improving monitoring and surveillance techniques
8. Developing sustainable soil, water and crop management practices
9. Breeding studies on major crops for tolerance / resistance
10. Conducting climate-linked research studies

Conservation and Watershed Development Mission. The outcomes of the analysis of weather data to identify trends in climate variability and related weather-based knowledge services will reach the farmers through cluster-level climate change resource centers. Farmers will be able to make more informed decisions with the information that reaches through these strengthened delivery mechanisms.

4.1.4 Undertaking capacity-building

Climate change is a new challenge that is confronting the agriculture sector. Substantive capacity building will be required for primary and secondary stakeholders for the better management of land and water in the context of climate risks. Technical and capacity building support to Community-Based Organizations (CBOs), extension officers and farmers will have to be provided on a continuous basis. Information dissemination on climate change - through the use of the Gram Panchayat Training hubs - will be constantly required. These initiatives will be implemented across the state.

4.1.5 Continuing the livelihood-focused, people-centric integrated watershed development in rainfed areas

Climate change is likely to cause high variability of rainfall, drought and dry spells and flash floods during the rainy season.

At the grassroot implementation level, the integrated watershed approach is the most appropriate way to cope with these changes. The approach brings together livelihoods focus, is people-centric, is socially inclusive and is poverty targeting. Both agricultural growth and enhancement of land productivity is ensured in these rain fed areas that are vulnerable to climate variations. Livelihoods interventions are implemented in the form of cropping system strategy, pisciculture, livestock promotion, non-wood forest production collection, marketing and various other land-based income generating activities. As a part of the livelihoods intervention, steps are also taken to improve the quality of life through improved sanitation and other health interventions. There is enough evidence of successes in implementing projects under the Orissa Watershed Development Mission (OWDM). There will be a continued investment in integrated watershed development programmes in climate sensitive areas and in furthering their replication across Orissa.

4.1.6 Increasing the area under perennial fruit plantation

With the predicted increase in the vagaries of climate/weather, the horticulture sector will have to look towards establishing areas for perennial fruit plantation. Promoting of fruit plantation will also lead to enhancing carbon sinks. Based on the implementation



experience, plans to replicate across other fruit-growing areas of the state will be made.

4.1.7 Developing water use-efficient micro irrigation methods and individual/community farm ponds

Water availability is expected to become uncertain due to climate change. This will require the development of water-use efficient micro-irrigation methods such as different drip irrigation systems and individual/community farm ponds to cater to their water requirements. This initiative will be implemented as a demonstration project in selected areas. Here again, following the implementation experience, plans to replicate across other fruit-growing areas of the state will be made.

4.1.8 Improving monitoring and surveillance techniques

Climate change is likely to delay the onset of monsoons as well as bring greater pest and disease attacks on crops. Improved monitoring is therefore required. Deciding on appropriate cropping, strengthening of pest surveillance, building response capacity through training, proactive measures for plant protection and introducing appropriate new farming techniques will be undertaken as a part of this



initiative.

4.1.9 Developing sustainable soil, water and crop management practices

In the context of adapting to climate change, there will be need to improve soil management through integrated nutrient management, residue incorporation, minimum tillage and other related measures. More efficient water management will also be required as the vagaries of weather will control the water availability. In addition, crop management practices will also have to be strengthened to cope with drought proofing, reduced submergence damage and other climate/weather extremes. Under this initiative, all of these aspects will be addressed.

4.1.10 Breeding studies on major crops for tolerance /resistance

Increased temperatures, possible submergence due to floods and occurrence of drought conditions necessitates breeding studies for tolerance resistance. Under this initiative, research will be conducted to identify genotypes of rice, green gram, black gram and other agricultural crops that have specific resistance to multiple stresses. Once these research studies show conclusive results, follow-up initiatives to promote the more tolerant varieties will be undertaken.

4.1.11 Conducting climate-linked research studies

Given the unknowns and uncertainties associated with climate change, research will be a focus initiative. Research will lead to strengthening preparedness to tackle emerging scenarios of pests, increased production of rice seeds under various weather scenarios and establishing climate risk management services and piloting weather-based crop insurance.

4.2 Coasts and Disasters

4.2.1 Introduction

The state of Orissa has an extensive coastline measuring 480 kms, bestowed with rich diversity of mangroves, sea grasses, salt marshes, sand dunes, estuaries, lagoons, and unique marine and coastal flora and fauna. Chilika and Bhitarkanika are two important coastal wetlands and Ramsar sites. Chilika is the largest wintering ground of migratory avian species of Asian subcontinent. The largest rookery of Olive Ridley Sea turtles is located at Gahirmatha. These sites are full of creeks and swamps that have great ecological and socio-economic significance. The coast is also known for highly diverse mangrove or tidal forests. These are found in the delta areas of the Mahanadi, Brahmani and Baitarani rivers, and their tributaries. This unique coastal biodiversity of Orissa is under severe threat due to various biotic and ecological pressures. Climate change has the potential to further worsen.

Climate-mediated disasters such as cyclones are expected to increase in intensity and frequency. The Orissa State Disaster Management Authority (OSDMA) is responsible to deal with all issues pertaining to disasters. The Authority has the mandate to cover the entire gamut of disaster management that includes risk reduction, relief, restoration, reconstruction and other

Table 4.2: Coasts & Disasters Key Information

S.No.	Description
1	Extensive coast line of 480 Km .
2	36% population of the state live in 9 coastal Districts.
3	Two unique coastal wetlands of International importance i.e. Chilika and Bhitarkanika are located along the coast.
4	About one third of cyclonic disturbances in Bay of Bengal hit Orissa coast.
5	Five cyclones in Bay of Bengal each year
6	Tsunami threat from the seismic disturbances at Indo-Australian plate boundary
7	Situated in Zone-3 (Moderate damage risk zone) in Seismic Hazard Map of Vulnerability Atlas of India published by Government of India
8	Floods in 11 major river systems of the State including Mahanadi system
9	The coastal ecosystem is vulnerable to global warming and sea level rise.

Source: OSDMA

measures. It also coordinates with the line departments whose support is required in dealing with various aspects of disaster management. This Authority was established after the super cyclone in 1999 and, over the last decade, has established itself in preparing, planning and tackling a range of disasters. The



establishment of the OSDMA has been the model for other states as well as the National Disaster Management Authority.

Even though the NAPCC does not have a separate National mission on coastal protection and disasters, this is vitally important for Orissa as it has a 480 km coast line that comprises rich biodiversity and is also frequently subject to extreme weather events. Key priorities in this sector have been identified and are covered in the rest of this section.

4.2.2 Coastal Zone Management

For sustainable management of coastal zone of the state, a World Bank assisted Integrated Coastal Zone Management Project (2010 - 2015) would be implemented. Orissa Coastal Zone Management Authority also looks after proper addressal of CRZ issues.

4.2.3 Flood mapping, flood forecasting and downscaled climate change projections modeling

With climate change, extreme cyclonic events are expected to increase in frequency and intensity. This can lead to coastal flooding. To prepare for these situations, flood modeling - mapping and forecasting - will be extremely useful. This needs to be done through the downscaling of the global circulation models as pertaining to the Orissa coast. As a part of this initiative, such modeling studies will be undertaken. Once in place, these models will be used to strengthen preparedness.

Coasts & Disasters - Key Priorities

1. Flood mapping, flood forecasting and downscaled climate change projections modeling
2. Assessment of erosion prone areas with the help of Digital Elevation model
3. Studying coastal erosion
4. Conducting micro-level vulnerability assessment
5. Constructing flood shelters in unconventionally vulnerable locations
6. Needs assessment and constructing multipurpose cyclone shelters
7. Developing a hydrological framework
8. Dredging and river mouth widening to improve flood management
9. Strengthening coastal protection methods
10. Developing a techno-legal regime for construction of disaster resilient housing and public infrastructure
11. Integrating climate change risk in the state's disaster management policy
12. Setting up an integrated training and capacity building protocol
13. Assessment of risks due to lightning and thunderstorm
14. Improving flash flood management
15. Prediction through appropriate modeling the impact of sea level rise on coastal ecosystem
16. Study of impact of global warming on the biodiversity of coastal ecosystem with special emphasis on flagship species



4.2.4 Assessment of erosion prone areas with the help of Digital Elevation model

Orissa experiences coastal erosion sea level rise, extreme weather events and storm surges are expected due to climate change. These may worsen the coastal erosion. It is in this context that the assessment of erosion prone areas using the Digital Elevation Model will be done. More precision is required in identifying the erosion-prone areas and also in determining appropriate methods to protect these areas. This assessment will be done in selected stretches of the identified erosion-prone areas. Once the assessment is done and appropriate methods are determined, capacity building and awareness generation of the coastal communities will also be undertaken.

4.2.5 Studying coastal erosion

Increasing coastal erosion due to sea level rise and related sea behaviour is already seen along the coast of Orissa. To gain a better understanding of the micro and meso-level effects, a special study will be done. This will focus on the coastal settlements and public infrastructure (e.g. roads). Based on the outcome of this study, further plans will be made to strengthen approaches to manage the coastal erosion problem.

4.2.6 Conducting micro-level vulnerability assessment

Different state resources like housing, public infrastructure, agriculture land, livelihood issues are likely to be affected due to extreme weather events that climate change is expected to induce. Also, socio-economic implications on different population groups will have to be considered. In this regard, a micro-level vulnerability assessment will be conducted on a pilot basis. Based on the outcomes of such a vulnerability assessment, further planning across the state will be initiated.

4.2.7 Constructing flood shelters in unconventionally vulnerable locations

In general, one would not expect traditionally dry areas to confront floods and water logging. However, with climate change, the possibility of such extreme swings in

weather conditions is being predicted. In that context, construction of flood shelters in unconventionally vulnerable locations and capacity building of the community to face the changing weather patterns is required as a part of climate change adaptation. This will be accomplished under this initiative.

4.2.8 Needs assessment and constructing multipurpose cyclone shelters

Through various funding sources projects from World Bank aided National Cyclone Rehabilitation and Management and Integrated Coastal Zone Management Project (Orissa), construction of multipurpose cyclone shelters in the cyclone prone areas of the state is being done. This includes the provision of emergency equipment to the cyclone shelters and strengthening the capacity of the local people for disaster management. With the project increase in climate-induced extreme cyclone events, preparedness in terms of cyclone shelters is required. This will be done under this initiative.

4.2.9 Developing a hydrological framework

Water is a central climate change adaptation issue. In this regard, developing a hydrological framework with legally binding connotations is required. Identification, protection and rejuvenation of traditional water bodies, natural drainage channels and moribund river channels will be necessary. Ground water conservation/replenishment through the development of watershed both in semi-arid and rain fed areas is also required. All of these will be identified under the overall hydrological framework that will be developed.

4.2.10 Dredging and river mouth widening to improve flood management

Erratic and intense pattern of rainfall/precipitation due to climate change is likely to worsen the flood and water logging situation. Dredging and widening of river mouths is essential to facilitate efficient discharge of floodwater to the sea would address this problem. Under this initiative, selected locations will be identified for dredging and river mouth widening.

4.2.11 Strengthening coastal protection methods

The natural vegetation shelterbelt plantation and mangroves act as a bio-shield for protection of coastal area, there is need for further expanding these entities. Changes in cropping patterns in the coastal districts will also need to be kept in view. Utilization of traditional knowledge and adaptive mechanisms already available with the community, need to be institutionalized in a systematic way to assist in adapting to climate change.

4.2.12 Developing a techno-legal regime for construction of disaster resilient housing and public infrastructure

Occurrence of more frequent and more intense extreme weather events - predicted due to climate change - is bound to have negative impacts on housing and public infrastructure. This can be due to extreme heat events, flooding of non-flood prone areas and coastal erosion. To manage these impacts on properties, a techno-legal regime is required for disaster-resilient construction. This will be developed under this initiative.

4.2.13 Integrating climate change risk in the state's disaster management policy

Climate change is expected to induce more frequent and more intense extreme weather events. In this context, the existing disaster management policy needs to be strengthened to deal with them. Under this initiative, a robust framework with a proactive and multi-hazard approach to disaster management will be developed.

4.2.14 Setting up an integrated training and capacity building protocol

Climate change implications require an integrated response. To enable such a response, integrated training and capacity building will be required. An integrated protocol will be necessary. Raising awareness of community and stakeholders on the implications on agriculture, livelihoods support and disaster preparedness will be required and will be done under this initiative.

4.2.15 Assessment of risks due to lightning and thunderstorm

There is a marked increase in frequency of death due to the natural calamity i.e. lightning and thunderstorm. There is possibility of increase of frequency of lightning and thunderstorm due to climate change. A scientific study is required in this context. Under this initiative, an elaborate scientific study would be carried out for planning appropriate measures.

4.2.16 Improving flash flood management

Climate change is expected to bring heavy, intense and unexpected precipitation that will cause flash floods. Under this initiative, potential locations for possible occurrence of flash floods will be identified across the state. Wherever viable, check dams will be constructed to contain flash flooding in high gradient river basins due to extreme precipitation.

4.2.17 Prediction through appropriate modeling the impact of sea level rise on coastal ecosystem

The predicted sea level rise due to climate change has the potential to impact adversely on the unique coastal ecosystems. Research studies will be done using appropriate modeling to generate different scenarios pertaining to Chilika. This will include the generation of low series and the prediction of the changed salinity regime, salinity flushing, upstream breeding migration, impact on the lake fishery and biodiversity through modeling. Possible changes in the migration trends through the inlet of Chilika due to climate-mediated coastal processes will also be studied as 75% fish fauna of Chilika Lake are migratory in nature.

4.2.18 Study of impact of global warming on the biodiversity of coastal ecosystem with special emphasis on flagship species

There is a likelihood of climate change impacting the unique mangroves - a flagship biodiversity species - of coastal Orissa. With a focus on the Bhitarkanika mangrove system, modeling studies will be done to predict the impact on the mangrove diversity. Using the findings of these studies, further biodiversity conservation measures will be planned to protect the flagship species from climate change impacts.

4.3 Energy

4.3.1 Introduction

The State of Orissa is on a rapid development and its energy needs will be rising significantly over the coming decade.

Presently, the average demand for energy is about 2,500 MW and the peak demand is about 3,200 MW. This demand is constantly increasing with the State finding it difficult to meet its energy. In the next 2-3 years, the average demand is likely to increase by another 1,500 MW and the total average demand will be 4,000 MW. This additional demand is due to extending grid connectivity to most of non-grid locations. In parallel, the demand from industry - a key component of the rapid development path - will also increase significantly.

To meet the growing needs, GoO has treaded on an aggressive path to generate more power. The installed generation capacity is about 2,965 MW with hydel being about 2,085 MW and thermal (coal) being about 880 MW. In the next 5 years, another 4,000 MW will be added so as to meet the average demand in the same time frame. In the last 2-3 years, as many as 27 MOUs have been signed for an additional 35,000 MW. In addition, NTPC is planning 3 power plants (total of 7720 MW) for their national grid and three ultra-mega power plants (total of 12,000 MW). The state government through its own PSUs is planning to add 3120 MW. As things are proceeding on course, about 58,000 MW of power will be generated in the next 7-8 years in the state. Once this generation capacity is established,

Table 4.3: Energy Demand & Supply

Year	Demand of power (MW)	Supply/ Generation of power (MW)	Transmission & Distribution Loss %
2003-04	1422	1815	40.75
2004-05	1488	2025	39.21
2005-06	1631	2261	39.59
2006-07	1792	2154	38.57
2007-08	2064	2390	37.48
2008-09	2256	2289	37.50
2009-10	2550	2260	NA
2010-11 (approx)	2600	2250	NA

Source: Energy Department



Orissa will become self - sufficient and also contribute to the National Power Grid. Not only will Orissa but also the whole of India will benefit from the power generated in Orissa. In the coming decade, the present mix of more hydel power will change significantly to more thermal (coal)-based power. In fact, the hydel power will become a small proportion of the overall mix. This will cause substantive stress on the local environment and natural resources, particularly water.



Apart from water, there will also be a huge generation of fly ash, which is already causing a major disposal problem.

Transmission and distribution losses are one of the highest in the country. It is estimated that between 600-900 MW of power can be saved. Stoppage of these losses will go a long way in meeting the present demand - supply gap and in establishing sound energy management practices. Also, promoting energy - efficiency and demand side management in the user industries can also bring about a saving of about 500 MW.

On renewable energy, hydro power is presently the largest contributor of power in the state. About 70% of the overall power production in the state and for the state is hydro power. However, further hydro power development has lagged behind. There is potential for more medium scale hydro power (90-150 MW per unit) and also for small hydro (10-25 MW per unit). The potential is about 2,400 MW and 150-200 MW respectively. At present 57 MW is generated from small hydel plants in the state and rest have not yet been harnessed. Also, solar PV power and wind power also have the potential of 1,40,000 MW and 1,70,000 MW respectively. Only some pilots have been done so far. There is also potential for bio-mass based power, municipal solid & liquid waste -based power. These are estimated to have the potential for 350 MW, 12 MW and 8 MW respectively. There are about 4,000 villages in the State, which need to have power from renewable energy sources as these villages cannot be connected by grid.

The energy sector in Orissa (both state supply and captive power) is going to be a large contributor to the carbon dioxide emissions. Assuming about 60,000 MW of power generation by 2020 and 5 million tons of carbon per 1,000 MW, the local carbon emissions will be 300 million tons of carbon per year. Over a 30-year period, this will be about 9 billion tons of carbon. This is a large contribution from a single Indian state. Recognizing this situation on the one side and realizing that energy is vital to meet the

Energy - Key Priorities

1. Generating cleaner energy through clean coal approaches
2. Institutional development of the Energy Department
3. Reducing transmission and distribution (T & D) losses
4. Promoting demand side management (DSM) and energy efficiency
5. Encouraging effective fly ash utilization and emission reduction
6. Promoting of small and medium hydel plants
7. Harnessing the biomass potential
8. Promotion of grid based wind power generation
9. Maximizing solar power generation
10. Developing bio fuels

development needs, GoO will proceed on a carbon-conscious development path. Key priorities were identified and constitute the rest of this section.

4.3.2 Generating cleaner energy through clean coal approaches

Moving to clean coal approaches will reduce carbon emissions and requires a shift in the policy framework. The following policy initiatives will be implemented: (i) Switch over from sub- critical technology to super-critical technology by which coal consumption will reduce from 1 MT to 0.88 MT per MWh and increase in plant efficiency from 37% to 42%, (ii) Encourage more gas-based Combined Cycle Power Plants where CO₂ emission is 0.46 and which can be reduced to 0.25 per MWh, (iii) Washed coal to be used by the Independent Power Producers (IPP) and Captive Power Producers (CPP) for the generation of power if ash content in coal exceed 40 %, (iv) Use of fluidized bed boiler and coal gasification. This will utilize the mines' rejects and washery rejects for power generation, (v) Improvement of boiler efficiency through combustion optimization by installation of dynamic coal flow balancing system with continuous online residual carbon analyser in the boilers, (vi) Promoting merchant power plants in existing

industrial units with variable Power Purchase Agreement option, (vii) Develop state level energy efficiency standards for various sectors adopting Energy Conservation Building Code (ECBC) and (viii) Existing thermal power plants to conduct Life Cycle Analysis of their plants as per CEA benchmark and implementation of rehabilitation and modernization measures to improve the efficiency.

4.3.3 Institutional development of the Energy Department

To meet the rising challenges, both capacity building and restructuring of the Energy Department will be required for implementing policies and conducting studies. This will include the following: (i) Functional reorganization and capacity building of the Energy Department including the Energy Conservation Cell, Orissa Electricity Regulation Commission (OERC), Orissa Renewable Energy Development Agency (OREDA), creation of separate cell for small & medium hydel plants to have a coherent road map to achieve efficient functioning and implementation of energy efficiency, energy conservation, promotion of renewable energy, (ii) Integrated super critical (660 MW) IPP Policy (Coal Washeries, Fly Ash based cement and brick plants) with a minimum unit size for the purpose of IPP/MPP, which should not be less than 300 MW to achieve minimum standards of efficiency, (iii) Revised RPO based on the changing load mix and assessment of evacuation Infrastructure, (iv) Conducting a study for determining the state's emission intensity, (v) Develop an operational plan for the Fund that will get revenue for the sale of power that is exported, (vi) Feasibility study for the establishment of coal-based thermal power plants along coast of Orissa, use of saline water and dedicated rail corridor for coal transportation to be conducted, (vii) Feasibility of implementing emerging clean coal technologies through pilot projects in Orissa and (viii) Training of the members of working group or their representatives of different departments and organizations on sector specific climate change issues. All of these have a direct or indirect bearing on the carbon emissions from this sector.

4.3.4 Reducing Transmission and Distribution (T&D) losses

The reduction of T & D losses will continue to be a focus for reducing carbon emissions. An operational plan for the targeted reduction of losses (estimated to be 40%) due to pilferage and outdated systems will be developed. This will include the augmentation of T & D infrastructure and investment plan, enhancing present practices for improved load management and feasibility study of evacuation corridors.

4.3.5 Promoting Demand Side Management (DSM) and energy efficiency

DSM and energy efficiency will reduce the demand for energy and therefore reduce carbon emissions. Under this initiative, a comprehensive policy and plan to save energy use in order to reduce the demand-supply gap and contribute towards climate change abatement will be done. This will include the following activities: (i) Implementation of utility level DSM measures, (ii) Awareness Generation for Energy Conservation, (iii) Promotion and implementation of the National Bureau of Energy Efficiency's adopting the ECBC for widespread adoption in the state to reduce the energy consumption in buildings, and (iv) For proper energy monitoring, capacity building of energy auditors, strengthening of existing Energy Conservation Cell under the Energy Department supported with manpower and infrastructure.

4.3.6 Encouraging effective fly ash utilization and emission reduction

For effective fly ash utilization and emission reduction (both carbon and particulates) from power plants, there is a necessity of capacity building of State Pollution Control Board. Under this initiative, the following policy actions/studies will be done: (i) Compiling information from the several studies and initiatives that have been done on fly ash and developing an operational plan for effective utilization of fly ash, and (ii) Installing of equipment at the IPPs/CPPs for Nitrous Oxides (NOx) reduction.



4.3.7 Promoting of small and medium hydel plants

Promoting hydel power will reduce generation from thermal and therefore bring about carbon emission reduction. This initiative will be mostly location specific, i.e. hydel power plants will be established wherever the resources and conditions are favourable. At present, about 118 micro, mini and small hydro projects (up to 25 MW) have been identified on canal drops and run of the river sites with a total capacity of about 350 MW. Besides there are several locations where off-grid hydel power plants can be located to supply energy to surrounding villages. This initiative will undertake a range of activities that will promote hydel power plants: (i) Identification of sites for both on grid and off grid applications, (ii) Survey and investigation, (iii) Preparation of pre-feasibility reports, (iv) Selection of entrepreneurs, (v) Creating an enabling policy framework for providing clearances, (vi) Building capacity of Government by creating a separate cell under Energy Department and capacity building of stakeholder organizations, (vii) Establishing demonstration/pilot projects if required and (viii) Promoting investment projects.

4.3.8 Harnessing the biomass potential

Promoting on-grid and off-grid biomass power projects will reduce the use of coal based power and hence lower carbon emissions. Under this initiative, the following will be done to harness the biomass potential to the maximum: (i) Study of the existing policy and develop investment friendly policy to promote additional biomass application,

(ii) Conducting a detailed feasibility study for scoping biomass-based project, (iii) Developing a biomass supply chain involving agro, agro industrial and other biomass resources including dedicated energy plantation, (iv) Promoting biomass based gasifiers project in agro based industries, (v) Raising awareness, (vi) creating a conducive scenario for investment and (vii) implement demonstration/pilot projects if required.

4.3.9 Promotion of grid based wind power generation

Like any other renewable source, carbon emissions will be reduced through the commensurate reduction of conventional power use. Under this initiative, wind resource assessment will be done, areas will be developed as wind farms, a promotional policy framework will be developed, demonstration projects established and hybrid wind-solar plants on degraded hill slopes along with greenbelt development will be explored. The required activities such as pre-investment studies, infrastructure development and promotional awareness generation activities will be done.

4.3.10 Maximizing solar power generation

To the extent of solar power generated, the use of coal-based power and therefore carbon emissions will be reduced. Under this initiative, the state will promote both solar photovoltaic as well as solar thermal. An increase in the market penetration of stand-alone solar systems for use by institutions,



communities and individuals is proposed. A range of activities - required promotional policy initiatives, survey and investigation studies to identify appropriate sites, feasibility reports, demonstration projects, awareness and capacity building, and strengthening the manufacturing base will be done. This will also consider generating solar power in the overburden dumps of open cast coal mines. All of these will lead to generating more solar power in the state.

4.3.11 Developing bio fuels

Blending of conventional fuels with bio-fuels will lead to reduce fuel use and therefore carbon emissions. Capacity of biogas

production in the state needs to be enhanced. To enhance the capacity of generation of bio-fuel, seeds to be harvested and oil extracted prior to making them available for blending. Under this initiative, the different activities relevant to promoting establishment of more biogas plants, the supply chain for bio fuels will be done. This will include the identification of land for cultivation, building the capacity of the farmers/entrepreneurs for raising plantations, promoting the establishing of oil extracting units and linking up with the blending infrastructure. Through these initiatives, the increase in the use of bio fuels and the associated reduction in conventional fuels will be the outcome.

4.4 Fisheries and Animal Resources

4.4.1 Introduction

Animal husbandry is a land-based activity, which is practiced in rural Orissa. This promotes rural incomes, does not require much infrastructure and capital for their sustainability. The key concern is the methane emissions from the livestock. Today, the livestock are largely fed through grazing, i.e. natural feeds. Given the paucity of grazing land, there is a trend towards concentrated feeds. The level of methane emissions from livestock living on concentrated feeds is significantly higher than those fed through natural grazing. Given the relatively higher global warming potential, there is carbon dioxide equivalent of the methane emissions could become high due to the shift to concentrated feeds. In addition, the prevailing livestock practices are such that the generation of methane emissions is not arrested. The other concern of the state is that there is a large population of unproductive livestock. Due to religious/cultural ethos, the unproductive livestock are retained till their natural lifetimes. The methane emissions from the unproductive livestock are also a concern.

Orissa endowed with water resources in the form of reservoirs that offer itself for exceedingly well for inland fisheries. There is immense potential in closed water bodies, e.g. ponds and tanks (freshwater and brackish),

Table 4.4: Fisheries and Animal Husbandry Key Statistics

S.No.	Description / Particulars			
A	Fisheries Sector			
A1	Coastal Fisheries			
1	Coast line	480 Kms		
2	Continental shelf area	24,000 Sq.Kms		
3	MSY (Continental Shelf area)	160,931 Million T/annum		
4	Marine fishermen	1,73,197		
A2	Inland Fishery			
5	Culture in tank and pond	Water spread area	Production potential	Current production
		1.18 million ha	2.59 million tonnes	1.33 million tonnes
6	Total fish production of the State	2,89,210 M.T.		
7	Import	35,706 M.T.		
8	Export	81,569 M.T.		
9	Inland fishermen	6,61,477		
10	Total fishermen	8,34,674		
B	Animal Resources Sector			
1	Cattle population of Orissa	1,42,80,559		
2	Total Live stock population of Orissa	2,40,22,206		

Source: Fisheries and Animal Resources Sector



and open water bodies like reservoirs, rivers, estuaries, lakes, lagoons, canals and swamps for sustainable aquaculture. In addition, it has a 480 km coast line that is a tremendous resource for brackish and marine water fishery. Fishery outputs contribute to the food and nutritional security of the coastal community. However, fish production in Orissa is among the lowest in the coastal states even though the state has immense potential. Being water dependent, the fisheries sector will be impacted by climate change though no directly attributable impacts have been recognized so far. Erratic rainfall is relevant in the context of open reservoirs and ponds / tanks, risk in sea level and the climate-mediated hazards is relevant in the context of coastal fishing will influence the reservoirs and impact fisheries livelihoods. The global warming can affect the spawning and breeding migration of the fish.

Fisheries and Animal Resources Department is responsible for this sector in Orissa. Key priorities identified in this sector are covered in this section.

4.4.2 Continuing ongoing programmes - vaccination, green fodder development, training / capacity building and conservation of local hardy animals

Climate change will have implications to the animal husbandry sector as a whole. Therefore, the ongoing programmes in animal husbandry will be integrated to incorporate climate change considerations. These include (i) vaccination against contagious diseases, (ii) deworming and early disease warning system, emphasis on Green fodder, pasture development and grazing, (iii) Training on fodder production, fodder conservation, rotational grazing, Rain Water harvest technology, Methane gas harvesting technology, biogas tanks management and (iv) conservation of local hardy animals.

4.4.3 Gobar Gas tanks/packing to cylinders

Methane from livestock is a greenhouse gas. Having a large greenhouse gas potential, capturing its release and ensuring their use will result in reducing the net emissions.

Fisheries and Animal Resources - Key Priorities

1. Vaccination against contagious diseases,
2. Deworming and early disease warning system, emphasis on Green fodder, pasture development and grazing,
3. Training on fodder production, fodder conservation, rotational grazing, Rain Water harvest technology, Methane gas harvesting technology, biogas tanks management
4. Conservation of local hardy animals.
5. Gobar Gas tanks/packing to cylinders
6. Easy and handy Methane Harvest at farmers point
7. Enhancing Disease Early Warning Systems with climate change considerations
8. Application of biotechnology and skilled animal breeding for development of better adopted species
9. Capacity building of livestock keepers
10. Research on disease early warning system relevant to livestock
11. Impact of climate change on inland and coastal aquaculture
12. Development of infrastructure for early warning systems in coastal areas for fishers

Under this initiative, compressing and packing gobar gas in cylinders like CNG will be piloted or attempted on a demonstration basis. From the results of this pilot/demonstration, scaling-up of this initiative across the state will be considered. This initiative will be done as a collaborative initiative of the



Energy Department and the Khadi & Village Industries.

4.4.4 Easy and handy Methane Harvest at farmers point

Capturing methane at the point of its generation introducing harvesting technologies and involves revamping the operational practices. This needs to be done across the state. As a part of this initiative, easy and handy methane harvesting technologies and practices will be introduced on a pilot basis in selected farmer locations. Based on the experiences, plans for replication will be made across the state.

4.4.5 Enhancing Disease Early Warning Systems with climate change considerations

Changes in climate can lead to the occurrence and prevalence of new diseases for which greater vigil is required. Under this initiative, an enhanced disease early warning system will be put in place. Ongoing research being done - both within the national and internationally - will be studied to extrapolate lessons for the Orissa context. This research will form the backbone of the disease early warning system.

4.4.6 Application of biotechnology and skilled animal breeding for development of better adopted species

To adapt to climate-induced concerns such as disease outbreaks, there is a need develop more hardy species. Conservation of genetic pool of local hardy animals will form a part of the approach towards breeding management. Mapping and documentation of local hardy animals will form the basis for formulating the breeding strategies. Application of biotechnology and skilled animal breeding practices will also be done. All of these will constitute this initiative, which will be done in targeted areas to begin with. Based on the results, this will be expanded to other areas within the state.

4.4.7 Capacity building of livestock keepers

In the context of climate change, a range of capacity development training would be



required to re-orient livestock keepers to more responsible practices. The training will need to cover fodder production, fodder conservation, rotational grazing, rainwater harvest technology, methane gas harvesting technology and biogas tank management. This will be hands-on training that will also include self-execution. About 2,000 farmers will be trained every year and about 10,000 farmers over a 5-year period.

4.4.8 Research on disease early warning system relevant to livestock

Climate change may have implications for livestock development in the state through the outbreak of diseases. To reduce the magnitude of casualties, there is a need to better understand the inter-linkage between weather / climate variations and diseases. Data will be collected, models will be developed and analysis will be made to determine the linkage. Under this initiative, a particular area will be selected for closer study / research. Based on the outcomes, the relevance of the findings will be extrapolated to across the state.

4.4.9 Impact of climate change on inland and coastal aquaculture

State-wide management methods of marine fishery resources will have to be reviewed through a climate change lens. There is likelihood of changes in fishing grounds and migratory habits due to climate change. The hatchery would be affected due to rise in ambient temperature. Management methods need to be adapted to suit the climate-induced scenarios. Under this initiative, such a study will be done to modify and strengthen management methods.

4.4.10 Development of infrastructure for early warning systems in coastal areas for fishers

Climate change is expected to result in more frequent and more intense coastal hazards. For the coastal fisherman, there is a need to receive information so that they can plan their fishing activities better and also take measures to protect their properties. Under this initiative, the early warning systems will be improved to safeguard their lives and properties.

4.5 Forestry

4.5.1 Introduction

The State has a total recorded forest area of 58,140 sq km. Out of this, there is forest cover (above 10% canopy density) over 48,855 sq km, which is about 31% of the state's geographical area. It has dense forest (canopy cover more than 40%) of 28,467 sq km and open forest (canopy cover 10 to 40%) of 20,388 sq km. As is true across India, there is tremendous pressure on the forests. On the one hand, climate change will add to these pressures and forest management will become a greater challenge. On the other hand, climate change could also serve as an excellent opportunity to arrest forest degradation and develop more forest cover (and carbon stocks / sinks) through afforestation and reforestation measures.

Forestry sector is particularly important both from climate mitigation as well as adaptation perspectives. Reducing emissions from deforestation, building larger carbon stocks / sinks through afforestation and reforestation pertain to mitigation. Planting mangroves along the coastal belts, and doing forest plantations as part of soil and water conservation in watersheds pertain to climate adaptation.

Availability of funds from CAMPA has enhanced the allocation in the forest sector, which has enabled substantially larger programmes on afforestation and protection measures.

Under the NAPCC, there is a separate National Mission for a Green India. This mission recognizes that forests constitute one of the most effective carbon sinks, and

Table 4.5: Forests Cover in Orissa (Area in Sq Kms)

Year	Very Dense	Dense	Moderately Dense	Open	Mangrove	Total	Scrub	Tree Cover
1997		26101		20629	211	46941	5461	
1999		26073		20745	215	47033	5489	
2001		27972		20866	219	48838	5782	
2003	288		27882	20196	203	48366	5346	6381
2005	7077		21421	20257	217	48755	4797	4589
2007	7073		21394	20388	221	48855	4852	4435

Source: State of Forests Report





also that they play an indispensable role in the preservation of ecological balance and maintenance of biodiversity. Orissa's key priorities are in line with this National Mission. The rest of this section focuses on these key priorities.

4.5.2 Increasing reforestation/afforestation activities in degraded forest areas

There is tremendous potential to increase the carbon stock within the state. The canopy density of open and degraded forest of about 20, 000 sq km can be increased through assisted natural regeneration. In addition, there is about 10,000 sq km of forest land devoid of any forest growth. Such land can be identified and brought under forest cover. In total, there will be reforestation/afforestation over 30,000 sq km. In 2010, it is targeted to cover 2,500 sq km under this programme and 12,500 sq km will be covered in the next 5 years.

4.5.3 Protecting existing forest stocks to act as carbon sink with stronger conservation

Protecting existing forest cover/carbon stocks is as important as undertaking reforestation/afforestation. Recent Forest Survey of India (FSI) statistics revealed an increase of 100 sq km of forest cover in two years' period from 2005 to 2007. This is the result of stronger protection measures and people participation in forest conservation. These activities are to be continued with renewed vigor. All the

Forestry - Key Priorities

1. Increasing reforestation / afforestation activities in degraded forest areas
2. Protecting existing forest stocks to act as carbon sink with stronger conservation
3. Increasing planting on non-forest land and also exploring where new and increased tree planting could create barriers to storm and cyclone impacts in coastal zones
4. Covering bald-hills with suitable species mix
5. Increasing and protecting existing mangrove cover along the coast
6. Assessing fire management strategies
7. Improving tree planting and forest management to integrate with watersheds and water resources management
8. Working to establish new systems to support for community users.
9. Undertaking studies on indigenous trees species to assess their vulnerability to climate change
10. Assessing additional threats to biodiversity and wildlife
11. Obtaining access to updated knowledge on climate change science and policy developments
12. Capacity building of Panchayati Raj institutions/communities/JFM institutions to adapt to climate change
13. Monitoring carbon stock and biodiversity at regular intervals

current working plans will be revisited with a climate change lens. Carbon accounting at the beginning and end of the plan period will be integrated. Prescriptions for increased carbon stock will be formulated with stronger protection measures and community participation.

4.5.4 Increasing planting on non-forest land and also exploring where new and increased tree planting could create barriers to storm and cyclone impacts in coastal zones

There is vast scope for increasing the carbon stock by increasing planting on non-forest land such as orchards, trees on farm lands, roadside plantation, canal bank and irrigation projects. In addition, there is a 480 km coast line and shelterbelt plantations can protect against storms, cyclone and shifting sand dunes along the coast. Under this initiative, tree planting on these non-forest lands will be undertaken.

4.5.5 Covering bald-hills with suitable species mix

Scrub lands across Orissa are mostly bald-hills devoid of any appreciable forest growth.

Maximum such lands are available in Ganjam district (750 sq km), followed by Koraput (624 sq km), Rayagada (476 sq km), Kalahandi (475 sq km), Kandhamal (367 sq km), Gajapati (259 sq km), Nayagarh (225 sq km), Bolangir (221 sq km), Khurda (156 sq km) and others (1299 sq km). These are very difficult sites to raise plantations. Under this initiative, 5 sq km of bald-hills will be covered each year and 25 sq. km in 5 years.

4.5.6 Increasing and protecting existing mangrove cover along the coast

Mangroves act as excellent barriers against climate-induced extreme weather events such as cyclonic storms. Its protective role was evident in the super cyclone of 1999. While serving as a protection to humans, this unique coastal ecosystem in itself is the most threatened because of climate change. It also acts as a carbon stock. Orissa has 221 sq km of mangrove in the districts of Kendrapada, Bhadrak, Jagatsinghpur, Balashore and Puri. Under this initiative, the area under plantation will be increased and potential mangrove areas will be protected. 42 sq km of open and degraded mangrove areas will be





restocked with planting and assisted natural regeneration. With change in climate and sea salinity, there will be changes in species mix of mangroves in its habitats and it will affect the marine and terrestrial biodiversity. Under this initiative, it is also proposed to establish a mangrove study centre, which will take up research on mangroves and associated biodiversity vis-à-vis climate change.

4.5.7 Assessing fire management strategies

Forest fires are recognized to be a major cause of degradation of Orissa's forests even though statistical data on fire loss are weak. With the change in climate there will be increased forest fires as warmer climate means more fires, and more fires mean more greenhouse gases. It is therefore necessary to assess fire management strategies of Orissa in the face of climate change. Under this initiative, a strategy of fire forecasting, fire prevention and fire fighting will be developed. Modern technologies will be increasingly used to locate fire and in fire forecasting. Based on satellite imageries fire risk zones will be prioritized and monitored. Incentive-based community participation will be introduced.

4.5.8 Improving tree planting and forest management to integrate with watersheds and water resources management

Climate change will make weather less predictable, rains more uncertain and heavy storm rainfalls more likely. Soil and water conservation measures in watersheds will be taken up to control runoff, to conserve water and to harvest (excess) water. Some of the measures indicated here are drainage line treatment, contour trenches, check dams, percolation tanks, planting pits, etc. in the forested areas of the State. Improved tree planting will be taken up to conserve soil and moisture.

4.5.9 Working to establish new systems to support for community users

Climate change will be exacerbating the pressures on forest. In that context, it is required to reduce the existing pressures such as those caused communities dependent on Non-Timber Forest Produce (NTFP). Under this initiative, it is proposed to enhance capacity of communities to manage, to store under ambient conditions, to provide institutional credit and to create alternative market options (based on market information).

4.5.10 Undertaking studies on indigenous trees species to assess their vulnerability to climate change

Climate change is expected to have significant impacts on forest ecosystems. It is necessary to evaluate the long-term effects of climate change on forests and determine what to do now and in the future to respond to this threat. Adapting to climate change in the face of the uncertain timing of impacts means, a suite of readily available options must be available. A high priority will be coping with and adapting to forest disturbance while maintaining the genetic diversity and resilience of forest ecosystems. Research studies to address the issues of adaptation concerning tree genotypes particularly indigenous tree species suitable to Orissa will be undertaken.

4.5.11 Assessing additional threats to biodiversity and wildlife

Climate change poses a threat to wildlife because many species may be unable to tolerate the weather changes. Due to extreme weather conditions, there will be increased disturbance through fire and insects, reduced regeneration success and increased

competition from exotics (vegetation, insects, and diseases). Strengthening the resilience of plants and wildlife through the development of protected areas and wildlife habitat is necessary. The risk of floods, landslides, erosion and loss of ecosystem services will largely be reduced. As elephants require much larger areas of natural forest range than many other terrestrial mammals, they are often the first species to suffer the consequences of climate change. It is, therefore, proposed to maintain connectivity by linking forest fragmentations in a varied and dynamic landscape. There will be continuous monitoring of the ecosystem to determine when and what changes are occurring so as to take steps suitable for the conservation of biodiversity.

4.5.12 Obtaining access to updated knowledge on climate change science and policy developments

Climate change is likely to impact significantly forests and forest-dependent communities. In this context, a number of management questions must be addressed, e.g., (1) What research must be done





now to aid development of strategies for adapting to climate change? (2) What are the educational needs of the forestry community to increase awareness on climate change, and to facilitate adaptation? (3) What do we need to know to evaluate forest response to climate change? (4) What forest management actions could be taken now that does not compromise future responses? (5) What barriers exist to implementing adaptation in forest management? (6) What forest policies need to be in place to facilitate adaptation? (6) Are current monitoring systems adequate to spot problems induced by climate change soon enough to allow implementation of an acceptable response? (7) Which forest ecosystems and species will have to adapt autonomously and where can we intervene to assist adaptation?

To deliberate on these questions and strive to determine the appropriate answers, it is necessary to sensitize the front line managers, policy makers and essentially staff in all levels of the Forest Department. This capacity building will be done to develop strategy to adapt to climate change as part of a sustainable forest management plan. This initiative will be integrated with the proposed Orissa State Forest Academy.

4.5.13 Capacity building of Panchayati Raj/JFM institutions and Communities to adapt to climate change

There is an overall ongoing effort to transfer forest-related responsibilities to the Panchayats Raj Institutions. For instance, the control of Non-Timber Forest Produce (NTFP) has been transferred to the panchayats. Similarly, Vana Samrakshyana Samitis have been empowered through Joint Forest Management Resolutions to protect forests adjoining villages. To integrate climate change considerations, it is required to sensitize and build capacity of Panchayati Raj institutions and communities. Under this initiative, a series of trainings and awareness generation programmes will be undertaken.

4.5.14 Monitoring carbon stock and biodiversity at regular intervals

Monitoring of carbon stock and biodiversity at regular intervals is necessary to gauge the success of the various programmes implemented. Under this initiative, developing a new and independent organization - a forest monitoring agency - under the Forests department will be undertaken. Roles, responsibilities, authorities and resources for this new and independent organization will be formulated; and this organization will be made operational.

4.6 Health

4.6.1 Introduction

Climate change will cause a range of human health impacts. These include morbidity and mortality due to increased heat, air pollution effects, impacts of post-extreme events, malnutrition, water-borne diseases such as diarrhea, cholera, typhoid and gastroenteritis, and vector-borne diseases such as malaria and dengue. Orissa has already a combination of all of these human health-related issues. And, climate change is likely to exacerbate them. Changes in temperature and rainfall are likely to change disease patterns for the vector borne diseases such as malaria and dengue fever. Food production may be adversely affected and create pockets of hunger and malnutrition. With the likely increase in the intensity and frequency of extreme cyclone events, there may be significant post-event human health issues to reckon.

Though the NAPCC does not identify human health as a separate National Mission, GoO will focus on climate change implications on human health. Key priorities have been identified and are briefly described in this section.

4.6.2 Capacity Building to meet the challenges on climate change on both adaptation and mitigation aspects

Climate change is a new subject in the health sector. There is a need to build capacity within the health sector institutions on both mitigation and adaptation aspects. As the implications of climate change on health is expected to be widespread, strengthening awareness, knowledge and skills at all levels across the state will be required. This capacity building initiative will aim to work towards this goal.

Advocacy and sensitization of policy makers, massive general awareness campaigns, sensitization of the health service providers (ANMs, ASHA, AYUSH, Doctors, AWW), strengthening the curriculum of ANMs, Health workers & Paramedic staff, recognizing gender issues, promoting health insurance for vulnerable groups, strengthening community resilience and enhancing psychological aid to disaster victims.

Table 4.6: Health Sector in Orissa - Vital Statistics

S.No.	Indicator description	Data
1	Crude Birth Rate (2004-SRS)	22.7 per 1000 population
2	Crude Death Rate (2004-RS)	9.6 per 1000 population
3	Infant Mortality rate (NFHS-3)	65 per 1000 live birth
4	Infant Mortality Rate (Urban)	40 per 1000 live birth
5	Infant Mortality Rate (Rural)	69 per 1000 live birth
6	Natural Growth Rate (2004-SRS)	13.1%
7	Total Fertility Rate (NFHS-3)	2.4
8	Couple Protection Rate (NFHS-3)	50.7%
9	Life Expectancy at Birth (1996-2001)	61.64 years
10	Maternal Mortality Rate (2004-SRS)	358 per 1,00,000 live births
11	Perinatal Mortality Rate (1997-SRS)	65.3 per 1000 live & still births
12	Crude Birth Rate (2004-SRS)	22.7 per 1000 population

Source: Department of Health & Family Welfare, Government of Orissa Website, 2010

4.6.3 Integrating climate change considerations in the State Health Policy

Health impacts due to climate change are presently not included in the State Health Policy. This policy should include climate change implications on health such as occupational health and vector biology. Once the integration is done at the policy level, it will be easier to integrate those at the programmatic and other implementation levels.

4.6.4 Strengthening approaches to manage vector borne disease that have worsened due to climate change impacts

Under the Dept. of Health and Family Welfare, a network has been established for the control of vector borne diseases. Due to climate change, incidents of vector borne diseases

Health - Key Priorities

1. Capacity Building of the health sector on climate change
2. Integrating climate change considerations in the State Health policy
3. Strengthening approaches to manage vector borne disease that have worsened due to climate change impacts
4. Strengthening approaches to deal with heat wave conditions exacerbated due to climate change
5. Strengthening approaches to deal with the physical and psychological impacts due to extreme weather conditions caused by climate change
6. Addressing drought, nutrition & food security due to increased risk of drought, consequent decline in agriculture and increased malnutrition & food security
7. Undertaking measures to manage water borne disease that have worsened due to climate change impacts
8. Research & studies on climate change and health impacts
9. Addressing food safety that is undermined as a result of increased ambient temperatures and extreme events
10. Studying the interlinkages between air quality and climate change, and implications on health

are likely to increase and so will the spread. Therefore, the present set-up is required to be strengthened with better monitoring surveillance, better diagnosis and control of vectors with a particular focus on vulnerable groups. These will be done as a part of this initiative.

4.6.5 Strengthening approaches to deal with heat wave conditions exacerbated due to climate change

The rise in temperature due to climate change is likely to make more intense the heat wave conditions during the summers. Heat waves pose risk of deaths, disease and injury. The risk to vulnerable groups such as infants, elderly, pregnant women, disabled,

farm labourers and industrial & construction workers are expected to be very high.

There has to be an organized approach for sensitization and awareness. Strengthening the existing facilities and infrastructure for managing health impacts due to heat waves is also required. Under this initiative, all of these will be implemented.

4.6.6 Strengthening approaches to deal with the physical and psychological impacts due to extreme weather conditions caused by climate change

The extreme weather events are becoming more frequent, intense and widespread, resulting in physical and mental health impacts. At present, Orissa State Disaster Management Authority (OSDMA) is the nodal agency to respond the situation. The present infrastructure needs to be strengthened. A medical wing will be established and strengthened to demonstrate an integrated approach for responding natural disasters. Actions such as community resilience and disaster preparedness, strengthening psychological aid to victims, strengthening surveillance including traditional knowledge and cultural norms will be undertaken.

4.6.7 Addressing increased drought, malnutrition & food security issues due to climate change

Climate variations will create increased drought conditions. This will lead to the consequent decline in agriculture and increased malnutrition & food security. With the increased impacts due to climate change, it will be required to develop strategies to improve nutritional status of vulnerable population. Monitoring and managing migration and psychological impacts of food security on vulnerable rural population will also be required. These will be done under this initiative.

4.6.8 Undertaking measures to manage water borne disease that have worsened due to climate change impacts

Water borne diseases such as diarrhea, cholera and leptospirosis are likely to increase due to climate change. Further



institutional strengthening is required through prevention, better management and improved surveillance. This initiative will lead to reduce the incidents of water-borne diseases.

4.6.9 Research & studies on climate change and health impacts

To strengthen the understanding of the health impacts due to climate change, further inter disciplinary research is required. Collaborations are required for linking vector biology, agriculture, air quality, etc. with human health. Research studies will be done on a variety of subjects that include links between heat waves and health, compilation of best practices in a disaster context, using traditional knowledge and cultural norms, and reducing the burden of vector-borne diseases in the context of climate change. A

research centre will be established under this initiative.

4.6.10 Addressing food safety due to climate-induced changes

Food safety is another challenge related to climate change that needs to be addressed. Clear guidelines available in the state on food safety is required to be revisited. Under this initiative, a mechanism to strengthen food safety will be undertaken.

4.6.11 Studying the interlinkages between air quality and climate change, and implications on health

There is a strong linkage among air quality, human health and climate change. Strengthening the monitoring and evaluation of health impacts of air quality will be done under this initiative.

4.7 Industry

4.7.1 Introduction

Being a mineral rich state, industrial development is focused on metallurgical and other metal-based industries. As these are energy-intensive, coal-based thermal power generation tends to be an integral part of industrial development. Given climate change, industrial development is required to explore ways of reducing greenhouse gas/carbon emissions (mitigation) and, at the same time, be equipped to cope to climate change impacts (adaptation). In its current stage of industrial development, Orissa will work towards achieving both carbon-conscious and climate-resilient industrial development without compromising on the current pace of industrialization. The transition to address these climate change concerns will be done in a smooth and effective manner. As climate change is a relatively new challenge, substantive capacity building and institutional re-alignment will be required. In developing the key priorities, these three broader goals - reducing emissions/mitigation without compromising industrial growth, developing climate-resilient industrial systems and building capacity as well as realigning institutions - were kept in view. In addition,

Table 4.7: Profile of Industry in Orissa

S.No.	Sector	No. of Industries			
		Large	Medium	Small	Total
1.	Iron & Steel	99	69	25	193
2.	Aluminum	2	-	-	2
3.	Pulp & Paper	4	2	-	6
4.	Sugar	4	1	-	5
5.	Fertilizer	2	1	-	3
6.	Thermal Power	10	-	-	10
7.	Cement	7	2	1	10
8.	Fermentation Industries	4	7	1	12
9.	Chemical Industries	1	2	3	6
10.	Mineral Processing and Crushers	15	116	1042	1,173
11.	Food Processing and Allied Industries	1	83	273	357
12.	Refractory/ Bricks/Tiles	2	22	254	278
13.	Other Industries	17	74	493	584
	Total:	167	471	2116	2754

Source: State of the Environment Report, 2006

consistency with the various missions under the NAPCC was also ensured. Key priorities of this sector constitute the rest of this section.



4.7.2 Integrating climate concerns in policies and plans

To achieve climate-friendly industrial development, institutional re-alignment is required. As a first step, the two key industrial policies - Industrial Policy Resolution and the MSME Framework Development Policy has to integrate climate change considerations. Under this initiative, these policies will be reviewed to determine how emission reduction can be encouraged and climate-resilience be emphasized. Following the usual GoO processes, these policies will be revised and finalized. There are other policies and frameworks like SEZ policy, PCPIR framework which are also required to be looked through the lens of climate change policies and thus need reorientation. The first step in integrating climate concerns is preparation of state level baselines and policy goals. This is a critical activity and many cross-cutting issues will emerge particularly with mines, energy, water, forest and general administration.

4.7.3 Assessing GHG profiles of major industrial clusters

Reducing carbon emissions requires a good baseline data/information about current level of emission. For this purpose, carbon inventories or GHG profiling is the first step. Under this initiative, particular industrial clusters will be selected, an appropriate institute will be identified and GHG profile reports will be prepared in line with the best international practices. Based on this profiling, a system of GHG auditing will also be introduced. This GHG profile reports will assist in understanding industrial performance on carbon emission intensities vis-à-vis international best practices. The GHG profile will be an important input for policy making and monitoring performance of the industrial clusters with respect to carbon efficiency. The next logical step will be to institute a system of continuous carbon audit

Industry - Key Priorities

1. Integrating climate concerns in policies and plans
2. Prepare GHG profiles of major industrial clusters
3. Conducting heat-island study for Talcher and Jharsuguda area
4. Training various stakeholders on climate change issues
5. Implementing a system of compensatory water harvesting
6. Streamlining institutional arrangement and strengthen OSDMA to tackle extreme climate events in coastal area
7. Carrying out energy efficiency studies
8. Promoting the use of bulk waste material
9. Setting emission targets for thermal power plants

procedure to track the carbon footprint of industrial system in the state.

4.7.4 Conducting heat-island study for Talcher-Angul and Jharsuguda area

There is a perception that Talcher-Angul and Jharsuguda area are becoming hotter every passing year. It is also believed that since large coal mines, thermal power plants and metallurgical industries are in operation a good amount of heat is generated causing a heat island. Climate change and the associated temperature increase are likely to worsen the situation. In this context, a research study will be undertaken to identify the cause of the high temperatures, the various contributing factors and what measures can be taken to reduce the prevailing heat levels. The study can also suggest various location specific adaptive measures.

4.7.5 Training various stakeholders on climate change issues

Capacity building on climate change is of paramount importance. This needs to cover both general as well as specific climate change concerns. This should also include how carbon emissions can be met without compromising on industrial outputs and how climate proofing or building resilience can be achieved. Training needs to reach all organizations involved with



promoting industrial development and industrial enterprises in the large, medium and small-scale sectors. The activity includes identifying training needs of various stakeholders, designing the training modules, networking with institutions.

4.7.6 Implementing a system of compensatory water harvesting

Climate change is expected to induce uncertain monsoons and therefore water availability will become an issue. With the rapid industrial development, water has already become a constraint in certain industrial areas. Due to climate change, this may worsen. In consultation with stakeholders, a mechanism will be devised to encourage compensatory water harvesting and storage around industries/ industrial clusters. This mechanism will look for investment coming from industrial sectors to create rainwater harvesting & storage and ground water recharging & storage facilities and associated infrastructure within and around palnt. This adaptation measure will benefit the industries as well as the surrounding areas by providing water security.

4.7.7 Streamlining institutional arrangement and strengthen OSDMA to tackle extreme climate events in coastal area

Coastal industrial infrastructure, assets and people need to be protected from climate-induced extreme weather events. In addition, these extreme weather events could also lead to industrial disasters for which better preparedness is required within the state. This is particularly relevant for Paradeep, Dhamra and Gopalpura. OSDMA is the only institute, which undertakes disaster management. However, managing industrial disaster requires different kind of skill and equipment. Thus, it is important that capacity building and skill up-gradation in OSDMA for addressing industrial disaster is an important activity. Under this initiative, streamlining of institutional arrangements and strengthening OSDMA to tackle these issues will be undertaken.

4.7.8 Carrying out energy efficiency studies

Reducing carbon emissions by promoting energy efficiency is a viable proposition for industrial

enterprises as reduced energy consumption implies financial savings. The major industrial activities in the state are highly energy intensive; iron and steel, aluminum, ferro-alloys, cement and paper are the sectors, which have been identified by IPCC as some of the most energy intensive sectors. Even though this is the case, industrial enterprises do not often strive to ensure high levels of energy efficiency. There seem to be a lot of potential for augmenting energy efficiency in these sectors. Under this initiative, studies will be undertaken to encourage energy intensive industries such as; aluminum, ferro-alloys, cement, pulp and paper, integrated steel plants and sponge iron plants to adopt energy efficient practices. In particular, the recovery and use of waste heat will be explored. Through these studies, it is envisaged that best practices will be implemented in the iron and steel, aluminum and cement industries in Orissa.

4.7.9 Promoting recovery, recycle and reuse of waste material

Coal-based thermal power plants generate ash and sponge iron plants generate char. The reuse of this bulk material offers a win-win solution. The waste that pollutes is fixed into an application and the energy required to produce the alternative material is saved. In addition relieves the land which otherwise would have been used for dumping causing environmental pollution in the locality. Under this initiative, a range of activities that include enabling policies, conducting studies, carrying out demonstration projects and promoting investments will be done.

4.7.10 Setting emission standards for thermal power plants

Coal-based thermal power plants are the largest contributor of carbon dioxide emissions. Establishing emission targets for thermal power plants and directing these plants to meet these targets will be done under this initiative. With the focus on thermal power plants, this initiative will also have a bearing on major source of particulate emissions, which create serious local environmental impacts. Care shall be taken that the process of setting targets will be in line with the national policy in this respect.

4.8 Mining

4.8.1 Introduction

Mining is a mainstay activity in Orissa and contributes significantly to the state's economic development. The state has rich deposits of coal, bauxite, chromite, iron ore, manganese ore, dolomite, limestone and mineral sands. These deposits of certain minerals constitute a significant portion of the total deposits of the country. While mining activities commenced more than a 100 years back, there has been a remarkable growth in recent times, particularly in bauxite, chromite, iron ore and coal. Mining in Orissa has serious local environmental impacts. This includes the air pollution impacts (particulates), water pollution (mine water discharges), social impacts (displacement and rehabilitation) and forest impacts (part of the mining area is in the forests or in the vicinity). Therefore, mining is highly regulated sector on environmental aspects and basic environmental awareness is substantive. Mining is also a contributor to global greenhouse gas emissions. There are various initiatives planned to mitigate as well as to adapt to climate change. All these initiatives pertain to three goals - emission reduction, capacity-building and adaptation measures. The key priorities in this sector constitute the rest of this section.

Table 4.8: Mineral Resources of Orissa

S. No.	Mineral	Resources (Metric Tonnes)
1.	Bauxite	1,819.7
2.	China Clay	313.9
3.	Chromite	173.8
4.	Coal	65,226.7
5.	Dolomite	330.9
6.	Fireclay	175.5
7.	Base Metal	4.9
8.	Graphite	4.4
9.	Iron Ore	5,153.3
10.	Limestone	1,007.2
11.	Managanese	119.8
12.	Mineral Sand	226.2
13.	Pyrophyllite	8.3
14.	Quartz	70.3
15.	Vanadium	2.5

Source: Department of Steel & Mines, 2009

4.8.2 Incorporating climate concerns in the State Mineral Policy

The State Mineral Policy provides the guidance and direction to realizing the enormous mineral development potential. Augmenting the mineral resource and using the identified resources in a sustainable manner are a part of the policy. Given the





nature and scale of the climate change threat, it is required to review the Mineral policy in the context of climate change concerns. The state Mineral policy will be revised to incorporate and integrate climate change considerations. The implementation of the revised policy will ensure tracking of the greenhouse gas emissions from this sector.

4.8.3 Analyzing appropriate policies to promote energy-efficiency

Mining processes and mineral transportation requires energy. Its use cannot be stopped but can be made more efficient. In order to move this sector into an energy-efficiency path, new economic / policy instruments are required to encourage efficient energy use. A research study will be carried out to determine what kind of economic/policy instruments will be appropriate in the Orissa context.

4.8.4 Realizing the potential of low-grade mineral beneficiation

There is a lot of potential in the beneficiation of low grade iron ore, manganese, graphite and chrome ore, which is currently not being utilized. A research study will be carried to identify the potential across the various minerals and to propose methods/approaches to realize this potential.

Mining - Key Priorities

1. Incorporating climate concerns in State Mineral Policy
2. Analyzing appropriate policies to promote energy-efficiency
3. Realizing the potential of low-grade mineral beneficiation
4. Strengthening environmental monitoring
5. Protecting water bodies
6. Expanding and maintaining green zones
7. Building capacity and generating awareness
8. Realizing energy-savings potential in mining

4.8.5 Strengthening environmental monitoring

Mining is confronted with serious local environmental challenges. Monitoring of environmental parameters - both local and global pollutants - is required. Presently, the monitoring systems are not robust enough. To improve environmental monitoring, particular mining clusters will be identified and a robust environmental monitoring system will be established. Based on the monitoring results, appropriate modifications will be made in these clusters and climate change abatement measures will be initiated.



4.8.6 Protecting water bodies

Water resources will be affected due to climate change. Mining causes substantive silting that affects water bodies such as water harvesting structures, reservoirs and weirs. These need to be protected. Particular water bodies in the mining intensive areas will be identified and protection measures will be installed. Water pollution and capacity reduction will be arrested. These water bodies will be restored as a climate change adaptation measure.

4.8.7 Expanding and maintaining green zones

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.

4.8.8 Building capacity and generating awareness

This will be given paramount importance. Integration of climate change in mining can only be achieved through substantive capacity building. Training on the Clean Development Mechanism, cleaner production/low carbon/efficient technologies and climate abatement measures will be organized both within the GoO (Steel & Mines, Directorate of Mines and State Pollution Control Board) and with the associated stakeholders (Indian Bureau of Mines and Mining lease holders).

4.8.9 Realizing energy-savings potential in mining operations

There are different processes within the mining operations. Some of these are energy-intensive processes. In these processes, the energy savings potential is large. As a first step, a research study will be conducted to determine the particular processes within mining operations that should be targeted for realizing the energy-savings potential.

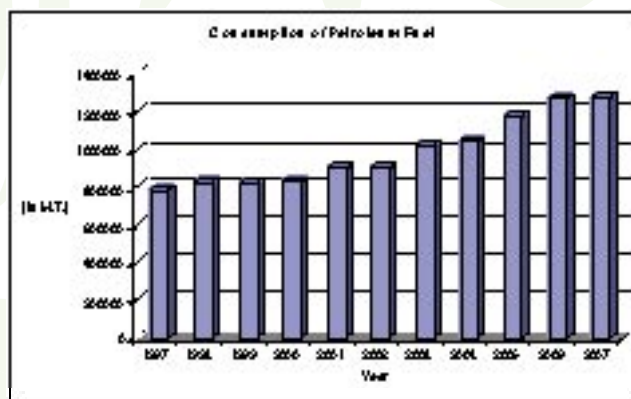
4.9 Transport

4.9.1 Introduction

Table 4-10 Transport-Key Statistics

Global estimates are that transport contributes about 10% of the total Greenhouse Gas (GHG) emissions. With greater economic growth and rapid urbanization, there is a constant increase in the number of vehicles, which leads to greater use of fuel and more GHG emissions. If current rate of urbanization and motorization continues, GHG emissions could grow to about 8 times the current level by 2030.

Similar situation prevails in the Orissa context. There is a lack of public transport and an increasing middle income population that is resorting to private motorized transport. With greater availability of low cost vehicles, the numbers are growing - growth is highest in Cuttack - and so is the fuel consumption. And, there is a commensurate increase in the emissions from the transport sector. Apart from inadequate public transport, Orissa is largely dependent on the road network that is comparatively less GHG or carbon friendly among the different modes of transport. About 18,000 km of national highways, state highways, major district roads and other district roads cater to the transportation needs of the state. The railways within the state are below the national average, i.e. an average



Source: Commerce & Transport Department

railway route length of 15.03 Km per 1000 sq km as against National average of 19.0 Km per 1000 sq Km. Less railway network implies more pressure on the road infrastructure. Being on the coast, Orissa handles materials through its ports. The largest is the Paradip port, which handles about 57 MT annually. Substantial part of export / import cargo move by road. In addition, the people of Orissa tend to assign a poor social image / status for using public transport and non-motorized transport, both of which are vitally important in the context of responding to climate change.

At the national level, there are policies that encourage the move towards a more climate responsible transport sector. The Auto Fuel Policy (2003) encourages the use of CNG/LNG in cities affected by high motor vehicle pollution.



Transport - Key Priorities

1. Revising state transport policies
2. Integrating urban and transport planning
3. Enhancing the use of rail
4. Moving towards low carbon fuel
5. Piloting low carbon, green highways
6. Encouraging fuel use efficiency and tightening enforcement
7. Promoting non-motorized transport
8. Sequestering carbon through avenue plantations
9. Estimating carbon emissions from the sector
10. Developing inland waterways

The Integrated Transport Policy (2001) promotes the use of ethanol-blended petrol and bio-diesel. Under the NAPCC, the National Mission on Sustainable Habitat suggests a future focus on strengthening the enforcement of vehicle fuel economy standards, and using pricing measures to encourage the purchase of efficient vehicles and incentives for the use of public transportation. Also, better urban planning and modal shift to public transport has been emphasized. The National Urban Transport Policy emphasizes the development and usage of extensive public transport facilities (including non-motorized modes) over personal vehicles. All of these were considered in formulating the key priorities in the transport sector in Orissa.

4.9.2 Revising state transport policies

State Transport Policy of Orissa 2007 is the guiding policy document that aims at efficient, transparent and modernized transport

administration and management system for both freight and passenger movement in the state. In addition, Orissa has the Boat policy that addresses inland waterways transport. Incorporating climate change considerations in these policies is essential in order to have a tangible, consistent and sustainable response. Better management of transport demand, increased public transportation, encouraging cleaner technology and promoting non-motorized transport are elements that need to be incorporated in these policies. Further initiatives to reduce emissions will be taken for phasing out old commercial vehicles of more than 15 years. This will be undertaken as a policy initiative.

4.9.3 Integrating urban and transport planning

Effective transport planning requires better transport demand management. And, the integration of urban development and land use planning with transport planning is the first step. Making this integrated approach operational is a challenge that will be addressed as a policy initiative.

4.9.4 Enhancing the use of rail

From a climate perspective, the use of rail is more rewarding. Freight transport through rail requires to be encouraged further. Specific geographical areas within the state will be identified, the feasibility of using rail more effectively will be explored, policies will be formulated and implemented. Movement of bulk and dirty cargo like ores and minerals should only be done by rail. In addition, the introduction of Mass Rapid Transport Systems (MRTS) in suburban areas will be a priority. The preparation of DPR for the identified stretch between Greater Bhubaneswar and Cuttack will be initiated.

4.9.5 Moving towards low carbon fuels

Switching to alternate fuel such as Compressed Natural Gas (CNG) from the conventional fuel requires close coordination and interactions with the Central Government. Background studies will be conducted to prepare a case for greater access to alternate fuels. In addition, blending of conventional fuel with bio-fuels



will also be explored through research studies and demonstration projects. Plantation options will be considered and blended fuel shall be first introduced in the State Corporation buses.

4.9.6 Piloting low carbon, green highways

At present, Orissa is dependent on its road network to meet its transportation needs. This scenario is unlikely to change in the near future. In this context, constructing and maintaining its roads in a more climate responsible way will be piloted to determine its viability and potential for replication. Selected road stretches will be identified, feasibility studies conducted for the use of cleaner technologies, detailed designs and approaches planned and implemented. Throughout the pilot implementation, carbon emissions will be monitored and tracked. Using this implementation experience, plans will be made for its further expansion.

4.9.7 Encouraging fuel use efficiency and tightening enforcement

There is potential for improving fuel use efficiency through better driver training. Though the public road transportation is limited within the state, adoption of better practices will be first introduced, tested and monitored here. Based on the experience, plans will be made to advise and influence the private operators to improve their practices as well. Drivers Training Institutes and Heavy Vehicle Training Institute can take the lead in this regard. Given that it is a win-win situation, there will be a strong buy-in from the private operators as well. This will be supplemented by building the capacity of the enforcement wing for emission level check up. Training modules will be developed and enforcement officers will be trained as a part of this capacity building initiative. In addition, a survey of ambient air quality in selected locations in particular towns and cities will be undertaken. This will focus not only on determining the linkages between the increase in road transportation and deteriorating urban air quality but also improvements in air quality due to ameliorative activities.

4.9.8 Promoting non-motorized transport

With greater focus on motorized transport, pedestrians in urban areas are getting more sidelined. This is particularly true in crowded local areas in the cities of Bhubaneswar and Cuttack. As a demonstration initiative, a particular area in Bhubaneswar will be selected and a pilot scheme will be implemented to promote non-motorized transport. Using the experience gained, plans to promote and expand the concept of non-motorized transport will be made.

4.9.9 Sequestering carbon through avenue plantations

Roadside avenue plantations can be gainfully used to sequester carbon. These also provide tremendous local benefits by protecting road users from the oppressive heat particularly in the summer months. Particular roads stretches will be identified, plantation species will be selected that bring both local and sequestration benefits, and plantations will be undertaken. Based on this demonstration initiative, a plantation plan for the entire state will be developed.

4.9.10 Assessment of carbon emissions from the sector

Presently, there is no overall assessment of the carbon emissions from the transport sector in Orissa. It is only extrapolated that the growing increase of vehicle population is resulting in greater fossil fuel use and therefore more carbon emissions. A study will be commissioned in order to better assess and establish a



baseline. Also, this study will include the potential of modal shifts and other transport options to reduce the carbon emissions.

4.9.11 Developing Inland waterways

Presently inland water transport system in Orissa is confined to passengers launch services operating in sectors like Chandabali (47 km), Chilika (33 km) and Astaranga (20 km). The inland water transport system will reduce

carbon emission while providing transport services to the inhabitants of inaccessible riverine areas. Major river stretches in the State having potential for expansion of inland water transport systems can be identified. Like the National Waterways 5 (NW5), the GoO shall undertake studies to identify State Waterways to develop an inland water transport corridor in order to increase their cargo transportation potential.

4.10 Urban Planning

4.10.1 Introduction

Urbanization is recognized as one of the engines of economic growth and is seen as an indicator of development. On the other side, urbanization has its own challenges particularly the local environmental concerns / issues. Typical urban locations comprise relatively small geographical units that are highly energy intensive, generate large quantities of waste (both liquid and solid) and tend to become heat islands.

As is true for the rest of India, there has been a constant need to keep pace with the growing demands of the urban sector in Orissa as well. Effective and adequate steps are required for efficient management & delivery of basic urban services like provision of safe drinking water, sanitation, roads, solid waste management and housing. In terms of reform and its implementation, the 74th Constitutional Amendment of the 1990s empowered the Urban Local Bodies (ULBs) to function as local self-government. Building the capacity of these ULBs is also one of the challenges being presently dealt with.

In percentage terms, the population living in urban areas in Orissa is significantly lower than the national averages. Therefore, Orissa is in a unique position to chart out an urban development path that learns from the

Table 4.10: Urban Profile of Orissa

S.No.	Title / Description	Particular Data / Information	
1	Urban Local Bodies - Profile	Notified Area Councils (NACs): 63 Municipalities: 37 Municipal Corporations: 3	
2	Urban share of the population	Previous (1941) 3%	Last Census (2001) 14.95%
3	Urban centres - Growth	Previous (1951) 39 nos.	Last Census (2001) 138 nos.
4	Most Urbanized districts (% Urban Population)	Khordha (42.93%) Jharsuguda (36.40%) Sundargarh (34.38%)	
5	Least Urbanized Districts	Nayagarh (4.29%) Jajpur (4.49%) Boudh (4.82%) Nuapada (5.66%)	

Source: Housing & Urban Development Department

mistakes/experiences of other Indian cities (particularly the metropolitan cities) and also other international cities that are confronted with similar urban challenges. Given the climate change dimension, Orissa can go further by defining a climate-responsible urban development path. Such a path will include initiatives such as promoting energy-efficiency



Urban - Key Priorities

1. Building capacity on climate change
2. Incorporate climate considerations in water supply and sewerage design
3. Working towards greater water-efficiency
4. Preparing a climate-friendly MSW management plan
5. Orienting towards energy-efficient street lighting through CDM
6. Developing a climate-responsible master plans
7. Strengthening infrastructure for promoting non-motorized transport
8. Improvements to water harvesting in urban areas with restoration of water tanks and artificial recharge
9. Developing models of urban storm water flows and capacities of existing drainage systems with climate change

in urban living/lifestyles, addressing methane capture from Municipal Solid Waste (MSW), promoting green buildings with use of energy-efficient and water-efficient approaches, dealing with flash flood issues that could be due to heavy precipitation events that are predicted as climate change impacts, promoting the use of solar lights and also working towards energy auditing. The key priorities of urban sector are covered in the rest of this section.

4.10.2 Building capacity on climate change

Climate change is a new challenge confronting the urban sector. There is a need to orient and sensitize the stakeholders at all levels of the Urban Local Bodies. Building their



capacity is vital to make the initiatives that lead to climate change abatement as well as adaptation operational. At the outset, a training need assessment will be done and different training modules will be designed based on the outcomes. These training programmes will be conducted and all of these will have a practical orientation with field / exposure visits. This capacity-building initiative will set the foundation for further initiatives in the urban sector.

4.10.3 Incorporating climate considerations in water supply and sewerage design

One of the key activities in the urban sector is the provision of water supply and sewerage services. It is required to better understand and appreciate how the planning, design and implementation of these services will modify due to climate change. These could include the use of more energy-efficient technologies and better provision for dealing with climate impacts such as flash floods. A research study will be done to develop a model climate-friendly water supply and sewerage design, plan and scheme.

4.10.4 Working towards greater water-efficiency

Variations in water availability are likely to be single largest impact due to climate change. The urban sector is a large water consumer. There is potential to reduce water losses and to promote water conservation measures. A study will be undertaken to determine the extent of these losses within cities / towns and also to identify particular actions that needs to be promoted to reduce these losses. Installation of water meters will be initiated in a phased manner to promote better monitoring and use.

4.10.5 Preparing a climate-friendly MSW management plan

Yet another key activity in the urban sector is the provision of MSW management services. Here again, it is required to better understand and appreciate how the planning, design and implementation of these services will modify due to climate change. On the one hand, municipal solid waste generates methane emissions, a greenhouse gas. On the other hand, municipal

solid waste treatment can be used to generate methane as a non-conventional energy source. All of these aspects will need to be considered and an ideal climate-friendly MSW management plan will be developed. This plan will also include a pre-investment study and lead to a demonstration project in a selected city / town where the climate-friendly plan will be piloted. Based on the implementation experience of the pilot, scaling-up to a state-level will be done.

4.10.6 Orienting towards energy-efficient street lighting through CDM

Initiatives to promote energy-efficient street lights are being across the country. Many of these initiatives are also done using the Clean Development Mechanism (CDM) as a financing option. In Orissa as well, this will be promoted as a public-private partnership on a pilot basis in selected urban areas. CDM as a financing option will be explored. Once established and proven, a plan to scale-up the public-private partnership and CDM approach to energy-efficient street lighting across the state will be developed.

4.10.7 Developing a climate-responsible master plan

Master Plans and Comprehensive Development Plans (CDPs) need to incorporate climate change considerations. Being a new area, there is a need to prepare and implement such a climate-responsible plan for a selected city. Based on the experience, the approach of preparing climate-responsible plans will be made standard across the state.

4.10.8 Strengthening infrastructure for promoting non-motorized transport

Promotion of non-motorized transport is a climate-friendly initiative that requires urban infrastructure development. Whereas the Transport sector will work on the traffic management aspects pertaining to non-

motorized transport, this initiative will focus on (i) policies required to promote non-motorized transport including how this can be incentivized, and (ii) building the infrastructure in a particular area in Bhubaneswar to test how non-motorized transport can be promoted in practice.

4.10.9 Improvements to water harvesting in urban areas with restoration of water tanks and artificial recharge

Variability of the rainfall/monsoons due to climate change is likely to bring about water supply shortages. These will lead to urban areas not having enough water. Under this initiative, conservation of water will be undertaken through improving water harvesting mechanisms in the cities/towns. Existing water reservoirs/tanks will be surveyed, few of these will be selected, plans for their renovations with improved water harvesting will be prepared and implementation of these plans will be undertaken.

4.10.10 Developing models of urban storm water flows and capacities of existing drainage systems with climate change

Climate change can cause sudden and heavy precipitation that will result in flash floods and flooding of low lying areas. In this context, it is required to be better prepared through modeling of storm water flows in a climate-induced scenario and assessing the capacities of existing drainage systems to cope with this change. As a pilot, the city of Cuttack will be chosen, as this city has always been encountering frequent flash floods and water logging. Storm water flows will be projected and the capacity of the existing drainage system will be assessed. Based on the outcome, a model for a long-term sustainable drainage system will be developed and implemented.

4.11 Water Resources

4.11.1 Introduction

Impact of climate change on water resources is likely to be due to erratic monsoons creating variability in river flows and increased frequency / intensity in extreme events such as floods, droughts and cyclones. Further research and studies are required for a realistic assessment of climate change impacts. This will have to be done at the state level and basin level. However, at the same time, conservation of water resources, adoption of better management practices with emphasis of optimal utilization and increase in efficiency requires to be implemented. Apart from being climate change adaptation measures, these constitute good water resource management.

Under the NAPCC, a National Water Mission was established. This Mission will ensure integrated water resource management to conserve water, minimize wastage and ensure more equitable distribution both across and within states. Basin level management strategies will be reconsidered to deal with variability in rainfall and water flows. The Mission will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with a special effort to increase storage capacity. The Mission will also establish a framework to increase water

Table 4.11: Water Key Statistics

S.No.	Description	India	Orissa
1	Annual precipitation	4,000 BCM	230.76 BCM
2	Average annual water resources	1,869 BCM	141.41 BCM
3	Utilizable water resources (surface & ground)	1,122 BCM	108.15 BCM
4	Utilizable resources (% of precipitation)	28%	46.7%
5	Per capita water availability	1,820 cu.m	3,359 cu.m.

Source: Department of Water Resources, Annual Activities Report, 2008-2009

use efficiency by about 20%. There will be initiatives to reduce fresh water use in urban areas and work towards providing alternative sources to meet the water requirements for coastal cities. Most of the initiatives under the National Water Mission fall under the purview of the State Governments. Therefore, it is important that the key priorities undertaken by the State are consistent with those included in the National Water Mission. Even prior to the formulation of this Orissa State Climate Change Action Plan, the Water Resources Department had established a Climate Change Cell (GoO Order No. 21093, dated August 5, 09) The Cell is designed to advise, co-ordinate, monitor and evaluate the different



initiatives. This Cell will also undertake the same activities in the context of this Orissa State Climate Change Action Plan. The Climate Change Cell has conducted four seminar for capacity building of the departmental engineers by way of inviting experts from academia (IIT, Bombay, Monash University Australia, ICHARM). Sharing of experience of state engineers handling projects are also a part of this capacity building.

Department of Water Resources has a major initiative planned for construction of check dams for providing (i) Drinking water facilities in villages lying both sides of river, (ii) Irrigation during late kharif and rabi through lifting by beneficiaries, (iii) Recharging of ground water, which will help indirectly to provide drinking water facilities to nearby villages, (iv) Industrial requirements whenever necessary and constructed through self funding and (v) ecological balance.

The key priorities in the Water Resources sector constitute the rest of this section.

4.11.2 Expansion of hydrometry network

Data pertaining to water resources becomes even more important as variations in availability are caused due to climate change. This will provide a better assessment of water availability and extreme events and information for effective water resource planning. The state's Hydrometry Directorate functions as the data centre for surface water. Under this capacity building initiative, selected locations will be identified and hydromet stations installed to expand the hydrometry network. This network will process raw data received from its own and other sources to provide for analysis by different users. It is envisaged that the expanded hydrometry network will be made functional in the next 5 years.

4.11.3 Development of flood forecasting models

One of the climate change impacts is floods. For forecasting, models are required to assist in preparedness and response actions. Under this research initiative, a prototype

Water Resources - Key Priorities

1. Expansion of hydrometry network
2. Development of flood forecasting models
3. Downscaling of Global Circulation Model
4. Increasing the water use efficiency in irrigation
5. Constructing and protecting water harvesting structures
6. Improving drainage systems
7. River health monitoring and eco-systems environmental flow demand studies
8. Raising awareness raising with Pani Panchayat through Farmers' Training Programme and creating agro-climatic stations
9. Integrated Water Resources Management

information system will be developed, demonstrated and validated for effective near-real time flood forecasting, warning and management.

4.11.4 Downscaling of Global Circulation Model

Realistic assessments of climate change impacts require the downscaling of the global circulation models to the regional scale and then to the river basins. This will require a close co-ordination between the Government departments and the academic institutions. As a part of this initiative, climate change impact models on the Mahanadi, Brahmani and Baitarani basins will be undertaken. Subsequently, this will be extended to the other basins as well.

4.11.5 Increasing the water use efficiency in irrigation

Conservation of water resources is generally a good management practice, which becomes more important as it is also a climate change adaptation measure. Under this capacity building initiative, sectoral use of water will be identified, wastage will be monitored, technologies/approaches to reduce wastage will be explored and implemented. This will be first undertaken in critical areas and then expanded across the state. The need for new regulatory structures with appropriate entitlements and pricing to adopt water-

neutral and water-positive technologies will also be explored.

4.11.6 Constructing and protecting water harvesting structures

In water scarce areas, there is a potential for climate change to make water availability even worse. Under this investment initiative, particular areas will be identified, existing water bodies will be protected, new water harvesting structures, e.g. check dams for retention of run-off water, are being planned and implemented, and ground water recharge options will also be implemented. This will ensure that the local demand for drinking water as well as agriculture is made available.

4.11.7 Improving drainage systems

With the possibility of flooding increased due to climate change, the improvement of drainage systems will be required to overcome this problem. Improvements will be done through the reuse of drainage water in irrigation and in reclaiming the water-logged areas. Drainage and water logging problems are mostly in the coastal belt of Mahanadi Delta System and coastal belt of Ganjam, Bhadrak and Balasore. Nearly 30% of GCA of these areas, i.e. 2.18 lakhs Ha out of 6.83 lakhs Ha are affected due to poor drainage condition and 1.9 lakhs of Ha can be retrieved by improving drainage systems. The total area is divided into 17 doabs by the rivers and their branches. Out of which, 8 doabs are in Mahanadi Delta System. A master plan for drainage development in coastal belt of Orissa covers all the 17 doabs.

4.11.8 River health monitoring and ecosystems environmental flow demand studies

With climate change and the associated vagaries of rainfall/precipitation, maintenance of the river health and its ecosystems becomes vitally important. Under this initiative, a research study will be done in different river basins to determine the environmental flow that will be required to sustain the health and the aquatic ecosystems. Based on the

outcomes of this research study, the thrust actions will be identified, planned and implemented.

4.11.9 Raising awareness raising with Pani Panchayat through Farmers' Training Programme and creating agro-climatic stations

With water availability becoming an increasingly important focus under a climate change regime, it is required to build awareness on the optimal use of water and on conservation of water resources. It is also required to build the farmer awareness of scientific crop management to be adopted in the context of varying water availability. These will be done with the Pani Panchayats through the Farmers's Training Programme. Apart from sensitization, agro-climatic stations will also be created with a view to provide weather-based information for decision-making to the farmers on a periodic basis.

4.11.10 Integrated Water Resources Management

As indicated in the National Water Mission, promotion of integrated water resources management will get an additional focus as an effective response to climate change. Integrated water resources management leads to conserving water, minimizing waste and ensuring equitable distribution across various applications. This is already being practiced within the state. Further capacity building will be done to make operational integrated water resources management practices across the different river basins in Orissa.



4.12 Cross cutting issues

4.12.1 Activities with cross cutting relevance

In each sector, the Working Group deliberated on the relevance of climate change concerns and identified key priorities have been defined. In identifying the key priorities, a multi-departmental approach was taken by having different department representatives in each

Working Group. In doing so, it was realized that implementing many of the activities pertaining to the key priorities have cross cutting relevance. For instance, promoting green buildings in urban areas is relevant in terms of reducing energy use as well as in reusing fly ash, a by-product from coal-based thermal power generation. The various activities having such cross cutting relevance are listed and briefly described in the table 4.12.

Table 4-12 Activities having cross cutting relevance

S.No.	Title	Description
1	Promoting water use efficiency	Requires technologies, methods and mindset change in practices. Important both from a climate change adaptation as well as a mitigation (e.g. energy-efficient water supply) perspective. Water resources, agriculture, urban and rural are main sectors that are concerned with water.
2	Institutionalizing Energy-use efficiency	Requires technologies, methods and mindset change. Important from a climate change mitigation perspective as it leads to reduced carbon emissions. Energy-use efficiency needs to be promoted across all sectors that include energy, urban, agriculture, rural and transport.
3	Promoting Green Buildings	Requires the use of energy-efficient, water-efficient approaches and also using alternative building materials such as fly ash. Important from a climate change mitigation perspective. Involves the following sectors - energy, water and urban.
4	Improved fly ash management	energy, works, urban and environment
5	Transport and urban planning	Reducing transport emissions is best achieved by addressing the source, i.e. the need for transportation. Through integrated urban and transport planning, this can be achieved involving transport, urban and works.
6	Rural development planning	Water is an important factor in rural development planning. With climate change induced variability to water availability, rural development planning will need to be suitably strengthened. Involves different sectors - agriculture, water, rural development, energy and industry.
6	Coastal planning	With climate change-induced changes - more extreme events, sea water rise and coastal intrusion, the emphasis on integrated approach to coastal planning increases even further. Involves - disaster management, agriculture, urban, and water.
7	Biodiversity - forests, agriculture, fishery	Biodiversity conservation will need to adapt itself to climate change. This pertains to biodiversity relevant to forests, fisheries and agriculture.
8	Basin management/flood plain management	Basin-level water resource planning is an integrated approach to determine how the water available should get apportioned to various applications. Flood plain management is a part of this basin-level planning. With the climate change inducing precipitation variability, the basin level planning will need to be further strengthened. Involves all sectors that need and use water, primarily agriculture, energy, industry, rural and urban.

S.No.	Title	Description
9	Watershed management	By its very nature, watershed management approaches are cross cutting. Soil and moisture conservation practices will now need to address climate concerns. Involves the following sectors - agriculture, forests, water and rural development.
10	Livelihoods support	Climate change impacts are likely to be borne by the most vulnerable, i.e. the poor. All community livelihoods support programme in the different sectors, e.g. watershed management (agriculture) and rural development programmes, will have consider climate change dimensions as this has the potential to aggravate an existing problem.

In conducting activities pertaining to these cross cutting issues, GoO will ensure that there is inter-department co-ordination so that the effectiveness of outcome.

4.12.2 Common cross cutting needs/ requirements

Apart from the cross cutting relevance, there are also cross cutting needs. In other words, these are required across all the individual

sectors. The following table lists these requirements/needs.

GoO recognizes these cross cutting common needs and requirements, and will consider them in more effective planning and implementation of its overall response towards climate change.

Table 4-12 Common Cross cutting needs / requirements

S.No.	Title	Description
1	Awareness	Climate change is a relatively new issue. Awareness within the GoO, businesses and civil society associated with the different sectors needs to be strengthened.
2	Capacity building	Awareness is the first step. The next is to build the capacity - knowledge, skills and resources - to be able to address climate change concerns. This is again a need across all the individual sectors.
3	Information needs	Information on the climate change impacts/implications of different sectors are not readily available. Both top-down (from climate projections) as well as bottoms-up (from collecting empirical data / information) is required by all sectors that are impacted due to climate change, e.g. water resources, agriculture and coasts & disasters.
4	Estimation of extent of emissions and impacts	While all individual sectors recognize the climate change relevance, there is no data / information on the extent to which their sector contributes to the overall emissions. In a similar, there is no data / information on the extent to which the sector has to adapt to climate change impacts. Such an estimation is a common need.
5	Integration with state planning processes	Climate change is relevant across a number of activities within each individual sector. As these activities are planned as a part of the overall annual state planning, it is required to for each sector to integrate climate change concerns into their respective planning. Development planning needs to integrate climate change concerns.

Analysis and Synthesis

5.1 Introduction

This chapter outlines the findings from the analysis and synthesis of the previous chapter. The analysis in each sector provided a set of key priorities. Certain cross cutting areas were also identified. These were synthesized to arrive at findings, which describe what the CAP will achieve. The case is made for new institutional arrangements that will be required in the context of the proposed initiatives. This is introduced and described. The independent monitoring and evaluation required to ensure effective implementation is then described. Finally, the chapter concludes with the financial budget for the CAP.

5.2 Findings

Changes in policies, organizations and practices

Analyzing the key priorities revealed that climate change orientation needs to be provided at policy, organizational and practice levels in different sectors. Policies need to integrate climate change considerations. At an organizational level, awareness, skills and capacity has to be built. In certain sectors, new organizations, e.g. the Forest Monitoring Agency, have to be established. And, at a practice level, implementation initiatives will be required to shift towards a more climate-friendly development path. There are significant actions - Marginal/incremental actions will not suffice and there are significant actions required at all these levels to move on a climate-friendly development

path.

Awareness generation and capacity building - a focus

Considering that climate change is a relatively new challenge, the focus of this CAP will be on generating awareness and building capacity. This will be done across all levels of the GoO and external stakeholders involved in the different sectors. This strong drive towards building capacity will result in empowering people and organizations to be able to address, manage and respond to climate change concerns.

Action implemented across the economy

Given the all-pervading nature of climate change, action will be taken across the state economy. The inter-connectedness of issues pertaining to climate change necessitates this approach. Selecting and initiating work only in some of the sectors will undermine the effectiveness in an overall sense. Therefore, progress will be made across all the identified sectors in a parallel and simultaneous manner.

Climate-intrinsic sectors distinguished

Broadly, the different sectors can be classified as climate-intrinsic and climate add-on sectors. Climate-intrinsic are sectors that are so heavily associated with climate change that every action within these sectors have a strong bearing or related to climate change. These include energy, forests, water, agriculture and coastal disasters. Climate add-on sectors are those wherein the climate dimension is additional, e.g. fisheries, health, industry, mining, transport and urban. While the key

priorities across all these sectors will be met, GoO will recognize that every activity - particularly any new policies, organizations and initiatives - in the climate-intrinsic sectors will have a strong association with climate change.

Integrated perspective imperative

To be effective in implementing initiatives pertaining to the key priorities, it is vitally important to have an integrated outlook and not work in isolation. This will be required to ensure maximum returns to the efforts being made.

Carbon-conscious development

The various mitigation initiatives being planned across the 11 sectors will ensure that the Orissa proceeds on a carbon-conscious development path.

Green Jobs

The different adaptation and mitigation initiatives will ensure a transition to environmentally sustainable forms of production and consumption, which include designing energy efficient buildings, practice of sustainable farming, installing water recycling systems, promoting renewable energy technology, maintaining energy efficiency & balance in sustainable transport, water supply, sanitation and waste management etc. All these efforts to tackle climate change will result in millions of “green jobs” thus redefining business as usual in favour of more sustainable practices.

Biodiversity in addressing livelihoods

The key adoptive strategy being envisaged in the climate change action plan will facilitate conservation of biodiversity including restoration and rehabilitation which will help vulnerable people, mostly the tribal communities and economically most backward strata, to cope with climate change. Biodiversity plays a central role in ensuring livelihoods especially amongst rural populations and indigenous people. The climate change adaptation so planned will aim

at integrated management of biodiversity, thus immensely facilitating the poverty reduction and food security planning in the state.

Building climate resilience

The different adaptation initiatives being planned will ensure better preparedness to climate-induced changes, including extreme events. For a climate sensitive state such as Orissa, climate change adaptation is an integral part of good development.

5.3 Institutional Arrangements

In initiating the preparation of the Climate Change Action Plan, a scoping study was done. The findings of the scoping revealed the inter-sectoral and inter-departmental nature of climate change response action. In preparing the Climate Change Action Plan, 11 different working groups have been constituted. These working groups comprised representation from various departments. These deliberations revealed that implementation also requires strong inter-sectoral and inter-department co-ordination.

To meet this need, a Orissa Climate Change Agency will be put in place during the first year of implementation. This will have an advisory, supervisory and co-ordinating role on climate change issues. This Agency will be a single-window contact for dealing with the Gol and other external funding agencies in issues pertaining to climate change. The responsibility for establishing this Agency will be with the Forests & Environment Department. However, the Agency’s role will include and involve all sectors and all departments. It is envisaged that this Agency will function in an independent and autonomous manner so that it can execute its various roles, responsibilities and duties in a smooth, quick and effective manner.. The Agency will be equipped with appropriate quality manpower resources and infrastructure that are commensurate with the requirements and challenges faced. The Agency’s functioning style will be collaborative and inclusive, not

only within Departments of the Government but also with the different external stakeholders.

5.4 Financial budgets

Each working group put together a budget for the initiatives proposed to meet the key priorities in each sector. There are a number of ongoing initiatives, which are also relevant to climate change, these budgets have also been included in determining the overall budget for the CAP. The additional resources required in each sector has also been estimated and resources for these will be sourced from the Gol or external funding agencies. The following table provides the budget for the first CAP.

Table: Budget for CAP, 2010-15

S. No.	Particulars	Approx. Amount Rs. Crores
A	Sectors	
1	Agriculture	1,500
2	Coasts & Disasters	1,300
3	Energy	6,500
4	Fisheries & Animal Resources	217
5	Forests	4,650
6	Health	500
7	Industry	325
8	Mining	55
9	Transport	60
10	Urban	1,200
11	Water	725
	Sub-total:	17,032
B	Institutional Arrangements	
1	Establishing new Orissa Climate Change Agency	TBD
2	Independent external Monitoring & Evaluation	TBD
	Sub-total:	TBD
	Grand Total:	Approx 17,000

5.5 Monitoring and Evaluation Framework

A key part of a climate change action plan has to be:

- The monitoring of impacts of climate change and of progress in achieving key targets
- The evaluation of programs undertaken to mitigate climate change as well as to adapt to its consequences.

Both the monitoring and evaluation have to be done regularly and a feedback loop should be established so that corrective action can be taken in the case of:

- Impacts being more or less severe than originally anticipated,
- Key targets not being attained in a timely manner and
- Programs underperforming.

In the case of Orissa CAP, the main areas where monitoring will be required and where there are risks of underachieving key targets and programs are presented in the framework table.

The following points should be noted:

- Baseline data will be required and will be collected urgently. This is essential so that targets can be set for the key programs.
- Where impacts can be expected as a result of climate change, these should be monitored and the programs that have been set up modified where major deviations from expected impacts are found. Since this is a relatively long term exercise one can expect to make changes only to future programs, i.e. after 5 years as a minimum and more likely after ten years.
- Progress on actual programs implemented now, however, can be monitored on a shorter time frame and changes enacted following reviews undertaken every 3-5 years, depending on the program.

Table 5-1 Orissa Climate Change Action Plan Monitoring & Evaluation Framework

Area	Key Impacts to Monitor	Targets to Monitor	Key Programs to Evaluate	Frequency	Feedback Loop (if any)
Agriculture	Changes in yields for key crops Frequency of crop failures	Increases in yields in watershed development program areas Addition to areas under perennial plantation. Adoption of improved seed varieties	Integrated watershed development program Micro irrigation and farm ponds Perennial plantation program	3 years	Adjust budgets. Modify programs.
Coasts & Disasters	Frequency of extreme events Losses per event Loss rates for flagship species Rates of erosion in sensitive areas	Building targets to provide protection measures Investment programs to protect ecologically sensitive areas.	Effectiveness of implemented protection measures Program to control erosion losses Program to protect ecologically sensitive areas	3-5 years depending on program	Adjust budgets. Modify programs.
Energy	Emissions of CO2. Emissions intensity	Emissions per Mwh from coal Emissions per Mwh from gas Amount of coal that is washed No of fluidized bed plants Average boiler efficiency No of PPAs signed Losses in T&D in state systems Installation of solar power Installation of wind power Generation of energy from biogas	Adoption of clean coal technologies program Promotion of gas CC plants Coal washing program Fluidized bed program Boiler efficiency program Wind and solar programs Biogas promotion program Promotion of merchant power program Energy department capacity building program Operations of special CESS fund T&D Loss Program Energy saving/demand management program.	3-5 years depending on program	Adjust programs if not successful. Tighten or loosen targets based on experience.
Fisheries/ Animal Resources	Yields in aquaculture Fish catch rates adjusted for effort Animal weight and output	Targets for livestock protection. Targets for fish catch per year.	Skilled animal breeding program Early warning system for diseases	3 years	
Forests	Loss rates for forest biomass Loss rates for mangroves	Reforestation rates Reduction in loss of forests Coverage of bald hills with forest Mangrove expansion rates Watershed plantation rates Losses from fires	Reforestation/afforestation program Forest conservation program Bald Hill coverage program Mangrove program Fire management program Capacity building in Panchayati Raj.	5 years	If programs do not meet targets modify allocation of budgets

Area	Key Impacts to Monitor	Targets to Monitor	Key Programs to Evaluate	Frequency	Feedback Loop (if any)
Health	Incidence of vector borne diseases Incidence of water borne diseases Frequency of heat wave losses	Vector borne disease impacts relative to baseline Water borne disease impacts relative to baseline Nos. affected by heat waves Cases of food poisoning	Vector borne disease program Water borne disease program Heat wave impacts program	3 years	Modify programs according to evaluation
Industry	Losses to industry from extreme events in coastal areas.	Targets for climate proofing industrial infrastructure.	Coastal zones extreme events program Promotion of bulk waste program Compensatory water harvesting program.	3 years	Modify programs according to evaluation
Mining		Mining waste output reduction targets Targets for expansion of green zones Targets for water harvesting damage Energy savings targets	Protection of water harvesting structures program Creation of green zones program Energy savings program	3 years	
Transport		Bulk transport using rail Use of biofuels Kilometers of low carbon highway Trees planted on highways No of electric operated vehicles	Bulk transport promotion program Biofuels program Low carbon highway program Tree plantation program Emission check up program	3 years	Modify funding for programs failing to meet targets.
Urban		No of water meters installed Waste collection rates % of HH connected to water supply No of energy efficient street light installed Average energy efficiency in buildings	Water metering program Waste collection program Water supply connection program Energy efficient lighting program Promotion of energy efficiency in buildings Promotion of non-motorized transport program		Modify funding for programs failing to meet targets.
Water	Frequency of rainfall in different seasons	Accuracy of flood forecasting Water use efficiency rates No of harvesting structures built Drainage of water indicator	Flood forecasting program Water use efficiency program Water harvesting structures investment program Improvement of drainage program Environmental flow in wetlands program	3-5 years depending on program	Modify funding for programs failing to meet targets.



Conclusions and Recommendations

6.1 Introduction

This chapter draws the conclusions from the different key priorities, their analysis and synthesis. This chapter also includes recommendations for preparing future Climate Change Action Plans.

6.2 Conclusions

The CAP will lead Orissa to move towards a carbon-conscious, climate resilient development path. The following are the key conclusions of this CAP:

Significance of climate change

The nature, scale and magnitude of the climate change impacts is likely to be of high significance given that the state's agriculture is largely rain fed and is periodically exposed to climate-induced extreme events. In addition, Orissa has substantive coal reserves and its development plans include harnessing the potential of thermal power. Therefore, Orissa will be a focus of both national and international attention in the context of climate change.

Addressing both adaptation and mitigation

The state CAP will address both mitigation and adaptation issues in a holistic manner by implementing all the activities in the action plan. It has been recognised that adaptation is of much greater significance.

Information on climate change implications

In terms of assessing the climate change implications for the state, GoO will adopt a dual approach, i.e. top-down approach through the downscaling of global models as well as a bottom-up approach through collecting empirical evidences of climate change at a grassroots level.

Awareness and capacity-building

Awareness and capacity building to face this new challenge will be the primary focus; this will be undertaken across the different sectors and the state economy as a whole

Overall approach

A multidisciplinary, integrated and co-ordinated convergence approach is required and will be adopted in implementing this CAP. GoO will adopt a proactive, preventive and preparedness-oriented approach rather than a reactive approach.

Different sectors have different key priorities to be addressed through different initiatives over different timeframe. Each sector will implement its initiatives relevant to their key priorities within themselves and in close integration with different departments and stakeholders involved.

During this CAP implementation, GoO will demonstrate, promote and encourage different initiatives through policy changes and implementation actions as a response to climate change.

Involve stakeholders

GoO will involve stakeholders, particularly community, in a more proactive way in the CAP implementation. This involvement will relate to (i) promoting much greater climate change awareness within community, (ii) identifying problematic issues relevant to climate change, (iii) support in monitoring of climate-induced problems and (iv) ensuring greater accountability to the people on climate change issues. Stakeholder involvement will be an effective tool with stakeholders, who play an important part in bringing out the solutions. If stakeholder involvement as described here is not initiated, then stakeholders are bound to look at GoO as an adversary and not as a partner.

Orissa Climate Change Agency

To ensure the effective implementation of the above approach, a Climate Change Agency will be put in place to provide advisory, supervisory and co-ordination services to the state. This Agency will facilitate dealing with the GoI and the various external funding agencies in the context of climate change.

Once the Orissa Climate Change Agency is established, GoO will ensure transparency by sharing information on all its climate change related activities on a public website.

Going beyond environmental & climate change professionals

From the range of issues / concerns, it is quite clear that even though climate change is an environmental challenge, the response requires non-environmental professionals. Resolving climate change issues cannot be done in isolation by the environmental or climate change fraternity alone. The issues/problems are so fundamental and deep in the sectoral context that the respective sector professionals have to address these problems. Policy-makers, economists, planners, engineers, scientists, development programme specialists and others have to be encouraged to contribute towards resolving climate change problems in a structured way.

Dynamic document

Approaches to responding to climate change are fast changing based on research being done across the world. Given this situation, this 5-year CAP should be seen as a dynamic document rather than a fixed in time or static one. The key priorities provide the guidance and direction that GoO wishes to take. Keeping these key priorities, flexibility will have to be exercised in implementing the proposed initiatives so that these are in line with the latest and upto-date developments in this fast-changing discipline.

Integrate climate change in new initiatives

This CAP was prepared taking into account the current development activities and how climate change considerations need to be integrated in all those. As there will be new development activities in each of these sector, it will also be ensured that climate change considerations are integrated with these as well.

Monitoring of CAP

Climate change is relevant to most sectors and departments within the GoO. As activities across all sectors and departments are identified and planned through state planning processes, the monitoring and evaluation of this CAP will be done in close co-ordination with the monitoring of the stake planning activities. Over a period 1-2 years, the process of monitoring the CAP will be streamlined with the monitoring of activities under the state planning framework.

Budget

The budget for climate change response actions has been estimated to be Rs. 17,000 crores for a 5-year period between 2010 and 2015. This estimate includes both existing / already earmarked resources and additional resources required to shift Orissa towards a carbon-conscious, climate-resilient development path. Energy, forests, coasts & disasters, agriculture, water resources and urban are the sectors that constitute about 80% of the overall budget.

6.3 Recommendations for future CAPs

The preparation of this CAP was undertaken over approximately a 6-month period from the commencement of the climate change scoping study. Being the first CAP of its kind, the next steps of the preparation process / methodology was developed as progress was made. From the experience of preparing this CAP, the following are the recommendations for preparing future CAPs in the state:

- Following the implementation of this first CAP, awareness and knowledge on climate change issues / concerns would have developed across the state. Therefore, the overall capacity of both Government staff across all levels as well as those of the external stakeholders will be considerably higher. Once built, this capacity should be collectively and gainfully used in a consultative, participatory and inclusive manner in determining the focus areas of attention in the next version of the CAP.
- As was done in the first CAP, a set of sector working groups - 11 working groups were established - should be created within the GoO to prepare subsequent CAPs as well. The ownership and commitment of the GoO in implementing this CAP gets a substantive boost if there is an active involvement and engagement of the GoO staff in preparing these plans. A similar multi-sector and integrated approach should therefore be adopted for future CAP preparations.
- While all sectors were directly or indirectly covered in preparing the first CAP, there were some departments of the GoO that were not actively engaged, e.g. Education department. The overall focus on capacity building addresses an educational goal / target but this is not implemented through the formal systems of the Education department. In the next version of the CAP, those GoO departments that have not been directly engaged should be encouraged to be involved so that new perspectives and approaches emerge.
- As climate change has an all-pervading influence, it is relevant to most sectors and departments within the Government. Activities across all sectors and departments are identified through state planning processes and budgets are prepared on an annual basis. With the implementation of this first CAP, the move towards climate-friendly sectoral development will be achieved. Subsequent CAPs should aim to identify only the additional activities and budgets required to further move the sector development plans towards being more climate-responsible.



Annexure I

List of Working Groups Chairpersons, Convenors and Members

Name	Designation	Department
Agriculture		
Shri U P Singh, Chairman	Secretary	Agriculture
Shri G.B. Reddy, Convenor	Director	Orissa Watershed Development Mission
	Secretary/Additional Secretary	Water Resources Department
Shri B J Sharma	Ex-Director	Agriculture
Shri B. Giri	I/C Director, Agriculture	Agriculture
Shri G N Mohanty	Joint Director, Agriculture	Agriculture
Dr K C Das	I/C Director, Horticulture	Agriculture
Shri P.K. Sahu	I/C Director, Soil Conservation	Agriculture
Shri N.K. Mohapatra	Director, Hydrology	Water Resources Department
ShriPrasant Ku Satapathy	Agril Economist	Agriculture
Prof S S Nanda	Dean, Extension	Orissa University of Agricultural Technology
Dr Madan Mohan Panda	Dean, Research	Orissa University of Agricultural Technology
Mr. S N Pasupalak	Agro-meteorologist	Orissa University of Agricultural Technology
Shri Niranjana Sahu	PSU Coordinator	Orissa Watershed Development Mission
Coasts & Disasters		
Shri. Raj Kumar Sharma Chairperson	Commissioner-cum-Secretary	Revenue & Disaster Management Department
Shri Ajit Kumar Patnaik, Convenor	Chief Executive	Chilika Development Authority
Shri Nikunja K Sundaray	Managing Director	Orissa State Disaster Management Authority
Shri Khagendranath Jena	Additional Secretary	Fisheries and Animal Husbandry Department
Shri N.K.Mohapatra	Director, Hydrology	Water Resources
Shri Guru Ch. Ray	Special Secretary	Commerce & Transport
Shri S. S. Srivastava	Chief Conservator of Forests (CCF), Wildlife	Forests
Miss Shenhalata Bhuiyan	Joint Secretary	Revenue & Disaster Management Department
Shri S. Kabi	Executive Director	Orissa State Disaster Management Authority (OSDMA)
Dr.C.S.Kar	Senior Research Officer	Wildlife Wing of Forest Department

Name	Designation	Department
Energy		
Shri Pradeep Kumar Jena, Chairperson	Commissioner cum Secretary	Energy Department, Government of Orissa (GOO)
Shri B. P. Singh, Member	Special Secretary	Forest & Env. Dept., GOO
Smt. Debadutta Saranjita Jena, Member	Under Secretary	Steel & Mines
Shri D. P. Mohanty, Member	Additional Secretary	Industries
Shri Y. Sethi, Member	Additional Secretary	Commerce & Transport
Shri R. P. Panda, Member	General Manager	IPICOL
Dr. Akhila Kumar Swar, Convenor	Senior Environmental Engineer	State Pollution Control Board, Orissa
Shri Bhabagrahi Mohapatra, Nodal Officer	Addl. Secretary	Energy Department, GOO
Fisheries		
Shri G. Mohan Kumar, Chairperson	Principal Secretary	Fisheries & Animal Husbandry
Shri Ajit Kumar Patnaik, Convenor	Chief Executive	Chilika Development Authority
Shri Sibanarayan Mishra	Director, Fisheries	Fisheries & ARD Department
	Director	Animal Husbandry and Veterinary Sciences
Shri Khagendranath Jena	Additional Secretary	Fisheries & ARD Department
Shri Balaram Sahu	Research Associate OBPI	Directorate of Animal Husbandry & Veterinary Services
Forests		
Shri U.N. Behera, Chairperson	Principal Secretary	Forests & Environment
Shri A.K. Bansal, Member	Project Director	Orissa Forests State Development Project (OFSDP)
Shri P.N.Padhi, Member	Principal Chief Conservator of Forests, Wildlife	Forests
Shri U.P. Singh, Member	Secretary/Additional Secretary	Agriculture
Shri S.N. Tripathy, Member	Secretary	Panchayati Raj Department
Shri B.Behera, Member	Director, Environment	Forests & Environment
Shri S.S. Srivastava, Member	CCF(WL)	Forests & Environment
	Secretary/Director	Tourism
Shri G.B.Reddy, Member	Project Director	Orissa Watershed Development Mission
Shri R. Kumar, Member	Joint Project Director	Orissa Forests State Development Project (OFSDP)
Shri S.K.Lohani, Member	Director (SP)	
Shri B.N. Mishra, Member	Dy Director (Tourism)	Tourism
Shri B.B. Rath, Member	Tourism Officer	Tourism
Shri Debabrata Swain, Convenor	CCF (PP&A)	Forests

Name	Designation	Department
Health		
Working Group:		
Smt Anu Garg, Chairperson	Commissioner-cum-Secretary	Health & Family Welfare
Shri Dilip K. Behera, Convenor	Senior Environmental Scientist	State Pollution Control Board
Dr. G. N. Mahalik	Director	Health Services
Shri P. K. Das	Director	Directorate of Medical Education & Training
Shri P. K. Panigrahi	Chief Engineer	Rural Water Supply & Sanitation
Shri Dillip Singh	Chief Engineer	Public Health
Shri Siddhanta Das	Member Secretary	State Pollution Control Board
Dr. D. Muduli, Nodal Officer	Spl. Secretary	Health & Family Welfare
Other key contributors:		
Dr. Alison Dembo Rath	Team Leader	Technical & Management Support Team (TMT) - OHSP
Shri Amalin Pattnaik	Programme Manager	OHSP
Dr. P. K. B. Pattnaik	State Leprosy Officer	
Dr. Bikas Pattnaik		Integrated Disease Surveillance Project
Dr. Madan Mohan Pradhan	Dy. Director	Malaria
Shri Suvendu Mendali	Waste Manager	
Shri Jyoti Kanungo		F & CW
Shri Devjit Mittra		TMST & DMD
Dr. S. Kar	Additional Director	Health
Industry		
Shri Saurabh Garg, Chairperson	Commissioner-cum Secretary	Industries
Shri Nihar Ranjan Sahoo, Convenor	Senior Environmental Engineer	State Pollution Control Board
Shri Siddhanta Das	Member Secretary	State Pollution Control Board
Shri H. Sharma	Director of Industries	Industries
Shri D. P. Mohanty	Additional Secretary	Industries
Shri B. Mohapatra	Additional Secretary	Energy
Shri R. P. Panda	General Manager	IPICOL
Shri P. Pradhan	Joint Director of Industries	Industries
Mining		
Shri Ashok Mahadeo Rao Dalwai	Principal Secretary	Steel & Mines
Shri Manoj Ahuja	Commissioner-Cum- Secretary	Steel & Mines
Shri Rama Nagaraja Reddy, Convenor	Chief Conservator of Forests, Forest Diversion, FC Act	Forests
Shri Harihar Panigrahi	Special Secretary	Steel and Mines
Shri Bhanu Pratap Singh	Special Secretary	Forests & Environment
Shrimati Devidutta. Suranjana Jena	Under Secretary	
Shri B. C. Pattanaik	Director	Mines
Shri M. R Pattanaik.	Additional Director	Steel and Mines
Shri Nihar Ranjan Sahoo	Senior Environmental Engineer	State Pollution Control Board
Shri Singa Tiu,	Chairman, Regional Controller of Mines	IBM Bhubaneswar.

Name	Designation	Department
Transport		
Shri Satyabrata Sahu, Chairperson	Commissioner-cum Secretary	Commerce & Transport
Shri P.K. Prusty, Convenor	Senior Scientist	Forests & Environment
Shri G C Ray	Special Secretary	Commerce & Transport
Shri P Dash	Special Secretary,	Industry
Shri Deepak K. Mohanty	Additional Secretary	Housing & Urban Development
Shri B K Sahu	EE, Asst to Chief Engineer, Roads	Works
Urban		
Shri Arun Kumar Panda, Chairperson	Principal Secretary	Housing & Urban Development
Shri Deepak K. Mohanty, Convenor	Additional Secretary	Housing & Urban Development
ShriG.C.Ray	Commissioner, Rail Coordination and Spl. Secy	Commerce & Transport
Shri Siddhanta Das	Member Secretary	State Pollution Control Board
Shri B.B. Mohanty	Additional Secretary	Energy
Er. B. Tripathy	Executive Engineer	Works (World Bank Project)
ShriP.K. Pattnaik	Asst. Town Planner	
ShriP. B. Rout	Coordinator, S.E.(P&M), O/o C.E.	Public Health (Urban)
Water Resources		
Shri Suresh Chandra Mohapatra, Chairperson	Principal Secretary	Water Resources
Shri B.N. Bhol, Convenor	Senior Env Scientist	State Pollution Control Board
Shri Phani Bhusan Rout	Superintending Engineer	Housing & Urban Development
Shri Siddhanta Das	Member Secretary	State Pollution Control Board
Shri N.K. Mohapatra	Director, Hydrology	Water Resources Department
Shri P.K. Sathpathi	Chief Statistician	Directorate of Agriculture & Food Production
Shri B.K. Soren	Asst Chief Engineer	Public Health Urban
Shri Prabhat Kumar Behera	Executive Engineer	Public Health Urban
Shri Harish Chandra Behera	Engineer-in-Chief	Water Resources

Department:

Date:

[Note: To be completed only for High Priority Activities]

- A. Reference No.
- B. Objective and Proposed Action
- C. Type of Activity (Mitigation or Adaptation)
- D. Scale of Activity (State-wide or district or particular area)
- E. Nature of Activity (Research Study/Policy Action/Pre-investment Study/Demonstration Project/Investment Project/Capacity Building)
- F. Organizations involved
- G. Description of stages/sub-activities
 - G1.
 - G2.
 - G3.
- H. Monitoring & Evaluation
 - H1. Process indicators
 - H2. Results/Outcome Indicators
- I. Timeframe (Short -term, i.e. 1-2 years/Medium-term, i.e. 3-5 years)
- J. Indicative Budget
- K. Source of funding, if identified

Summary of Stakeholder Consultations

Government of Orissa is one of the states that have started developing its own action plan modelled in line with the National Action Plan on Climate Change. The sense of urgency was understandable, as Orissa is more vulnerable to climate change because of its long coast line of about 480 Km having linkages with sea level rise and extreme weathers like drought and flood; high dependence on agriculture (more than 2/3rd of its population depend on it and out of which more than 75% depends on paddy which is highly sensitive to vagaries of monsoon); high growth in metal and mineral sector has put pressure on the environment both due to land use change and degradation of forest area. Rapid urbanisation and industrialisation have

resulted in high congestion in transport and scarcity of water and electricity. To consider these issues in a holistic manner, a high level committee was formed under the chairmanship of Chief Secretary with Principal Secretary Forest and Environment acting as its convenor. 11 working groups were formed drawn from departments to deliberate on various actions that would help in reducing the impact of climate change in the state.

The main purpose of the workshop was to share the draft climate change action plan with the other stakeholders like Civil Society, Grassroots Agencies, industries and academic bodies to get their feedback so that the plan

Location	Date	Chaired by	No of Participants	Sectors Covered
Bhubaneswar (Central/East)	13 th May 2010	Sri Pradeep Jena, IAS, Commissioner-cum-secretary, Energy	128	Urban, Transport, Industry, Energy, Mining and Health
Berhampur (South)	19 th May 2010	Dr CS Kumar, IAS, Revenue Divisional Commissioner, South	71	Urban, Water, Agriculture, Fisheries and Health, Coasts & Disasters
Anugul (Central/ West)	20 th May 2010	Sri R Raghuprasad, IFS, DFO-Wild Life	61	Industry, Mining, Forests, Water, Energy
Balasore (North/ East)	22 nd May 2010	Sri Ajit Bharthuar, IFS, Regional Chief Conservator of Forest, Simlipal	47	Industry, Forest, Water and Agriculture, Coasts & Disasters, Fishery
Bhubaneswar (State Level)	24 th May 2010	Sri R N Senapati, IAS, Agricultural Production Commissioner cum Additional Development Commissioner, Orissa	153	Agriculture, Coasts & Disasters, Energy, Fisheries, Forests, Health, Industry, Mining, Transport, Urban and Water

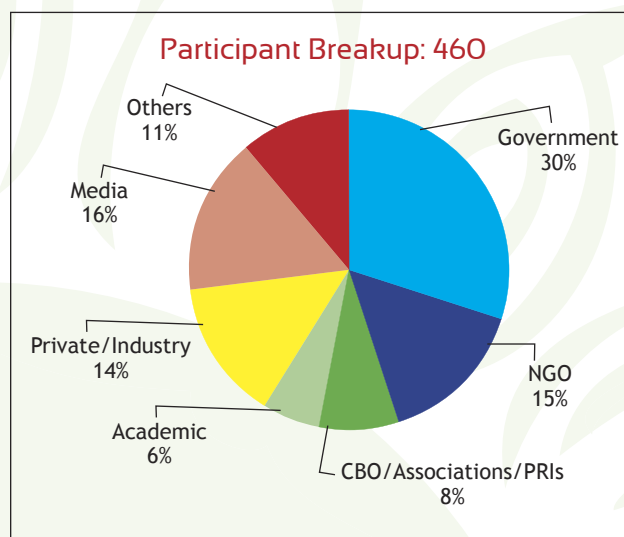
which was largely drawn up by the departments to make it more inclusive.

As part of that process five stakeholder consultation workshops were planned. The following table shows the locations, sectors covered and the total number of participants. Subsequent charts show the breakup of the participants, the breakup of the priority actions debated in the workshops.

As a whole about 460 participants registered for the workshop which does not include the CTRAN staff, support staff and some of the invited speakers who did not sign the registration sheet. So the total number was about 500.

Effort was made to invite almost double the number of persons to ensure that all sections are represented and the consultations were well attended covering all priority sectors. The following chart shows the breakup.

The NGOs included both national level NGOs like CEE, RCDC, PRADAN, BASIX and



bi-lateral and multilateral agencies. CSOs are combination of grassroots organisations, associations and unions like Matsyajibi Mahasangh (Federation of Fisherfolks), Jangal Adhikar Manch, SHG federations, etc. Industry associations like CII and Utkal Chambers of Commerce who participated are not included in this category and classified as industries. Others category included retired experts, research students, activists, etc.

The **workshop format** for the regional consultation was as follows.

Session Plan	Content
Inaugural session	Introduction to workshop objective, context and process of CCAP formation
Technical sessions	Presentation on priority sectors and priority actions
Discussion	Feed back about the sectors and the action plan: this was done sometimes in small groups and sometimes after the technical presentation of a particular sector.

In total the Draft Climate Change Action plan validated the **287 priority actions** in 11 sectors.

Sectors	No. of priority actions deliberated
Agriculture	37
Coastal Disaster	9
Energy	42
Fishery	14
Forestry	13
Health	10
Industry	60
Mining	42
Transport	19
Urban	21
Water	20
Total	287

In terms of spatial break up; 136 related to adaptation, 123 related to mitigation and 28 could not be classified either way. Similarly, 190 actions had state-wide repercussions and 66 actions were related to specific area/ clusters; and 30 fell in other category.

The following sections capture the issues raised and suggestions made by the

stakeholders in different consultations. It also captures how the panels fielded for the consultation responded to some of these issues. The suggestions arising out of these consultations have been forwarded to the convenors to discuss in their respective working group before the draft version gets finalised.

Cross cutting issues

Key Processes	Observations/Issues	Remark
CAP formulation process	<p>The process is well coordinated; but seems to be moving very fast; many regional level experts and activists did not get a chance</p> <p>There should be definite time frame for CAP finalisation</p> <p>World Bank Influence on the process</p>	<p>The workshops are meant for this after the workshop due process will be followed through web-hosting for wider consultation.</p> <p>State Climate Change Action Plan is modelled as per the National Climate Change Action Plan and World Bank is only providing help of experts and supporting the public consultation to get wider views. State is the ultimate owner and implementer and would seek support where such expertise is available.</p>
Exclusion	<p>CAP does not have enough focus on tribal groups and impact of Climate in their life;</p> <p>Education department can play an active role in disseminating the environmental concerns but have been left out</p> <p>Panchayati Raj department has been left out though they play an active role</p> <p>Senior officials (technical experts are ignoring districts; policies ignoring certain regions and favouring only certain sectors so balance is needed)</p> <p>District level planning needed which is eco-system specific should be the process to build up state plan; should be in local language and easily understandable</p>	<p>Jangal adhikar Manch who participated felt strongly about this</p> <p>Some representation from PRIs and department was there but need consideration</p>

Key Processes	Observations/Issues	Remark
Implementation Process	<p>First a baseline for the state in different sectors need to be established so that the impact can be measured; the plan does not have any clear indicators and budget; Focus should be on livelihood creation and restoration and risk management; there seems to be more thrust on policy making.</p> <p>Inter-departmental coordination is crucial; but there should be accountability. Past experience of external agencies and international consultants has not helped the state (e.g. power sector reform); involvement of multiple stake-holders, local agencies and local research institutions in implementation would make it successful.</p> <p>Climate change cells should be formed at the district level</p> <p>Perception survey should follow capacity building. Information, education and communication on various aspects of the climate change should be a major component.</p> <p>Existing policies/programmes need to be examined before attempting to build a new one; actions to be monitorable. Larger administrative reform will be necessary to mainstream the climate change agenda, technology transfer and dissemination.</p> <p>There is very little focus on investment budget and the indicative figures show high variance (in one sector budget for mainstreaming climate change cost in lakh in other in crore); details are missing or not explained in the plan.</p>	<p>Modalities of the institutional arrangement will factor in these views.</p> <p>Budget will be rationalised and currently the budget is only indicative.</p>

Sector Specific Issues

Agriculture:

- Main-stay of our state, worst affected because of climate change and maximum investment should be in this sector.
- Promote traditional, organic and sustainable agriculture
- Preservation and management of germ-plasm, traditional varieties and seeds
- Reduce chemical fertiliser for NO₂ reduction and also encourage efficiency in irrigation to reduce CO₂ emission

- Crop diversifications
- Use varieties that can withstand weather stress and also varieties that can sequester carbon and other GHG; introduction of bio-technology
- Prevent diversion of agricultural land for non-agricultural use and ensure groundwater management
- Weather insurance for risk transfer

Coastal and Disaster Management:

- Detailing of the research studies/ conservation measures and how this is going

to help in planning needs to be outlined

- Investment measures missing (in drainage, dredging and mangrove management)
- Need thrust on climate resilient infrastructure planning (e.g. Sea Water Guard/Wall for Coastal Cities) in coastal region with a long term perspective to prevent storm surge, flood plain damage

Energy:

- Focus and promote renewable energy and a clear policy to incentivise them and fast track them (include renewable policy, RPO, technology transfer)
- Promote hydro power : dedicated cell for hydro power
- Reorganise the energy department to tackle the emerging challenge
- Concrete action plan for T&D loss reduction (Orissa is not getting APDRP support despite being a pioneer in reform)
- Promoting energy efficiency in all sectors industry, irrigation, housing, etc and ensuring regular M&V through energy audit
- Advance technology (super-critical) for fossil fuel plant
- Integrated policy taking into account all energy sources (Bio-gas, bio-mass, energy conservation, reuse and rehabilitation of the old plants)

Fisheries:

- Livelihood planning for the fishermen and capacity building to adapt to climate change
- Modern technology for forecast at the local level and early warning
- Protection of fishery infrastructure and catch
- Investment in habitat and estuary management and protection of endangered species like horse shoe crab, olive ridley turtles and mangroves and managing the conflict with fishing through a compensation formula
- Research needed on impact of climate change on inland and coastal aquaculture and balance

Forestry:

- Focus on sustainable timber harvest plan along with forestation and reforestation and revenue plantations
- Focus on forest based livelihood and their protection
- No diversion of forest land/plantations for construction and ensuring g plantations in hilly areas
- Streamlining the usage of CAMPA and preparation of a plan that is convergent with agriculture, watershed, mining, industry and tribal development

Health:

- Bio-medical waste management
- Assessment of health impact due to climate stressed areas
- More research and capacity building to tackle vector borne diseases
- Food security should not come under health department. Agriculture and public distribution departments should be involved with it
- Disease forecasting system like weather forecast
- Health and climate impact of appliances like ACs
- Legal measures to check polluters and recover the health hazrd costs through regulatory measure at local level

Industry:

- Focus on clean production (industrial waste management, recycling and reuse: creation of waste bank): fly ash, waste water, chemicals etc.
- Finding innovative partnership and incentive mechanism like CSR and PPP in carbon market operations like CDM and VCM
- Spreading out of industrial clusters based on carrying capacity, carbon foot print
- Water management, effluent management and energy management plan
- Capacity building and awareness creation on clean technology and processes and emission profile monitoring especially for the MSME sector

Mining:

- Monitoring of socio-economic and environment in the mining clusters in intervals
- Investment plan for green zones leveraging funds from different sources
- Cleaner extraction and creating incentives for such processes through policy
- Investment plan for creation of dedicated corridors for transportation dirty cargo

Transport:

- Green transport system and low carbon high way pilot is fine but upscaling plan in other areas
- Improvement of public transportation system and policy disincentive for private carriage (MRTS and BRTS)
- Traffic planning and forecast system for avoiding congestion
- Scrappage system for old vehicles (>15 years)
- Investment in infrastructure for clean fuel and check for fuel adulterations (steeper penalty: law exists)

Urban:

- Action on land use planning, tackling encroachment in urban CPRs/like wetlands and avenue plantations
- Regulatory measure to prevent land use changes that encroach river catchment, flood plains and discharge areas, and creation of urban forests and avenue plantation
- Attitudinal change of ULBs on energy efficiency measures
- Efficiency in water supply, water management (storm water) and rainwater harvesting
- Promotion of green building and manage essential regulatory aspects
- Specific plans for migrants and their livelihoods focussing on the pressure they exert on urban resources

Water:

- Management of wetland to have a cooling effect
- Management of groundwater and mechanism to monitor the theft
- Management of storm water
- Sustainable basin management for proper flow
- Investment in minor and sub-minors to reduce impact of flash flood in non-costal hilly areas
- Cleaning of encroachment in the discharge areas and flood plains around Bhubaneswar and prevent land use

Overall summary:

- Mainstream climate issues into the sectoral policies before that it is impropy to assess what we have already
- Finding the realistic budget should be based on clear norms and indicators and it should see the current availability from existing sources and estimate what is the short fall
- Building Capacities is not enough using the capacity is key
- Capacity of the implementing institutions should be assessed and enhanced

Way Forward:

- The feedback obtained so far though various discussions, consultations, emails have been made available to the convenors;
- The convenors will deliberate this and revise the action plan by the week ending 29th May 2010;
- Secretary Forest and Environment has assembled a tem that will read this whole dodument and plan and provide feedback;
- A web version will be hosted on 5th June 2010;
- This will be available for public inputs for a fortnight;
- The finalised plan will be released during the Vana Mahotsav week during July 2010.

Sectorwise table of key priorities

Agriculture - Key Priorities

Sl. No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
AG/KP/1	Rapid screening and strategy assessment of state Agriculture policy in the context of climate change	DOA/OUAT			Rs. 143 crores	Central sector & State Plan Schemes
AG/KP/2	Establishing institutional delivery mechanisms to promote best practices on climate change adaptation	OWDM			Rs. 100 crores	GOO/Externally Aided Projects
AG/KP/3.	Capacity Building on adapting to climate change					
(a)	Capacity Building and Technical Support to CBOs for better management of land & water to adapt to climatic risks	OWDM			Rs. 100 crores	EAP
(b)	Capacity Building of Extension Personnel & Farmers	DOA IMAGE/ RITES			Rs. 54 crores	Central sector plans and state plan
(c)	Use of GP training Hubs for dissemination of information on climate change	DOH			Rs. 4 crores	DFID
AG/KP/4	Continuing the livelihood-focused, people-centric integrated watershed development programmes in rainfed areas vulnerable to climate variations	OWDM			Rs. 1000 crores	GOI/GOO/Externally Aided Projects
AG/KP/5	Increasing the area under perennial fruit plantation to help cope with uncertain weather patterns	DOH			Rs. 50 crores	State Govt. & Central Govt

Sl. No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
AG/KP/6	Developing water-efficient micro irrigation methods and individual/community farm ponds	DOH			Rs. 12 crores	State Govt. & Central Govt
AG/KP/7	Improving monitoring and surveillance techniques in the context of climate change	DOA			Rs. 24 crores	Central sector & State Plan Schemes
AG/KP/8	Developing sustainable soil, water and crop management practices	OUAT			Rs. 2.5 crores	ICAR/GOI/GoO/EAP
AG/KP/9	Breeding studies on major crops for tolerance/ resistance to high temperature, submergence and drought under elevated carbon dioxide	OUAT			Rs. 2.5 crores	ICAR/GOI/GoO/EAP
AG/KP/10. Research						
(a)	Preparedness to tackle emerging scenarios of pests	OUAT			Rs. 2 crores	ICAR/GOI/GoO/EAP
(b)	Increased production of rice seeds to meet requirement under various weather scenarios	OUAT			Rs. 2 crores	ICAR/GOI/GoO/EAP
(c)	Climate risk management services	OUAT			Rs. 2 crores	ICAR/GOI/GoO/EAP
	Total:				Rs. 1498 crores (approx Rs. 1,500 crores)	

Coasts & Disasters Key Priorities

Sl. No.	Title	Departments/ Organisations	Budget (Rs. Crores)			Source of funding
			Exist	Addl.	Total	
CD/ KP/1	Flood mapping, flood forecasting, downscaled climate change projection modelling, preparation of improved flood management plans.	OSDMA, Water Resources, GoO (Institution to be identified for carrying out modelling)	0	50	50	Gol/External funding agency
CD/ KP/2	Assessment of erosion prone areas with the help of Digital Elevation Model	Housing and Urban Development, Works, Industry, Energy, Agriculture, Rural Development and Transport Department with the help of ICMAM, Chennai, ORSAC	0	3	3	Gol
CD/ KP/3	Special study on micro and meso level effects of coastal erosion along the coast of Orissa with special reference to coastal roads and settlement	OSDMA, Rural Development Department, Works Department, H & U.D. Department	0	200	200	Gol, Government of Orissa, External Aid
CD/ KP/4	Micro level vulnerability assessment of different state resources like housing, public infrastructure, agriculture land, livelihood issues and socio-economic aspects of different levels of population due to effects of climate change resulting in extreme weather events.	OSDMA, Housing & Urban Development, Works, Agriculture, Panchayati Raj	0	50	50	Gol, Government of Orissa, External Aid
CD/ KP/5	Construction of flood shelters in unconventionally vulnerable locations (i.e. traditionally dry areas facing flooding and water logging due to climate change) and strengthening the community to face the changing patterns of adaptation.	OSDMA, Rural Development	28	72	100	Gol, Government of Orissa, External Aid 50 shelters are under construction with Rs.28 crore from CMRF
CD/ KP/6	Need assessment and construction of multipurpose cyclone shelters in the cyclone prone areas of the state along with provision of emergency equipment to the cyclone shelters and strengthening the capacity of the local people for disaster management	OSDMA, Rural Development	180	220	400	Rs.165 crore provided by World Bank under NCRMP for construction of 155 multipurpose cyclone shelters and godowns 14 cyclone shelters have been taken up at a cost of Rs.15 crores under ICZM project

Sl. No.	Title	Departments/ Organisations	Budget (Rs. Crores)			Source of funding
			Exist	Addl.	Total	
CD/ KP/7	Developing a hydrological framework with legally binding connotations for ground water conservation/ replenishment through development of watershed both in semi-arid and rain fed areas, identification, protection and rejuvenation of traditional water bodies, natural drainage channels and moribund river channels.	OSDMA, Geological Survey of India, Water Resources, Public Health Department	0	100	100	Gol, Government of Orissa, External Aid
CD/ KP/8	Dredging and widening of river mouths to facilitate speedy discharge of flood water which otherwise aggravate the flood situation by lengthening the duration and depth of flooding arising out of erratic and intense pattern of rainfall due to effects of climate change.	Water Resources Department, Forest and Environment	0	150	150	Gol, Government of Orissa, External Aid
CD/ KP/9	Sustainable shelter belt plantation, natural vegetation, mangrove generation and cropping patterns in view of the changing climate and weather conditions. Utilization of traditional knowledge and adaptive mechanism available with the community in a systematic way through an organized institutional mechanism	Forest & Environment Department, Agriculture, OSDMA, Corporate sector working in coastal areas,	0	40	40	Gol, Government of Orissa, External Aid
CD/ KP/10	Developing a techno-legal regime for construction of disaster resilient housing and public infrastructure with respect to changing climate conditions such as extreme heat events, flooding of traditionally non flood prone areas and in the areas of coastal erosion and land subsidence.	OSDMA, Rural Development, Housing and Urban Development	Nil	1	1	Gol, GoO, External Funding Agency
CD/ KP/11	Integration and strengthening of climate change risk issues in the state Disaster management policy with robust framework for dealing with extreme events associated with climate change with its pro active and multi hazard approach to disaster management.	Revenue & Disaster Management, OSDMA	Nil	0.5	0.5	Gol, GoO, External Funding Agency

Sl. No.	Title	Departments/ Organisations	Budget (Rs. Crores)			Source of funding
			Exist	Addl.	Total	
CD/ KP/12	Setting up an integrated training and capacity building protocol for raising the level of awareness of the community and major stakeholders with respect to the mitigation and adaptation mechanism arising due to effects of climate change on agriculture and livelihood support systems and disaster preparedness.	Revenue & Disaster Management, Agriculture, F&ARD, OSDMA	Nil	100	100	Gol, GoO, External Funding Agency
CD/ KP/13	Assessment of risks due to lightning and thunder storm. Increase of such climate hazards may have climate change connotations which need to be explored through elaborate scientific study and mitigation measures.	Revenue & Disaster Management, OSDMA,	Nil	20	20	Gol, GoO, External Funding Agency
CD/ KP/14	Identification of potential location and construction of check-dams to contain flash flooding in high gradient river basins due to extreme rain events possibly owing to changing climate conditions.	Water Resources, OSDMA	Nil	300	300	Gol, GoO, External agency funding
CD/ KP/15	Prediction through appropriate modeling the impact of sea level rise on coastal ecosystem	CDA, Wildlife Wing Forest Department (for carrying out the modeling study appropriate international organisation to be identified.	Nil	1.5	1.5	ICZM project(World Bank)
CD/ KP/16	Study of impact of global warming on the biodiversity of coastal ecosystem with special emphasis on flagship species. CDA, Wildlife Wing of Forest Department Nil			5	5	Gol/External funding agency
	Total		208	1,105	1,313	Approx 1,300 crores

Energy - Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
ENERGY/KP/1	<p>For generating cleaner energy through clean coal approaches the following policies need to be implemented by the Energy Department:</p> <ul style="list-style-type: none"> • Switch over from Sub critical Technology to Super critical Technology by which coal consumption will reduce from 1 MT to 0.88 MT per MWh and increase in plant efficiency from 37% to 42%. • Encourage more Gas based Combined Cycle Power Plants where CO2 emission is 0.46 and which can be reduced to 0.25 per MWh • Washed coal to be used by the IPPs/CPPs for generation of power if ash content in coal exceed 40 % • Use of Fluidised Bed Boiler and coal gasification. This will utilize the mines' rejects and washery rejects for power generation. • Improvement of Boiler Efficiency through combustion Optimization by installation of dynamic coal flow balancing system with continuous Online residual carbon analyser in the boilers. • Promoting Merchant Power Plant in Existing Industrial unit with variable PPA (Power Purchase Agreement) option • Develop state-level energy efficiency standards for the various sectors adopting ECBC. • Existing Thermal power plant to conduct Life Cycle Analysis of their plants as per CEA Benchmark and implementation of R&M measures to improve the efficiency 	Energy Dept.	Nil	Nil	Nil	Not Applicable

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
ENERGY/KP/2	<p>Institutional development (Capacity building/restructuring) of Energy Department for implementing policies and conducting studies consisting of following activities.</p> <ul style="list-style-type: none"> ● Functional Reorganization And Capacity Building Of The Energy Department, OERC & OREDA To Have A Coherent Road Map to achieve efficient functioning and implementation of energy efficiency, energy conservation, promotion of renewable energy. ● Integrated Super critical (660 MW) IPP Policy (Coal Washeries, Fly Ash based cement and brick plants) Minimum unit size for the purpose of IPP/MPP should not be less than 300 MW to achieve minimum standards of efficiency. ● Revised RPO based on the Changing Load mix and Assessment of Evacuation Infrastructure ● To conduct a study for determination of State Emission intensity ● Develop an operational plan for the Fund that will get revenue for the sale of power that is exported. ● Feasibility study of establishment of coal based thermal power plants along coast of Orissa, use of saline water and dedicated rail corridor for coal transportation to be conducted. ● Feasibility of Implementation of emerging Clean Coal Technologies through pilot projects in orissa ● Training of the Members of working group or their representatives of different departments and organisations on sector specific climate change issues 	Energy Department	Rs. 10 crores	Rs. 30 crores	Rs. 40 crores	GoO/Gol/EFA

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
ENERGY/KP/3	Reduction of T & D losses: Develop an operational plan for a targeted reduction of losses due to pilferage and outdated systems (estimated to be about 40%). The activity includes augmentation of T & D infrastructure and investment plan, enhancing present practices for improved load management & feasibility study of evacuation corridors	Energy dept. & DISCOMS	Rs.2,000 crores	Rs. 3,500 crores	Rs. 5,500 Crores	GOI, APDRP, RGGVY Funding from R&M resources/EFA
ENERGY/KP/4	DSM/EE: Develop a comprehensive policy and plan to save energy use in order to reduce the demand - supply gap and contribute towards climate change abatement including the following measures: <ul style="list-style-type: none"> ● Implementation of utility level DSM measures - Policy action ● Awareness Generation for Energy Conservation ● Promotion and implementation of the National BEE's ECBC code for widespread adoption in the state to reduce the energy consumption in buildings. ● For proper energy monitoring, capacity building of energy auditors, strengthening of existing energy conservation Cell supported with manpower and infrastructure. 	Energy Department, DISCOMS & ESCO	Rs. 75 crores	Rs. 385 crores	Rs. 460 Crores	GoO/External Funding Agencies
ENERGY/KP/5	For effective fly ash utilization and emission reduction from power plants there is necessity of capacity building of State Pollution Control Board including the following policy actions/studies. <ul style="list-style-type: none"> ● Compile information from the several studies and initiatives that have been done on fly ash and develop an operational plan for effective utilization of fly ash - Study ● Installation of equipments at IPPs/CPPs for NOx reduction - Policy action 	State Pollution Control Board	Nil	Rs. 60 crores	Rs. 60 Crores	GoO/External Funding Agencies
ENERGY/KP/06	Promotion of Small and Medium Hydel plants	EIC/Energy Dept.	Rs. 5 crores	Rs. 36 crores	Rs. 41 Crores	GOO/GOI/ External Funding Agencies

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
ENERGY/ KP/07	Maximize harnessing biomass potential in the state through co-generation/thermal/ power plant/gasification to feed the grid as green power. Increase in application of CPP both in grid and stand alone mode	OREDA	Nil	Rs. 50 crores	Rs. 50 Crores	Central Financial Assistance of MNRE/IREDA on different biomass projects/ Green cess/ Users' contribution/CDM revenue/EFA
Energy/KP/08	Promotion of Grid based Wind power generation	OREDA	Nil	Rs. 50 crores	Rs. 50 Crores	Central Financial Assistance of MNRE/IREDA/ CDM revenue/EFA
Energy/KP/09	Maximize solar power generation in the state in both PV and thermal routes and increase the penetration of stand alone solar systems for use by institutions, communities and individuals	OREDA	Nil	Rs. 100 crores	Rs. 100 Crores	Central Financial Assistance of MNRE/IREDA/ Users' contribution/CDM revenue
Energy/ CAP/10	Development of Biogas and manure management including examining the bio fuel policy in the state and linkage with blending infrastructure	OREDA	Nil	Rs. 4 crores	Rs. 4 Crores	GoO/EFA
Total:			Rs. 2,285 crores	Rs. 4,215 crores	Approx. Rs. 6,500 crores	

Fisheries & Animal Husbandry Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
FARD/ CAP/1	Vaccination against contagious diseases, Deworming, early disease warning system	Department of AH&VS	Rs. 34.00 crores	Nil	Rs. 34.00 crores	GoO - Ongoing programme
FARD/ CAP/2	Emphasis on Green fodder, pasture development and grazing	Department of AH&VS	Rs. 144.00 crores	Nil	Rs. 144.00 crores	GoO - Ongoing programme
FARD/ CAP/3	Training on fodder production, fodder conservation, rotational grazing, Rain Water harvest technology, Methane gas harvesting technology, bio-gas tanks management	Department of AH&VS	Rs. 0.50 crores	Nil	Rs. 0.50 crores	GoO - Ongoing training on fodder
FARD/ CAP/4	Conservation of local hardy animals	Department of AH&VS	Nil	Rs. 1.00 crores	Rs. 1.00 crores	GoO - Ongoing programme
FARD/ CAP/5	Gober Gas tanks/ packing to cylinders by compression like CNG	Energy Department, Khadi & Village Industries	Nil	Rs. 0.50 crores	Rs. 0.50 crores	GOI/Donor Agency/ External aid
FARD/ CAP/6	Easy and handy Methane Harvest Technology at farmers point	Energy Department, Khadi & Village Industries	Nil	Rs. 0.50 crores	Rs. 0.50 crores	GOI/Donor Agency/ External aid
FARD/ CAP/7	Disease Early Warning System	Veterinary Research Institute/ Research Organisations	Nil	Rs. 2 crores	Rs. 2 crores	GOI/Donor Agency/ External aid
ARD/KP/1	Impact of climate change on animal husbandry. Application of biotechnology and skilled animal breeding for development of better adopted species.	FARD, OUAT	Nil	Rs. 2 crores	Rs. 2 Crores	Gol/External Funding Agency

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
ARD/KP/2	Capacity building of livestock keepers.	FARD	Nil	Rs. 2.5 crores	Rs. 2.5 crores	Gol/GoO
ARD/KP/3	Research on disease early warning system	Veterinary Research Institute, FARD	Nil	Rs. 2.0 crores	Rs. 2.0 crores	Gol/GoO
FISH/KP/1	Impact of climate change on inland and coastal aquaculture.	FARD with national ICAR institutes.	Nil	Rs. 3.0 crores	Rs. 3.0 crores	Gol/External Funding Agency
FISH/KP/2	Development of infrastructure for early warning systems in coastal areas for fishers	FARD, OSDMA	Nil	Rs. 5.0 crores	Rs. 5.0 crores	Gol/External Funding Agency
Total:			Rs. 178.50 crores	Rs. 18.50 crores	Rs. 197.00 crores	

Forests: Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
FOR/KP/1	Increasing reforestation/ afforestation activities in degraded forest areas	Forests Dept	Rs. 1,100 crores	Rs. 1,400 crores	Rs. 2,400 crores	Rs 1100 crore from State and Central budget, CAMPA, Finance Commission Grant; Remaining Rs 1400 crores is to be funded externally
FOR/KP/2	Protecting existing forest stocks to act as carbon sink with stronger conservation	Forests Dept	Rs. 100 crores	Rs. 400 crores	Rs. 500 crores	Rs. 100 crores from State and central budget, CAMPA, Finance Commission Grant; Rest Rs 400 crore has to be funded externally.
FOR/KP/3	Increasing planting on non-forest land and also exploring where new and increased tree planting could create barriers to storm and cyclone impacts in coastal zones	Forests Dept	Rs. 10 crores	Rs. 40 crores	Rs. 50 crores	Rs. 10 crores from State and central budget, CAMPA, OFSDP; Rest Rs 40 crore has to be funded externally.

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
FOR/KP/4	Covering bald-hills with suitable species mix	Forests Dept	Rs. 10 crores	Rs. 10 crores	Rs. 20 crores	Rs10 crore from State budget, CAMPA; Rest Rs 10 crore has to be funded externally
FOR/KP/5	Increasing and protecting existing mangrove cover along the coast	Forests Dept	Rs. 50 Crores	Rs. 50 crores	Rs. 100 crores	Rs 50 crore from State and central budget, OFSDP, CAMPA; Rest Rs 50 crore has to be funded externally.
FOR/KP/6	Assessing fire management strategies	Forests Dept	Rs.10 crores	Rs. 90 crores	Rs. 100 crores	Rs 10 crore from the state and central budget, OFSDP, Finance Commission grant; Rest Rs 90 crore has to be funded externally.
FOR/KP/7	Improving tree planting and forest management to integrate with watersheds and water resources management	Forests Dept, Orissa Watershed Development Mission and Water Resources Dept	Nil	Rs. 1,200 crores	Rs. 1,200 crores	External Funding Agencies
FOR/KP/8	Working to establish new systems to support for community users	Forests Dept	Rs. 10 crores	Rs. 40 crores	Rs. 50 crores	Rs 10 crore may be funded from State budget, Finance Commission Grant, CAMPA and OFSDP; Rest of Rs 40 crore has to be funded from External Agency.
FOR/KP/9	Undertaking studies on indigenous trees species to assess their vulnerability to climate change	Forests Dept	Nil	Rs. 10 crores	Rs. 10 crores	External Funding Agencies

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
FOR/ KP/10	Assessing additional threats to biodiversity and wildlife	Forests Dept	Rs. 20 crores	Rs. 80 crores	Rs. 100 crores	Rs 20 crore may be funded from State and Central budget, Finance Commission Grant, CAMPA and OFSDP; Rest of Rs 80 crore has to be funded from External Agency.
FOR/ KP/11	Obtaining access to updated knowledge on climate change science and policy developments	Forests Dept	Rs. 5 crores	Rs. 5 crores	Rs. 10 crores	Rs 5 crore may be funded from State budget, Finance Commission Grant, CAMPA and OFSDP; Rest of Rs 5 crore has to be funded from External Agency.
FOR/ KP/12	Capacity building of Panchayati Raj institutions/communities/JFM institutions to adapt to climate change	Forests Dept	Nil	Rs. 5 crores	Rs. 5 crores	External Funding Agencies
FOR/ KP/13	Monitoring carbon stock and biodiversity at regular intervals	Forests Dept	Nil	Rs. 5 crores	Rs. 5 crores	External Funding Agencies
Total:			Rs. 1315 crores	Rs. 3,335 crores	Approx. Rs. 4,650 crores	

Health Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
HEALTH/KP/1	Capacity Building of the health sector on climate change on both adaptation and mitigation aspects	DoHFW/WCD/Lab. & Employment/ Revenue			Rs. 110 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/2	Integrating climate change considerations in the State Health policy	DoHFW			Rs. 1.5 crores	GOI/External Funding Agencies/CSR budgets

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
HEALTH/KP/3	Strengthening approaches to manage vector borne disease that have worsened due to climate change impacts	DoHFW/NVBDCP			Rs. 75 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/4	Strengthening approaches to deal with heat wave conditions exacerbated due to climate change.	DoHFW/Revenue			Rs. 165 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/5	Strengthening approaches to deal with the physical and psychological impacts due to extreme weather conditions caused by climate change	DoHFW/OSDMA			Rs. 15 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/6	Addressing drought, nutrition & food security due to increased risk of drought, consequent decline in agriculture and increased malnutrition & food security	DoHFW/WCD/ Agric.			Rs. 35 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/7	Undertaking measures to manage water borne disease that have worsened due to climate change impacts	DoHFW/PHED			Rs. 30 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/8	Research & studies on climate change and health impacts	DoHFW/Agric./ WCD			Rs. 65 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/9	Addressing food safety that is undermined as a result of increased ambient temperatures and extreme events	DoHFW/Agric.			Rs. 5 crores	GOI/External Funding Agencies/CSR budgets
HEALTH/KP/10	Studying the interlinkages between air quality and climate change, and implications on health	SPCB/DoHFW			Rs. 1 crore	GOI/External Funding Agencies/ CSR budgets
Total:					Rs. 502.5 crores or Approx Rs. 500 crores	

Industry Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
IND/KP/1	Integrate climate concerns in policies and plans for industrial development and related areas.	Industries Dept.			Rs. 30 crores	External Funding Agencies
IND/KP/2	Prepare GHG profile of major industrial cluster	Industries Dept. and State Pollution Control Board			Rs. 10 crores	GOI
IND/KP/3	Heat-island study for Talcher and Jharsuguda area	State Pollution Control Board			Rs. 10 crores	GOI
IND/KP/4	Training various stakeholders on climate change issues	Forests & Environment Dept			Rs. 62 crores	GOI/External Funding Agencies
IND/KP/5	Implement a system of compensatory water harvesting	Water Resources Dept			Rs. 100 crores	GOI/External Funding Agencies
IND/KP/6	Streamline institutional arrangement and strengthen OSDMA to tackle extreme climate events in coastal area	OSDMA			Rs. 110 crores	External Funding Agencies
IND/KP/7	Carry out energy efficiency study for iron & steel, thermal power, cement and aluminum sector	State Pollution Control Board			Rs. 10 crores	GOI/External Funding Agencies
IND/KP/8	Promote use of bulk waste material like fly ash, dolo-char, slag etc.	Industries Dept and State Pollution Control Board			Rs. 10 crores	GOI/External Funding Agencies
IND/KP/9	Setting emission targets for thermal power plants	Industries Dept and State Pollution Control Board			Rs. 10 crores GOI	
Total:					Rs. 322 crores (Approx Rs. 325 crores)	

Mining Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
MIN/KP/1	Draft State Mineral Policy incorporating climate concerns	Steel & Mines Dept.			Rs. 10 lakhs	GOO
MIN/KP/2	Carry out a study to determine appropriate policy instruments to promote energy efficiency in mining clusters and mineral transport.	Steel & Mines Dept.			Rs. 2 crores	GOO
MIN/KP/3	Conduct a study to identify the potential of beneficiation of low grade iron ore, manganese, graphite and chrome ore.	Steel & Mines Dept.			Rs. 1 crores	GOO/IBM
MIN/KP/4	Establish a robust system of environmental monitoring in major mining clusters	State Pollution Control Board			Rs. 30 lakhs	GOO
MIN/KP/5	Protection of water harvesting structures, reservoirs, weirs etc. from pollution and capacity reduction in catchments in mining intensive areas and restoration	Steel & Mines Dept. and Water Resources Dept.			Rs. 20 crores	GOO
MIN/KP/6	Creation and maintenance of green zones in major mining clusters	Forests & Environment Dept			Rs. 20 crores	GOI (Campa Funds)/GOO
MIN/KP/7	Imparting training on CDM to the officials of Steel and Mines Department, Directorate of Mines, IBM and SPCB	Steel & Mines Dept			Rs. 20 lakhs	External Funding Agency
MIN/KP/8	Training of officials of S&M department, Directorate of Mines, SPCB, IBM etc on various aspects of climate change	Steel & Mines Dept			Rs. 10 crores	GOI/GOO
MIN/KP/9	Generate awareness, create capacity and train the mining personnel/lease holders on benefit of cleaner production	Directorate of Mines, IBM			Rs. 10 lakhs	GOI/GOO
MIN/KP/10	Identify areas in mining process where energy savings and emission reduction can be achieved.	Directorate of Mines, IBM			Rs. 10 lakhs	GOO
Total:					Rs. 53.8 crores (Approx Rs. 55 crores)	

Transport: Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
TRANSPORT/KP/1	Revising State Transport Policy & Boat Policy.	Commerce and Transport Dept.			Rs. 20 lakhs	External Funding Agency
TRANSPORT/KP/2	Integration of Urban Development and land use planning with transport planning.	Commerce and Transport Dept.			Rs. 50 lakhs	External Funding Agency
TRANSPORT/KP/3	Introduction of MRTS in suburban areas - including electric operated vehicles, Preparation of DPR	Housing & Urban Development and ULBs			Rs. 4 crores	External Funding Agency
TRANSPORT/KP/4	Encouraging transportation of bulk dirty cargo through rail network	Commerce and Transport Dept.			Rs. 50 lakhs	External Funding Agency
TRANSPORT/KP/5	Use of alternate fuel to conventional fuel	Commerce and Transport Dept.			Rs. 150 lakhs	External Funding Agency
TRANSPORT/KP/6	Blending of bio fuel in automobiles	Commerce and Transport Dept.			Rs. 50 lakhs	External Funding Agency
TRANSPORT/KP/7	Green low carbon foot-print highway	CE (Roads & NH)			Rs. 40 crores	External Funding Agency
TRANSPORT/KP/8	Ensuring Fuel Efficiency (Drivers Training)	Commerce and Transport Dept.			Rs. 50 lakhs	External Funding Agency
TRANSPORT/KP/9	Strengthening Enforcement wing for emission level check up (Burning fuels more efficiently.)	Commerce and Transport Dept.			Rs. 50 lakhs	External Funding Agency
TRANSPORT/KP/10	Survey of ambient air quality of Towns/Cities	Commerce and Transport Dept. and State Pollution Control Board			Rs. 30 lakhs	External Funding Agency
TRANSPORT/KP/11	Promoting and incentivizing use of non-motorized vehicles	Housing & Urban Development and ULBs			Rs. 50 lakhs	External Funding Agency
TRANSPORT/KP/12	Avenue tree plantation for carbon sequestration.	Forests & Environment Dept. and CE (Roads & NH)			Rs. 5 crores	External Funding Agency
TRANSPORT/KP/13	Commissioning study of Estimation of carbon emission From Transport sector	Commerce and Transport Dept.			Rs. 25 lakhs	External Funding Agency
Total:					Rs. 53.50 crores or approx. Rs. 55 crores	

Urban: Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
HUD/KP/1	To orient and sensitise the stakeholders at all levels of ULBs towards issues related to climate change and capacitate them for carrying out the planning and execution of different activities	H&UD Deptt and State Pollution Control Board	Nil	Rs. 20 Crores	Rs. 20 crores	GOI/Externally Aided Projects
HUD/KP/2	To develop a model design for urban water supply and sewerage projects thereby bringing in a shift in planning and designing of such projects keeping in view the climate change issues.	H&UD Deptt, OWSSB and consultants	Nil	Rs. 5 crores	Rs. 5 crores	GOI
HUD/KP/3	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	H&UD Deptt and C.E.PH (Urban)	Nil	Rs. 5 crores	Rs. 5 crores	GOO/GOI
HUD/KP/4	To develop and implement an ideal MSW management plan in a selected city and prepare such plans for state wide implementation	H&UD Deptt, ULBs and Consultants	Nil	Rs. 300 crores	Rs. 300 crores	GOI/Externally Aided Projects
HUD/KP/5	To orient the city dwellers on energy efficient street lighting and piloting the same through a CDM proposal.	ULB and Private partners	Nil	Rs. 20 crores	Rs. 20 crores	GOI/Externally Aided Projects
HUD/KP/6	To strengthen the existing guidelines for preparation of Master Plan/CDP by incorporating measures to combat climate change and prepare & implement such a Master Plan/CDP for a selected city. The activity will be outsourced through a technical organization.	H&UD Deptt, Town Planning, Dev. Authorities, ULBs	Nil	Rs. 50 crores	Rs. 50 crores	GOI/Externally Aided Projects

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
HUD/KP/7	To improve urban infrastructure by making non motorized 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.	H&UD Deptt, Commerce & Transport Deptt, Works and ULBs	Nil	Rs. 500 crores	Rs. 500 crores	GOI/Externally Aided Projects
HUD/KP/8	Improvements to water harvesting in urban areas with restoration of water tanks and artificial recharge	H&UD Deptt,	Nil	Rs. 200 crores	Rs. 200 crores	GOI/Externally Aided Projects
HUD/KP/9	Developing models of urban storm water flows and capacities of existing drainage systems with climate change H&UD Deptt,		Nil	Rs. 100 crores	Rs. 100 crores	GOI/Externally Aided Projects
Total:			Nil	Rs. 100 crores	Rs. 1200 crores	

Water: Key Priorities

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
WATER/KP/1	Expansion of Hydrometry network	WR, CWC, CGWB, SRC/OSDMA, F & E			Rs. 15 crores	GOI/GOO/ External Funding Agencies
WATER/KP/2	Development of flood forecasting models	WR, DST, OSDMA, IMD			Rs. 2 crore	GOI/GOO/ External Funding Agencies
WATER/KP/3	Downscaling of Global Circulation Model	WR, IMD, Research Organisations, Academia, F & E			Rs. 2 crore	GOI/GOO/ External Funding Agencies
WATER/KP/4	Increasing the water use efficiency, Bench Marking & Water Audit in irrigation projects.	WR, H & UD, Industry, RD, Energy, Agrl.			Rs. 20 crores	GOI/GOO/ External Funding Agencies

No.	Title	Orgns.	Budget			Source of funding
			Exist.	Addl.	Total	
WATER/KP/5	Construction of Water Harvesting Structures i.e., Check-dam to adapt to the climate change scenario	WR			Rs. 470 crores	GOO/GOI/ External Funding Agencies
WATER/KP/6	Improvement of drainage system	WR			Rs. 200 crores	GOO/GOI/ External Funding Agencies
WATER/KP/7	River Health Monitoring, Ecosystem Environmental Flow demand studies	WR, IMD Research Org., F & E			Rs. 2 crores	GOO/GOI/ External Funding Agencies
WATER/KP/8	Awareness raising with Pani Panchayat through Farmers' Training Programme & creation of Agro-climatic stations	WR, Agrl.			Rs. 5 crores	GOO/GOI/ External Funding Agencies
WATER/KP/9	Integrated Water Resources Management	WR/Stakeholders			Rs. 10 crores	GOO/GOI/ External Funding Agencies
Total:					Rs. 726 crores (Approx. Rs. 725 crores)	

Comprehensive List of Activities Considered

Agriculture

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
AG/CAP/1	Continued Investment in Integrated watershed development programmes in climate sensitive area and ensuring replication across Orissa (Livelihoods based)	Orissa Watershed Development Mission (OWDM)	H	AD/MI	S	IP	LT
AG/CAP/2	Rapid screening and strategy assessment & seed improvement	DOA/OUAT	H	AD	S	PA/RS/OM	MT
AG/CAP/3	Increase knowledge & Capacity	DOA/OUAT	M	AD	S	CB	MT
AG/CAP/4	Capacity Building of Extension Personnel & Farmers.	DOA/IMAGE/RITES	H	AD	S	CB	MT
AG/CAP/5	Improved monitoring surveillance then devise new farming techniques.	DOA.	H	AD	S	PS/DP	ST
AG/CAP/6	Continued liaison work with NCCP and the National Mission on Sustainable Agriculture.	DOA.	H	AD	S	PA	
AG/CAP/7	Training of Farmers in water efficiency	DOH	L	MI	S	CB	ST
AG/CAP/8	Use of GP training Hubs for dissemination of information on climate change	DOH	H	AD	S	CB	ST
AG/CAP/9	National Mission on sustainable Agriculture	DOH	H	AD/MI	S	DP	MT
AG/CAP/10	Establishment of Agromet System in KVKs	OUAT	M	MI	S	DP	
AG/CAP/11	Creation of awareness among farmers	OUAT/DOA	M	AD	S	CB	
AG/CAP/12	Revisit of agronomic practices of major crops	OUAT	M	AD	S	RS	

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
AG/CAP/13	Establish Institutional delivery mechanisms to promote best practices on climate change adaptation in rainfed farming conditions	OWDM	H	AD	A	CB	ST
AG/CAP/14	Capacity Building and Technical Support to CBOs for better management of land & water to adapt to climatic risks	OWDM	H	AD	A	CB	ST
AG/CAP/15	Research & Policy: Conduct a study to determine implications of climatic changes on small and marginal farmers of rainfed areas	OWDM	M	AD	A	RS/PS	ST
AG/CAP/16	Establishment of Climate Change Resource Center Network	OWDM	M	AD	S	CB	ST
AG/CAP/17	Promotion of low carbon technologies in climate sensitive watershed area	OWDM	M	MI	A	IP	ST
AG/CAP/18	Promotion of SRI	DOA	M	AD	S	CB/DP	ST
AG/CAP/19	Popularization of environment friendly crop husbandry	DOA/OUAT.	M	AD/MI	S	CB/DP	ST
AG/CAP/20	Crop diversification	DOA	M	AD	S	DP/CB/OM	ST
AG/CAP/21	Development of Micro Irrigation & Devt.of Individual/Community Farm Pond	DOH	H	AD	S	DP	MT
AG/CAP/22	Emphasis on Shade net House/Poly House & Mulching	DOH	H	AD	S	DP	MT
AG/CAP/23	Increased area under perennial fruit plantation	DOH	H	AD	S	DP	MT
AG/CAP/24	Documentation of ITK helping in adaptation of climate change	OUAT/DOA	M	AD	S	CB	
AG/CAP/25	Promotion of organic agriculture	OUAT/DOA	M	AD	S	DP	
AG/CAP/26	Popularization of agro-forestry models	OUAT/DOA	M	MI	S	DP	
AG/CAP/27	Impact analysis of climate change on major crops in Orissa	OUAT	H	AD/MI	S	RS	
AG/CAP/28	Screening of and value addition to resilient species from local agrobiodiversity.	OUAT	M	AD	S	RS	

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
AG/CAP/29	Breeding studies on major crops for tolerance/resistance to high temperature, submergence and drought under elevated carbon dioxide	OUAT	H	AD	S	RS	
AG/CAP/30	Screening of available crop production technologies suitable as potential adaptation and mitigation measures through modelling	OUAT	M	AD/MI	S	RS	
AG/CAP/31	Development of sustainable soil, water and crop management practices	OUAT	H	AD	S	RS	
AG/CAP/32	Performance of situation specific contingent measures in crop production	OUAT	M	AD	S	RS	
AG/CAP/33	Preparedness to tackle emerging scenarios of pests	OUAT	H	AD	S	RS	
AG/CAP/34	Increased production of rice seeds to meet requirement under various weather scenarios	OUAT	H	AD	S	RS	
AG/CAP/35	Identifying suitable rice varieties for vulnerable coastal areas	OUAT	M	AD	A	RS	
AG/CAP/36	Standardizing crop and soil management practices for vulnerable coastal areas	OUAT	M	AD	A	RS	
AG/CAP/37	Climate risk management services	OUAT	H	AD	S	RS	

Coasts & Disasters

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
CDA/CAP/1	Predictions through appropriate modeling to generate different scenarios.	CDA & To be identified	H	AD	A	RS	MT
CDA/CAP/2	Generation of flow series and prediction of the changed salinity regime, salinity flushing, upstream breeding migration, impact on the lake fishery and biodiversity.	CDA & To be identified	H	AD	A	RS	MT
CDA/CAP/3	Prediction of the rate of migration, cross section based on numerical modeling.	Central Water and Power Research Station, Pune	H	AD	A	RS	MT

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
CDA/CAP/4	Impact on the mangrove diversity.	CDA & To be identified					
CDA/CAP/5	Predictions based on the modeling on the mangrove ecosystem.	CDA & To be identified					
OSDMA/CAP/1	Flood mapping, flood forecasting models, downscaled climate change projections	Water Resources Department	M	AD	S	OM	ON
OSDMA/CAP/2	Climate-proofing coastal road infrastructure	Works Department, Rural Development Department, H & UD Dept.	M	AD	A	OM	ON
OSDMA/CAP/3	Capacity building of Urban Local Bodies (ULBs) of the coastal towns on potential climate change impacts	Housing & Urban Development Department, ULBs, OSDMA, Water Resources Department	M	AD	A	OM	ON
OSDMA/CAP/4	Integration of climate change risks into the State Disaster Management Policy	OSDMA, Water Resources Department	M	AD	A	OM	ON
OSDMA/CAP/5	Assessment of erosion prone areas with the help of Digital Elevation Model	Housing and Urban Development Department, Works Department, Industries Department and Energy Department, Agriculture Department and Rural Development Department, Transport Department	M	AD	A	PS	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
OSDMA/ CAP/6	Strengthening delivery and monitoring systems and preparedness in disaster prone regions due to sea level rise	Revenue and Disaster Management Department, OSDMA, Housing and Urban Development Dept.	M	AD	A	RS	ON
OSDMA/ CAP/7	Strengthening delivery and monitoring systems of health systems preparedness in disaster prone regions	Forests and Environment Department	M	AD	A	OM	ON
OSDMA/ CAP/8	District authorities to develop heat wave disaster plans	OSDMA	M	AD	S	OM	ON
OSDMA/ CAP/9	Running drought monitoring and assessment models	Ministry of Agriculture, Govt. of India, Department of Agriculture, Govt. of Orissa, NRSC, ORSAC, OSDMA	M	AD	A	RS	ON
OSDMA/ CAP/10	Study to ascertain long term sustainability of coastal settlements, vegetation and cropping patterns	OSDMA and Special Relief Organisation	M	AD	A	OM	ON
OSDMA/ CAP/11	Conduct a detailed study on cause and effects of micro and meso level effects of coastal erosion.	OSDMA along with different line departments					
OSDMA/ CAP/12	Study/survey may be conducted to ascertain long term sustainability of coastal settlements, vegetation and cropping patterns	OSDMA, Specialized institutions.					
WL/CAP/1A	Survey, Identification, mapping, demarcation, fencing and earmarking of non-forest Government/Private land in 1-5 km stretch of coastal zone for taking up Reforestation & Afforestation activities both within and out side Sanctuaries and National Parks as bio-shield.	Wildlife	M	MI	A		ST
WL/CAP/2A	Undertake studies on indigenous tree species to assess their vulnerability to climate change. Develop saline resistant, water logging resistant, heat resistant genotypes.	Wildlife	M	AD	A	RS	

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
WL/CAP/3A	Study and assessment of population of biodiversity of all genera of Invertebrates and Vertebrates with emphasis on flagship species such as Marine Mammals (Cetaceans species) and Sea turtles in the coastal waters and estuarine crocodiles, estuarine terrapins, migratory birds in estuarine as well as tidal influenced habitat. This will also include the biology, lifecycle, abundance and distribution of the species and habitat conditions.	Wildlife	H	AD	A	RS	
WL/CAP/4A	Capacity building through training of wildlife field functionaries for access to up-dated knowledge on climate change and policy issues in connection with climate change.	Wildlife	M	AD	A	CB	
WL/CAP/1B	Establishment of rescue centers, equipped with modern facilities so as to cater to the needs of wildlife affected due to climate change	Wildlife	M	AD	A	CB	
WL/CAP/2B	With rise of ambient temperature, erratic rainfall more drought like situation is expected, so to cope up with the situation more water hole for wildlife in protected areas to be created.	Wildlife	M	MI	A	OM	
WL/CAP/3B	Establishment of conservation breeding centres of land and aquatic wildlife of rare, threatened and endangered species as well as other targeted species for maintaining gene pool and for taking of re-introduction programmes of these species as and when the need arises	Wildlife	M	AD	A	OM	

Energy

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
Energy/CAP/01	Study to develop a policy framework for generating cleaner energy through clean coal approaches	Energy Dept./ Consultant	H	MI	S	PA	ST
Energy/CAP/02	Switch over from Sub critical Technology to Super critical Technology by which coal consumption will reduce from 1 MT to 0.88 MT per MWh and increase in plant efficiency from 37% to 42%	Energy Dept	H	MI	S	PA	MT

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
Energy/CAP/03	Land bank for gas based power projects in potential areas to utilize gas find from Mahanadi basin	Energy Dept	M	MI	A	PA	MT
Energy/CAP/04	Encourage more Gas based Combined Cycle Power Plants where CO2 emission is 0.46 and which can be reduced to 0.25 per MWh	Energy Dept	H	MI	S	PA	MT
Energy/CAP/05	Washed coal to be used by the IPPs/ CPPs for generation of power if ash content in coal exceed 40 %	Energy Dept.	H	MI	S	PA	ST
Energy/CAP/06	Use of Fluidised Bed Boiler and coal gasification. This will utilize the mines' rejects and washery rejects for power generation	Energy Dept	H	MI	S	PA	ST
Energy/CAP/07	Import of Power from neighboring countries like Bangladesh (rich in gas deposits), Nepal and Bhutan having the scope of huge Hydro potential. Exploring the possibility of state/ central PSUs to construct power plants in those countries with a bilateral agreement to export a large portion of the power to India.	Energy Dept.	H	MI	S	PA/PS	ST
Energy/CAP/08	Implementation of emerging Clean Coal Technologies through pilot projects	Energy Dept	H	MI	S	DP	LT
Energy/CAP/09	Installation of equipments at IPPs/CPPs for NOx reduction	SPCB	H	MI	S	PA	MT
Energy/CAP/10	Adoption of Hg reduction measures like Activated Carbon Injection (ACI) or Co-capture with FGD (Flue Gas Desulphurisation)	SPCB	H	MI	S	PA/RS	ST
Energy/CAP/11	SO2 removal from coal/flue gas through dry/wet FGD system	SPCB	H	MI	S	PA/RS	ST
Energy/CAP/12	Installation of High efficiency ESPs followed by Bag Filters in all thermal power Plants	SPCB	H	MI	S	PA	ST
Energy/CAP/13	Implementation of Carbon Cap-Trade mechanism for TPP with a system of incentive and penalty for lower/higher level of emissions.	Energy dept./ SPCB	H	MI	S	PA/RS	ST
Energy/CAP/14	Capacity building of Energy Dept, OERC and SPCB	Energy Dept.	H	MI	S	RS	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
Energy/CAP/15	Integrated Super critical (660 MW) IPP Policy (Coal Washeries, Fly Ash based cement and brick plants) Minimum unit size for the purpose of IPP/MPP should not be less than 300 MW to achieve minimum standards of efficiency.	Energy Dept.	H	MI	S	PA/RS	ST
Energy/CAP/16	Promoting Merchant Power Plant in Existing Industrial unit with variable PPA (Power Purchase Agreement) option	Energy Dept., Industry Dept. and GRIDCO	H	MI	A	PA	MT
Energy/CAP/17	Revised RPO based on the Changing Load mix and Assessment of Evacuation Infrastructure	Energy Dept., OREDA and GRIDCO	H	MI	S	PA/RS	ST
Energy/CAP/18	Functional reorganization of the energy department to have a coherent road map	Energy Dept./ OREDA (DST)	H	MI	S	PA/RS	ST
Energy/CAP/19	Life Cycle Analysis of Existing Thermal power plant as per CEA Benchmark and implementation of R&M measures to improve the efficiency	Energy Dept.	M	MI	S	RS	MT
Energy/CAP/20	Improvement of Boiler Efficiency through combustion Optimization by installation of dynamic coal flow balancing system with continuous residual carbon analyser in the boilers.	Energy Dept./ SPCB	H	MI	S	PA/IP	ST
Energy/CAP/21	Exploration of Alternate Energy Sources(Tidal, Geothermal, Run of the River, Wind)	Energy Dept, OREDA and Consultants	M	MI	S	RS	ST
Energy/CAP/22	To conduct a study for determination of State Emission intensity	Energy Dept.	H	MI	S	RS	ST
Energy/CAP/23	Develop state-level energy efficiency standards for the various sectors	Energy Dept.	H	MI	S	PA	ST
Energy/CAP/24	Reduction of T & D losses: Develop an operational plan for a targeted reduction of losses due to pilferage and outdated systems (estimated to be about 40%). Plan should include enhancing present practices for improved load management & implementation	Energy dept. & DISCOMS	M	MI	S	IP	MT
Energy/CAP/25	Feasibility Study of Evacuation Corridor	Central Power Utilities and Energy Dept./ OPTCL	H	MI	S	RS	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
Energy/CAP/26	Augmentation of T & D infrastructure and investment plan	DISCOMS	H	MI	S	PA	ST
Energy/CAP/27	Implementation of utility level DSM measures	Energy Department, DISCOMS and ESCO	H	MI	S	IP	MT
Energy/CAP/28	Awareness Generation for Energy Conservation	Energy Department	H	MI	S	CB	MT
Energy/CAP/29	Promotion and implementation of the National BEE's ECBC code for widespread adoption in the state to reduce the energy consumption in buildings.	Works Dept./ HUD and ULB	H	MI	S	PA/CB	MT
Energy/CAP/30	For proper energy monitoring, capacity building of energy auditors, strengthening of existing energy conservation Cell supported with manpower and infrastructure.	Energy Dept.	M	MI	S	CB	ST
Energy/CAP/31	To increase energy efficiency through optimization usage pattern and incorporating energy efficiency measures.	Energy Dept.	H	MI	S	RS	ST
Energy/CAP/32	Compile information from the several studies and initiatives that have been done on fly ash and develop an operational plan including capacity building of concern dept.	State Pollution Control Board	H	MI	S	PA/PS/CB	MT
Energy/CAP/33	Develop an operational plan for the Fund that will get revenue for the sale of power that is exported.	Energy dept/ F&E Dept/ SPCB	H	MI	S	PA/PS	ST
Energy/CAP/34	Climate-proofing of proposed power infrastructure proposed in coastal belts e.g 2 Ultra Mega Power Plants	Energy dept.	H	MI	A	RS	ST
Energy/CAP/35	Feasibility study of establishment of coal based thermal power plants along coast of Orissa, use of saline water and dedicated rail corridor for coal transportation to be conducted.	Energy dept/ Private Sector	H	MI	A	RS	ST
Energy/CAP/36	Small and Medium hydel plants	OREDA	H	MI	A	PA/PS	MT

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
Energy/CAP/37	To maximize harnessing biomass potential in the state through co-gen/thermal/power plant/gasification to feed the grid as green power. Increase in application of CPP both in grid and stand alone mode	OREDA	H	MI	S	PA/PS/DP/IP	MT
Energy/CAP/38	Promotion of Grid based Wind power generation	OREDA	H	MI	S	PS/CB	MT
Energy/CAP/39	To maximize solar power generation in the state in both PV and thermal routes and increase the penetration of stand alone solar systems for use by institutions, communities and individuals	OREDA	H	MI	S	PA/PS/IP/DP/OM	MT
Energy/CAP/40	Development of Biogas and manure management	OREDA	H	MI	S	PS	LT
Energy/CAP/41	Examining the bio fuel policy in the state and examining linkage with blending infrastructure	OREDA	H	MI	S	PA/PS/DP/CB	LT
Energy/CAP/42	Training of the Members of working group or their representatives of different departments and organisations on sector specific climate change issues	F&E Dept.	H	MI	S	CB/RS	ST

Fisheries & Animal Husbandry

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
ARD/CAP/1	Scientific Animal Health Management	FARD	H	AD	S	OM	ON
ARD/CAP/2	Improved feeding management	FARD	M	AD/MI	S	OM	ON
ARD/CAP/3	Capacity Building of livestock keepers	FARD	H	AD/MI	S	CB	LT
ARD/CAP/4	Breeding Management	FARD, Orissa Veterinary college	M	AD	A	PA	MT
ARD/CAP/5	Better Waste Management	Energy Department, Khadi & Village Industries	H	MI	S	OM	ON

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
ARD/CAP/6	Research on easy Methane Harvest Technology	Energy Department, Khadi & Village Industries,	H	MI	S	OM	MT
ARD/CAP/7	Research on Disease Early Warning System	Veterinary Research Institute/ Research Organizations	H	AD	A	OM	MT
FISH/CAP/1	Loss of livelihood due to ban and climate change related implications on the fishery livelihood	FARD	H	AD	A	OM	ON
FISH/CAP/2	Study on climate change and Catch of marine fish	FARD	M	AD	S	RS	ON
FISH/CAP/3	Impact of exuberated extreme climatic events due to climate change	FARD	H	AD/MI	S	PA	MT
FISH/CAP/4	Protection of Fisheries infrastructure and assets	FARD	H	AD/MI	A	PA	ON
FISH/CAP/5	Fishing methods and gears	FARD	H	MI	S	OM	ON
FISH/CAP/6	Health and sanitation in the coastal area	FARD	H	AD	A	OM	ON
FISH/CAP/7	Fishermen welfare activities	FARD	H	AD	S	OM	ON

Forests

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
FOR/CAP/1	Increase reforestation and afforestation activities in degraded forest areas	FED	H	MI	S	PA/IP	ST/MT
FOR/CAP/2	Protect existing forest stocks to act as carbon sink with stronger conservation	FED	H	MI	S	PA/IP	ST/MT
FOR/CAP/3	Increase planting on non-forest land and promote agro-forestry and farm forestry	FED, Works Department, Water Resources Department and Agriculture Department	M	MI	S	PA/IP	ST/MT
FOR/CAP/4	Cover bald-hills with suitable species mix	FED	H	MI	S	PA/IP	ST/MT

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
FOR/CAP/5	Increase and protect existing mangrove cover along the coast	FED	H	AD	A	RS/PA/IP/CB	ST/MT
FOR/CAP/6	Assess fire management strategies	FED	M	MI	S	PA/IP	MT
FOR/CAP/7	Improved tree planting and forest management to work further in watersheds and with integrated water resources management to increase water storage, reduce surface flow and soil erosion; to assess where tree planting could provide protection in flood prone areas	FED	M	AD	S	PA/IP	ST/MT
FOR/CAP/8	Decrease people dependence on firewood and timber and increase use of improved stoves (chullhas) and wood substitutes	FED and Orissa Renewable Energy Development Agency	L	MI	S	PA/IP	LT
FOR/CAP/9	Work to establish new systems to support for community users. Aim to create new marketing structures for users of traditional forest products to improve incomes and livelihoods to reduce pressures on forest destruction.	FED	M	MI	S	PA/IP	LT
FOR/CAP/10	Undertake studies on indigenous trees species to assess their vulnerability to climate change. Develop heat resistant genotypes in tree nurseries.	FED and Indian Council of Forestry Research and Education	M	AD	S	PA/IP	LT
FOR/CAP/11	Assess additional threats to biodiversity and wildlife. Forest consolidation, linking forest fragmentations, habitat development and mitigation of man-wild animal conflicts	FED	H	AD	S	PA/IP	LT
FOR/CAP/12	To obtain access to updated knowledge on climate change science and policy developments and make this available for frontline staff and forest managers and policy makers. Bring in trainers to develop modules for forest training institutes	FED	H	AD	S	PA/IP/CB	LT

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
FOR/ CAP/13	Capacity building of Panchayati Raj institutions/communities/JFM institutions to adapt to climate change, e.g. in the handling of NTFPs, value addition and employment generation	FED and Panchayati Raj Department	M	AD	S	PA/IP/ CB	ST/MT
FOR/ CAP/14	Monitoring carbon stock and biodiversity at regular intervals	FED	H	MI	S	RS	LT

Health

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
H/CAP/1	Health impact due to climate change to be included in State Health Policy	Dept. of Health & Family Welfare	H	AD/MI	S		
H/CAP/2	Heat waves	Dept. of Health & Family Welfare	H	AD	S		
H/CAP/3	Extreme weather conditions	Orissa State Disaster Mitigation Authority (OSDMA)	M	AD	S		
H/CAP/4	Air quality	Dept. of Health & Family Welfare	M	AD/MI	S		
H/CAP/5	Vector Borne diseases	Dept. of Health & Family Welfare	H	AD	S		
H/CAP/6	Drought, Nutrition & Food Security	Dept. of Health & Family Welfare/ WCD/WR/Revenue/ Agriculture	M	AD	S		
H/CAP/7	Food Safety	Dept. of Health & Family Welfare	M	AD	S		
H/CAP/8	Water Borne Diseases	Dept. of Health & Family Welfare	H	AD/MI	S		
H/CAP/9	Capacity Building	Dept. of Health & Family Welfare	H	AD/MI	S		

Industry

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
IND/CAP/1	Integrate climate concerns in IPR	Ind Dept	H	MI	S	PA	ST
IND/CAP/2	Formulate industrial cluster policy for minimum carbon footprint	Ind Dept	H	MI	S	PA	LT
IND/CAP/3	Carry out a study to determine appropriate policy instruments to promote energy and material efficiency in industrial clusters	Ind Dept, SPCB	H	MI	S	PA	ST
IND/CAP/4	Providing incentives for RD&D in climate resilient technology development	Ind Dept	M	AD	S	PA	
IND/CAP/5	Devise a mechanism for green belt development and maintenance for industrial clusters	IDCO, SPCB	M	MI	A	OM	
IND/CAP/6	Incorporate climate change concerns in the draft SEZ policy and PCPIR master plan	Ind Dept	H	MI/AD	S	PA	ST
IND/CAP/7	Preparation of an SEA framework to be used as templates for policy making in cross Sectoral issues like energy policy, Water plan, tourism policy, Agro processing policy etc	Ind Dept	M	MI/AD	S	PA	
IND/CAP/8	Integrating climate concerns in steel and mining policy	Ind Dept	H	MI/AD	S	PA	ST
IND/CAP/9	Study the impact of climate change on supply side capacity of the food processing industries.	Ind Dept	L	AD	S	RS	
IND/CAP/10	Study the feasibility of establishing and operating bio-methanation process for food processing cluster in PPP mode	IPICOL	L	MI	A	PS	
IND/CAP/11	Installation of centralized solar heating system in food processing cluster for supplying hot water.	IPICOL, OREDA	L	MI	A	IP	
IND/CAP/12	Preparation of Regional Environmental Management Plans for major industrial clusters	SPCB	L	MI/AD	A	RS	
IND/CAP/13	Preparation of GHG profile of major industrial clusters and introduce a system of GHG auditing for major industrial sectors	SPCB, Ind Dept	H	MI	A	PS	MT
IND/CAP/14	Heat Island study for Angul-Talcher and Jharsuguda-Ib valley area	SPCB	H	AD	A	RS	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
IND/ CAP/15	Setting emission targets for Thermal Power, Iron & Steel, Aluminium and Cement sector	Ind. Dept, SPCB	M	MI	S	PA	
IND/ CAP/16	Establishment of a monitoring network for GHG emission in major industrial clusters	SPCB	M	MI	A	IP	
IND/ CAP/17	Devise a sensitization programme for adoption of CDM in MSME industries through seminars and other awareness programmes	DI, SPCB	L	MI	S	PA	
IND/ CAP/18	Strengthening of help desk in IPICOL for advising MSME industries on benefit of CDM	Ind Dept	L				
IND/ CAP/19	Establishing facilitation cell in regional offices of SPCB for advising MSME industries on benefit of CDM	SPCB	L	MI	S	CB	
IND/ CAP/20	Imparting training on CDM to the officials of Industries Department, IPICOL and SPCB	IPICOL	H	MI	S	CB	MT
IND/ CAP/21	Provision of subsidy on consultancy charges to MSME for adopting CDM	Ind. Dept	M	MI	S	PA	
IND/ CAP/22	Establishment of a system of empanelment of CDM consultants	IPICOL	L	MI	S	PA	
IND/ CAP/23	Identify a host training institute assess the training needs of related agencies and prepare training modules	F & E Dept.	H	MI	S	CB	ST
IND/ CAP/24	Training of officials of Industries department, Directorate of Industries, IPICOL, SPCB etc on various aspects of climate change	F & E Dept	H	MI/ AD	S	CB	MT
IND/ CAP/25	Imparting training to MSME sector on climate change risk and mitigation	SPCB, DI, IPICOL	H	MI/ AD	S	CB	MT
IND/ CAP/26	Establishment of a Training and Research Institute on Climate Change	Ind. Dept	L	MI/ AD	S	CB	
IND/ CAP/27	Establish a network with Research and educational institutes like IITs, IMMT etc.	F & E Dept	M	MI/ AD	S	CB	
IND/ CAP/28	Strengthening Center for Environment Studies to build capacity to carry out RD&D projects in climate change mitigation and adaptation	F & E Dept.	L	MI/ AD	S	CB	
IND/ CAP/29	Institute a study on impact of climate change on paddy, sugarcane and forest	APICOL, Agriculture Dept	L	AD	S	RS	

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
IND/ CAP/30	Introduce a programme for mandatory water and wastewater audit in water intensive industries like Thermal Power, Iron & Steel, Sponge Iron, Paper etc	SPCB, WR Dept., CGWB	M	AD	S	PA	
IND/ CAP/31	Establishment of a benchmark for water use in respective sectors	SPCB, IPICOL	M	AD	S	PA	
IND/ CAP/32	Revision of water charges and incentivising water efficiency to ensure efficient water management for industrial consumption.	Ind Dept. WR dept.	M	AD	S	PA	
IND/ CAP/33	Promoting water harvesting and storage in industrial clusters	IDCO, SPCB	M	AD	S	PA	
IND/ CAP/34	Devise a mechanism to implement a system of compensatory water harvesting and storage around industries/industrial clusters by the concerned industries	WR Dept	H	AD	A	PA	LT
IND/ CAP/35	Establishment and monitoring of Pollution Prevention Plans in industrial clusters	SPCB	M	AD	A	IP	
IND/ CAP/36	Heat Island study for Angul-Talcher and Jharsuguda-Ib valley area	SPCB	M	AD	A	RS	
IND/ CAP/37	Creation of adequate green zones and water bodies in industrial clusters	IDCO	M	AD	A	IP	
IND/ CAP/38	Establishment of a mechanism to ensure that the coastal industries incorporate the extreme climate conditions during structural design phase	OSDMA, SPCB	L	AD	A	PA	
IND/ CAP/39	Streamlining institutional arrangement for Disaster Management in coastal industrial belts like Paradeep, Dhamra and Gopalpur	Ind Dept, Directorate of Factories and boilers	H	AD	S	CB	MT
IND/ CAP/40	Strengthen OSDMA with training and equipments for technical disaster management	OSDMA	H	AD	S	CB	MT
IND/ CAP/41	Establishment of a network with DMI, Bhopal, OSDMA and coastal industrial houses	OSDMA	M	AD	S	CB	
IND/ CAP/42	Reclamation of coastal low lying areas with scientific disposal of fly ash of thermal power plants	SPCB	M	AD	S	IP	
IND/ CAP/43	Development of coastal green belt in Paradeep and Dhamra	F&E Department	L	AD	A	IP	
IND/ CAP/44	Generate awareness, create capacity and train the industrial personnel on benefit of cleaner production	IPICOL, SPCB, NPC	L	MI	S	CB	

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
IND/ CAP/45	Launching a awareness campaign on benefits of CP for the MSME sector	DI	L	MI	S	CB	
IND/ CAP/46	Technology assessment and exploring alternatives for steel making with an objective of minimizing carbon foot print	IPICOL	M	MI	S	RS	
IND/ CAP/47	Carry out an energy efficiency study for, integrated steel plant and sponge iron plants and exploring scope of waste heat utilization.	SPCB	H	MI	S	RS	ST
IND/ CAP/48	Institute a comprehensive study on processing and utilization of char from sponge iron plants.	SPCB	H	MI	S	PS	ST
IND/ CAP/49	Setting emission targets for Iron & Steel, sector	Ind. Dept, SPCB	M	MI	S	PA	
IND/ CAP/50	Discourage accumulation of fly ash in thermal power plants. Instituting a system of cess on accumulated fly ash	Ind. Dept, Energy dept, SPCB	H	MI	S	PA	MT
IND/ CAP/51	Demonstration project for Carbon Capture and storage in thermal power sector	IPICOL, SPCB	L	MI	A	IP	
IND/ CAP/52	Setting emission targets for Thermal Power plants	Ind. Dept, SPCB	H	MI	S	PA	ST
IND/ CAP/53	Technology assessment and exploring alternatives for power generation with an objective of minimize use of water and coal	IPICOL, Energy Department	M	MI	S	PS	
IND/ CAP/54	Conducting an energy efficiency study for ferro-alloys sector in Orissa	Energy Department	M	MI	S	PS	
IND/ CAP/55	Developing a mechanism to use waste plastics, rubbers, tyres and other waste carbonaceous waste material for co-processing in cement kilns	SPCB, H&UD Department	L	MI	S	PS	
IND/ CAP/56	Carry out a material and energy audit in paper industries of Orissa.	Energy Department	L	MI	S	PS	
IND/ CAP/57	Carry out a material and energy audit in aluminum industries of Orissa.	Energy Department	M	MI	S	PS	
IND/ CAP/58	Carry out a material and energy audit in cement industries of Orissa.	Energy Department	M	MI	S	PS	
IND/ CAP/59	Institute a comprehensive study on processing and utilization of spent pot lines from aluminum smelters.	SPCB	M	MI	S	PS	
IND/ CAP/60	Setting emission targets for Cement, paper, Aluminium and Cement sector	sSPCB	L	MI	S	PA	

Mining

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
MIN/CAP/1	Draft State Mineral Policy incorporating climate concerns	S&M Department	H	AD	S	PA	
MIN/CAP/2	Prepare Regional sustainable mining plans 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	S&M Department, IBM, CMPDI	M	MI			
MIN/CAP/3	Carry out a study to determine appropriate policy instruments to promote energy efficiency in mining clusters and mineral transport.	S&M Department	H	MI	S	RS	
MIN/CAP/4	Providing incentives for RD&D projects in environmental friendly technology development for small mining sector (Graphite and granite and other minor mineral)	S&M Department	M	AD			
MIN/CAP/5	Devise a mechanism for green belt development and maintenance in mining clusters	S&M and F&E Department, IBM	M	MI			
MIN/CAP/6	Explore cleaner technology and best practices in coal mining	S&M Department, CMPDI	M	MI			
MIN/CAP/7	Conduct a study to identify cleaner technology for using coal (Like coal washing, coal to liquid etc.) in industrial process	S&M Department	M	MI			
MIN/CAP/8	Conduct a study to determine the potential of coal bed methane in the coal fields of Orissa	Directorate of Mining, CMPDI	M	MI			
MIN/CAP/9	Exploring techno-economic viability of capturing coal bed methane for use in industrial sector	S&M Department, CMPDI	M	MI			
MIN/CAP/10	Prepare a coal evacuation plan separately for Talcher Coalfield and Ib-valley coalfield	S&M Department, Transport department, CMPDI	L	MI			
MIN/CAP/11	Carry out a research programme for controlling coalfield fire and subsidence due to underground coal mining	S&M Department	M	MI			

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
MIN/ CAP/12	Conduct a study to identify the potential of beneficiation of low grade iron ore, manganese, graphite and chrome ore.	S&M Department	H	MI	S	RS	
MIN/ CAP/13	Conduct a study to explore best practices in metal mining	S&M Department	H	MI	S	RS	
MIN/ CAP/14	Conduct study to explore feasibility of nickel extraction from nickeliferrus overburden of Sukinda mining area		M	MI			
MIN/ CAP/15	Prepare an action plan to mitigate hexavalent chromium pollution in the streams and ground water of Sukinda valley area.	Directorate of Mining	M	MI			
MIN/ CAP/16	Conduct a R&D project for recovery of metallic ore and strategic minerals from tailings		M	MI			
MIN/ CAP/17	Prepare a energy efficient mineral evacuation plan separately for Joda-Barbil area, Sukinda and Koira area.	S&M Department, Transport department	M	MI			
MIN/ CAP/18	Institute a system of energy audit in metal mining sector	Directorate of Mining	M	MI			
MIN/ CAP/19	Preparation of Regional Environmental Management Plans for major mining clusters like Talcher-Angul, Ib valley, Joda-Barbil, Koira and Sukinda	SPCB	M	MI & AD			
MIN/ CAP/20	Establish a robust system of environmental monitoring in major mining clusters	SPCB	H	MI	A	IP	
MIN/ CAP/21	Protection of water harvesting structures, reservoirs, weirs etc. from pollution and capacity reduction in catchments in mining intensive areas and restoration.	S&M Department and WR Department	H	AD	A	IP	
MIN/ CAP/22	Creation and maintenance of green zones in major mining clusters	F&E Department	H	MI	A	OM	
MIN/ CAP/23	Devise a sensitization programme for adoption of CDM in mining sector through seminars and other awareness programmes	S&M Department, SPCB, IBM	M	MI			
MIN/ CAP/24	Imparting training on CDM to the officials of Steel and Mines Department, Directorate of Mines, IBM and SPCB	World Bank	H	MI	S	CB	

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
MIN/ CAP/25	Identify a host training institute to assess the training needs of related agencies and prepare training modules	S&M Department.	M	MI			
MIN/ CAP/26	Strengthen Directorate of mines in respect of human resources, technology and development of database.		H	MI&AD	S	CB	
MIN/ CAP/27	Training of officials of S&M department, Directorate of Mines, SPCB, IBM etc on various aspects of climate change	S&M Department	H	MI & AD	S	CB	
MIN/ CAP/28	Establishment of a Training and Research Institute on Climate Change	S&M Department	M	MI & AD			
MIN/ CAP/29	Establish a network with Research and educational institutes like IITs, ISM and IMMT etc.	S&M Department	M	MI & AD			
IND/ CAP/30	Strengthening Center for Environment Studies to build capacity to carry out RD&D projects in climate change mitigation and adaptation	F & E Dept.	M	MI & AD			
MIN/ CAP/31	Generate awareness, create capacity and train the mining personnel/lease holders on benefit of cleaner production	Directorate of mines, IBM	H	MI	S	CB	
MIN/ CAP/32	Imparting training on energy efficiency in haulage, transport, pumping system, motors, process heating, compressed air system etc.	Directorate of mines, IBM	M	MI			
MIN/ CAP/33	Identify areas in mining process where energy savings and emission reduction can be achieved.	Directorate of mines, IBM	H	MI	MI	RS	
MIN/ CAP/34	Develop a methodology to measure, monitor and verify the amount of carbon sequestered by plantation programmes in mining sector	F&E Department	M	MI			
MIN/ CAP/35	Develop emission intensity targets for different mining sectors	SPCB, IBM	M	MI			
MIN/ CAP/36	Carry out Regional Hydro-geological survey for major mining cluster of Joda-Barbil, Koira, Talcher-Angul, Ib valley, Sukinda valley area, Sundergarh lime stone and dolomite belt, eastern ghats bauxite zone.	WR Department, S&M Department, CGWB	M	MI			
MIN/ CAP/37	Devise a mechanism to implement a system of compensatory water harvesting and storage around mining clusters by the concerned mines	S&M Department, WR Department, CGWB	M	AD			

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
MIN/ CAP/38	Protection and restoration of water harvesting structures in catchments in mining intensive areas	S&M Department and WR Department	H	AD	A	IP	
MIN/ CAP/39	Creation of an environmental restoration fund by contribution from mining houses.	S&M Department	M	MI			
MIN/ CAP/40	Prepare an action plan for reclamation and rehabilitation of old abandoned mines	S&M Department	L	MI			
MIN/ CAP/41	Construction of rest shelters with plantations in mining areas to provide shelters during heat wave conditions	S&M Department	M	AD			
MIN/ CAP/42	Plan for supply of drinking water in the vicinity of mining clusters	RWSS	H	AD	A	PS	

Transport

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
C&T/CAP/1	Use of alternate fuel to conventional fuel	C&T	H	MI	S	PA	ST
C&T/CAP/2	Policy of Phasing out old Vehicles for emission reduction	C&T	H	MI	S	PA	ST
C&T/CAP/3	Ensuring Fuel efficiency (Drivers Training)	C&T	H	MI	S	CB	ST
C&T/CAP/4	Strengthening enforcement wing for emission level check-up (Burning fuels more efficiently)	C&T	M	MI	S	CB	ST
C&T/CAP/5	Revising State Transport Policy	C&T	H	MI	S	PA	ST
C&T/CAP/6	Introduction of MRTS in suburban areas including electric-operated vehicles, preparation of DPR	Housing & Urban Dev Dept	H	MI	A	DP	MT
C&T/CAP/7	Protection of Coastal Road Infrastructure from sea erosion	Works Dept.	H	AD	A	IP	MT
C&T/CAP/8	Green low carbon footprint highway	Works Dept	H	MI	A	DP	MT
C&T/CAP/9	Avenue tree plantation for carbon sequestration	Forest & Env Dept & Works Dept	H	AD	A	DP	ST
C&T/CAP/10	Integration of urban development and land use planning with transport planning	Housing & Urban Dev Dept	H	MI	S	PA	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
C&T/CAP/11	Development of inland waterways/ setting of ports	C&T	H	MI	S	PS	ST
C&T/CAP/12	Survey of ambient air quality of towns/cities	C&T and PCB	H	MI	A	RS	ST
C&T/CAP/13	Generating public awareness on road safety and traffic management of carbon emission reduction	C&T and NGOs	H	MI	A	CB	ST
C&T/CAP/14	Encouraging transportation of bulk dirty cargo through rail network	C&T	H	MI	S	PA	MT
C&T/CAP/15	Promoting and incentivizing use of non-motorized vehicles	Housing & Urban Dev Dept	M	MI	A	DP	ST
C&T/CAP/16	Strategic study for expanding public transportation across the state	C&T	H	MI	S	PA	ST
C&T/CAP/17	Expansion of rail network to reduce carbon emissions	C&T	H	MI	S	PS	ST
C&T/CAP/18	Carbon emissions estimation from the transport sector	C&T	H	MI	S	RS	ST
C&T/CAP/19	Blending of biofuel in auto fuel	C&T	M	MI	S	RS	MT

Urban

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
HUD/CAP/1	Capacity Building of ULBs on Climate Change impacts & preparedness	H&UD and SPCB	H	AD	S	CB	ST
HUD/CAP/2	Conduct a techno-economic study on energy efficient designs and equipment for urban water supply and sewerage schemes in ULBs	H&UD, OWSSB and Consultants	H	AD	A	RS	ST
HUD/CAP/3	MSW composting for both energy efficiency and addressing the methane generation from waste	H&UD, ULBs and Consultants	H	MI/AD	A	IP	LT
HUD/CAP/4	Conduct a techno-economic study on switching to energy efficient street lighting and develop a Programmatic CDM proposal for implementation by ULBs	H&UD and ULBs	H	AD	A	PS/DP	LT
HUD/CAP/5	Mandating water assessment and audit	H&UD and CE, PH(Urban)	H	AD	S	PA	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
HUD/CAP/6	Revising the guidelines for preparation of Master Plan/CDP and preparing an Integrated City Development Plan with land use and transport planning	H&UD, Town Planning, Dev. Authorities, ULBs	H	MI/AD	A	PS/DP	ST
HUD/CAP/7	Promoting & Incentivising use of non-motorised transport	H&UD, ULBs, Works Deptt	H	MI	A	PA/PS/DP	LT
HUD/CAP/8	Introduction of BRTS/MRTS and Solar or electric operated vehicles	H&UD, ULBs	M	AD	A	IP	LT
HUD/CAP/9	Formulate state specific ECBC code and Revision of OPWD Act in line with ECBC code	Energy Deptt, Works deptt	H	AD	S	PA	ST
HUD/CAP/10	Developing a promotion plan of energy-efficiency in buildings through the adoption of ECBC code and piloting in one city - Green Building	BDA, Town Planning, OREDA, CE(Building)	H	AD	A	PS/DP	ST
HUD/CAP/11	Improvements to water harvesting in urban areas with restoration of water tanks and artificial recharge	Water Resources deptt	H	MI/AD	A	IP	LT
HUD/CAP/12	Developing models of urban storm water flows and capacities of existing drainage systems with climate change	Water Resources deptt	H	AD	A	PS/DP	ST
HUD/CAP/13	Commissioning Urban Heat Island Study	Energy Deptt, SPCB	H	MI/AD	A	RS	ST
HUD/CAP/14	Coastal Road Infrastructure	CE (Roads), CE (N.H), CE (RD QP)	H	MI	A	PS	LT
HUD/CAP/15	Fly ash in road construction	CE (World Bank Projects), CE (RD QP)	M	MI/AD	S	RS/CB/DP	ST
HUD/CAP/16	Green low carbon foot print Hwy	CE (Roads), CE (N.H), CE (World Bank Projects), CE (RD QP)	M	MI	S	RS/CB/DP	LT
HUD/CAP/17	Urban tree Plantation	CE (Roads), CE (N.H), CE(World Bank Projects), F&E	H	MI/AD	S	CB/IP	ST
HUD/CAP/18	Transport Policy & Boat Policy	Commerce & Transport Deptt	H	MI	S	PA	ST

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
HUD/ CAP/19	Development of inland water ways/ setting of ports	Commerce & Transport Deptt	M	AD	S	IP	LT
HUD/ CAP/20	Survey on ambient air quality of Towns/Cities and encouraging use of Bio fuel, CNG/LPG	Commerce & Transport Deptt and OSPCB	H	MI	S	PA	ST
HUD/ CAP/21	Generating Public awareness on Road Safety	Commerce & Transport Deptt, CE (World Bank Projects), NGOs, VOs	H	MI	S	CB	ST

Water

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
WR/CAP/1	Expansion of Hydrometry network	WR, CWC, CGWB, F& E	H	AD	S	CB	MT
WR/CAP/2	Development of flood forecasting models	WR, IMD	H	AD	S	RS	MT
WR/CAP/3	Downscaling of Global Circulation Model	WR, IMD, F & E	H	AD	S	CB	MT
WR/CAP/4	Increasing the water use efficiency, Bench Marking, Water Audit in irrigation projects	WR, H&UD, Industry, RD, energy, Agril.	H	AD	S	CB	MT
WR/CAP/5	Construction of Water Harvesting Structures i.e., Check-dam to adapt to the climate change scenario.	WR	H	AD	S	IP	ST
WR/CAP/6	Provision of fresh water storage structures (Major & Medium) for enhancement of per capital availability	WR, IMD, Agril., H&UD, Ind.	H	AD	S	IP	MT
WR/CAP/7	Improvement of drainage system	WR	H	AD	A	IP	MT
WR/CAP/8	Maintaining Environmental Flow in wetland	WR, IMD Research Organisation, F & E	H	AD	S	RS	MT
WR/CAP/9	Awareness raising with Pani Panchayat through Farmers' Training Programme & creation of Agro-climatic stations.	WR, Agril.	H	AD	A	CB	ST
WR/CAP/10	Integrated Water Resources Management	W.R	H	AD	S	CB	MT
WR/CAP/11	Renovation and improvement of existing storage structures	WR, Panchayati Raj	H	AD	S	IP	MT

No.	Title	Orgns.	Priority	Type	Scale	Nature	Time Frame
WR/CAP/12	New Ground Water Legislation for Urban Water Harvesting	WR, CGWB, H&UD, Development Auth. & Imprv. Trust	H	AD	S	PA	MT
WR/CAP/13	Consumptive use of surface and ground water	WR	H	AD	S	CB	MT
WR/CAP/14	Regulation of Water drawal and wastewater discharge	WR, F&E, H&UD	H	AD	S	CB	MT
WR/CAP/15	Improvement and implementation of Technology for desalination of sea and brackish water	WR, H&UD	M	AD	A	RS	MT
WR/CAP/16	Encourage the use of non-conventional water for beneficial uses.	WR, H&UD, Agril., F&E, Research Organisation	M	AD	A	RS	MT
WR/CAP/17	Improvement of flood management plan and other extreme events like cyclone, drought etc.	WR, IMD, OSDMA, Revenue Dept.	H	AD	S	CB	MT
WR/CAP/18	Creation of database for ground water resource	WR, CGWB	H	AD	S	CB	MT
WR/CAP/19	Establishment of Academia - Department Interaction	WR, Research Organisation	H	AD	S	CB	MT
WR/CAP/20	Inter Basin Transfer of Water from Surplus Basin to Deficit	WR, IMD, CWC	M	AD	S	PA	MT

Legend:

Priority: H - High, M - Medium, L - Low

Type: MI - Mitigation, AD - Adaptation

Scale: S - State-wide, A - Particular/Focused Area

Nature: RS - Research Study, PA - Policy Action, PS - Pre-investment Study, DP - Demonstration Project, IP - Investment Project, CB - Capacity Building, OM - Regular Operation & Maintenance

Timeframe: ST - Short-term (1-2 years), MT- Medium Term (3-5 years), LT - Long term (> 5 years)

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To be included.

Energy

To be included.

Fisheries

To be included.

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To be included.

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To be included.

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