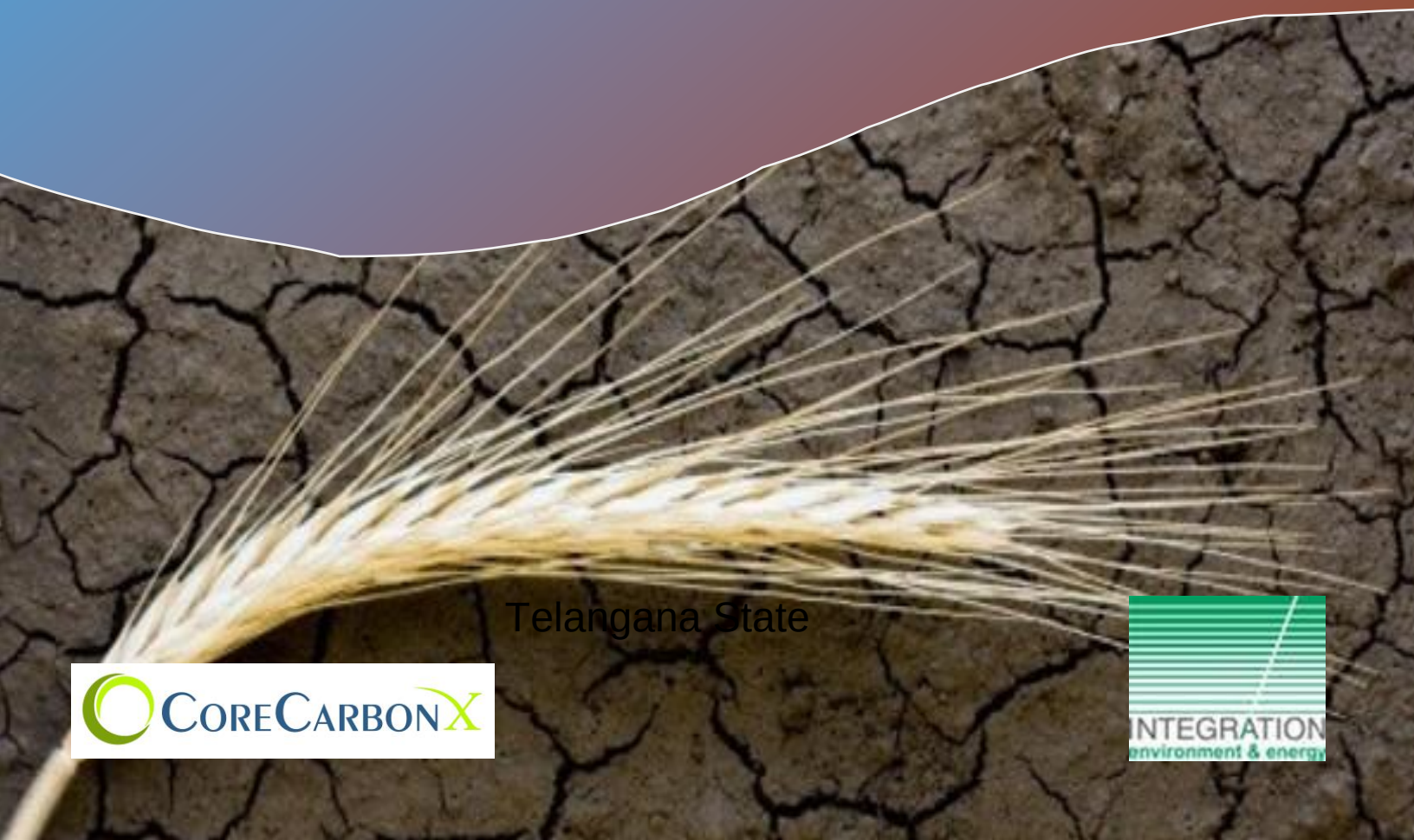
Preliminary Screening of Industrial Parks in Telangana

As a Part of the study on Baselining and Selection of IPs for CCA project in the state of AP and TS

On behalf of INTEGRATION Environment and Energy GmbH

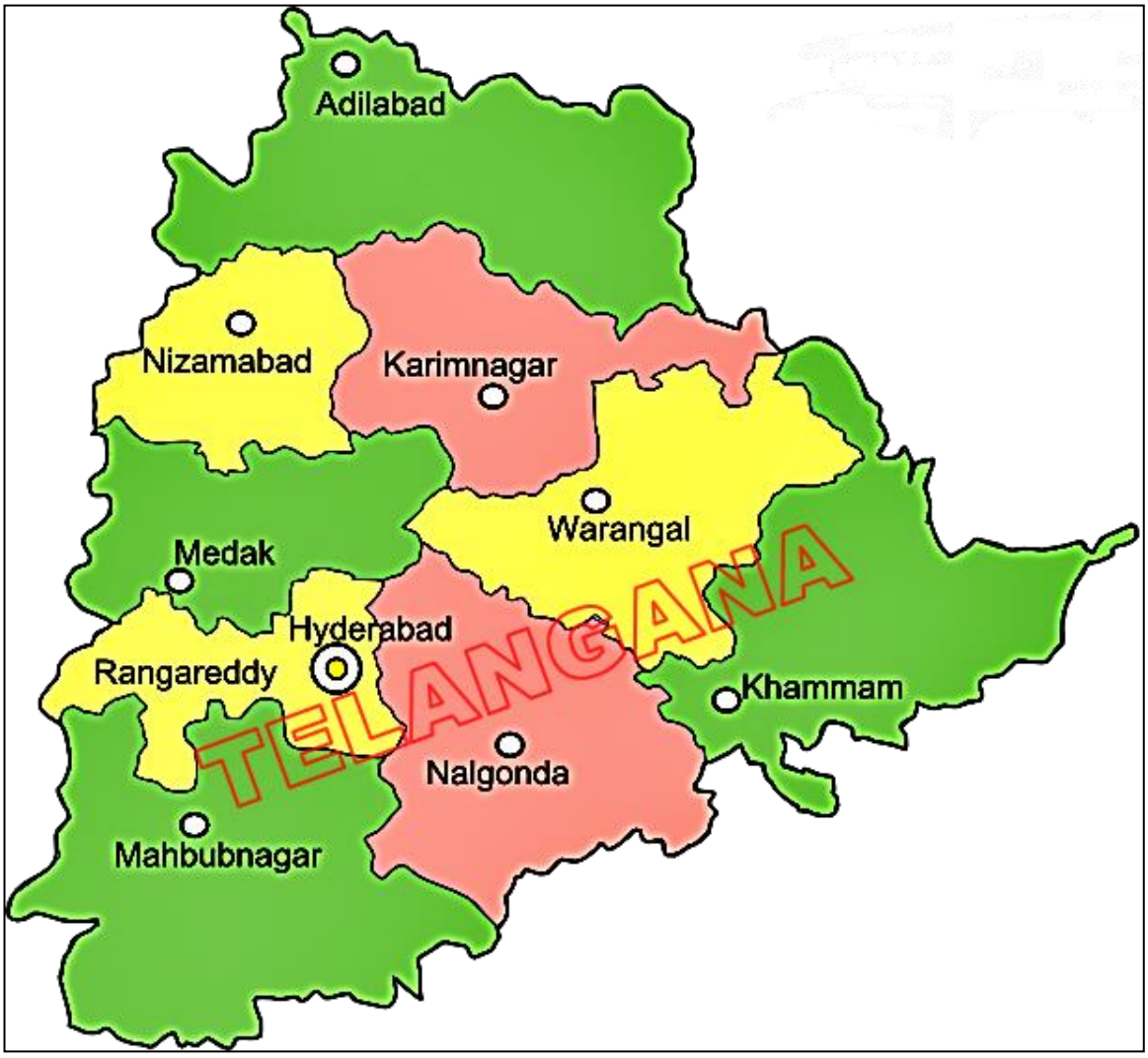
Date 28/10/2015



Telangana State

CoreCarbonX

INTEGRATION environment & energy


Adilabad
Nizamabad
Karimnagar
Warangal
Medak
Hyderabad
Rangareddy
TELANGANA
Khammam
Nalgonda
Mahbubnagar

Acknowledgement

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Niroj Mohanty

Managing Director

Core CarbonX Sols Pvt Ltd

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List of Abbreviations

APIIC	Andhra Pradesh Industrial Infrastructure Corporation Limited
CCA	Climate Change Adaptation
DRM	Disaster Risk Management
IALA	Industrial Area Local Authority
IMD	Indian Meteorological Department
IPs	Industrial Parks
IT	Information Technology
ITeS	Information technology enabled services
PCB	Pollution Control Board
SEZs	Special Economic Zones
SC	Scheduled Castes
ST	Scheduled Tribes
TSIIC	Telangana State Industrial Infrastructure Corporation Limited

Summary

Effects of climate change are already being felt on plants, animals and sectors worldwide. This is having a significant impact on hundreds of living species and infrastructure around the world. With the increasing frequency and severity of climate change events, there is an urgent need to build up preparedness for addressing climate change. In the state of Andhra Pradesh, the impact of climate change has been felt all over the state as it varies from region to region and sector to sector. Industries are no exception and they face equal threat due to climate change.

Telangana State Industrial Infrastructure Corporation Limited (TSIIC), an undertaking of Government of Telangana State, is a premier organization, vested with the objective and responsibility of building and holding land banks, developing Industrial Parks/Estates and Special Economic Zones by providing necessary Industrial infrastructure. Over 131 Industrial Parks have been established throughout the State in six (6) industrial zones. In addition, several new industrial parks are under planning and /or implementation stage.

In spite of a significant visible climate hazard impacts, there is a lack of representative data available on climate change impact and preparedness of industrial parks in its industrial zones. Hence, this study aims at:

- Providing baseline data on the climatic exposure and climate impact on industrial parks for enabling them for building up on CCA measures in future, and
- Assessing the climate adaptability status of Industrial Parks in the State of Andhra Pradesh.

The study is a statewide survey of IPs in the six industrial zones. To achieve the objective of the study, i.e. selection of 5 existing and 5 new IPs, a systematic screening was undertaken to arrive at most suited to be pilot IPs for Climate Change Adaptation Project.

Based on pre-screening out of 131 existing IPs, 53 (considering all phases of an IP to be one single IP) were selected for the survey, which involved designing of a questionnaire for the study. The preliminary screening questionnaire focused on exposure, impacts and adaptive capacity of these IPs to understand their vulnerability to climate change. In

addition, a secondary data collection was also undertaken on climatic hazards and climatic pattern changes.

A two-step process was developed to screen and rank the surveyed IPs. The objective of Step1 of the screening methodology was to exclude IPs of minor relevance and suitability for the study. Step 2 of the study focused on ranking of remaining IPs based on section wise scoring i.e. 1.Climatic exposure 2.Climatic impact and 3.Adaptive capacity/capability.

All the IPs surveyed were subjected to Step 1 of the analysis, after which 27 IPs were selected for Step 2. All the IPs which had passed step 1 i.e. Criterion 1, 2 and 3 were given a section-wise scoring for the three section, i.e. climatic exposure, climatic impact and adaptive capacity & capability. The final score for each IP was derived by adding the points against each question/Criterion. Scoring for all these sections were normalised by dividing with the maximum score of the section for indices. The scores for the three section indices are then aggregated into a composite index using geometric mean for ranking. IPs with highest score index was marked as 1 and so on.

The IPs with highest (top 5) overall rank are IP Pashamaylaram, IP Jeedimetla, IP Manikonda & Hi-tech City Madhapur &Software Units Layout (IP Manikonda, Hi tech city Madhapur and software unit layout Madhapur are adjacent to each other), Financial district Nanakramguda & IT Park Nanakramguda. (Financial district Nanakramguda and IT Park Nanakramguda are adjacent IT parks) and Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar, These IPs are located in areas where the surrounding population density is either medium or high. Based on the analysis, these IPs found suitable for the CCA project.

All the new / upcoming IPs, which are in different developmental stages, when subjected to Step 1 of screening methodology were found to be exposed to climatic changes similar to that of existing IPs.

1 Background

1.1 Introduction

The State of Telangana is home to large manufacturing industries in bulk drugs, pharmaceuticals, agro-processing, cement & mineral-based industries, high precision engineering, textiles, leather, iron & steel, gems & jewelry, biotechnology, defense, etc. The State is one among the major industrial states in the Country ranked 6th in terms of industries and ranked 8th in terms of Gross Value Added industries in the country.[1] The Government is promoting industrial incentive policy to create quality infrastructure coupled with congenial industrial environment to make Telangana an attractive investment destination for both foreign and domestic investors, with special emphasis on creating an enabling eco-system for women entrepreneurs and for those from the Scheduled Castes (SC) and Scheduled Tribes (ST). The growth of industrial sector in Telangana has been impressive and one of the successful instruments for this growth is industrial parks.

1.2 Industrial Parks in Telangana

Telangana State Industrial Infrastructure Corporation Limited (TSIIC), an undertaking of Government of Telangana State, is a premier organization in the state, vested with the objective of providing Industrial infrastructure through development of Industrial Parks and Special Economic Zones. Over 131 Industrial Parks have been established throughout the State of Telangana. The Industrial Parks and Special Economic Zones are playing a pivotal role, in attracting international and national investors to the State by providing multiple incentives like investor-friendly policies, state-of-the-art infrastructure, educated manpower, and attractive incentive schemes etc., to make Telangana State a choicest destination for industrial investment, particularly in the manufacturing sector.

Table 3: Zone-wise distribution of industrial sectors

Industrial Zones	Existing industrial sectors	Proposed Industrial sectors[1]
Jeedimetla	Automotive based Industries, General Engineering, Steel Re rolling, R & D of Biotech, Pharmaceuticals, Vaccines, Chemicals, Paints, Pesticides, Bulk Drugs	Pharma, Food processing, Chemicals, Engineering
Karimnagar	General engineering, Rice mills, Oil mills, and other agro based industries,	Fertilizer, Power, Cement, Textiles, Paper, Minerals

[1] Conceptual plan for district development, Pg 117, Socio Economic Outlook 2015

	Pipes, Paints, Granite etc.,	and Food processing
Patancheru	Pharmaceutical, Chemical, Textile, Logistics and warehousing, Edible Oils, General Engineering, Steel rolling, Paints, Rubber and Tyre	Chemicals, Engineering, Automobiles and Pharmaceuticals
Shamshabad	Pharmaceutical, Auto ancillary, chemicals, Warehousing, Food processing and Beverage industry, Aerospace, Solar Equipment, Electronic Hardware, Bulk Drugs	IT, Pharma, Food processing, Defense and Aerospace, Textiles, Consumer products
Warangal	General Engineering, Agro based industries, Plastic, granite based, Warehousing	Mineral, Food processing, Textile and Leather, Cement, Pharma, Granite, Power, Metallurgy and Paper
Cyberabad	IT & ITeS (Information Technology & Information technology enabled services)	IT and ITeS

1.3 Industrial Parks and Climate Change preparedness

Effects of climate change are already being felt on plants, animals and sectors worldwide. This is having a significant impact on living species and infrastructure around the world. With the increasing frequency and severity of climate change events, there is an urgent need to build up preparedness for addressing climate change. In the state of Telangana, the impact of climate change has been felt all over the state and it varies from region to region and sector to sector, based on their capacity of the sector and population based on their adaptability and capability. Similarly, Industrial parks in the different industrial zones have different kind of climate variability and are facing a wide range of challenges because of climate change. Although climate exposure and variability is known for the state and region, it has not been systematically linked to the industrial parks located in different industrial zones. It is very eminent that the strategy and approach for addressing climate change measures in these industrial parks will differ based on its exposure to climate hazard, vulnerability and adaptive capacity. With such a situation, an understanding of the climate change exposure and adaptive capacity of Industrial parks is essential to explore the potential solutions for overcoming the overall deficiencies to the crisis. Unfortunately, in spite of a significant amount of climate hazard impacts visible, there is a lack of representative data available on climate change impact on industrial zones and preparedness of industrial parks. Developing a consolidated information base is considered essential to enabling a detailed understanding of the climate hazard on industrial parks and the development of an appropriate response to tackle this issue.

In this regard, Core CarbonX Sols Pvt Ltd had conducted a preliminary survey of the industrial parks in the state of Telangana under, “Climate Change Adaptation (CCA) in Industrial Areas” project in the state of Telangana on behalf INTEGRATION Environment and Energy GmbH, Adelphi consult and Ifanos concept & planning of Germany as a part of Indo-German Development Cooperation.

The preliminary selection of the industrial parks included in the study was based on the size and number of allottees. The study focused on climatic Exposure, Climatic Impact and adaptive capacity for the reasons outlined briefly under section 2.

This report discusses the preliminary findings on climate exposure and climate impact data on the adaptive capacity status of the industrial parks; and provides list of most probable IPs for further short listing of 5 existing and 5 upcoming industrial parks for the detailed baseline assessment for the development of an appropriate and evidence-based climate change adaptation strategy for identifying 2 IPs and presents the findings of the survey conducted for Industrial Parks in the state of Telangana in the month of September 2015.

2 Approach to the study

2.1 Purpose of the study and objective of the report

Integration has commissioned Core CarbonX Solutions Pvt Ltd to carry out an assessment for the selection of industrial parks (2 from Andhra Pradesh & Telangana State each) and establish the base line study for implementing climate change adaptation project in those industrial parks as a part of the CCA project.

The study involves below mentioned task:

Main task 1: Developing methodology for Rapid Climate Risk Analysis for direct and indirectly induced climate hazards and vulnerabilities with respect to geographical location, industries types and set up, land use, logistics, environment and socio economic conditions for EXISTING and UPCOMING IPs of Telangana state (TS).
Main task 2: Preliminary screening of climate risks in existing and upcoming industrial parks / SEZs in the States of TS.
Main task 3: Selection of one existing and one upcoming industrial area in each of the states of TS.
Main Task 4: Conduction of the Rapid Climate Risk Analysis and baseline for the 2 study cases.
Main Task 5: Consultants should also assist the partners for various financing instruments available for implementing the project.

The current study has highlighted the findings as a part of main task 2 preliminary screening of climate risks in existing and upcoming industrial parks/SEZs in the state of Telangana. The purposes of this study are two-fold:

a) Providing baseline data on the climatic exposure and climate impact of industrial parks for enabling them for building up on CCA measures in future, and

b) Assessing the climate adaptability status of Industrial Parks in the
c) State of Telangana

The objectives of this report are:

a) To determine climate exposure in the IPs areas using climate hazard and climate change indicators

b) To assess the Climate impact on the IPs

c) To assess the adaptive capacity of the IPs

d) To identify 5 existing and 5 upcoming industrial parks from the state of Telangana for the next step

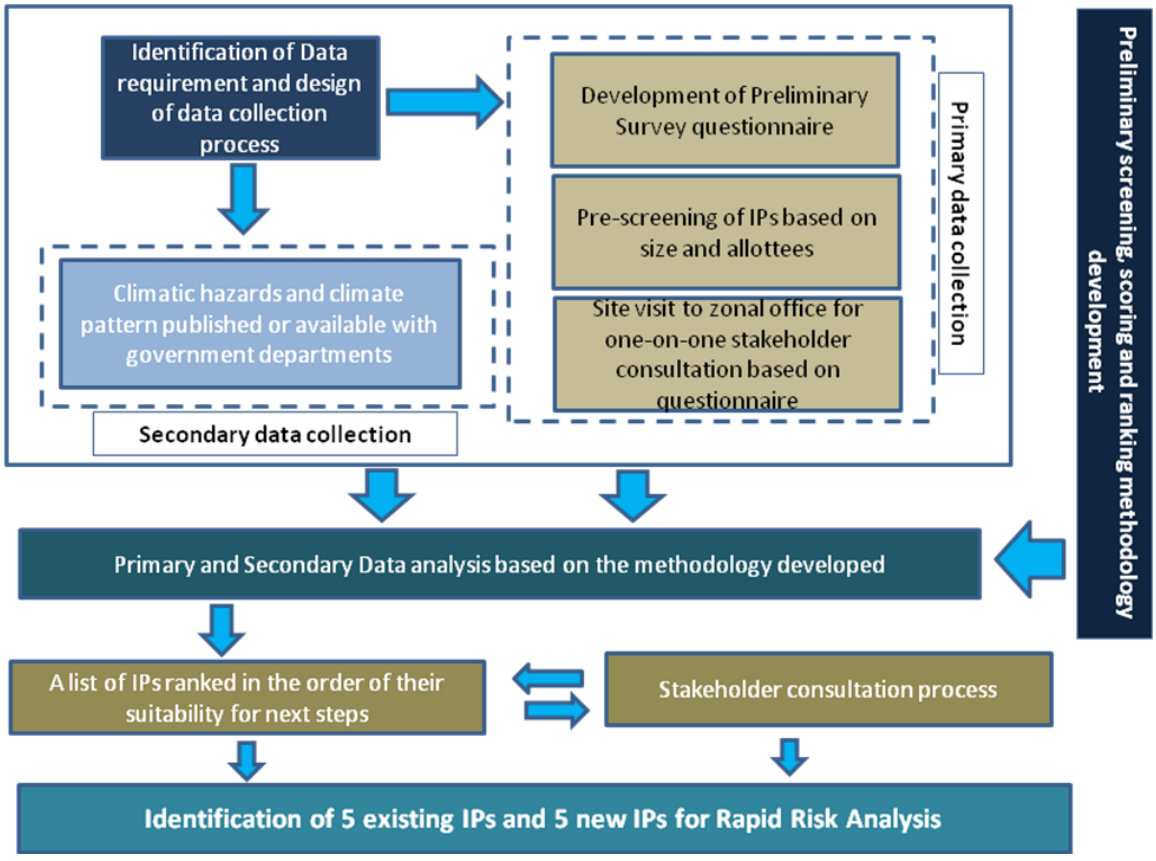
2.2 Study Design

The study was a statewide survey of IPs in the six industrial zones of TSIIC. A list of all IPs with their area and number of allottees within each IP was compiled. To achieve the objectives of the study for selection of 5 existing and 5 new IPs, a systematic screening of IPs was undertaken to arrive at IPs which are most suited to be pilot IPs for climate change adaptation project.

Data was obtained mainly from list drawn up by TSIIC and project partner. The screening considered significance of IPs size and number of allottees. The screening considered significance of size and number of allottees in the IPs, and the lowest quartiles in terms of size (i.e. less than 25 acres) and number of allottees were excluded. Based on screening out of 131 existing IPs, 53 IPs (considering all phases of an IP to be one single IP) were selected for the survey.

An overview of the approach to this study is provided in the figure below.

Figure 1: Approach to Preliminary Screening of IPs in the State of Telangana



2.2.1 Data Collection

To find out exposure to climate change, data was collected from two sources:

a. the primary data which captured through the preliminary survey

b. the secondary source information collected from related government departments

2.2.1.1 Primary Data

Designing of Survey Questionnaire

The survey questionnaire was designed for preliminary screening of existing IPs as well as new IPs. The questionnaire was designed to provide relevant indicators on exposure, impacts and adaptive capacity of IPs to understand their vulnerability as outlined in the survey objectives. The survey questionnaire is provided in Annexure I. The survey questionnaire has four sections i.e., general, exposure to climatic changes, climatic impact and adaptive capacity of these IPs to understand their vulnerability.

Table 4: Overview of sections of the preliminary screening questionnaire

Main Section	Information collected	Purpose
General	Geographic location, surrounding population condition, type of industries, age of IP, size of IP, occupancy	To gather an overall view of the IP
Climatic Exposure	Exposure to climatic hazards and changing weather patterns like rainfall pattern and temperature pattern changes	To understand if an IP or mandal or district where it is located are subject to any climatic hazard or changing weather pattern. Exposure to any of these climatic hazards indicates that the IP is exposed to climatic risks
Climatic Impact	Impact of climatic changes on operations, humans, supply chain, waste management and similar other things	To understand the impacts already experienced by an IP, it's severity and their severity
Adaptation	Financial capacity, climate	This information helps in

	knowledge, and other management systems to help reduce the impact of climatic change	gathering a basic understanding on the capability of IPs to undertake climate change adaptation work. It also works as a knowledge base on capacity needs assessment

The survey questionnaire was developed by team of experts from Core CarbonX Sols Pvt Ltd, INTEGRATION Environment and Energy GmbH, Adelphi consult and Ifanos concept & planning of Germany in coordination with APIIC & TSIIC Environmental Engineers.

Table 3: Team involved in development and validation of questionnaire

Name of the Experts	Organization
APIIC	GM(EMP) & Environment Engineer
TSIIC	Environment Engineer
Dieter Brulez, S. Vara Prasad, Hrishikesh Mahadev, Rajani Ganta	INTEGRATION Environment and Energy GmbH
Peter Bank	Ifanos concept & planning of Germany
Sibylle Kabich	Adelphi consult
Niroj Mohanty, Shaily Maloo, Shailendra Kewat	Core CarbonX Sols Pvt Ltd

Pilot Test of survey questionnaire

The questionnaire developed was further tested through pilot testing in few of the IPs. During the pilot testing of the questionnaire for a few IPs, the quality of the sample collection, questionnaire and other aspects of the survey were examined. Each team was allowed to make a presentation on the challenges and obstacles faced during the pilot testing and any short comings were discussed. Based on the findings, the questionnaire sections were revised and further validated by the above team of experts.

Survey design

The baseline survey was conducted by CoreCarbonX team for all the selected IPs through expert one to one consultation/ interview with the Zonal managers, Deputy Zonal Managers, Industrial Area Local Authority (IALA) Commissioners, Environmental officers and other relevant officials of TSIIC from every zone.

2.2.1.2 Secondary Data

In India, state revenue department and Indian meteorological department (IMD) have information on various climate hazard and climate change data. These secondary data on past heat wave, flood, drought, temperature and rainfall at district level were collected from the state revenue department. The secondary data was used to validate the findings on climatic exposure (the occurrence of a climatic hazard and weather pattern changes in mandal or district where the IP is located) collated through the survey data originally collected by CoreCarbonX (i.e. primary data). Secondary data collection was therefore part of the input phase of the assessment process. Primary and secondary data collection jointly yields all the data CoreCarbonX needs to produce the output required.

3 Preliminary Screening, Scoring and Ranking Methodology

3.1 Existing Industrial Parks

The following two step screening methodology was followed for the existing industrial parks.

- Step - 1: Screening the existing parks to exclude IPs of minor relevance and suitability, and
- Step - 2: Ranking of remaining IPs based on section wise scoring

Detailed approach followed is presented below.

Step 1: Screening of Existing Industrial Parks to exclude IPs of minor relevance and suitability

IPs which were exposed to climatic change, have certain minimum capacity and capability to adapt to climate change, are considered as relevant and suitable. Those IPs which pass step 1 were subjected to step 2 of scoring and ranking.

Criterion 1: Exposure

Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location. Climate descriptions for different time intervals, such as decades, years, seasons, months, or specific dates of the year can refer to areas that are local, regional, or global in extent.

The climatic hazards considered in this study for TS are floods caused due to inundation of nearby water body, floods caused due to sudden heavy rainfall, drought, and heat.

It has been observed that TS is not affected by the climatic hazards like cyclone, wind storm and storm surge but they had experienced climatic change in the form of shift in weather patterns, change in rainfall pattern, temperature pattern etc. Thus, data on change in climatic pattern has been collated and considered to understand the exposure of an IP to climatic change.

A combination of exposure to climatic hazard and climatic pattern changes helped in identifying if an IP was exposed to climate change. If an IP was not exposed to climate change then it is not in need of a CCA plan immediately, hence, the same IP was excluded from the study.

If an IP experienced even one climatic hazard or change in temperature and rainfall pattern, answer to questions 1 and 2 was mentioned in Criterion 1 as Yes'; otherwise it was mentioned as "No". Each "Yes "is equal to 1 and "No" is equal to 0.

The scoring was then summed up for cumulative scoring. If the cumulative score for IP was more than zero, then IP was chosen and subjected to Criterion 2 otherwise it was dropped. Cumulative score of zero indicated that the IP was not exposed to any type of climatic risk at this point.
The same is presented in table below:

Table 4: Criterion 1 – Exposure of existing Industrial Parks to climatic changes

Criterion 1: Exposure		
1.	Exposure experienced based on Secondary Data (District / Mandal Wise); IPs / SEZs in the Districts / Mandals (Based on Actual Data)	
	a. Declared with any disaster in past 15-20 years, preferably with the duration of occurrence	Yes / No (1/0)
	b. Extreme change in Temperature / Rainfall from IMD data in past 15-20 years and occurrence with regular frequency (1-5 years)	Yes / No (1/0)
2.	Past exposure to climatic hazard and climatic change based on responses received in the questionnaire	
	a) Climatic hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	Yes / No (1/0)
	b) Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	Yes / No (1/0)
IP shall be excluded, if all 4 questions are answered with "NO" (0)		

The IPs which passed the Criterion set out in Criterion 1 was subjected to Criterion 2. The 53 IPs which passed through Criterion 1 was also validated with data on drought and heat wave and all the 53 IPs passed through it. All these IPs were further processed to next stage. Details are provided in Chapter 4 and Appendix I of the report.

Criterion 2: Capacity and capability to implement climate change adaptation measures

The IPs chosen after criterion1 of the selection process were assessed for their preparedness towards climate change. To execute CCA exercise both financial and human resource are desirable. IPs with basic financial capability, human resource capacities and existing systems to address disasters should be ideal candidates for choosing them for the pilot studies which were assessed through preliminary survey.

The financial status of an IP was assessed based on excess revenue, qualitative basis i.e. financial capability to contribute towards CCA. It was ranked on a five point scale as poor, bad, not bad/not good, good and very good. The IPs that scored poor or bad under these questions were eliminated because it was considered that these IPs are not in a position to contribute for implementation of measures like planning, monitoring, capacity building etc.

Procedures and systems to deal with disasters whether natural or man-made indicate that the IP has process to respond to emergency situations. There is a case for Disaster Risk Management (DRM) procedure as a part of the CCA measures. Thus, even if financial capacity and resource capabilities to undertake CCA is absent; and a DRM system is in place, the same IP was chosen for CCA measures.

The criterion 2 is presented in the below table 5.

Table 5: Criterion 2 – Assessment of capacities and capabilities to implement CCA measures

Criterion 2: Capacities and capability to implement Climate Risk Analysis; planning, implementation, and monitoring of CCA measures; and participate in related Capacity needs assessment activities		
1.	Does the IP have at least some financial capacity at its disposal to contribute to the implementation of measures and related supporting activities (planning, monitoring, capacity development)? (If the answer to this question is poor or bad (as per the questionnaire responses) it indicates that IP does not have enough financial capability to undertake this study. Thus, a poor or bad rating will be taken as 'No' and any other would be taken as 'Yes')	Yes / No (1/0)
2.	Is IP capable to undertake activities to reduce sensitivity to climate change through adaptation on its own?	Yes / No (1/0)
3.	Are there existing DRM or other management plans in place for the IP?	Yes / No (1/0)
IP shall be excluded, if one of the questions 1-2 are answered with "NO" (0); One "NO" in questions 1-2 can be overruled by a "YES" in question 3.		

For each question that was answered, 1 point for 'Yes" and 0 for every 'No' was assigned. For an IP to be selected, answer to both question 1 and 2 was required to be a "Yes". If the answer to question no. 3 was "Yes", then that IP was chosen irrespective of the answer to question 1 & 2. The IPs which passed Criterion 2 were subjected to Criterion 3.

The criterion 2 resulted in 35 IPs which were further subjected to Criterion 3. Details are provided in Chapter 4 and Appendix II of the report.

Criterion 3: Representativeness of IP

The targeted IPs for CCA measures under pilot study should be representative of the IPs in the state. Occupancy level and age of IPs are identified as other important parameters to arrive at a representative set of IPs.

Occupancy level of an IPs means the percentage of the total IPs areas that is occupied by industries. In case an IP has low occupancy level it is likely that the industries would be sparsely located and the infrastructure utilization has not reached its peak. Thus, the impact of climatic changes and the kind of intervention measures needed for IPs with lower occupancy level is not same and as severe as that for IPs operating at higher capacities. Hence, IPs with less than 50% occupancy were excluded to maintain representativeness. If the answer to question 1 under Criterion 3 was "Yes" then the IP was given a score of 1 point.

It was assumed that recently set up IPs are expected to have more environmental protection components with certain climatic safeguards, well designed treatment and drainage systems for both effluents and storm water and good infrastructure etc. It was also assumed that the industries set up in such IPs use latest, more efficient and environment friendly technologies, better layouts etc. Hence, these IPs have more resilience capacity to cope up with climatic changes. Thus, IPs established in the last decade were excluded from the study. If the answer to question number 1 under Criterion 3 was "Yes" then the IP was given 1 point.

Under Criterion 3, if answer to any one of the questions was "No", the IP was excluded from the study.
Criterion 3 is presented in the table below. IPs which would remain after Criterion 3 were scored and ranked in step 2.

Table 6: Criterion 3 – Identification of representative IP

Criterion 3: Representativeness		
1.	Is the occupancy level of the IP is more than 50%?	Yes / No (1/0)
2.	IP older than 10 years	Yes / No (1/0)
IP shall be excluded, if one of the questions is answered with "NO" (0)		

The Criterion 3 resulted in 30 IPs pass which was subjected to step 2 i.e. scoring and ranking. Details are provided in Chapter 4 and Appendix III of the report.

Step 2: Scoring and ranking of the remaining IPs

All the IPs which have passed step 1 i.e. criteria 1, 2 and 3 were given a section-wise scoring and ranked based on the score achieved. Ranking was done as per sections 2 (Climatic Exposure), 3 (Climatic impact) and 4 (Adaptive capacity and capability) of the questionnaire.
Each question in the section was scored as per the scoring methodology presented in the table below.

Table 7: Each question wise scoring methodology

Assessment Parameter		Score for each question
Section 2: Climatic Exposure		
2.1	Climate hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	1 point for each climate hazard experienced
2.2	Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	1 point for each climate change experienced
Section 3: Climatic Impact (Assessment based on Matrix)		
	Is any climatic matrix answered?	Yes/No (1/0)
	Severity of an event experienced on humans, operations, infrastructure and building, supply chain, supply and waste management services. (For example: If climatic impact is experienced on account of heat wave and the impact rating is moderate on operations and slight on humans then the rating will be 2 and 1 respectively. So the overall score for impact of heat wave would be 2+1 = 3.)	Very Severe = 4, Severe =3, Moderate =2, Slight = 1, No occurrence and no knowledge = 0
Section 4: Adaptive Capacity and Capability		
4.1.1	How is the financial condition of IPs? (This means the IP's management/ IALAs are able to generate enough revenue for maintenance of IPs or it has surplus money to maintain it)	Very good = 5, Good =4, Not good/Not bad = 3
4.2 Capability to adapt		
4.2.1	Are the IP's management and industries aware of climate change? (Yes/No)	Yes/No (1/0)
4.2.2	Whether IP's would be willing (i.e. capable) to undertake activities to reduce sensitivity to climate change through adaptation? (Yes/No)	Yes/No (1/0)
4.4	Does the IP have a disaster management plan?	Yes/No (1/0)
4.5	Does the IP have a management plan for implementation?	Yes/No (1/0)

All the IPs which had passed step 1 i.e. Criterion 1, 2 and 3 were given a section-wise scoring. The final score for each IP was derived by adding the points against each question/Criterion. Scoring for all these sections were normalised by dividing with the maximum score of the section for indices. The scores for the three section indices are

then aggregated into a composite index using geometric mean for ranking. IPs with highest index was marked as 1 and so on.
The analysis resulted in ranking of IPs where the top 5 IPs are IP Pashamaylaram, IP Jeedimetla, IP Manikonda & Hitech City Madhapur &Software Units Layout (IP Manikonda, Hi tech city Madhapur and software unit layout Madhapur are adjacent to each other), Financial district Nanakramguda & IT Park Nanakramguda. (Financial district Nanakramguda and IT park Nanakramguda are adjacent IT parks) and Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar. The ranking is presented in the chapter 4 of this report.

3.2 Upcoming Industrial Parks

New/ upcoming IPs comprises IPs, which are in different developmental stages, i.e., under preplanning, site identification, land acquisition, site master planning (i.e. layout development), land allotment, and implementation stage.

The climatic exposure of new IPs is similar to the exposure of existing IPs. Hence, Criterion 1 (i.e. exposure) of step1 of the screening methodology for existing parks were used to upcoming industrial parks as well.

Table 8: Criterion 1 – Exposure of upcoming Industrial Parks to climatic changes

Criterion 1: Exposure		
1.	Exposure experienced based on Secondary Data (District / Mandal Wise); IPs / SEZs in the Districts / Mandals (Based on Actual Data)	
	a. Declared with any disaster in past 15-20 years, preferably with the duration of occurrence	Yes / no (1/0)
	b. Extreme change in Temperature / Rainfall from IMD data in past 15-20 years and occurrence with regular frequency (1-5 years)	Yes / no (1/0)
2.	Past exposure to climatic hazard and climatic change based on responses received in the questionnaire	
	a) Climatic exposure/ hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	Yes / no (1/0)
	b) Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	Yes / no (1/0)
IP shall be excluded, if all 4 questions are answered with "NO" (0)		

The IPs which passed the Criterion 1 are the ones which are exposed to climatic changes. Hence, these IPs were considered for CCA. 9 IPs passed the criterion 1; details of the same are presented in Chapter 4 of the report.

4 Results of preliminary screening of IPs in Telangana

4.1 Introduction

Telangana has 131 existing and 9 upcoming IPs spread across 6 zones, namely, Shamshabad, Patancheru, Jeedimetla, Warangal, Karimnagar and Cyberabad.

Primary data collection was undertaken between 02nd of September 2015 and 15th of September 2015. CoreCarbonX team visited each of the zonal offices and interviewed the zonal manager to collect the preliminary screening data. At most of the zones, Zonal Managers, Deputy Zonal Managers, Project Engineers, Environmental Engineers and some of the IALA commissioners were interviewed based on the suggestions of zonal manager and availability of people. Visit schedule and people interviewed at each zone is provided in table below.

Table 9: Persons interviewed at each zone during the survey

Industrial Zone	Date/s of visit	Name of Person Interviewed	TSIIC Officers
Shamshabad	03/09/2015 - 04/09/2015	K.Shyam Sunder	Zonal Manager,
		Kalavati	Commissioner, Moula Ali
		A.Pawan	Commissioner and Manager
		Sam Ratnakar Philips	Environmental Engineer Ltd
Patancheru	07/09/2015	P.K. Revathi Bhai	Zonal Manager
		Santhosh Kumar Reddy	Deputy Zonal Manager
		R. Maheshwar	Commissioner
		K.Suman	Project Engineer
	11/09/2015	J.Vijay Kumar Reddy	Environmental Engineer
Jeedimetla	10/09/2015 -11/09/2015	B Madhavi	Zonal Manager
		Mr. Satyanarayana	Commissioner, Jeedimetla
		J.Vijay Kumar Reddy	Environmental Engineer
Cyberabad	11/9/2015	C.Vinod Kumar	Zonal Manager
		Maloth Nanu	Environmental Engineer

Warangal	14/09/2015	D.Ravi	Zonal Manager
		S.Suresh Kumar	Commissioner
Karimnagar	15/09/2015	D Laxman Rao	Zonal Manager
		A.Swamy	Deputy Zonal Manager

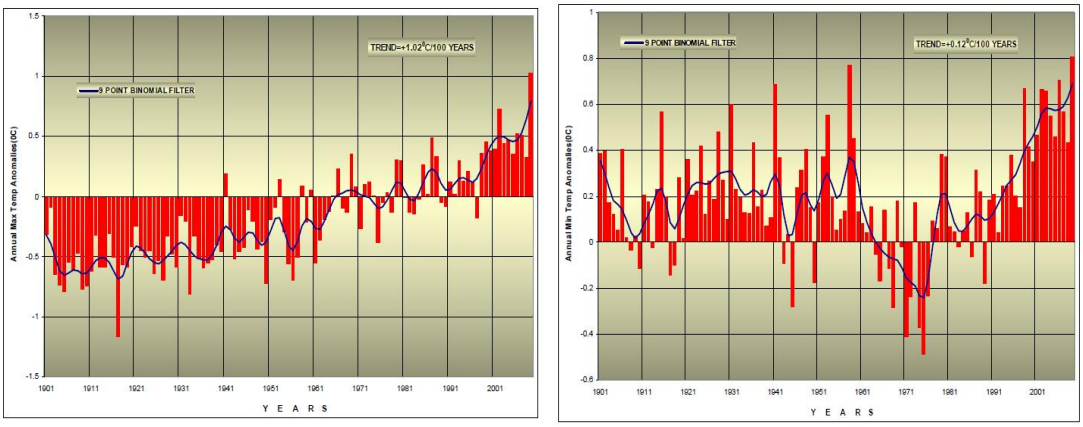
4.2 Secondary Data

Secondary data comprising of three main climatic hazards, i.e. drought and heat wave experienced by Telangana in addition to Information on rainfall and temperature was collected from its Revenue Department.

Temperature:

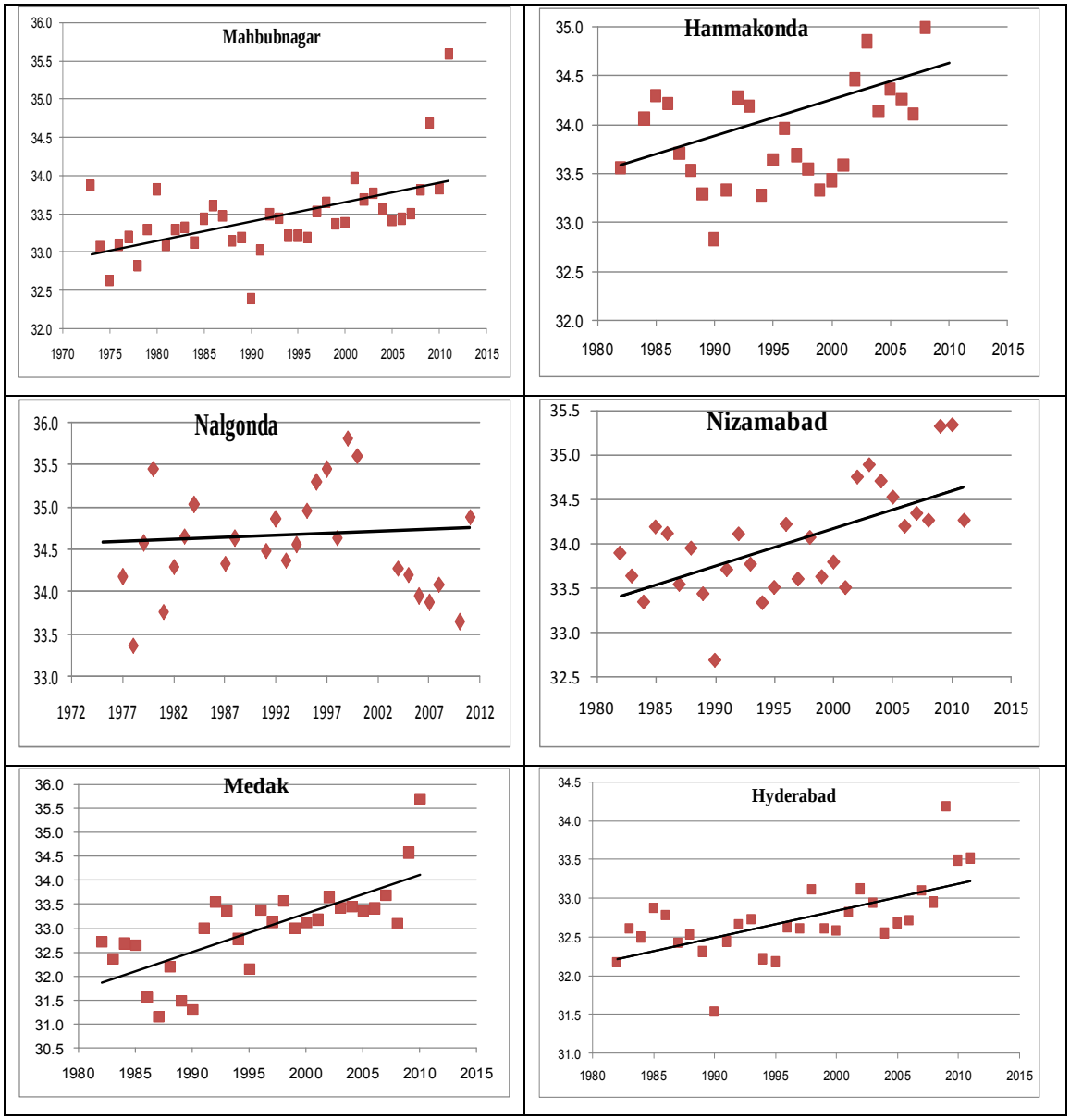
Temperature data for the period 1901-2009 suggests that annual mean temperature for the country as a whole has risen by 0.560C (Fig 2 (a)) over the period. It may be mentioned that annual mean temperature has been generally above normal (normal based on period, 1961-1990) since 1990. This warming is primarily due to rise in maximum temperature across the country, over larger parts of the data set. However, since 1990, minimum temperature is steadily rising (Fig 2 (b)) and rate of its rise is slightly more than that of maximum temperature (IMD Annual Climate Summary, 2009). Warming trend over globe of the order of 0.740C has been reported by IPCC (2007).

Figure – 2: **All India annual maximum & minimum temperature anomalies for the period 1901-2009 (based on 1961-1990 average) shown as vertical bars**



The secondary data analysis for the state of Telangana has also shown similar increase in temperature trends during the period of 1982-2011 (Fig 3).

Figure – 3: Zone wise temperature trend in last 30 years



Rainfall Scenario[2]:

Agriculture in Telangana is mostly dependent on rainfall. Agricultural production depends upon the seasonal distribution of rainfall. In the State, South-West and North-East Monsoons are the two important periodic winds, which are the important sources of the

[2] http://agri.ap.nic.in/rainfallsenario.htm

rain. South-West Monsoon (66%) is spread over the period from June to September and North-East Monsoon (24%) (from October to December).

The normal annual rainfall of the State is 940 mm. Major portion (66%) of rainfall is contributed by South-West Monsoon (June-Sept) followed by 24% North-East Monsoon (Oct-Dec). The rest 10% of the rainfall is received during the winter and summer months. The Normal rainfall distribution in the three regions of the State differs with the season and Monsoon. The influence of South-West Monsoon is predominant in Telangana region (716 mm) followed by Coastal Andhra (620 mm) and Rayalaseema (407 mm), whereas the North-East Monsoon provides high amount of rainfall in Coastal Andhra area (324 mm) and Rayalaseema (238 mm). There are no significant differences in Normal distribution of rainfall during winter and hot weather periods among three regions.

Heat Wave

There is a significant increase in the frequency, persistency and spatial coverage of high frequency temperature extreme events (heat wave) during the decade (1991-2000)[3].

In Telangana state, the period from April to June is summer months. During this period the temperatures rise considerably, sometimes touching 47^0C in May month in the Districts like Khammam, Nizamabad, Nalgonda, Karimnagar and Warangal.

The term heat wave is a description of prevailing temperature conditions relative to daily normal value. Spells of abnormally high temperatures that occur in different parts of the country during April to June are referred as heat waves, which are considered only after the maximum temperature of a station reaches 40^0C for plains and at least 30^0C for hilly regions. The IMD (India Meteorological Department) has laid down the following criteria for describing a heat wave and severe heat:

- When normal temperature of a station is less than or equal to 40^0C. Heat wave is departure by 5^0C-6^0C from normal temperature. Severe heat wave is declared when departure from normal temperature is 7^0C or more.
- When normal maximum temperature of a station is more than 40^0C a departure from normal temperature by 4^0C – 5^0C is termed as heat wave. Severe Heat Wave is departure from normal temperature by 6^0C or more

[3] Page 27, Section 3.5, Climate Profile of India, Met Monograph No. Environment Meteorology-01/2010, http://www.imd.gov.in/doc/climate_profile.pdf

- When actual maximum temperature is 45^0C or more, irrespective of normal maximum temperature, heat wave is declared.

In Telangana, during 1986-1993, the heat waves were mainly of moderate nature with maximum duration of seven days. The highest maximum temperature of 47^0C was recorded at Nalgonda, and Ramagundam on 11 May 1988.

From 1994 onwards, the frequency and the duration of heat wave spells have increased significantly. In 1997 (18 May to 5th June) and 1998 (23 May 10 June) the duration of moderate to severe heat wave spells have extended up to 19 days. Since Heat Wave conditions prevail in several parts of the state during the summer, deaths due to sunstroke occur every year.

Records of last ten year show that the deaths due to heat wave have increased and every district is impacted at least once during the year leading to some deaths. The heat wave in the year 2015 had maximum impact on human population (Table10).

Table 10: Year-wise death cases due to Heat Waves during 2005-2015

District	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015*
Nalgonda	11	1	0	0	0	0	1	0	209	22	139
Karimnagar	NA	NA	NA	NA	NA	NA	NA	22	91	0	120
Khammam	NA	NA	NA	NA	NA	NA	NA	42	35	0	95
Mabubnagar	NA	NA	NA	NA	NA	NA	NA	2	27	0	42
RangaReddy	NA	NA	NA	NA	NA	NA	NA	0	11	0	36
Medak	NA	NA	NA	NA	NA	NA	NA	7	24	2	35
Adilabad	NA	NA	NA	NA	NA	NA	NA	44	43	7	26
Warangal	NA	NA	15	14	NA	6	NA	25	40	0	20
Nizamabad	0	0	0	3	7	5	0	2	36	0	18
Hyderabad	0	0	0	0	0	0	0	0	0	0	10
Total	0	0	15	17	7	11	0	144	516	31	541

**as on 30-05-2015*

Drought

Most of the regions in Telangana are semi-arid and arid regions. Droughts are a frequent hazard in the former State of Andhra Pradesh; according to the World Bank it is the third highest drought prone state of India after Rajasthan and Karnataka. Most parts of Telangana where rainfall can vary a lot are considered to be the most vulnerable. District wise drought profile of Telangana from the year 1995 to 2012, shows that in the year 2002-2003, nearly 95% of the mandals amongst the 10 districts of Telangana were affected due to drought (table 11). Similarly, in the year 2011-12 nearly 90% of the mandals in these 10 districts were affected by drought (table 12). This indicates that nearly all the mandals where IP is located are likely to be affected by drought.

Figure 4: Drought Map of Telangana[4]

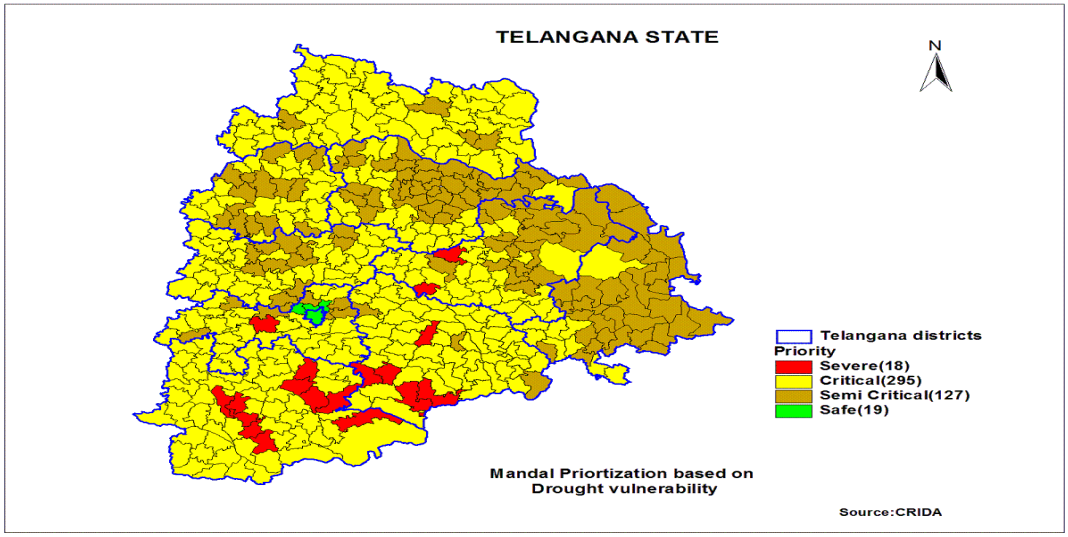


Table 11: District- Wise, Year-Wise No. of Mandals Declared as Drought Affected (1995-96 to 2004-05):

District	Total Mandals	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Mahabubnagar	64	15	10	64		64		64	64	19	64

[4] CRIDA

Karimnagar	57			56		24		39	57	41	56
Nizamabad	36			36				36	36	21	32
Nalgonda	59			53		53		53	59	23	55
Ranga Reddy	37			35		34		34	36	5	34
Khammam	46			41		7		38	46	0	5
Adilabad	52		7	52			30	51	52	7	51
Medak	46			45		33		45	45	19	46
Warangal	51			51		30		46	51	16	40
Hyderabad	16										16
Total	464	15	17	433	0	245	30	406	446	132	399

Table 12: District- Wise, Year-Wise No. of Mandals Declared as Drought Affected (2005-06- 2011-12)[5]:

District	Total Mandals	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Mahabubnagar	64		56			64		64
Karimnagar	57					57		57
Nizamabad	36					36		6
Nalgonda	59		32			59		59
Ranga Reddy	37		5			32	6	37
Khammam	46					46		46
Adilabad	52					52		52
Medak	46		10			46		46
Warangal	51					50		51
Hyderabad	16					0		0
Total	464	0	103	0	0	442	6	418

Based on the primary and secondary data collected during the survey, preliminary screenings of IPs was carried out. The district wise drought and heat wave data indicate that some of the districts are more susceptible to climatic hazards. Thus, the industries

[5] Memorandum on drought in Andhra Pradesh

present and planned in these districts are more vulnerable to climatic changes. The analysis under Criterion 1 provides validation of secondary data on IPs in addition to primary data.

4.3 Existing Industrial Parks

Pre-screening of IPs was done to remove the IPs which are very small in size and have very few allotments. Based on statistical analysis all IPs which are less than 25 acres in size and have few industries, have been excluded prior to preliminary survey. 53 IPs passed the prescreening test. These 53 IPs were subjected to step 1 and step 2 of the analysis.

Step 1: Screening the existing parks to exclude IPs of minor relevance and suitability

Results of Criterion 1

All the 53 IPs were assessed for exposure to Criterion 1. The result of this screening Criterion through inputs from survey data showed that all 53 IPs were exposed to climatic changes. These 53 IPs were further validated with the secondary data available for heat wave, drought, temperature change and rainfall.

Based on the primary data survey preliminary screening of IPs and secondary data sets screening, 53 IPs were selected and subjected to Criterion 2. Results are presented in Appendix I.

Results of Criterion 2: Capacity and capability to implement climate change adaptation measures

Out of 53 IPs remaining after Criterion 1, 18 IPs did not pass through Criterion 2 and hence are excluded from any further analysis, leaving 35 IPs getting selected for Criterion 3. These results are presented in Appendix II.

Criterion 3: Representativeness of IP

Out of 35 IPs remaining after Criterion 2 and screened for criteria 3, 30 passed the Criterion 3 and are selected for scoring and ranking. Balance 5 IPs did not pass Criterion 3 and hence are excluded from any further analysis. These results are presented in Appendix III.

Step 2: Scoring and ranking of the remaining IPs

All the 30 IPs selected from step 1 of the methodology, were assigned a score in step two. Each question wise score was allotted to all the IPs based on the scoring method presented in Table 13. All the IPs which had passed step 1 i.e. Criterion 1, 2 and 3 were given a section-wise scoring for the three section, i.e. climatic exposure, climatic impact and adaptive capacity & capability. The final score for each IP was derived by adding the points against each question/Criterion. Scoring for all these sections were normalised by dividing with the maximum score of the section for indices. The scores for the three

section indices are then aggregated into a composite index using geometric mean for ranking. IPs with highest score index was marked as 1 and so on. The results are provided as per the norms in Table 13.

An example of IP scoring approach has been illustrated below:

Scoring for IP Pashamaylaram:

(A)(Exposure) Climate hazard type	**Experienced (Yes/No)**
Cyclone / Storm	0
Storm surge	0
Floods caused by local heavy rains	1
Floods caused by inundation of a nearby water course / water body	0
Drought	0
Heat wave	1
Total (A1)	2
Change observed	Experienced (Yes/No)
Change in rainfall pattern, (annual season, annual amount, single events)	1
Change in annual temperature patterns (e.g. increase in max / min temperatures, increase / decrease in duration of hot / cool season, etc.	1
Total (A2)	2
Total Score= A1 +A2= 2+2=4	
Highest Score assigned in this category to IP =4	
Indices=Score for individual IP/Highest score assigned to individual IP in that category=4/4=1	

(B)Climate Impact Matrix:

Floods caused by local heavy rains	Humans	Infrastructure and buildings	Supply and waste management services	Operation	Supply Chain	
No occurrence	0					
Slight					1	
Moderate						
Severe		3	3	3		
Very severe						
Total (B1)	10					
Heat Wave	Humans	Infrastructures and buildings	Supply and waste management services	Operation	Supply Chain	
No occurrence		0	0		0	
Slight	1			2		
Moderate						

Severe						
Very severe						
Total (B2)	3					
Total (B)	Total (B1) + Total (B2) = 10+3 = 13					
Highest Score assigned in this category to IP =13						
Indices=Score for individual IP/Highest score assigned to individual IP in this category =13/13=1						
(C)Adaptive Capacity and Capability						
How is the financial condition of IPs? (This means the IP's management/ IALAs are able to generate enough revenue for maintenance of IPs or it has surplus money to maintain it)				Not Good/Not Bad = 3		
4.2 Capability to adapt						
Are the industries and management of IPs aware of climate change? (Yes/No)				Yes (1)		
Whether IP's would be willing (i.e. capable) to undertake activities to reduce sensitivity to climate change through adaptation? (Yes/No)				Yes (1)		
Does the IP have a disaster management plan?				No (0)		
Does the IP have a management plan for implementation?				No (0)		
Total (C)				5		
Highest Score assigned in this category to IP =7						
Indices=Score for individual IP/Highest score assigned to individual IP in that category =5/7=0.7143						
Geometric Mean (GM) of A, B and C Indices=$3\sqrt{}(A\times B\times C)= 3\sqrt{}(1\times1\times0.7143)=0.893$						
The GM has resulted in ranking of 1 for IP Pashamaylaram:						

Top 5 IPs with highest overall rank are IP Pashamaylaram, IP Jeedimetla, IP Manikonda & Hitech City Madhapur &Software Units Layout (IP Manikonda, Hi tech city Madhapur and software unit layout Madhapur are adjacent to each other), Financial district Nanakramguda & IT Park Nanakramguda. (Financial district Nanakramguda and IT park Nanakramguda are adjacent IT parks) and Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar. These IPs are located in areas where the surrounding population density is either high or medium. Thus, based on the above analysis these identified IPs are the most suitable to be identified as the IPs for future action plans.

Table 13: Overall and section-wise scoring and ranking of IPs

Sr No	IP Name	Zone	Climatic Exposure		Climatic Impact		Adaptive Capacity		Overall Score	Age in years	Size in acres	Population density	Geometric Mean	Rank	Final Rank
			Total Score	Indices	Total Score	Indices	Total Score	Indices							
	Financial district, Nanakramguda	Cyberabad	4	1	3	0.23077	7	1	14	2005	158	medium	0.613374854	3	4
1	IT park, Nanakramguda	Cyberabad	4	1	3	0.23077	7	1	14	2005	168	medium	0.613374854	3	
	IP Manikonda	Cyberabad	4	1	3	0.23077	7	1	14	2003	603	medium	0.613374854	3	
	Hitech city, Madhapur	Cyberabad	4	1	3	0.23077	7	1	14	1998	149	high	0.613374854	3	
2	Software Units Layouts, Madhapur	Cyberabad	4	1	3	0.23077	7	1	14	1998	64	high	0.613374854	3	3
3	IP Bhongir	Warangal	4	1	1	0.07692	7	1	12	1981	63	medium	0.42529037	13	
4	IP Jeedimetla	Jeedimetla	3	0.75	9	0.69231	6	0.857143	18	1973	894	high	0.763492093	2	2
5	IP Medchal	Jeedimetla	3	0.75	3	0.23077	6	0.857143	12	1999	113	medium	0.52937585	9	
6	IP Pashamaylaram	Pathancheru	4	1	13	1	5	0.714286	22	1974	1645	high	0.893903535	1	1
7	IP Rampur	Warangal	2	0.5	3	0.23077	6	0.857143	11	1987	188	Low	0.462452401	10	
8	IP Madikonda	Warangal	2	0.5	3	0.23077	6	0.857143	11	1987	175	Low	0.462452401	10	
9	IE Warangal	Warangal	2	0.5	3	0.23077	6	0.857143	11	1974	31	high	0.462452401	10	
10	IP Mahbubnagar	Shamshabad	3	0.75	1	0.07692	6	0.857143	10	1975	34	high	0.367048714	15	
11	Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar	Jeedimetla	3	0.75	4	0.30769	5	0.714286	12	1973	150	high	0.54829795	8	5
12	IP Nacharam	Shamshabad	2	0.5	2	0.15385	6	0.857143	10	1975	550	high	0.403989384	14	
13	IP Cherlapally	Shamshabad	2	0.5	1	0.07692	6	0.857143	9	1973	1140	high	0.320646586	16	
14	IP Khammam	Warangal	2	0.5	0	0	7	1	9	1974	102	high	0	22	
15	IP Uppal	Shamshabad	2	0.5	0	0	7	1	9	1973	446	high	0	22	

Sr No	IP Name	Zone	Climatic Exposure		Climatic Impact		Adaptive Capacity		Overall Score	Age in years	Size in acres	Population density	Geometric Mean	Rank	Final Rank
			Total Score	Indices	Total Score	Indices	Total Score	Indices							
16	IP Miryalaguda	Warangal	3	0.75	0	0	6	0.857143	9	1974	58	medium	0	22	
17	AIE RC Puram	Pathancheru	2	0.5	0	0	6	0.857143	8	1973	25	high	0	22	
18	IP Kothagudem	Warangal	2	0.5	0	0	6	0.857143	8	1974	62	medium	0	22	
19	IDA Ramagundam	Karimnagar	2	0.5	1	0.07692	5	0.714286	8	1982	53	medium	0.30173999	17	
20	IP Mancherial	Karimnagar	2	0.5	1	0.07692	5	0.714286	8	1974	25	Low	0.30173999	17	
21	IE Nirmal	Karimnagar	2	0.5	1	0.07692	5	0.714286	8	1979	37	Low	0.30173999	17	
22	IE Adilabad	Karimnagar	2	0.5	1	0.07692	5	0.714286	8	1979	37	medium	0.30173999	17	
23	IP Karimnagar	Karimnagar	2	0.5	1	0.07692	5	0.714286	8	1974	35	medium	0.30173999	17	
24	RIE Zaheerabad	Pathancheru	2	0.5	0	0	5	0.714286	7	1973	24	high	0	22	
25	IP Manhkal	Shamshabad	2	0.5	0	0	5	0.714286	7	1980	107	high	0	22	
26	IDA Moula Ali and IP Moula Ali	Shamshabad	2	0.5	0	0	5	0.714286	7	1965	170	high	0	22	
27	IP Sarangpur	Karimnagar	0	0	0	0	5	0.714286	5	1974	56	high	0	22	

4.4 Upcoming industrial parks

In Telangana several new IPs have been proposed in different industrial zones. These IPs are under different states of planning and commissioning during the survey carried out between 2nd of September and 15th of September 2015. The climatic exposure of new IPs is similar to the climatic exposure of existing IPs. Hence, Criterion 1 (i.e. exposure) of step1 of the screening methodology for existing parks was used to upcoming industrial parks as well.

The IPs which passed the Criterion set out in Criterion 1 are the ones which are exposed to climatic changes. Hence, these IPs were considered for CCA.

It was found that all 9 IPs passed the criterion 1. All these IPs are prone to certain type of climate change. Thus, all these IPs under consideration need to have intervention for addressing climate changes issues and have to have CCA measures. The CCA measures need to be integrated at each stage of IPs development process. Mainstreaming climate change adaptation into policies plans, and development of these IPs will contribute towards minimizing the vulnerability of climate impacts and variability and increasing adaptive capacity of IPs. Details list of IPs and its score are presented in below table 14.

Table 14: Screening result for upcoming IPs in different stages of planning and commissioning

IP Name	Zone	Climatic Exposure				Screening result	Type of industries	Size in acres	Population density	Planning stage
		1a	1b	2a	2b					
IP Sultanpur	Patancheru	1		0	1	Yes	Only industries under green category and non-polluting industries	471	Low	Master planning
IP Buchinelly	Patancheru	1		0	1	Yes	auto, auto ancillary units and edible oil	314	Low	Implementation
IP Chegunta	Patancheru	1		0	1	Yes	All types of industries	36	Medium	Land allotment
Auto Nagar Miryalaguda	Warangal	1		0	1	Yes	Automobile service	34	Low	Master planning
IT Park	Warangal	1		0	1	Yes	IT	45	Low	Land

IP Name	Zone	Climatic Exposure				Screening result	Type of industries	Size in acres	Population density	Planning stage
		1a	1b	2a	2b					
SEZ Manikonda										allotment
IP Kallem	Warangal	1		0	1	Yes	Textiles	86	Low	Master planning
Mega food park	Warangal	1		0	1	Yes	Food processing	60	Low	Master planning
Hyderabad Knowledge	Cyberabad	1		0	1	Yes	IT, Residencial, Commercial	86	High	Master planning
Pharma City	Shamshabad	1		0	1	Yes	Pharma and all associated pharma sectors	11840	Low	Land acquisition

5 Way Forward

Following are the key findings of this report:

- All the IPs both existing and upcoming, which were considered for the survey are in areas which are exposed to climate hazard
- The severity of climatic impact experienced by various IPs are different
- Some of the general problems faced by IPs in Telangana are water scarcity and excessive temperature along with some localized water logging issues
- The knowledge on climate change and its impacts o potential to impact the IPs is limited and varying with different people. This indicates a need for extensive capacity building on climate change so that adaptation measures can effectively be implemented by IPs.

The 5 IPs as per the ranking are IP Pashamaylaram, IP Jeedimetla, IP Manikonda & Hitech City Madhapur &Software Units Layout (IP Manikonda, Hi tech city Madhapur and software unit layout Madhapur are adjacent to each other), Financial district Nanakramguda & IT Park Nanakramguda. (Financial district Nanakramguda and IT Park Nanakramguda are adjacent IT parks) and Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar, which may be considered for further detailed evaluation under CCA project.

The next steps of the study are:

- Finalization of 5 existing and 5 upcoming IPs for a detailed risk analysis
- The results of the risk analysis would help in identifying the most suitable IP and develop a baseline document
- To support this exercise the interviews will be conducted with a larger stakeholder base i.e. industry members, IALA, PCB etc.

Annexure I

Preliminary Screening Questionnaire

Preliminary Screening Questionnaire

(The below questionnaire needs to be filled for each IP separately)

1. General Information	
Name of IP	Zone of IP
Existing ☐ IP Mandal……	
New IP ☐	Start year of Operation
Occupancy Level	Type of Industries
Size of IPs (In HA) Dense/Medium/Low	Surrounding Population:

2. Exposure					
2.1 Climate Hazards experienced by the IP in last 30 years					
Climate hazard type	**Experienced (Yes/No)**	**Severity of single events (try to get information as per the specific event) (Very Severe/Severe/Moderate/ Slight/ None)**	**Frequency**	**Did you observe increase in frequency or severity of events over the years?**	**Any documents available to support the same (photo's, mandal reports, press documents)**
Cyclone / Storm					
Storm surge					
Floods caused by local heavy rains					
Floods caused					

by inundation of a nearby water course / water body					
Drought					
Heat wave					
2.2 Observed changes in annual weather patterns in the last 30 years					
Change observed	**Experienced (Yes/No)**	**Extent observed (quantification; if not available qualitative description of changes observed)**	**Any documents available to support the same (photo's, mandal reports, press documents)**		
Change in rainfall pattern, (annual season, annual amount, single events)					
Change in annual temperature patterns (e.g. increase in max / min temperatures, increase / decrease in duration of hot / cool season, etc.					
Remarks					

3.0 Climate Impact Matrix
Please insert number and severity of observed events in the IP;
fill one matrix per hazard and IP

3.1 IP specific Impact matrix

Climatic hazard (please mark)	Cyclone / Storm		Storm surge		Floods caused by local heavy rains
	Floods caused by inundation of a nearby water course/ water body;		Drought		Heat wave
	Humans	**Infrastructures and buildings**	**Supply and waste management services**	**Operation**	**Supply Chain**
No Knowledge					
No occurrence					
Slight	persons not or only slightly injured	infrastructures and buildings not or only slightly damaged	no interruption of supply and waste management	no interruption of operation	No interruption
Moderate	persons moderately injured	infrastructures and buildings moderately damaged, no significant reconstruction required	interruption of supply and waste management for the duration of the event only	interruption of operation for the duration of the event only	interruption of operation for the duration of the event only
Severe	persons heavily injured	damages to buildings and infrastructure requiring significant reconstruction	interruption of supply and waste management for up to one day after the event	interruption of operation for up to one day after the event	interruption of operation for up to one day after the event
Very severe	losses of lives	damages of buildings and infrastructures leading to demolition	interruption of supply and waste management for several days,	interruption of operation for several days	interruption of operation for several days
Remarks:		Indicate here which infrastructures / buildings were affected	Indicate which supplies / services were affected	Indicate which operations were affected	

3.2 IP specific Impact matrix

Climatic	Cyclone / Storm	Storm surge	Floods caused by local

hazard (please mark)			heavy rains	
	Floods caused by inundation of a nearby water course/ water body;	Drought	Heat wave	

	Humans	**Infrastructures and buildings**	**Supply and waste management services**	**Operation**	**Supply Chain**
No Knowledge					
No occurrence					
Slight	persons not or only slightly injured	infrastructures and buildings not or only slightly damaged	no interruption of supply and waste management	no interruption of operation	No interruption
Moderate	persons moderately injured	infrastructures and buildings moderately damaged, no significant reconstruction required	interruption of supply and waste management for the duration of the event only	interruption of operation for the duration of the event only	interruption of operation for the duration of the event only
Severe	persons heavily injured	damages to buildings and infrastructure requiring significant reconstruction	interruption of supply and waste management for up to one day after the event	interruption of operation for up to one day after the event	interruption of operation for up to one day after the event
Very severe	losses of lives	damages of buildings and infrastructures leading to demolition	interruption of supply and waste management for several days,	interruption of operation for several days	interruption of operation for several days
Remarks:		Indicate here which infrastructures / buildings were affected	Indicate which supplies / services were affected	Indicate which operations were affected	

3.3 IP specific Impact matrix			
Climatic hazard (please mark)	Cyclone / Storm	Storm surge	Floods caused by local heavy rains
	Floods caused by inundation of a nearby water course/ water body;	Drought	Heat wave

	Humans	Infrastructures and buildings	Supply and waste management services	Operation	Supply Chain
No knowledge					
No occurrence					
Slight	persons not or only slightly injured	infrastructures and buildings not or only slightly damaged	no interruption of supply and waste management	no interruption of operation	No interruption
Moderate	persons moderately injured	infrastructures and buildings moderately damaged, no significant reconstruction required	interruption of supply and waste management for the duration of the event only	interruption of operation for the duration of the event only	interruption of operation for the duration of the event only
Severe	persons heavily injured	damages to buildings and infrastructure requiring significant reconstruction	interruption of supply and waste management for up to one day after the event	interruption of operation for up to one day after the event	interruption of operation for up to one day after the event
Very severe	losses of lives	damages of buildings and infrastructures leading to demolition	interruption of supply and waste management for several days,	interruption of operation for several days	interruption of operation for several days
Remarks:		Indicate here which infrastructures / buildings were affected	Indicate which supplies / services were affected	Indicate which operations were affected	

4.0 Adaptation
4.1 Economic status of IP
4.1.1How is the financial condition of IPs? (This means the IP's management/ IALAs are able to generate enough revenue for maintenance of IPs or it has surplus money to maintain it)

Very good	Good	Not good/not bad	Bad	Poor
4.2 Capability to adapt				
4.2.1Are the IP's management and industries aware of climate change? (Yes/No)				
4.2.2Whether IP's would be willing to undertake activities to reduce sensitivity to climate change through adaptation? (Yes/No)				
4.3 What percentage of the IP has green patch?				
4.4 Does the site have a disaster management plan? Y / N, if yes please assess adequacy and explain your assessment				
4.5 Describe the IP's infrastructure management plan? Y / N, if yes please assess adequacy and explain your assessment				

_____
_____
Name of the Respondents **Designation**

_____ ____ _____
Signature Date

For Official Use of CoreCarbonX

Date: _____ Name of Officer: _____ Entry. No. _____

Appendix I

Results of Criterion 1- Exposure to climate change

Name of IP	Zone	1. Exposure experienced based on Secondary Data (District / Mandal Wise); IPs / SEZs in the Districts / Mandals (Based on Actual Data)		2. Past exposure to climatic hazard and climatic change based on responses received in the questionnaire		Result
		1a.Declared with any disaster in past 15-20 years, preferably with the duration of occurrence	1b. Extreme change in Temperature / Rainfall from IMD data in past 15-20 years and occurrence with regular frequency (1-5 years)	2a. Climate hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	2b. Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	
AIE RC Puram	Patancheru	1		1	1	Select
IP Indrakaran	Patancheru	1		1	1	Select
IP Yelumala	Patancheru	1		1	1	Select
RIE Zaheerabad	Patancheru	1		1	1	Select
IP Patancheru	Patancheru	1		1	1	Select
IP Pashamylaram	Patancheru	1		1	1	Select
IP Rampur	Warangal	1		1	1	Select
IP Miryalaguda	Warangal	1		1	1	Select
IP Madikonda	Warangal	1		1	1	Select
IP Suryapet	Warangal	1		1	1	Select
IP Bhongir	Warangal	1		1	1	Select
IP Kothagudem	Warangal	1		1	1	Select

Name of IP	Zone	1. Exposure experienced based on Secondary Data (District / Mandal Wise); IPs / SEZs in the Districts / Mandals (Based on Actual Data)		2. Past exposure to climatic hazard and climatic change based on responses received in the questionnaire		Result
		1a.Declared with any disaster in past 15-20 years, preferably with the duration of occurrence	1b. Extreme change in Temperature / Rainfall from IMD data in past 15-20 years and occurrence with regular frequency (1-5 years)	2a. Climate hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	2b. Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	
IP Kodada	Warangal	1		1	1	Select
IP Annargudem	Warangal	1		1	1	Select
IP Khammam	Warangal	1		1	1	Select
IE Warangal	Warangal	1		1	1	Select
IP Manikonda	Cyberabad	1		1	1	Select
Financial district, Nanakramguda	Cyberabad	1		1	1	Select
IT park, nanakramguda	Cyberabad	1		1	1	Select
Hitech city, Madhapur	Cyberabad	1		1	1	Select
Software Units Layouts, Madhapur	Cyberabad	1		1	1	Select
IE Vikarabad	Jeedimetla	1		1	1	Select
IP Jeedimetla	Jeedimetla	1		1	1	Select
Automotive park	Jeedimetla	1		1	1	Select
IDA Kukatpally	Jeedimetla	1		1	1	Select

Name of IP	Zone	1. Exposure experienced based on Secondary Data (District / Mandal Wise); IPs / SEZs in the Districts / Mandals (Based on Actual Data)		2. Past exposure to climatic hazard and climatic change based on responses received in the questionnaire		Result
		1a.Declared with any disaster in past 15-20 years, preferably with the duration of occurrence	1b. Extreme change in Temperature / Rainfall from IMD data in past 15-20 years and occurrence with regular frequency (1-5 years)	2a. Climate hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	2b. Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	
IP Medchal	Jeedimetla	1		1	1	Select
Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar	Jeedimetla	1		1	1	Select
Biotech park phase II Extn	Jeedimetla	1		1	1	Select
IP Kucharam	Jeedimetla	1		1	1	Select
Biotech park phase III	Jeedimetla	1		1	1	Select
IP Rakamcherla	Jeedimetla	1		1	1	Select
Apparel Export Park	Jeedimetla	1		1	1	Select
IDA Ramagundam	Karimnagar	1		1	1	Select
IE Sarangapur	Karimnagar	1		1	1	Select
IP Mancherial	Karimnagar	1		1	1	Select
IE Nirmal	Karimnagar	1		1	1	Select
IE Adilabad	Karimnagar	1		1	1	Select

Name of IP	Zone	1. Exposure experienced based on Secondary Data (District / Mandal Wise); IPs / SEZs in the Districts / Mandals (Based on Actual Data)		2. Past exposure to climatic hazard and climatic change based on responses received in the questionnaire		Result
		1a.Declared with any disaster in past 15-20 years, preferably with the duration of occurrence	1b. Extreme change in Temperature / Rainfall from IMD data in past 15-20 years and occurrence with regular frequency (1-5 years)	2a. Climate hazards (Cyclone / storm / storm surge / floods / drought / heat wave)	2b. Climate change (change in rainfall pattern / max. temperature increases / salinization / sea level rise)	
IP Karimnagar	Karimnagar	1		1	1	Select
IP Uppal	Shamshabad	1		1	1	Select
IP Katedan	Shamshabad	1		1	1	Select
IP Autonagar	Shamshabad	1		1	1	Select
IP Mahbubnagar	Shamshabad	1		1	1	Select
IP Nacharam	Shamshabad	1		1	1	Select
IP Palem	Shamshabad	1		1	1	Select
IP Kothur	Shamshabad	1		1	1	Select
IP Manhkal	Shamshabad	1		1	1	Select
IP Mallapur	Shamshabad	1		1	1	Select
IP Cherlapally	Shamshabad	1		1	1	Select
IDA Moula Ali and IP Moula Ali	Shamshabad	1		1	1	Select
EC Kushaiguda	Shamshabad	1		1	1	Select
IP Hardware Park	Shamshabad	1		1	1	Select
IP Fab city	Shamshabad	1		1	1	Select
GIP Jedcherla	Shamshabad	1		1	1	Select

Appendix II

Results of Criterion 2 - Capacity and capability to implement CCA measures

Name of IP	Zone	1. Does the IP have at least some financial capacity at its disposal to contribute to the implementation of measures and related supporting activities (planning, monitoring, capacity development)?	2. Would the IP be willing to undertake activities to reduce sensitivity to climate change through adaptation?	3. Are there existing DRM or management plans in place for the IP?	Result
AIE RC Puram	Patancheru	1	1	0	Select
IP Indrakaran	Patancheru	0	0	0	Exclude
IP Yelumala	Patancheru	0	0	0	Exclude
RIE Zaheerabad	Patancheru	1	1	0	Select
IP Patancheru	Patancheru	0	1	0	Exclude
IP Pashamylaram	Patancheru	1	1	1	Select
IP Rampur	Warangal	1	1	0	Select
IP Miryalaguda	Warangal	1	1	0	Select
IP Madikonda	Warangal	1	1	0	Select
IP Suryapet	Warangal	1	0	0	Exclude
IP Bhongir	Warangal	1	1	0	Select
IP Kothagudem	Warangal	1	1	0	Select
IP Kodada	Warangal	0	0	0	Exclude
IP Annargudem	Warangal	1	1	0	Select
IP Khammam	Warangal	1	1	0	Select
IE Warangal	Warangal	1	1	0	Select
IP Manikonda	Cyberabad	1	1	0	Select
Financial district, Nanakramguda	Cyberabad	1	1	0	Select
IT park, nanakramguda	Cyberabad	1	1	0	Select
Hitech city, Madhapur	Cyberabad	1	1	0	Select
Software Units Layouts, Madhapur	Cyberabad	1	1	0	Select
IE Vikarabad	Jeedimetla	0	0	0	Exclude
IP Jeedimetla	Jeedimetla	1	1	0	Select
Automotive park	Jeedimetla	0	1	0	Exclude
IDA Kukatpally	Jeedimetla	0	0	0	Exclude
IP Medchal	Jeedimetla	1	1	0	Select

Name of IP	Zone	1. Does the IP have at least some financial capacity at its disposal to contribute to the implementation of measures and related supporting activities (planning, monitoring, capacity development)?	2. Would the IP be willing to undertake activities to reduce sensitivity to climate change through adaptation?	3. Are there existing DRM or management plans in place for the IP?	Result
Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar	Jeedimetla	1	1	0	Select
Biotech park phase II Extn	Jeedimetla	0	1	0	Exclude
IP Kucharam	Jeedimetla	0	0	0	Exclude
Biotech park phase III	Jeedimetla	1	1	0	Select
IP Rakamcherla	Jeedimetla	0	1	0	Exclude
Apparel Export Park	Jeedimetla	0	1	0	Exclude
IDA Ramagundam	Karimnagar	1	1	0	Select
IE Sarangapur	Karimnagar	1	1	0	Select
IP Mancherial	Karimnagar	1	1	0	Select
IE Nirmal	Karimnagar	1	1	0	Select
IE Adilabad	Karimnagar	1	1	0	Select
IP Karimnagar	Karimnagar	1	1	0	Select
IP Uppal	Shamshabad	1	1	0	Select
IP Katedan	Shamshabad	1	0	0	Exclude
IP Autonagar	Shamshabad	1	0	0	Exclude
IP Mahbubnagar	Shamshabad	1	1	0	Select
IP Nacharam	Shamshabad	1	1	0	Select
IP Palem	Shamshabad	0	0	0	Exclude
IP Kothur	Shamshabad	1	0	0	Exclude
IP Manhkal	Shamshabad	1	1	0	Select
IP Mallapur	Shamshabad	0	1	0	Exclude
IP Cherlapally	Shamshabad	1	1	0	Select
IDA Moula Ali and IP Moula Ali	Shamshabad	1	1	0	Select
EC Kushaiguda	Shamshabad	1	0	0	Exclude
IP Hardware Park	Shamshabad	1	1	0	Select
IP Fab city	Shamshabad	1	1	0	Select
GIP Jedcherla	Shamshabad	1	1	0	Select

Appendix III

Results of Criterion 3 – Identification of representative IP

Name of IP	Zone	1. Is the occupancy level of the IP is more than 50%?	2. Is the IP older than 10 years?	Result
AIE RC Puram	Patancheru	1	1	Select
RIE Zaheerabad	Patancheru	1	1	Select
IP Pashamylaram	Patancheru	1	1	Select
IP Rampur	Warangal	1	1	Select
IP Miryalaguda	Warangal	1	1	Select
IP Madikonda	Warangal	1	1	Select
IP Bhongir	Warangal	1	1	Select
IP Kothagudem	Warangal	1	1	Select
IP Annargudem	Warangal	1	0	Exclude
IP Khammam	Warangal	1	1	Select
IE Warangal	Warangal	1	1	Select
IP Manikonda	Cyberabad	1	1	Select
Financial district, Nanakramguda	Cyberabad	1	1	Select
IT park, nanakramguda	Cyberabad	1	1	Select
Hitech city, Madhapur	Cyberabad	1	1	Select
Software Units Layouts, Madhapur	Cyberabad	1	1	Select
IP Jeedimetla	Jeedimetla	1	1	Select
IP Medchal	Jeedimetla	1	1	Select
Ancillary private Industrial Estate Balanagar, IDA Balanagar, APIE & TIE Balanagar	Jeedimetla	1	1	Select
Biotech park phase III	Jeedimetla	0	0	Exclude
IDA Ramagundam	Karimnagar	1	1	Select
IE Sarangapur	Karimnagar	1	1	Select
IP Mancherial	Karimnagar	1	1	Select
IE Nirmal	Karimnagar	1	1	Select
IE Adilabad	Karimnagar	1	1	Select
IP Karimnagar	Karimnagar	1	1	Select
IP Uppal	Shamshabad	1	1	Select
IP Mahbubnagar	Shamshabad	1	1	Select
IP Nacharam	Shamshabad	1	1	Select

Name of IP	Zone	1. Is the occupancy level of the IP is more than 50%?	2. Is the IP older than 10 years?	Result
IP Manhkal	Shamshabad	1	1	Select
IP Cherlapally	Shamshabad	1	1	Select
IDA Moula Ali and IP Moula Ali	Shamshabad	1	1	Select
IP Hardware Park	Shamshabad	0	0	Exclude
IP Fab city	Shamshabad	0	0	Exclude
GIP Jedcherla	Shamshabad	0	1	Exclude

List of References

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3	Central Research Institute for Dry land Agriculture (CRIDA)
4	http://agri.ap.nic.in/rainfallsenario.htm
5	Memorandum on drought in Andhra Pradesh
6	Telangana National Disaster Risk Reduction Portal