

Presentation on  
Climate Change  
and Sea Level Rise  
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# **Climate Change/ Global Warming:**

## **INTRODUCTION**

# DEFINING THE CLIMATE CHANGE

Climate Change is a significant statistical variation of the average state or climate variabilities which occur during a long period (at least some decades).

In other words, climate change represents a trend in the behaviour of a climate variable, for example, a trend towards an increase in average temperature.

# CLIMATE CHANGE/GLOBAL WARMING

## **The Green House Effect**

Some gases naturally exist in the atmosphere, the so called Greenhouse Gases (GHGs) that form a blanket surrounding the earth and keeps the earth warmer. This is called Greenhouse Effect.

## **The Enhanced Greenhouse Effect**

Human activities (fossil fuel burning, depletion of sinks like forests etc.) has been increasing the concentration of GHGs in the atmosphere and is leading to rise in temperatures. This is called Enhanced Greenhouse Effect.

## **Global Warming/Climate Change**

Rise in temperatures of earth and other associated climatic changes as caused by the Enhanced Green House Effect is called “Global Warming” and in broader term “Climate Change”.

# IMPACTS OF CLIMATE CHANGE

## EXTREME WEATHER EVENTS (ABRUPT SWINGS).

- More frequent and powerful cyclones and hurricanes,
- More frequent and intense floods and heavy, snowfalls,
- Severe and longer drought periods,
- Unexpected climatic events,
- Changes in Weather Patterns,
- Short winters, earlier spring and longer summers.

# IMPACTS OF CLIMATE CHANGE (Contd...)

## WATER RESOURCES

- Decrease in fresh water supply,
- Deteriorated water quality due to salt water intrusion in aquifers,
- Melting northern glaciers and polar ice,
- Rising sea levels due to melting of polar ice caps,
- Increased water loss from reservoirs due to dryness,

# IMPACTS OF CLIMATE CHANGE (Contd...)

## ENVIRONMENTAL DAMAGE

- Impacts on production of ecosystems,
- Shrinking habitats (forests and wetlands),
- Desertification,
- Damage to aquatic ecosystems (coral reefs, fisheries),
- Shifts in the natural world (climate change impacts at least 420 physical and biological processes),
  - *Upward migration of plant and animal species,*
  - *Disappearance of some plant and animal species in certain areas,*
  - *Impact on breeding behavior,*
  - *Change in growing season of plants and agriculture crops,*
  - *Species extinction (some 25% of mammals and 12% of birds).*

# IMPACTS OF CLIMATE CHANGE (Contd...)

## ECONOMIC IMPACTS

- Decrease in production value of ecosystems, agricultures, forests and fisheries etc.
- Increased economic damage due to climatic catastrophes like floods and droughts etc.
- Economic impacts due to loss of human, livestock, fisheries and poultry health.

## HEALTH IMPACTS

- Heat-related illnesses (heat stroke and dehydration).
- Respiratory and cardiovascular illness.
- Physical and mental stress.
- Spread of infections.
- Spread of epidemics and vector borne diseases (diarrhea, malaria).
- Contamination of drinking water and food

# IMPACTS OF CLIMATE CHANGE (Contd...)

## TOURISM

- Impacts on protected areas.
- Depleted winter resorts and ski resorts.
- Impacts water sports (boating and canoeing) due to shrinkage of water bodies.
- Impacts on trekking, mountaineering etc due to degraded ecosystems.

## AGRICULTURE & FORESTRY

- Decrease in agriculture production due to change in temperature water scarcity.
- Decrease in forest production due to water availability
- Increased risks of pest and pathogens.
- Increase in occurrence and distribution of forest fires.
- Change in vegetation zones due to change in weather (upwards shifting of forest types).

# CLIMATE CHANGE IMPACTS ON PAKISTAN

Climate change is expected to result in changes in land and water resources that will subsequently affect agricultural productivity.

Dry land areas, including arid and semi-arid regions like Pakistan are most vulnerable to these climatic changes as these regions are already facing significant water shortages and temperatures are already close to the tolerance limits.

Alter bio-physical relationships by changing growing periods of the crops, altering scheduling of cropping seasons, increasing crop stresses (thermal and moisture stresses), changing irrigation water requirements, altering soil characteristics, and increasing the risk of pests and diseases, thereby negatively affecting agricultural productivity.

## CC IMPACTS ON PAKISTAN (Contd...)

Decline in irrigated wheat yield in semi-arid areas of Pakistan is expected to be in the range of 9 to 30% for temperature increases of 1 to 4 °C.

About 80% of the nations food and fiber needs are met from irrigated agriculture, with canal irrigation network mainly dependent on glaciers of the Hindukush and Himalayas which are believed to be receding over the last few decades,

These impacts are changing the hydrology of the upper Indus Basin, which has serious consequences on people living in the entire river basin and will result in water shortages for millions of people.

## CC IMPACTS ON PAKISTAN (Contd...)

Climate change has adverse impacts on forest resources and natural ecosystems of Pakistan. Forest lands in northern mountain areas of Pakistan would shift from one biome to another, which would also result in an increase in the total potential coniferous forest area and decrease the productivity of this precious resource.

*Many other that we don't even know...*

## CHANGES IN HUMAN AND NATURAL DRIVERS OF CC

CO<sub>2</sub> concentrations have increased from 280 ppm (since 1750) to 368 ppm in 2000 (31.4%) to 379 in 2005 (35.4% rise)

CH<sub>4</sub> concentrations have increased from a pre-industrial value of about 715 ppb to 1732 ppb in early 1990s (142% rise) and is 1774 ppb in 2005 (148% rise). The rise since 1990s is only 2.4%. Growth rates have declined since early 1990s

N<sub>2</sub>O concentrations have increased from a pre-industrial value of about 270 ppb to 319 ppb in 2005 (18% rise). The growth rate has been approximately constant since 1980s. More than a third of all N<sub>2</sub>O emissions are anthropogenic and are primarily due to agriculture

## EXTREME EVENTS

Severe climatic events in Pakistan. Flooding, now in Margallah etc

The Great Flood of 1993 occurred in the American Midwest, along the Mississippi and Missouri Rivers. Damages ~ US\$ 20 billion

1998 massive flooding parts of the Yangtze River in China. Damages US\$ 24 billion.

2003 Southern European heat wave combined with drought to create a crop shortfall. Killing~ 35,000 people.

The 2007 South Asian floods (India, Nepal, Bhutan, and Bangladesh) killing 2,000.

### HURRICANES

Hurricane Katrina, Rita, Charley, Jeanne, Frances in USA. ~ killing thousands and economic losses worth billions USD.

Billion Dollar Climatic Disasters:

A Chronology of U.S. Events

[http://www.livescience.com/environment/disaster\\_chronology\\_1980\\_2004.html](http://www.livescience.com/environment/disaster_chronology_1980_2004.html)

# **Scientific Evidence of Climate Change/Global Warming**

## **Global Concerns**

## THE GLOBAL CONCERNS

Climate change: the greatest threat of the 21st Century (UNDP Human Development Report 2007/2008).

UN Secretary General Ban Ki-moon has warned that climate change poses as much of a danger to the world as war. (In his first address).

UN Secretary General Ban Ki-moon said that the slaughter in Darfur was triggered by global climate change and that more such conflicts may be on the horizon. atrocities committed by the Sudanese-government against the black African farmers of Darfur where more than a million people have been driven from their homes and thousands more have been butchered.

Security Council holds first-ever debate on impact of climate change (5663rd Meeting April 2007 ). called for the United Nations to urgently consider convening a global summit. “our collective security in a fragile and increasingly interdependent world”.

# FOURTH ASSESSMENT REPORT OF IPCC

The 4<sup>th</sup> Assessment Report of Inter- Governmental Panel on Climate Change (IPCC) published in 2007 indicates that:

- Global temperature rises of 2 – 4.5 °C are almost inevitable due to increased concentration of green house gases as caused by human activities (fossil fuel use, land use changes etc.).
- The above global warming (or in broader term Climate Change) is expected to have serious consequences for:
  - Agricultural production
  - Biodiversity
  - Health
  - Sea Level rise
- Poor will be most affected by the Climate Change.

# GLOBAL ENVIRONMENT OUTLOOK (GEO- 4)

GEO- 4 is the most comprehensive UN document published in 2007, indicated that:

- 11 of the last 12 years (1996- 2006) are the warmest years since 1850.
- Average temperature have increased 0.74 °C during last centaury.
- Impacts include: shrinking glaciers
- Thawing permafrost earlier breakup of river ice,.
- Lengthening of growing season,
- Changes in precipitation patterns,
- Increase in frequency and intensity of heat waves,
- Storms, floods and droughts.

# HUMAN DEVELOPMENT REPORT OF UNDP 2007/2008

Current concentration have reached 380 ppm of CO<sub>2</sub>e, Exceeding the natural range of the last 650,000 years.

In the course of 21<sup>st</sup> century average global temperature could increase by more than 5°C.

## MITIGATION AND ADAPTATION

Mitigation of global warming involves taking actions aimed at reducing the extent of global warming

Adaptation to global warming involves taking action to minimize the effects of global warming.

# **Addressing Climate Change Or Mitigation**

# INTERNATIONAL RESPONSE

## **The United Nations Framework Convention of Climate Change (UNFCCC)**

Adopted in June 1992 by over 180 countries at the “Earth Summit” in Rio de Janeiro, Brazil.

The Convention was signed by 154 states (including Pakistan) and entered into force on 21<sup>st</sup> March, 1994.

UNFCCC is a non-binding legal framework:

Aims at stabilization of GHG concentration in the atmosphere at a safe level.

To balance out the response along mitigation and adaptation measures

# PRINCIPLES OF UNFCCC

Based on the principle of common but differentiated roles

## **On one hand it recognises the:**

Primary Responsibility of Developed Countries for higher emissions, and therefore,

Asks Developed Countries to take a Leading Role

## **On other hand it establishes:**

Social and Economic Development as the Rightful Priority of the Developing Countries, and

The need to assist developing countries that are vulnerable to climate change

# THE KYOTO PROTOCOL OF UNFCCC

Adopted in Kyoto, Japan in 1997 and ratified in February 2005 (Pakistan signed the Protocol on 11<sup>th</sup> January, 2005)

The Kyoto Protocol: Aims to reduce GHG emissions by 2012 and distinguish two types of countries:

Annex-I countries: With binding emission targets (industrialised countries):

Western and Eastern Europe, Canada, Japan, New Zealand, Russia, Ukraine etc.

Non-Annex I countries: With voluntary participation (developing countries):

China, India, Pakistan, South Africa, Philippines, Uruguay, Brazil, and other developing countries.

# THE KYOTO PROTOCOL MITIGATION OPTIONS

- Source oriented measures

  - Energy conservation and efficiency improvement
  - Fossil fuel switching
  - Renewable energy

- Sink enhancement measures

  - Capture and disposal of CO<sub>2</sub> (under discussion)
  - Enhancement of forest sinks (limited options)

# MECHANISMS UNDER THE KYOTO PROTOCOL

The Kyoto Protocol introduces three market based flexible mechanisms for the emissions reduction:

- Joint Implementation (JI),
- Activities Implemented Jointly (AIJ), and
- Clean Development Mechanism (CDM).

# CLEAN DEVELOPMENT MECHANISM (CDM)

CDM is a market based instrument under the Kyoto Protocol of UNFCCC:

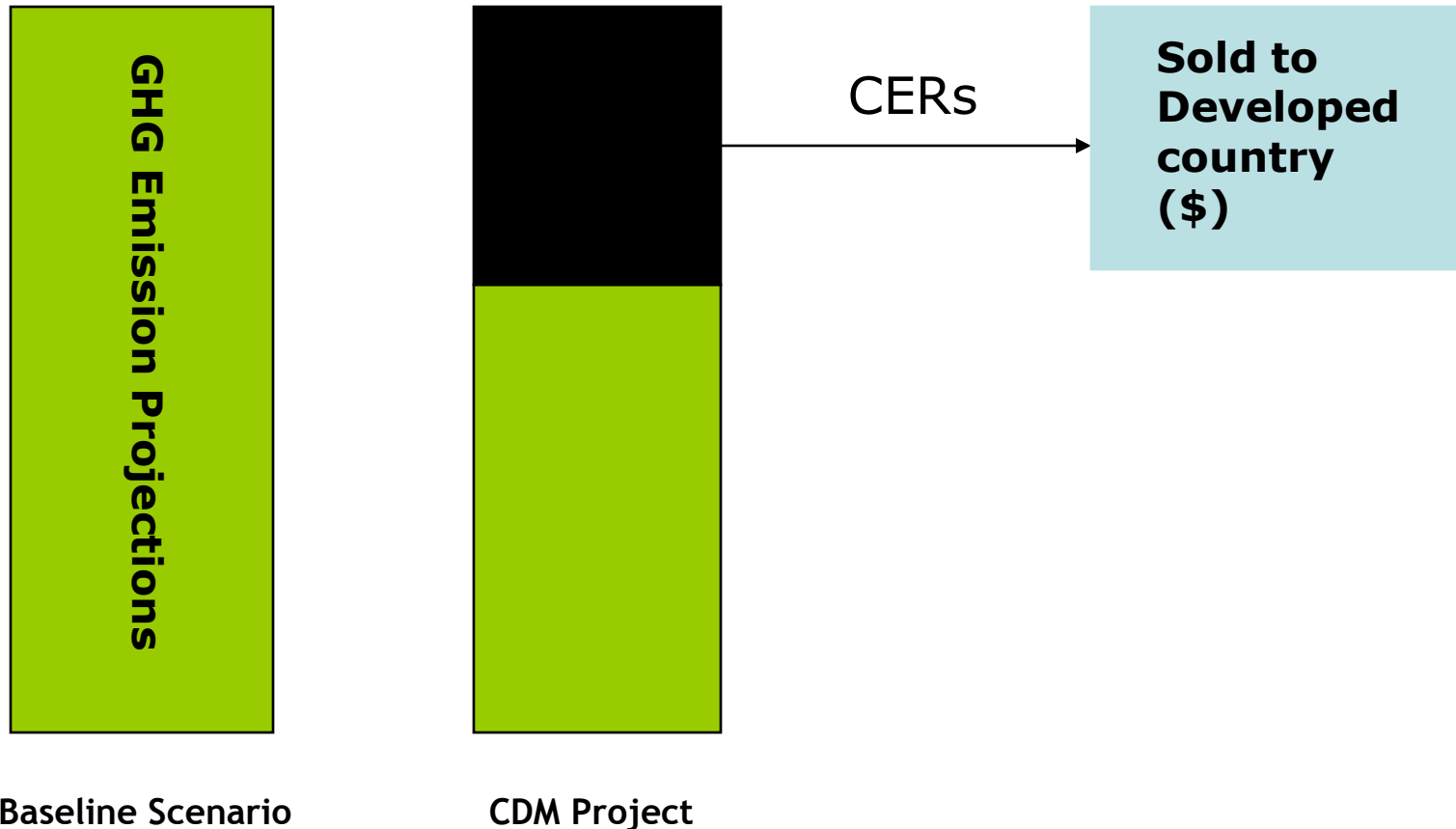
Assists developing countries in sustainable development while at the same time contributing to the ultimate objective of the Convention.

Developed countries to support project activities that reduce GHG emissions in the developing countries in return for Certified Emission Reductions (CERs)/ Carbon Credits.

The CERs generated by such project activities can be used by developed countries as credits to meet their emissions targets under the Protocol.

# CONCEPT OF CER/ CARBON CREDITS

Developing Country (host)



# AREAS ADDRESSED BY KYOTO PROTOCOL

The KPs emissions targets cover the six main GHGs:

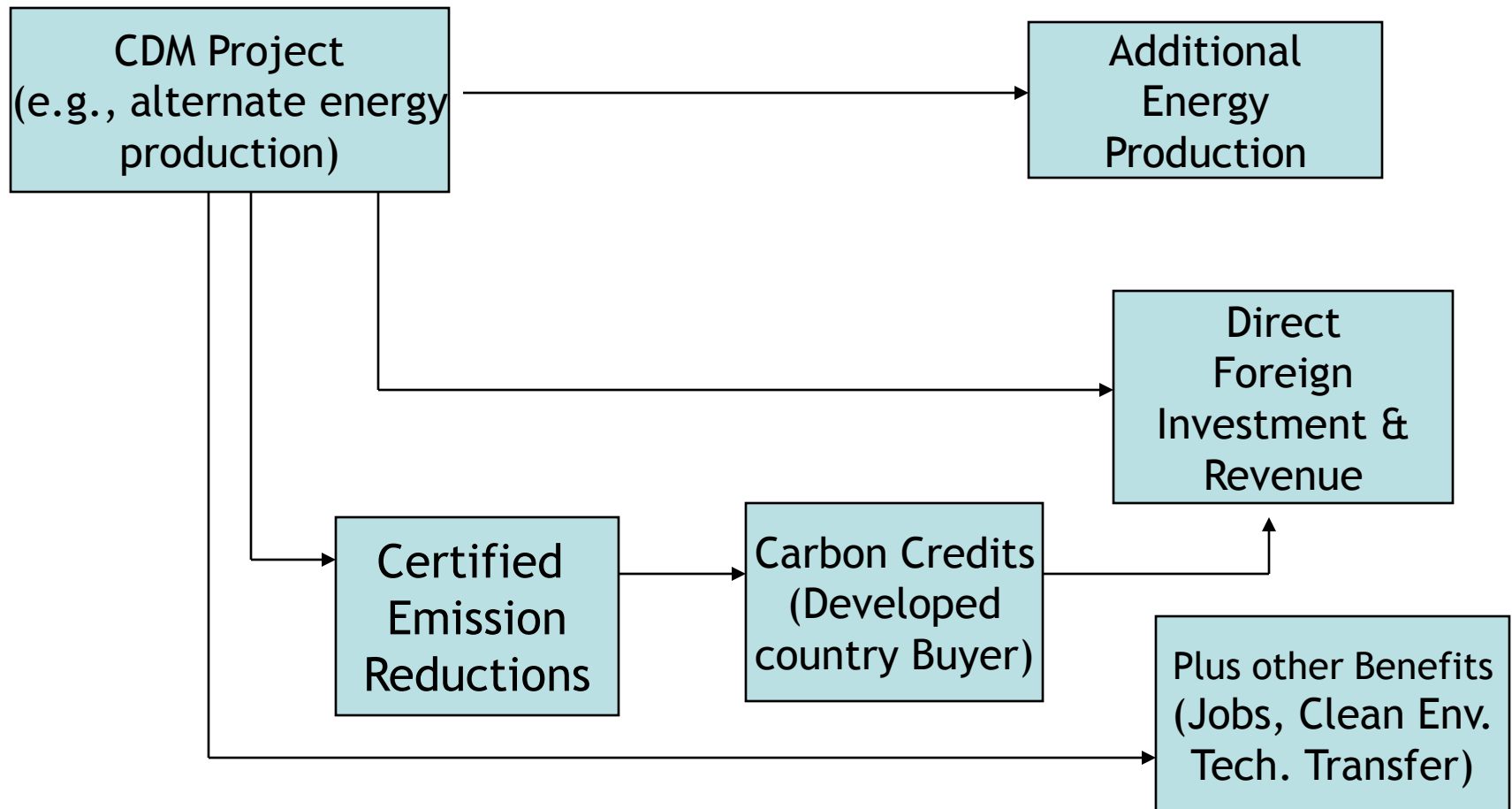
	Name	Formula	GWP (CO <sub>2</sub> eq.)
1.	Carbon- dioxide	(CO <sub>2</sub> )	1
2.	Methane	(CH <sub>4</sub> )	21
3.	Nitrous oxide	(N <sub>2</sub> O)	310
5.	Per- fluorocarbons	(PFCs)	92,00
4.	Hydro- fluorocarbons	(HFCs)	11,700
6.	Sulphur hexafluoride	(SF <sub>6</sub> )	23,900

Sinks (carbon sequestration)

# BENEFITS FROM CDM (CARBON FINANCE)

(An Example)

Benefits to Host country



# CDM INCENTIVE FOR DEVELOPED COUNTRIES

Developed countries have been subjected to legally binding emission targets.....**2008/12.**

Due to **un-localized** nature of CO<sub>2</sub>...it does not matter for environment where reduction occurs.

Costs of abatement or reduction of emissions :

Developed Countries : **U\$ 50-100/ton**

Developing Countries : **U\$ 1-10/ton**

Reductions of GHG is much **cheaper in developing countries.**

# CDM INCENTIVES FOR DEVELOPING COUNTRIES

Capitalize an **“unvalued”** commodity..... CER

**“Additional”** financing for local Sustainable Development priorities and as such has potential of **“Catalyzing” large Foreign Direct Investment (FDI) flows**

Instrument for **“appropriate” Tech. Transfer**

**Linkage** with local environmental issues – (air pollution etc.)

**Financial viability** ~ Carbon financing can increase project Internal Rate Returns (IRRs) between 0.5 to 50% (WB)

# TYPE OF CDM PROJECTS

## Unilateral, bilateral and multilateral CDM projects allowed in:

### Energy

- renewable/alternate energy,
- energy efficiency/conservation and cogeneration

### Waste Management

- landfill gas capture
- recycling

### Transportation

- alternative fuel vehicles
- mass transit systems, cleaner engines, CNG

Industrial processes (sugar, cement, fertilizer, textile)

Land, Land use and Forestry (A/F)

Agricultural and livestock practices

# PAKISTAN STATUS ON CLIMATE CHANGE INITIATIVES

The Country re-affirmed its commitment to meeting the objectives of the Rio Convention at the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002.

Pakistan also carried out a comprehensive study for assessing the impact of climate change in Pakistan through UNEP/Ministry of Environment in 1998.

Pakistan signed the UNFCCC as Non Annex- I Party in June 1994 and it became effective for Pakistan, with effect from 30<sup>th</sup> August 1994.

Pakistan has undertaken a comprehensive inventory of GHG emission sources and sinks, as well as prioritized feasible mitigating options and formulated Least Cost Greenhouse Gas Abatement Strategy (ALGAS) under the GEF/UNDP Asia completed in 1997.

# PAKISTAN STATUS

(Contd...)

Pakistan has submitted the Initial National Communication to UNFCCC in which national GHG inventory was updated and strategy for addressing climate change concerns were developed.

Pakistan initiated the process of formulation of the Second National Communication on climate change and has requested GEF for the provision of necessary resources.

A high level National Committee on Climate Change, chaired by the Prime Minister of Pakistan has been formed to review policies and monitor progress on climate change initiatives in the country.

Global Change Impact Studies Centre (GCISC) has been established for conducting research on impacts and adaptation to climate change in the country.

## PAKISTAN STATUS

(Contd...)

Pakistan adopted Kyoto Protocol in 1997 acceded to it in January 2005.

Pakistan established a Designated National Authority for CDM in Pakistan in 2005.

A Clean Development Mechanism (CDM) Cell was established in Aug. 2005.

Pakistan National Operational Strategy for CDM has been approved in February 2006.

Pakistan granted Host Country Approval to Three (03) CDM Projects. One of them got registered with CDM Executive Board.

## PAKISTAN STATUS

(Contd...)

The CDM Cell in the Ministry of Environment has further been strengthened under a Public Sector Development Programme with a total cost of Rs. 38.93 million for a period of 3 year (June 2006 to June 2009).

The Ministry of Environment has established a Climate Change Unit in 2007.

Various capacity building workshops and seminars have been conducted by the Ministry of Environment and other national organizations.

# WORLD WIDE IMPACTS OF A RISE IN SEA LEVEL

- A large part of the world's population has always lived in the low-lying coastal areas.
- The presence of fertile soil and fishing waters and ready accessibility of these areas have always held a great power of attraction over people.
- About 10% of world's population lives several ten of kilometers or less from the coast.
- Two-Third of these coastal areas has a relatively low population density.
- Developing SAARC countries are strongly dependent on the river deltas for their food production.
- These areas will be partly inundated at a sea level rise of one meter causing the water to become brackish.

# SEA LEVEL CHANGES IN THE KARACHI AREA AND CHANGES IN THE TIDAL RANGE

Karachi Tidal Station records of the past 100 years a rate of 1.1mm/yr rise in the Local Level has been estimated.

Projected levels after 100 years

Tidal State	Present Level (m)	Projected Level (m)
Lowest Astronomical Tide	-0.49	+0.11
Mean Lower Low Water	+0.97	+1.57
Mean Higher Low Water	+1.43	+2.03
Mean Sea Level	+2.04	+2.64
Mean Lower High Water	+2.65	+3.25
Mean Higher High Water	+3.38	+3.98
Highest Astronomical	+3.84	+4.44





# RECOMMENDATIONS

- Rising in mean sea level, maximum and seasonal variation more observation are required to fill up missing data and correlated it with neighboring countries and to improve resulted.
- Plantation of more saline tolerant species or strains of mangrove.
- Strict control on removal of mangroves trees for which community participation is intrinsic.
- Carrying out a topographical survey of coastal and mangrove areas to identify areas most at risk from sea level.