

ACTION ON CLIMATE CHANGE IN ORISSA: Scoping Report

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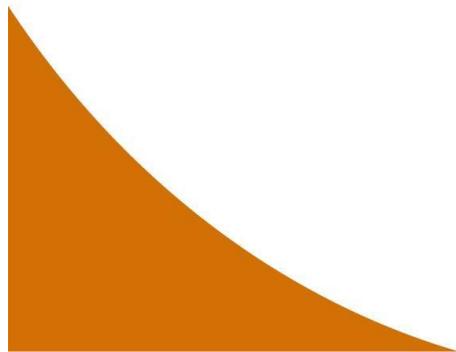
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ADDENDUM JUNE 2010

This report was commissioned by DFID-India to support the Government of Orissa prepare its Climate Change Action Plan (CCAP) 2010-2015. This was published on June 5th. The CCAP was prepared following presentation of the findings of this scoping study. The GoO established a High Level Co-Ordination Committee headed by the Chief Secretary to steer preparation of the CAP. The GoO established 11 working groups to cover the different sectors (covered in this report). The full methodology is explained in section 1.2 of the CCAP www.orissa.gov.in/forest&environment/ActionPlan/CAP_Report_Draft.pdf

EXECUTIVE SUMMARY

Orissa has long been prone both 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. Whilst the extent to which climate change will exacerbate these events is not yet fully understood- one thing is clear- their frequency and intensity will increase- not diminish. Cyclones may intensify.

The State Government of Orissa intends to prepare a State Action Plan on Climate Change. DFID India commissioned a Strategic Environmental Assessment (SEA) to provide support for the Action Plan. The India PM has urged each state Government to create their own State level action plan consistent with the National Action Plan on Climate Change¹. The National Plan has been prepared under the guidance and direction of Prime Minister's Council on Climate Change. The Government has a vision to create a prosperous but not wasteful society, and an economy that is self –sustaining because maintaining a high growth rate to increase living standards is vital for the vast majority of the people and to reduce their vulnerability to climate change. The National Action Plan focuses attention on 8 priority National Missions.

A small team of DFID staff and consultants carried out the Strategic Environmental Assessment (SAE) scoping study over a period of two weeks in November and December 2009. The study comprised a review of existing documentary information, and a series of meetings and small group discussions with GoO officials and some representatives of civil society.

Because climate change is so cross-cutting there is a need to address risks and opportunities in the development and appraisal of many policies, plans and programmes. For this purpose, SEA was a useful reference tool that provided a basic framework for assessing and managing a broad range of issues that contribute to the integration or mainstreaming of climate change considerations in development planning. There was no perfect ready-fit methodology that could be applied that would have worked within the scoping study. As policy on climate change is in its infancy in Orissa, and will need to be delivered within existing departmental and institutional structures, a bottom-up sector by sector approach was adopted for the scoping study.

In this report, each sector is analysed with reference to relevant background issues at state and national levels, key issues and concerns are identified and current and potential responses at state level indicated. For each sector, a table is also provided summarising the climate change context, the necessary responses and the state level institutions which will be involved.

Two sets of sectors are reviewed in different sections: those which relate closely to energy issues and those where the major issues arise from climate change impacts and adaptation. Energy sectors are; industry, energy, transport, mining, infrastructure, and urban. Sectors where actions will be dominated with adaptation to the serious impacts of climate change are: water, forestry, agriculture, animal husbandry, coasts, fisheries, health and social vulnerability. Obviously most sectors involve both dimensions, for example, opportunities exist to utilise the carbon sequestration function of trees and soils in forestry and agriculture, and critical industry and power infrastructure may be vulnerable to more intense and extreme weather events in the coastal zone. The report recommends that developing

¹ 18th August 2009

integrated strategies for these cross cutting issues will need to be considered further in the next stage and suggests key dimensions.

Finally, the report outlines what the next steps might be. It will be vital that climate change is embedded into the state's development planning so all the actions identified in this report need to be reviewed by GoO technical specialists and department experts. The state Government intends to factor climate change into its activities for next year and ultimately climate change needs to be embedded within the five year and annual planning process in all components. However, this will need institutional and technical capacity and additional revenues for investments. Priorities need to be chosen and efforts mobilised. It will be vital to establish what actions are underway but need to be scaled up, what undertaken differently, and what new actions should be started up. A coordinating institutional structure within the state Government is urgently needed to spearhead actions. This could be possibly a task force of key departments- supported by a dedicated small technical team which could link with climate cells/ champions in the different departments/ agencies.

Section A Context and Approach

1.1 Background

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 life². 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 intensify.

For India as a whole, the Government has decided that climate change may alter the distribution and quality of India's natural resources and adversely affect the livelihood of its people. India may face a major threat because of projected changes in climate as its economy is closely tied to into its natural resource base and climate sensitive-sectors.

The Government has a vision to create a prosperous but not wasteful society, and economy that is self –sustaining: maintaining a high growth rate to increase living standards is vital for the vast majority of the people and to reduce their vulnerability to climate change. The vision aims to achieve national growth objectives by enhancing ecological sustainability leading to further mitigation of greenhouse gas emissions. NCCP 2008

The Government recognises that to deal with the challenge of climate change there is a need to act on several fronts simultaneously. Eight National Missions form the core of the National Action Plan which will promote understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation. Some of the strategies and programmes are already part of current action, although they may need a change direction and accelerated implementation. The Missions are being institutionalised by their respective Ministries and it is clear that several will involve action at state level. The India PM urged each state Government to create their own State level action plan consistent with the strategies in the National Plan³. The National Action Plan has been prepared under the guidance and direction of Prime Minister's Council on Climate Change.

The National Action Plan focuses attention on 8 priority National Missions. These are:

1. Solar Energy
2. Enhanced Energy Efficiency
3. Sustainable Habitat
4. Conserving Water
5. Sustaining the Himalayan Ecosystem
6. A "Green India"
7. Sustainable agriculture
8. Strategic Knowledge Platform for Climate Change⁴

The State Government of Orissa intends to prepare a State Action Plan on Climate Change. DFID India commissioned a Strategic Environmental Assessment to provide support for the Action Plan.

1.2 Recent observations and trends on climate

² OSDMA State Disaster Management Policy 2005

³ 18th August

⁴ From WORLP report but can check with National Plan

Analyses of observed trends and projections of future climates are better developed for India and South Asia as a whole than Orissa. Further, they provide an overall context for the external changes which are affecting and will affect the state.

Key observed past and present climate trends and variability for India were identified in the IPCC Fourth Assessment Report⁵:

- increasing trends in annual mean temperature which have resulted in an increase of 0.68°C over the last century
- an increase in extreme rains in north west India with decreasing monsoonal rainfall *and a lower number of rainy days along the east coast*
- In coastal Asia an increased rate of sea level rise over the past decade has been reported⁶.

Key changes in extreme events identified in the IPCC Fourth Assessment Report:

- There has been an increase in the number of hot days and an increase in multiple-day heat waves in the past century and an increase in deaths due to heat stress in recent years;
- There have been serious and recurrent floods in the north east States of India in 2002, 2003, and 2004 with further extreme events in Mumbai (2005) and in Sutra, Barmer and Srinigar during the monsoon season of 2006;
- Consecutive droughts in 1999 and 2000 in NW India led to sharp decline in water tables, consecutive droughts between 2000 and 2002 caused crop failures, mass starvation and affected 11 million people in Orissa;
- It would seem that the frequency of the monsoon depressions and cyclones in the Bay of Bengal and the Arabian Sea are on the decline but the intensity is increasing causing severe droughts floods in terms of damages to life and property⁷.

1.3 What climate change could mean

These observed features are of interest as they mirror projected climate changes for India which will have serious impacts for water supply, agriculture and health⁸. There are however are considerable uncertainties about the future behaviour of the monsoon which makes precise prediction difficult:

- Annual mean temperature is expected to rise between 2.5°C and 5°C degrees under range of scenarios with warming more pronounced in the northern parts of India.
- Some simulations have indicated that summer monsoon intensity may increase beginning from 2040 by 10% by 2100⁹. There may be a general increase in monsoon precipitation in the monsoon season but an overall decrease in the number of rainy days and an increased intensity of rainfall.
- For South Asia, most of the AR4 models project a decrease in precipitation in December, January and February.
- An increase in occurrence of extreme events including heat wave and precipitation events is also projected along with an increase in the inter annual variability of daily precipitation in the Asian summer monsoon.
- An increase of 10-20% in tropical cyclone intensities is projected for a rise in sea surface temperature of 2-4 degrees relative to the current threshold temperature.

⁵ IPCC 4AR chapter 10 Tables 10.2 and 10.3

⁶ according to simulations produced by IITM Pune

⁷ according to simulations produced by IITM Pune

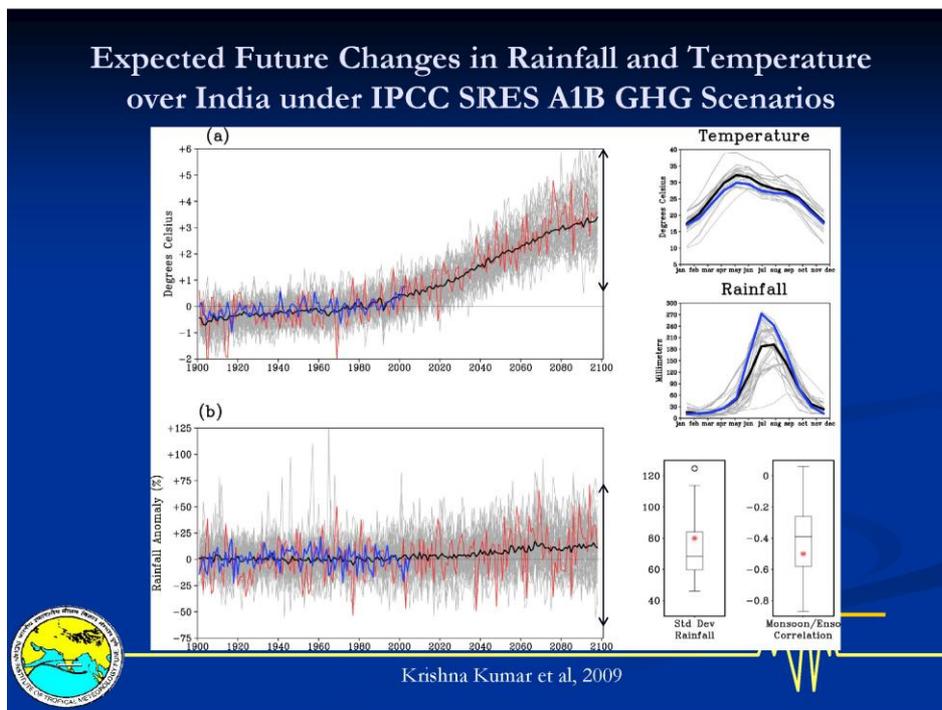
⁸ See IPCC 4AR chapter 10 Tables 10.2 and 10.3

⁹ NCCP

On sea level rise several factors are involved:

- Amplification of storm surge heights could result from the occurrence of stronger winds, with an increase in sea surface temperatures and low pressures associated with tropical storms resulting in an enhanced risk of coastal disasters along South Asian regions.
- In monsoonal Asia, decreasing sediment flux is generally a main cause of coastal erosion, and with further expected declines in river sediment, coastal erosion will worsen.
- The most conservative scenario, sea level will be about 40cm higher by the end of the 21st century.
- It has also been estimated than more than one million people will be directly affected by sea-level rise by 2050 in the Ganges/ Bramaputra/ Meghan delta in Bangladesh¹⁰.

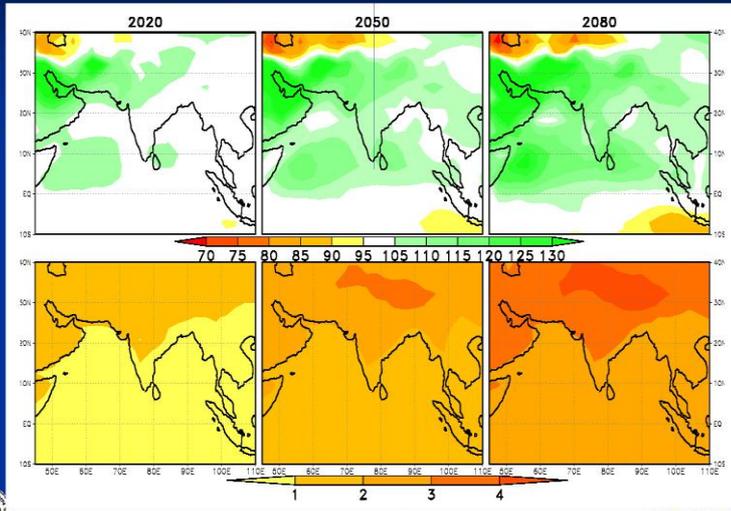
The diagrams below from the Indian Institute of Tropical Meteorology IITM, Pune show some results using a range of IPCC emissions scenarios and a range of global climate models.



¹⁰ It was reported during the study that migration from this region into Orissa had already occurred.

Expected Future Change in Monsoon Rainfall and Annual Surface Temp for 2020's, 2050's and 2080's

Rainfall



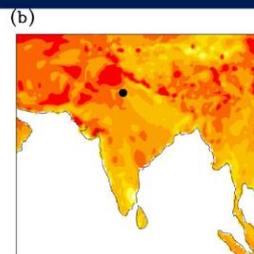
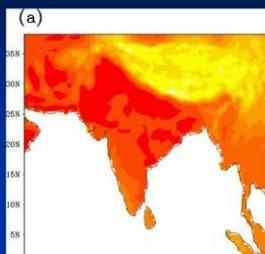
Temp



Krishna Kumar et al, 2009

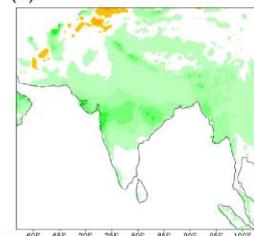
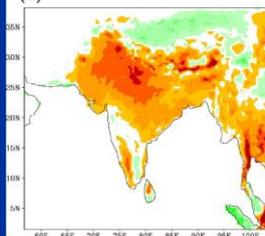
Projections of Regional Tmax and Daily Rainfall Changes

Highest daily Tmax (°C) in The Baseline Period



Expected change in Tmax in Future under A2

Expected change in No. of Rainy Days In future under A2



Expected change in Rainfall Intensity in a rainy day in future



Krishna Kumar et al, 2009

1.4 Critical features of Orissa

Orissa is part of 'Poorest India' and has the highest incidence of poverty. Latest figures show that 57% live below the poverty line¹¹ and almost 90% of the poor live in rural areas. Poverty is significantly worse in the western and southern districts of the state- linked to agriculture with more than two-thirds of the population employed in the sector. Most people are subsistence farmers and many practice sharecropping. Productivity is low; the poorest scraping together a living on marginal lands¹².

Comment [sm1]: I assume this is a typo – the earlier figure was 46%, now revised upwards to 57% by the Suresh Tendulkar committee whose methodology has now been accepted by the Planning Commission

The Human Development Index (HDI) of the State increased from 0.27 in 1981 to 0.40 in 2001, which was a rise of around 51%. However Orissa's relative position was only 11th among major states. Of Orissa's 40 million people¹³, about 16% live in urban areas. 22% of the population comprises Scheduled Tribes (against the all-India percentage of 8%) and 16.5% Scheduled Castes (about the same as the all-India percentage).

Orissa continues to be off track on all the MDGs. IMR rates, despite an impressive decline from 2001 to 2006, continue to be among the highest in the country. Institutional births are still low at below 40%¹⁴. Trends are closest to the target in education (including gender equality) and tackling infectious diseases¹⁵. The rate of literacy has increased by 14% till 1990 and the number of drop outs in schools has decreased in ten years from 1.27 million to 0.2 million.

The state of Orissa has been called the disaster capital of India. Between 1965- 2009 it has been repeatedly hit by various disasters such as cyclones (6) , floods (17), droughts (19) and heatwaves. Climate change has increased the intensity and range of disasters and reportedly, more areas within the state have become vulnerable to disasters. Increased disaster intensity interacts with low resilience to compound problems with food security, water security and livelihood security in the state and is leading to poor health conditions¹⁶.

1.5 Orissa's Economic Transformation

The GoO wants to ensure that climate change does not undermine the economic development which is now underway. Orissa has transformed itself in economic and fiscal terms in the years since 2000. 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 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 as a result of this, employment opportunities have increased in private sector leading to poverty reduction.

¹¹ Suresh Tendulkar committee

¹² All this from DFID case sheet- mainstreaming the livelihoods agenda

¹³ Census of India – projected population 2008

¹⁴ Statistics for 2004-05 (BPL) and 2006 (others) taken from the Orissa Budget 2008-2009, quoting the GoI Economic Survey 2007-2008

¹⁵ Orissa however continues to account for a third of all malaria deaths in India. The tuberculosis prevalence rate also is high, at 60% above the Indian average, but detection and treatment success rates are 64% and 87% respectively, against the national figures of 69% and 86% (and the WHO recommended levels of 70% and 85%). Orissa performs much better than Bihar, UP and MP on this count.

¹⁶ Health team

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 modernisation of procurement systems for converting outlays to outputs and outcomes; and continuing tax reforms for transition to Goods and Services Tax.

1.6 Orissa's CO₂ emissions

Studies on state-level emissions are limited. One of these studies revealed that there is considerable inter-state variation in CO₂ emissions. State level CO₂ emissions figures for 2000 indicate that Uttar Pradesh (prior to the state's bifurcation) has the highest level of pollution followed by Madhya Pradesh, Maharashtra, Andhra Pradesh, West Bengal, Gujarat and Tamil Nadu. In per capita emission terms, Madhya Pradesh (prior to the state's bifurcation) has the highest emissions at 660 metric tonnes followed by 450 metric tonnes for Delhi, Orissa and Goa. The following table provides the comparative data - both aggregate and per capita - of key states.

Table: State-level CO₂ Emissions: 2000

('000 metric tons of carbon)

No.	State	Aggregate	Per Capita
1	J&K	696.5	0.07
2	HP	659.1	0.11
3	Punjab	10845.7	0.45
4	Haryana	5460.5	0.26
5	Uttar Pradesh	44268.3	0.27
6	Rajasthan	8929.3	0.16
7	Delhi	6033.8	0.44
8	Bihar	9012	0.11
9	Orissa	16172.3	0.44
10	West Bengal	23363.7	0.29
11	Assam	1097	0.04
12	Gujarat	18461.5	0.37
13	Maharashtra	35595.4	0.37
14	Goa	652.2	0.44
15	Madhya Pradesh	39729.4	0.66
16	Andhra Pradesh	30126	0.40
17	Karnataka	9059.6	0.17
18	Kerala	3034.2	0.10
19	Tamil Nadu	17584.9	0.28
20	Others	43712.6	0.62

Source: Ghoshal and Bhattacharya (2007)

In terms of per capita emissions, Orissa has an aggregate emissions of 16,172.3 tons and per capita emissions of 0.44. Orissa's emissions are due to its coal-based thermal power and also the major energy-intensive plants (aluminium and steel).

1.7 Study Aims and Approach

Action on climate change will involve reframing development pathways with low carbon growth so development opportunities are protected and increased. Climate change policy could provide a new drive to deliver better access to energy in rural areas and for poor groups. People's livelihoods and assets will also need protecting from the potentially damaging impacts of climate change which again will require increased resources; and existing resources will need to be deployed in new ways so that investments in development are not undermined, for example by investing in agricultural strategies that are resilient to higher temperatures and more variable and intense rainfall, or by building new schools which will not flood and/ or get very hot.

Because climate change is so cross-cutting there is a need to address risks and opportunities in the development and appraisal of many policies, plans and programmes. There was no specific ready-fit methodology that could be applied that would have worked perfectly within the scoping study. As policy on climate change is in its infancy in Orissa, and will need to be delivered within existing departmental and institutional structures, a bottom-up sector by sector approach was adopted. For this purpose, the SEA is an effective tool that provides a framework for assessing and managing a broad range of issues that contribute to the integration or mainstreaming of climate change considerations in development planning¹⁷. The overarching development objective of this SEA is to assist the GOI to build greater climate resilience by strengthening institutional and planning capacities to adapt to climate change at the state level. More specifically, the SEA applied to climate change aims to:

- Identify key climate vulnerabilities and risks likely to affect development and development plans of the states,
- Assess institutional and planning capacities to manage these risks and vulnerabilities identifying key institutional and planning gaps at the state level and their inter-linkages with national and local level planning.
- Facilitate the development of improved strategic and sector plans for continued sustainable development and economic growth, taking into account changing climatic conditions and promoting,
- Facilitate better coordination, integration, and enhancing of various existing programmes, currently delivered by different departments/institutions in a fragmented manner.
- Assess and recommend specific measures to strengthen the policy and incentive framework, including the knowledge base, for supporting the process of adaptation.
- Assess and recommend specific measures for climate change mitigation and adaptation co-benefits.
- Support the development of a State level action plan and strategy to deal with climate change.

1.8 DFID's Role

DFID has a long-standing programme in Orissa that addresses the overarching goal of poverty alleviation. During the various engagements, it was noted that the Government of Orissa (GoO) had been shown proactive addressing climate change issues. Orissa has set up a CDM cell in IPICOL and has initiated climate change studies in the Forest and Environment Department. The State, however, is faced with the immense challenge of understanding how to identify and prioritize adaptation and mitigation measures, and in turn, estimate the

¹⁷ In this context, see Organisation for Economic Cooperation and Development / Development Assistance Committee (OECD/DAC) Advisory note 'Good Practice Guidance on SEA' (OECD/DAC 2006) and its supplementary note 'Strategic Environmental Assessment and Adaptation to Climate Change' (OECD/DAC 2008).

financial costs of ensuring that the State development plans are climate resilient, if the government were to play a pivotal role in addressing the future risks and challenges of climate change. It was in this context that the scoping study was envisaged as a first step in assisting GOO address this issue.

A small team of DFID staff and consultants carried out the scoping study. The team included (i) Virinder Sharma, Livelihoods & Environmental Adviser, Climate Change and Energy Unit, DFID India; (ii) Merylyn Hedger (International Consultant); and (iii) Vaideeswaran S. (National Consultant).

1.9 Methodology & Timeframe

(i) Review of existing information

A study of the information available with DFID India on Orissa and additional web-based secondary information research was done. This covered reviewing the information available with the IPCC, other research articles relevant to climate change impacts in India and studies relevant to Orissa. This analysis of secondary information was undertaken in November 2009, i.e. prior to proceeding on the visit to the state.

(ii) Primary information

Initial kick-off meeting at the DFID India office, New Delhi: The consulting team presented an overview of the scoping study with a specific focus on the methodology. In response, feedback was collected from the participants on different aspects of working within the state. Subsequently, further secondary information was collected from the different participants. This was held on November 26, 2009.

Initial kick-off meeting with GoO at Bhubaneswar: The consulting team presented an overview on climate change and its impacts on developing countries, including India. The team also shared the salient outcomes of three similar scoping studies done in the states of Karnataka, Gujarat and West Bengal. In the discussions that followed, the GoO officials felt that the study should not be restricted only to adaptation and should consider all the climate change implications as a whole. Subsequently, the scope of this study was modified suitably to cater to the expressed need of the GoO officials. This meeting was held on November 27, 2009.

Individual meetings with GoO departments and stakeholder organisations: A series of individual meetings were held with the GoO officials of the various departments. Given the short timeframe, it was not possible to cover all the GoO departments. But the departments that were expected to have a major role in the climate change context were covered. In addition, individual meetings were also held with DFID programmes that included WORLP, OTELP and the DFID Health Task Team. Selected meetings with individual experts and consulting companies were also held. All of these individual meetings were held in Bhubaneswar between November 30, 2009 and December 3, 2009.

GoO Secretary-level meeting on the interim findings: A meeting of the Secretaries and other senior Government officials was organized to discuss the interim findings of the scoping study. The consulting team made a presentation and also shared their interim findings. Feedback on the findings was obtained and the overall next steps in terms of using the outputs of the scoping study to develop the state climate change action plan was discussed. This meeting was held in Bhubaneswar on December 4, 2009.

De-briefing meeting at DFID: The consulting team presented the findings of the scoping study and shared some of the outputs that were prepared. In response, feedback was collected from the participants. This meeting was held on December 7, 2009.

Based on the secondary information review and the information collected from the various meetings and feedback from the different presentations made, the team prepared the report. The draft report was completed and submitted to the GoO in January 2010. The task of taking the scoping study forward will form part on a broader programme of work.

1.10 Report structure

Two sets of sectors are reviewed in different sections: those which relate closely to energy issues (Section B) and those where the major issues arise from climate change impacts and adaptation (Section C). Energy sectors are; industry, energy, transport, mining, infrastructure, and urban. Sectors where actions will be dominated with adaptation to the serious impacts of climate change are: water, forestry, agriculture, animal husbandry, coasts, fisheries, health and social vulnerability. Each sector is analysed with reference to relevant background issues at state and national levels, key issues and concerns are identified and current and potential responses at state level indicated. For each sector, a table is also provided summarising the climate change context, the necessary responses and the state level institutions which will be involved.

Obviously most sectors involve both dimensions, for example, opportunities exist to utilise the carbon sequestration function of trees and soils in forestry and agriculture, and critical industry and power infrastructure may be vulnerable to more intense and extreme weather events in the coastal zone. In Section D of the report several cross cutting issues such as these are examined. Finally, in Section E, the report outlines what the next steps might be in relation to organisational and institutional dimensions.

Section B Sectors: Energy focused

Industry

1.1 Background¹⁸

Orissa is a state rich in mineral resources like bauxite, iron ore, lime stone, dolomite and chromite. Understandably, its industrial sector comprises largely of mineral-based industries. Since these industries are energy-intensive, the acceleration of industrialization is closely linked to the availability of power. In the past, the power generated from the Hirakud dam catered to the industry's power needs. Subsequently, most mineral-based industries established captive power plant that was based on coal, which is also found in Orissa. Water is also an important requirement for these industries. With the five rivers - Mahanadi, Brahmani, Baitarani, Rushikulya and Subarnarekha along with its tributaries / distributaries, there was availability of fresh water. Similarly, ground water availability is also very high in the state. The industrialization in the state is linked with the proximity to mineral resources, power and water. These are now found in 12 major industrial areas / zone¹⁹. Through the Industries department, GOO is presently adopting an aggressive industrial promotion and investment policy. For this purpose, Industrial Policy Resolution 2007²⁰ has been put in place which emphasizes deregulation, simplification of rules and procedures to enable a conducive business climate and facilitate ease of doing business in the State.

The same level of industrial promotion activities is also true of the steel sector, which comes under the Steel & Mines department. The current output of steel is at about 55 million tons per annum and, by 2020, the expected achievement is around 250 million tons per annum. Orissa is expected to take the lead in terms of the steel capacity enhancement and become a major contributor to the national wealth. Steel is a high consumer of energy and therefore relevant sector vis-à-vis carbon emission abatement. Steel is also a large consumer of water. There is already an initiative to promote clean, green and sustainable technologies in iron & steel making within the State. In July 2009, the Steel & Mines Department organized an international convention on this subject. In the short-term, specific technologies such as using top gas pressure in blast furnaces needs to be promoted.

Discussions revealed that of these Talcher-Angul and Jharsuguda area are particularly stressed in terms of serious local pollution issues. About 65% of the industries in the state are regarded as high-polluting (red zone) ones. Apart from mineral-based industries, the state's rich rice production has facilitated the growth of rice mills.

1.2 Key concerns/Issues

Broadly, it can be said that 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.

¹⁸Activities Report, Industries Department, 2007-08 and note titled "Recommendation" obtained from the Steel & Mines Department.

¹⁹ Orissa State of the Environment Report 2006.

²⁰ Industrial Policy Resolution 2007.

The mineral-based industries have to work in extremely hot conditions. With the likely increase in the average temperatures due to climate change, this will also become an issue in the future. The other large non-mineral based industry, rice mills, can also be adversely affected due to rainfall / precipitation variations. Industries in the coastal areas have so far not been largely affected due to climatic events. But with a prediction of increased intensity and frequency, protection of industrial assets will have to be considered.

1.3 Response Actions

The mineral-based industries have local pollution issues and also due to the coal-based captive power plants, the major issue of fly ash disposal. Given these serious local environmental concerns, the challenge in the industry sector will be to address both the global and local pollution problem in an integrated and coordinated manner. Cleaner production technologies, methods and practices need to be adopted on a high-priority. The waste heat recovery technology was actively promoted and that resulted in substantial energy savings. Similarly, sub-sector specific or technology-specific plans need to be evolved and executed. As GoO is aggressively promoting further industrialization, the approach should be more promotional / voluntary rather than regulatory. To the extent feasible, the adoption of cleaner production should be made cost-neutral for industries.

Under IPICOL, CDM initiatives have been taken to promote more efficient use of energy. Over the last few years, IPICOL has been undertaking capacity-building and facilitation initiatives to promote the use of CDM. This should be further explored, particularly in industry clusters and industry sub-sectors. Rather than having individual CDM projects, the approach of having a programmatic CDM across many industry sub-sectors with focused interventions should be considered. Presently, there is an ongoing initiative in the sponge iron sub-sector. Similar initiatives should be considered in the other industry sub-sectors as well.

Yet another area is the promotion of wood-based industry. Having commercial plantations will serve as a carbon sink at the first instance. If this wood is gainfully used prior to its degrading, then it will contribute to reducing emissions arising from other alternative construction materials that it would displace. This needs to be considered.

Undertaking industry-level or sub-sector level initiatives need to be supported by policy level considerations. In this context, the IPR 2007 and the MSME Framework Development Policy 2009 should be reviewed from a climate change perspective. The subsequent versions of these policies should incorporate climate change considerations. Similarly, other sub-sector-specific policies being drafted - Tourism, Export promotion and Food Processing policy – should also include climate considerations.

Very recently, the Central Ministry of Environment & Forests announced that it will be agreeing to a non-binding emission intensity reduction target of 20-25% at the Copenhagen Summit. If this has to be met, all states will have to contribute to this goal. As a response action, it is required to assess the implications on the industry sector in the state of Orissa.

1.4 Summary

For the industry sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
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Protecting industrial assets and emissions reduction	<u>IPR & MSME Framework Development Policy 2009</u> : Integrating climate change considerations in these policies.	Industry Department
Protecting industrial assets and emissions reduction	<u>Other industry-linked policies</u> : Integrating climate change considerations in the tourism industry policy, export-oriented industry policy or food processing policy that are presently being drafted. Similarly, integrating climate change considerations in the draft state steel policy should be undertaken.	Industry Department and Steel & Mines Department (for Steel).
Emissions reduction	<u>Local pollution issues</u> : Developing a policy and operational plan to prepare local sustainable industrial development plan using financial resources that climate change will bring. These should be gainfully used for addressing in parallel the serious local pollution issues, e.g. fly ash from captive power plants, particulate matter / fluorine levels in the Angul-Talcher industrial area and local pollution in Jharsudhga.	Industry Department, Steel & Mines Department (for Steel), Pollution Control Department, Private Sector
Emissions reduction	<u>CDM</u> : Programmatic CDM for energy-efficient technologies in energy-intensive industry sub-sectors such as sponge iron.	Industry Department, Steel & Mines Department (for Steel), IPICOL, Consultants, Private Sector industries
Capacity-building	<u>Awareness</u> : Sectoral training and capacity-building programmes on the risks and opportunities that climate change brings in various industry sub-sectors.	Industry Department, Steel & Mines Department (for Steel), Consultants and Private Sector industries
Adapting to climate change	<u>Agro-based industry</u> : Analytical study on the implications of climate variability on agro-based industry such as rice mills and other food processing. <u>Water demand management</u> : mandatory water assessments and audits for industry, mandatory water harvesting; exploration of new regulatory structures with entitlements, pricing and efficiency incentives <u>Groundwater protection</u> : Mandatory water assessments and audits; ensuring proper industrial waste disposal .	Industry Department, Consultants and Private Sector industries Water Resources Department and UBLs
Adapting to climate change	<u>Heat waves</u> : Analytical study on extreme heat conditions that prevail in the summer in the context of mineral-based industries, e.g. steel and aluminium smelters. The industrial belt of Angul-Talcher is a possible choice.	Industry Department, Steel & Mines Department (for Steel), Consultants and Private Sector

		industries
Protecting industrial assets & emissions reduction	<u>Coastal industries:</u> Climate-proof existing coastal industries in coastal belts such as the Paradip Phosphates plant.	Industry Department, Steel & Mines Department (for Steel), and Private Sector industries
Emissions reduction	<u>Cleaner production centres:</u> Establish these centres for the various sub-sectors through industry associations and large companies. Focus of these centres should be on establishing the baseline for energy consumption, cost-competitive cleaner production technologies and processes, and targeted specific energy-intensive goals for each of the sub-sectors.	Industries Department, Steel & Mines Department (for Steel), Industry associations & large companies
Emission reduction	<u>Emission intensity targets:</u> To conduct a study to determine the implications on the proposed national emission intensity reduction targets on the state's industrial promotion plans.	Industries Department

Energy

2.1 Background

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. With the rapid industrial development, the power generation scenario in the State reveals that the demand for power will continue to increase significantly and will outstrip the available and planned generation capacity if commensurate efforts on the supply side are not taken.

On the policy front, the State of Orissa has 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, reliable and quality supply of power. The aim was to address the fundamental issue underlying the poor performance of the Orissa State Electricity Board and restructure the power sector. The reform addressed restructuring, unbundling, privatization, regulator commission, licensing and tariff.

Presently, the average demand for power 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 the demand. 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. The demand from the industry will increase astronomically but these are through captive power plants and therefore not dependent on the state grid.

To meet the growing needs, GoO has treaded on an aggressive path to generate more power. The installed generation capacity²¹ is about 2,800 MW with hydel being about 1,900 MW and thermal (coal) being about 900 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. At the same time, in the last 2-3 years, as many as 21 MoUs have been signed for an additional 30,000 MW. In addition, NTPC is planning 3 power plants (total of 12,000 MW) for their national grid and three ultra-mega power plants (total of 12, 000 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

²¹ Renewable Energy Strategy for Orissa, CTRAN Consulting, May 2008.

generation capacity is established, 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 this time period, 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. Already, one of the main rivers – Brahmani river - is the biggest casualty to excessive development. Apart from water, there will also be a huge generation of fly ash, which is already causing a major disposal problem.

Comment [sm2]: This appears to contradict the previous sentence

Transmission and distribution losses are one of the highest in the country. There has been no investment on system upgrading and pilferage is not checked. Presently, 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 savings of about 500 MW.

As per the Electricity Act 2003, there is no need to seek any clearance from the Energy Department for establishing power generation plants in the state. However, as the project proponents need coal (for thermal), land, water and pollution clearance, there is a Task Force that reviews the proposals. It is only after obtaining the clearance from the Task Force that the other formalities can be done.

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 potential²² 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. These have not yet been harnessed. Also, solar PV power and wind power also have the potential of 14,000 MW and 1,700 MW respectively. Only some pilots have been done so far. There is also potential for biomass-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 the grid.

2.2 Key concerns / issues

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 coal-based thermal power generation by 2020 and 5 million tons of carbon per 1,000 MW, the total 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. Going by global estimates that the world can generate only 1,000 billion tons of carbon between 2000 and 2050, this figure from a single Indian state is a substantive one. Considering that one-third of the carbon has already been emitted, the additional 9 billion tons over 600 billion tons is a large proportion for a single state. Given that, there is really no doubt that Orissa will be in the eye of the world's attention in terms of adopting best practice measures. Two ultra mega power plants are being established in the coastal areas. While there are benefits in terms of access to water (using desalination) and the port (imported high-quality coal), these large investments will be exposed to climate-mediated risks.

Comment [sm3]: Based on what mix of coal/hydel/other renewables?

²² Estimates of the potential for different types of renewable power were obtained from OREDA literature.

Promotion of renewable energy is a direct way of reducing emissions. There is a GoI subsidy scheme to promote renewable energy. However, this has not yet led to the realization of the renewable energy potential. One of the reasons is the lower tariff from conventional power. This makes the price difference between conventional and renewable power fairly large, and hence the disincentive to go for renewable power. The change in climatic conditions has also the potential to affect the generation of renewable power, e.g. change in wind directions will affect wind power. Erratic rainfall will affect small hydro project and reduced number of sunny days will affect the solar potential.

2.3 Response Actions

Already, cleaner technologies, e.g. super critical technologies are being used. Further specific studies are required to promote cleaner technologies in all aspects of coal-based thermal power generation uses cleaner technologies. Coal-based thermal power has fly ash as a major issue. Wherever the power plants are close to the pit head, efforts are required to determine how the fly ash can be stored in the mining area itself. In power plants located away from the mines, a major effort is required to determine how to address the fly ash utilization and disposal issue. No initiatives – addressing global concerns – can be done without addressing this serious local environmental concern. There is already a policy that power generated for export will create an environmental development fund. For every unit of power, 6 paise has been set aside for this fund. There is a need to develop an operational plan for the use of this fund. There are already several initiatives to reduce T&D losses and to promote energy efficiency in the state. All of these need to be given a further thrust as these efforts become that much more important in the climate change context. Coastal power plants – both existing and new ones – should be climate-proofed in order to protect these assets from climate risks such as cyclones, coastal erosion and sea level rise.

Very recently, the Central Ministry of Environment & Forests announced that it will be agreeing to a non-binding emission intensity reduction target of 20-25% at the Copenhagen Summit. If this has to be met, all states will have to contribute to this goal. As a response action, it is required to assess the implications on the energy sector in the state of Orissa.

There are already several initiatives to expand renewable energy generation in the state. All of these need to be given a further thrust as these efforts become that much more important in the climate change context. OREDA under the Science & Technology Department need to work closely with the Energy Department in order to scale-up their operations. Apart from the GoI subsidies, there are also further incentives that are possible through CDM. These should be explored through a programmatic CDM approach.

2.4 Summary

For the conventional energy sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Emission reduction	<u>Clean coal technologies:</u> Study to develop a policy framework for generating cleaner energy through clean coal approaches.	Energy Department
Emission reduction	<u>Emission intensity targets:</u> To conduct a study to determine the implications on the proposed national emission intensity reduction targets on the state's energy plans.	Energy Department
Emission	<u>Standards:</u> Develop state-level energy efficiency	Energy Department

reduction	standards for the various sectors	
Emission reduction	<u>T&D losses</u> : Develop an operational plan for a targeted reduction of losses due to pilferage and outdated systems (estimated to be about 40%). Plan should included enhancing present practices for improved load management.	Energy Department
Emission reduction	<u>DSM / EE</u> : Develop a comprehensive policy and plan to save energy use in order to reduce the demand-supply gap and contribute towards climate change abatement. Promotion of the National BEE's ECBC code for widespread adoption in the state to reduce the energy consumption in buildings.	Energy Department, Distribution companies, Consultants & Civil Society Organisations
Emission reduction & local concerns	<u>Taking stock on fly ash</u> : Compile information from the several studies and initiatives that have been done on fly ash, and develop an operational plan.	Energy Department, Industries Department & Pollution Control Board
Emission reduction and local concerns	<u>Making operational the Environmental Development Fund</u> : Develop an operational plan for the Fund that will get revenue for the sale of power that is exported.	Energy Department
Protecting industrial assets	<u>Coastal power investments</u> : Climate-proofing of proposed power infrastructure proposed in coastal belts, e.g. 2 Ultra Mega Power Plants.	Energy Department, Private Sector

For the renewable / non-conventional energy sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Emission reduction	<u>Small and medium hydel plants</u> : Develop a policy and operational plan to invest in small and medium hydel plants as there is a potential to generate about 5000 MW.	S&T Department, OREDA, Energy Department, Private Sector
Emission reduction	<u>Biomass energy</u> : Develop a policy and operational plans to cover both power from available biomass (if feasible) and commercial plantations	S&T Department, OREDA, Energy Department, Forest Department, Private Sector
Emission reduction	<u>Solar & wind</u> : Develop the state-level action plan to harness the potential of 14,000 MW and 1,700 MW respectively. This should consider massive, large scale solar land banks and wind farms.	S&T Department, OREDA, Energy Department, Private Sector
Emission reduction	<u>Biogas</u> : Further expanding the capacity of small biogas for cooking as a means to use rural biomass	OREDA and Civil Society Organisations
Emission reduction	<u>CDM</u> : Develop a plan to have programmatic CDM projects for biogas, biomass based power, run-of-river hydro, solar and wind farms.	S&T Department, OREDA & Consultants

Emission reduction	<u>State subsidy policy:</u> Develop a policy for subsidies with or without GoI assistance	Finance Department – Planning & Coordination, S&T Department & OREDA
Emission reduction	<u>Non-grid renewable energy:</u> Identify blocks / villages where grid connectivity is not feasible and determine appropriate RE solutions.	S&T Department, OREDA and Energy Department

Transport

3.1 Background

Transportation plays a key role in the socio-economic development of any society. It is through a network of various transportation systems that the fragmented markets are integrated, consuming hinterlands are linked to production centres, administrative, commercial, cultural & religious centres are connected and made accessible for the general populace. The Transport Department of Govt. of Orissa, plans, co-ordinates and monitors all activities not only relating to transportation by road, also co-ordinates for all kinds inter-modal transport such as railways and waterways. The state is largely connected through roads. The railway network does not connect the interior parts of the state and the waterways exist but are not developed for transportation.

3.2 Key concerns / Issues

Emissions from the transport sector are the key concern. This has local pollution implications as well. This is particularly relevant in the major urban cities, i.e. Bhubaneswar, Cuttack, Rourkela, Sambalpur, Berhampur and Baleswar. Enforcement is not tight for the want of manpower resources. No alternative, less carbon-emitting fuel such as CNG exists in the state. Effort to move to a more carbon-friendly mass rapid transport system is also only at an early stage. Given this scenario, the emissions from the transport sector are bound to adopt an increasing trajectory.

3.3 Response Actions

At a policy level, the state road transport policy needs to be reviewed with a climate change perspective. As the boat policy pertains to waterways that have the potential to reduce road transport, this policy should also be reviewed from a climate change perspectives. Alternatives such as the use of CNG in transport in the congested cities and introducing MRTS in the twin city of Cuttack and Bhubaneswar needs to be explored. With regard to controlling the emissions from road transport, the following needs to be considered: better enforcing a ban of polluting vehicles, phasing-out of old vehicles and introducing fuel-efficiency standards for new vehicles in the state.

3.4 Summary

For the transport sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Emissions reduction	<u>Use of CNG in transport:</u> Conduct a viability study to determine whether CNG can be used as a fuel for urban transportation in congested cities such as Bhubaneswar and Cuttack in order to reduce emissions from the transport sector	Transport & Commerce Department
Emissions	<u>MRTS:</u> Undertake a preliminary study on	Transport &

reduction	introducing MRTS in Bhubaneswar and Cuttack in order to reduce emissions from the transport sector	Commerce Department, Eastern Railways
Emissions reduction	<u>Phasing-out policy of old vehicles:</u> Prepare a background study to support a policy that needs to be formulated for phasing-out old vehicles	Transport & Commerce Department,
Emissions reduction	<u>Fuel-efficiency:</u> Conduct a background study and developing state fuel-efficiency norms for new vehicles and also norms for maintenance levels during their operation.	Transport & Commerce Department,
Emissions reduction	<u>Emissions enforcement:</u> Conduct a study to devise innovative approaches to vehicle emissions enforcement and develop an operational plan	Transport & Commerce Department
Emissions reduction	<u>Transport policy & boat policy:</u> Develop a plan of action for integrating climate change considerations in these policies.	Transport & Commerce Department

Mining

4.1 Background²³

Orissa is a mineral rich state with an enormous development potential. Coal, bauxite, iron ore, chromite, uranium, diamonds, gemstones, gold, graphite, manganese, limestone and beach sand minerals are the different resources under the state. Mineral exploration, mining, quarrying and processing are activities that are constantly done in the state. Mining is a highly regulated sector in terms of obtaining mining leases (MMRDR Act, Mineral Concession Rules and Mineral Conservation and Development Regulations), getting environmental and forest clearances. As many of the mines are located in forests and tribal areas, there are local environmental and social issues that need to be addressed. Transportation of ores and minerals is also a major activity in the state. And, illegal mining, trading and transporting is widespread. The mining sector in Orissa is characterized with a few large mining companies (SAIL, TISCO and OMC) operating large leases and several small mining companies operating small leases. The large companies adopt good mining practices with proper environmental and social considerations, whereas the small mining companies do not adopt scientifically sound practices and create a huge negative impact. All of these have a huge, deleterious impact on the common infrastructure (e.g. roads, treatment systems and ports) in the mining areas in particular and in the state as a whole. Interventions are required to address local sustainable development issues as well as the problem of the global pollution.

Coal has a special place in the mining sector in Orissa. Coal reserves of India are currently estimated at around 247 billion tons, 25% of which is in Orissa²⁴. Reserves of at least 61 billion tons make Orissa a coal rich state by any standards of the world. The current estimate is a conservative one, and is bound to rise substantially with further exploration. Unfortunately, the quality of coal in India is such that it has a high ash content. Fly ash generation, storage, reuse and disposal is a huge problem that the state needs to reckon with.

4.2 Key concerns / issues

²³ Notes titled "Executive Summary" given by the Steel & Mines Department.

²⁴ Coal Sector, Orissa and Challenges, A CTRAN Consulting Compilation for CII Coal Summit

By its very nature, coal is an important climate change concern. If more coal is mined, more coal is burned and more carbon dioxide is produced. With its large deposits, Orissa is bound to use coal to cater to the power needs of the state and the country as a whole.

Related to coal are the methane emission issues in the coal bed. Coal bed methane (CBM) naturally exists as a gas absorbed in coal deposits. To date in coal mining production, the most common practice has been to disregard the value of coal bed methane by merely pumping it directly into the atmosphere. In actuality, extracting the methane prior to coal mining offers many important benefits including its utilization as a new and viable energy source. Pumping methane before mining coal significantly reduces outflux volumes of gas during production by 70-85 percent, allowing for a significant reduction in greenhouse gas emissions and increased safety conditions in coal mines.

Another recent trend in coal is the conversion of solid coal to a liquid. Liquid coal also requires huge amounts of water, and would lead to an over 40% increase in coal mining just to marginally replace other fuels. It is argued that liquid coal is arguably the dirtiest, expensive and also leaves behind a significantly larger carbon footprint. Recently, two coal blocks in Orissa have been allotted to Jindal Steel & Power Ltd. (JSPL) and a joint venture between the Tata group and South Africa's Sasol Ltd to build coal-to-liquid plants.

4.3 Response Actions

As coal is an inevitable reality in Orissa, the focus should be on clean coal technology in all aspects concerning this resource. This should begin with the mining practices. Apart from carbon emissions pertaining to coal, actions are required to capture the methane embedded in the coal. New technologies such as coal-to-liquid technology are being introduced in Orissa. These should be studied to determine whether the carbon emissions are increasing due to adoption of such new technologies. New carbon-capture-storage (CCS) technologies needs to be explored in the pit-head

Very recently, the Central Ministry of Environment & Forests announced that it will be agreeing to a non-binding emission intensity reduction target of 20-25% at the Copenhagen Summit. If this has to be met, all states will have to contribute to this goal. As a response action, it is required to assess the implications on the coal mining plans in the state of Orissa.

With regard to mining in general, eco-friendly mining practices need to be promoted particularly in the several small mines. Enforcement to check adherence to the various clearance conditions should be strengthened. Capacity building on climate-friendly sustainable practices needs to be built in the entire sector, particularly within the Steel & Mines department. There is a constant need to upgrade infrastructure facilities pertaining to the mining sector. Climate-proofing of these investments need to be done. In addition, the infrastructure should serve to address some of the local sustainable development concerns. In this context, the involvement of the community in the mining sector should also be substantially strengthened. Rehabilitation of used mining areas in a climate-friendly manner needs to be considered. At a policy level, the overall draft state minerals policy needs to reflect climate change considerations.

4.4 Summary

For the mining sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Emissions	<u>Clean coal technologies</u> : Conduct a study to	Steel & Mines

reduction	identify relevant technologies that can be used in the mining and develop an operational plan	Department
Emission reduction	<u>Emission intensity targets:</u> To conduct a study to determine the implications on the proposed national emission intensity reduction targets on the state's coal mining development plans.	Steel & Mines Department
Emissions reduction	<u>Coal-to-liquid:</u> Carry out a study to determine whether adopting this technology is resulting in higher carbon emissions in order to develop a state government policy in this regard.	Steel & Mines Department
Emissions reduction	<u>CBM:</u> Conduct a study to determine the potential of coal bed methane in Orissa and exploring its technical viability	Steel & Mines Department
Emissions reduction	<u>CCS:</u> Conduct a study to explore the viability of carbon capture and storage (CCS) in pit-head coal-based power plants	Steel & Mines Department
Adapting to climate change and emissions reduction	<u>Drafting the state mineral policy:</u> Develop a plan to integrating climate change considerations in this policy that are presently being drafted.	Steel & Mines Department
Capacity-building	<u>Sustainable mining:</u> Capacity-building of the Government mining departments, agencies and associated organisations on sustainable mining	Steel & Mines Department
Capacity-building	<u>Sustainable mining practices in small mines:</u> Building capacity in small mines to adopt sustainable practices.	Steel & Mines Department, Private Sector
Emissions reduction	<u>Transporting minerals:</u> Conducting a viability analysis to determine the relative cost-benefit and carbon emission analysis via-a-vis transporting minerals to the processing unit through road, rail and slurry pipeline.	Steel & Mines Department
Adapting to climate change and emissions reduction	<u>Mining infrastructure:</u> Techno-economic viability study of developing climate-proofed infrastructure that will address the local development challenges.	Steel & Mines Department
Emissions reduction	<u>Mineral fines:</u> Using mineral fines to improve energy-efficiency in industries	Steel & Mines Department
Adapting to climate change and emissions reduction	<u>Strengthening community linkages:</u> Conduct a study to develop an operational plan on strengthening community linkages in the mining sector, which is confronted with serious challenges in terms of local sustainable development	Steel & Mines Department, NGOs
Adapting to climate change and emissions reduction	<u>Reuse of old mining areas:</u> Conduct a study to determine a climate-friendly way of reusing the old mining areas.	Steel & Mines Department

Works Infrastructure

5.1 Background²⁵

The public works sector includes the construction, repair and maintenance of buildings, roads, bridges and other related structures financed from the state and capital budget allocations in Orissa. Development and maintenance of an extensive road network is a major pre-requisite on which the pace and pattern of development rests. Road communication is a key element for economic development of Orissa. The focus, therefore, is to improve the living condition of rural people by providing all weather road communication to inaccessible areas and upgrading the existing road network. Good roads improve the accessibility of the rural areas to markets and facilitate better delivery of a range of services. Therefore, the Government strategy in this sector is to provide all weather road linkages to rural settlements. The Works Department looks after National Highways, State Highways & District roads. These carry the bulk of the traffic and are the principal carrier of economic activities. The thrust given to rural connectivity shall bring positive result only when the principal road net works are developed systematically. There has been conscious effort to develop roads of Orissa under various schemes. The Works Department is implementing a US\$ 250 million Orissa State Roads Project with the assistance of World Bank funding. In the first phase, about 461 km of busy road corridors of the state are being improved.

5.2 Key concerns / issues

The key concerns / issues are in terms of protecting the coastal assets that are being maintained by the Works Department. Construction and maintenance of the extensive road network require technologies that generate carbon emissions in addition to other local pollutants. Also, the buildings that are constructed will be using energy for the rest of its life. Therefore, adopting energy-efficiency concepts in the design and construction practices of the Works department will be a useful contribution. Though these carbon emission reduction approaches are relatively insignificant when compared to the energy sector, these are the key concerns within the Works sector.

5.3 Response Actions

In terms of adaptation, the coastal assets of the Works Department should be identified and climate proofing of the existing assets should be done. In addition, the likely future assets that are being or will be created should also be done at the design stage itself.

Given the extensive network of roads, the Works department should consider enhancing the use of fly ash in road & building construction in a structured and systematic manner. Being a coal-dependent economy, use of fly ash as a building material will assist in both reducing the local environmental concerns as well as mitigate carbon emissions by replacing the alternative materials being presently used. The Works Department should also consider constructing green highways that use modern technology that minimize the carbon emissions per kilometer of the road constructed. Piloting road stretches under the ongoing World Bank-funded project should be considered. This will contribute towards bringing down the carbon emissions from the Works sector.

The adoption of BEE's Energy Conservation Building Code (ECBC) for the buildings constructed by the Works Department should be done. In addition, roadside tree plantation should be strongly encouraged as a road sector policy in order to create better micro-

²⁵ Activities Report of the Works Department for the Year 2008-09.

climatic conditions to counter the rise in the average temperature that is expected due to global warming.

5.4 Summary

For the road & buildings construction sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Protecting road assets	<u>Coastal road infrastructure:</u> Determine the vulnerability of the coastal assets, particularly roads, to climate-mediated hazards & sea erosion and develop an operational plan to climate-proof these assets.	Works Department
Emissions reductions and adapting	<u>Fly ash in road construction:</u> Compile the existing knowledge on the use of fly ash in road construction and develop an operational plan for enhancing fly ash use to assist in abating the problems caused by a coal / carbon-oriented state development path.	Works Department, Industries Department and Energy Department
Emissions reduction	<u>Green, low carbon footprint highways:</u> Conduct the preliminary studies to determine the extent of carbon emissions in road construction and introduce pilot road stretches in the state highways network, which aims at road construction practices that have a minimal carbon footprint	Works Department & Consultants
Adapting to climate change and emissions reduction	<u>Energy-efficiency in buildings:</u> Develop an operational plan to improve the energy-efficiency of all Government buildings in the state through the adoption of BEE's ECBC.	Works Department & Consultants
Adapting to climate change and emissions reduction	<u>Urban tree plantation:</u> Enhance the tree cover to improve micro-climatic conditions to negate gradual temperature increases due to climate change.	Works Department & Forests Department

Urban

6.1 Background²⁶

The urban sector comprises the cities and towns. Ensuring proper and planned growth of cities and towns with adequate infrastructure and basic amenities is a constant need. The continuous exodus of rural population to urban areas has contributed to the exponential growth resulting in severe strain on the existing infrastructure and subsequent demand for additional provisions. The responsibility for this sector falls under the Housing & Urban Development Department. To keep pace with the growing demands of the urban area, the Department has been taking effective and adequate steps 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

²⁶ Activity Report of the Housing and Urban Development Department, 2008-09.

Constitutional Amendment Act of the 1990s empowered the Urban Local Bodies (ULBs) to function as local self-government. It is the responsibility of the Housing & Urban Development Department to make the ULBs self-sufficient and centres for good governance.

6.2 Key concerns / issues

The three broad areas of concern are for the ULBs to be prepared for flash floods and heavy precipitation events, promoting energy efficiency in the different aspects of their functioning and capturing the methane from the Municipal Solid Waste (MSW) that is generated in the cities & towns. These emission concerns are relatively minor and do not compare with those of the energy sector. Nevertheless, these contribute to the overall problem and are the key concerns of this sector.

6.3 Response Actions

In terms of addressing flash floods and heavy precipitation events, the ULBs need to be trained. There is a need for the Department of Water Resources to develop models of urban storm water flows and for estimations of capacities of storm water and for sewers. In conjunction with the OSDMA, the Housing & Urban Development Department will have to build the capacity of the ULBs to tackle these events. On energy-efficiency, there are opportunities in buildings (using BEE's ECBC), street lighting, water and sewage pumping systems. In terms of methane from municipal solid waste, there is a strong case of a win-win-win solution through generating energy from waste or composting the waste into manure. For promoting both energy-efficiency and addressing the methane generation from waste, the programmatic CDM approach should be considered.

6.4 Summary

For the urban sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Capacity-building on protecting assets and communities to flood risk	<u>Preparedness</u> : Building capacity of Urban Local Bodies (ULBs) of the coastal towns on potential climate change impacts (flash floods, flooding of low-lying coastal areas, land loss and displacement) and additional preparedness requirements. Improvements to water harvesting in urban areas with restoration of water tanks . Modelling of urban storm water flows and capacities of existing drainage systems and with climate change	Housing & Urban Department, ULBs and OSDMA Water resources department
Emissions reduction	<u>Energy-efficient buildings</u> : Develop a promotion plan of energy-efficiency in buildings through the adoption of the ECBC code	Housing & Urban Development, OREDA, Builders, Contractors and End Users.
Adapting to climate change (drought) and emissions reduction	<u>Energy-efficient and water efficient urban areas</u> : Develop an operational plan to switch more efficient design & construction approaches in housing construction done by the Government. This is to be done using the ECBC code. Mandating water harvesting and artificial	Housing & Urban Development, Bhubaneswar Development Authority, and Orissa Housing Development Corporation. Water

	recharge. Mandating water assessment and audits	Resources Dept.
Emissions reduction	<u>Energy-efficient street lighting</u> : Conduct a techno-economic study on switching to energy-efficient street lighting and develop a Programmatic CDM proposal for consideration in Municipal Corporations, Municipalities and other ULBs	Housing & Urban Development and ULBs
Emissions reduction	<u>Energy-efficient pumping</u> : Conduct a techno-economic study on adopting energy-efficient designs and equipment for urban water supply and sewerage schemes in Municipal Corporations, Municipalities and other ULBs. Develop a Programmatic CDM proposal.	Housing & Urban Development, ULBs and Consultants
Emissions reduction	<u>MSW composting</u> : Using the various existing techno-economic studies on alternative approaches to composting, develop a programmatic CDM proposal.	Housing & Urban Development, ULBs and Consultants

Section C Sectors: Impacts and adaptation focused

Water

Box 1: *Impacts of climate change on water resources in South Asia*

Climate change-related melting of Himalayan glaciers could seriously affect river run off and eventually will lead to a decrease with consequences for downstream agriculture. Over exploitation of groundwater has resulted in a drop in its level leading to ingress of sea water in coastal areas. The projected decrease in the winter subcontinent rainfall will reduce total seasonal precipitation over December, January and February implying lesser storage and greater water stress. Intense rain periods are anticipated occurring over fewer days which implies increased frequency of floods during the monsoon will also result in the loss of rainfall as direct run-off, resulting in reduced groundwater recharging potential. Knock-on effects: gross per capita water availability in India is expected to decline from as low as -1830m³/yr in 2001 to 1140m³/yr in 2050. Source: IPCC 4AR

India's NATCOM1 Identified that there were serious potential impacts from climate change on water stress and reduction in the availability of rainfall. Historic climate variability with floods and droughts, and extreme events have caused widespread destruction and loss of life so there is a need to understand what might happen better by improving the reliability of climate change projections at the regional level, and to develop and implement adaptation strategies involving water conservation, changing land use and cropping patterns flood warning systems and crop insurance. NATCOM1 also identified the need for intensive development of ground water resources, exploiting both dynamic and in-storage potential.

1.1 Background

NCCP has established the National Water Mission to take account the provisions of National Water Policy. Under the NCCP Orissa has already formed a climate change cell in the Department of Water Resources²⁷. Its work is intending to run alongside the National Water Mission's plan which has the following goals and objectives: realising a comprehensive water data base for the assessment of the impact of climate change on water resources; conservation, augmentation and preservation of water resources; focused attention to over exploited areas; increasing water efficiency by 20%, and the adoption of new and appropriate technologies. The NWP is to be re-visited with states to ensure that, and enhance storage both above and below ground, rain water harvesting combined with equitable and efficient management structures and basin level management strategies deal with climate change.

River basin planning is a major thrust of policy. Orissa has 11 river basins- the largest being the Mahanadi and the Brahmani where many major industries are located^{28, 29}. Comparatively, Orissa may be a water-rich state but water requirements for all state uses (domestic, agriculture, industry and the environment) have been estimated to increase by

²⁷ Govt of Orissa order no21093 dt.05.08.09

²⁸ SOE 2006

²⁹ State Pollution Control Board, Orissa 2006. State of Environment Report Orissa 2006, State Pollution Control Board, with Administrative Staff College of India, Hyderabad, and MOEF, GOI.

50% between 2001-2015 without climate change impacts being included³⁰. Nine of Orissa's eleven river basins are inter-state basins. No agreements have yet been concluded with the upper riparian states (Chatisgarh and Jharkand)^{31, 32}. About 80% of rainfall is carried as surface run-off so there is potential for capture and storage. On average 55% of the available water resources are used for irrigation but the intention is to increase this especially as its availability is widely variable (as little as 5% in some blocks).

1.2 Key Concerns/Issues

In Orissa, over 80% of annual rainfall occurs during the monsoon period, average 1400mm, 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 concern³³. 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. For example, in 2009, 1451 villages in 15 districts were affected, 13,000 houses were lost or damaged, over 60,000 people were evacuated and accommodated in 80 camps³⁴. Saline water ingress has been observed in some coastal districts. There also major pollution and water quality issues emerging as industrialisation and urbanisation proceed in the state. Obviously with climate change projections indicating a decline in predictable rainfall, but increasing intensities (see Box 1 above) water is a critical sector for the state.

1.3 Response Actions

The cell has drafted an action plan for short term and long term adaptation to climate change based on the National Water Mission's strategy. It has four components: studies on the management of surface water resources management and regulation of groundwater; upgrading storage structures for freshwater and drainage systems for wastewater and conservation of wetlands; development of desalination technologies. The Summary table below has been based on this Action Plan.

1.4 Summary

Context	Response Action	Organisations
Increased inland flooding Flash floods (Coastal floods- see Coasts Urban floods- see Urban)	<u>Research</u> : Provide: river flow data, rain gauge data, flood mapping, flood forecasting models, downscaled climate change projections and regional circulation models. Key actions: expansion of hydromet stations; down scaling of global climate models for : Mahanadi, Brahani and Baitarani Basins, Integrated Water Resources Mgt. Plans; expansion of groundwater observatories and creation of database of groundwater aquifer	Water Resources Department (CC cell), Universities Orissa Water Planning Organisation Hydrometry Directorate Asian Development Bank

³⁰ GoO Department of Water Resources Annual Report 2007-08 p 14.

³¹ GoO Department of Water Resources Annual Report 2007-08 p 91,

³² The Government of Chatisgarh is proposing to construct a number of irrigation projects upstream from the Hirakaud dam in Orissa

³³ SOE 2006

³⁴ www.OSDMA.org

Increased inland flooding Flash floods	<u>New Infrastructure:</u> Upgrading storage structures for freshwater drainage systems for storm flow/waste water, Enhancing recharge of groundwater	Housing and Urban Development Department Rural Development Department Agriculture Department Groundwater Directorate
Floods	<u>Preparedness:</u> Improved flood management plans for inland flooding; new groundwater legislation for urban water harvesting Awareness raising with Pani Panchayat, farmers training camps and CSOs	OSDMA Orissa Housing Development Corporation Water Resources Department (CC cell) and Agriculture Department
Drought Lack of water for irrigation	<u>Research and Preparedness:</u> Provide: downscaled climate change projections and regional circulation model; Studies on improved management of surface water resources and how to increase efficiency of water use; Undertake studies on groundwater resource and recharge with climate change Awareness raising with Pani Panchayat, farmers training camps and CSOs	Water Resources Department (CC cell) Groundwater Directorate Water Resources Department (CC cell) and Agriculture Department
Drought (see Industry and Urban) Lack of water for irrigation	<u>New infrastructure:</u> provision of additional freshwater storage structures <u>Increase water harvesting:</u> provision of additional freshwater storage structures; restoration of old water tanks <u>Improved watershed land management systems</u> and Integrated Water Resources Management plans <u>Demand management and optimisation of water use:</u> Investigate new regulatory structures with entitlements and prices to adopt water efficient, and innovatory technologies; identify water wastage and	Water Resources Department (CC cell) Rural Development Department Agriculture Department with WALMI

	leakage	
Climate change impacts on wetlands and conservation areas	<u>Research:</u> Environmental appraisal of current settlement, and development projects on wetlands and mangroves with climate change; <u>Formulating climate change sensitive management regimes</u> and increasing awareness of climate change amongst coastal communities.	Fisheries Department Revenue and Disaster Management Department Forest and Environment Department

Forestry

2.1 Background

Orissa ranks fourth in terms of forest cover in India. According to the State Forest Report (2003) around a third of the state is under forest cover with a further 4% under tree cover. Of the forest, only a small proportion (under 1%) was still classified as very dense forest with a (canopy density of greater than 70%), 58% was moderately dense (canopy density 40% to 70%) and 41% was open forest (canopy density 10% to 40%). Forests provide important livelihoods to the rural poor, and sustenance. Combined with the substantial tribal populations is a high proportion of constitutionally protected majority scheduled areas. The forests also have important ecological functions, checking soil erosion and reducing the impact of droughts, floods and cyclones (mangroves).

There are 6 types of forest in Orissa: Tropical Semi-Evergreen, Tropical Moist Deciduous, Tropical Dry Deciduous, Subtropical Broad leaved hill forests, Littoral and Mangrove forests³⁵. Logging, fuel wood collection, agricultural/ pastoral encroachment, forest fires mining (which also causes resettlement) industrialisation and associated infrastructure, and other development projects cause depletion. Around 20% of the state population, the tribal people, derive their livelihoods from the forest and are intimately connected with forest ecology and their use for "podu" slash and burn agriculture has led to severe deforestation in some places. In addition extraction of kendu leaf threatens forest canopy coverage.

Laws and development projects have tried to address the causes and consequences of shifting cultivation with success in some places. The state has a history of extensive protected/managed common lands and forests. The total livestock production is around 24 million and in the absence of stall-grazing increased pressure may be put on forest grazing. Natural regeneration is poor due to forest fire. Depletion of forest for reasons noted above, and in addition natural disasters, cyclones, flood and droughts contribute to depletion

2.2 Key Concerns/Issues

No assessment of the impact of climate changes on Orissa's forests has yet been undertaken using the latest range of climate scenarios- 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 climate³⁶. About 70% of vegetation is likely to find itself less optimally adapted to its existing location making it more vulnerable to adverse climate conditions and biotic stresses (pests and diseases) which occur from time to time.

³⁵ According to SOE 2006

³⁶ NATCOM1 p100

2.3 Response Actions

The NCCP provides for the Green Mission which advocates bringing one-third of the country under forest cover. Forest management is a very active area of state policy with 10,500 people being employed by the state in the sector. The forest department have finalised their "Vision 2020" after wide stakeholder consultations with all levels of forest personnel. Participatory decision-making and management would be a key part in this. The forest sector goal in the 11th five year Plan is sustainable forest management with the larger goal of supporting rural livelihoods. Forest protection is an immediate goal, and the regeneration of degraded forest is to be undertaken with reforestation to improve their crown density. Plans are to create employment opportunities for tribal scheduled castes as well as other economically marginalised people living around the forest areas.

Orissa's forest programme could potentially match well with India's approach to REDD- (Reducing Emissions from Deforestation in Developing Countries) associated with the UNFCCC. India supports the REDD plus approach arguing for compensating countries not only for reducing deforestation but also for conservation, sustainable management of forest and increase in forest cover³⁷. India now advocates a mechanism outside the purview of the CDM with national accounting for REDD, together with a mix of market and fund based approaches. With funds for maintaining carbon stocks but selling of carbon credits for change in stocks due to a decrease in deforestation or degradation. Agreement on the immediate establishment of a REDD-plus mechanism was agreed in the Copenhagen Accord, and it was also agreed this could be funded from the "Copenhagen Green Fund".

In addition, it has been proposed to use 20% of NREGS fund for plantation activities which could mean that resources for afforestation and management of degraded land³⁸.

There is also considerable potential to reduce fuelwood use for cooking with benefits to health and a reduction in deforestation. There may be other sources of UNFCC associated funds available, for example, the Clean Development Mechanism, available to support technical change here.

What is needed is for Orissa to prepare itself for REDD plus and other potential additional funding schemes with formulation of projects. It already has the resources of Kampa to deploy to start the step up in activities.

2.4 Summary

Context	Response Action	Organisations
Potential resources available for forest services- carbon sinks and sequestration	<u>Increase reforestation and afforestation activities in degraded forest areas.</u>	Forest and Environment Department
	Plan programme of intensive afforestation in one District for demonstration and then extend across the State	OREDA
	<u>Protect existing forest stocks</u> to act as carbon sink with stronger conservation	Water Resources Department
	<u>Assess existing and innovatory sources of</u>	Agriculture Department

³⁷ TERI 2009 Is India ready to implement REDD plus?

³⁸ TERI 2009 Is India ready to implement REDD plus?

	<p>funding, for forest conservation, forest management, and afforestation including GOI- KAMPA, and UNFCCC REDD plus</p> <p><u>Undertake studies</u> on potential for traditional and new biomass energy technologies <u>Work to establish new systems of support for community users.</u> Aim to create new marketing structures for users traditional forest products to improve incomes and livelihoods to reduce pressures on forest destruction</p> <p><u>Increase planting on non-forest land</u></p>	<p>Rural Development Department</p> <p>Regional Plant Resource Centre (RRPC)</p> <p>WORLP, OTELP</p>
Increases in temperature and changing rainfall patterns will affect forest growth, and regeneration in all parts of Orissa.	<p><u>Explore where new and increased tree planting</u> could create barriers to storm and cyclone impacts in coastal zones;</p> <p><u>Improved tree planting and forest mgt.</u> to work further in watersheds and with IWRM to increase water storage, reduce soil erosion and improved climate reliance in agricultural areas; to assess where tree planting could provide protection in flood prone areas.</p>	<p>Forest and Environment Department</p> <p>Agriculture Department Water Resources Department climate change cell WORLP, OTELP Regional Plant Resource Centre (RRPC)</p>
Increased risk of forest fires	<p><u>Undertake studies</u> on indigenous trees species to assess their vulnerability to climate change. Develop heat resistant genotypes in tree nurseries</p> <p><u>Assess fire management strategies</u></p>	<p>Forest and Environment Department</p>
Climate change impacts will affect forest diversity	<p><u>Assess additional threats to biodiversity</u> and wildlife and see if climate change adaptation and <u>explore whether funding</u> from carbon sequestration funds might be accessed</p>	<p>Forest and Environment Department</p> <p>Consultants</p>
Forest and climate change policy impacts is fast growing policy area	<p><u>To obtain access to updated knowledge</u> on climate change science and policy developments and make this available for foresters, forest guards, range forest officers. <u>Bring in trainers</u> to develop modules for forest training institutes</p>	<p>Forest and Environment Department</p> <p>DFID and other donors</p>

Agriculture

Box 2 Impacts of climate change on cereal production in South Asia

Recent studies reviewed in the IPCC 4AR suggest that substantial decreases in cereal production potential in Asia could result from climate change but there will be significant regional differences. Crop simulation studies based on future climate scenarios indicate that substantial losses are likely in rainfed wheat and maize. In South Asia the drop in yields in non-rainfed wheat and rice will be significant for a temperature increase of beyond 2.5 deg. Overall the net cereal production of South Asian countries is expected to decline at least by 4-10% by the end of the century with the most conservative climate scenarios in South and South-east Asia and possibly by 30%. Source: IPCC 4AR

3.1 Background

Orissa is an Agrarian State. Almost 70 per cent population of the State are dependent on agriculture. The agriculture sector contributes only about 26 per cent of the Gross State Domestic Product (GSDP), with more than 70% population dependence resulting in low per capita income in the farm sector. About 60% of land is devoted to rain fed agriculture. Rice dominates the crop area 75%. The kharif crop is dominated by rice; farmers diversify the cropping pattern during the Rabi crop. Increased problems with germination with variable rainfall have been reported. Due to the predominantly subsistence nature of agricultural production, the use of fertilisers and pesticides is very low (one of the lowest), so no serious pollution problems have been observed from agriculture. Ground water use is also low in the state. However, saline water ingression has been observed in some coastal districts³⁹.

Whilst there are major uncertainties about the future behaviour of the monsoon with climate change, any changes are likely to upset delicate balances in long-established systems, and moreover there is already disturbing observational evidence at national level (see Box 2 above) of trends which match climate projections and will adversely affect food production. Apart from direct impacts through temperature, water balance and atmospheric composition as well as extreme weather events there may be indirect changes with changes in the distribution, frequency and severity of pest and disease outbreaks, incidence of fire and in soil properties. Change national level, and globally in food production is likely to affect Orissa as well as change within the state. There may for example be greater pressure on agricultural production in Orissa to intensify food production systems if food supplies decline elsewhere.

3.2 Key Concerns/Issues

Over the last two to three decades there has been stagnation in agriculture in Orissa and growth in agriculture production is well below the national average. The state has wider disparity in terms of agricultural growth. Districts like Kalahandi, Koraput rank much lower as compared to the other districts of the state. Some of the Western Orissa districts are poorest in India with 70% of their 4 million people below the poverty line. Severe drought in this region (*check*) in late 2009 had resulted in farmers' suicides. These droughts were connected by civil society organisations to climate change and messages taken to COP 15 in support of organic and sustainable agriculture supported by improved technical knowledge⁴⁰.

3.3 Response Actions

Both National and State Policy for Agriculture is directed to improving low productivity, crop diversification, improving agricultural practises, increasing and improving irrigation and

³⁹ State Pollution Control Board, Orissa 2006. State of Environment Report Orissa 2006, State Pollution Control Board, with Administrative Staff College of India, Hyderabad, and MOEF, GOI.

⁴⁰ Water Initiatives Orissa Sambalpur 07-12-09 Orissa Farmers Agenda for the World Leaders Attending COP15

water use efficiency, all of which will involve increased long term investment, and increase credit for small and marginal farmers. There is existing strategic policy -the National Policy for Farmers 2007- to promote the economic well-being of the farmers. The National Agriculture Policy approved by the Government of India during 2000, aimed to achieve annual growth of more than four per cent in the agriculture sector on a sustainable basis. However, the growth rate achieved during the Tenth Five Year Plan only averaged around 2.3 per cent whilst the non-farm sector has grown much faster⁴¹.

There is great deal of potential: the National Mission for Sustainable Agriculture within the NCCP could drive action and account for climate change. This programme is indeed to devise strategies to make Indian agriculture more resilient to climate change: identifying new varieties of crops capable of being resilient to drought and flood. There is also an intention to create products to support better risk management including insurance and derivatives. Underlying the strategy is the need to improve the information base and supplying customised information about climate changes, agro-climatic variables. Irrigated agriculture is the biggest potential way of providing employment throughout the year and is regarded as the utmost importance in the state and 2 mega river basin project proposals are underway⁴².

There is a strong institutional base to work from. The Agriculture Department consists of 3 executive wings namely, Directorate of Agriculture, Directorate of Horticulture, Directorate of Soil Conservation and Watershed Mission⁴³.

Orissa has developed its own integrated set of solutions for climate change which directly impinge on the crucial problems of farmers' poverty and tackling variability on water availability both too much and too little- Watershed Plus Development

The Western Orissa Rural Livelihood Programme (WORLP) was established to work in some of the poorest areas of Orissa. Whilst the driver was not the need to adapt to climate change, the model has many features which make it a relevant approach:

- At its core it is focused on sustainable rural livelihoods
- The livelihoods asset base is increased through the five social capitals: natural, social, financial, physical and human
- The approach rested on analysis of 50 years of meteorological data identifying specific risks in the project areas. These were: high variability of rainfall leaving people with two peak periods of food stress in the region; drought and dry spells every 2 years with a major drought every 5-6 years; and flash floods during the rainy season

No environmental impact was envisaged at the outset of the Programme other than enhancement of natural resource assets. As the poverty reduction goals of the project meant that the capacity of the poor was enhanced which would increase their adaptive capacity, an add-on study was undertaken. This aimed to document the coping mechanisms and adaptation practices being adopted by local communities in WORLP areas in response to

⁴¹ Source State Agric Plan

⁴² GOO Annual Plan 2007-8 ch17.3

⁴³ A number of autonomous bodies also work under the Agriculture Department: Orissa State Seeds Corporation (O.S.S.C), Orissa Agro Industries Corporation (O.A.I.C.), Agriculture Promotion and Investment Corporation of Orissa Limited (APICOL), Orissa State Seed and Organic Products Certification Agency (OSSOPCA), Institute on Management of Agricultural Extension (IMAGE), Orissa Cashew Development Corporation.

climate induced vulnerability; and, to recommend technically feasible and socially acceptable adaptation strategies and mitigation options to further improve livelihoods. WORLP has had a substantial impact on poverty with a 30% reduction in the number of poor households. For the most part this can be attributed to enhanced levels of livelihood assets- financial, natural, and social.

Successful WORLP interventions

Natural Resource Management interventions aimed at checking run-off and reducing sediments with a view to enhancing water resources and improving productivity. Interventions have raised groundwater tables by as much as 6 metres combined with a reduction in intra-annual fluctuation.

- Increased water availability has permitted a second crop during the Rabi season which has enabled an increase in gross cropped area. (up to 16%) and a 10% increase in cropping intensity. This has impacted on agricultural production and productivity, with crop diversification and an increase in yield frequency of 50-100%.
- Supporting infrastructure has enabled seed exchange and agricultural diversification though livestock and aquaculture activities have also taken place. New plantations (4000 ha), widespread composting technology have provided potential for harnessing carbon credits
- Self help groups have increased social cohesion, particularly for women, reduced vulnerability and cushioned the effects of climate related shocks.
- Overall there has been an increase in food security with an overall decrease in the number of households suffering lean season food deficit from 25% pre-project to 5% (at the current stage). This has happened through enhanced coping capacity, increased agricultural production, diversification of livelihood activities and better access to consumption credit.

3.4 Summary

Context	Response Actions	Organisations
Climate change impacts will increase variability in rainfall, with increased floods and droughts and change soil moisture levels.	<p><u>Rapid screening and strategy assessment</u> Using tools such as ORCHID, a screening of the State Agricultural Policy should be undertaken to identify which parts are most sensitive to climate change and actions started.</p> <p><u>Seed improvement</u>; Development of: seed varieties of rice that can withstand irregular rainfall; and, seed varieties of other crops that will germinate grow in increased temperatures during the rabi season</p>	<p>Agriculture Department</p> <p>Rural Development Department</p> <p>OUAT with national institutions</p>
Increased temperatures will change seasonality and add to evapo-transpiration.	<p><u>Increase knowledge and capacity</u>: Increased analysis of weather data to identify trends in climate variability. An associated database could be established of problem areas to identify trends and priority targets. Associated with this, a register of successful and remedial actions could be established to build up good practice- WORLP model</p>	<p>Agriculture Department</p> <p>Water Resources Department (CC cell)</p> <p>Department Revenue and</p>

	Continued investment in integrated watershed development programmes and ensuring replication across Orissa	Disasters Watershed Mission
Manage, and implement changes needed to agriculture with climate change	Priority actions could involve: Establishment of training programmes for extension officers through Universities and CRII Training programmes for farmers in water efficiency. Use of GP training hubs for dissemination of information on climate change.	Agriculture Department OUAT
Increased salinisation in coastal areas	Development of saline resistant crop varieties	Agriculture Department OUAT
Changes in pests and diseases will impact on crop production	Improved monitoring, surveillance then devise new farming techniques	Agriculture Department OUAT
Food security pressures will increase globally and in India	Continued liaison work with NCCP and the National Mission on Sustainable Agriculture	Agriculture Department

Animal Husbandry

4.1 Background

Animal Husbandry is a rural sector that promotes rural incomes and does not require much infrastructure and capital for their sustainability. The production of meat, milk and eggs is low in comparison to other states of the country. To improve the socio-economic standard of the general public, different Animal Husbandry and Dairy Development programmes. This sector is managed by the Animal Resources Department, which is under the Fisheries and Animal Husbandry Department. The department aims at increasing the milk, egg & meat production of the state through scientific breeding, feeding and management practices. On the one hand, it increases rural income. On the other hand, it aims at providing nutritional supplements.

4.2 Key concerns / issues

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 is that the state has a large population of unproductive livestock. Due to religious / cultural regions, the unproductive livestock are retained till their natural lifetimes. The methane emissions from the unproductive livestock are also a concern.

4.3 Response Actions

Under the Animal Husbandry Department, there is a Veterinary Officer's Training Institute. This institute developed a training programme on better livestock management practices in the context of environmental concerns about five years back. The training material is already available but the programme has not been administered in recent times. It will be useful to re-initiate this training programme that addresses both local and global pollution issues in the context of livestock management. Another response action that will be required is estimating the quantum of methane emissions due to the livestock population in the state.

4.4 Summary

For the animal husbandry sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up is to be included in the following table:

Context	Response Actions	Organisations
Emissions reduction	<u>Emissions</u> : Study to estimate the extent of livestock-based GHG emissions from the state	Animal Resources Dept and Consultants
Capacity building	<u>Better practices</u> : Develop a plan for enhancing the awareness on more sustainable livestock practices	Animal Resources Dept

Coasts

5.1 Background

Orissa's extensive coastline is 480kms long with Baleswar, Bhadrak,, Kendrapara, Jagatsingphur, Puri, and Ganjam the key districts containing 30% of the state's population but less than 15% of the coastal area. Most people live in rural areas with high poverty rates, low literacy rates and low per capita income, so with less adaptive capacity.

The coastal area contains many distinct uses and activities. There are a number of important and sensitive wildlife and conservation areas, most notably Chilika a unique wetland and designated Ramsar site and also the Bhitarkanika Sanctuary(mangroves) and critical species which need protection from poaching and other threats- Olive Ridley turtles, Estuarine crocodiles and the Irrawady Dolhin. The coastal zone is also critical to fisheries production⁴⁴. However the coast is also critical to Orissa's industrial development pathway with new power plants, ports and industries planned⁴⁵ which are likely to add to the pollution and effluent problems already causing concern. There are several important world-renowned archaeological sites in the coastal zone (Jagannath and Konark temples for example) which help to underpin the state's tourism industry. Even without the risk of cyclones -between the period 1965 to 2004 6 cyclones hit the state- the coast presents a very challenging set of issues to tackle.

5.2 Key Concerns/Issues

The coastal districts of Orissa regularly experience flooding. Heavy rains in the upper catchment areas result in heavy loads of silt and high tides can block discharge. Further the whole coast is prone to storm surge which is usually accompanied by heavy rainfall, making the estuary region vulnerable to both storm surge and river flooding. There is already

⁴⁴ See section C.6 below

⁴⁵ See sections above on industry(B.1) and energy (B.2)

concern about coastal erosion with loss of Gahirpur in Rajnagar and part of Pentha with the "first climate refugees"⁴⁶.

Climate change will make the situation worse. The IPCC 4AR projected that sea level is expected to increase by 0.18m to 0.59m by 2100. More recent scientific analysis suggests that increasing loss of mass from glaciers, ice caps, and the Greenland and Antarctic ice sheets leads to projections of global sea level rises of 1m (+/- 0.5m) over the century⁴⁷ depending on different greenhouse gas emission scenarios. An increase of 10-20% in tropical cyclone intensities is projected for a rise in sea surface temperature of 2-4 degrees relative to the current threshold temperature.

5.3 Response Actions

In terms of tackling the issues regarding the natural environment and physical impacts of human activities, Integrated Coastal Zone Management (ICZM) with a Coastal Zone Authority (OCZA) has been proposed as the way forward⁴⁸. In respect of disasters in the coastal zone, the state is now well-served by the Orissa State Disaster Management Authority (OSDMA). The Authority has the mandate to cover not only cyclones but all disasters and the entire gamut not only of management but also relief, restoration, reconstruction and other measures. It also coordinates with the line departments involved in reconstruction, with bilateral and multi-lateral aid agencies, and with UN Agencies, International, National and State-level NGOs. The establishment of the Agency was driven by the 1999 super cyclone but means that Orissa is now well-placed with an effective agency which can now prepare, plan and tackle a range of disasters across the state including heat waves⁴⁹. It also has data and monitoring systems which can identify trends, for example, in lightning deaths. All its activities are well disseminated on its website (www.osdma.org).

Increased risks due to climate change (from cyclones to lightning) need to be considered within ICZM and the OSDMA activities and then plans and programmes modified accordingly. This effort will need more scientific research and close working with a range of state departments and agencies.

Context	Response Actions	Organisations
Possibly stronger cyclones on different storm tracks	Preparedness: Integration of climate change risks into the State Disaster Management Policy which provides a robust framework for dealing with extreme events associated with climate change with its pro-active and multi-hazard approach to disaster management.	OSDMA Water Resources Department (CC cell)

⁴⁶ As reported in "Victims of climate change unaware about the climate change summit" RCDC, Focus Orissa Day 3 COP15 Bulletin. However, not all current erosion may be due to sea-level rise and other changes associated with climate change, some may be as a result of natural geomorphological processes

⁴⁷ 2009 Synthesis report from Copenhagen Climate Congress Climate Change, global risks, challenges, decisions 10-12 March 2009.

⁴⁸ SOE p253

⁴⁹ See for example the report: Understanding Heatwaves in Orissa. Proceedings of the National Workshop on Heat Waves Bhubaneswar 13-03-06. OSDMA.

Increased storm surge, storminess and wave action causing coastal erosion and increased damage to coastal infrastructure: roads, communities and livelihoods	<p><u>New and improved coastal protection</u>: Assess where measures of coastal protection are needed and can be installed. More information is needed on coastal erosion with Digital Elevation Model, and an assessment of historical data.</p> <p><u>Capacity building and awareness raising</u> of coastal settlements, communities and industries</p>	<p>Housing and Urban Development Department</p> <p>Works Department, Industries Department and Energy Department</p> <p>Agriculture Department and Rural development Department</p> <p>Transport Department</p>
Rising sea levels	<p><u>Study</u> the climate mediated hazards and <u>explore the strengthening</u> of the State Coastal Zone Management Plan</p>	<p>Revenue and Disasters Department, OSDMA</p> <p>Housing and Urban Development</p>
Impacts of climate change on protected areas	<p><u>Research</u> on impacts, <u>increase awareness</u> of coastal communities and <u>devise management plans</u> through ICZM</p>	<p>Forests and Environment Department</p>

Fisheries

6.1 Background

Orissa has immense water resources in the form of reservoirs that offer itself for exceedingly well for inland fisheries. There is potential in closed water bodies, e.g. ponds and tanks (freshwater and brackish), and open water bodies like reservoirs, rivers, estuaries, lakes, lagoons, canals and swamps. In addition, it has a 487 km coast line that is a tremendous resource for brackish and marine water fishing. Fishery outputs contribute to the food and nutritional security of the state. There is also the opportunity of expanding export markets for high value products. The fisheries sector generates revenue for the State Government through lease value, royalty (direct) and taxes (indirect).

Fish production in Orissa is amongst the lowest in the coastal states though the state has immense potential. Construction of shrimp ponds around the Chilka lake and the use of feed material has brought algal blooms and the depletion of oxygen. Long retention of saline water in intensive shrimp pond affects the sub-water causing loss of land productivity. The large number of net enclosure (shrimp gheries) has reduced shrimp stock (obstacles for free flow of water and migration of shrimp and fish juveniles) and causes lake siltation conflicts between traditional fishermen who have depended for their livelihood and the new entrepreneurs.

6.2 Key concerns / issues

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.

6.3 Response actions⁵⁰

Policies, plans, programmes and practices in the fisheries sector need to be reviewed from a climate change perspective. At the policy level, there is a State Reservoir Fishery Policy⁵¹, which is focused on enhancing fish production in open water bodies. As there are implications on water resources, this policy needs to integrate climate considerations. To understand the implications, not only in open reservoir fishing but also in coastal fishing, there is a need to conduct a state-wide study on the implications to the sector as a whole. This should lead to an overall climate-consistent state fishery policy. At an operational level, an effort needs to be made to study and compile best environmental practices that need to be widely adopted. Once the state-wide study and the best practices are done, capacity-building needs to be planned and undertaken across the various organisations involved in this sector. The organisations include the Fisheries Department (part of the Fisheries & ARD Department) at the state level, a Co-ordination Committee at the District level, which includes a Fishery Officer and the Gram Panchayats at the village level. As this capacity-building on climate change needs to be ongoing, an information access mechanism should be created to access latest, up-to-date information relevant to Orissa. Assets in the fishery sector, particularly those in the coasts, are vulnerable to climate-mediate hazards. Studies to determine the vulnerability levels and introducing mandatory requirements such as protecting ponds through green belts have to be considered.

6.4 Summary

For the fisheries sector, the findings that relate the climate change context with the response actions and organisations that have to follow-up are to be included in the following table:

Context	Response Actions	Organisations
Adapting to climate change	<u>Policies</u> : Ensure that the Integrated coastal zone management plan encompasses issues pertaining to fishery resources, aquaculture and fishing communities.	Fisheries Department, Environment Department
Assess vulnerability to climate change of coastal habitats important for fish production	<u>Research & policy</u> : Conduct a study to determine the state-wide implications of climatic changes, particularly changed / erratic precipitation, on fishery livelihoods. Use the outcome of this study to integrate climate considerations in the state Fishery policy.	Fisheries Department
Protecting the fishing infrastructure assets	<u>Policies</u> : Prepare a background paper and approach to make mandatory the development of a green belt around aquaculture projects.	Fisheries Department & Forests Department
Adapting to climate	<u>Research</u> : Develop a plan to intensify research and pilot hardy species to overcome the effect	Fisheries Department

⁵⁰ The response actions have reflected the points made in the study's Initial Questions format completed by the Fisheries Department.

⁵¹ Orissa State Reservoir Fishery Policy 2004, <http://www.orissa.gov.in/fisheries&ard/fisherypolicy.pdf>

change	of higher salinity, temperature and low dissolved oxygen on fisheries.	
Adapting to climate change	<u>Practices:</u> Develop a plan to enhance the protection of existing natural habitats (wetlands and mangroves) and fishing grounds, and to create big tank ponds in selected drought-hit areas.	Fisheries Department and Water Resources Department
Capacity-building	<u>Practices:</u> Establish a mechanism for the Fisheries Department to access to information on climate change and its implications on the fisheries sector.	Fisheries Department
Adapting to climate change	<u>Practices:</u> Conduct a study to improve current practices through the promotion of environment-friendly fishing methods and gears	Fisheries Department
Capacity-building	<u>Capacity-building:</u> Develop a phased capacity-building plan for increasing the awareness and knowledge levels of the fishing communities to cope with climatic changes	Fisheries Department
Protecting the fishing infrastructure assets	<u>Vulnerability of assets:</u> Conduct a study to determine the vulnerability of the coastal fishing assets and develop an operational plan.	Fisheries Department and OSDMA

Health and Social Vulnerability

7.1 Background

Due to the high poverty levels in Orissa, there is a high level of vulnerability in Orissa to increased health risks which will arise from climate change. Key health indicators- Infant Mortality Rate and Maternal Mortality Rate -are improving but these are still comparatively high in an Indian context. In Orissa 81% of people in the rural areas were still without pucca housing compared to 56% at an Indian level: for the urban areas the figures are 36% compared to 18%⁵². Poor sanitation and shelter therefore already contribute to environmental health hazards, and with the projected increased temperatures and increased heavy rainfall associated with climate change problems will be exacerbated for example heavy rainfall can mobilise toxic wastes. In 2001 over 90% of households did not have access to sanitation but access to safe drinking water was higher than the national level⁵³

Rapid urbanisation in Orissa is associated with industrialisation generated by increased exploitation of mineral resources. This can be associated with occupational health diseases, some of which may worsen with climate change. In addition contamination of water by chemicals, industrial wastes and sewage makes it unfit for human use. With accelerated industrial growth various types of water pollution problems have occurred with the release of untreated chemical and hazardous wastes in to the river and other water sources. Leaching from fertilisers refuse and spoil heaps can pollute groundwater.

Indoor air pollution associated with the combustion of biomass fuels is also a serious problem.

⁵² Source check envt report

⁵³ SOE p268

Over the last five decades, India has built up a vast health infrastructure and manpower at primary, secondary and tertiary care in government, voluntary and private sectors⁵⁴. Improvement in the health and nutritional status of the population has been one of the major thrust areas for the social development programmes of the country. This is being achieved through improving the access to and utilization of Health, Family Welfare and Nutrition services with special focus on under served and under privileged segments of the population.

7.2 Key Concerns/Issues

All dimensions of climate change are likely to impact on health over time. Changes in two key variables: temperature and rainfall distribution and intensity are likely to change disease patterns for serious diseases such as malaria and dengue fever. Some reports suggest that incidence of malaria may already be changing. Food production may be adversely affected aggravating hunger and malnutrition and reducing adaptive capacity. In addition it is expected that climate change will increase the intensity and frequency of extreme events such as heat waves and may increase the intensity of cyclones. The World Meteorological Organisation has estimated that the number of heat related fatalities could double globally in less than 20 years. In recent years has been experiencing acute heat wave conditions during the summer, whilst there has not been a repeat yet of the conditions in 1998 when over 2000 people died, normally deaths are below 100. In addition to direct impacts on people, there are also aspects of the health delivery systems (buildings, transport disruptions for medical personnel and drug distribution which may be vulnerable, with increased temperatures and flooding. In summary key problems are:

- Increases in incidence of vector borne and water borne diseases
- Occupational health hazards
- Heat stress
- Nutrition related health hazards

These issues may not be addressed as:

- General awareness is not adequate with respect to climate
- Routine preparedness is in place in disaster prone areas but needs strengthening of delivery and monitoring systems
- There is a lack of triangulation and analysis of data at different levels
- State specific action plan does not exist
- Integration of health and other departments may be weak.

7.3 Response Actions

At national level it has been recognised that changes in the incidence of malaria may be one of the most important clearly identifiable impacts of climate change⁵⁵. The First National Communication on Climate change also recognised that the complexity of factors about varying vulnerabilities of different demographic and geographic sections of the population as well as uncertainties around adaptive measures make anticipation and planning difficult for the health sector. For this reason, stress was laid on improvements to environmental practises, preparation of disaster management plans, improving public health infrastructure and disease surveillance and emergency response capabilities will lay a sound foundation to cope with climate change. It can be noted that the more recent NAPCC includes health within the Strategic Knowledge Mission on climate change.

⁵⁴ Indian National Health Plan on Orissa State health department website

⁵⁵ INC p115

The Government of Orissa (GoO) has developed a comprehensive Orissa Health Sector Plan (OHSP) 2007-2012 to address the major shortcomings in health provision in the State. OHSP aims to achieve equity in health outcomes and has a key focus on access and utilisation of services by vulnerable and marginal groups including women, schedule caste (SC) and schedule tribe (ST) populations. It aims at delivering accountable and responsive health care to reduce maternal mortality; infant and child mortality; reduce the burden from infectious diseases; under-nutrition and nutrition-related diseases and disorders.

With so many existing health challenges to face, it is important to adopt a step by step approach to preparing for climate change in the health sector and to work with existing health strategies. Some preliminary work has already been undertaken by the Technical and Management Support Team with a rapid assessment of the Orissa Health Sector Plan (OHSP). This assessment has suggested that some aspects of the plan could already be tackled with a climate change lens and over time additional actions could be introduced. For example, the Integrated Disease Surveillance Program (IDSP) is intended to be the backbone of public health delivery system in the country could be linked to meteorological data. This rapid assessment could be used within the Action Plan. It is also recommended that a systematic assessment of the impact of the climate change on the OHSP be undertaken using a screening methodology linked with the annual reviews already established. Each year the Department sets out a number of milestones to be achieved in each of the strategy areas. Activities and budgets required to meet the milestones are worked out by the responsible Directorates and detailed in the Annual OHSP Plan. Activities are planned to complement the activities of the National Rural Health Mission (NRHM) and are implemented by the Health Directorates, line agencies and DWCD.

7.4 Summary

CONTEXT	RESPONSE ACTIONS	ORGANISATIONS
Climate change impacts on health sector infrastructure and strategies	<p><u>Preparedness</u>: Assess Orissa Health Sector Plan (OHSP) for vulnerability to climate change and identify priorities for action.</p> <p><u>Institutional change</u>: Establish links with climate change actions in relevant areas (industrial pollution, urban sanitation)</p> <p><u>Awareness-raising</u> of health service professionals about climate change</p> <p>Empower community groups Gaon Kalyan Samithi (GKS) to take account of climate change</p> <p><u>Enhance resilience</u> of infrastructure of health institutions to meet climate change.</p> <p><u>Assess</u> drinking water standards for salinity in coastal communities</p>	DOH, FWW and CD, TMST Industry, Pollution control board, Forest and Env., PWD with Health NRHM
Increased intensity and frequency of	<u>Strengthen delivery and monitoring systems</u> of health system preparedness in disaster prone regions	OSDMA

disasters		
Increased incidence of heat waves	<u>District authorities to develop heat wave disaster plans</u> for application when severe heat periods occur.	OSDMA
Changing disease patterns e.g malaria	<u>Link IDSP with meteorological data</u> Start integration of climate change into OHSP by integrating surveillance of malaria with climate data	OSDMA Health Department, Women and Child Development Department Revenue and Disasters Department
Greenhouse gas emissions reduction from biomass stoves	<u>Develop CDM projects</u> to introduce improved cooking stoves	IPICOLForestry and ERnvit

Section D Cross Cutting Aspects and Assessment

1.1 Overview

This section contains a rapid assessment of cross-cutting aspects: energy and low carbon development; adaptation, generic institutional and planning dimensions; Orissa state institutional and planning dimensions and next steps.

This sector-driven approach to identifying actions has benefits in that it is comprehensive and will enable the sector specialists to engage and refine the potential actions in their areas to identify actions. But it was an ambitious decision with the resources available to start across the whole climate change action agenda. The study has overviewed not just those sectors which are likely to be impacted by climate change due to historic and projected global emissions, but also to those energy-using sectors in Orissa which are developing and contributing to the emissions. It has produced a very substantial programme of actions which need to have a timescale and perspective of delivery over the next set of plans. What is clear so far is that:

- Orissa –which has been already described as the disaster capital of the world – is increasingly likely to experience more floods and droughts and a complex set of key climate vulnerabilities and risks likely to affect development and development plans of the state have been identified.
- Orissa has a whole range of complex challenges at both ends of the spectrum surrounding low carbon growth. It could then benefit from being an “early mover” from its emerging position as a major industrial force and power generator. Also for the majority of its population who have no or little contact with the commercial energy sector- and need access to energy for economic and social development, there may be new opportunities to tackle long standing problems with a new focus on these issues at national and international levels.

Both of these climate change challenges could benefit from having a strategic integrated cross-sectoral approach devised at state level, with reference to the national and global frameworks a the next stage.

1.2 Issues relating to low carbon development:

For long-term economic development opportunities in Orissa, which has a growing industrial sector which needs to be globally competitive, it might be advantageous to devise a strategy which promotes the most cost-effective and efficient technologies across the sectors. The following table provides a useful reference point.

Energy technologies: Opportunities⁵⁶

Abatement Opportunities	Availability in Middle income countries	Availability in Low income countries
Efficiency gains		
Lighting	✓✓	✓
Insulation	✓	✓
Motor systems efficiency	✓✓	✓
Clinker substitution by fly ash	✓✓	✓
Efficiency improvements other industry	✓✓	✓
Residential electronics and appliances	✓✓	✓
Retrofit residential	✓✓	✓
Cars full hybrid and plug-in hybrid	✓✓	✓
Building efficiency (new build)	✓✓	✓
Nuclear	✓	✓
Coal CCS new build	✓✓✓	✓
Iron and steel CCS new build	✓✓✓	✓
Coal CCS retrofit	✓✓✓	✓
Gas plant CCS retrofit	✓✓✓	✓
Use of carbon assets		
Crop land nutrient management	✓✓	✓✓✓
Rice management	✓✓	✓✓
Reduced slash and burn agriculture	✓	✓✓
Reduced pastureland conversion	✓	✓
Reduced intensive agriculture conversion	✓	✓
Pastureland afforestation	✓	✓✓✓
Grassland management	✓	✓✓✓
Organic soil restoration	✓	✓✓✓
Degraded land restoration	✓✓	✓✓
Degraded forest reforestation	✓✓	✓✓
Renewable energy supply		
Electricity from landfill gas	✓✓	✓
1 st generation biofuels	✓✓	✓✓✓
2 nd generation biofuels	✓✓	✓
Small hydro	✓✓	✓✓
Waste recycling	✓✓	✓
Geothermal	✓✓	✓✓
High and low penetration wind	✓✓	✓✓
Power plant biomass co-firing	✓✓	✓✓
Solar CSP	✓✓	✓✓✓
Solar PV	✓✓	✓✓✓

Source: Adapted from McKinsey (2009)

1.3 Adaptation to climate change

The table below sets out a typology of adaptation practises that has been established through the research literature⁵⁷ and provides potentially some integrating themes for the sectors. Many of the sectors have similar activities such as research, awareness raising and capacity-building and these could be delivered at sate level in an integrated way.

Adaptation Strategy	Description
Changing Natural Resource Management Practices	Emphasizes new or different natural resource management practices (e.g., for managing water, land, protected areas, fisheries) as adaptation strategies.
Building Institutions	Creates new or strengthens existing institutions (e.g., establishing committees, identifying

⁵⁶ As opposed to income level, geographical location is a more important determinant of the ability to produce some renewable energies (the exception is likely to be those that use waste as an input).

⁵⁷ See Burton Willows and Connell and Mcgray et al

	mechanisms for sharing information across institutional boundaries, training staff responsible for policy development).
Launching Planning Processes	Sets in motion a specific process for adaptation planning (e.g., developing a disaster preparedness plan, convening stakeholders around vulnerability assessment findings).
Raising Awareness	Raises stakeholder awareness of climate change, specific climate impacts, adaptation strategies, or the environment in general.
Promoting Technology Change	Promotes implementation or development of a technology new to the location (e.g., irrigation technology, communications technology).
Establishing Monitoring/Early Warning Systems	Emphasizes the importance of creating, implementing, and/or maintaining monitoring and/or early warning systems.
Changing Agricultural / forest utilisation practices	Focuses on new or different agricultural / forest utilisation practices as adaptation strategies.
Empowering People	Emphasizes literacy, gender empowerment, or the creation of income generation opportunities as a basis for adaptation.
Promoting Policy Change	Promotes establishing a new policy or adjusting an existing policy.
Improving Infrastructure	Focuses on creating or improving built infrastructure (e.g., roads, sea walls, irrigation systems).
Providing Social Protection	Creates, modifies and promotes insurance, credit, asset transfers and safety nets (NREG).
Other Strategies	Adaptation in disaster relief, eradication of climate-related diseases, assisted migration schemes etc.

1.4 Generic institutional and planning dimensions

Moving from this scoping study to devising an action plan and then organising its delivery will be a major challenge. More detailed planning work and analysis will be necessary. This report is the first step. The following actions in particular need to be undertaken: institutional and capacity assessment and improvements in planning.

- **Institutional capacity assessment**

A preliminary identification has been made of institutional and planning capacities within Orissa. There is a need to assess these more precisely and then monitor to plot progress. It is suggested that a systematic capacity assessment as to manage these risks and vulnerabilities is undertaken identifying key institutional and planning gaps at the state level and their inter linkages with national and local level planning. This assessment can then be repeated regularly and progress monitored. The following table shows one system which allows for self-reporting by departments⁵⁸.

⁵⁸ Derived from UK Treasury risk assessment by UK National Audit Office

SELF ASSESSMENT AGAINST CLIMATE CHANGE RISK ASSESSMENT ⁵⁹					
	Level 1 Getting started	Level 2 Awareness and Understanding	Level 3 Implementation planned and progress	Level 4 Implemented in all key areas	Level 5 Embedded and Improving
Leadership					
Policy and Strategy					
People					
Partnerships					
Processes					

- **Planning**

Planning ahead allows:

- building understanding and capacity to deal with problems
- keeping options flexible so actions can be adjusted to changing experience of climate change and changes in projections
- reduction in overall cost, by building in changes as you go and avoiding retrofitting
- And is especially important for policies and infrastructure with long lifetimes and timescales

There is an ongoing need to facilitate the development of improved strategic and sector plans for continued sustainable development and economic growth, taking into account changing climatic conditions. Better coordination, integration, and enhancing of various existing programmes, currently delivered by different departments/institutions in a fragmented manner is vital. An organization/ unit needs to have responsibility to assess and recommend specific measures to strengthen the policy and incentive framework, including the knowledge base, for supporting the process of adaptation. There is also a need to assess and recommend specific measures for climate change mitigation and adaptation co-benefits.

1.5 Government of Orissa institutional and planning dimensions

In starting action on climate change the Government of Orissa's will need identify its priorities and assess to what extent its plans need modification to cope with climate change so it is locked into the state's development pathway. Here is a rapid assessment of the current economic strategy's **critical climate change sensitivities- highlighted in blue**

Current Development Plan **Climate change sensitivity**

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-**

⁵⁹ This approach to capacity assessment was derived from the UK Treasury

intensive investments in the State; greater attention to financial management and modernisation of procurement systems for converting outlays to outputs and outcomes; and continuing tax reforms for transition to Goods and Services Tax

The quality of the labour force that the state can produce and retain – the need for healthy and qualified young men and women will be very high in coming years;

The availability of quality infrastructure - severe existing infrastructural gaps will have to be filled quickly in order to meet the needs of the manufacturing and service industries as well as the growing urban population (shanty towns are springing up near new industrial towns now); and

An enabling environment for (downstream and ancillary) SMEs to realise the multiplier effect of the large private investments - the regulatory climate will need to be improved⁶⁰.

From a social viewpoint the need is to ensure that Orissa's poorest and excluded – in particular its tribal population – are able to gain some benefit from the wider growth in the state.

From a governance viewpoint the need is to

Raise the efficiency, effectiveness and accountability of public spending;
Improve service delivery, and link allocation with outputs and outcomes; and
Ensure that industrial expansion takes place in a socially and environmentally friendly way.

There is a lot to build on. The state, because of its rapid industrialisation especially in the power and metal sectors, has been very conscious on the issues relating to climate change. Considering several departments work on some aspects of climate change, while agriculture, animal husbandry and fishery work on some issues relating to adaptation; labour department and social welfare department work on issues relating to autonomous adaptation and coping; health, revenue & disaster management departments work on response and forest & environment department works on adaptation issues. There are some strong institutions and experience in working across sectors. The Forests and Environment department have led this study. OSDMA is a world leader in Disaster Agencies, Health, Rural Water Supply and Sanitation (RWSS) provide support in checking water-borne diseases. Agriculture and Animal Husbandry departments provide support in terms of restoring the depleted input supply and disease & pest surveillance. Some of the civil society organisations of Orissa are leaders at international level. The OUAT and Regional Plant Research Centre are high calibre technical institutions which could consolidate their current activities and absorb new roles and responsibilities were resources to allow- there are others too.

It will also be critical to work through the implications of action at all scales of governance. Invariably, the responses for climatic events are coordinated by the district administration. Orissa has combined revenue and disaster mitigation into a single department and collectors act as the nodal officers in the districts. These aspects have not been examined in this report. But it is known that in water and agriculture departments, there are systems which enable communication on a regular basis from the state to panchayat level which could for example, be rapidly mobilised for increasing awareness on climate change.

⁶⁰ Drawing on the World Bank draft document "Orissa in Transition: From Fiscal Turnaround to Rapid and Inclusive Growth", May 2008

Making it happen

However what is lacking is that there is no comprehensive policy framework on climate change at the state level. It will be vital that climate change is embedded into the state's development planning so all the actions identified in this report need to be reviewed by GoO technical specialists and department experts. The state Government intends to factor climate change into its activities for next year and ultimately climate change needs to be embedded within the five year and annual planning process in all components. However, this will need institutional and technical capacity and additional revenues for investments. Priorities need to be chosen and efforts mobilised. Training of staff needs to start. It will be vital to establish what actions are underway but need to be scaled up, what undertaken differently, and what new actions should be started up. From initial discussions there seems to be a recognition that a coordinating institutional structure within the state Government is urgently needed to spearhead actions. This could be possibly a Task Force of key departments- supported by a dedicated small technical team located in Forests and Environment department in the first instance which could link with climate cells/ champions in the different departments/ agencies.

Annexes

1. Action Plan on Climate Change: GOO representatives Meeting 27th Nov 09

Bhaskar Sarma	Director	Agriculture
P.K. Hota	Additional Secretary	Agriculture
Satyabrata Sahu	Secretary	Commerce & Transport
P.M. Mishra	Executive Engineer	Energy Conservation, Dept of Energy
Bhagirathi Behera	Director	Environment
Bishnupada Sethi	Director	Fisheries & Animal Resources
Sibanarayan Sarkar	Senior Research Officer	Fisheries, Orissa
Gangadha Singh	Director	Fisheries, Orissa
U.N. Behera	Principal Secretary	Forest & Environment
B. P. Singh	Special Secretary	Forest & Environment
N.K. Mohapatra	Director	Hydrology and Water Planning, Dept of Water Resources
Saurabh Garg	Secretary	Industries
D.K. Senapati	Deputy Manager	IPICOL
R.R. Mallick	Director	Municipal Administrator
P. Krishna Mohan	Conservator of Forests (Wildlife)	Office of PCCF
Pravakar Behara	Conservator of Forests (Wildlife)	Office of PCCF
S Raghavan	Chief Executive	Orissa Renewable Energy Development Agency
Siddhanta Das	Secretary	Pollution Control Board
Ajay.N. Mahapatra	Chief Executive	Regional Plant Resource Centre
Ashok Dalwai	Secretary	Steel & Mines
B.N. Mishra	Assistant Director	Tourism
Suresh C. Mahapatra	Secretary	Water Resources
Niranjan Sahoo	M&E Specialist	WORLP (OWDM)

Meeting 4th Dec 09

S.N. Mishra	E.I.C. SDA	
P.N. Padhi	Principal CCF	
P.K. Sahu	JDSC	
S. Pasupaleh, Dr.	Agrometeorologist	
Chittaranjan Mishra	Additional Chief Executive	
S.P. Nanda	D.C – cum - Additional Chief Secretary	
R.N. Serapati	APC	
G. Bhaskar Reddy	Director - Watershed Mission	Agriculture
B. Giri, Dr.	Additional Director	Agriculture
Ashok Singh	CTran Consulting	Commerce & Transport

Guru Charan Ray	Special Secretary Transport	Commerce & Transport
B.B. Mohanty	Additional Secretary	Energy
P.M. Mishra	Executive	Energy Conservation
Bhagarathi Behera	Director	Environment
J. K. Mohapatra	Principal Secretary	Finance
S.N. Sarkar	Senior Research Officer	Fisheries
P. Sahoo	Joint Secretary	Fisheries & Animal Resources
U.N. Behera	Principal Secretary	Forests and Environment
Ajay Mahapatra	Chief Executive, RPRC	Forests and Environment
B.P. Singh	Special Secretary	Forests and Environment
Pravat Mohan Dash	Programme Officer, CES	Forests and Environment
Dushasan Mudali, Dr.	Special Secretary	H&FW
Arun K. Panda	Secretary	Housing & Urban Development
Saurabh Garg	Secretary	Industries
S.S. Srivastava	Conservator of Forests (Wildlife)	Office of PCCF
S. Raghavan	Chief Executive	OREDA
R.V. Singh, Dr.	Special Secretary	Planning & Coordination
B.N. Das	Special Secretary	Revenue & DM
B Mishra	Additional Secretary	Rural Development
Siddharta Das	Member Secretary	State Pollution Control Board
Ashok Dalwai	Secretary	Steel & Mines
Mona Sharma	Secretary	Tourism
S.C. Mahapatra	Secretary	Water Resources
S.N. Dey	Additional Secretary	Work
Supriya Pattanayak		DFID
Virinder Sharma, Dr.		DFID

1:1 Meetings November/ December 2009

Name	Job Title	Organisation
Arif Hussain	Programme Manager – Sustainable Development	DFID
Bidisha Pillai	Communications Adviser	DFID
Jaya Singh Verma, Dr	Programme Manager	DFID
Sandeep Rai	Policy Support Officer - CC & Energy	DFID
Soumen Bagchi, Dr	Economic Advisor	DFID
Supriya Pattanayak	State Representative	DFID
Vivek Misra	Governance Adviser	DFID

Upendra N. Behera	Principal-Secretary	Forest & Environment Department
Alison Dembo Rath	Team Leader	TMST 4 Orissa Health
Ashok Dalwai	Secretary to Government	Steel & Mines Department
Ashok Kumar Singha	Managing Director	CTRAN Consulting Pvt. Ltd.
Bhagirathi Behera	Director Environment	Forest & Environment

		Department
Bhaskar Sarma	Director of Agriculture & Food Production	Orissa
Deepak Mohanty	Programme Director	Orissa Tribal Empowerment & Livelihoods Programme
B.P. Singh		Forest Dept
Satyabrata Sahu		Commerce & Transport
Ashok Dalwai		Steel & Mines
Dr. Tripathi		Animal Husbandry
Mohanty Aranya Bhawan		PCCF
Er. N.K. Mohapatra	Director	Hydrology & Water Planning
Suparna Nanda		C.I.I.
Bhaskar Sarma	Director	Agriculture & Food Production
Peter Reid		WORLP: DFID project
Suresh Ch. Mohanty	Pr. Chief Conservator of Forests	Orissa
Suvra Majumdar	Senior Consultant	CTRAN Consulting Pvt. Ltd.

Annex 2

WORLP project on low carbon

There are certain activities in this project that has been helpful in abetting the green house gases (especially CO₂, N₂₀ and Methane).

Table 1 Project activities and GHG mitigation

Project activities	GHG gases mitigated	Key Impact
Plantations	CO ₂	Sequestration
Vermi-compost	CH ₄	Nutrient Management
Distribution of low energy consuming pumping devices like surface treadle pumps	CO ₂	Low energy intensity
Distribution of smokeless chullah, solar lanterns	CO ₂	Low energy intensity
SRI Method-less water and hence less pumping	CO ₂	Low energy intensity

The statistics for various energy saving devices has been depicted below.

Table 2 Low energy consuming devices in the project

ACTIVITIES	DETAILS	UNIT OF MEASUREMENT	Cumulative Up to April-March 07	Cumulative Up to April-March 08
Surface treadle pump	Installed	Total number	1260	1464
Rope and washer pumps	Installed	Total number	31	41
Pressure pumps	Installed	Total number	17	24
Drip irrigation systems	Installed	Total number	47	49
Others, if any (specify)	Specify	Specify	0	1

Source: MIS of WORLP

These devices ensure better coping by reducing drudgery and also have low emission because of the clean energy use and hence help in mitigation of CO₂.

The composting and vermi-compost help in mitigating the methane emission from the field which has more potent warming potential.

Table 3 Composting for methane emission reduction

ACTIVITIES	DETAILS	UNIT OF MEASUREMENT	Cumulative up to March 07	Cumulative up to March 08
Composting	Type of compost	Type	35	73
	Farmers involved	Total number	6537	8024
Others, if any (specify)	Vermi Compost pit		449	933