ISLAMIC REPUBLIC OF AFGHANISTAN
NATIONAL ENVIRONMENTAL PROTECTION AGENCY

Afghanistan Initial National Communication

To the United Nations Framework Convention on Climate Change

FOREWORD

On behalf of the Government of the Islamic Republic of Afghanistan, it gives me great pleasure to present Afghanistan's Initial National Communication to the United Nations Framework Convention on Climate Change. This fulfills our commitment under Article 12 of this convention. The communication has been prepared involving all the key stakeholders in the multi-disciplinary study teams and through consultative process. The National Environmental Protection Agency of Afghanistan has coordinated this exercise. The communication not only describes our endeavors towards addressing the challenges of the climate change but also outlines our future strategies and planned activities.

I wish to congratulate all those involved in the long process of preparing the initial national communication and specifically to the members of National Study Teams and National Climate Change Committee. The Government of the Islamic Republic of Afghanistan acknowledges the financial and technical support of GEF and UNEP for assisting us in fulfilling this national obligation. In the end, I would like to reiterate the commitment of Afghanistan to the principles of UNFCCC and fulfillment of our national obligations.

Mostapha Zaher
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National Environmental Protection Agency of the Islamic Republic of Afghanistan

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EXECUTIVE SUMMERY

Acronyms

ADB	Asian Development Bank
AHP	Analytical Hierarchy Process
ANDMA	Afghanistan National Disaster Management Authority
ANDS	Afghanistan's National Development Strategy
ANSA	Afghanistan National Standards Authority
ARTF	Afghanistan Reconstruction Trust Fund
ASY	Afghanistan Statistical Yearbook
BTU	British thermal unit
CARD-F	Comprehensive Agriculture and Rural Development - Facility
CAREC	Central Asia Regional Economic Cooperation initiative
CEC	Committee for Environmental Coordination
CH_4	Methane
CO	Carbon Monoxide
COP	Conference of Parties
CO_2	Carbon Dioxide
CP	Clean Production
CSO	Central Statistics Organization
DABM	Da Afghanistan Breshna Moassessa (the Afghan Electric Utility)
DFID	Department for International Development
DJF	December, January, February
EIA	Environmental Impact Assessment
EITI	Extractive Industries Transparency Initiative
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GIRoA	Government of Islamic Republic of Afghanistan
GWP	Global Warming Potential
HDI	Human Development Index
HFC	hydrofluorocarbons
ICE	Inter-Ministerial Commission for Energy
ICIMOD	International Centre for Integrated Mountain Development
IDA	International Development Assistance
INC	Initial National Communication
IOD	Indian Ocean Dipole
IPCC	Inter Governmental Panel on Climate Change
ISAF	International Security Assistance Force
JJA	June, July, August
kWh	Kilowatt hour
LDCF	Least Developed Country Fund
LPG	Liquid Petroleum Gas
MAIL	Ministry of Agriculture, Irrigation and Livestock
MAM	March April May
MCA	Multi Criteria Analysis
MDG	Millennium Development Goals
MEA	Multilateral Environmental Agreements

MEW	Ministry of Energy and Water
MHP	Micro Hydro Plants
MPH	Ministry of Public Health
MRRD	Ministry of Rehabilitation and Rural Development
MW	Mega Watt
N_2O	Nitrous Oxide
NAPA	National Adaptation Program of Action
NATO	North Atlantic Treaty Organization
NBSAP	National Biodiversity Strategy and Action Plan
NCCC	National Climate Change Committee
NCSA	National Capacity Self-Assessment
NCSP	National Communication Support Program
NDMC	National Disaster Management Commission
NEPA	National Environmental Protection Agency
NERAP	National Emergency Rural Access Project
NEAC	National Environmental Advisory Council
NGO	Non-Governmental Organization
NMVOC	non-methane volatile organic compounds
NO_X	Nitrogen Oxides
NPA	National Protected Area
NREL	National Renewable Energy Laboratory
NRVA	National Risk and Vulnerability Assessment
NST	National Study Team
PFC	perfluorocarbons
PIF	Project Identification Form
PMO	Project Management Office
PV	Photovoltaic
REDD	Reducing Emissions from Deforestation and Forest Degradation
RIMES	Regional Integrated Multi-hazard Early Warning System
SAARC	South Asian Association of Regional Cooperation
SEI	Stockholm Environment Institute
SHS	Solar Home System
SME	Small and Medium Enterprises
SNAP	Strategic National Action Plan
SOE	State of Environment
SON	September October November
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNCBD	United Nations Convention on Bio-diversity
UNCCD	United Nations Convention to Combat Desertification
USAID	United States Agency of International Development
V&A	Vulnerability and Assessment
WB	World Bank
WCS	World Conservation Society
WHO	World Health Organization
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

NATIONAL CIRCUMSTANCES

Afghanistan is a landlocked, mountainous and very dry country in South and Central Asia with an area of 647,500 square kilometers and population of about 26 million. It is bordered by Pakistan in the south and east, Iran in the west, Turkmenistan, Uzbekistan and Tajikistan in the north, and the People's Republic of China in the far northeast. Afghanistan has an arid and semi-arid continental climate with cold winters and hot summers. The climate varies substantially from one region to another due to dramatic changes in topography. The wet season generally runs from winter through early spring, but the country on the whole is dry, falling within the Desert or Desert Steppe climate classification.

In theory, Afghanistan is not a water-scarce country, and possesses an estimated overall surface water availability of 2,775 cubic meters per capita per year. Nonetheless, it remains burdened by many constraints and the relatively significant amounts of water available in the country hide important variations within and across river and sub-river basins. The distribution of the available water does not always correspond with the location of the irrigable land and the settled populations. And the availability of water in Afghanistan is characterized by considerable intra- and inter-annual variations. Further the country also has the lowest water storage capacity in the region.

Degradation of environmental quality and loss of resources presents one of the big challenges in the development of Afghanistan. Between 1990 and 2000, Afghanistan lost an average of 29,400 hectares of forest per year, to an average annual deforestation rate of 2.25% which further increased to 2.92% per annum between 2000 t0 2005. Forest now occupies less than 2% of county's total area. Rangelands are being converted to rain-fed wheat production, exposing vast areas to wind and soil erosion.

Afghanistan is reported to have a significant mineral endowment (upwards of US$1 trillion), but much of that wealth is locked in the ground pending development of supporting infrastructure that will link mines to global markets. In recent years, the most significant development in the Afghanistan mineral sector has been the Government's successful tender of the Aynak copper deposit, the Hajigak iron ore deposit (considered the largest in Asia), as well as three petroleum blocks. In addition to copper and iron ore, Afghanistan has extensive oil and natural gas, limestone, and other mineral resources; as well as significant gold and gemstone deposits. On March 16, 2009 GIRoA endorsed the principles of the Extractive Industries Transparency Initiative (EITI), signaling its commitment to transparent and accountable sector governance.

Reliable energy data for Afghanistan is about as scarce as energy in Afghanistan. In 2005, it is estimated that 20 percent of the population have access to public power (grid-supplied) on certain days for a limited number of hours. Nationally seven grids distribute power, with supply coming from domestic hydro generation; imported power and thermal generation. Isolated diesel generation has dramatically increased since 2002 and will continue to play a large role in power supplies. Rural populations use local waste, solar panels, batteries and small wood, coal, kerosene supplies for basic cooking and heat. Renewable energy offers the greatest hope for Afghanistan in general and rural energy in particular. Hydro, both large and small, represents significant untapped resources, and it is estimated that Afghanistan has 18,400 MW of untapped hydro potential in the country. And in addition, it has excellent potential for wind energy (total estimated capacity of 158,100 MW) and solar energy (solar radiation averages about 6.5 kWh per square meter per day and the skies are sunny about 300 days a year). Besides these,

biomass/biogas and geothermal energy are other important sources of renewable energy for rural communities.

In terms of human development Afghanistan is ranked 155th among 169 United Nations member states, which reveals the profound difficulty the country faces in seeking to advance the well-being of its citizens. A large percentage of the population (about 36%) is living with extreme poverty and is the most vulnerable to the climatic hazards. The under-5 mortality rate decreased from 257 per 1,000 live births in 2000 to 161 in 2007/08, the maternal mortality rate at 1,600 deaths per 100,000 live births- is the second highest in the world. However, in terms of educational opportunities in Afghanistan indicates that, since 2001, primary and secondary enrolment rates-a critical HDI indicator-have expanded considerably, and more children than ever are attending school.

In the economic front, Gross Domestic Product (GDP) has increased significantly since 2002, on average in double digits, though is still volatile due to a heavy dependence on unreliable rain-fed agricultural production. In recent years, the service sector continues to lead the contribution in the GDP with 48% in 2010/11, the most dynamic subsectors being communication, finance and insurance, and transport. At 28 percent of gross national income, agriculture is still a key component of Afghan livelihoods and economic growth providing direct and indirect employment to 85 percent of the Afghan population. Although the industry sector's contribution to the GDP is around 20% at present, with the major mining industries under development it will play a major role in the economic development of Afghanistan in coming years.

With double digit growth in recent years, and efforts on rehabilitation and construction of the road networks both rural and urban, there have been significant rise in the number of vehicles registered in Afghanistan, reaching more than one million in 2010/11 from just 380,000 in 2004/05. Unlike in many developing countries, 69% of the total vehicle fleet in Afghanistan comprises passenger cars. Similarly over the years air traffic has also increased significantly, and Afghanistan has initiated rail transport completing the construction of 75 km of railway line in recent years.

In parallel to the urban development, the problem of pollution of air, water, waste management, and noise pollution is growing in major cities. High level of particulates in the air of Kabul and many other big cities are a major concern. Contamination of water bodies and insufficient infrastructure for waste collection and treatment are other main urban environmental problems.

The Islamic Republic of Afghanistan is a presidential system. The legislative authority is a bicameral National Assembly with a House of People (Wolesi Jirga) and a House of Elders (Meshrano Jirga). The legislative process requires that any law be approved by both Houses of the National Assembly before being endorsed by the President. In 2007, both houses of the parliament passed the Environment Law, which provides the basis for environmental governance in Afghanistan. The National Environmental Protection Agency (NEPA), as an independent institutional entity, is responsible for coordinating and monitoring conservation and rehabilitation of the environment, and the implementation of the law. NEPA has established many coordinating mechanism involving different line ministries, academia and nongovernmental organizations to promote environmentally sustainable development in Afghanistan.

GREEN HOUSE GAS INVENTORY

The greenhouse gas inventory of Afghanistan was developed as per methods and procedures provided in revised 1996 IPCC Guidelines for the fiscal year 2004/05 of Afghanistan and covers five key sectors: energy; industrial processes; agriculture; land use change and forestry; and waste.

The total emissions for 2005 were 28759 CO2 equivalents with no net removals. In the total emissions of CO_2 equivalents, the agriculture sector contributed 52.6% followed by land use change and forestry 32.8%, energy sector 13.1%, industrial processes 1%, and the waste merely 0.5%. The contribution of CO_2, CH_4 and N_2O in the total CO_2 equivalent emissions is 43.7%, 35.6% and 20.7% respectively.
Of the total CO_2 emissions of 12563 Gg in Afghanistan, the energy sector is responsible for only 2910 Gg in which the transport sector contributed almost 58% followed by electricity generation (17%), residential (13%), other energy industries (5%), agriculture (4%) and commercial sector (3%). Emissions of CO_2 of 312.15 Gg were from industrial processes, mainly clinker production with 312.13 Gg and the chemical industry only 0.0254 Gg. The major contributor of CO_2 emissions is land use change and forestry with9341.13 Gg of $CO_2$of which 8888.88 Gg $CO_2$was the result of forest and grassland conversion, and 452.25 Gg CO_2 from changes in forest and other woody biomass stocks.

For 2005, the total methane (CH_4) emissions amounted to 487.8 Gg. The agriculture sector is the main contributor of methane emissions contributing almost 91%. The second largest contributor is energy with almost 7% and the rest coming from waste management at about 2%. Of the total emissions of methane of 442.69 Gg from agriculture sector, majority came from livestock- 309.03 Gg from enteric fermentation, 99.59 Gg from manure management, and rice cultivation contributing 24 Gg. Of the methane emissions 33 Gg from energy sector came from the fuel consumption in the residential sector (26.06 Gg), and commercial and institutions (6.40 Gg). Waste management contributed 6.21 Gg, and under the LUCF, forest and grassland conversion resulted was 3.84 Gg. Fugitive emission of CH_4 is only 2.04 Gg.

Total nitrous oxide emissions were 19.20 Gg in 2005. The main contributor was the agricultural sector; with18.75 Gg (97.7% of the total nitrous oxide emissions in 2005) followed by energy 0.42 Gg and a very small quantity of 0.03 Gg from LUCF.The GHG inventory of Afghanistan also includes the emissions of NOx- 65.28 Gg, CO-1110.25 Gg, NMVOC-334.3 Gg, SO_2-13.86 Gg, and HFC-0.05 Gg.

VULNERABILITY ASSESSMENT AND ADAPTATION

Current Climate Trends (1960-2008)
Mean annual temperature has increased by 0.6°C since 1960, at an average rate of around 0.13°C per decade. The rate of increase is most rapid in SON, with increases at an average rate of 0.29°C per decade, slower in DJF at a rate 0.11°C per decade. The frequency of hot days and hot nights has increased every season since 1960; similarly the frequency of cold days and nights, annually, has decreased since 1960.

Mean rainfall over Afghanistan has decreased slightly (an average rate of 0.5mm per month (or 2%) per decade,) since 1960. This is mainly due to decreases of around 2.7mm per month (6.6%) per decade in MAM rainfall, but is offset by small increases in JJA and SON rainfall. The proportion of rainfall that occurs in heavy events has not changed with any consistent trend since 1960. The observed maximum 1- and 5-day rainfalls generally show small decreases in MAM, but increase slightly in other seasons.

Climate Projections (2008-2090):

The mean annual temperature is projected to increase by 1.4 to 4.0°C by the 2060s, and 2.0 to 6.2 degrees by the 2090s. The range of projections by 2090 under any one emissions scenario is around 1.5 to 2.5°C. The projected rate of warming is most rapid in spring and summer and relatively uniform across the countries in regions. All projections indicate that the days and nights that are considered ‘hot’ days and hot nights in current climate, will increase substantially particularly in summer months.

In the short term, average rainfall is projected to show a small increase, although by little more than about 10-20mm. Mean annual rainfall changes in the 2090s show conditions are generally drier (-40 mm high, -20 mm medium, -10 mm low) over much of Afghanistan. Much of the drying is due to decreases in spring rainfall (MAM). Winters are expected to be significantly drier in the South. Projections of mean annual rainfall from different models are broadly consistent in indicating decreases.

Impacts of Climate Change in Afghanistan:

Climate change in Afghanistan will have severe consequences for socio-economic development. The vulnerability assessment of a potential seven different sectors revealed that water resources is the most vulnerable sector followed by forestry and rangeland, agriculture, health, biodiversity, energy and waste.

Water Resources: Climate change is leading to scarcer water resources in Afghanistan. Development efforts are struggling to keep up with the challenges. As mountains are the major sources of water, widespread mass losses from glaciers and reductions in snow cover over recent decades are projected to accelerate throughout the twenty-first century, reducing water supplies and hydropower potential as well as changing the seasonality of flows in basins supplied by melt-water from snow and ice. Further, more rapid and earlier spring snow melt, creates risks of flash flooding. Any efforts by Afghanistan to increase its share of water use in the region may have additional regional security or diplomatic implications.

Agriculture: Drier conditions are predicted throughout Afghanistan, as well as annual temperature increase by between 2.8°C and 5°C. Both scenarios will have consequences for farmers relying exclusively on rain-fed agriculture, particularly farmers in the northern and western river basins, where more than 60 percent of the rain-fed land is located. Increased soil loss, reduced river flow from earlier snow melt, and less frequent rain during peak cultivation seasons will impact upon agricultural productivity and crop choice availability. Livestock numbers may be reduced by up to 50% during the periods of drought due to outward migration and starvation, reduced availability of animal feed, less funds available for livestock husbandry. By 2060, large parts of the agricultural economy will become marginal without significant investment in water management and irrigation.

Forest, Rangeland and Biodiversity: Climate change can impact enormously on forests and forest resources in Afghanistan with temperature changes. Warmer winters would imply reduced snow cover and less carryover of water to the growing season, leading to drought-induced forest decline. A combination of climate change with deforestation, land use change, habitat degradation and fragmentation presents a significant threat to biodiversity. Climate change can affect biodiversity either directly, by changing the physiological responses of species, or indirectly, by changing the relationships between species. This assessment, however, employs a general approach with no specification to clarify the impact of climate change to Afghanistan's biodiversity, demanding more in-depth assessment in future.

Livelihood and Social Protection: Eradicating extreme hunger and poverty by 2020 is a GIRoA goal. The severity of climate change impacts depends not only on changes in temperature and precipitation patterns but on a host of other factors related to the various dimensions of poverty. According to the latest estimate, 36% of Afghanistan population lives below the poverty line, and are highly vulnerable to the climate risks as they are the most exposed with least means to adapt. A significant percentage of people (almost 20%) dependent on the agriculture economy live slightly above the poverty line and are extremely vulnerable to climate shocks so eradicating extreme hunger and poverty will be more challenging, widening the economic gap between rich and poor. Food security issues may be pronounced leading to malnutrition, high dependence on food aid, and reduced dietary diversity and consumption.

Human Health: Climate change will continue to impact upon the spread of food, water, and vector-borne diseases in Afghanistan. Climate change will undermine Afghanistan's ability to achieve its goals in reducing malaria morbidity and mortality by 50% and 80% within the next 5 years. Women and children, mainly because they are not involved in paid income are also highly vulnerable to the climatic shocks.

Energy: Hydro power is a major source of energy for Afghanistan, and is particularly sensitive to the impacts of climate change. Changes in precipitation, accelerated mass losses from glaciers and reductions in snow cover throughout the twenty-first century, siltation, increased demand of water for irrigation and drinking water purposes (upstream), reducing water supplies, changing the seasonality of flows in basins will all have direct impact on the availability of water for hydropower generation. Small hydro powers (HPP) and run-of-the-river types are particularly vulnerable as most are sensitive to variations in water flows. The predicted stronger flow peaks in winter and less flow in summer, could lead to forced closure of HPPs during both periods. In terms of large thermal power plant and transmission infrastructure, the main threat arises from damage caused by extreme climatic events, such as flash floods or storms.

National Response and Adaptation

The Afghanistan National Development Strategy (ANDS) with its Vision 2020 aims for environmentally sustainable development. Although, ANDS does not emphasize "climate change", various sectoral programs/projects included in ANDS and more recently in the form of National Priority Programs help build national capacity to adapt to the impacts of climate change in Afghanistan. Mainstreaming climate change mitigation and adaptation in the national and sectoral policies plans and programs is urgent. Existing institutional and coordinating mechanisms and some environment and disaster related policy and legal frameworks are supportive but need to be reviewed from climate change perspectives.

Afghanistan as a LDC, has prepared its National Adaption Program of Action (NAPA) though a nationally driven consultative process submitted to UNFCCC in 2009. The NAPA process identified 51 different actions in seven different sectors as the potential adaption projects and form them prioritized 11 of them for immediate implementation. The prioritized adaptation actions are: Improved Water Management and Use Efficiency; Land and Water Management at Watershed Level; Development of Horticulture; Improved Terracing, Agro-forestry and Agro-silvo Pastoral System; Agriculture Research; Rangeland Management; Development of Disaster Management Strategy; Improved Food Security; Improved Livestock Production; Creation of Off Farm Employment; and Climate Related Research and Early Warning System. All these projects need to be implemented with priority and GIRoA is seeking financial and technical support from bilateral and multilateral partners and the GEF.

MEASURES TO MITIGATE IMPACTS OF CLIMATE CHANGE

At present, GIRoA does not have a National Strategy on Climate Change including the mitigation strategy. Neither has it done any detailed mitigation assessment of various opportunities available. In the absence of reliable data there are no models developed for mitigation assessment. Efforts have been made in projection of key sectors and existing policies and measures supportive to achieve the goal of sustainable development. There has been listing of the prevailing barriers and available opportunities to promote environmentally sound technologies and knowledge transfer in Afghanistan.

If the current population growth rate as well as GDP growth rate continues, the population of Afghanistan will reach 39 million by 2030 from the current population of 26 million. The GDP will have a significant growth reaching to US $ 100 billion by 2030 from 16 billion in 2010. The per capita GDP is expected to be around US$ 2564 by that time. The electricity demand is expected to reach 77800 million kWh from the 1467 million kWh in 2010. With the development of two major mining industries (copper and iron

ore) and exploration of oil and natural gas along with supportive industries, the industrial sector is expected to drive the economy of Afghanistan in coming decades. The current growth of transport sector both road and air, will increase demand on diesel and gasoline from 1.2 million tons in 2010 to 12 million tons in 2030, and aviation fuel from 1.0 million tons in 2010 to 22 million tons in 2030. Parallel with the economic development and changing lifestyle of people, waste volume generated in cities is projected to reach 3.1 million tons annually by 2030, compared to 1.4 million tons in 2010.Between 1990 and 2005, Afghanistan lost 33.8% of its forest cover, or around 442,000 hectares. If this trend continues by 2030 Afghanistan will further lose a further 500,000 hectares of forest. In the agriculture sector, GIRoA is giving high priority to rehabilitation and construction of irrigation infrastructure, there will be significant rise in the irrigated land and also the livestock population in coming years to meet the national demand.

As mentioned above, GIRoA does not have a national climate change policy or strategy, but the energy sector strategy of ANDS promotes a low carbon energy sector development with maximum focus on hydropower development and promotion of alternative energy sources for meeting the national demand of energy. Rail transport and programs to expand rail network to promote mass transport system are starting. GIRoA is now adding Environmental Conservation as the Nationally Prioritized Programs with focus on forest and rangeland management and renewable energy development with a target of regenerating 15% of degraded forest and rangeland area through implementation of the programs. A National Waste Management Policy and draft regulations to support policy implementation, Clean Air Regulation to deal with the air pollution problem, and programs to strengthen the EIA procedures will promote environmentally sound technologies (ESTs) in industries, waste management, and transport sector. Afghanistan will review its national and sectoral developmental policies to integrate climate change adaptation and mitigation as part of its 2013-2016 LDCF Adaptation Project and is in the process of ratifying the Kyoto Protocol to get benefits from the CDM and REDD+ mechanisms under the UNFCCC.

SYSTEMATIC OBSERVATION AND RESEARCH

Before 1979, Afghanistan had the most advanced meteorological monitoring in the region. This was subsequently rendered non-functional or destroyed due to years of conflict and war. Since 2001, there has been some rehabilitation of non-functional weather stations and installation of new stations. The Afghanistan Meteorological Authority (earlier Department of Meteorology) is the lead agency in collecting, processing and reporting of weather data including temperature, precipitation and weather forecasts. Besides AMA, an AgroMet Program is assisting the GIRoA in collecting and analyzing agricultural and meteorological data as it relates to crop production, irrigation, water supply, energy, and aviation. With support from International Civil Aviation Organization (ICAO), an Aviation (automated) Weather Observing System (AWOS) is currently being installed at Kabul International Airport which will complement the MESSIR System under the Government of Afghanistan. Ministry of Energy and Water which currently has 105 total hydrological monitoring stations covering all the five river basins.

There are very limited climatic research works at the national level on Afghanistan. Recently Afghanistan has been involved in some publications released by ICIMOD on research works for the Hindu-Kush-Himalayan region on the impact of climate change on the glaciers, and snow cover, at regional scale. The World Meteorological Organization (WMO), Government of India, and DFID has agreed to support the Afghanistan Meteorological Authority in more systematic observation of meteorological parameters, analysis, forecasting and institutional capacities to support and carry out research works.

MAIL is prioritizing agricultural research works and under its organization a Department of Agriculture Research Institute with some research institutes in some provinces has been set up. It is supported by

many donors such as AgroMet, USDA, USAID, FAO, DFID, CIMMYT, AUSAID, FRANCE, and ICARDA in conducting agricultural research works and national capacity building initiatives.

The National Renewable Energy Laboratory (NREL) of the United States of America had done research on wind energy potentials, solar energy potentials and assessments of the biomass in Afghanistan and their potential utilization. Published results of the research works have been very encouraging showing huge potential of renewable energy development in Afghanistan.

OTHER INFORMATION

TECHNOLOGY TRANSFER

At present, Afghanistan does not have institutional arrangements for information and know-how on environmentally sound technologies available to private companies or individuals. However, many donor agencies, the World Bank, USAID, GIZ, and UN agencies are providing technical and financial support in the development of micro-hydro, solar systems, and bio-gas plants. Some INGOs are promoting ICS (improved cooking stoves) in villages to reduce the pressure on fuel and for better indoor air quality.

In terms of an enabling environment for technology transfer, national and sectoral policies have objectives to promote cleaner and environmental sound technologies. In order to promote renewable energy, the Energy Ministry is working on the draft policy. Existing projects such as the National Solidarity Program (NSP) and Energy for Rural Development Afghanistan (ERDA) under the MRRD, and the Afghanistan Clean Energy Project have made good demonstrations of micro-hydro, solar energy system, wind energy and bio-gas plants. Communities contribute 10% in kind to the effort.

Key weaknesses for the promotion of technology transfer is lack of human resources in the country, poor coordination amongst the institutions, low capacity of the coordination committees formed and the absence of institutional arrangements to collect and disseminate ESTs. Poor enforcement of pollution control provisions, traditional tax and customs without incentives for cleaner technologies, and no networking with regional institutions are key barriers for smooth technology transfer. Afghanistan has not been able to benefits from CDM and REDD+ under the UNFCCC this far.

Education, Training and Public Awareness

The UNFCCC emphasizes stakeholders' participation in climate change activities and processes. The Environmental Law of Afghanistan provides the general public rights to access environmental information, participate in environmental decisions-making, and access to environmental justice. This Law makes Nepenthe legally responsible institution to develop and implement plans for environmental training, environmental education and environmental awareness-raising in cooperation with relevant ministries and public bodies.

In preparing the INC report, a National Climate Change Committee was created involving all key stakeholders to guide the INC procedures. Involvement of stakeholders in the inception workshop, different study teams and participation in the consultation meetings on discussion on thematic issues of INC has helped to initiate a number of initiatives to promote education and awareness about climate change related issues in Afghanistan. NEPA with technical support from UNEP has developed a draft Environmental Education, Training and Awareness Strategy for Afghanistan. A separate Department of

Environmental Protection and Disaster Management in Kabul University with Strategic Development Plan of the department and initiation of private universities to run bachelor's and master's program on environmental engineering fields will generate more capacity in Afghanistan in coming years.

There has been a significant rise of mass media in Afghanistan with a lot of interest in environmental issues. Many donor supported programs have components on education and awareness. This has helped to raise the level of understanding on environmental issues including climate change. However, more focus is needed to include climate change from school level to higher education curriculum. Universities need support on special courses for climate change and research. Climate mainstreaming and developing national and sectoral policies is vital. Demonstration of community based adaptation and renewable energy projects; appropriate trainings and materials to mass media; and training to religious leaders on climate change issues all need to be prioritized.

CONSTRAINTS AND GAPS, AND RELATED FINANCIAL TECHNICAL AND CAPACITY NEEDS

In the process of developing INC of Afghanistan, Afghanistan has identified constraints and gaps associated with the preparation of the initial national communication as well as the needs to develop national capacity for the improvement of national communications on a continuous basis. As such a list of projects are identified for improving the quality of national GHG inventories, vulnerability assessment of various sectors at national and regional level and adaptation measures, assessment of mitigation potential with detailed cost-benefit analysis including exploring the opportunities for technology transfer, and enhancing the national capacities in doing climate change related research works with a systematic observation system in place, and making citizen more informed about the likely impacts of climate change and prepare with appropriate adaptations.

Significant work needs to be undertaken to ensure that capacity is built in all sector of society to deal with climate change related issues and to utilize the opportunities provided by UNFCCC including investment opportunities through CDM and REDD+. Priority lists of projects identified in the process aim to enhance the future communication system of Afghanistan and Afghanistan needs financial and technical support for the implementation.

1 NATIONAL CIRCUMSTANCES

1.1 LOCATION AND HISTORY

Afghanistan is a landlocked country in South and Central Asia (See Figure 1). With a population of about 26 million, it has an area of 647,500 km², making it the 42nd most populous and 41st largest nation in the world. It is bordered by Pakistan in the south and east, Iran in the west, Turkmenistan, Uzbekistan and Tajikistan in the north, and the People's Republic of China in the far northeast.

FIGURE 1. REGIONAL LOCATION MAP

The territory that now forms Afghanistan has been an ancient focal point of the Silk Road and human migration. Archaeologists have found evidence of human habitation from as far back as 50,000 BC. Urban civilization may have begun in the area as early as 3,000 to 2,000 BC. The country sits at an important geostrategic location that connects the Middle East with Central Asia and the Indian subcontinent, which has been home to various peoples through the ages. The land has witnessed many military conquests since antiquity, notably by Alexander the Great, Chandragupta Maurya, and Genghis Khan. It has also served as a source from which local dynasties such as the Greco-Bactrians, Kushans, Saffarids, Ghaznavids, Ghorids, Timurids, Mughals and many others have established empires of their own. The political history of modern Afghanistan began in the 18th century, when the Hotaki dynasty rose to power in Kandahar in 1709 followed by Ahmad Shah Durrani's rise to power in 1747. The capital of Afghanistan was shifted in 1776 from Kandahar to Kabul and part of the Afghan Empire was ceded to neighboring empires by 1893. In the late 19th century, Afghanistan became a buffer state in the "Great Game" between the British and Russian empires. On August 19, 1919, following the third Anglo-Afghan war and the signing of the Treaty of Rawalpindi, the nation regained control over its foreign policy from the British. Since the late 1970s, Afghanistan has experienced a continuous state of war, with major occupations in the form of the 1979 Soviet war, the Taliban era in the late 1990s and the October 2001 US-led military operations that overthrew the Taliban government. In December 2001, the United Nations Security Council authorized the creation of an International Security Assistance Force (ISAF) to help maintain security and assist the administration in Afghanistan. (*http://www.reegle.info/countries/afghanistan-energy-profile/AF*)

1.2 GEOLOGY

Afghanistan is split east to west by the Hindu Kush mountain range, rising in the east to heights of Nowshak at 24,000 ft (7,315 m). Most of the country is covered by high snow-capped mountains (some 63 per cent is mountainous), and traversed by deep valleys. More than a quarter (27 per cent) lies above 2,500 m. the rugged Hindu Kush range, about 456 000 square kilometers, forming central core from where ridges fan out to the west and south, with the Paropamisus mountains extending westwards to the border with Iran. The Hindu Kush area in Northeast Afghanistan contains the high-altitude Wakhan Corridor, where the Pamir and Karakoram mountains meet. This corridor extends as a narrow strip of land to a short border with China, separating Tajikistan from Pakistan. The most extensive flatlands are located in the southwest of the country, centered around the internal drainage basin of the Helmand River, and in the north of the country, between the northern foothills of the Hindu Kush and the Amu Darya (Oxus) River (here marking the border with Tajikistan and Uzbekistan). Both regions, the southwest in particular, include large areas of sandy desert.

Afghanistan has some of the most complex and varied geology in the world. The oldest rocks are Archean and they are succeeded by rocks from the Proterozoic and every Phanerozoic system up to the present day. The country also has a long and complicated tectonic history, partly related to its position at the western end of the Himalaya. This diverse geological foundation has resulted in a significant mineral heritage with over 1400 mineral occurrences recorded to date. Historical mining concentrated mostly on precious stone production, with some of the oldest known mines in the world believed to have been established in Afghanistan to produce lapis lazuli for the Egyptian Pharaohs. More recent exploration in the 1960s and 70s resulted in the discovery of significant resources of metallic minerals, including copper, iron and gold, and non-metallic minerals, including halite, talc and mica. The bedrock geology of Afghanistan can be thought of as a jigsaw of crustal blocks separated by fault zones, each with a different geological history and mineral prospectively. This jigsaw has been put together by a series of tectonic events dating from the Jurassic. (Afghanistan Geological Survey, Ministry of Mines, taken 14-11-2011) (http://www.bgs.ac.uk/AfghanMinerals/geology.htm)

1.3 CLIMATE

Afghanistan is a mountainous and very dry country located in the arid sub-tropics at 29-37° north of the equator. Afghanistan has an arid and semi-arid continental climate with cold winters and hot summers. The climate varies substantially from one region to another due to dramatic changes in topography. The wet season generally runs from winter through early spring, but the country on the whole is dry, falling within the Desert or Desert Steppe climate classification. The snow season averages October-April in the mountains and varies considerably with elevation with very little snow falling in the lowland deserts of the southwest. The lowland plains in the south of Afghanistan experience extreme seasonal variations in temperature, with average summer (JJA) temperatures exceeding 33°C and mean winter (DJF) temperatures of around 10°C. Much of the country is at very high altitude and experiences much lower temperatures all year round, with average summer not exceeding 15°C, and winter temperatures below zero in the highest regions (*NAP, and UNDP Climate Change Country Profile-Afghanistan*).

The arid climate of Afghanistan is characterized by large areas with little or no precipitation, but the rainfall that does occur falls primarily as snow on high mountains from winter storms of Mediterranean origin between November and April with peaks in February/March. The Asian summer monsoon system tends to suppress rainfall over Afghanistan. Rainfall in the more arid lowlands is rare, and can be very unpredictable. Snowfall is reported as having become more variable. The east of the country lies near the margin of the monsoon system affecting the Indian subcontinent. Here, parts of the eastern provinces,

including Kunar, Nuristan, Laghman, and Nangarhar, have up to 1200 mm of rainfall in summer (roughly five times the national average). Afghanistan is currently in the grips of the most severe drought in living memory. The period 1998 to 2005/6 in Afghanistan marked the longest and most severe drought in Afghanistan's known climatic history. According to the EU Emergency Humanitarian Aid Division, in general in Afghanistan, based on historical observation, regular cycles of around 15 years are observed, during which one would expect 2-3 years of drought conditions. In recent years, however, there has been a marked tendency for this drought cycle to occur more frequently than the model predicts, and since 1960, the country has experienced drought in 1963-64, 1966-67, 1970-72 and 1998-2006.

On the intermountain plateaus the winds do not blow very strongly, but in the Sistan Basin severe blizzards occur during the winter, generally December through February. In the western and southern regions a northerly wind, known as the "wind of 120 days", blows during the summer months from June to September. This wind is usually accompanied by intense heat, drought and sand storms, bringing hardship to the inhabitants of the desert and steppe lands. Dust and whirlwinds frequently occur during the summer months on the flats in the southern part of the country. Starting midday or early afternoon, these "dust winds" advance at velocities ranging between 97 and 177 kilometers per hour, raising high clouds of dust (*NAPA*).

1.4 FOREST, RANGELAND AND BIODIVERSITY

Afghanistan is geographically and ecologically diverse with four broad eco-regions, namely: i) temperate coniferous forests in the east; ii) temperate grasslands, savannas and shrub-lands with minor occurrence in the northern region; iii) montane grasslands and shrub-lands in the northern, southern and western parts of the mountainous regions; and iv) deserts and xeric shrub-lands in the southwest (*UNEP2008: Biodiversity Profile of Afghanistan*)

A few centuries ago deciduous and evergreen forests covered five per cent of Afghanistan's current land area, including one million hectares of oak and two million hectares of pine and cedar growing mostly in the eastern part of the country. Open woodland dominated by pistachios, almonds and junipers occupied a third of the land area. Today most of the original forests have gone. By the middle of the 20th century, the total forest cover of Afghanistan was estimated at 3.1–3.4 million hectares. Forest now occupies less than 1.0–1.3 million hectares (2% of county's total area), with just 0.5 million hectares of forests with 10 per cent crown density, including 0.05 million hectares with 50 per cent crown density. The forest area declined at the rate of 2.92 percent a year from 2000 to 2005 (equal to annual removal and conversion of 29,600 hectares of forestland) (SOE 2008). The largest areas of forest are located in the eastern provinces of Nuristan, Kunar and Nangarhar. Remote sensing with satellite analysis of these provinces in 1977 and 2002 revealed forest cover has been reduced by more than 50 per cent.

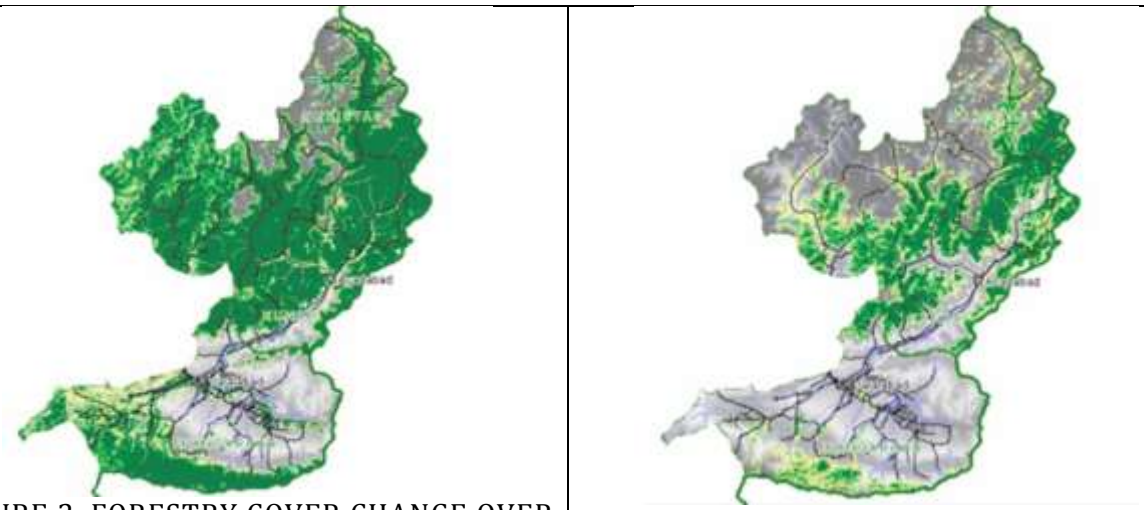


FIGURE 2. FORESTRY COVER CHANGE OVER 30 YEARS

1977	2002

At present the rangelands of Afghanistan occupy about 30 million hectares, representing roughly 45 per cent of the country's territory. However large areas which are considered 'barren land' or 'waste land' are also used for grazing, particularly in winter. The total grazeable area is therefore much larger, estimated at 70–85 per cent of the total land area, providing habitat and forage for nearly 35 million livestock as well as numerous wild animals. Indirectly rangelands have significant export potential and generate income for the rural population via livestock sub-products carpets and rugs, wool, and medicinal plants (Ferrula, Bunicum, Rosa, etc). Regrettably the country's many rangelands are in poor condition, with overgrazing a common problem, while competition between farmers for the use of scarce productive rangelands is increasing. The land cover of Afghanistan is presented in Figure 3.

FIGURE 3. LAND COVER OF AFGHANISTAN

In the mountains overgrazing is the main factor in increased soil erosion and forest degradation, hampering forest regeneration. Changes in vegetation and its productivity (as well as changes in climatic patterns such as rain, snow and the length of the vegetative season) forced rural people to shift grazing from traditional to higher ranges thus increasing pressure on the alpine ecosystems, where vast areas of vegetation – formerly highly productive grasslands – have been converted into grazing-resistant cushion shrub lands (*SOE 2008*).

Much as for the rangelands and forests, a great deal of Afghanistan's wildlife heritage is under threat. Flamingos have not bred successfully in Afghanistan for about eight years; Siberian cranes have not been observed for 20 years. Several mammalian species – such as the Caspian tiger (Panthera tigris virgata) or cheetah (Acinonyx jubatus ventucus) – are on the verge of global extinction and have not been seen in Afghanistan for decades. Others – such as markhor (Capra falconeri) – are considered endemic and live only in Afghanistan and adjacent territories. The important feature of biodiversity is its high dynamism, and cross-border and seasonal migration, which helps to maintain animal populations in adequate numbers. The Wakhan Corridor is one of the few intact high mountain ecosystems, home to populations of endangered snow leopards and other mammals, including Marco Polo sheep (*SOE 2008*)

IUCN (globally threatened mammals and bird species of Afghanistan)

Mammal: snow leopard (*Uncia uncia*), wild goat (*Capra aegagrus*), markhor (*Capra falconeri*), Marco Polo sheep (*Ovis ammon polii*), urial (*Ovis orientalis*), and Asiatic black bear (*Ursus thibetanus*). Other mammals of interest include ibex (*Capra ibex*), wolf (*Canis lupus*), red fox (*Vulpes vulpes*), jackal (*Canisaureus*), Afghanistanacal (*Afghanistanacal Afghanistanacal*), manul or Pallas's cat (*Otocolobus manul*), striped hyena (*Hyena hyena*), rhesus macaque (*Macaca mulatta*), and brown bear (*Ursus arctos*)

Birds: Siberian crane (*Grus leucogeranus*), white-headed duck (*Oxyura leucocephala*), marbled teal (*Marmaronetta angustirostris*), Pallas's sea-eagle (*Haliaeetus leucor yphus*), greater spotted eagle (*Aquilla clanga*), imperial eagle (*Aquilla heliaca*), lesser kestrel (*Falco naumanni*), corncrake (*Crex crex*), sociable lapwing (*Vanellus gregaria*) and the pale-backed pigeon (*Columba hodgsonii*).

1.5 AGRICULTURE AND LIVESTOCK

Agriculture is a key component of Afghan livelihoods and economic growth (28 % of gross national income in 2010/11, 37% in 2005/06). About 85 % of the Afghan population is either directly or indirectly dependent on agriculture for their livelihoods (estimated national farming population is 12.1 million while the non-farming rural population is only 2.5 million). Although the relative importance of agriculture is expected to decline with economic development, the sector will increase in absolute size and presents the main focus for economic recovery, poverty reduction and poppy eradication. It is estimated that between 12-15 percent of the total area of Afghanistan is suitable for cultivation (either irrigated or rain fed). Irrigation plays a vital role in crop production and therefore in rural livelihoods; it is used to grow 85 percent of Afghanistan's crops. Of the households engaged in agriculture, 79 percent rely on irrigated land. The harvested yield of wheat on irrigated land is three times the corresponding yield on rain-fed land.

There has been an annual decline of 3.5 percent of agricultural production since 1978, equating to loss of 30 percent of agricultural land and pastures through degradation or abandonment. Only 6 percent of cultivatable land is now productive. Growing urban centres have encroached upon fertile agricultural

land, and important wetlands have been drained for urban expansion. More than 80 percent of the land could be subject to soil erosion. Tectonic activity, irregular rainfall events and friable soils contribute to erosive processes. More than half of all irrigated arable land lies north of the main Hindu Kush range in the drainage systems of the Amu Darya River. Much of the remaining irrigated land lies in the river basins draining southwest, west and southeast out from the central massif, most significantly the basin of the Helmand River system. It is thought that about 3.3 million ha (5 percent of the total land area) is irrigated and regularly cropped, while 4.5 million ha (7 percent) is rain-fed and cropped opportunistically, depending on precipitation. With increasing population and the return of refugees, the agriculture resource base is under stress. Increasing pressure on available land over the last two to three generations has led to expansion of rain-fed wheat crops into traditional grazing land and high mountains.

10% of the irrigated land uses modern engineered systems while the rest depends on traditional irrigation methods. In many cases irrigation depends on river run-off or use of aquifers. The majority of these aquifers are degraded as a result of unsustainable abstraction rates and insufficient conservation of basins. In addition, war-inflicted damage to irrigation infrastructure and the frequent disruption of water supplies prevent the use of this essential resource. The existing irrigation system is operating at a low efficiency rate of approximately 25% (*NAPA*)

It is estimated that livestock products contribute more than 50 percent of the agricultural GDP. Over the past 30 years livestock populations in Afghanistan have fluctuated from between about 4 million cattle and over 30 million sheep and goats to the lowest levels recorded in the recent history of the country (end of the drought) of 3.7 million cattle and approximately 16 million sheep and goats. Many experts in Afghanistan see mismanagement, especially overgrazing, and conversion to rain-fed wheat production as causing deterioration of rangelands resulting in extensive desertification and decreasing productivity (*NAPA*).

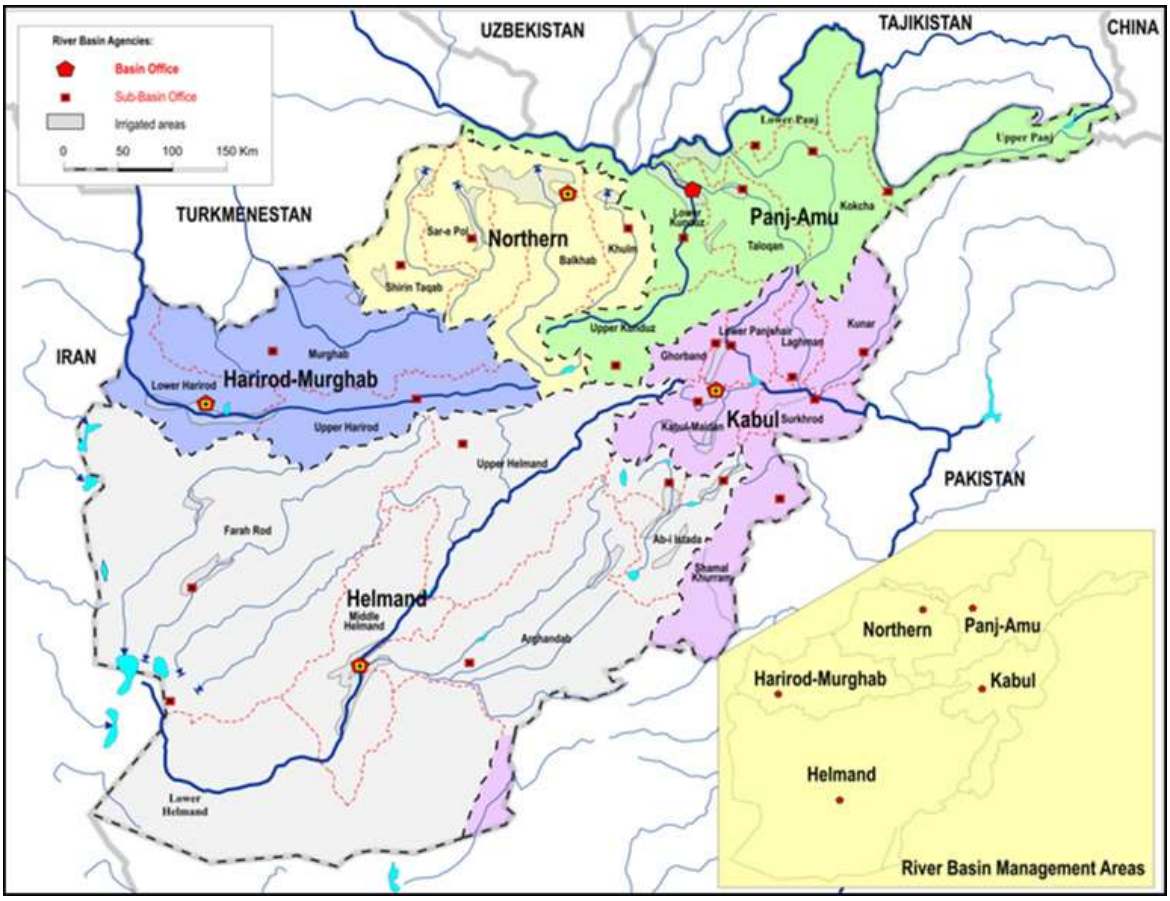
Poppy eradication efforts are underway in Afghanistan and the number of poppy-free provinces has increased from 6 to 20 since 2001 (Afghanistan Opium Survey 2010). However Afghanistan is still a world leader in the production of illegal opium. Net opium cultivation covers 123,000 ha of land with production of about 3,100 metric tons, worth US$ 604 million (5% of Afghanistan's legal GDP) in 2010. Not only profitable, opium is a drought-resistant crop and source of income for communities in times of failing crops and water scarcity (*NRVA 2007/08*).

The vulnerability of the agricultural sector to increased temperatures and changes in rainfall patterns and snow melt is considered to be high. Increased soil evaporation, reduced river flow from earlier snow melt, and less frequent rain during peak cultivation seasons will all impact upon agricultural productivity and crop choice availability.

1.6 WATER RESOURCES

Afghanistan's annual renewable surface water resources are estimated at 57 billion cubic meters. They are distributed and managed within five river basins that are defined as independent hydrological units (Figure 4). The annual discharge of five river basins is presented in Table2.

Figure 4: Five river basin and 34 sub-basins of Afghanistan



(Source: HDRA 2011)

Table 2: Annual Discharge of River Basins

River Basin	***Annual Discharge (billion cubic meters)***
Panj Amu	22.00
Northern	1.88
Helmand	9.3
Harirod Murghab	3.06
Kabul	20.76

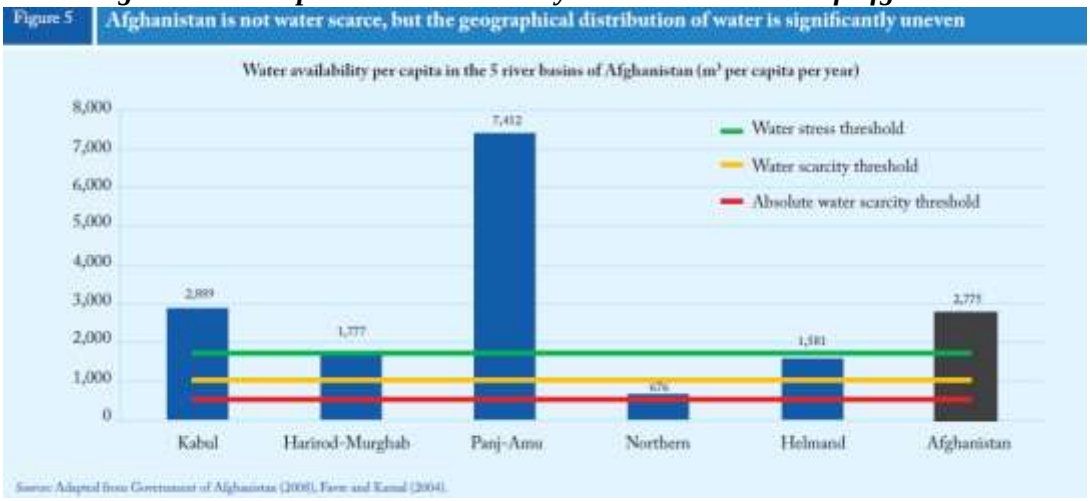
Source: HDRA 2011

Indicators suggest Afghanistan is not a water-scarce country with an estimated overall surface water availability of 2,775 cubic meters per capita per year. Experts consider 1,700 cubic meters per capita per year sufficient to satisfy the water demand of a given population for domestic, food production, industrial, energy and environment. The country thus has, in theory, sufficient water to meet domestic, agricultural, industrial and environmental needs (*HDRA 2011*).

Nonetheless, it remains burdened by constraints that limit the capacity to make full use of the potentially available resources. The relatively significant amounts of water available in the country hide important variations within and across river and sub-river basins. The distribution of the available water does not always correspond with the location of the irrigable land and the settled populations. For example, while the Panj-Amu river basin holds almost 40 percent of the country's available water resources, at more than

7,400 cubic metres per capita per day, it only accounts for 13 percent of the irrigated land. In contrast the Northern river basin holds 20 percent of all irrigated land; however, only 3 percent of the country's total water resources flow within the basin's hydrological borders. This represents less than 700 cubic meters per capita per year, which is perilously close to absolute water scarcity (*HDRA 2011*). The per capita water availability in five river basins of Afghanistan is presented in Figure 5.

Figure 5: Per Capita Water Availability in Five River Basin of Afghanistan



(HDRA, 2011)

The availability of water in Afghanistan is characterized by considerable intra- and inter-annual variations. The country also has the lowest water storage capacity in the region (Afghanistan-140 m3/capita; Pakistan-150 m3/capita; Iran-379 m3/capita; China-2200 m3/capita; Asia-353 m3/capita; *HDRA 2011*). If water becomes abundant during certain periods in the year, it cannot be stored to meet demand during periods of shortage. This reduces the opportunity to harness surface resources and renders the country more vulnerable to drought and other climate shocks.

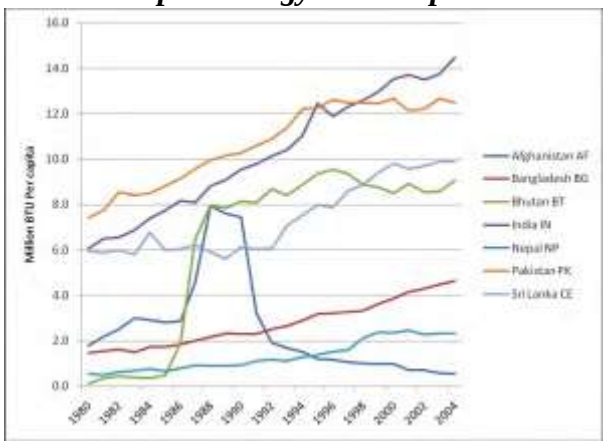
Population growth, economic development and improved standards of living will be the main drivers of water scarcity in coming decades. As economies grow, the demand for water for domestic uses, agriculture and industry will increase. It is projected that, in Afghanistan by 2025, the amount of water available per capita will have declined by approximately 36 percent relative to 2004. Urbanization will also result in more demand, which, in the case of Kabul, is already causing grave concern. Projections for the capital city indicate that, by 2050, six times more water will be required (*HDRA 2011*). Significant dependence on agriculture, the lack of water storage infrastructure and ongoing land degradation render Afghanistan particularly sensitive to the effects of floods and drought.

1.7 ENERGY SECTOR

In 1980, the per capita energy consumption of Afghanistan was fourth in the region, greater than that of Sri Lanka and Bangladesh. By 2004, per capita consumption had fallen drastically from less than 2 million BTU per person to just around 0.5 million BTU. This is at a time when all other economies in region exhibited strong growth, and the energy sector in Afghanistan suffered considerable damage due to war and operational neglect. Figure6 provides the comparison of energy consumption in the region with

significant jump in consumption between the late 1980s and early 1990s due to export of natural gas to Russia.

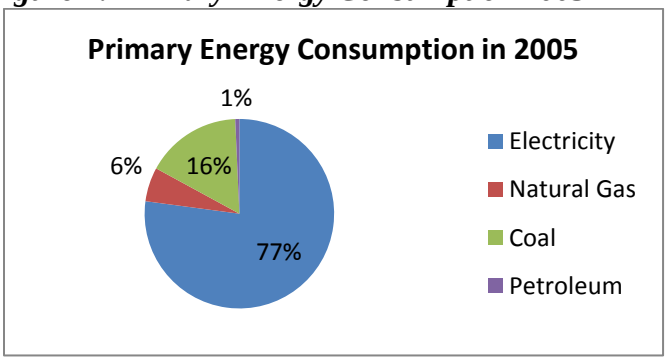
Figure 6: Per Capita Energy Consumption in the region



Source: GoIRA, USAID and Bearing Point, Energy Sector Strategy for ANDS, 2007

Reliable energy data for Afghanistan is scarce. In 2005, it is estimated that 20 percent of the population have access to public power (grid-supplied) on certain days for a limited number of hours (*ANDS*). Seven national grids distribute power, with supply from domestic hydro generation; imported power and thermal generation. Isolated diesel generation has increased since 2002 and will continue to play a role in power supplies. Rural populations use local waste, solar panels, batteries, small wood, coal, kerosene supplies for basic cooking and heat. Electricity (hydro and imports) comprises the vast majority of energy consumed or about 77% of commercial energy. This is followed by coal, natural gas and then petroleum. Figure 7 presents the composition of commercial energy in 2005. Petroleum products account for less than 1% of primary energy consumption.

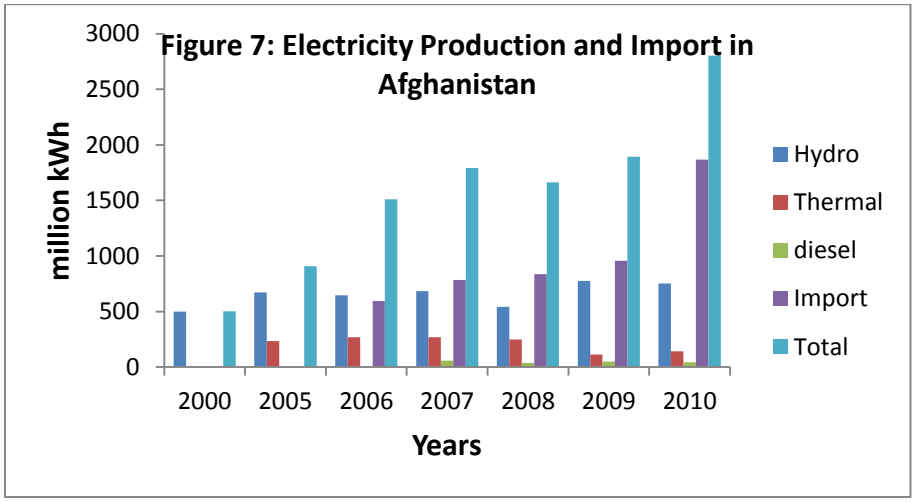
Figure 7: Primary Energy Consumption 2005



Source: GoIRA, USAID and Bearing Point, Energy Sector Strategy for ANDS, 2007,

Since 2002, the Government has worked with the international community to increase the availability of electricity and other energy resources and to carry out the planning necessary to make the transition to a more sustainable and efficient private sector led energy sector. Considerable investment in domestic generation capacity has been undertaken, including rehabilitation of damaged power infrastructure, electricity import infrastructure, and promotion of small renewable energy projects. Since 2006, there has been an on-going program for commercialization of operations in power operations by the state owned power company, DABM. The Inter-Ministerial Commission for Energy (ICE) was established in 2006 to coordinate Government policy in energy; to leverage donor resources; and integrate sector planning. These efforts have resulted in a significant improvement in the availability of electricity and other energy

sources compared to 2002. Electricity generation and supply capacity compared to 2000 has significantly increased, largely due to imported supply, which was non-existent prior to 2005. The rise of electricity availability in Afghanistan since 2000 to 2010 is presented in Figure 7.
However, on a per capita basis, the electricity generating capacity is well below what it was in 1978. The present goal of electricity availability set for 2010 is below 40 kwh per capita, (compared to a present availability in, for instance, Tajikistan of over 2,200 kwh per capita) (ANDS 2008-2013). Technical standards of operations remain antiquated and do not appropriately reflect the new technologies or modern safety measures.



Source: GIRoA/CSO: Afghanistan Statistical Year Book 2003 to 2010/11

Domestic oil production in Afghanistan is insignificant producing around 400 barrels per day of crude oil. However, according to US government estimates total oil reserves could be as much as 270 billion barrels (Energy Sector Strategy for ANDS; *GIR0A, USAID and Bearing Point, 2007).* At present, Afghanistan imports petroleum products mainly from Pakistan and Uzbekistan, and limited volumes from Iran and Turkmenistan. Since 2002, due to significant annual growth of vehicle numbers in the country and increase of generators, there have been significant rise in the import of petroleum products in Afghanistan. National statistics do not reflect import of products illegally or by many international agencies, including military. Central Statistics Office of Afghanistan data on increase in the import of petroleum products is presented in Table 3.

Table 3: Import of Petroleum Products in Afghanistan (Metric Tons)

Products/year	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Diesel	234283	206076	265500	239602	228681	356059	679779
Gasoline	136657	142093	130155	213885	92953	156953	572382
Aviation Fuel	2831	63984	120191	168050	251082	165360	1031624
Kerosene	27141	23576	22090	21164	34150	41683	21358
LPG	79081	79017	82522	107593	121908	122194	174131
Total	***479994***	***514746***	***620458***	***750294***	***728773***	***842248***	***2479275***

IRoA/CBS: Afghanistan Trade Statistics 2004 to 2010

Natural gas can be a significant source of energy and an important source of revenue to the government though hasn't yet reached major output. Consumption of gas is supply constrained and declining over the years (Table 4). According to the Energy Sector Strategy for ANDS (*GoIRA, USAID and Bearing Point, 2007),* there is uncertainty about reserves. This can be resolved with further exploration (studies put proven reserves between 1 trillion cubic feet (tcf) and 15 to 20 tcf. Other studies estimate additional reserves of 15 or 20 tcf.). The strategy states "regardless, of the whether reserves are 1 tcf or more, there is still sufficient gas to justify immediate exploration and develop and utilization in power and, possible, for compressed natural gas (CNG) vehicles". Coal is another important national source of energy for Afghanistan. Out of 11 potential coal mines, 5 are found to be reasonably safe for operation and viable for local production and use. Since 2007, with lease arrangements with private sector, the national production is being increasing rapidly (Table1.3). Afghan coal is basically used for household cooking and heating but now its use is expanded to cement industries and thermal power plants.

Table 4: National Production of Coal and Natural Gas in Afghanistan

Products/Year	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Coal (MT)	32010	33118	34987	257025	346934	506934	725005
Natural Gas ('000 M3)	191308	172342	171142	160573	154795	142181	141939

IRoA/CBS: Afghanistan Trade Statistics 2004 to 2010

Renewable energy offers the great hope for Afghanistan in general and rural energy in particular. This includes hydro, solar, wind, geothermal, biomass and wood. Hydro, both large and small, represents significant untapped resources. It is estimated Afghanistan has 18,400 MW of untapped hydro (Energy Sector Strategy for ANDS; *GIR0A, USAID and Bearing Point, 2007).* There is excellent wind potential in many areas in the wind category of good to excellent. This is 158,100 MW (*National Renewable Energy Laboratory*) of which a portion can be tapped at US $ 0.09 per kWh. Estimates indicate that in Afghanistan solar radiation averages about 6.5 kWh per square meter per day and the skies are sunny about 300 days per year. Consequently, the potential for solar energy development is high, not only for solar water heaters for homes, hospitals and other buildings, but also for generating electricity. Besides these, biomass/biogas and geothermal can provide significant renewable energy for rural communities.

Availability of the renewable resources and their current use status is presented in Table 5 (*Draft Afghanistan's Renewable Energy Policy*

Table 5: Potential and Status of Renewable Energy in Afghanistan		
Resource	**Potential**	**Status**
Hydro	For the next 5 to 10 years, potential is estimated at about 800 MW, which consists of all sizes of hydropower plants, including storage based and run-of-the-river plants.	Based on MEW records, as of October 2009, the installed capacity is 270 MW. The Ministry of Rural Rehabilitation and Development (MRRD) has completed prefeasibility studies of micro hydropower (MHP) plants in nine provinces. MRRD has installed over 840 (MHP) plants with a capacity of 14 MW. The ongoing installation is an additional 1130 MHPs with a capacity of 15 MW. After completion there will be 1,940 MHPs with capacity of 29 MW.
Wind	Commercially exploitable wind resources exist in many parts of the country. The US National Renewable energy Laboratory (NREL) developed in 2006 high resolution solar and wind resource data including maps for Afghanistan. The findings indicate that 31,600 sq.km. of the country can support large scale wind power plants. Major wind resource areas include Northwestern Nimroz, Western Farah, Western Herat, Eastern Balkh, Northern Takhar and wind corridor areas include Near Jabalsaraj, Sarobi, and Tirgari in eastern Afghanistan.	Only a few micro wind turbines have been installed in different parts of the country.
Solar	The country has excellent solar energy resources throughout its regions. Typically averaging over 5.5 kWh/m^2/day annual global horizontal insolation and estimated at least 300 days for most of the country, with the south having the highest insolation. There exists a significant potential for solar heating (water and space) and standalone solar PV application for household lighting. Surveys indicate that kerosene is the most common fuel for lighting in non-electrified communities.	Over 100,000 solar home systems (SHSs) have been installed in various parts of the country by MRRD. However, MRRD discontinued the program due to quality related issues. Other donors and international NGOs are also involved in promotion of SHSs.

Biomass/ Biogas	Significant amounts of biomass are produced in the form of crop residues and animal waste, much of which is collected and used outside the commercial economy as unprocessed fuel for household heating and cooking. Municipal solid waste produced by urban population is dumped. Waste could be disposed in proper landfills to produce methane gas as fuel. Establishment of provincial network of rural biogas service centers will provide the infrastructure necessary to support dissemination, financing and maintenance. Also, training at community level of technical and managerial skills for construction of biogas plants has to be developed. Strategic efforts may include investing in design research to make biogas suitable for different climatic conditions and developing models that take into account local problems like low temperature, and different fuel inputs for biogas systems.	Dried animal dung and crop residue are the two dominant sources of thermal fuel at the household level. These are followed by bushes and firewood, both of which are generally collected. An estimated 200 small biogas digesters have been installed in Kandahar. About 100 plants were installed in Jalalabad area by an Afghan NGO. Recently, MRRD initiated biogas promotion in Nangarhar Province
Geothermal	In Afghanistan, active geothermal systems are located in the main axis areas of the Hindu Kush, which runs along the Herat fault system, up to the Wakhan corridor in the Afghan Pamir. Geothermal systems of Afghanistan are mainly associated with the fault and fracture networks, seismic activity encountered at this boundary and its associated branching fault systems. There is potential for direct-use applications of these resources, such as in the food processing, fruit drying, refrigeration, fish hatchery and farming, carpet and wool processing, recreation and tourism and other small-scale industries. Development of potential geothermal prospects for commercial use, reconnaissance surveys are required to identify resources.	Prospects of low to medium temperature geothermal resources are widespread all over Afghanistan.

Afghanistan recognizes that energy is a critical input to economic growth. The ANDS strategic vision and goal for the energy sector strategy is: "an energy sector that provides drivers of growth in the economy with long term reliable, affordable energy based on market-based private sector investment and public sector oversight". This strategy supports (1) commercially and technically efficient energy delivery as a priority; (2) reformed sector governance that will safeguard consumers, workers and resources; (3) the establishment of a market-based enabling environment where legitimate private investment will be facilitated; (4) the diversification of energy resources for long term low cost energy security and clean energy use; and (5) identifying and supporting inter-sectoral supporting linkages including comprehensive system- based planning not limited to projects, energy for industry and vehicles.

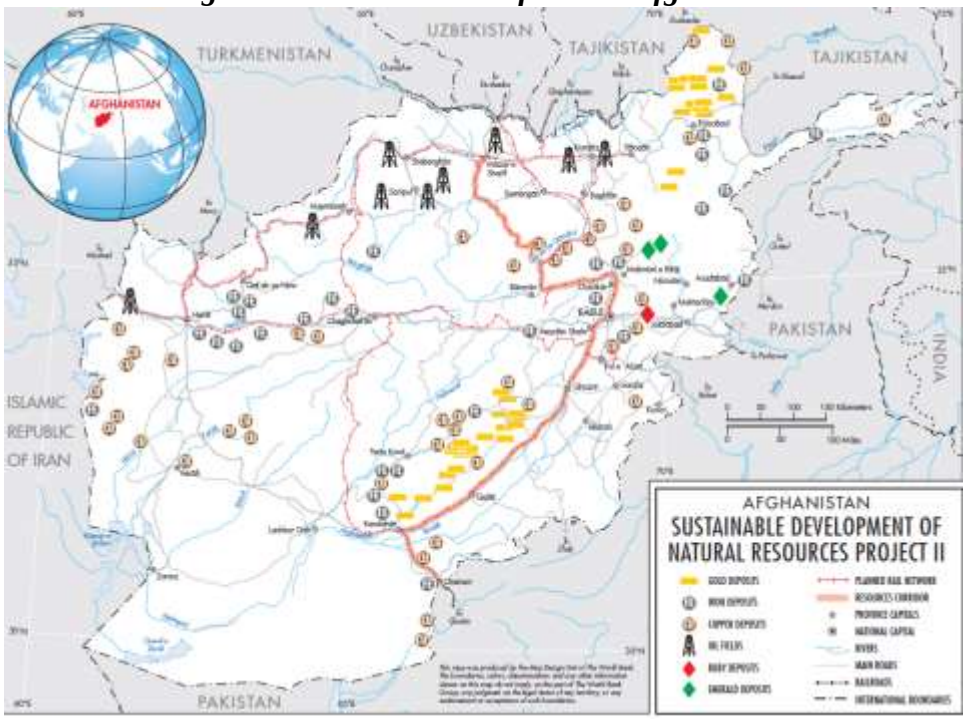
The Afghanistan Compact benchmarks that specifically deal with the energy sector include:

- "By end 2010, electricity will reach at least 65 percent of households and 90 percent of non-residential establishments in major urban areas and at least 25percent of rural households."
- "By end 2010, at least 75 percent of the costs will be recovered from users connected to the national power grid", a benchmark that the Government now intends to exceed for all but the poorest members of society.

1.8 MINERAL RESOURCES

According to the recent US Geological Survey report, Afghanistan's untapped mines have a potential value of more than USD 3 trillion. These deposits include copper, iron ore, cobalt, gold and metals such as lithium. The survey also reveals that there are huge deposits of Niobium, rare earth elements and gas and oil. These natural resources could substitute a major share of the current external support, if well managed. Mineral and oil field deposits in Afghanistan are presented in Figure 8.

Figure 8:Mineral and Oil fields in Afghanistan



Afghanistan has become a candidate for the Extractive Industries Transparency Initiative (EITI), the global standard for improved transparency in the oil, gas and mining sector. On March 16, 2009 the Government endorsed the principles of the Extractive Industries Transparency Initiative (EITI), signaling its commitment to transparent and accountable sector governance.

Recent development in Afghanistan particularly the two large scale investments at Aynak and Hajigak could mark a fundamental shift in the contribution mining sector in the overall development of the country. Aynak aims to produce 200,000 tons of concentrate per annum in phase I and expand the capacity to 500,000 tons of concentrate in phase II. The Hajigak Iron Deposit is estimated at around 1.8 billion metric tons of iron ore. The country is estimated to have US$25 billion worth of gold deposits.

The World Bank is continuing its technical assistance for the sustainable development of the mining in Afghanistan (Second Sustainable Development of Natural Resource Project, May 6, 2011) including a focus on environmental and social safeguards to minimize the adverse impacts on environmental and natural resources through sound policy, legislations and institutional capabilities to enforce them.

1.9 DEMOGRAPHIC PROFILE

According to the Afghanistan Statistical Yearbook 2010/11, Central Statistics Office, the population of Afghanistan is estimated around 26 million people (24.5 settled and 1.5 nomadic and kuchi) a significant

increase from 14.6 million in 1979. The male population is 51% compared to female population of 49%. The ethnic breakdown comprises Pashtuns (majority), Tajiks, Hazaras, Uzbeks, Turkmens, Aimaqs, Pashaee, Baluchis and Nuristanis. Almost 99% percent of the population is Muslim (Sunnis and Shiites). The remainder is Hindu and Sikh. Dari and Pashto are the two official languages of Afghanistan and in addition Uzbeki, Trukmeni, Nuristani, Baluchi, and Pashaee are spoken in their respective communities.

Population growth in 2010/11 is estimated at 2.03%, and total fertility rate is estimated at 6.3 percent, the highest in South Asia. There is a constant rise in the urban population. In 2010/11, estimated urban settled population was 23.2%, a significant rise from 20% in 2004. Afghanistan has an age distribution pyramid typical of developing countries (Figure 9) with a wide base indicating a high number of young people. 46% are below age of 14 and 50% in the group from 15 to 64. Only 4% of the population is above 65.

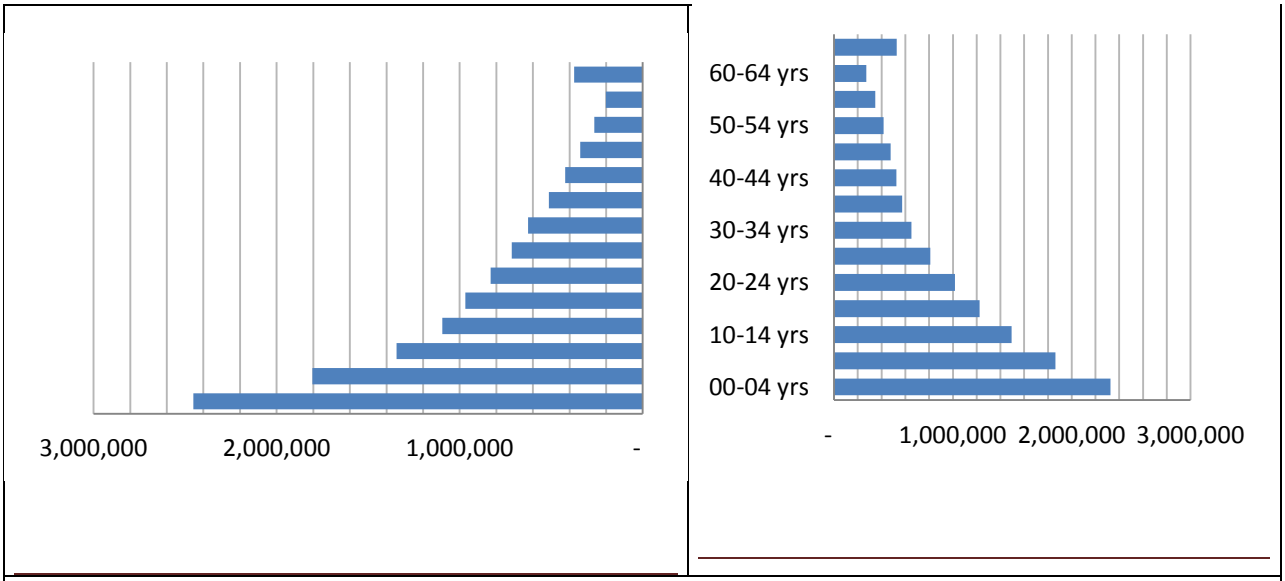
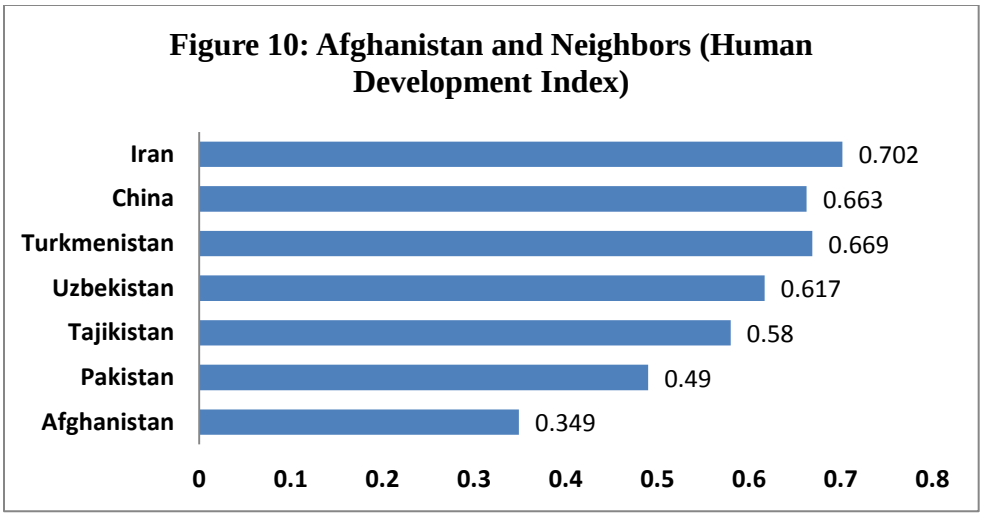


Figure 9: Population Distribution (by age) of Afghanistan in 2011

1.10 HUMAN DEVELOPMENT AND POVERTY

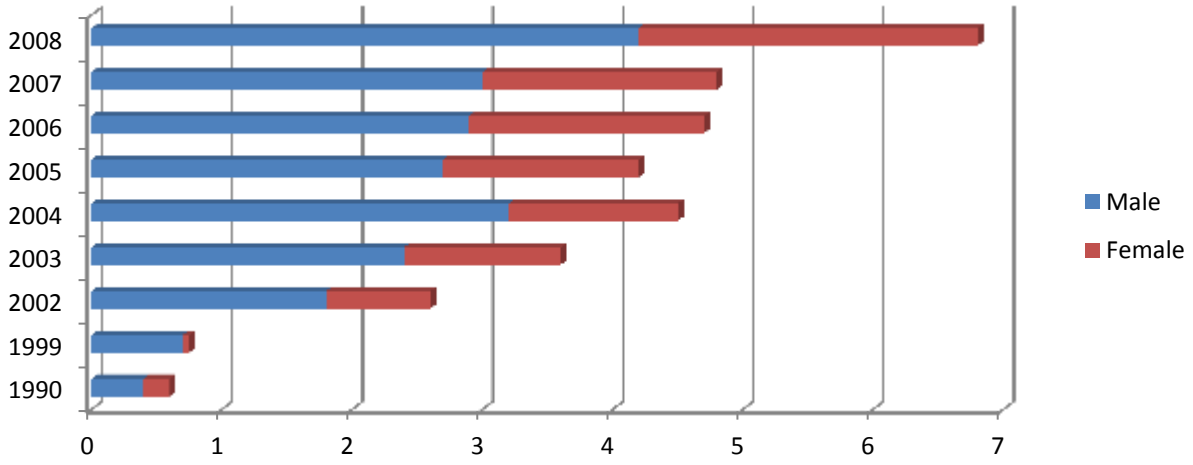
According to the Human Development Index for 2010, Afghanistan is ranked 155th among 169 United Nations member states. This reveals the profound difficulty the country faces in seeking to advance the well-being of its citizens. Figure 10 compares Afghanistan with its neighbors the HDI.



Encouraging advances have been made in health service access and in the reduction of the under-5 children and maternal mortality rates in Afghanistan over the last decade. Many Afghans in rural areas are now enjoying access for the first time to health clinics where they receive basic care through maternal and new born health, immunization and disability services that have been introduced through the Basic Package of Health Services, and also through mobile health clinics to extend services to nomadic populations, Kuchis. In 2010, 79 percent of urban populations are within an hour walk to public health facilities; it is only 37% among Kuchis and 54% among rural populations. However, 65% of rural populations now have access to public health facilities within two hours of walk (*HDRA 2011*). The under-5 mortality rate decreased from 257 per 1,000 live births in 2000 to 161 in 2007–2008, and from 2000 to 2006, full immunization coverage increased from 27 to 37 percent. More than half of all children 12 to 23 months old (56 percent) have been immunized against measles. Despite these achievements, most health indicators show that Afghanistan is still at the bottom in relative international terms. Child mortality is the highest in the world, every day, 600 children under the age of 5 die owing to a variety of causes, including 23 percent who die because of problems related to diarrhea, and also more than 50% of children (ages 6-35 months) were reported underweight in 2004.

Health services targeting pregnant women are also improving (in 2008/09, professional birth attendants assisted in 31 percent of deliveries, a 5% increase from 2007/8); however Afghanistan has the second highest maternal mortality rate in the world, at 1,600 deaths per 100,000 live births.
An analysis of educational opportunities in Afghanistan indicates that, since 2001, primary and secondary enrolment rates-a critical HDI indicator-have expanded considerably, and more children than ever are attending school. In 2007, 61 percent of school-aged children (4.7 million) were enrolled across the country. The number increased to a total of 6.8 million students at all levels of the educational system in 2008 (Figure 11). Moreover, a remarkable surge in literacy has occurred among children aged 12–16: 37 percent of girls and 62 percent of boys can now read and write.

Figure 11: Number of children attending primary and secondary schools (millions)



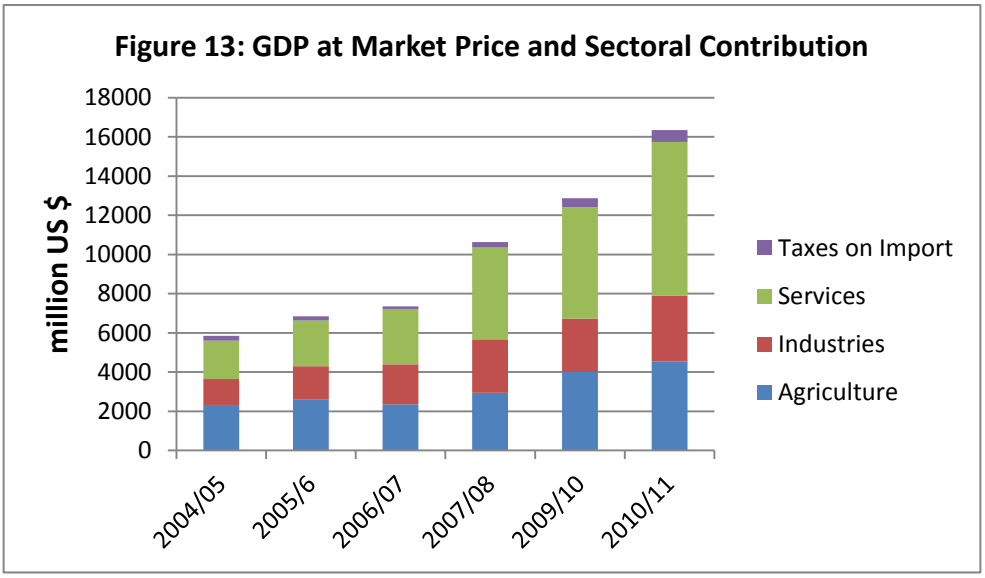
Geographically disaggregated data reveal considerable discrepancies in educational participation across provinces. Kabul boasts the highest enrolment rate, at 75 percent, while Uruzgan Province is last, at less than 5 percent. Kuchi and disabled children continue to be underrepresented in education. Average school enrolment rate among nomadic children is only 6.6 percent for boys and 1.8 percent for girls. In 2005, only 22.4 percent of the 196,000 disabled school-aged children were enrolled. Drop-out rate for these children was 75 % in primary and secondary school, mainly because the education system doesn't have capacity to handle children with disabilities.

Insecurity, social issues, geographical coverage of schools, inadequate facilities, lack of separate schools for girls, the demand for domestic work, and poor educational quality are some of the causes of the inequitable educational opportunities and the high numbers of drop-outs. Enrolment rates are lowest in the southern provinces owing primarily to the ongoing insurgency. A lack of school facilities for girls continues to be a major problem. Distance, lack of transport, poor water provision and poor sanitation often prevent girls from attending school even in areas in which separate facilities are available. Poor enrolment is also caused by the lack of female teachers, particularly in rural areas. In 2005, only 28.1 percent of teachers were women.

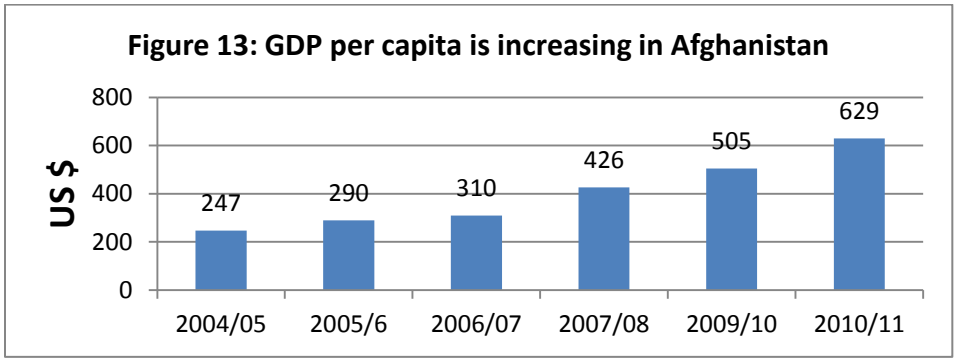
According to National Risk and Vulnerability Assessment (NRVA) Survey 2007/08, 36 percent of the population is unable to obtain the means to satisfy their basic subsistence needs in 2007/08. Thus, from an income-based perspective, an estimated 9 million Afghans are poor. The regional differences are meanwhile much more acute: the poverty incidence ranges from 23 percent in the south-west to 45 percent in the eastern region.

1.11 ECONOMIC PROFILE

Since fiscal year 2002/03, Afghanistan has seen average growth rates in the double digits but with high levels of volatility due to the prominence of agriculture sector which is subject to weather change. In fiscal year 2009/10, like previous five years, the service sector continued to lead the contribution, almost half of the output (WB: Afghanistan Economic Update, May 2011). The most dynamic subsectors were communication (45% annual growth), Finance and Insurance (27%) and Transport (22%). The agriculture sector's contribution has been volatile because Afghanistan's arable land and irrigation system depend heavily on seasonal rain and snow. Furthermore, Industry contracted 3 percent from last year, due largely to weaker manufacturing which contracted by 12 percent. Construction contributed 1.9 percentage points, while mining added a marginal 0.11 percentage points of last year's GDP growth rate (2008/09). The GDP at market price with sectoral contribution is presented in Figure 12 for last six fiscal years. Per capita GDP has risen over the years (Figure 13).



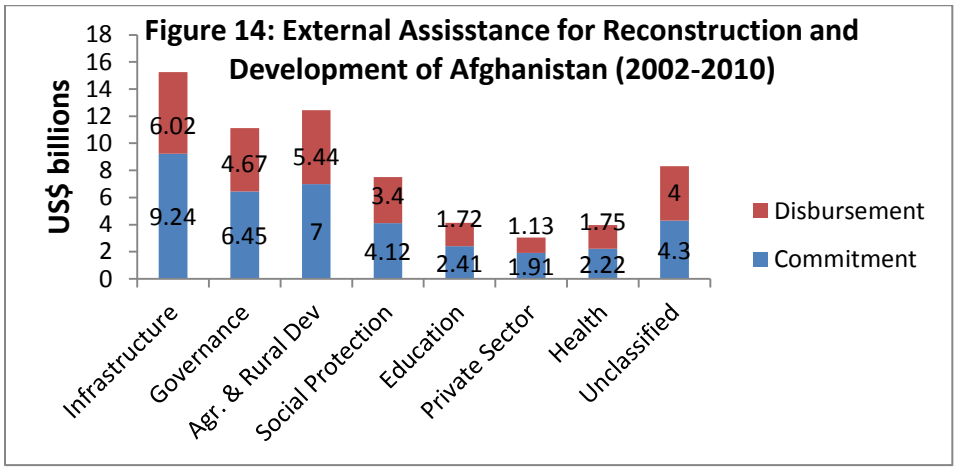
Source: GIRoA/CSO: Afghanistan Statistical Year Book 2010/11 and 2007/08



Source: GIRoA/CSO: Afghanistan Statistical Year Book 2010/11 and 2007/08

The driver of the economy continues to be the private consumption. Also the external assistance for the reconstruction and development of Afghanistan has contributed significantly over the years, and the status

of commitment and disbursement of such assistance for the period of 2002-2010 in seven different sectors and others is presented in Figure 14.



In the external sector, trade as a share of GDP declined over recent years. During the fiscal year 2005/06, imports as a share of 84% of total GDP declined to 64% in 2009/10. In the same period, share of exports fell from 24% in 2005/06 to 15% in 2009/10. In recent years, the composition of exports changed with dry fruits and seeds becoming the largest official Afghan export. During FY2005/06-2009/10, the share of dry fruits and seeds grew to half of total exports, surpassing carpets, which dropped from 60 percent to 38 percent. In addition, the export of fresh fruits accounted for just 6 percent of the export trade, a reflection of weaknesses in its value chain (cold storage facilities) which limit their export potential. The remaining exports were leather, spices, and medicinal plants (*WB: Afghanistan Economic Update, May 2011*).

1.12 INDUSTRIAL PROFILE

Despite the intention to promote national and foreign direct investment in the development of industrial sector, the indicators both the value of industrial production by sector at 1978 prices (Table 6) and GDP contribution by industrial sector in current price (Table 7) show that the sector has not seen the growth as desired. The contribution of the private sector to industrial production has increased since 2005 with public sector declining. Manufacturing followed by the construction sector is the major contributor to the GDP of the industrial sector in Afghanistan. And in the manufacturing sector, the food, beverage and tobacco has the dominant role (95 % of the whole manufacturing sector's contribution) followed by chemical industry (2.7%). The total number of industrial units in operation in 1978 and in recent years has seen little growth but the trend in recent years has also seen the closure of some units (Table 8).
As Afghan construction has increased, the cement industry remains static, despite in-country limestone deposits, Afghanistan heavily depends on import of cement to meet rapid growth. National consumption of cement has increased from 1.02 million tons in 2005/06 (national production 30,000 tons) to 2.669 million tons (national production 35,000 tons), a total dependence on imports (*GIRoA/CSO: Afghanistan Statistical Year Book 2005/06 to 2010/11*).

Table 6: Value of Industrial Production by Sector at 1978 Prices (Million Fas)

Year	***1978***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Total	33181	9482	12611	9218	9100	8991	8949

Public Sector	13433	3339	5579	1386	1155	850	294
Private Sector	19748	6143	7032	7832	7945	8141	8655

Source: GIRoA/CSO: Afghanistan Statistical Year Book 2010/11 and 2007/08

Table 7: GDP by the Industrial Sector in Current Price (Million Afs)						
Sector/year	2005	2006	2007	2008	2009	2010
Mining and Quarrying	788	1203	1783	2481	2921	4473
Manufacturing	51401	68244	77553	91879	80437	90943
Electricity Gas and Water	461	593	645	527	630	640
Construction	30135	35455	42568	43741	49954	57552
Total	82785	105495	122549	138628	133942	153608

Source: GIRoA/CSO: Afghanistan Statistical Year Book 2010/11 and 2007/08

Table 8: Total Number of Major Active Industrial Establishments in Afghanistan							
Sector	***1978***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***
Chemical	25	45	58	61	58	58	55
Construction Material	13	65	84	93	101	105	105
Machinery and Metal Works	17	54	78	86	78	80	75
Pharmacy	5	7	10	12	14	11	13
Printing	24	47	56	60	63	63	70
Carpentry and Paper	6	43	47	50	45	37	32
Light Industries	47	31	49	57	64	66	66
Food Industries	67	152	199	206	212	199	195
Other Industries	1	123	161	183	196	192	195
Total	***205***	***567***	***742***	***808***	***831***	***811***	***806***

Source: GIRoA/CSO: Afghanistan Statistical Year Book 2010/11 and 2007/08

The World Bank's Doing Business Index 2011 ranked Afghanistan lowest in the region and 167th out of 183 countries surveyed. Afghan businesses are restrained by red tape, lack of policy predictability, and corruption. Its regulatory framework is relatively well ranked on two indicators – Starting a Business (25th) and Paying Taxes (53th). However, it is ranked last (183th) for three indicators, on Protecting Investors, Trading Across Borders and Closing a Business. In order to address and enhance Afghanistan's ranking in the Doing Business Report, the Ministry of Commerce and Industries launched an initiative in December 2010 aimed to make improvements across five Doing Business areas. (*Afghanistan Economic Update: The World Bank, May 2011*).

1.13 TRANSPORT SECTOR

Over three decades of civil war had done severe damage to the Afghanistan road network at all levels: main highways and local access roads. As the nation emerged from the conflict in 2001, only 10% of the estimated 130,000 km of major and rural roads network at that time was in good condition. Rehabilitation of the core network whilst creating quick employment has been the government's priority that underpinned the then transitional strategy to consolidate peace and stability. By its labor intensive nature, rural roads rehabilitation was considered as crucial to generate employment opportunities while opening

up the isolated rural areas to basic services. The World Bank, through IDA and ARTF resources, has been supporting the programs with a primary objective of creating employment in rural areas, and working up to more extensive involvement in building institutional capacity in the Ministry of Public Works and Ministry of Rural Rehabilitation and Development. In parallel, US-AID and the Asian Development Bank have focused their financing on major highways, with a view to restoring the national-level ring highway that links all major cities and main border crossing points.

The Donor's policy dialogue with GIRoA has also addressed the keen interest of Central Asian governments (all landlocked) to see trade corridors opened to ports on the Indian Ocean. The Asian Development Bank has been supporting this multi-country dialogue through its Central Asia Regional Economic Cooperation initiative (CAREC). In this connection GIRoA recently commissioned a railways master plan, which has examined, at strategic level, the options for developing a railway network for the benefit of the Afghan economy, as well as serving the transit interests of Central Asia. Interest in this concept was heightened in 2010 by announcement of substantial mineral deposits in large areas of northern and central Afghanistan, for which –at least in the longer run—export by rail would be less costly than road transport.

With double digit growth in recent years, and the efforts on rehabilitation and construction of the road networks both rural and urban, there have been significant rise in the number of vehicles plying in the roads of Afghanistan (Table 9). Similarly over the years the air traffic has also increased significantly, the number of planes from just 7 with government in 2003 (seats capacity of 1192) increased to 24 in 2010/11 (seats capacity of 3203) with private sector having more planes (15 airplanes) than the government (9 planes). In recent years, Afghanistan have completed the construction of 75 km of railway line and also feasibility study of additional 1225 km to be constructed in the future (*Ministry of Economy: ANDS Annual Progress Report 1389*).

Table 9: Import of Vehicles with type

Type	***2004/05***	***2005/06***	***2006/07***	***2007/08***	***2008/09***	***2009/10***	***2010/11***
Lorries	83374	100883	117460	135446	156469	169737	184799
Busses	40590	41731	48513	58049	65471	71581	74834
Passenger Cars	197449	262700	314165	517604	558495	621937	691573
Motorcycles	65430	64817	108282	127959	132130	134596	141833
Total	386843	470131	588420	839058	912565	997851	1093039

Source: GIRoA/CSO: Afghanistan Statistical Year Books 2003/04 to 2010/11

The Transport Sector Strategy of the Government (ANDS 2008-2013) continues to give high priority to rehabilitate the badly damaged road system. The main programs of the strategy are (i) Regional, National Highways and Provincial Roads (ii) Rural Road (iii) Urban Transport (iv) Civil Aviation (v) Transport Sector Maintenance (vi) Pubic Transport (vii) Railway Program. A Transport Sector Inter-Ministerial Working Group has been formed to coordinate the work of the ministries in the sector to assure that projects are properly designed to obtain the highest returns and greatest impact on the poverty reduction goals.

1.14 URBANIZATION AND URBAN POLLUTION

According to the Afghanistan Statistical Yearbook 2010/11 of Central Statistical Organization, out of the total settled population of 24.5 million, 5.7 million people lived in various cities of Afghanistan, that is, almost 23% of population. If the current growth trend of urban population continues, by 2030, 30% of the total population will be living in cities. Of the total urban population of 5.7 million in 2010/11, 3.7 million (65%) live in Kabul, the capital city alone. The main other cities of Afghanistan are Heart, Mazar-e-Sharif, and Kandahar.

Rapid and haphazard urbanization in Kabul and other major cities has put significant pressures on the city infrastructures. According to ANDS, the number of challenges and constraints faced by the urban sector are:

- Low coverage of basic services and inadequate public resources to meet growing needs
- A rapid pace of urbanization partly due to returning refugees and rural-urban migrants, leading to high population density
- Widespread urban poverty and limited access to productive employment
- A high proportion of informal settlements and associated problems
- Lack of capacity and coordination among urban sector institutions
- Limited scale of private sector investment in urban enterprises, facilities or services
- Lack of accurate data on which to base critical policy decisions
- Land security and titling: absence of proper land registration system, land grabbing, inadequate legal instruments and institutions
- Lack of available financial funds due to limited interest of donors in the urban sector,

In parallel to the urban development, the problem of pollution of air, water, waste management, and noise is growing in major cities. Although, there are very limited studies on the ambient environmental quality, a comprehensive study of Kabul air quality in 2005/6 by NEPA/ADB revealed that elevated concentrations of particulates, nitrous oxides, and sulphur dioxide is causing an estimated excess annual mortality of 2,000 people, increased respiratory diseases, and asthma (*SOE 2008*). Since then, there have been significant rise in the number of vehicles which led to frequent traffic congestion, and significant rise in construction activities, the air of Kabul has received more pollutants and more population are exposed to higher level of air pollution, particularly the fine particulates. NEPA recently has installed a continuous air quality monitoring station at its office compound along the road-side; the initial results suggest that the air is heavy polluted by fine particles.

Water resources are being polluted due to disposal of untreated industrial and domestic effluent, and the discharge of household and street waste directly into streams. In urban areas, most of the demand of water is supplied from groundwater sources; cross-contamination is a significant issue. The 2003 UNEP Post-Conflict Environmental Assessment found that urban drinking water supplies are often being cross-contaminated with coli form bacteria. This is due to groundwater extraction wells being placed close to solid waste and liquid waste disposal points; the existence of open sewers; lack of urban wastewater treatment plants; and lack of properly designed solid waste landfills.

With increasing population and changing lifestyle, management of solid waste including hospital and industrial hazardous waste is another big urban environmental problem in Kabul and other major cities. The challenge is lack of the properly designed and managed landfill sites and very poor collection efficiency of the responsible authorities and poor public awareness on segregation of wastes at source. Noise pollution is also becoming a serious problem in cities.

As per the provisions of Environmental Law 2007, National Environmental Protection Agency of Afghanistan (NEPA) has taken many legal initiatives to address the urban environmental problems. Clean Air Regulation, 2009 and National Ambient Air Quality Standard of Afghanistan 2011 are already approved and more standards for Mobile and Stationary sources are in the process. To facilitate implementation of provisions of National Waste Management Policy 2010, NEPA has drafted the Waste Management (domestic) Regulation and Waste Management (Bio Medical) Regulation which are in the process of approval with environmental requirements for various methods of waste treatment as part of the regulation. Further, GIRoA has initiated the process of becoming party to Basel, Stockholm, and Rotterdam conventions and Kyoto Protocol to facilitate technology transfer in dealing the problem of urban pollution. A draft Noise Pollution Control Regulation is in the process to deal with the noise pollution problem. However, the implementation of these legal documents faces many challenges.

1.15 SECURITY, GOVERNANCE SYSTEM AND LEGISLATIVE PROCESS

The current Constitution of the Islamic Republic of Afghanistan was adopted by the delegates of a constituent assembly (Loya Jirga) representing the Afghan people, held between December 13, 2003 and January 4, 2004. It was formally ratified by the President on January 26, 2004.

The Islamic Republic of Afghanistan is a presidential system where the executive branch of government is composed of a popularly elected President and two Vice Presidents. The President appoints the ministers, attorney general and Supreme Court. Justices. Legislative authority in Afghanistan is a bicameral National Assembly with a House of People (Wolesi Jirga) and a House of Elders (Meshrano Jirga). Duties are enumerated under article ninety of the Constitution.

Judicial power is composed of the Supreme Court, Courts of Appeal and Primary Courts. Cases are resolved in courts taking into consideration the quality and nature of the case in two stages, primary and appeal. The Supreme Court deals with the referred cases of Courts of Appeal only in terms of accurate application of law(to see if any provision of law is breached or accurately applied), unless it has been authorized by law to resolve a case taking into consideration the quality and nature of the case.

Afghanistan currently faces a range of security threats. Implementing development policies outlined in ANDS can only be possible if there is peace and security in the country because security and sustainable development inevitably go hand in hand (ANDS 2008-2013). NATO is currently the major force through which the International Community is providing security assistance to Afghanistan. Government aims to secure stronger commitments from NATO in building the capacity of Afghanistan's national armed and other security forces. The Government provides highest priority in building administrative capacity, investing in human resources development and justice sector, and spurring private sector development to help improve Afghanistan's internal situation. The legislative process in Afghanistan means that any law has to be approved by both Houses of the National Assembly before it is endorsed by the President. Laws can be proposed by either the National Assembly or the members of the Government.

1.16 ENVIRONMENTAL GOVERNANCE

Article 15 of the Constitution of the Islamic Republic of Afghanistan states "the state shall be obligated to adopt necessary measures to protect and improve forests as well as the living environment." In 2007, both the houses of the parliament passed the Environment Law. It was then ratified by the president and provides the basis for the environmental governance in Afghanistan. The primary aim of the law is the conservation and management of the environmental resources and their sustainable use to improve the livelihood and protect health of human, flora and fauna; maintain ecological functions and evolutionary

processes; secure needs of present and future generations; conserve natural and cultural heritage; and facilitate reconstruction and sustainable development of national economy. The National Environmental Protection Agency (NEPA) is an independent institutional entity, responsible for coordinating, monitoring conservation and rehabilitation of the environment, and the implementation of the law.

As per the constitution and the Environment Law, people of Afghanistan have the following rights (individuals and their associations) with regard to the environment:

- The right of everyone to receive environmental information that is held by public authorities ("access to environmental information")
- The right of both women and men to participate in environmental decision-making ("public participation in environmental decision-making");
- The right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general ("access to environmental justice"

The National Environmental Protection Agency which is headed by the Director General has its central office in Kabul and already has established 32 provincial offices out of 34 provinces in Afghanistan. As per the Environment Law, National Environmental Advisory Council has been established to advise NEPA on financial matters, regulatory matters, and environmental matters of public interest. In addition to NEAC, Committee for Environmental Coordination (CEC) is constituted to promote the integration and coordination of environmental issues and fundamental principles of the law at central level as well as provincial level. The committee is composed of representative of line ministries, national institutions, provincial councils and district and village councils.

GIRoA is party to many Multilateral Environmental Agreements including Rio Conventions (UNFCCC, UNCBD, UNCCD), CITES and is in the process of becoming party to many more including Basel, Stockholm, and Rotterdam Conventions and Kyoto Protocol. These MEAs are also the part of legal tools that support environmental governance in Afghanistan. NEPA has added Clean Air Regulation, EIA Regulation, National Environmental Action Plan, EIA Policy, Waste Management Policy, and Regulation on Ozone Depleting Substances and is in the process of adding more regulations in waste management, noise control, and environmental requirements to promote the environmental governance in the country. Sectoral Laws and regulations including Mines Law, Hydrocarbon Law, Forest Law, and others promote environmental conservation. Implementation of the provisions of the law and regulations and MEAs is a big challenge. Through institutional capacity building support provided by UNEP and other UN and donor agencies over the years, NEPA's role has now been recognized by sectoral development ministries. Afghanistan has established the procedures in mainstreaming environment in the development initiatives which need to be further strengthened to mainstream climate change adaptation and mitigation.

1.17 INSTITUTIONAL ARRANGEMENT FOR ENVIRONMENT, CLIMATE CHANGE AND DISASTER RISK REDUCTION

The above sections briefly highlight environmental governance in Afghanistan. Other key institutions to share the responsibility of addressing climate change risks with NEPA are Ministry of Agriculture, Irrigation and Livestock (MAIL); Ministry of Energy and Water; Ministry of Rural Development and Reconstruction; Afghanistan Disaster Management Authority; and Afghanistan Meteorological Authority. In addition to these institutions, Ministry of Economy and Afghanistan National Development Strategy has a key role in planning and allocation of resources for priority programs to minimize and adapt the climatic risks in Afghanistan. As in many developing and least developed countries, establishing the

coordination amongst the sectoral ministries and environmental authorities is considered the biggest hurdle, Afghanistan faces similar challenges. However there are institutional arrangements for better coordination in different priority areas of concerns, especially environmental conservation, climate change and disaster risk reduction. These are presented in Table 10 with main roles and responsibilities.

Table 10: Coordinating Mechanism in Afghanistan in Environment, Climate Change and Disaster Risk Reduction

Focus Area	***Coordination Mechanism***	***Main Roles and Responsibilities***
Environmental Conservation and Pollution Prevention and Control	National Environmental Advisory Council	• To advise NEPA on financial, regulatory and environmental matters of national importance • Council members appointed by president in recommendation of DG of NEPA and council will meet once a year
	High Level Commission on Air Pollution Control	• Created by Clean Air Regulation to promote sectoral coordination and participation in designing and implementing the action programs to prevent and control air pollution • Meets on monthly basis
	Committee for Environmental Coordination	• Established as per Environmental Law to promote mainstreaming of environmental into sectoral ministries and other national institutions • Meets on monthly basis
	National Climate Change Committee	• Established to promote participation of all the stakeholders in the INC process • Will continue to promote coordination in future climate change related project implementations
	Supreme Committee for Environment	• To address all areas of interest in urban pollution control • Take immediate decision to address the environmental problems
Disaster Risk Reduction	National Disaster Management Commission (NDMC)	• To respond to national emergencies in the country • Established under the chairmanship of vice president
	Provincial Disaster Management Committee	• To promote coordination and cooperation in the implementation of provincial disaster management plans
Water Security	Supreme Council for Water Resources Management	• National level coordinating body to promote the integrated water resources management in Afghanistan • Provides guidance to line ministries, river basin councils, sub-

		basin councils
	River Basin Councils	• Five different river basin councils to promote cooperation and coordination for the integrated water resources management in five different river basin system of Afghanistan
	Sub-basin Council	• Support water users association to manage the water resources at sub-river basin
	Water Users Association	• Community implementing agents at the field level
Food Security	Inter-Ministerial Committee	• Managing body of the Comprehensive Agriculture and Rural Development - Facility (CARD-F). • Coordinate in the implementation of the food security programs.
Energy Security	Inter-Ministerial Commission on Energy	• Coordinate Government policy in energy; to leverage donor resources; and integrate sector planning. • Restructure the energy sector governance • Promote private sector investment in energy infrastructure development

1.18 PARTICIPATION OF AFGHANISTAN IN REGIONAL INITIATIVES TO ADDRESS CLIMATE CHANGE IMPACT

The Government of Afghanistan is member of two important regional organizations namely Eco-Member States and South Asian Association of Regional Cooperation (SAARC) and actively participating and contributing in enhancing regional partnership and cooperation with great focus on conservation and protection of environmental resources as well as climate change mitigation and adaption in the regions. Both the associations have developed regional action plans and committed for implementation.

Framework Plan of Action on Environmental Cooperation and Global Warming for Eco-Member States, 2011-2015: Environmental ministers of Eco-Member States on June 2011 at Teheran adopted this Framework Plan of Action with the key objective of enhancing regional cooperation in Environmental Management, and Global Warming and Climate Change. Member states recognize the adverse impact of climate change in the region and make commitment to cooperate in eight broader areas, namely GHG Inventory, Vulnerability and Adaptation to Climate Change, Climate Change Mitigation, Clean Development Mechanism, Technology Transfer, Climate Change Research and Systematic Observation, Climate Change Education, Training and Awareness, and Climate Change Policies and Measures. The framework plan of action also has proposed the implementation plan and one of the key aspects of this is to present common views of the region at global climate change forums.

SAARC Action Plan on Climate Change: Afghanistan, as the youngest member of SAARC, is actively participating in the regional initiatives to deal with the impact of climate change in the region. The

fifteenth summit of SAARC heads of Government or States in 2008 in Dhaka has adopted the Dhaka declaration on Climate Change and also agreed on the three year SAARC Action Plan on Climate Change (2009-2011), which is recently been extended till 2014 by the environment ministers conference held in Thimpu on September 2011. This action plan has seven thematic areas namely Adaptation to Climate Change, Policies and Actions for Climate Change Mitigation, Policies and Actions for Technology Transfer, Finance and Investment, Education and Awareness (New Delhi Action Plan), Management of Impacts due to Climate Change, and Capacity Building for International Negotiations.

1.19 INC PREPARATION PROCEDURES

The Islamic Republic of Afghanistan with technical support from UNEP/Afghanistan initiated the process of getting financial support from GEF to start the project on INC preparation of Afghanistan in 2007. The project on "Enabling Activities for the Preparation of the Islamic Republic of Afghanistan's Initial National Communication under the UN Framework Convention on Climate Change (UNFCCC)" was agreed upon with the initial starting date of January 2008 with four years project period. The steps followed in the preparation of the INC of Afghanistan are as follows:

- Establishment of Project Management Office with INC Project Coordinator by NEPA and UNEP.
- Constituted National Climate Change Committee with representation from relevant ministries, academia and other national institutions to facilitate the participation in the process and provide policy guidelines to PMO and National Study Teams (the composition of the NCCC is in annex 1).
- Organization of the Inception Workshop of key stakeholders and agreed composition of six study teams, terms of references for each study teams and the working procedures of the study teams, and procedures to be followed in the preparation of INC. The details on the composition of the six National Teams are provided in Annex 1.
- NSTs decided their working modalities- study of the guidelines and handbook, understanding of the procedures, consultation (once in a week or two weeks amongst the study team members), preparation of thematic reports, presentation of the thematic reports to all the members of study teams, update the thematic reports (all thematic reports in local language, DARI)
- National Study Team on National Circumstances and INC report writing combined the thematic report, the initial draft presented to all the members of the study team, the revised draft presented to the workshop of stakeholders, and the final draft presented to NCCC for their recommendation for approval, and the final INC report approved by the NEPA.

1.20 SUMMARIZED STATISTICS OF AFGHANISTAN

Table 11 below presents the summarized main statistics related to Islamic Republic of Afghanistan's national circumstances for the year 2005 and 2010.

Table 11: National Circumstances in 2005 and 2010

Criteria	***Units***	***Year***	
		2005	***2010***
Area	Square Kilometer	647,500	647,500
Agricultural area	Percent	15	15
Forest Area	Percent	3	2.6

Permanent Pasture	Percent	52	46
Mountainous Area	Percent	63	63
Area above 2500 m	Percent	27	27
Population	Millions	24*	26*
Rural Population	Millions	19	20
Urban Population	Millions	5	6
Population Growth Rate	Percent	2.03	2.03
Population in absolute poverty (%age)	Percent	36	NA
Literacy rate (%)	Percent		
Child Mortality Rate	1000 live births	135	111
Maternal Mortality Rate	100,000 live births	1600	1600
Life Expectancy at Birth		44	44
Gross Domestic Product (GDP), million US$	Million US$	6853	16343
Share of Agriculture on GDP	Percent	38	28
Share of Industries on GDP	Percent	25	21
Share of Services on GDP	Percent	34	48
Share of Taxes on Imports on GDP	Percent	3	3
Per Capita GDP	US $	290	629

*includes 1.5 million nomadic population

2 GREEN HOUSE GAS (GHG) INVENTORY OF AFGHANISTAN

2.1 INTRODUCTION

Afghanistan being a party to UNFCCC and included in the category of non-Annex I Party shall, in accordance with Article 4, paragraph 1 (a), and Article 12, paragraph 1(a) of the Convention, communicate to the Conference of the Parties a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol, to the extent its capacities permit, using the revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. As an LDC, Afghanistan has the flexibility of choosing the year to estimate the GHG inventories. During the INC inception workshop, it decided to estimate for the Afghanistan fiscal year 2004/05 (2005 for reporting), as data are available.

2.2 METHODOLOGIES FOR GHG INVENTORIES

Green House Gas Inventories were developed as per the methods and procedures provided in revised 1996 IPCC Guidelines. NEPA in consultation with key stakeholders and approved by the inception workshop formed an eight member National Study Team on Green House Gas (NST-GHG) Inventory development. The NST not only followed the guideline but also followed the IPCC Good Practice Guidance. Five key sectors were identified and agreed upon during the Inception Workshop to focus to estimate the national GHG inventories, namely:

Energy: Total emission of all greenhouse gases from stationary and mobile energy activities (fuel combustion, as well as fugitive fuel emissions); includes electricity generation, energy used in heat production, manufacture of solid fuels, other energy industries, manufacturing industries and construction, transport, commercial, residential, agricultural/forestry/fishing, as well as fugitive emissions from coal mining and oil and natural gas activities.

Industrial processes: Emissions within this sector comprise by-product or fugitive emissions of greenhouse gases from industrial processes. Emissions from fuel combustion in industry are reported under *Energy*; focus here on mineral products, chemical industry and metal production.

Agriculture: All anthropogenic emissions from this sector except for fuel combustion emissions and sewage emissions, which are covered in *Energy* and *Waste*; includes enteric fermentation, manure management, agricultural soils, and field burning of agricultural residues.

Land use change and forestry: Total emissions from and removals by forest and land use change activities; includes changes in forest and other woody biomass stocks, forest and grassland conversion, and emissions from and removals by soil.

Waste: Total emissions from waste management; includes solid waste disposal on land and wastewater treatment.

The solvents and other product use, the sixth category prescribed in the guidelines, have been excluded because of the data deficiencies in Afghanistan.

NST-GHG focused on government published reports verified with ministry databases and also with publications of the various UN agencies, the World Bank and the ADB. Information collected by the NST is maintained as database in the Climate Change (CC) Division of NEPA and will be updated in the second communication development. The study team will continue with more experts' involvement. NST-GHG held weekly meetings to review the data collection, quality of data, choose of emission factors, and presented them to the members of all five national study team to get feedback on the quality

of the information. NEPA with ADB have prepared in 2007 the National Inventory of GHG of Afghanistan for the data on 2004/05. This inventory was prepared as per the IPCC guidelines on a gas-by-gas basis and in units of mass, estimates of anthropogenic emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) by sources and removals by sinks. There have been no efforts on developing national emission factors, so IPCC default emission factors were used to estimate the GHG inventories. Rough estimates were made on anthropogenic emission by sources of other greenhouse gases such as carbon monoxide (CO), nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOCs), sulfur dioxide (SO_2), and hydroflurocarbon (HFC). To estimate fuel consumption by different sectors, CO_2 fuel combustion emissions was estimated using the sectoral approach. Global Warming Potentials of the GHGs over a period of 100 year time horizon used by the IPCC Second Assessment Report ("1995 IPCC GWP Values") were used to prepare the aggregated GHG emissions and removals in CO_2 equivalents. As such the GWP of CO_2, CH_4, and N_2O used are 1, 21 and 310 respectively.

2.3 TOTAL EMISSIONS OF AFGHANISTAN

This section provides an overview on estimates of total emissions of three greenhouse gases for 2005. Table 12 provides an overview of contributions of greenhouse gas emissions from each of five categories selected. Total emissions for 2005 were 28759 CO2 equivalents and no net removals.

Carbon dioxide emissions calculated according to the IPCC sectoral approach for the energy sector indicated a total of 2910.04 Gg for 2005. In Afghanistan, there is little data on sectoral consumption of energy. ADB and NEPA tried to estimate the GHG for Afghanistan in 2007 based on the data of 2004/05 using the sectoral approach. The emissions mentioned here are based on fuel consumption by this study. The total emissions for each sector, calculated as carbon dioxide equivalents, are presented in Table 13 and the percentage contribution in Table 14.

Table 12: Green House Gas Emissions of CO_2, CH_4 and N_20 in Afghanistan in 2005

GHG Sources	***Green House Gas Emissions (Gg)***			
	CO_2 (emissions)	***CO_2 (removals)***	***CH_4***	***N_20***
National	***12563.32***		***487.80***	***19.20***
Energy (Sectoral Method)	**2910.04**		**33.0160**	**0.4188**
Energy & Transformation Industries	500.27		0.01506	0.00345
Manufacturing Industries and Construction	150.41		0.0104	0.0026
Transport	1671.20		0.49	0.03
Commercial and Institutional (fossil)	93.9		6.40	0.071
Residential (fossil)	381.05		26.07	0.31
Agriculture, Forestry and Fishing	113.21		0.031	0.0018
Fugitive Emissions	***NO***		***2.0443***	***NO***
Industrial Processes	**312.15**			
Mineral Products	312.13		NE	NE
Chemical Industry	0.0254		NE	NE
Metal Production	NE		NE	NE
Other Production	NE		NE	NE
Agriculture			**442.69**	**18.75**
Enteric Fermentation	NO		309.03	NE
Manure Management	NO		99.59	NE
Rice Cultivation	NO		24.00	NE

Agriculture Soils	NO		NO	18.73
Field Burning of Agr. Residues	NE		10.07	0.021
Land Use Change & Forestry	**9341.13**		**3.84**	**0.03**
Changes in Forest and Other Woody Biomass Stocks	452.25			
Forest and Grassland Conversion	8888.88		3.84	0.03
Abandonment of Managed Land	NE	***NE***	NE	NE
Emissions and Removals from Soils	NE	NE	NE	NE
Waste			**6.21**	
Solid Waste on Land	NO		6.21	NE
Waste Water Handling	NO		NE	NE
Human Sewage	NO		NE	NE

Note: NE- not estimated.

This shows that the energy sector only contributed 13.1 % of total emissions in 2005. Agriculture is the biggest contributor with 15109 Gg CO_2 equivalents, contributing 52.6% followed by land use change and forestry 32.8%, industry 1% and the waste merely 0.5%. In the land use change and forestry sector, net emissions are counted in the total emissions estimation.

Table 13: Aggregated Emissions of CO_2, CH_4 and N_2O in Afghanistan in 2005

Sectors	**CO_2 Equivalent, Gg**			
	CO_2	***CH_4***	***N_2O***	***Aggregated***
Energy	2910.04	736*	129.828	3776
Industry	312.15	-	-	313
Agriculture	-	9296.49	5812.5	15109
Land use change and Forestry	9341.13	80.64	9.3	9431
Waste	-	130.41	-	130
Total				***28759***

****includes fugitive emissions***

Table 14: Percentage Contribution of CO_2, CH_4 and N_2O in total GHG Emissions in 2005

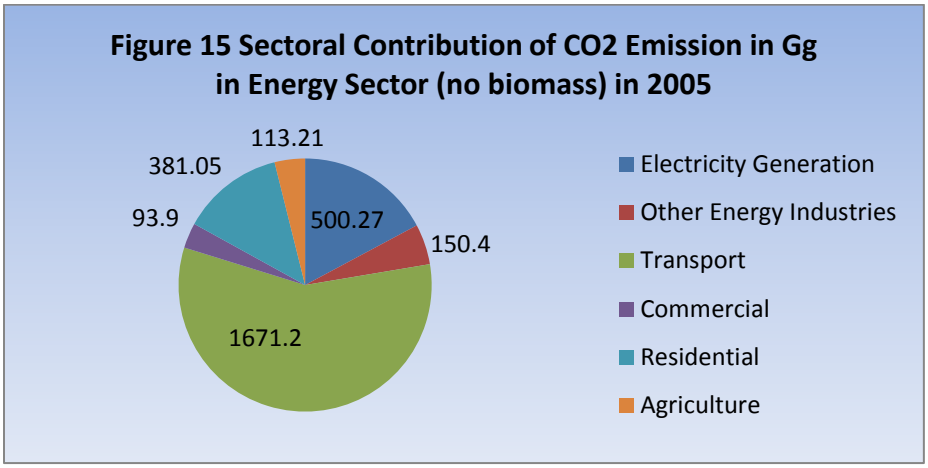
Gas	***Emissions (Gg)***	***CO_2 Equivalent (Gg)***	***Percentage of total emissions***
CO_2	12563.3	12563	43.7
CH_4	487.8	10244	35.6
N_2O	19.2	5952	20.7
Total		***28759***	***100***

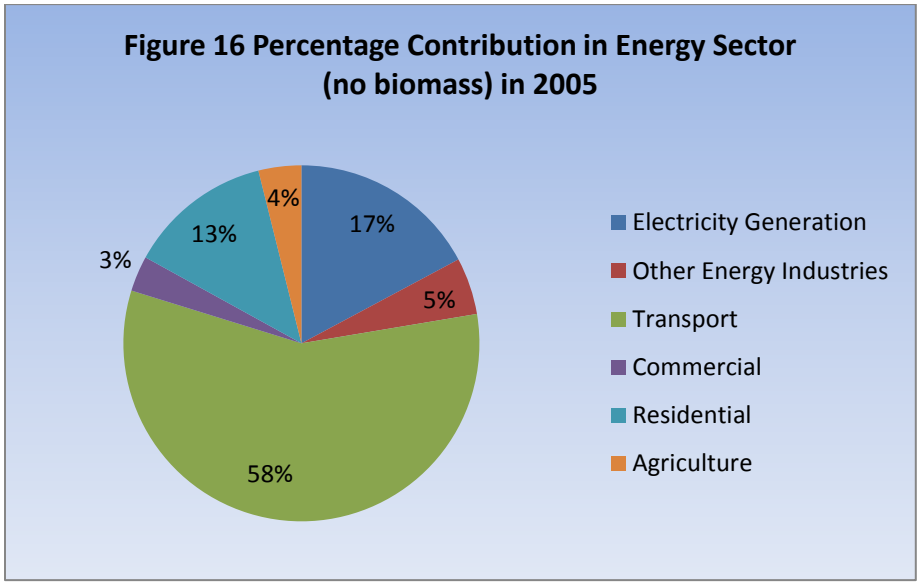
2.4 CARBON DIOXIDE EMISSIONS

2.4.1 ENERGY SECTOR

Carbon dioxide is the most significant greenhouse gas in Afghanistan's GHG emissions contributing nearly 44% of the total emissions in 2005. As mentioned in the national circumstances, per capita energy consumption of Afghanistan is amongst the lowest in the world and because of this the energy sector's contribution to the total GHG emissions is only 13.1 percent contributing only 2910 Gg of CO_2. The sub-sectoral contribution from fuel combustion (not including biomass) is presented in Figure 15 and the percentage contribution in Figure 2.2. This shows transport sector contributes almost 58% followed by

electricity generation (17%), residential (13%), other energy industries (5%), agriculture (4%) and commercial (3%). Contribution of 2427.05 Gg of CO_2 from biomass combustion in residential sector and 651.63 Gg of CO_2 from biomass in commercial sector are not included here as per the IPCC guidelines.





2.4.2 INDUSTRIAL PROCESSES

Carbon dioxide emissions from industries in Afghanistan are primarily due to production of cement clinker, lime production, and ammonia production. There were only four cement factories running with total capacity of 2200 tons per day producing 615520 tons of clinker in 2005. Although there are other ten more industries registered they were not in operation (*NEPA/ADB: GHG Inventory of Afghanistan*). Using the emission factor of 0.5071 tCO_2 released per ton of clinker production, the estimated annual CO_2 emissions in 2005 is 312.13Gg.

Quick lime production figure for the year 2005 in Afghanistan is only 19.3 tons. Using the default emission factor of 0.79 tons of CO_2 per ton of quicklime, the estimated emissions of CO_2 is 15.25 tons (00.01525 Gg).
Afghanistan produced 40,000 tons of urea and 1621 tons of ammonia in 2005. Using the 1500 Kg/ton of Ammonia produced, the estimated emissions of CO_2 for the base year of 2005 is 25.36 tons (0.025 Gg)

Metal industries in Afghanistan are not developed although Afghanistan has huge deposits of metal ore. Two major reserves (copper and iron) are in the feasibility study phase for development, considered to be amongst the biggest in the globe. At the moment there is no contribution of CO_2 emissions from the sector. Other industry sector like food and drink also does not contribute in notable quantity.

The total CO_2 emission from the industrial processes is estimated to be 560.16 Gg for the year 2005.

2.4.3 LAND USE CHANGE AND FORESTRY

In this sector, the fundamental basis for GHG inventory estimates rests upon the fact that the flux of CO_2 to or from the atmosphere is assumed to be equal to the changes in carbon stocks in existing biomass and soils, and that changes in carbon stocks can be estimated by first establishing rates of change in land use and the practices used, to bring about the change (e.g., burning, clear cutting and selective felling etc.). The IPCC approach involves four estimates of carbon stock changes due to; (a) changes in forest and other woody biomass stocks; (b) forest and grassland conversion; (c) uptake from abandonment of managed lands; and (d) emissions and removals from soils.

Changes in Forest and Woody Biomass Stocks
This section deals with the emissions or removals of carbon (and carbon dioxide) due to changes in forest and other woody biomass stocks affected by human activity. To calculate net uptake of CO_2, the annual increment of biomass in plantations, forests which are logged or otherwise harvested, the growth of trees in villages, farms and urban areas and any other significant stocks of woody biomass, is estimated. The calculated net carbon uptake amount, due to these sources, is positive then this counts as removal of CO_2, and if the figure is negative, it counts as an emission.

Area of forest/biomass stock covered in Afghanistan, and the calculated total carbon uptake increase is given in Table 15. According to World Resources Institute, the forest area in Afghanistan in 2005 is 867,000 hectares and the wood removal in 2005 is 836 km3 (170 k m3 is industrial round wood and 693 km3 for wood fuel). The total biomass consumption from stocks due to wood removal is 3830.90 kt dry matters (dm) in 2005.

Table 15: Total Biomass Consumption from Stocks and Total Carbon Uptake Increase

Forest Type	Area of Forest/Biomass Stocks (Kha)	Annual Growth Rate t dm/ha	Carbon Fraction of dry matter	Total Carbon uptake increment (/kt C)
	2005			2005
Acacia Spp.	10.35	15	0.5	77.63
Eucalyptus Spp.	2.13	14.5	0.5	15.44
Other dry forest	854.52	4	0.5	1709.04
Total	867			1802.11

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Since, undisturbed forests maintain carbon dioxide equilibrium, any changes in the forest system due to deforestation or logging can severely affect the equilibrium. This will lead to a change in the net carbon uptake or release. Table 16 represents the annual carbon release/uptake and emission/removal.

Table 16: Carbon Release/Uptake and CO2 Emissions and Removal

Total carbon intake increment (kt)	1802.11
Annual carbon release (kt)	-1925.45
Net annual carbon uptake (kt)	-123.34
CO2 Emission (-)/Removal (+)	(+) 452.25

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Forest and Grass Land Conversion

Forest and grassland conversion to permanent cropland or pasture is a general practice in tropical areas. Tropical forest is usually accomplished by cutting undergrowth and felling trees followed by burning biomass on-site or as fuel wood. By this process some of the biomass is burned while some remains on the ground where it decays slowly (usually over a period of ten years in the tropics). Of the burned material, a small fraction (5-10 percent) is converted to charcoal which resists decay for 100 years or more, and the remainder is released instantaneously into the atmosphere as CO_2. Carbon is also lost from the soils after conversion, particularly when the land is cultivated.

The forest area has been declining at 2.92 percent per year from 2000 to 2005. On an average 29,600 hectares of forest land is being removed or converted annually. The information on biomass burnt onsite and offsite is very crucial for CO_2 release. Annual C and CO2 released due to the burning of forest biomass and natural decomposition is given in Table 17.

Table 17: Carbon Emissions due to Burning and Decaying above Ground Biomass

Annual Loss of Biomass (kt dm)	5328
Immediate Release from burning (kt C)	2157.84
Delayed emissions from decay (kt C) – 10 year average	266.40
Total annual carbon release (kt C)	2424.24
Total annual CO_2 in Gg	(+) 8888.88

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

2.5 METHANE EMISSIONS

For the year 2005, the total methane emissions amounted to 487.8 Gg. In terms of CO_2 equivalent, methane contributed 35.6 percent. Agriculture sector is the main contributor for methane emissions contributing almost 91%. The second largest contributor is energy sector almost 7% followed by waste management 1.3%, and LUCF less than 1%.

2.5.1 AGRICULTURE SECTOR

Agriculture and livestock is the main source of methane emission in Afghanistan. According to IPCC Guidelines, the main sources of methane from agriculture sector results from:

- Domestic live stock

- Rice cultivation, flooded rice fields
- Prescribed burning of Savannas
- Field burning of agricultural residues
- Agricultural soil

Domestic Livestock

Methane is produced in livestock as a byproduct of the digestive process (enteric fermentation) and also as a result of anaerobic decomposition in the manure management process (mainly in dairy farms or cattle farms). Both Ruminant animals (e.g., Cattle, sheep) and some non-ruminant animals (e.g. horse) produce methane. The amount of methane that is released depends on type, age and weight of the animal and the quality and quantity of the feed consumed. However in the present inventory all the animals were brought to a standard unit called livestock unit. Cattle are mainly used for meat production. The livestock population of Afghanistan from 2004/05 to 2010/11 is given in Table 18. The emission for the year 2005 is based on the livestock population of 2004/05.

Table 18: Livestock Population of Afghanistan (thousands)

Livestock species	***2004/05***	***2005/06***	***2006/07***	***2007/08***	***2008/09***	***2009/10***	***2010/11***
Cattle	3494	3723	4110	4357	4745	4721	5673
Sheep	10136	10773	9259	8105	10710	12287	13286
Goat	7648	6977	6746	5387	6386	5810	6789
Chicken	13022	14414	10880	9035	10689	10193	12888
Horse	155	149	146	145	162	177	197
Asses	1612	1390	1215	1472	1209	1322	1505
Mule	29	29	23	24	24	26	24
Camel	190	188	174	186	183	190	191

Source: Afghanistan statistical year book, 2007-8, 2009-10 and 2010-11

The emission factors for enteric fermentation and manure management systems are scanty. No scientific evaluation has been done locally in estimating the emission factors for enteric fermentation and manure management. The recommended default values suited for Afghanistan conditions are therefore used, and are given in Table 19 for methane emission and in Table 20 for Nitrogen Excretion (Nex) by different livestock species. The estimated methane emission from the domestic livestock in Afghanistan for the year 2005 is presented in Table 21 together with Nitrous Oxide.

Table 19: Methane Emission Factors for Enteric Fermentation and Manure Management

Livestock Species	***Emission Factors (kg/head/year)***	
	Enteric Fermentation	***Manure Management***
Dairy Cattle	55	27
Non Dairy Cattle	44	2
Sheep	5	0.16
Goats	5	0.17
Camels	46	1.92
Horses	18	1.64
Mules and Assess	10	0.9
Poultry	Not emitted	0.018

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Table 20: Nitrogen Excretion (Nex) by different livestock species

Livestock Species	*Nitrogen Excretion (Nex) kg/head/year*
Dairy cattle/buffalo	60
Sheep	12
Goat	12
Poultry	0.6
Other	40

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Table 21: Emissions from Livestock Sector

Methane Emissions (Gg)		*Nitrous Oxide (Gg)*
Enteric Fermentation	*Manure Management*	
309.03	99.59	0.22

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Rice Cultivation

Anaerobic decomposition of organic material by methanogenic bacteria in flooded rice fields produces Methane, which escapes to the atmosphere primarily by diffusive transport through the rice plants during the growing season. The amount of Methane that gets released to atmosphere will be as much as 10 to 40 percent of the produced Methane and rest of it will be oxidized by aerobic methanotrophic bacteria in the soils (Holzapfel-Pschorn et al., 1985; Sass et al., 1990). Some of the Methane is also leached away as dissolved Methane in floodwaters that percolate down the field. Some Methane also escapes from the soil via diffusion and bubbling through the floodwaters. The water management system and the duration and depth of flooding, under which rice is grown, are some of the most important factors affecting Methane emissions. Upland rice fields are not flooded, and therefore, are not subjected to produce Methane. Other factors that influence Methane emission from flooded rice fields are soil temperature, soil type, and fertilizer-use and cultivation practices. However, the extent of the influence of these factors in combination has not been well quantified. Rice is one of the major food crop grown in Afghanistan with an annual production of about 350,000 tons. About 195,000 hectares of land is in under paddy cultivation in 2004/5. The details of irrigation type and the land under its cultivation, and the estimated methane emissions are given in Table 22. Rice cultivation produces 24 Gg of methane.

Table 22: Rice Cultivation and Methane Emission in Afghanistan, 2005

Irrigation Type	*Category of Rice Cultivated Land*	*Harvested Area (Ha)*	*CH4 emissions (Gg)*
Canal Type	Continuously flooded	25000	5.00
	Intermittently flooded	80000	8.00
Rain-fed	Flood prone	20000	3.20
	Drought prone	30000	2.40
Deep water	Water depth ≤1m	15000	2.40
	Water depth≥1 m	25000	3.00
Total		195,000	24.00

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Field Burning of Agriculture Residues

Large quantities of agricultural residues are produced from farming system in Afghanistan and it is a common practice to remove the crop residue from the field and burned as a source of energy. Some of the

crop residue will also be burnt on the site. The major crop production, their dry residues, N:C ratio, carbon fractions are given in Table 23. The crop production and the default conversion factors to estimate the resulting residues are given in Table 24 and the methane emissions in Table 25.

Table 23: Crop Production in Afghanistan and their Residue Standards

Product	Production (kt)	Residue/Crop Ratio	Fraction of Dry Matter	Carbon Fraction	N/C Ratio
Wheat	4266	1.3	0.89	0.4853	0.012
Barley	337	1.2	0.89	0.4567	
Maize	3150	1	0.4	0.4709	0.02
Rice	350	1.4	0.89	0.4144	0.014
Potatoes	300	0.4	0.45	0.4226	
Sugar Beet	5	0.2	0.15	0.4072	

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Table 24: Total Biomass Burnt, Carbon and Nitrogen Release from Field Burning of Crop Residues

Total dry mass burnt (Gg)	3170.67
Total carbon released (Gg)	1510.49
Total nitrogen released (Gg)	19.41

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

Table 25: Emission ratio and Emission of Methane from Field Burning of Agriculture Residues

Gas	***Ratio***	***Emission Gg***
CH_4	0.005	10.07
CO	0.06	211.47
N_2O	0.007	0.021
NO_X	0.021	7.72

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

2.5.2 LAND USE CHANGE AND FORESTRY

Forest and Grassland Conversion

In addition to the CO2 released due to burning of forest biomass and natural decomposition, all burning biomass for energy and agriculture residues are the source of CH4, N20, CO and NOx. CH4 is estimated as ratios to carbon fluxes during burning, which is 3.84 Gg.

2.5.3 WASTE

Solid waste management and waste water collection and treatment are other sources of methane emissions. Municipal waste collection and disposal facilities are only in Kabul and in other major cities it is open dumped. Government of Afghanistan has recently come up with the National Solid Waste Management Policy and is under the process of making waste management regulations. These legal tools will lead towards more managed landfill sites in future and also some incineration of wastes. Methane will be emitted from solid waste disposal sites and wastewater handling. In 2005, 3 million people in Kabul generated around 438 Gg of solid waste of which only 100.74 Gg was disposed on the landfill site in Kabul. No facilities for methane recovery or any flaring facilities exist in Afghanistan. Using the IPCC default emission factor, the estimated methane emissions by waste management was estimated at 6.21 Gg

from waste management sector. No waste water is collected and treated, and hence there will be very negligible emission of methane from waste water handling.

2.5.4 ENERGY FUGITIVE EMISSION

Fugitive methane emissions from coal mines, during the annual production of 152,500 Kt of coal, are estimated to produce 2.04 Gg of CH4. And about 30% of gas production (1445.69 TJ) in the country is estimated to be lost during production and transmission. This will produce about 0.0043 Gg of methane *(ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report)*

2.6 NITROUS OXIDE

The total nitrous oxide emissions were 19.20 Gg in 2005, which is 20.7% of the total emissions in CO_2 equivalent. The main contributor was the agricultural sector, which generated 97.1% of the total nitrous oxide emissions in 2005 followed by energy sector and a very small quantity of 0.03 Gg from the abandonment of managed land.

2.6.1 AGRICULTURE

Table 24 shows that the total nitrogen released due to biomass burnt is 19.41 Gg and as per the Table 25 the emissions of N_20 from field burning of agriculture residues is 0.021 Gg and NOx 7.72 Gg. Agriculture soils are the main source of N_2O where the direct emission from the use of commercial N fertilizers (FSN), application of animal wastes as manure (FAW) and through N fixing crops (FBN) N_2O is released to the atmosphere. These sources are illustrated in Table 26.

Table 26: Direct Emission of N_20 from Agriculture Fields

	Fertilizer Input (kt)	Direct Emission Gg N_2O-N/Yr.
Synthetic Fertilizer (FSN)	18.4	0.21
Animal Waste (FAW)	44180.28	2.8
N-Fixing Crops (FBN)		
Crop Residues (FCR)	3844	0.49
Total		3.53

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

In addition to these direct emissions, N_2O is also released to atmosphere through histosols, pasture and range paddocks (AWMS). Also there is indirect emission from atmospheric depositions of NH_3 and NO_X. These emissions are given in Table 27.

Table 27: Emissions of N_2O from Histosols, Grazing Animals, Leaching N_2O Emission (Gg)

	N_2O Emissions (Gg)
From cultivation of histosols	5.55
Leaching	9.18
Atmospheric Deposition	0.47
Total	15.2

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

2.6.2 ENERGY

While estimating the CO_2 emissions from the sectoral approach, there has been emissions of N_2O from the different sub-sectors using energy. In total 0.4188 Gg of N_2O is estimated from use of energy in Afghanistan for the year 2005.

2.6.3 LAND USE CHANGE AND FORESTRY

Forest and Grassland Conversion

In addition to the CO_2 released due to burning of forest biomass and natural decomposition, all burning biomass for energy and agriculture residues are the source of CH_4, N_20, CO and NOx. Total nitrogen content is estimated based on the nitrogen carbon ratios and the estimated N_20 is 0.03 Gg.

2.7 OTHER GASES

The NEPA/ADB, 2007 study on the GHG inventory of Afghanistan also made efforts to estimate some other gases which include, NOx, CO, NMVOC, SO_2, and HFCs. The sectoral contribution of these gases is presented in Table 28.

Table 28: Estimates of the Emissions of Other Gases in Gg for 2005

Sectors	***NOx***	***CO***	***NMVOC***	***SO_2***	***HFC***
Energy	53.91	865.20	91.20	13.68	
Industrial Processes		0.01	243.11	0.18	0.05
Agriculture	7.72	211.47			
Land Use Change and Forestry	0.95	33.57			
Waste					
Total national emissions	62.58	1110.25	334.30	13.86	0.05

Source: ADB and NEPA, 2007: Afghanistan Green House Gas Inventory Report

3 VULNERABILITY ASSESSMENT AND ADAPTATION

3.1 INTRODUCTION

In accordance with Article 12, paragraph 1 (b) and (c), of the Convention, Islamic Republic of Afghanistan, as party to the convention, has to provide to the COP information on the general descriptions of steps taken or envisaged towards formulating, implementing, publishing and regularly updating national and, where appropriate, regional programmes containing measures to facilitate adequate adaptation to climate change, and any other information relevant to the achievement of the objective of the Convention and suitable for inclusion in its communications.

In recent years, climate change has become central to the development and poverty-reduction agenda. The need to conduct thorough impact assessments and carefully plan measures to help reduce impacts of climate change, through adaptation, has become more apparent. As a result, analyzing a nation's vulnerability to climate change and the options available to adapt is receiving greater priority on political agendas. As a LDC country, Afghanistan has already undertaken the National Adaption Program of Actions (NAPA) submitted to the convention in 2009.The NAPA findings are prioritized in this chapter.

3.2 SUPPORTS TO AFGHANISTAN UNDER ARTICLE 4.8 AND 4.9 OF CONVENTION

After being party to the UNFCCC, Afghanistan regularly participates and contributes to the objectives of convention in the conference of parties or regional meetings. Since 2001 the international community is providing support in the reconstruction and development of Afghanistan, mainly in the implementation of National Priority Programs identified by GIRoA in consultation with donor communities to meet the objectives of ANDS. Although this assistance is not directly linked as support under the UNFCCC, this external assistance for the reconstruction and development of Afghanistan has contributed significantly over the years towards developing national capacities to adapt the adverse impact of climate change. The status on the commitment and disbursement of such assistance for the period of 2002-2010 in seven different sectors and others is included in the National Circumstances chapter (Figure 14).

Besides this, under the financial mechanism established by the UNFCCC and financial support for the national capacity building and technology transfer, GIRoA has completed and initiated the following projects:

- Preparation of National Capacity Self-Assessment and National Adaptation Programme of Action (NAPA), US $ 400,000.00 (2005-2008)
- Preparation of Initial National Communication for Afghanistan (2008-2011), US $ 390,000.00
- Preparation of National Biodiversity Strategy and Action Plan (2009-2012), US$370,000

In addition to the above and to support the implementation of priority programs of NAPA, GEF has already approved a US$ 5.3 million climate change adaptation project to be funded from LDCF, which is expected to start January 2013. Afghanistan is not yet party to the Kyoto protocol, so has not been able to benefit from special climate change fund, adaption fund, and clean development mechanism.

3.3 STEPS TAKEN OR ENVISAGED TO ADAPT TO CLIMATE CHANGE

Over the years, Government of Islamic Republic of Afghanistan has made many initiations towards creating national capabilities to promote the sustainable development path in Afghanistan. A summary of initiatives on national policies and legal system, and implementation of programs and projects that can help Afghanistan to adapt the climatic risks is briefly presented here.

3.3.1 POLICY, PLANS AND LEGAL FRAMEWORK:

There have been good initiatives in development of national policy plan and legal frameworks to address environmental challenges, disaster risk reduction, water security, food security, protection of forest and rangeland, biodiversity conservation all having synergy to adaptation to the climatic risks (Table3.1).

Table 3.1: Policy, Plans and Legal Framework in Afghanistan to promote sustainable development

Policy & Legal Framework	***Key Objectives***
Afghanistan National Development Strategy, 2008	• National vision for poverty reduction in Afghanistan • Vision to achieve the Millennium Development Goals (MDG) in Afghanistan • Environmental sustainability a vision for long-term development goals • Provides sectoral development strategy and sets priority programs
Environmental Law, 2007	• Umbrella law for environmental conservation and pollution control in Afghanistan • Mandates environmental assessment in major policy plans and projects • Mandates setting environmental requirements and ensures compliance • Protected Area concept for biodiversity conservation
National Environmental Action Plan (NEAP), 2010	• Sets priority programs on air pollution and water pollution prevention and control • Priority actions for land, forests and rangeland management and biodiversity conservation • Priority cross-cutting action plans
National Waste Management Policy	• Promotes waste management hierarchy-avoidance; reduction; reuse; recycle and waste to energy; and safe disposal
EIA Regulation	• Defines procedures for environmental impact assessment of development projects to minimize the adverse environmental impacts and enhance the positive impacts of projects
Clean Air Regulation	• Requires environmental standards for both mobile and stationary sources of air pollution and compliance system • High level coordination mechanism
National Adaptation Program of Action	• Identified 51 different adaption actions in seven thematic areas and prioritizes programs to address the climatic risks in Afghanistan
Disaster Management Act	• An revised version of earlier act to incorporate risk reduction perspective as opposed to the earlier act's focus on post disaster relief and rescue activities • Requires government to mainstream DRR into regular planning process with clear sectoral roles and responsibilities • Establishes ANDMA as a national nodal body on DRM with clear roles and responsibilities
National Disaster Management Plan, 2010	• Clearly identifies roles and responsibilities of the NDMC and ANDMA along with its provincial committees and provincial offices, and associated line ministries, NGOs and international partners • Lays out operating procedures for risk reduction, response and recovery

Strategic National Action Plan for Disaster Risk Reduction	• Provides a road map to "A Safer and More Resilient Afghanistan" by addressing the risks of future disasters and climate change impacts in a cohesive way. • SNAP seeks to utilize the convergence of DRR and climate change adaptation, and endeavors continuity of and consistency with the country's plans and programs
Guidelines for the Use of National Emergency Fund	• Guideline for the effective use of National Emergency Fund in meeting the immediate needs of communities affected by disaster of catastrophic scales • Fund separated into preparedness and risk mitigation activities
Water Law 2009	• Adopted integrated water resources management and river basin management through multi-stakeholders platforms as the core concept of water resources management in Afghanistan
Water Sector Policy	• River basin and sub-basin approach • Promotes community participation in the management of water resources
Framework Regulation for Water User Association	• Legally mandates decentralization process Water Basin Council; Sub-basin Council; User Association • Establishes water rights for user association
Rural Renewable Energy Development Policy (draft)	• Promotes meeting rural energy through renewable sources • Economic incentives provisions for cleaner energy • Promotes community participation in rural energy development and distribution.
Power Sector Master Plan	• Primary focus on generation of power with different sources
Gas Sector Master Plan	• Primary focus on development of gas sector in Afghanistan
National Agriculture Development Framework, 2009	• Superseded and combined all previous strategic frameworks into a comprehensive inventory of key issues for agricultural development, • Divided into four main programmes (Natural Resource Management, Agriculture Production and Productivity, Economic Regeneration and Programme Support and Change Management
Forest Law 2011	• Passed by the lower house but yet to be passed by the upper house • Promotes community based natural resources management
Sustainable Rangeland Management Plan (draft)	• Aims to provide both a framework and a road map for MAIL and its development partners to facilitate a comprehensive integrated approach to rangeland management.
Ozone Regulation, 2007	• Legal provisions to phase out the ODS as per the Montreal Protocol
Minerals and Hydrocarbon Law	• Two laws (Mines Law and Hydrocarbon Law) which determine the ownership and control of the State over minerals and hydrocarbons, preservations, utilization, granting concessional rights, execution of contracts, exploration activities and developments and production of the oil and gas • Amendments to these laws is ongoing along with the relevant regulations for the sustainable development of mineral, and hydrocarbons

3.3.2 ONGOING AND COMPLETED PRIORITY PROGRAMS SUPPORTIVE TO ADAPTATION TO CLIMATE CHANGE

Major programs and projects being implemented or already implemented in Afghanistan with support from donor communities that will help to build the adaptive capacity to the impact of the climate change in Afghanistan are briefly discussed here. These include:

- Multi-tranche Financial Facility (2007 onwards):ADB, Water Resources Development Program for Afghanistan formed by three trenches with a total fund of US $300 million. The first Tranche has three components- Northern Basin Development; Nangarhar Valley Development Authority Improvement; and Flood Management Program.
- Multiannual Program (2011-2013):European Union, primary focus on rural development, governance, rule of law, and health. Main components are River Basin Management; Animal Heath; Horticulture and Seed Industry; Rural Infrastructure Development; Data Survey (vulnerability, food security, and poverty); Environment (natural resource management)
- National Solidarity Programme (NSP): initiated in 2003 and ongoing (implemented by MRRD), NSP aims to "develop the ability of Afghan communities to identify, plan, manage and monitor their own development projects. Through the promotion of good local governance, the NSP works to empower rural communities to make decision affecting their own lives and livelihoods.
- Strengthened Approaches for the Integration of Sustainable Environmental Management in Afghanistan (SAISEM): a UNDP, FAO, and UNEP joint program, to build institutional capacity of Afghan government and communities for sustainable environment management, and improve capability of national and local governance bodies for natural resources and disaster management.
- Energy for Rural Development Afghanistan (ERDA): 2008-2015 is supporting MRRD's Rural Energy and Enterprise Department; three components- policy review (rural and renewable energy); capacity development (government and communities); and pilot energy projects.
- Irrigation Restoration and Development Project (IRDP): the WB supported ongoing program aim to increase agricultural productivity and production in the project areas and supports the implementation of the National Priority Programs of government.
- Emergency Infrastructure Rehabilitation and Reconstruction Project (2003-2013): ADB projectto rehabilitate damaged facilities through the provision of civil works, equipment/material
- UNEP: Capacity building and Institutional Development Program for Environmental Management in Afghanistan (2008-2013)
- Pastoral Engagement, Adaptation and Capacity Enhancement (PEACE) Project: aims to reduce the social and economic risks associated with livestock production in Afghanistan;
- Agro Meteorological Project in Afghanistan (AgroMet) provides climatic information, validation of satellite monitoring and ground truth crop forecasts;
- World Food Programme (WFP): National Risk and Vulnerability Assessment (NRVA) of Afghanistan, collects information at community and household levels to better understand livelihoods of rural settled populations and nomadic pastoralists (*Kuchi*) throughout the country, and to determine the types of risks and vulnerabilities that they face throughout the year.
- Famine Early Warning Systems Network (FEWS Net): aims to strengthen the abilities of foreign countries and regional organizations to manage risk of food insecurity through the provision of timely and analytical early warning and vulnerability information.
- Catholic Relief Services (CRS) has initiated a sustainable land management program that aims at combining bio-physical watershed restoration activities with support for income generation and the provision of agricultural services.
- ADB: Rural Land Administration Project (RLAP) has concentrated on trialing new methodologies for community administration of rural land records, supporting the preparation of a comprehensive land policy, and developing recommendations for reform of relevant government institutions.

- Wildlife Conservation Society (WCS) is implementing conservation activities in three geographical areas: the Wakhan Corridor, the Hazajarat Plateau, and the Eastern Forest complex.
- International Centre for Integrated Mountain Development (ICIMOD) has established a Biodiversity and Community Forestry Programme in Afghanistan that aims to strengthen the natural resource management sector by providing increased access to institutional and policy innovations from the Hindu Kush Himalayan region.
- The Food and Agricultural Organization (FAO) of the UN supports the rehabilitation and development of the agriculture and natural resource sector and assists the country towards becoming food secure and self-reliant.

3.4 CURRENT CLIMATE AND VARIABILITY IN AFGHANISTAN (1960-2008)

3.4.1 GENERAL CLIMATE

Afghanistan, a mountainous and very dry country, has an arid and semi-arid continental climate with cold winters and hot summers. A brief description of the general climate is provided in the National Circumstances chapter and in this heading more information is provided on current trend and future projection.

3.4.2 RECENT CLIMATE TRENDS

In order to address the climate change information gap in many developing countries, National Communication Support Program and UK Department of International Development had funded the study of developing country climate change profiles conducted jointly by School of Geography and Environment, University of Oxford and Tyndall Centre for Climate Change Research. The outcomes are presented as UNDP Climate Change Country Profiles. These are main source of available information on many developing countries and the findings of Afghanistan country profiles are presented here.

Temperature

Historic norms and analysis of available data from surrounding countries indicates a trend of increasing mean temperatures, an increase in the number of hot days, and a reduction in cold night temperatures and cold spells, over recent years. This is consistent with trends in temperature across a broad region of central-south Asia.

- Mean annual temperature has increased by 0.6°C since 1960, at an average rate of around 0.13°C per decade. The rate of increase is most rapid in SON, with increases at an average rate of 0.29°C per decade, and slower in DJF at a rate 0.11°C per decade.
- The frequency of hot days and hot nights has increased since 1960 in every season.
    - The average number of 'hot' days per year has increased by 25 (an additional 6.8% of days) between 1960 and 2003. The rate of increases is greatest in SON, when the number of hot SON days has increased by 3 days per month (an additional 10.3% of SON days) over this period.
    - The average number of 'hot' nights per year has increased by 26 (an additional 6.7% of days) between 1960 and 2003.
- The frequency of cold days and nights, annually, has decreased since 1960.

- The average number of 'cold' days per year has decreased by 12 (3.2% of days) between 1960 and 2003. The rate of decrease is greatest in winter (DJF) when the average number of cold winter days has decreased by 1.6 days per month (5.2% of winter days) over this period.
- The number of cold nights has decreased at a similar rate to cold days.

The trends in Temperature (1960-2005) based on the above mentioned UNDP country profile of Afghanistan is presented in Figure 3.1.

Precipitation

The arid climate of Afghanistan is characterized by large areas with little or no precipitation, but the rainfall that does occur falls primarily as snow on high mountains from winter storms of Mediterranean origin between November and April with peaks in February/March. The Asian summer monsoon system tends to suppress rainfall over Afghanistan. Afghanistan recently had passed through the grips of the most severe drought in living memory. Rainfall in Afghanistan is very scarce, and mainly only affects the northern highlands, arriving in March and April. Rainfall in the more arid lowlands is rare, and can be very unpredictable. Snowfall is reported as having become more variable.

Changes in precipitation regimes tend to vary more between regions than temperature. In the case of Afghanistan, these can only be assessed from case study commentaries on drought and flood conditions. These include reports of the largest snowfall in a decade (and 80% more than the previous winter) in February 2005, which began melting in March, bringing flooding to northern, central and western provinces. Floods, although not as severe, were also reported in March 2003. Severe drought conditions prevailed between 1998 and 2001 and are believed to relate partly to La Nina conditions in the Pacific. It is also seen that IOD and ENSO impacts are opposite over Pakistan, Afghanistan and Iran (*Karumari and Saji: On Impacts of ENSO and Indian Ocean Dipole events on the sub-regional Indian summer monsoon rainfall*). The droughts were the most severe of the last 50 years.

- Mean rainfall over Afghanistan has decreased slightly (at an average rate of 0.5mm per month (or 2%) per decade,) since 1960. This is mainly due to decreases of around 2.7mm per month (6.6%) per decade in MAM rainfall, but is offset by small increases in JJA and SON rainfall.
- The proportion of rainfall that occurs in heavy events has not changed with any consistent trend since 1960.
- The observed maximum 1- and 5-day rainfalls generally show small decreases in MAM, but increase slightly in other seasons.

The trends in precipitation (1960-2006) based on the above mentioned UNDP country profile for Afghanistan is presented in Figure 3.2.

Under the Global Standards Normal project, climate normals were computed for Afghanistan for the period 1956-1989 and provided to WMO. The computed climate normals based on the seven stations are (NAPA):

- The average annual precipitation ranges from 5.2 centimeters (2.03 inches) at Zaranj in southwest Afghanistan to 99.2 centimeters (39.06 inches) in the northeast mountains at North Salang.
- Temperatures can vary widely, from as cold as -46 ºC (51 degrees below zero F) at Chakhcharan (in the north central mountains at an elevation of 7162 feet) to as hot as 51 ºC (124 degrees F) in the southwestern deserts at Zaranj.

- The mountain valleys can experience, on average, 10 to 30 days per year with snowfall, but the higher passes receive much more snow.
- At an elevation of 11,043 feet, North Salang receives snow, on average, 98 days out of the year with depths reaching as high as 177 inches. Snow has been observed on the ground there as early as August and as late as June.

Global mean monthly normals (WMO) of temperature (^{0}C) and precipitation (mm) for seven stations of Afghanistan are presented in Table 3.2.

It is clear that elevation and season strongly influence the mean monthly temperature ranging from -11º at Salang (3,366 m) in January to +34º at Farah (700m) in July. Like temperature, precipitation is strongly influenced by elevation, with the highest mean monthly precipitation of 996mm measured at Salang (3,366 m) and the lowest of 97mm at Farah (700 m). The strongly seasonal nature of precipitation is obvious with almost none falling in summer and most precipitation falling as snow in the winter and early spring. These trends are further illustrated in the following maps (Figure 3.3), which indicate maximum temperature and maximum precipitation during the driest and wettest seasons.

Table 3.2: Global Mean Monthly Normal of Temperature (^{0}C) and Precipitation (mm) for Afghanistan (1956-1989)

Mean Monthly Temperatures ^{0}C														
Stations	***Elevation(m)***	***J***	***F***	***M***	***A***	***M***	***J***	***J***	***A***	***S***	***O***	***N***	***D***	***Mean***
Herat	964	3	6	10	16	22	30	30	28	23	16	9	4	16
Farah	700	7	10	16	22	27	32	34	32	27	20	13	9	21
Chagcharan	2183	-9	-7	2	9	13	17	19	18	12	7	2	-4	6
Kandahar	1010	5	8	14	20	26	30	32	29	23	18	11	7	19
Kabul	1791	-2	2	6	13	17	23	25	24	19	13	6	1	12
Salang	3366	-11	-9	-6	0	3	8	9	8	4	1	-4	-8	0
Faizabad	1200	0	2	8	14	18	24	27	26	21	8	8	3	13
Mean Monthly Precipitation in mm														
Stations	***Elevation(m)***	***J***	***F***	***M***	***A***	***M***	***J***	***J***	***A***	***S***	***O***	***N***	***D***	***SUM***
Herat	964	51	46	56	28	10	0	0	0	0	3	10	36	239
Farah	700	25	23	23	8	3	0	0	0	0	3	3	10	97
Chagcharan	2183	30	33	41	36	20	0	0	0	0	10	15	18	203
Kandahar	1010	53	43	41	18	3	0	3	0	0	3	8	20	191
Kabul	1791	36	61	69	71	23	0	5	3	3	3	18	23	312
Salang	3366	109	142	185	198	124	10	8	8	8	30	79	104	996
Faizabad	1200	48	66	91	99	76	8	5	0	3	23	30	33	483

Figure 3.1: Trends in temperature (1960-2005) based on UNDP Climate Profile for Afghanistan

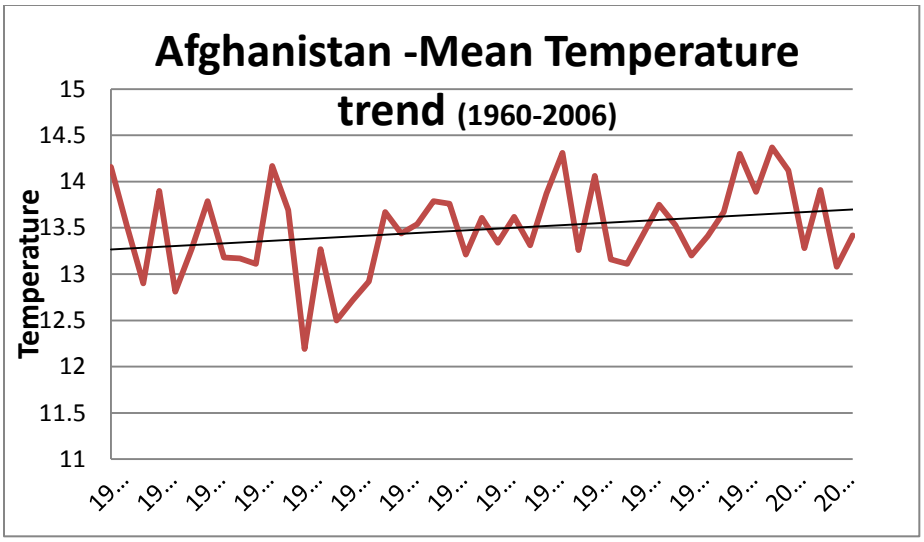


Figure 3.2: Trends in Precipitation (1960-2006) based on UNDP Climate Profile for Afghanistan

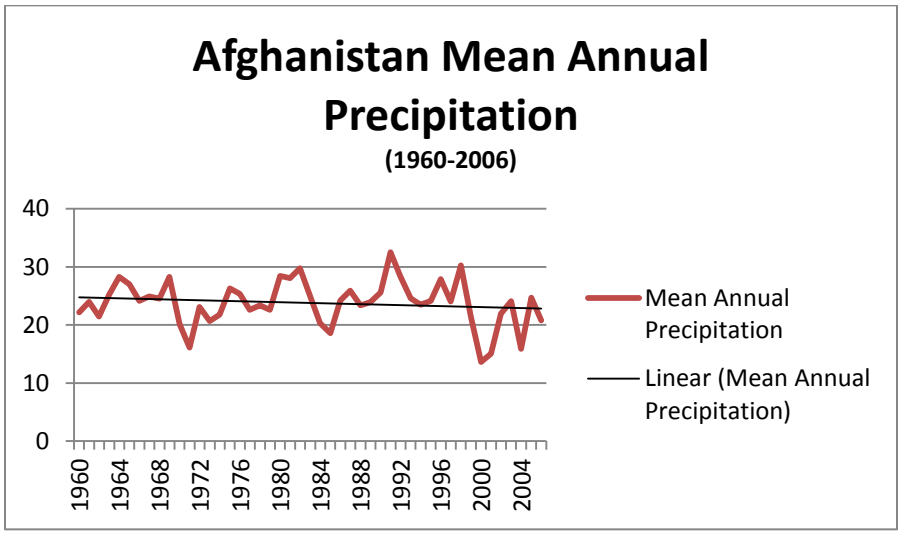
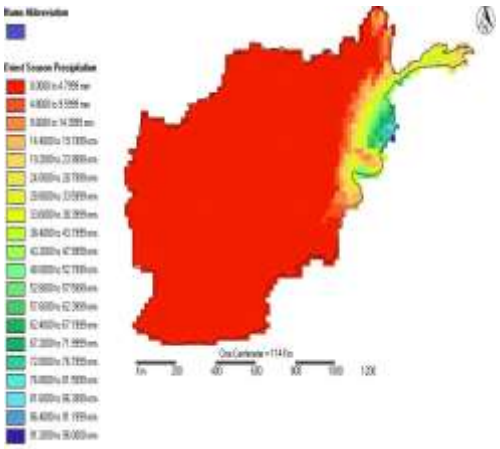
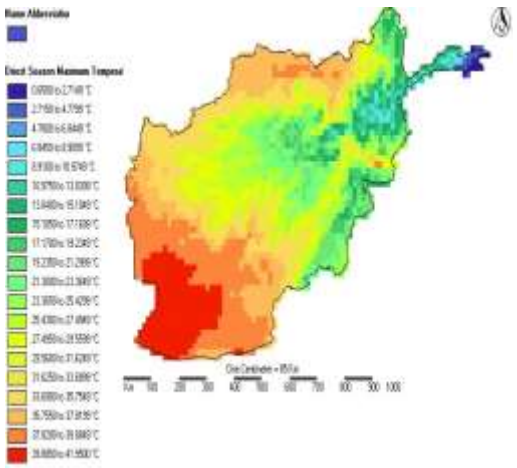
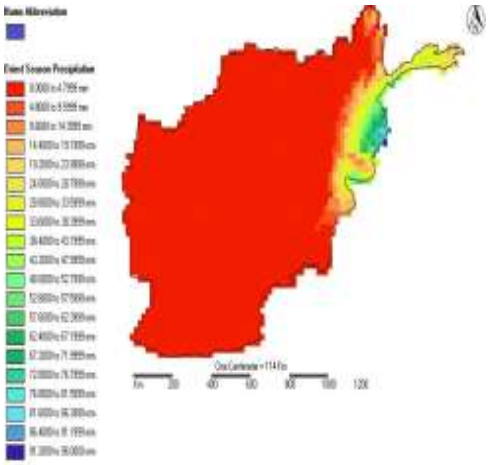
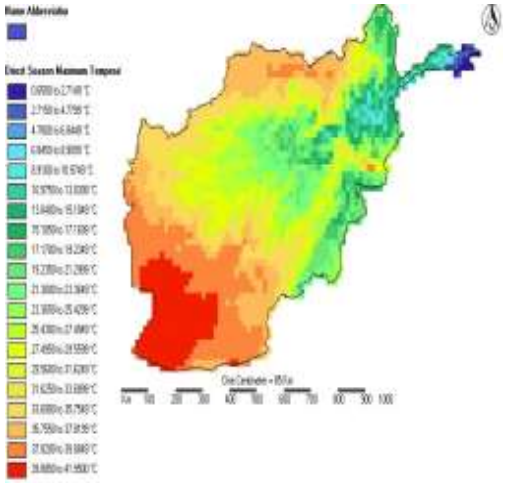


Figure 3.3: Maximum temperature and maximum precipitation during the driest and wettest seasons









3.4.3 CLIMATE PROJECTION 2008-2090

The UNDP Climate Change Country Profiles, the 2008-2090 projections are summed up here.

Temperature

- The mean annual temperature is projected to increase by 1.4 to 4.0°C by the 2060s, and 2.0 to 6.2 degrees by the 2090s. The range of projections by the 2090s under any one emissions scenario is around 1.5 to 2.5°C.
- The projected rate of warming is most rapid in spring and summer and relatively uniform across the regions of the country.
- All projections indicate substantial increases in the frequency of days and nights that are considered 'hot' in current climate.
    - Annually, projections indicate that 'hot' days are projected to occur on 14-25% of days by the 2060s, and 16-32% of days by the 2090s. Days considered 'hot' by current climate standards for their season are projected to increase most rapidly in Summer (JJA), occurring on 27-86% of days of the season by the 2090s.
    - Nights that are considered 'hot' for the annual climate of 1970-99 are projected to occur on 16-26% of nights by the 2060s and 19-36% of nights by the 2090s. Nights that are considered hot for each season by 1970-99 standards are projected to increase in frequency most rapidly in summer (JJA), occurring on 29-86% of nights in every season by the 2090s.
- All projections indicate decreases in the frequency of days and nights that are considered 'cold' in current climate. These events are expected to become exceedingly rare, occurring on 0-6% of days in the year by the 2090s.

Precipitation

In the 2030s, rainfall is projected to increase over much of Afghanistan though by little more than about 10-20mm. The increase is largest in the far northeast (20-50mm) and results from increases in spring and winter. Mean annual rainfall changes in the 2090s show conditions are generally drier depending on emissions scenario (-40 mm high, -20 mm medium, -10 mm low) over much of Afghanistan. Much of the drying is due to change in spring with decreases arising largely due to reductions in the wet season rainfalls. Autumn is projected to be slightly wetter, especially in the north. Projections of mean annual rainfall from different models in the ensemble are broadly consistent in indicating decreases over this timeframe. (*DFID: Socio-Economic Impact of Climate Change in Afghanistan-Final Report*)

The proportion of total rainfall that falls in heavy events does not show a consistent direction of change, but tends towards positive changes, despite overall decreasing trends in total rainfall. A 'Heavy' event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in current the climate of that region and season.

Figure 3.4: Changes in Annual Temperature1960-2100 by Season

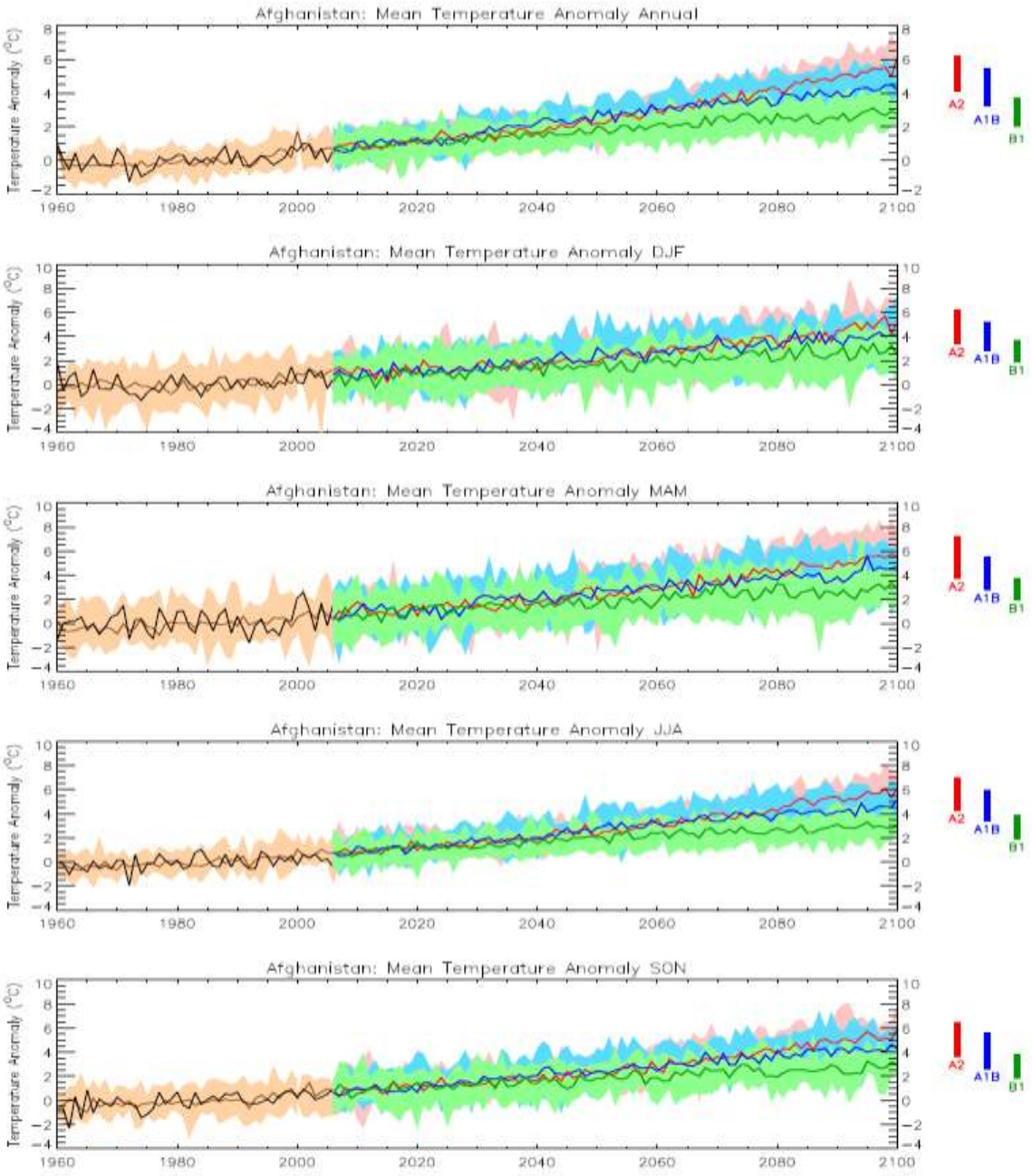


Figure 1: Trends in annual and seasonal mean temperature for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. Black curves show the mean of observed data from 1960 to 2006, Brown curves show the median (solid line) and range (shading) of model simulations of recent climate across an ensemble of 15 models. Coloured lines from 2006 onwards show the median (solid line) and range (shading) of the ensemble projections of climate under three emissions scenarios. Coloured bars on the right-hand side of the projections summarise the range of mean 2090-2100 climates simulated by the 15 models for each emissions scenario.

Figure3.5: ***Spatial Patterns in Temperature Change under the SRES A2 emissions scenario***

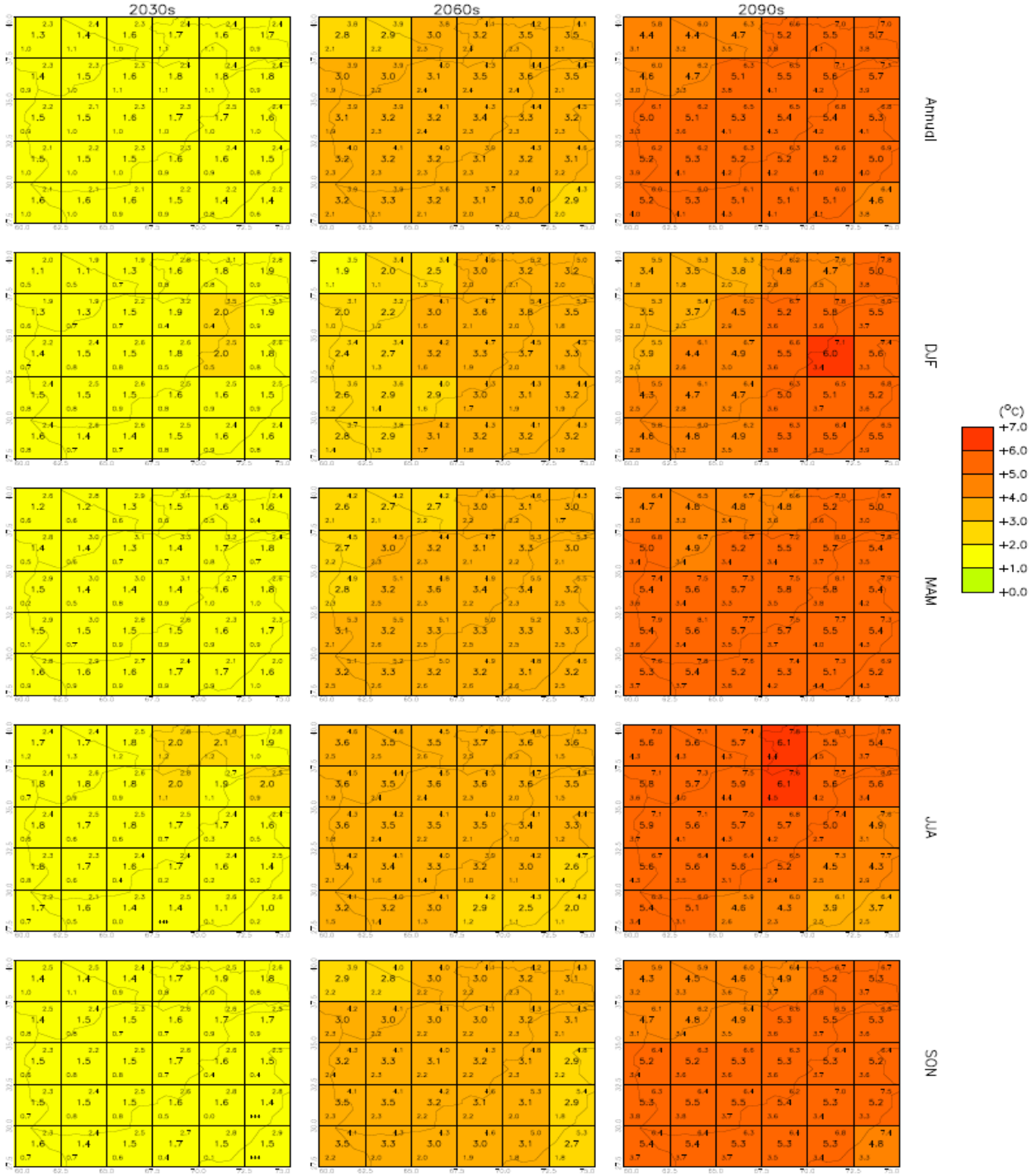


Figure 2: Spatial patterns of projected change in mean annual and seasonal temperature for 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999. In each grid box, the central value gives the ensemble median and the values in the upper and lower corners give the ensemble maximum and minimum.

Figure3.6: ***Historic and Predicted Changes in Precipitation 1960-2100 under 3 global emission scenarios***

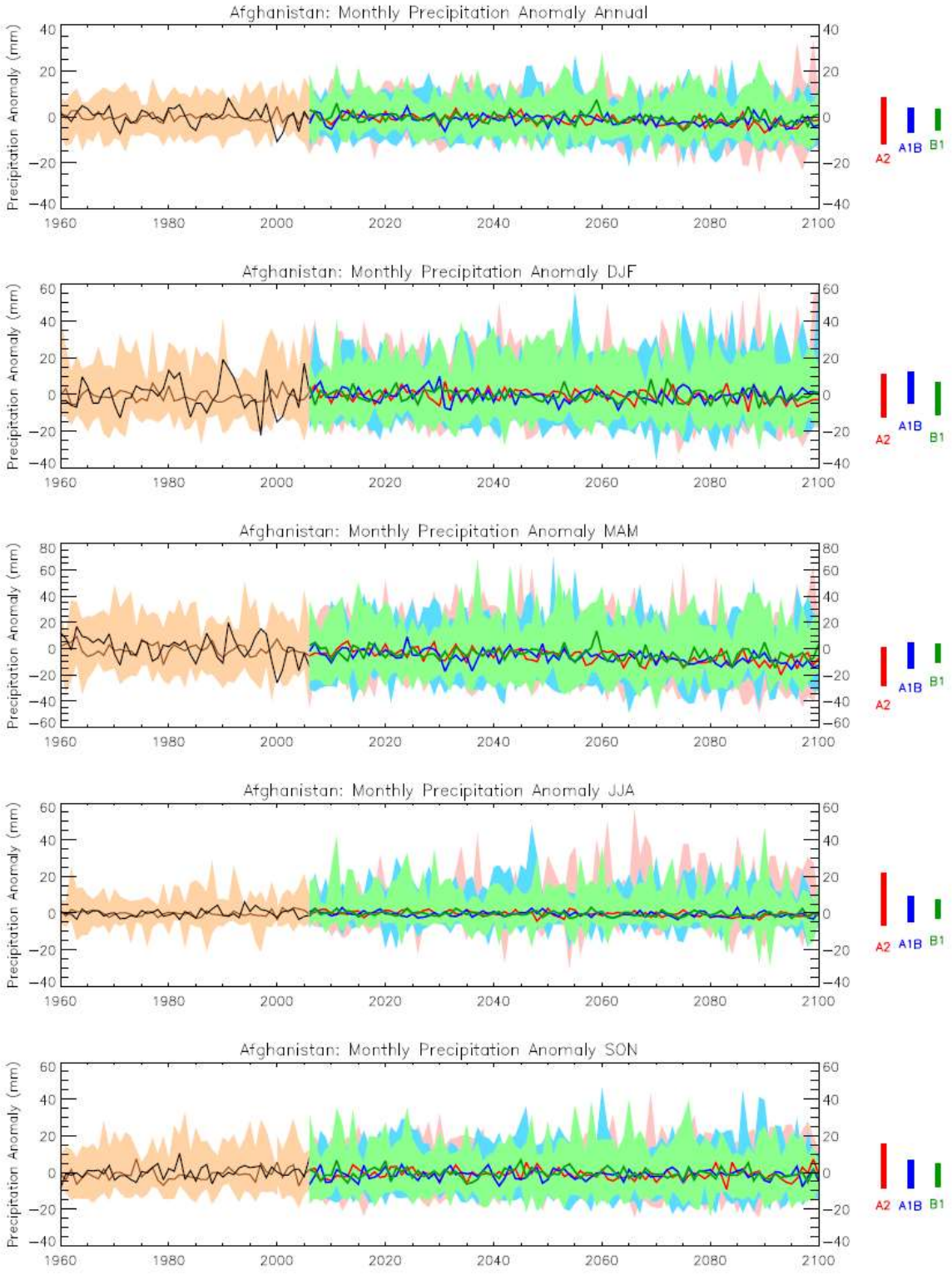


Figure 3: Trends in monthly precipitation for the recent past and projected future. All values shown are anomalies, relative to the 1970-1999 mean climate. See Figure 1 for details.

Figure 3.7: Spatial Patterns in Precipitation Changes in % terms 1960-2100 under SRES A2

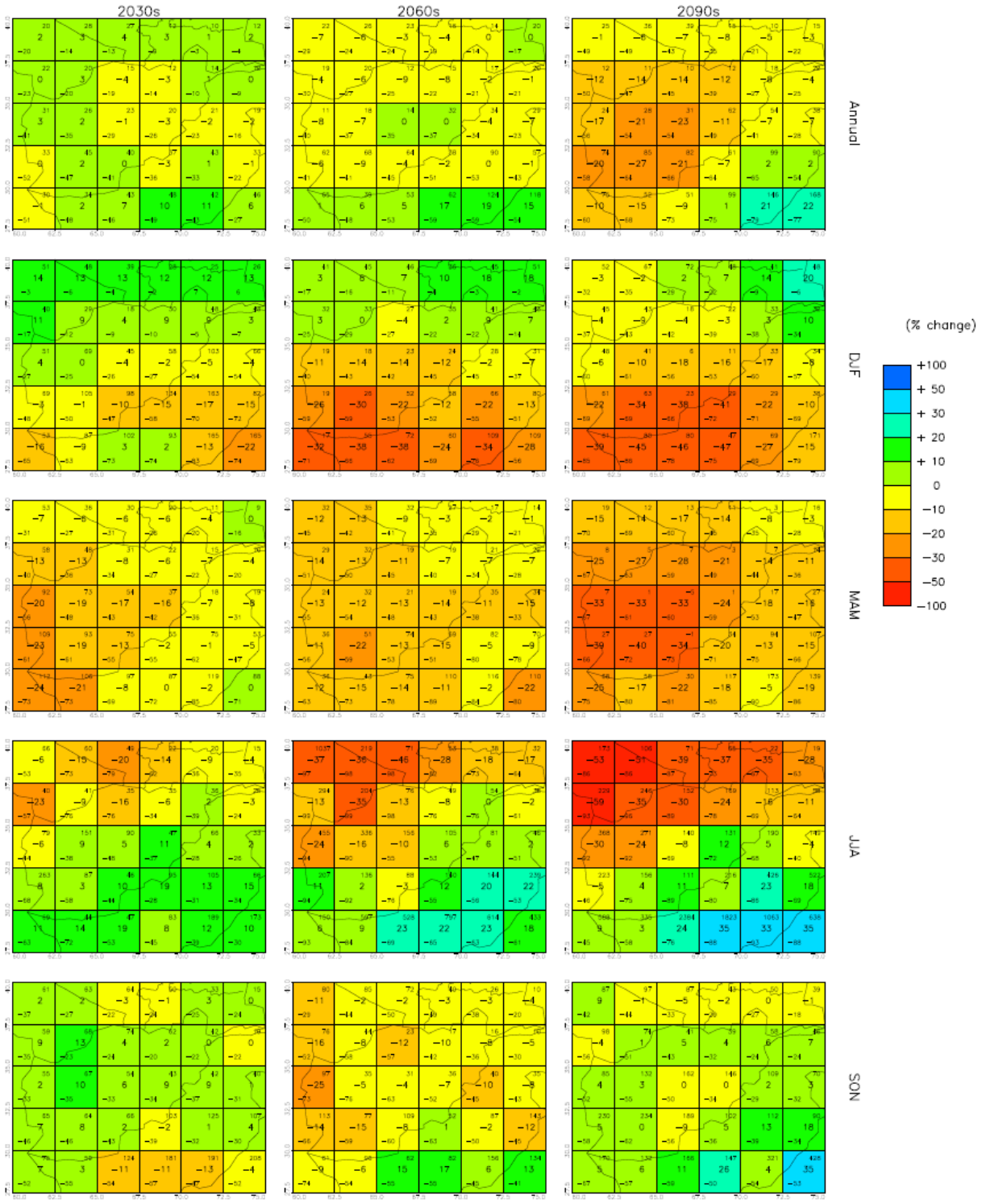


Figure 6: Spatial patterns of projected change in monthly precipitation for 10-year periods in the future under the SRES A2 scenario. All values are percentage anomalies relative to the mean climate of 1970-1999.See Figure 2 for details.

3.5 CLIMATIC HAZARDS IN AFGHANISTAN

3.5.1 OBSERVED CLIMATIC HAZARDS

The available statistics on the human and economic losses from disasters that have occurred between 1980 and 2010 show that the most frequent hazard is flood followed by earthquake and epidemic (percentage of people killed from 1900-2010: earthquake-49.87%; floods-18.87%; epidemic-16.93%; storm- 7.3%; landslide-2.56%; cold wave- 2.52%; avalanche-1.78%, drought-0.16%). While, floods caused the biggest economic damage, earthquake was the deadliest in terms of loss of life. Two earthquakes in 1998 killed 4,700 and 2,373. More than a dozen earthquakes were recorded during the last century. In 2002, one of three earthquakes had a maximum magnitude of 6.1 on the Richter scale with epicenter at Takhar, Nahrin District of Baghlan province. The earthquakes killed 1,800 people, leaving thousands homeless. (ANDMA, 2010: Afghanistan- Strategic National Action Plan (SNAP) for Disaster Risk Reduction: Towards Peace and Stable Development)

Nonetheless, drought affects most of population (*Table3.3: Top Ten Disasters in Afghanistan*). In Afghanistan, drought has occurred in 1963, 1966/67, 1970/71, 1998-2001, 2006, and 2008. Extended drought for several years is believed to have started in 1969, reaching a critical state during 1997 - 2002. Five million families were affected and a million were estimated to have migrated to neighboring countries. The drought changed the hydrological regime in some parts such as Kabul City. Before 1980, the river was snow fed but due to the persistent drought, it has become rain-fed. Droughts recorded in 2000, 2006 and 2008 affected 2.58 million, 1.9 million and 280,000 people, respectively.

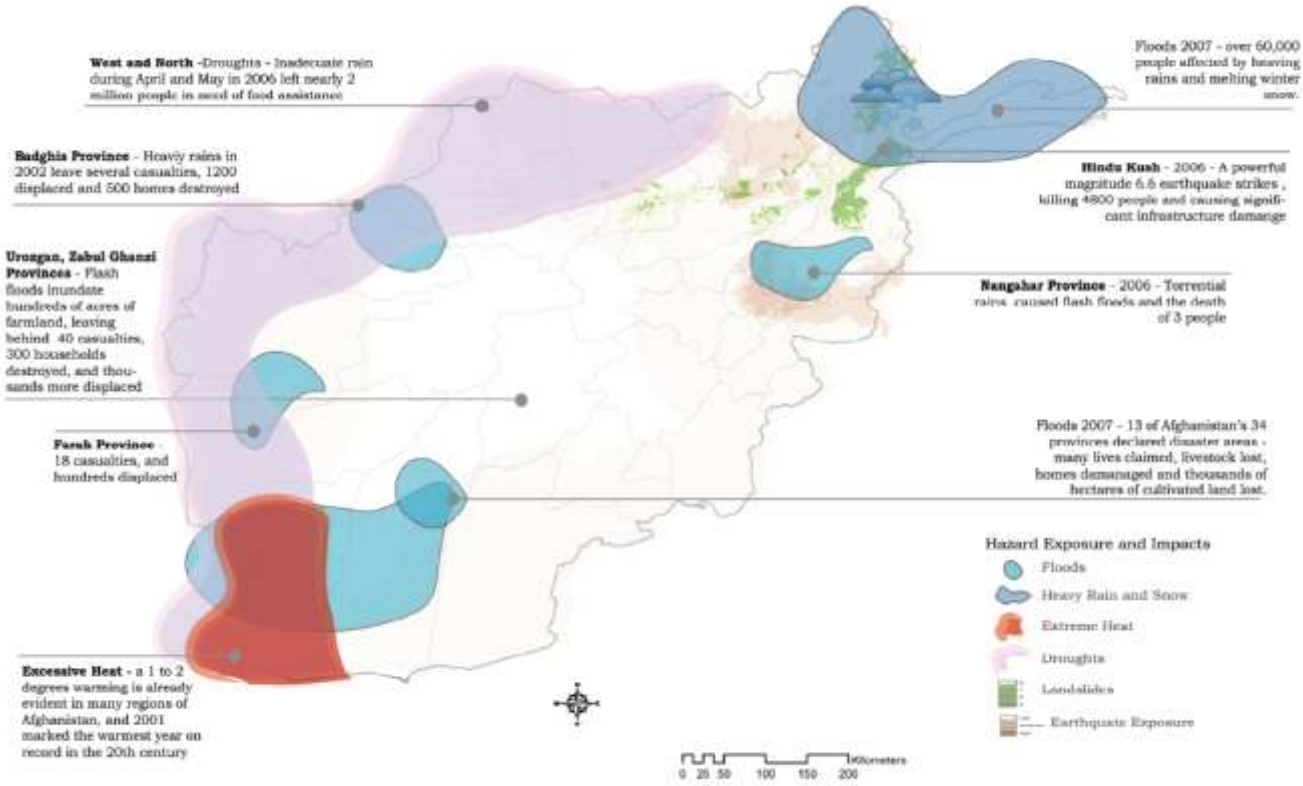
Table 3.3: Top ten disasters in Afghanistan

Disaster	***Period***	***Total Affected Population***
Drought	May 2000	2580,000
Drought	July 2006	1900,000
Mass Movement Wet	13 January 2006	300,000
Drought	October 2008	280,000
Flood	July 1978	271,684
Flood	January 1972	250,000
Epidemic	Jan 2002	200,000
Storm	January 05, 2008	170,684
Flood	June 1998	161,000
Earthquake (Seismic Activities)	30 May 1998	116,935

Source: ANDMA, 2010: Afghanistan- Strategic National Action Plan (SNAP) for Disaster Risk Reduction: Towards Peace and Stable Development

Nearly all of Afghanistan's provinces have been affected by at least one natural disaster in the last three decades. The principal climate hazard experienced by Afghanistan is drought, which impacts all provinces due to the high dependence on rain-fed crops (NAPA 2009). The recent climatic hazards in Afghanistan are presented in Figure 3.8) (SEI-Stockholm Research Institute).

Figure 3.8: Recent climate hazards in Afghanistan (SEI)



Government of Afghanistan in the process of preparing National Adaptation Programme of Action (NAPA) has identified through participatory discussion an inventory of common hazards faced by the country and each hazard were then critically assessed using criteria and scoring system developed in the process. The criteria used are damage to life, duration of impact, spatial extent, frequency, and tendency of impact which determined the level of impact. The detailed assessment along with the criteria and scoring system are presented in Table3.4. The NAPA process through participatory discussions elaborated each hazard and provided the basic assessment of the climatic hazards on the following factors: loss of life and livelihoods; human health; food security and agriculture; environment; water availability, quality and accessibility; and general trends. The narrative description of impacts on range of sectors is presented in the Table3.5.

Table 3.4: Assessment of Climatic Hazards (NAPA)

Hazard	Narrative	Impacts	Loss of Life	Duration	Spatial Extent	Frequency	Tendency
Periodic Drought	Decrease in productivity of crops; forced migration; ; decrease in amount of exports; and financial loss	3	3	4	6	2	↑
Floods due to untimely and heavy rainfall	Collapse and sedimentation of irrigation canals; destruction of agricultural lands; loss of crops and livestock; collapse of dwellings; spread of epidemic diseases; destruction of infrastructures (roads, bridges); damage to national economy	3	3	1	4	3	↑
Frosts and cold spells	River levels rise, destruction of agricultural and non-agricultural (forest and rangeland etc) lands, landslides, soil erosion, destruction of infrastructures (brides and gabions)	3	1	1	5	3	↑
Flooding due to thawing of snow and ice	Increase in levels of incidence of diseases that affects humans, agricultures and livestock; habitat changes affects wildlife; changes in vegetation covers and associated grazing patterns	3	2	3	5	3	↑
Rise in temperature	Degradation of fruits, crops, vegetation; rise in diseases; poor economy and increase in poverty	3	3	3	6	3	↑
Hail, Thunder Lightening	Destruction of crops (particularly horticultural crops); human/livestock losses; floods	2	1	1	3	3	⇧
Monsoon and 120 day winds	Desertification; degradation of agricultural lands and crops; destruction of infrastructure; air pollution; spread and transmission of diseases and respiratory problems; sedimentation of irrigation systems and springs; local/national economy adversely affected	2	1	3	5	3	⇧

1 Impacts: 1= US $ 1 per capita; 2= $10; 3= $ 100; 4=$1000; 5= $10000
2 Loss of life: 1= 1 person per event; 2= 10 people; 3=100 people; 4= 1000 people
3 Duration: 1= 1 day; 2= 10 days; 3= 100 days; 4= 1000 days (more than 1 year)
4 Spatial Extent: 1= 1 sq. km; 2= 10 sq. km; 3= 100 sq. km; 4= 1000 sq. km; 5= 10000 sq. km; 6= 100000 sq. km
5 Frequency: 1= 1% probability of occurrence in a year; 2= 10%; 3= 100% (occurs once a year)
Trend : ↑=significant increase; ⇧= moderate increase; ?= uncertain trends

Table 3.5: Narrative Description of Climatic Hazards and Some of their Impacts (NAPA)

Climatic Hazards	Description	Loss of life and livelihoods	Human Health	Duration	Food security and Agriculture	Environmental effects (Biological diversity, forestry)	Water availability, quality and accessibility	Trends
Periodic drought	Decrease in productivity of crops; forced migration; changes in livelihood; decrease in amount of exports; and financial losses.	Group of livestock herders including Kuchi, irrigated agriculturalists and dryland farmers are affected; and around 10,000 casualties per year of severe drought.	Malnutrition, spread of diseases such as malaria, sishnaia, cholera, typhoid, tenasagenata, asscaris and diarrhea.	Up to 8 years	Drought has generated an estimated loss production of: 75% wheat, 85% rice, 85% maize, 50% potatoe and 60% of overall farm production, between 1998 and 2005.	Pistachio, pine nut, wild almond and conifer forest production negatively affected. Waterfowl sanctuaries such as Dasht-i-Nawar, Ab-i-Estada and Kol-i-Hashmat Khan have dried up. Wildlife being displaced.	Decreased availability of under ground water, springs and karezes dry-up, flow of major rivers collapses, degradation of watersheds and drop in level of water reservoirs and dams.	Increasing frequency and intensity.
Floods due to untimely and heavy rainfall	Collapse and sedimentation of irrigation canals; destruction of agricultural lands; loss of crops and livestock; collapse of dwellings; spread of epidemic diseases; destruction of infrastructure such as roads and bridges; and damage to the national economy.	Approximately 750 casualties per year.	Increased incidence of cholera, typhoid, diarrhea and malaria.	3 months	Loss of 10% of agricultural production and gardens that are located alongside rivers and in high risk areas.	Soil degradation; loss of natural forest (riverine forest being particularly affected); increased levels of water siltation and sedimentation; and displacement of wildlife.	Infrastructure damage around US$ 300 million as a result of a severe flood.	Increasing frequency and intensity.
Flooding due to thawing of snow and ice	River levels rise; destruction of riverside agricultural and non-agricultural (forest, range, etc.) lands; land slides; soil erosion; destruction of infrastructure such as bridges and gabions.	Around 100 casualties per year.	Increased incidence of cholera, typhoid, diarrhea and malaria.	4 months	2% damage of agricultural land alongside rivers.	Soil degradation; loss of natural forest (riverine forest being particularly affected); increased levels of water siltation and sedimentation; and displacement of wildlife.	Destruction of river banks,, associated agricultural land and infrastructure at a value of around US$ 400 million as a result of a severe flood.	Increasing frequency
Rise in temprature	Increase in levels of incidence of diseases that affect humans, agriculture and livestock; habitat changes affect wildlife; changes in vegetation cover and associated grazing patterns.	Around 1,000 casualties per year	Increased incidence of malaria, leshmania, typhoid and diarrhea.	3 months	Decreased agricultural, livestock and horticultural production.	Less productivity of natural system, displacement and changing of wildlife habitat.	Increasing evapotranspiration rates; reduction in water level.	Increasing frequency and intensity.
Frost and cold spells	Degradation of fruits, crops, vegetable and health disease, poor economy and increasing of poverty.	Loss of fruits and potatoes; approximately 300 indirect casualties per year.	Illnesses associated with cold weather.	3 days, two times per year	20% of gardeners in the country are affected, particularly those with horticultural crops.	Affects forest rehabilitation and afforestation programs (particularly nurseries and saplings).	Low impact.	Increasing frequency and intensity.
Hail, thunder and lightening	Destruction of crops (particularly horticultural crops); human and livestock losses; and outflow/gush from floods.	Approximately 150 casualties per year.	Illnesses associated with cold weather.	Around 20 days	Up to 20% loss in horticultural and crop production.	Low impact.	Low impact.	Increasing frequency and intensity.
Monsoon and 120-day winds	Desertification; degradation of agricultural lands and crops; destruction of infrastructure; air pollution; spread and transmission of diseases and respiratory problems; sedimentation of irrigation systems and springs; local and national economy negatively affected.	Around 10 casualties per year.	Eyes, respiratory and skin diseases.	120 days	Decrease in horticultural and crop production, degradation of rangeland and reduced livestock production.	Desertification; decreased plant cover.	Losses (temporary and more permanent) of infrastructure, siltation of water sources, decreased quality of water.	Increasing frequency and intensity.

3.5.2 VULNERABILITY ASSESSMENT OF SECTORS TO CLIMATIC HAZARDS IN AFGHANISTAN

The NAPA preparation process, through participatory discussion process and based on the observed climatic hazards and assessment of hazards identified seven key sectors vulnerable to the climatic hazards: agriculture, water resources, forestry and rangeland, biodiversity, health, energy, and waste. A matrix was developed with the following specifications:

- Sectors vulnerable to climate change;
- Socio-economic index of each sub-sectors (the socio-economic index is calculated based on the following formulae: Socio-economic index = 0.3 * Socio index + 0.7 * Economic index)
- The impact of major climatic and climate induced parameters were assessed through the expert judgment and Thomas Saaty weighting method; and
- The vulnerability index for each sector was calculated as the sum product of socio-economic index and sub-sectors vulnerability rank on climatic parameters.

The NAPA assessment process on vulnerability of different sectors to climatic hazards has also included sub-sectors in each sectors identified for the assessment and determined the sub-sectoral vulnerability index and then the sectoral vulnerability index. The assessments are summarized in Table3.6 and shown in Figure3.9 (vulnerability rank of sectors to climatic hazards) and Figure3.10 (The vulnerability of different sectors to climatic and climate induced parameters change)

Figure3.9: Vulnerability rank of Sectors to climatic hazards

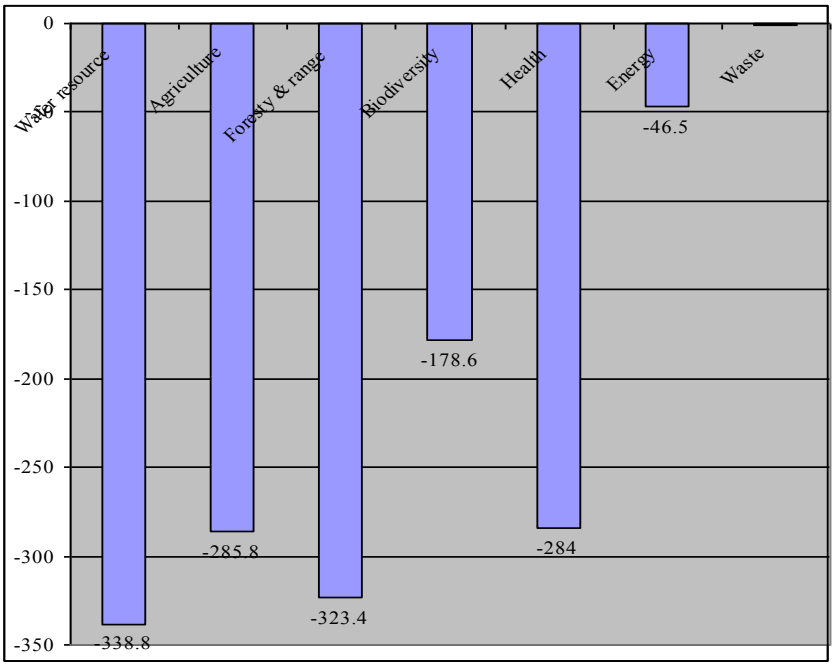
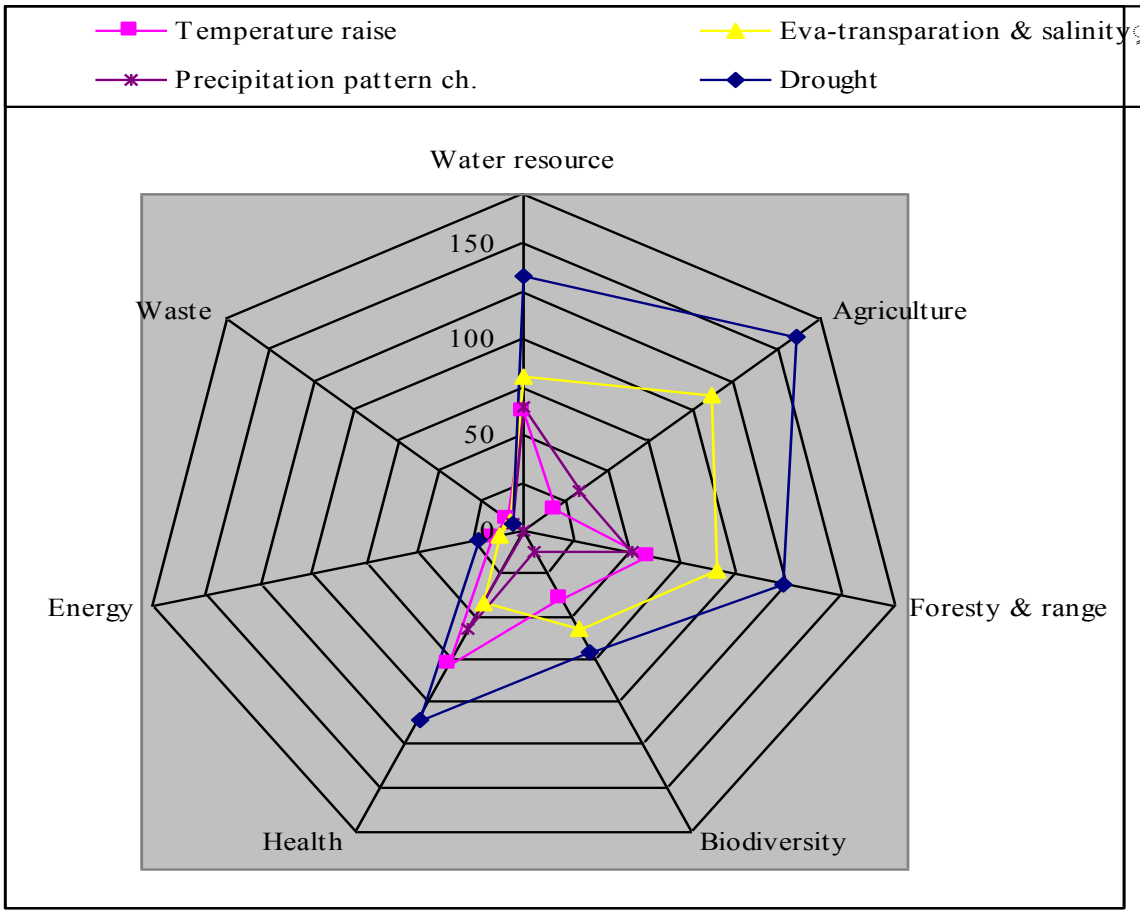


Figure 3.10: The vulnerability of different sectors to climatic and climate induced parameters change



In developing the table3.6, the socio-economic index ranged from 1-9 and climatic parameters from -9 to 9, according to the Saaty approach in AHP. The minus sign shows the adverse impact of climate change. The sub-sectoral vulnerability indices are calculated by multiplying the socio-economic rank to the summation of vulnerability ranks to climatic parameters. Then sectoral vulnerability index is calculated by summation of the sub-sectoral vulnerability indices.

Table 3.7: Vulnerability Assessment of different sectors and sub-sectors

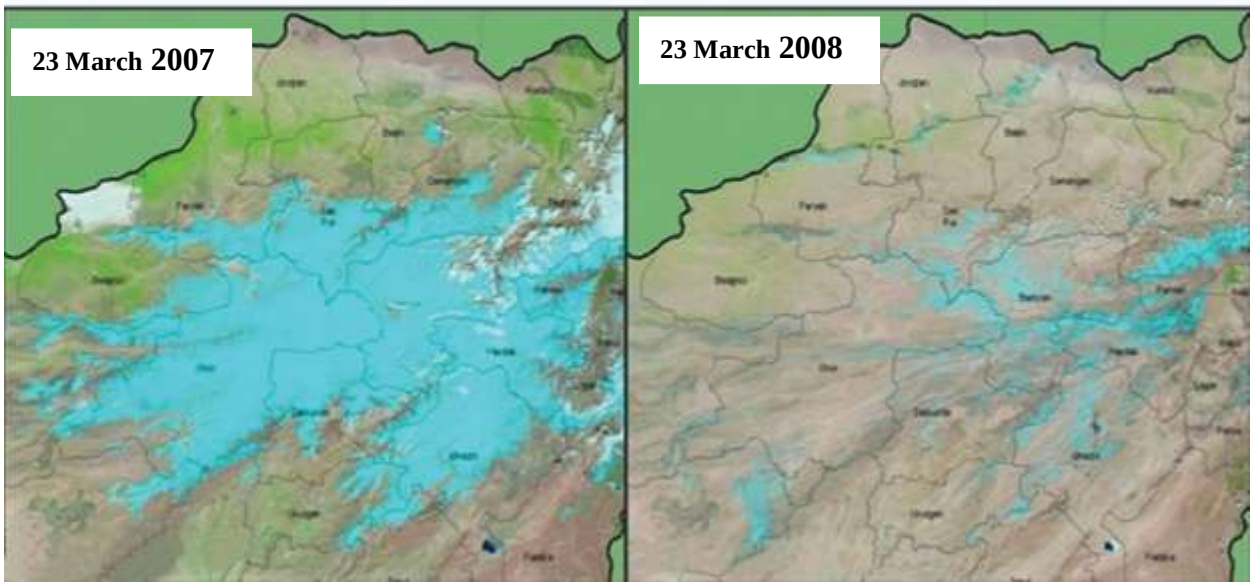
Sector	Sub-sector	Socio-economic rank	Climatic & climate induced parameters				Sub-sec Vul. index	Vuln. index
			Temp. raise	*Evapo-transp.salinity*	*Prep. change*	*Drought*		
Water resources	Hydro power generation	6	-3	-4	-1	-7	-90	-338.8
	Underground water	5.6	-1	-2	-7	-7	-95.2	
	Surface water	6.4	-6	-7	-3	-8	-153.6	
Agriculture	Wheat & rice production	8	2	-7	-3	-8	-128	-285.8
	Crop production	6.4	2	-4	-2	-7	-70.4	
	Livestock husbandry	6.4	-2	-3	1	-6	-64	
	Fisheries	2.6	1	-4	-1	-5	-23.4	
Forestry & rangeland	Desertification& soil erosion	4.6	-3	-6	-3	-9	-96.6	-323.4
	Forest & wood production	6.3	-3	-3	-3	-5	-88.2	
	Grassland & forage	6.3	-4	-7	-3	-8	-138.6	
Biodiversity	Lake & wetlands	3.9	-4	-6	1	-8	-66.3	-178.6
	Wildlife & heritage	4.9	-4	-6	-3	-6	-93.1	
	Migration of aquatic species	1.6	-2	-3	-1	-6	-19.2	
Health	Incidence of tropical diseases	5.6	-6	-2	-3	-7	-100.8	-284
	Diseases affected by	3.6	-4	1	-2	-7	-43.2	
	Access to fresh water	5.6	-5	-6	-6	-8	-140	
Energy	Primary energy production	4.3	-1	-1	0	-1	-12.9	-46.5
	Thermal electricity	3.6	-2	-1	-1	-2	-21.6	
	Domestic energy demand	3.0	-1	-1	1	-3	-12	
Waste	Liquid waste	2.5	-1	2	-1	1	2.5	-1.4
	Solid waste	3.9	-2	1	-1	1	-3.9	

3.5.3 SECTORAL IMPACTS OF CLIMATE CHANGE IN AFGHANISTAN

Impact on Water Resources:

The HKH (Hindu-Kush-Himalaya) region is often referred to as the 'water tower of Asia' as it stores large volumes of water in the form of ice and snow which release water gradually over a long period during the dry seasons. Of the total area, almost 61% of area of Afghanistan is within the HKH area and 4.4% of the total glaciated area in HKH is in Afghanistan (ICIMOD 2011: Climate Change in the Hindu-Kush-Himalaya- The state of current knowledge). As mountains are the major sources of water in Afghanistan, the impact of climate change on hydrology is likely to have significant repercussions not only in the mountains, but also in populated, lowland regions that depend on mountain water resources for domestic, agricultural, and industrial purposes as well as hydropower generation. Widespread mass losses from glaciers and reductions in snow cover over recent decades are projected to accelerate throughout the twenty-first century, reducing water supplies and hydropower potential as well as changing the seasonality of flows in basins supplied by melt-water from snow and ice (ICIMOD 2011).

Centre Afghanistan: Winter Snow Pack Comparison (HDRA 2011)



An analysis charting the extent of snow cover in the water-abundant Panj-Amu river basin in 1972–2007 found that, on average, snow cover has already shrunk 10 percent. How this will affect river flows and river levels has yet to be determined. However, there is a correlation between peak discharge and the extent of spring snow cover. Given that snow cover has decreased over the past 35 years, it is likely that this will be reflected in a decrease in peak discharge and the availability of water during the irrigation season (HDRA, 2011). More rapid and earlier spring snow melt, creates risks of flash flooding.

Climate change is making water resources scarcer in Afghanistan. This became particularly apparent during the recent years of drought, and development efforts are struggling to keep up with the challenges. Cumulative effects of more frequent and intense droughts on reservoirs and groundwater could threaten the water supply of entire communities in the most arid regions of Afghanistan, leading to a range of humanitarian crises, including hunger, disease, population displacement and conflict. The impact of

increasingly frequent flash floods is exacerbated by drought, which has the effect of hardening soils and reducing their permeability.

Further, an increase in evapotranspiration (that is, water demand for crops) also has an impact on irrigation. An average 1.4°C increase in temperature represents an average increase in standard evapotranspiration of less than 3.5 percent, and an average increase by 5°C (that is, the high scenario for the 2090s) would represent a nearly 13 percent increase in evapotranspiration. This will demand more water to produce the same amount of crops (HDRA 2011).

Water shortages from changes in snow-melt and droughts will increase pressure on Afghanistan to claim the greatest possible share of regional water sources in the medium term. Water disputes have plagued central Asian countries for years and will likely continue if climate change furthers water scarcity in the region. Any efforts by Afghanistan to increase its share of water use in the region may have regional security or diplomatic implications (DFID 2010).

Because Afghanistan is already extremely vulnerable to drought and floods, the consequences of climate change on water security is a serious concern. Water security contributes to the seven domains of human security, namely, economic, food, health, environmental, personal, community and political security.

Impact of Climate Change on Agriculture

According to long-term predictions, by the 2090s, drier conditions will prevail throughout much of Afghanistan, ranging from −10 to −40 milliliters depending on carbon dioxide emissions. Similarly, annual temperatures are projected to increase by between 2.8°C and 5°C. Both scenarios would have dire consequences for farmers relying exclusively on rain-fed agriculture, who are usually already impoverished relative to farmers enjoying access to irrigated land. This would apply particularly to farmers in the northern and western river basins, where more than 60 percent of the rain-fed land is located. Increased soil evaporation, reduced river flow from earlier snow melt, and less frequent rain during peak cultivation seasons will impact upon agricultural productivity and crop choice availability. Crop failure levels due to water shortages and the amount of potentially productive land left uncultivated will likely increase. More water intensive staple crops will become less attractive to farmers, with a likely increase in the attractiveness of those that are more drought hardy, including opium poppy. By 2060, large parts of the agricultural economy are likely to have become marginal without significant investment in water management and irrigation. The existing irrigation system is operating at a low efficiency rate of about 25 percent, which indicates that there is considerable scope for reducing wastage of water.

Livestock numbers are estimated to have been reduced by 50% during the prolonged period of draught due to outward migration and starvation. The effects of environmental degradation and lower agricultural output reduce the availability of animal feed, and the funds available for livestock husbandry. This is especially true for the more vulnerable Kuchi nomadic group. Reduced agricultural and pastoral productivity has the potential to impact heavily on livelihoods and distribution effects are greatest for the poorest and most vulnerable. Impacts on human health, like increased prevalence of disease affect labor available for agriculture and other non-farm rural economic activities.

Impact of Climate Change on Forest, Rangeland and Biodiversity

Climate change could have enormous impacts on forests and forest resources in Afghanistan with temperature changes. Weedy species with a high ecological tolerance will have an advantage over cold-adapted species (IPCC, 1998). While warming may have positive effects on the growth of some trees, it also could reduce tree survival by benefiting insects or pests. Warmer winters would imply reduced snow

cover and less carryover of water to the growing season, which could lead to drought-induced forest decline (IPCC, 1996).

The combination of climate change with the pressures of deforestation, land use changes, habitat degradation and fragmentation presents a significant threat to biodiversity of Afghanistan. Climate change can affect biodiversity either directly, by changing the physiological responses of species, or indirectly, by changing the relationships between species (IPCC, 1996). For example, a change in the insect population could influence the evolution of plant biodiversity and vice versa. Today its rich biodiversity resources still make a large contribution to the economy. Unfortunately, human activities are increasingly threatening all the existing ecosystems. In addition, several species are already endangered by climate change and extreme events. This assessment, however, employs a general approach with no specification to clarify the impact of climate change to Afghanistan's biodiversity.

Impacts of Climate Change on Energy Sector

Climate change will also significantly impact the energy sector in Afghanistan. As hydro power is one of the main sources of energy for Afghanistan, it is particularly sensitive to the impacts of climate change. Changes in precipitation, prediction of accelerated widespread mass losses from glaciers and reductions in snow cover throughout the twenty-first century, de-vegetation, increased demand of water for irrigation and drinking water purposes (upstream), reducing water supplies, changing the seasonality of flows in basins will all have direct impact on the availability of water for hydropower generation. Small hydro powers and run of the river types are particularly vulnerable as most do not have reservoirs and sensitive to variations in water flows. Single turbine hydropower plants are especially more sensitive to flow variations, power output decreases disproportionately with dropping water level, since the loss of the efficiency of turbine for redirecting the flow for fewer turbines is not possible. Depending upon the turbine-generator system, it can be switched off to avoid the damage. Frequent high water or flash floods will also increase further risk.

Expected impacts of climate change are likely to result in stronger flow peaks in winter (due to higher precipitation and earlier snow melt/deglaciation), and less flow in Summer, due to lower precipitation, higher evaporation rates and irrigation draw off. This could lead to forced closure of HPPs during both periods. For example, the Mahipar hydroelectric plant is a 66 MW capacity plant that is only operational 2-3 months a year due to low water levels. Of the three hydroelectric power plants that provide electricity to the capital city of Kabul, only one can remain operational year round because of the lack of water flow, a situation that could worsen. Both effects decrease energy-supply, and trigger conflict between different interest groups. Since the regional water flow varies, site specific assessments would have to be made to determine specific sensitivities. It is clear that climate change impacts have to be taken into consideration for mid- to long-term hydropower planning, since they have the potential to alter the patterns of precipitation and also the buffering function of the glaciers and snow-pack (*DFID 2010*).

In terms of large thermal power plant and transmission infrastructure, the main threat arises from damage caused by extreme climatic events, such as flash floods or storms.

Impacts of Climate Change on Livelihood and Social Protection

According to the latest estimate, 36% of Afghanistan population lives below the poverty line, that is, almost 9 million people are living on less than AFN 1,255 ($25.10) per person per month, and are highly socially vulnerable. Poverty eradication is the main goal of Government of Islamic Republic of Afghanistan, aiming to eradicating extreme hunger and poverty by 2020 (Millennium Development Goals in Afghanistan) and this could be severely hampered by the climate change. In its Fourth Assessment

Report, the IPCC indicated that the severity of climate change impacts depends not only on changes in temperature and precipitation patterns but on a host of other factors related to the various dimensions of poverty. Human development impacts are generally exaggerated where climate patterns interact with pre-existing social and economic vulnerabilities. Poor communities are highly vulnerable to the climate risks as they are the most exposed and least means to adapt. More than 75% of population who live in rural Afghanistan and are highly dependent on natural resources and ecosystem services, are particularly vulnerable to the impacts of climate change compared to urban poor. A significant percentage of population (almost 20%) dependent on agriculture economy lives slightly above the poverty line and are extremely vulnerable to climate shocks. Lack of economic diversification and dependent on the highly climatic sensitive agriculture sector, climate shocks can bring that population below the poverty line and thus making the goal of eradicating extreme hunger and poverty more challenging, as well as widen the economic gap between rich and poor. Food security issues are likely to be pronounced due to overall decrease in food availability mainly due to draught induced agriculture failure, leading to malnutrition, high dependence on food aid, and reduced dietary diversity and consumption of general population.

Impacts of Climate Change on Human Health

Human health is a key issue for all the population and particularly for poor groups in Afghanistan. According to the, National Malaria Strategic Plan, 2006-2010 (MPH), the WHO estimated 2.5-3 Million cases of Malaria in 2002 and 85,000 deaths per year from diarrhea in children under 5 years of age. Climate change will continue to impact upon the spread of food, water, and vector-borne diseases in Afghanistan. Correlations between climate change and disease propagation suggest these trends will worsen in the near- to mid-term (e.g., for Malaria, temperatures of 16-18 °C are necessary for the parasite to form, and higher temperatures cause faster development8). Climate change will undermine Afghanistan's ability to achieve its goals in reducing malaria morbidity and mortality by 50% and 80% within the next 5 years (*DFID 2010*). Women and children, mainly because they are not involved in paid income are also highly vulnerable to the climatic shocks. For example, children are widely responsible for realizing small scale livestock herding and collection of firewood (*NAPA*).

3.6 ADAPTATION TO THE IMPACTS OF CLIMATE CHANGE:

Government of Islamic Republic of Afghanistan in 2008 has prepared the National Adaptation Programme of Actions (NAPA) through a nationally driven consultative process. The primary objectives of NAPA were:

- Identify priority projects and activities that can help communities adapt to the adverse effects of climate change;
- Seek synergies with existing MEAs and development activities with an emphasis on both mitigating and adapting to the adverse effects of climate change; and
- Integrate climate change considerations into the national planning processes.

Multidisciplinary Working Group formed in the NAPA process first identified the potential actions and used the Multi-Criteria-Analysis (MCA) techniques to prioritize the identified actions. A total of 51 different potential adaption actions were first identified and then categorized them in seven broad different themes, namely human health; water resources and renewable energy; agriculture and food security; animal husbandry, grazing and rangelands; forests and biodiversity; natural disaster preparedness and infrastructure; and capacity building.

3.6.1 PRIORITY ADAPTATION ACTIONS IN AFGHANISTAN:

In order to prioritize the adaptation measures in the most vulnerable sector, firstly, four general criteria were used to screen and select priority adaptation activities: level or degree of adverse effects of climate change; poverty reduction to enhance adaptive capacity; synergy with other multilateral environmental agreements; and cost effectiveness. Using these four criteria the Multidisciplinary Working Group narrowed down these 51 potential activities to 11 general activities specially focusing to address the climatic hazards of draught and flooding in Afghanistan. In order to prioritize them with ranking, a second set of criteria (as per NAPA Guideline), namely: loss of life; human health; food security and agriculture; water availability, quality and accessibility; impact on vulnerable groups; essential infrastructure; cost of the project; biological diversity; and land use management and forestry were selected. The multidisciplinary working group through consensus had provided weightings to each criterion for prioritizing the adaption program of actions and then did the detailed assessment for rankings. These prioritized eleven projects of National Adaption Program of Action of Afghanistan are presented in Table 3.8 and the detailed lists of fifty-one projects with preliminary scoring in Table 3.9.

Not only the prioritized projects are important but , all the identified projects in NAPA, are very important for Afghanistan to adapt to the impacts of climate change. And therefore GIRoA seeks financial and technical support from developed country parties and the prevailing financial mechanism of GEF in the implementation of these adaption actions.

Table 3.8: National Adaptation Program of Actions with Priority Ranking

Priority	***Project Title***	***Outline of Project Concept***
1	Improved Water Management and Use Efficiency	Improved water management and use efficiency through the introduction of drip and sprinkle irrigation, improved physical structures and increased public awareness
2	Land and Water Management at the Watershed Level	Land and water management at the watershed level. Community based forest management and afforestation projects in ways that conserve land, water resources and wood production; realize afforestation of catchment areas and stabilization of unstable slopes; soil conservation techniques
3	Development of Horticulture	Development of horticulture through use of improved varieties, establishment of nurseries and plant protection
4	Improved Terracing, Agro-forestry and Agro-silvo Pastoral System	Terracing, agro-forestry, and agro-silvo-pastoral system that reduce soil erosion and run off on steep slopes; conserve land, water resources and wood production; soil conservation techniques
5	Agriculture Research	Research into draught resistance seeds, different varieties of plants and livestock and plant protection, including establishment of agricultural firms
6	Rangeland Management	Rangeland management including the development and implementation of system of rotational grazing and production of improved fodder along grazing routes (mixed grasses, legume)
7	Development of Disaster Management Strategy	Disaster Management Strategy-planning for food security and emergency supplies for vulnerable communities
8	Improved Food Security	Improving food security measures through diversification; promotion of households level industries, including chicken farms, beekeeping and silk farms; and development of market potentials for agriculture products
9	Improved Livestock Production	Improved livestock production through the creation of livestock unions, cooperatives and associations; introduction of improved species and veterinary services
10	Creation of Off-farm Employment	Create more off-farm or cash earning job opportunities for farmers who are affected by crop loss due to climate change effects
11	Climate Related Research and Early Warning System	Installation of Agro-Meteorological Stations, early warning system, hazard mapping; survey, assessment and projection of the impact of deep wells on the water table and future water supplies. Build capacity and expertise for assessment of climate change adaptation including technical capacity to monitor and analyze climate trends, plan and implement adaption activities, improve forecasts and inform policy makers

Table 3.9: List of proposed projects and preliminary scoring

	Cost effectiveness	Level or degree of adverse effects of climate change	Poverty reduction to enhance adaptive capacity	Synergy with other MEAs	Score
1. Human Health					
1.1 Regular cleaning and vaccination campaign in mosquito prevalent zones	High	High	High	Low	16
1.2 Monitoring of air and drinking water quality	Medium	High	Medium	Medium	14
2. Water resources and renewable energy					
2.1 Improvement of canals, de-silting of the karezes time by time ,raising concrete walls in front of passages of all karezes for prevention of flood flow into the karezes	High	High	High	High	20
2.2 Construction of retaining walls for prevention of water wastage and for reducing the risks of floods	High	High	High	Medium	18
2.3 Introduction of drip and sprinkle irrigation	High	High	High	Medium	18
2.4 Construction of reservoirs for rain water	Medium	High	Low	Low	10
2.5 Construction of dams from gabion for control of floods	High	Medium	High	High	18
2.6 Raise community awareness on sustainable use of water resources	High	High	High	High	20
2.7 Improve land management at the watershed level, promoting afforestation and improving watershed management	High	High	High	High	20
2.8 Solar power project	High	Medium	Medium	High	16
2.9 Design and installation of hydro power plants	Medium	High	High	Low	14
3. Agriculture and Food security					
3.1 Research into drought resistant seeds, different varieties of plants and livestock, and diseases of flora and fauna and the prevention measures , including establishment of agricultural farms	High	High	High	Medium	18
3.2 Establishment of cold stores for agricultural products	High	Medium	High	mm	16
3.3 Establishing agricultural cooperatives and associations	High	Medium	High	Low	14
3.4 Establish food processing industries	High	Medium	High	Low	14
3.5 Development of markets (international and national) for selling agricultural produce, including market analysis	High	High	High	Low	16

3.6 Ensure agricultural products meet international standards for exporting	High	Medium	Medium	Low	12
3.7 Market analysis according to crop and food quality	Medium	Low	Medium	Low	8
3.8 Establishment of an agricultural credit system for farmers	High	Low	High	Low	12
3.9 Improving food security measures through diversification	High	High	High	Medium	18
3.10 Disaster management strategy – planning for food security and emergency supplies to vulnerable communities	High	High	High	Medium	18
3.11 Provision of inputs for farmers ,including plant protection, chemical fertilizer and organic fertilizer	High	Medium	High	Medium	16
3.12 Establishment of agricultural extension mechanism	High	Medium	High	Medium	16
3.13 Provision of relevant agricultural machinery	High	Medium	High	Low	14
3.14 Development of horticulture through the use of improved varieties and establishment of nurseries	High	High	High	Medium	18
3.15 Promote terracing, agro forestry and agro-silvo pastoral systems to reduce soil erosion and run-off on steep slopes	High	High	High	High	20
3.16 Create more off-farm or cash earning job opportunities for farmers who affected by crop loss due to climate change effects	High	High	High	Medium	18
4. Animal husbandry, grazing and rangelands					
4.1 Promotion of small scale industries based in livestock, including chicken farms, beekeeping and silk farms	High	High	High	Medium	18
4.2 Improved breeding of animals, introduction of new breeds	High	High	High	Medium	18
4.3 Improved veterinary services	High	High	High	Medium	18
4.4 Cultivation of drought resistant fodder	High	High	High	Medium	18
4.5 Rangeland management and development and implementation of systems of rotational grazing	High	High	High	High	20
4.6 Protection and supervision of rangelands	High	High	High	High	20
4.7 Establishment of milk accumulation and pasteurization	Medium	Medium	Medium	Low	10
4.8 Establishment of agricultural and livestock unions, cooperatives and associations for the betterment of the condition of animal husbandry	High	High	High	Medium	18
4.9 Seeking proper marketing opportunities for selling the products	High	Medium	High	Low	12

4.10 Improve utilization of the wool and skin of the animals	Medium	Medium	Medium	Low	10
4.11 Improve slaughterhouse facilities	Medium	Medium	Medium	Low	10
5. Forests and Biodiversity					
5.1 Promote community based forest management and afforestation projects in ways to conserve land, water resources and wood production	High	High	High	High	20
6. Natural disaster preparedness and infrastructure					
6.1 Installation of agro- meteorological stations, development of early warning system, hazard mapping	High	High	High	High	20
6.2 Development of national database on landslide prone areas and intensity of landslides to assess related risks	Medium	Medium	Medium	Low	10
6.3 Reforestation of catchment areas and stabilization of slopes in those areas that are prone to flooding and landslides, soil conservation techniques	High	High	High	High	20
6.4 Establishing market sites at the district and provincial level	High	Medium	High	Low	14
6.5 Provision of improved transportation facilities	High	Medium	High	Low	14
6.6 Construction of highways	High	Medium	High	Low	14
7. Capacity building					
7.1 Build capacity to respond to natural disasters, including the preparations of a national disaster management strategy	High	High	High	High	20
7.2 Build technical capacity and expertise for integrated assessment of climate change adaptations, including technical capacity to monitor and analyze climate trends, plan and implement adaptation activities, improve forecasts and inform policy makers	High	High	High	High	20
7.3 Training of Vets regarding diagnosing and treating diseases	High	High	High	Medium	18
7.4 Increase public awareness of farmer through media	High	Medium	High	Medium	16
7.5 Capacity building and knowledge for environment protection in the market	High	Medium	Medium	Low	12
7.6 Promotion of Afghan foods through media	Medium	Low	Low	Low	8

3.7 LIMITATIONS OF STUDY

Afghanistan presents a number of specific challenges in terms of climate change assessment. The biggest challenge is the availability of qualified human resources to carry out vulnerability assessment using different available models. Lack of reliable historic meteorological records requires significant refinement of available data for climate projections. Topography of Afghanistan is very complex and the local variations in response to global warming, particularly precipitation, are likely to be large and many areas may vary from the regional trends. Non-availability of reliable socio-economic data further makes use of econometric modeling or detailed cost/benefit analysis of adaptation and mitigation policy/programs nearly impossible. Poor national security also restricts the ability to undertake structured fieldwork to assess potential mitigation and adaptation options.

4 PROGRAMMES CONTAINING MEASURES TO MITIGATE CLIMATE CHANGE

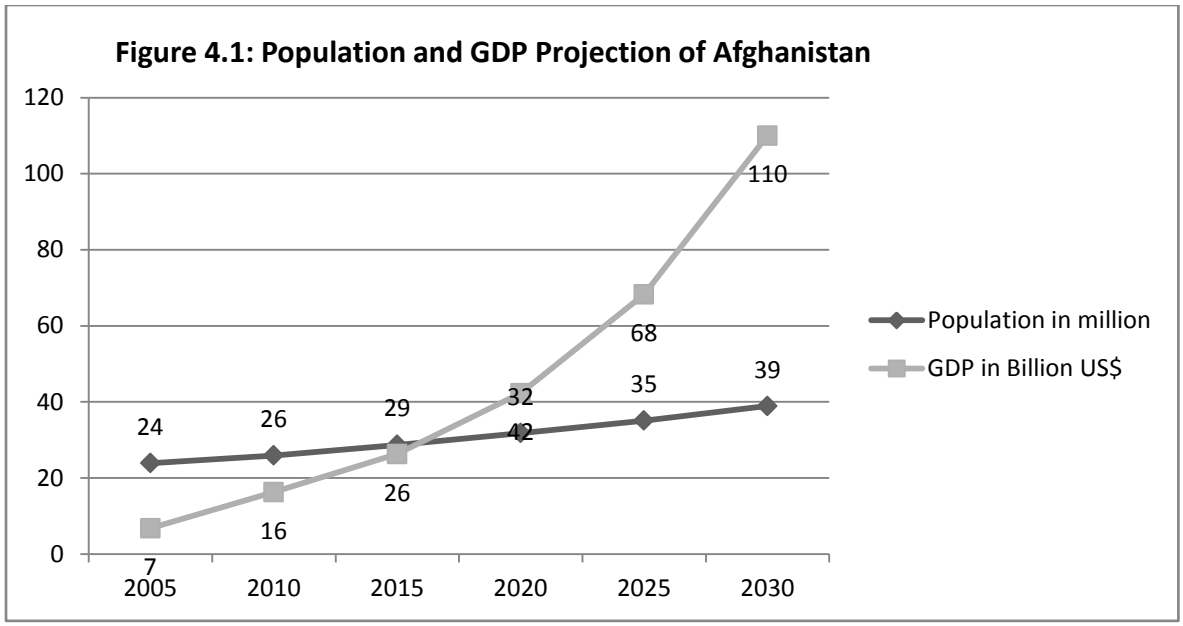
4.1 INTRODUCTION

Afghanistan as the Party to UNFCCC and in accordance with Article 12, paragraphs 1 (b) and (c), of the Convention, shall have to provide the information on the general descriptions of steps taken or envisaged for formulating, implementing, publishing and regularly updating national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. In accordance with the national circumstances, whatever methods available and appropriate can be used within the framework of sustainable development objectives. This chapter therefore provides very little information on steps taken and more focuses on steps envisaged towards achieving the objectives of sustainable development with low carbon footprint. For the key sectors, with the available limited data, efforts on projection for the coming 20 years as well as the brief description of the existing policies and measures are made.

4.2 SOCIO-ECONOMIC ISSUES

According to Afghanistan Statistics Year Book 2010/11, the population of Afghanistan is 26 million (including 1.5 million nomadic populations) and the population is growing at 2.03% annually. Of the total population around 22% of the population is living in various cities of Afghanistan in 2010/11. If this growth rate continues for the next two decades, the total population of Afghanistan will reach 39 million by the year 2030 and with the trend of urban population increase seen over the years; about 12 million people (30% of the total population) will be living in cities of Afghanistan. As there have been variations in data in Afghanistan, the UN data (data.un.org) has estimated the population of Afghanistan in 2010/11 at 30.3 million and projected the population to reach to 53.2 million by the end of 2030.

In the economic front, since 2002/03 the country has seen average growth rates in the double digits, but with great volatility because of its heavy reliance on agriculture, which is subject to weather fluctuations. Although the country is highly aid dependent, depends heavily on imports for reconstruction and food, and the gross revenues from opium trade are not reflected in official GDP numbers, **great hope is being placed on the development of the mining sector.** At present, the mining sector's contribution to GDP is marginal, at less than 0.3 percent. But two recent large scale investments at Aynak and Hajigak could mark a fundamental shift. It is estimated that Afghanistan has substantial, untapped mineral deposits which have the potential to make it to a major exporter of minerals. While there are many uncertainties about the actual benefits that would accrue to the country from mining, there is little doubt that the sector, if managed well, could be the main driver of growth in the years to come. With this trend of GDP growth (10%) and population growth (2.03%), the per capita GDP of Afghanistan will reach to US$ 930 in 2015 and almost tripled with US$ 2830 by 2030. The projected population and GDP for Afghanistan are presented in Figure 4.1.



One of the visions of the Afghanistan's National Development Strategy (ANDS 2008-2013) is to achieve the goal of environmental sustainability while pursuing the path of economic development. In order to support this goal, GIRoA has introduced Environmental Law in 2007, National Environmental Action Plan in 2010, Clean Air Act in 2009, and EIA Regulation in 2009 to ensure mainstreaming environment into the development projects. GIRoA with the support of World Bank has already initiated a project to strengthening the national capacity of Ministry of Mines and National Environmental Protection Agency to ensure that the development of the mining sector in Afghanistan moves with the objective of ensuring environmental sustainability.

4.3 ENERGY SECTOR

4.3.1 PROJECTIONS

Afghanistan's National Development Strategy (ANDS) recognizes that energy is a critical input to economic growth and the vision is "an energy sector that provides drivers of growth in the economy with long term reliable, affordable energy based on market-based private sector investment and public sector oversight". Further, ANDS on energy sector strategy aims to have per capita electricity availability to be 40 kWh in 2010. This has actually reached to 56 kWh per capita without counting the 48% loss in the distribution system. ANDS refers the availability of 2200 kWh/capita in the neighboring country Tajikistan and also comparing the GDP per capita of the countries and kWh/capita use of the availability of electricity in the neighboring countries and countries in the region, the per capita electricity usage as per the projected GDP growth and the national demand till 2030 are projected in Table 4.1. If Afghanistan continues to achieve the current growth rate of double digit, the per capita electricity availability will have to be around 2000 kWh/capita by 2030 as the per capita GDP is projected to be around US$ 2830 for the year 2030.

Table 4.1: Projection of Per Capita and National Demand of Electricity in Afghanistan

Year	*Population (million)*	*GDP/Capita*	*kWh/capita*	*Million KWh*
2005	24	290	25	597*
2010	26	630	57	1467*
2015	29	920	300**	8610
2020	32	1330	500**	15900
2025	35	1950	1000**	35100
2030	39	2830	2000**	77800

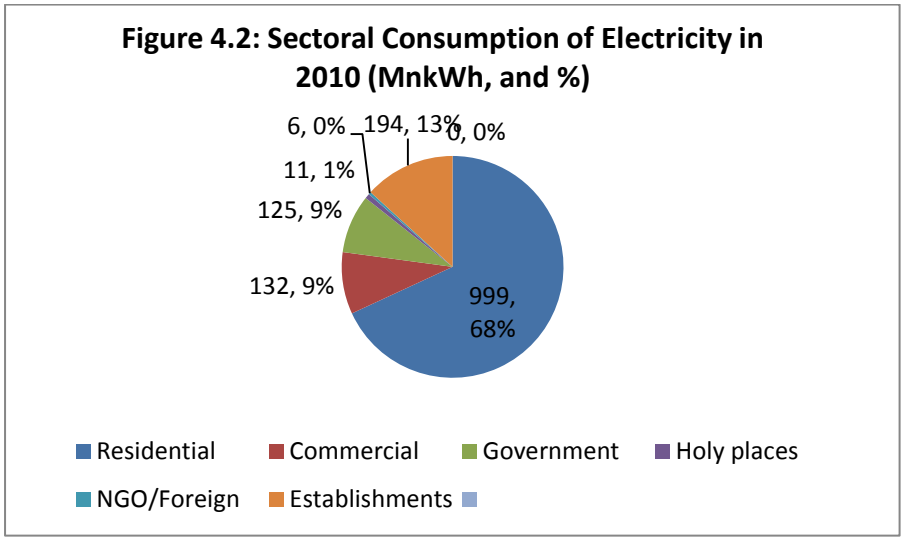
*actual figure; **estimated figure compared to GDP and per capita energy in other countries

One of the biggest challenges Afghanistan is facing today is that the significant amount of energy that is produced and imported is being wasted in the distribution system. According to the Statistical Year Book 2010/11 published by the Central Statistics Organization, the loss was as high as half of the generation and imported in 2008. Although it was reduced to 31% in 2009, it went up to 48% in 2010 (Table 4.2). The above mentioned demand of electricity is based on the consumption figure, and if the loss continues to follow the trend, the demand figure will be quite different from the above mentioned one. Majority of the electricity is consumed by the residential sector (68%) followed by the establishments (13%), commercial (9%), and holy places (6%) and NGO/foreign less than 1% in the year 2010. The details of the breakdown of the 1467 million kWh of consumed electricity in 2010 is presented in the figure 4.2. Less than 1% of electricity consumption by the foreign institutions and NGOs clearly shows that the use of diesel generators by those organizations to meet the demand of electricity is unaccounted.

Table 4.2: Loss of Electricity in Distribution in Afghanistan (million KWh)

Year	*Production and Import*	*Consumption*	*Loss in Distribution*	*Loss %*
2010	2802	1467	1335	48
2009	1893	1313	580	31
2008	1663	838	825	50

Source: IRoA/CSO: Statistical Year Book 2010-11



4.3.2 POLICIES AND MEASURES

ANDS, the vision of Afghanistan for 2020, gives priority to increase domestic generating capacity particularly with maximum focus on exploring the huge hydro power resources of the country which will not only meet the demand of the energy but also support the agriculture growth. The key programs of the energy sector in ANDS are: (i) efficient operation of infrastructure; (ii) market based sector governance; (iii) rural electrification and renewable energy; (iv) expand supplies. GIRoA has drafted a Renewable Energy Policy to promote development of the high potential renewable sources to meet the energy demand of majority of people living in rural areas. The highlights of the priority policies and projects (ANDS) are:

- *Implementation of key power infrastructure projects*; four major hydro power projects of 1900MW; 210MW; 100MW; and 180 MW; and also development of gas and oil fields.
- *Legal reform and Regulatory standard including* mining regulations, the Hydrocarbons Upstream Law and drafting legislation for the electricity sector.
- *Improve the enabling environment for private sector investment to promote* (i) increased domestic power generation that includes new hydro power, natural gas and coal-fired power facilities; (ii) power distribution including lines, substations and metering; (iii) power construction and services (i.e., outsourcing); (iv) exploration and exploitation of coal, natural gas and oil; (v) installation and operation of rural energy services.
- *Increase access to rural energy services including* micro-hydro, solar, waste and even small diesel power and energy generating sources to improve rural access.
- *Increase Regional Cooperation and Trade in Energy Products*: Afghanistan joined the Central Asia South Asia (CASA) 1300MW project, November 2007, with Power Purchase Agreements (PPA) for regular power imports from neighboring countries. Afghanistan is also participating in planning for a Turkmenistan- Afghanistan-Pakistan-India (TAPI) natural gas pipeline.
- *Environmental Protection* (the environmental implications of the expansion of the energy sector will be fully accounted for).

4.4 TRANSPORT SECTOR

4.4.1 PROJECTION

Since 2001, there have been significant changes in vehicles fleet some years showing quite high growth rate as compared to other years. Afghanistan does not have any automobile manufacturing industries and imports the vehicles from other countries, and the majorities of vehicles imported are second hand vehicles. Unlike many developing and least developed countries where two wheelers share the maximum percentage in vehicle composition, private passenger cars have the maximum share in Afghanistan. This is mainly because of the very low customs in second hand vehicles in Afghanistan and also the cold weather in most of the areas. The import of different type of vehicles for the period of 2004 to 2010 is presented in Figure 4.3, which shows an annual average growth rate of around 10 percent. As the GDP growth is projected in double digit, it is realistic that the vehicles fleet will follow the current trend, leading to the total vehicles in Afghanistan little above 7.3 million in 2030 with private passenger cars in majority with 5.3 million. The growth in vehicles will demand more vehicular fuel (diesel and gasoline) which is increasing at an annual average rate of 12% (diesel for power generating purposes only) over the years. The projected demand of diesel and gasoline is 12 million tons for the year 2030. The projection of vehicles along with the fuel is presented in Figure 4.3. For the last six years, the growth of air transport in Afghanistan has led to 17% annual growth in aviation fuel, if the same trend continues over the years, the demand of aviation fuel for Afghanistan is projected to be 2260 KT in 2015, 4956 KT in 2020, 10865 KT

in 2025 and 23822 KT in 2030. As Afghanistan has just started the rail transport system with further plan of expanding it, the growth of rail transport will definitely slow down the demand of vehicles and growth of air transport in Afghanistan.

Figure 4.3: Import of Vehicles in Afghanistan with types

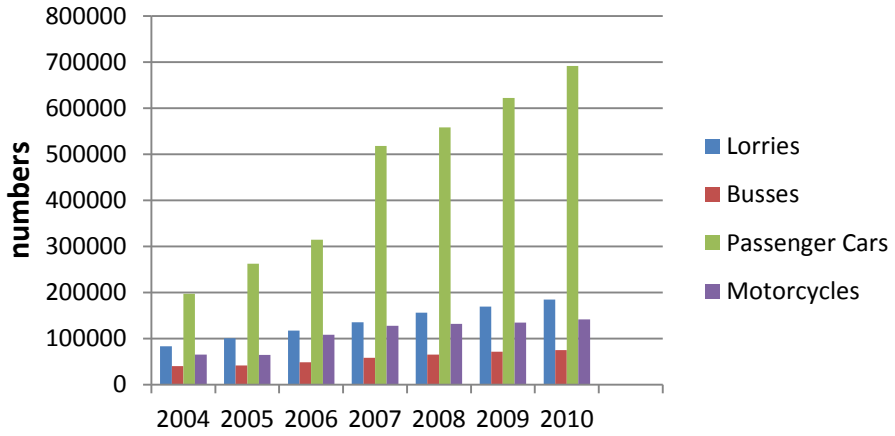
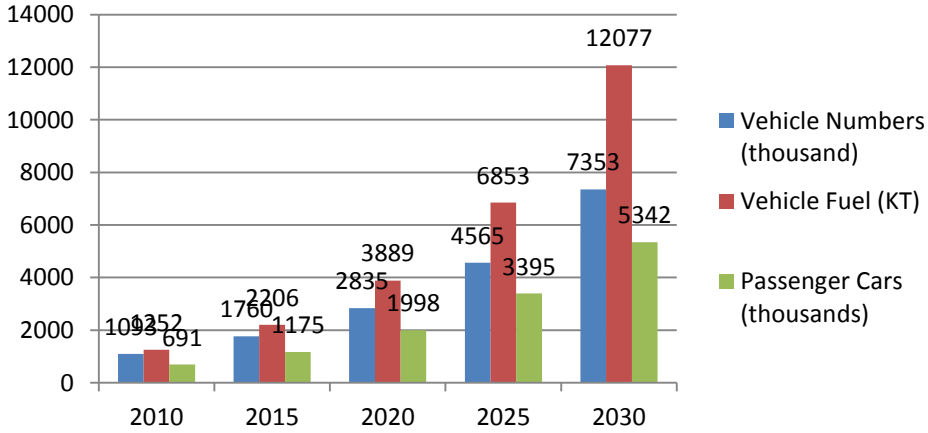


Figure 4.4: Projection of Vehicle Numbers and Vehicular Fuel



4.4.2 POLICIES AND MEASURES

The transport sector strategy of the ANDS primarily focuses on (i) Regional, National Highways and Provincial Roads (ii) Rural Road (iii) Urban Transport (iv) Civil Aviation (v) Transport Sector Maintenance (vi) Pubic Transport (vii) Railway Program. GIRoA in 2010 has brought the Clean Air Regulation and recently in 2011 has set the National Ambient Air Quality Standard and in the process of introducing Mass Emission Standards as per the EURO standards to import quality vehicles and In-Use Vehicle Emission Standard to promote better maintenance of vehicles to reduce the emissions. In addition to these, some of the key measures or planned programs that will promote less emission from the transport sector are:

- Pursue the Afghanistan Railway Project which will include 1,824 km rail links to connect Kabul, in the East with Islam Qala in the West through Kandahar and Herat. The Government will also undertake feasibility studies to assess the economic viability of railway links with neighboring countries.
- Municipal transportation management will be strengthened to improve urban road quality, road network maintenance, road network planning, and transportation facilities and services.
- Principal airports and the civil aviation authorities conform to the requirements of the ICAO and IATA
- Exploration of natural gas is also linked to promote fuel switching in vehicles

4.5 WASTE MANAGEMENT

4.5.1 PROJECTION

As the urbanization is haphazardly growing in Afghanistan, the management of solid waste is emerging as one the main environmental problems in urban areas. No studies available on the per capita generation of municipal waste and their composition in Afghanistan. The publication of multilateral agencies on waste generation in various region and economies on per capita waste generation and waste composition has not included Afghanistan mainly due to the long conflict and war. Although Afghanistan is the country of villages, urban population is increasing significantly and expected to be 30% by the end of 2030. The projection on waste generation in urban areas in Afghanistan is based on the projected GDP per capita, projected urban population, and on the per capita waste generation rate derived by the study conducted by the World Bank in Asian countries in 1999 for low income, medium income and high income categories. The projected waste generation using the average per capita waste generation rate for low income and medium income countries of Asia for the projected urban population in Afghanistan is presented in Table 4.3. Another important source of GHG in Waste Management is the waste water where the presence of degradable material and the treatment or discharge methods will determine the CH_4 emissions and also the choice of mitigation opportunities. Using the default value of India (IPCC Guideline 2006) of 34 gram/person/day of BOD_5 generation, the projected total organically degradable material in domestic waste water is projected in Table 4.4.

Table 4.3: Projection of Annual Urban Waste Generation in Afghanistan

Year	GDP/Capita (US$)	Urban Population (Million)	Waste Generation Factor (kg/capita/day)	Total Annual Waste ('000tons)
2010	630	6	0.64	1402
2015	920	7	0.64	1635
2020	1330	8	0.64	1869
2025	1950	10	0.73	2665
2030	2830	12	0.73	3197

Note: country expected to promote to medium income level in 2020.

Table 4.4: Projection of total organics in waste water in Afghanistan

Year	Population (Million)	BOD (g/person/day)	total organics in waste water (tons BOD/Year)*
2010	26	34	322660

2015	29	34	359890
2020	32	34	397120
2025	35	34	434350
2030	39	34	483990

Note: *estimated using equation 6.3 of 2006 IPCC Guideline for National GHG and correction factor of 1 (for uncollected) and BOD5 factor of India

4.5.2 POLICIES AND MEASURES

National Environmental Protection Agency of Islamic Republic of Afghanistan has brought the National Waste Management Policy in 2010. This policy of Afghanistan also follows the basic principles adopted all over, the waste management preferences: source reduction-reuse-recycle-waste to energy-safe disposal. In order to support the policy objectives implementation, NEPA has already drafted two separate regulations on domestic waste management and hospital waste management which are in the process of approval. Afghanistan had also initiated the process of becoming party to deal with the hazardous wastes and chemicals- Basel, Stockholm and Rotterdam conventions which could be helpful in technology transfer for sound waste management in Afghanistan. Municipalities are made responsible for the sound waste management, but with limited resources and infrastructure the implementation of the policy objectives is very poor. Initiations to ratify the Kyoto Protocol will open the door for CDM in waste management in Afghanistan, once ratified.

4.6 FORESTRY AND RANGELAND

4.6.1 TRENDS AND PROJECTION

Because of over two decades of war and social unrest, most of the original forests have disappeared, and now forests occupy less than 2% percent of the county's area adding to the burden on a large portion of the Afghan population which depends on the forest resource in a variety of different ways including timber for construction and fire-fuel for cooking and heating. Between 1990 and 2000, Afghanistan lost an average of 29,400 hectares of forest per year. The amounts to an average annual deforestation rate of 2.25%. Between 2000 and 2005, the rate of deforestation increased to 2.92% per annum. In total, between 1990 and 2005, Afghanistan lost 33.8% of its forest cover, or around 442,000 hectares. If this trend continues by 2030 Afghanistan will further loose around 500,000 hectares of forest cover. Rangelands cover an estimated 45% Afghanistan's land surface area providing the main feed supply for some 22 million small ruminants, the by-products of which (meat, dairy, wool, carpet and leather) is one of the main export of Afghanistan. Whilst more quantitative research is required, there is an indisputable downward trend in the state of Afghanistan's rangelands, caused by three main factors; harvesting of woody matter by humans; conversion of rangelands to rain-fed farming; and overgrazing by livestock. If the current trend of deforestation and degradation of rangelands continues, it will have the direct impact on the livelihood of millions of people and pose biggest challenge to achieve the goal of poverty reduction in Afghanistan. However, GIRoA is committed to reverse this trend and the policies and measures initiated as part of the National Priority Programs are expected to support this goal. (*Draft Paper on NPP Environmental Conservation*)

4.6.2 POLICY AND MEASURES

Environment is included in ANDS as cross cutting issue, it provides highest priority on conservation of forests and rangelands. The priorities include: restoration and sustainable use of rangelands and forests; conservation of biodiversity; preservation of Natural and Cultural Heritage sites or resources; encouragement to community based natural resource management, and improved environmental management, education and awareness. Since 2001, there have been a number of policy and strategy documents developed for the development of agriculture and natural resource management in Afghanistan. This include National Agriculture Development Framework (NADF), National Protected Area System Plan, Forest Law (approved by lower house), Rangeland Law (draft and under discussion), National Plan for Sustainable Rangeland Management (draft) are the prominent ones that will be instrumental in reversing the deforestation and degradation of forest and rangelands.

GIROA is now working to include the Environment Conservation as a separate National Priority Program to provide more efforts in the conservation and protection of natural resources of the country. The prioritized measures include:

- Conservation and Management of Rangelands (establishment of assessment and monitoring system; an integrated approach for decreasing rangeland degradation; policy and legal reform to promote community participation and benefit sharing; and institutional capacity building of government institutions and users groups; implementation of demonstration projects)
- Conservation and Management of Forests (alternatives to forest extraction and promotion of sustainable forestry paradigm; proactive watershed managements through afforestation schemes; legal framework for community rights and benefit sharing; institutional capacity building of government agencies and forestry users associations; implementation of demonstration projects; promotion of alternative energy sources and fuel efficient cooking and heating technologies)
- Protected Area Management (10% of the total area of Afghanistan will be under protected area category by 2030; identification of new protected areas; establishment of Afghanistan Parks and Wildlife Authority; legal framework; effective monitoring and evaluation system)
- Development of Renewable Energy (institutional mechanism to support renewable energy promotion; energy services to 150,000 families through implementation of 9.6 MW of micro and mini hydro power, 45,000 solar home systems, 2000 biogas systems, 20,000 improved cooking stoves, 50 wind energy systems, and 1000 other rural energy systems; establishment of community energy fund at provincial and community levels; establishment of rural energy service centers)

As part of these measures, 15% of the existing degraded forests and rangeland areas will be regenerated, covering approximately 195,000 hectares (1950 sq.km) of forest land and 4.5 million hectares (45,000 sq. km) of rangelands.

4.7 INDUSTRY AND MINING

4.7.1 PROJECTIONS

Recent development in Afghanistan particularly the two large scale investments at Aynak and Hajigak could mark a fundamental shift in the contribution of industry and mining sector in the overall development of the country. Current projections estimate that the two mines could generate up to US$342 million annually in government revenue until 2015 and up to US$704 million annually in 2016 and beyond. In the medium term the mining sector could contribute up to 5 percent of annual growth. The Aynak investment aims to produce 200,000 tons of concentrate per annum in phase I and expand the

capacity to 500,000 tons of concentrate in phase II. The energy consumption and GHG emissions of copper industry shows (Energy Consumption and Green House Gas Emissions in the Chilean Copper Industry, 2001-2008, ICSG/ILZSG/INSG Energy/Climate Change Seminar, Lisbon, Portugal, April 22, 2009) 17 Gigajoule per tons of concentrate production and 1.8 tons of CO_2 equivalent per ton of concentrate production respectively. The 2006 IPCC guideline has the default value of 0.56 tons of CO_2 per ton of coke production and 1.06 tons of CO_2 per ton of steel production. The Hajigak Iron Deposit is estimated at around 1.8 billion metric tons of iron ore. Further these developments are linked with coal mining and producing power to meet the demand of these industries which will further increases per unit of GHG emissions from these industries. A 400 MW thermal power plant based on coal mining will be constructed to meet the energy demand of the cooper industry alone. In addition the coal exploration is linked with the use of limestone to produce cement in the country itself. The national production of cement at the moment is only 36,000 tons and additional 2633,000 tons is imported to meet the demand in 2010. In Heart and Baghlan two cement factories are under development which will increase the national production capacity in near future to around 700,000 tons per annum. The country is estimated to have US$25 billion worth of gold deposits. Production is planned to begin in 2013, provided the government can satisfy the high security needs around the mine.

In 2011, Government of Afghanistan also reached agreement for the exploration of the three oil blocks in the Amu Darya Basin, and recently GIRoA is seeking bidders for oil exploration and production in the Afghan-Tajik Basin of northern Afghanistan to explore, develop, and produce hydrocarbons in six exploration blocks in the region north of Mazar-i-Sharif. The production in Amu Darya Basin is expected to be 80 million barrels while the Afghan-Tajik basin is expected to hold about 1.5 billion barrels of crude oil. There are ongoing activities to increase the production of natural gas to use in fertilizer production, power generation and supply for domestic and transport purposes.

Once all these mining industry come into operation will lead to more supporting industrial establishments in the country. The contribution of GHG of the industry sector for the year 2005 is only 150 Gg (energy consumption by manufacturing and construction industry) and 560 Gg from cement production, will rise significantly in the coming years.

4.7.2 POLICIES AND MEASURES

The existing mining law and the hydrocarbon law are reviewed and in the process of amendment. These amendments require the development to be carried out incorporating the principles of sustainability in the mining sector. The World Bank is also providing support in strengthening the legal system on Environmental Impact Assessment for the mining sector and make use of the clean technologies with possible minimum energy use and GHG emissions. Further NEPA is introducing emission standards for industries and guidelines for mining sector. As major technological improvements have taken place to have minimum GHG emissions in the mineral, coal and oil and gas mining, the EIA studies which are mandatory will promote the latest technology to be introduced in these developments.

4.8 AGRICULTURE AND LIVESTOCK

4.8.1 TRENDS AND PROJECTIONS

In the last 40 years Afghanistan's agricultural production has declined, while that of its neighbors, Iran and Pakistan, has increased five-fold. Less than half of available water is used and only one-third of the 7.5 million hectares available for agriculture are irrigated (Afghanistan Economic Update: The World Bank, May 2011). Further, the livestock products which contribute more than 50 percent of the agricultural GDP, during the past 30 years the livestock populations in Afghanistan have fluctuated between about 4 million cattle and over 30 million sheep and goats to the lowest levels recorded in the recent history of the country (end of the drought) of 3.7 million cattle and approximately 16 million sheep and goats. There is unanimous opinion in Afghanistan that mismanagement, especially overgrazing, and conversion to rain-fed wheat production is causing deterioration of rangelands resulting in extensive desertification and decreasing productivity (NAPA). As GIRoA is providing highest priority in the rehabilitation and construction of irrigation infrastructure, there will be significant rise in the irrigated land and also the livestock population in coming years. As agriculture is the major contributor to the GHG of Afghanistan, the rise in the irrigated land and the increase in the livestock populations to meet the national demand will further increase the emissions in coming years.

4.8.2 POLICIES AND MEASURES

As agriculture and rural development is the most prioritized sector to achieve the goal of poverty reduction, the strategic focus of ANDS is on five areas: local governance, agriculture production, agriculture and rural infrastructure, economic generation, emergency and disaster preparedness. In order to promote agriculture and rural development a Comprehensive Agriculture and Rural Development Program is introduced in ANDS with fifteen different programs including National Solidarity Program, National Food Security Program, National Area Based Program, the Horticulture Program, the livestock program, the Irrigation Program, National Rural Access Program, Rural Electrification Program, Rural Enterprise Program, National Resource Program, Research and Extension System, and Emergency Response System.

4.9 NATIONAL STRATEGIES/POLICIES ON MITIGATION, BARRIERS AND OPPORTUNITIES

Islamic Republic of Afghanistan as the party to the United Nations Framework Convention on Climate Change (UNFCCC) is committed to "*Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions…*(Article 4.1f). At present, GIRoA does not have the National Strategy on Climate Change including the mitigation strategy as such. Neither, Afghanistan has done any detailed mitigation assessment of various opportunities available and also in the absence of reliable data to use the models developed for mitigation assessment, it has not been used in the process of developing INC report. The focus has only been provided in presenting the strategies/policies or programs conducive to the mitigation of the GHG emissions or help Afghanistan to continue its economic development with lowest per capita GHG contributions. Islamic Republic of Afghanistan under the Least Developed Country Fund (LDCF) of GEF will be implementing a four year project on "Building Adaptive Capacity and Resilience to the Impact of Climate Change in Afghanistan", and one of the main outputs of this project will be to develop national Climate Change Mitigation and Adaptation Strategy for Afghanistan. This project will start in mid-2012. In the INC process, the technology options available to promote mitigation and the prevailing barriers and opportunities in different sectors in Afghanistan are analyzed (Table 4.5).

Table 4.5: Availability of Technical Options, Barriers and Opportunities

Technical Options	Barriers	Opportunities
A. Buildings, Households and Services		
• Hundreds of technologies and measures exist that can improve the energy efficiency of appliances and equipment as well as building structures	• Lack of information on available technologies and measures, • Lack of financing and skills, • Traditional customs and administered pricing • No building codes, and standards on appliances and equipment	• Review of customs to promote efficient appliances and equipment • Building codes to promote energy efficiency in heating and lighting • Demonstration program on energy audit and savings in commercial complexes • Capacity building and public awareness
B. Transportation		
• Transportation technology for light-duty vehicles has advanced more rapidly than anticipated (EURO I-EURO VI) • Hybrid-electric vehicles have already appeared in the market • Introduction of fuel cell vehicles • High quality fuel available • Electric railways, trolley buses as means of mass transport	• Traditional customs and administered pricing • No national standard on import of vehicles • Fuel adulteration • Dominance of secondhand and older technology vehicles (affordability) • Poor road infrastructures, traffic congestion, no infrastructures for railways and trolley buses • Yet to become party to the Kyoto protocol	• As the vehicle importing country can choose the latest technologies • Addressing the challenges of high urban air pollution problem (introduction of stringent standards on emissions and fuel quality) • Review of customs to discourage old secondhand vehicles and promote hybrid-electric vehicles, and investment on mass transport • Focus on infrastructures development with CDM opportunities for making attractive for private sector investment
C. Industry		
• Energy efficiency improvement is the main emission reduction option in industry • Integration of climate mitigation options as part of the EIA study for the forthcoming major mineral and hydro carbon industries in Afghanistan	• Majorities of Industries are SMEs and relatively low contribution of energy to production costs, • Lack of information on part of the advanced and efficient technology • Limited availability of capital and skilled personnel • No pollution prevention and control standards enforced	• Pollution Prevention and Control legislation to address local environmental concerns; • Voluntary agreements, and demonstration of CP and Energy Efficiencies in SMEs • Introduction of most efficient technologies and energy conservation technologies for the major forthcoming industries in the process of EIA • Prerequisite of clean coal technology for the development of coal industry
D. Waste Management		
• Utilization of methane from landfills and from	• Little is being done to manage landfill gas or to reduce waste in	• Link pollution control measures to develop landfill sites with methane

coal beds • Use of landfill gas for heat and electric power is also growing • Waste-to-energy facilities have become more efficient with lower air pollution emissions, paper and fibre recycling	major cities of Afghanistan • Afghanistan yet to become party to Kyoto Protocol	recovery and use as source of energy • Clean Development Mechanism provides opportunities for private sector to invest if conducive policies and legal system provided
E. Land Use Change and Forestry		
• There are three fundamental ways in which land use or management can mitigate atmospheric CO_2 increases: protection, sequestration, and substitution. • These options show different temporal patterns; consequently, the choice of options and their potential effectiveness depend on the target time frame as well as on site productivity and disturbance history.	• Lack of funding and of human and institutional capacity to monitor and verify • Population pressure and demand of more agriculture and pastures because of demand for food and meat • Minimal role for local communities and the private sector • Illegal trade of wood and wood products • Majority of rural people depending on fuel for cooking and heating on forest and rangeland • Afghanistan yet to become party to Kyoto Protocol	• Opportunities for reforestation and rehabilitation of degraded land with policies and incentives in the form of market payments for capturing and holding carbon as suggested in the Kyoto Protocol, • Ratification of Kyoto Protocol and participation in REDD+ • Opportunities to meet the CBD commitment • Poverty reduction opportunities through CBNRM and benefit sharing
F. Energy		
• Win-win options such as coal bed methane recovery and improved energy efficiency in coal and gas fired power generation as well as co-production of heat and electricity • Efficient transmission and metering system to reduce loss • Meeting the increasing demand through renewable forms of energy, including hydro and micro hydro power generation	• Lack of human and institutional capacity for adoption of cleaner technology • Imperfect capital markets that discourage investment in small decentralized systems, • Lack of information and lack of intellectual property rights for mitigation technologies • For renewable energy, high first costs, lack of access to capital, and subsidies for fossil fuels • No environmental standards to comply (emission and indoor) • Yet to become party to Kyoto	• Opportunities include promotion of leapfrogs in energy supply and demand technology, facilitating technology transfer through creating an enabling environment, capacity building, and appropriate mechanisms for transfer of clean and efficient energy technologies. • Demonstration of Demand Side Management programs and carbon trade through CDM • Opportunities to benefit from carbon trading through rural renewable energy development
G. Agriculture and Livestock		
• Increasing carbon stock by	• Lack of funding for R&D	• Expansion of credit schemes, shifts

cropland management; • Reducing CH_4 emissions from better livestock management and rice production • Soil carbon sequestration and reducing N_2O emissions from animal wastes • Energy cropping to displace fossil fuels has good prospects if the costs can be made more competitive and the crops are produced sustainably • Improved waste management	activities to conduct • Lack of national human and institutional capacity and information • Farm-level adoption constraints including lack of information and incentives	in research priorities, development of institutional linkages across countries, trading in soil carbon, and integration of food, fibre, and energy products are ways to overcome the barriers • Measures to be linked with moves towards sustainable production methods • Energy cropping provides benefits of land use diversification where suitable land is currently underutilized for food and fibre production and water is readily available.

5 SYSTEMATIC OBSERVATION AND RESEARCH

5.1 INTRODUCTION

Afghanistan being a non-annex 1 party to the UNFCCC is encouraged to provide information on climate change research and systematic observation including its participation in and contribution to the activities and programs at national, regional and global research networks and observation systems. It is also encouraged to provide information on research relating to programs containing measures to mitigate climate change; programs containing measures to facilitate adequate adaptation to climate change; and the development of emission factors and activity data in the country. The following sections are developed as per these instructions of the guidelines.

5.2 METROLOGICAL OBSERVATION AND RESEARCH

5.2.1 METEOROLOGICAL OBSERVATION

The history of observation of meteorological parameters in Afghanistan is almost 60 years old. Ministry of Transportation in 1953 installed meteorological weather stations in selected locations of the country. By the Soviet Union invasion (1979), around 600 staffs and 27 weather observational stations were operational. These were subsequently rendered non-functional or destroyed due to years of conflict and war. Since 2001, Afghanistan Meteorological Authority (earlier Department of Meteorology) under the Ministry of Transportation and Civil Aviation is the leading agency in collecting, processing and reporting of weather data including temperature, precipitation and weather forecasts.

World Meteorological Organization (WMO) helped AMA in providing them with the technical assistance and past meteorological data. Furthermore WMO with the request of Afghanistan Meteorological Authority, Ministry of Transport and Civil Aviation advocated for assistance, under the Voluntary Co-operation Program (VCP), in strengthening the Afghanistan Meteorological Authority with provision of MESSIR System for deployment at Kabul. The complete MESSIR System will ensure the provision of more accurate and timely forecasts and consequently secure the safety of aviation, improvement on natural disaster management and increase the flow of data to the GTS contemporaneously. The locations of the meteorological network of Afghanistan are presented in Figure 5.1 which includes five complete automatic stations, five classic stations, 106 rain gauges, 15 French component classic stations, five ICARDA automatic stations, three ISAF automatic stations and three further classic stations. USGS Agro-Meteorology (AgroMet) Program is also assisting the GIRoA in collecting and analyzing agricultural and meteorological data as it relates to crop production, irrigation, water supply, energy, and aviation. Key aspects of the program have involved establishing a country-wide network of meteorological data-collecting stations and creating an extensive national database for the analysis of meteorological, hydrological, and agricultural information. As part of the program, more than 100 AgroMet observation stations have been installed throughout Afghanistan. Out of these, 22 stations are complete agro-meteorological stations, providing observations three times a day; 18 of these are classical stations, recording seven kinds of weather parameters; and four of these sites are automatic stations that can report up to 20 weather parameters daily. Figure 5.2 provides the national network of AgroMet Stations in Afghanistan. With support from International Civil Aviation Organization (ICAO), an Aviation (automated) Weather Observing System (AWOS) is currently being installed at Kabul International Airport which will complement the MESSIR System under the Government of Afghanistan.

Figure 5.1: General Networks Indicating Stations Types as of 2011.

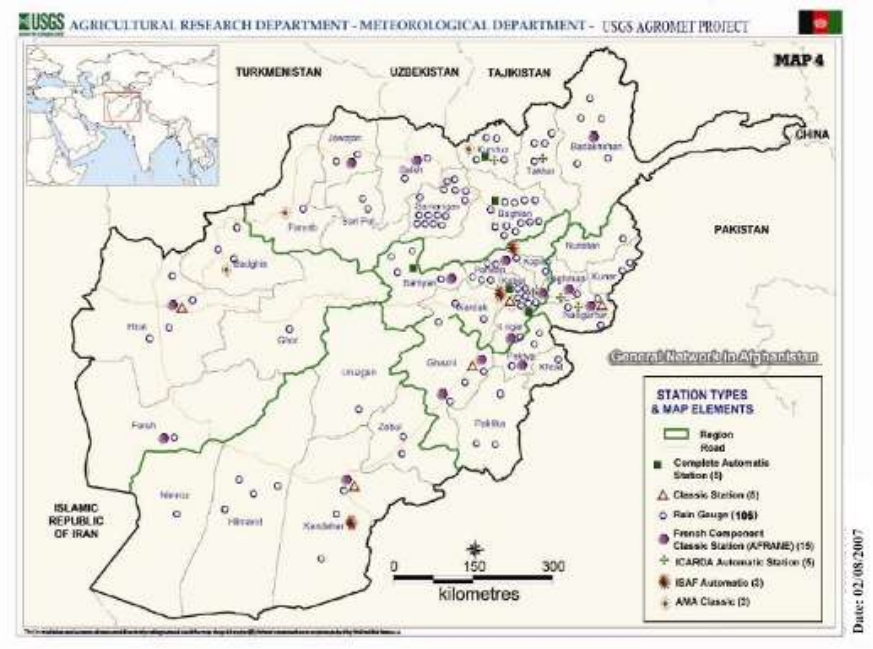
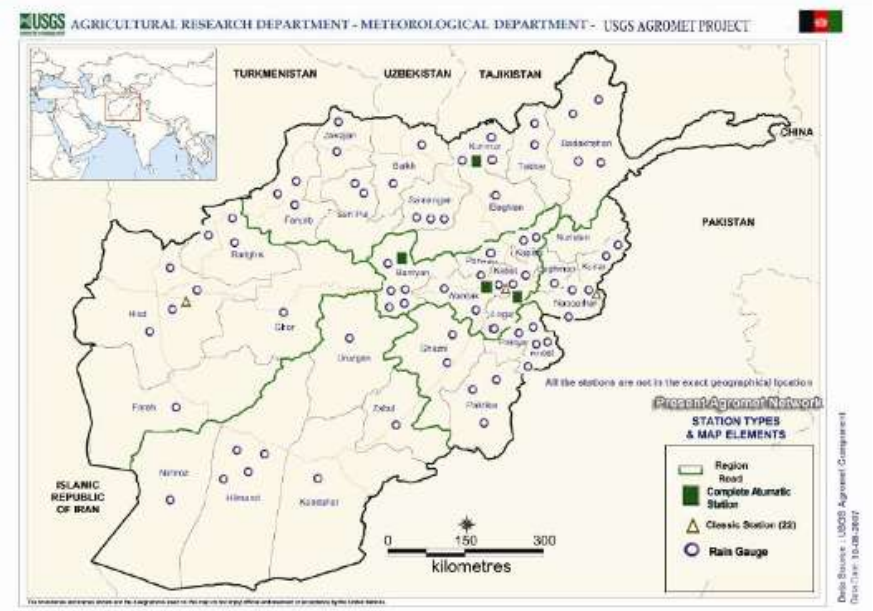


Figure 5.2: AgroMet Networks in Afghanistan



5.2.2 CLIMATIC RESEARCH WORKS IN AFGHANISTAN

There are very limited works at the national level on the climatic research in Afghanistan. However, AMA is collecting information, analyzing and making weather forecasts and dissemination through media. Information sharing with academic institutions and support to conduct research is also in the very early stage particularly due to limited resources.

However, there have been some publications released on the research works done on the Hind-Kush-Himalayan region on the impact of climate change, in which Afghanistan is also involved, and the findings are recently made public by ICIMOD, and those include:

- The Status of Glaciers in the Hindu-Kush-Himalayan Region (ICIMOD 2011)
- Snow Cover Mapping and Monitoring in the Hindu-Kush-Himalaya (ICIMOD 2011)
- Climate Change in Hindu-Kush-Himalayas- State of Current Knowledge (ICIMOD 2011)

In addition to the above research works, during the COP 16 of UNFCCC at Cancun, Mexico, the Ministry of Foreign Affairs (MFA) Norway announced its support to ICIMOD, the Center for International Climate and Environment Research – Oslo (CICERO), and UNEP/GRID-Arendal to help the Hindu-Kush-Himalayas in view of the rapidly melting glaciers and the need for people to prepare for the challenges of the future. A series of consultations with these and other strategic and operational partners from the region and beyond culminated in the creation of the Himalayan Climate Change Adaptation Programme (HICAP), which started in 2011 and will be completed by 2015. Afghanistan is actively participating in this program. Main objectives are:

- reduce uncertainty through downscaling and customizing of global climate change scenarios and develop water availability and demand scenarios for major river basins;
- develop knowledge and enhance capacities to assess, monitor, and communicate the impacts of and responses to climate change (compounded with other drivers of change) on natural and socioeconomic environments at local, national, and regional levels; and
- make concrete and actionable proposals for strategies and policies, considering vulnerabilities, opportunities, and potentials for adaptation, with particular reference to strengthening the role of women and local communities

5.2.3 PROGRAMS ON STRENGTHENING OF SYSTEMATIC OBSERVATION AND RESEARCH IN AFGHANISTAN

World Meteorological Organization (WMO), India, and DFID have agreed to support Afghanistan Meteorological Authority for more systematic observation of meteorological parameters, analysis, forecasting and institutional capacities to support and carry out research in Afghanistan.

WMO will support AMA from 2010 till 2020 on three major areas:

- Communication System Strengthening Program (2012-2015)
- Agro-Meteorology Program (2012-2015), and
- Aeronautical Meteorology Program (2012-15)

Government of India and Government of Islamic Republic of Afghanistan have recently signed bilateral cooperation agreement on RIMES (Regional Integrated Multi-hazard Early Warning System). Indian Meteorological Department will support AMA in establishing a Training Centre with all infrastructures including equipment and human resources development to continuously promote research activities in Afghanistan and its more active participation at regional basis.

AMA and UK Meteorological Office are working towards cooperation on strengthening Aviation Meteorological System and Human Resources Development. It is not signed but is in the process.

5.3 SYSTEMATIC OBSERVATION ON HYDROLOGY AND RESEARCH

As discussed in National Circumstances chapter on Water Resources in Afghanistan, it is divided into five river basin and Ministry of Energy and Water currently have 105 total hydrological monitoring stations covering all these five river basin. The number of stations is provided in Figure 5.3. And the analysis for the rainfall, ETP and deficit in all the five river basin in the year 2008 is provided in Figure 5.4 and the rainfall and ETP on monthly basis in Figure 5.5.

Figure 5.3: Hydrological Stations Installed and Planned

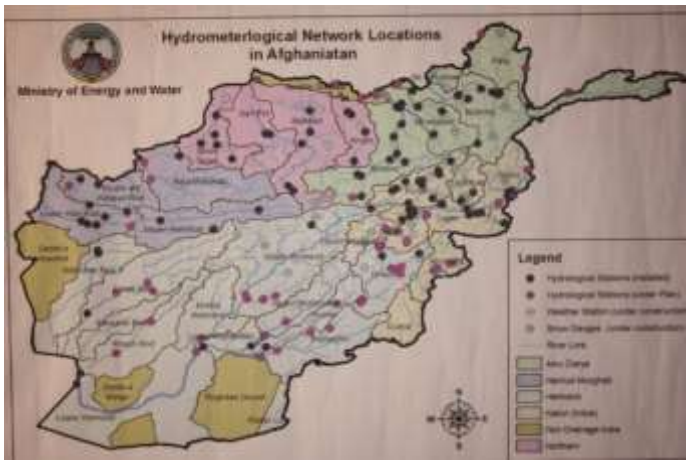


Figure 5.4: Mean annual rainfall, evapotranspiration and deficit in five river basins in 2008

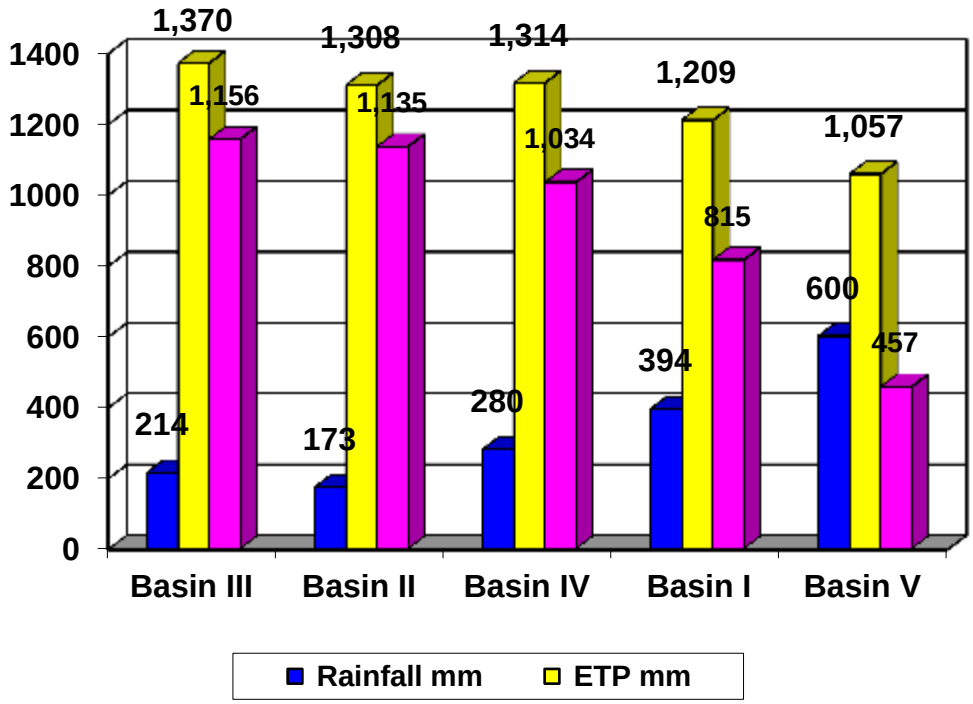
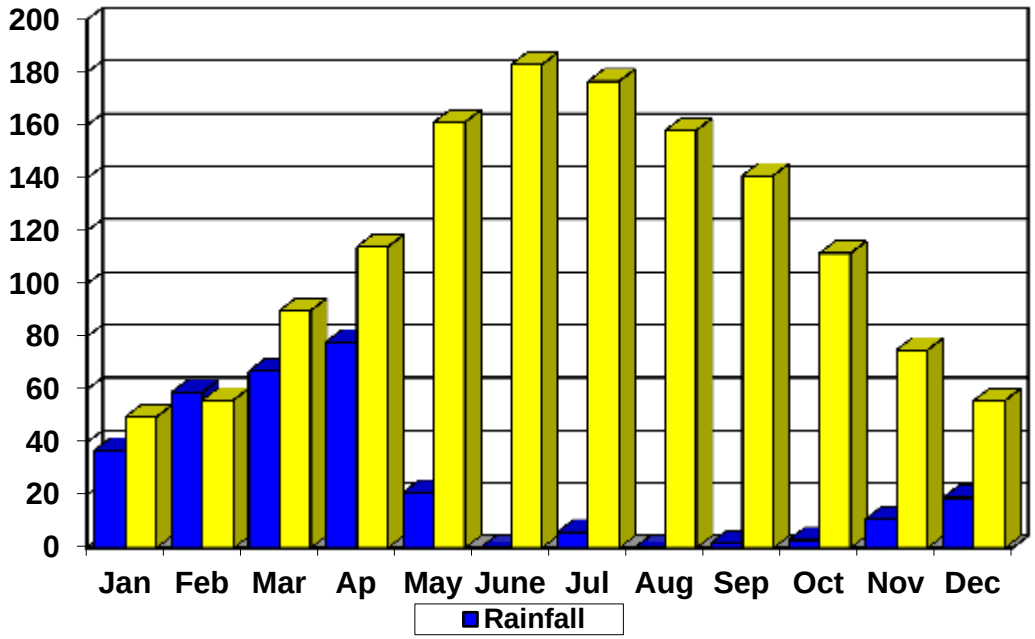


Figure 5.5: Average monthly rainfall and Evapotranspiration in mm, (2007).

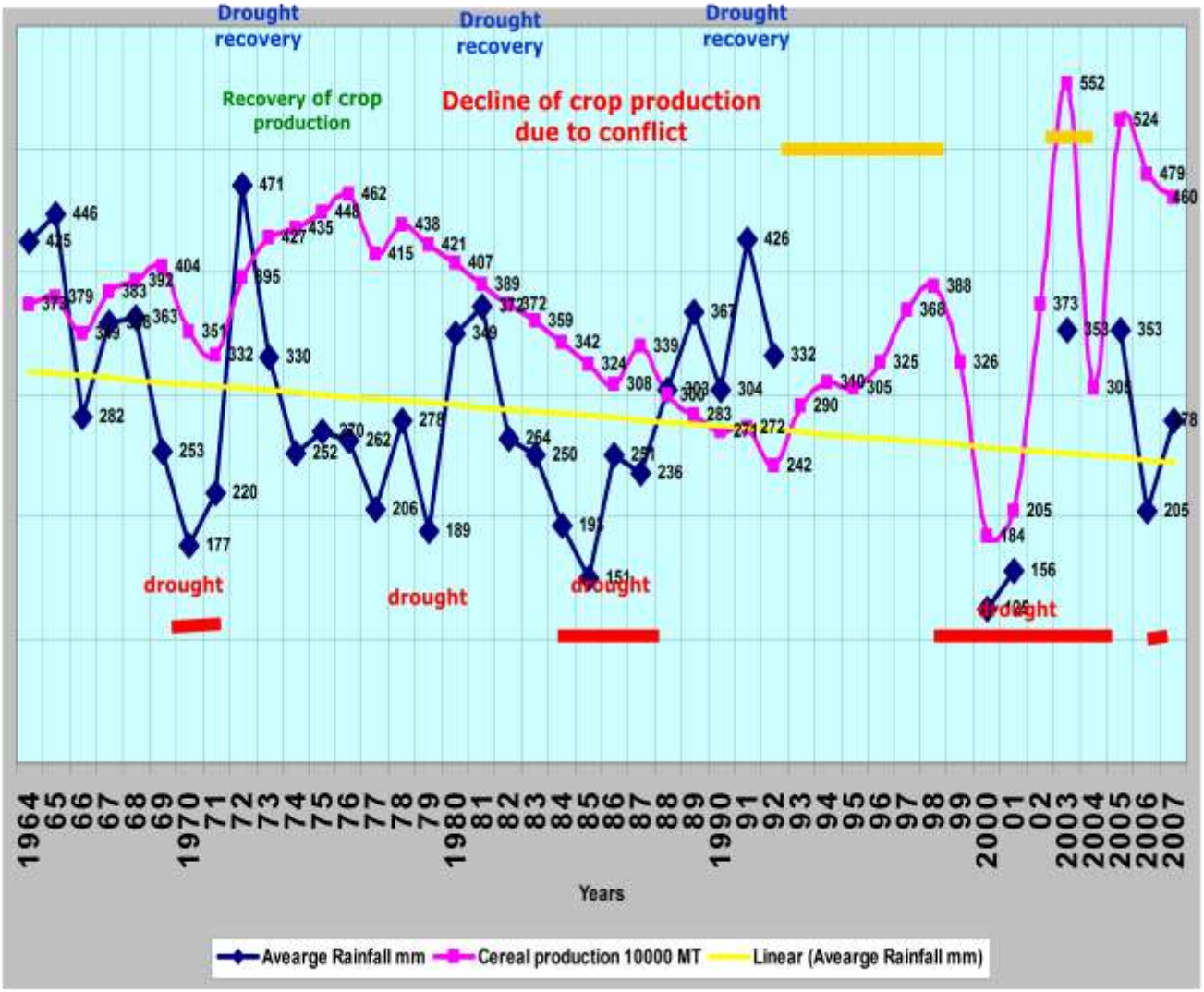


5.4 SYSTEMATIC OBSERVATION AND RESEARCH ON AGRICULTURE

Ministry of Agriculture, Irrigation and Livestock has provided priority on agricultural research works and under its organization has Department of Agriculture Research Institute to specifically focus on research

related activities. Department of Agriculture Research Institute has established research institutes at provincial level as well. Recently, ministry has also added Department of Dry Land Agriculture which will also support research activities in dry land areas. Many donor communities AgroMet, USDA, USAID, FAO, DFID, CIMMYT, AUSAID, FRANCE, and ICARDA are providing financial and technical supports in the agricultural research works and national capacity building initiatives. One of the recent research work on the impact of climate change and conflict on crop production is presented in Figure 5.6.

Figure 5.6: Impact of Climate Change and Conflict on Crop Production in Afghanistan



Some of the projects and programs that are research oriented and completed in recent years are summed up as follows:

- Community Based Research on Agricultural Development and Sustainable Resource Management in Afghanistan (supported by OPEC and completed in 2005)
- Rebuilding Agricultural Markets Project (USAID support and ended in 2006)
    - *Demonstrating New Technology in Farmers' Fields to Facilitate Rapid Adoption and Diffusion,*
    - *Development of Village-Based Seed Enterprises,* implemented by ICARDA.
    - *Introducing Protected Agriculture for Cash Crop Production in Marginal and Water Deficit Areas,*
    - *Clean Seed Production, Multiplication and Marketing for Increased Potato Production,* implemented by CIP (International Potato Center)
- Strengthening Seed Systems for Food Security in Afghanistan (supported by IDRC and ended 2006)
- Research in Alternative Livelihoods Fund (RALF) (DFID Support and Completed by 2008)
- USAID ALP (Alternative Livelihoods Program) – Eastern Region (Nangarhar and Laghman Provinces (*Completed 31st December 2008)*
- USAID ALP (Alternative Livelihoods Program) – *North Completed 30th November 2009*
- Program for Rehabilitation of Agricultural Livelihoods of Women in Marginal Post-Conflict Areas of Afghanistan and Pakistan(IFAD Support and Completed 30th June 2008)
- Mung bean Seed Multiplication Project (USAID support and *Completed 31st December 2009)*
- Increasing Food and Nutritional Security in Afghanistan through Crop Diversification of Wheat Based Cropping System (IFAD support and *Project completed 30th August, 2011)*

Ongoing/planned projects or programs supporting agriculture research in Afghanistan include:

- Women Livelihood Project (Goat)(IFAD-MAIL, 2010 – 2012)
    - The overall goal is to reduce the vulnerability and improve the livelihood means, incomes, food security and nutritional status of poor and vulnerable rural households on a sustainable basis in selected areas of Afghanistan.
- Research Program Afghanistan (Netherlands, 2010-2012)
    - The overall goal is to improve food security and livelihoods and build capacity of the Ministry of Agriculture
- Introduction of drought resistant crop varieties and increased production/ drop of water (2010-2013)
    - The overall goal is to reduce the vulnerability and improve the livelihood means, incomes, food security and nutritional status of poor and vulnerable rural households on a sustainable basis in selected areas of Afghanistan.
- Integrated catchment management and capacity building for improving livelihoods in Afghanistan (AusAid, 2012-2016)

5.5 RESEARCH RELATED TO PROMOTION OF MITIGATION AND ADAPTATION MEASURES

Afghanistan has huge potential of renewable energy sources which will help to reduce emissions of greenhouse gases but also to improve livelihoods for millions of Afghans. In recent years, the National Renewable Energy Laboratory (NREL), USA did research on wind energy, solar energy potentials and assessment of the biomass in Afghanistan and their potential utilization and published the results of the research works. The findings will provide all resources to policy makers in Afghanistan to take policy initiatives towards fulfilling the national demand of energy with low carbon energy sources, and achieve the goal of environmental sustainability. During the process, professionals working with Government of Afghanistan and non-governmental institutions in Afghanistan have been actively involved and gained significant knowledge. The results of the assessments are summed up as follows.

5.5.1 WIND-ELECTRIC POTENTIAL OF AFGHANISTAN

The conclusion of the NREL study on Wind Resource Assessment and Mapping for Afghanistan published in June 2007 are presented in the bullets here and shown in Figure 5.7 (map):

- Advanced modeling and analysis techniques for detailed wind resource maps of Afghanistan
- High resolution wind maps and assessment information
  - Useful to identify best prospective areas and screen out less promising areas, minimizing cost and time of prospecting
  - Does not eliminate the need for on-site wind measurement
- Windy land area and theoretical wind potential estimates
  - Class 4+ (good-to-excellent for utility-scale applications)
    - 31,600 sq. km, almost 5% of Afghanistan's total land area (650,000 sq. km)
    - 158,000 MW of potential installed wind capacity (assumes 5 MW/sq. km)
  - Good potential for many wind/diesel and off-grid applications
    - Almost 12% of Afghanistan's land area has Class 3 or better wind resource

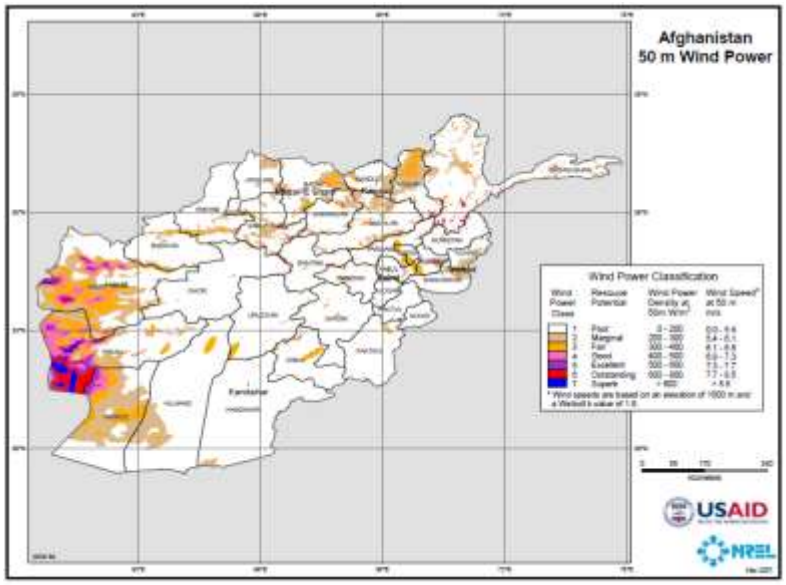
Major wind resource areas in Afghanistan are Western Afghanistan (especially northwestern Nimroz, western Farah, western Heart), North Eastern areas (especially eastern Balkh, northern Takhar), Wind Corridor Areas including (near Jabalsaraj, Sarobi, and Tirgari in eastern Afghanistan; near Qalat, Gadamsar, Walakhor, Golestan, and Gorzanak in central/southern Afghanistan), and Elevated mountain summits and ridge crests especially in northern and eastern Afghanistan.

Table 5.1: Afghanistan Wind-Electric Potentials

Wind Resources Utility Scale	***Wind Class***	***Wind Power (W/m2)***	***Wind Speed (m/s)***	***Land Area (km2)***	***Percent Windy Land***	***Total Capacity Installed (MW)***
Good	4	400-500	6.8-7.3	15193	2.4	75,970
Excellent	5	500-600	7.3-7.7	6633	1	33,160
Excellent	6	600-800	7.7-8.5	6615	1	33,100
Excellent	7	≥800	≥8.5	3169	0.5	15,800
Total				***31611***	***4.9***	***158,100***

Assumptions: Installed capacity per km2= 5MW; Total Land Area of Afghanistan= 645810 km2

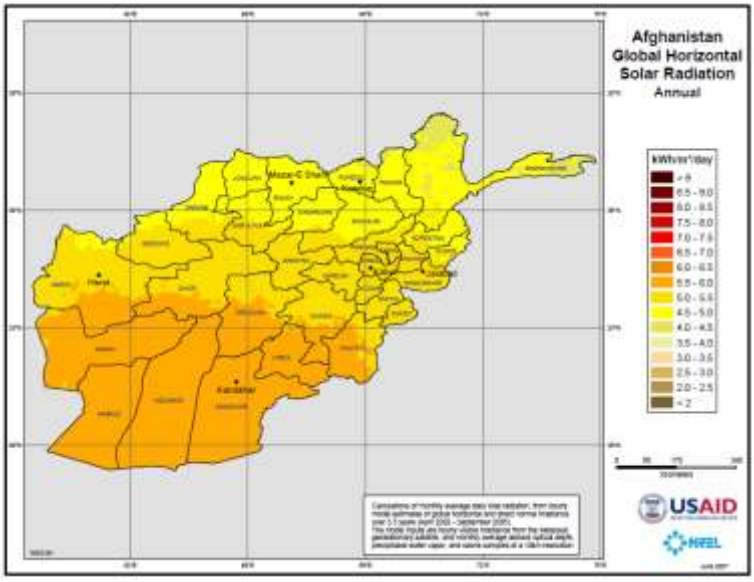
Figure (Map) 5.7: Afghanistan 50 m Wind Power



5.5.2 SOLAR ENERGY POTENTIALS IN AFGHANISTAN

The NREL/USAID works on solar energy potential in Afghanistan reveals that the country has excellent solar energy resources throughout its regions. Typically averaging over 5.5 kWh/m^2/day annual global horizontal insolation and estimated at least 300 days for most of the country, with the south having the highest insolation. There exists a significant potential for solar heating (water and space) and standalone solar PV application for household lighting. Surveys indicate that kerosene is the most common fuel for lighting in non-electrified communities and can be replaced with solar system. The NREL findings on the Afghanistan Global Horizontal Solar Radiation (annual) are presented in Figure (map) 5.8.

Figure (map) 5.8: Afghanistan Global Horizontal Solar Radiation (annual)



5.5.3 BIOMASS RESOURCES IN AFGHANISTAN

Assessment of Biomass Resources in Afghanistan (**Technical Report,** NREL/TP-6A20-49358, and January 2011) study estimated the biomass resources available in Afghanistan and evaluated potential resources that could be used for energy purposes. This is a highly valuable resource for policymakers and industry developers with information on the biomass resource potential in Afghanistan for power/heat generation and transportation fuels production. This study identified biogas generation from animal manure and waste-to-energy (WTE) from urban discards as the most promising sustainable biomass technologies that use existing resources in Afghanistan. The biogas technology is more applicable to rural regions and it provides many benefits to households including reductions in indoor air pollution, reductions in firewood use and collection time (especially for women), and increases in crop production by using the spent slurry as a fertilizer. WTE is best suited for urban areas and it provides two important benefits: environmentally safe waste management and disposal, as well as the generation of clean electric power. According to the NREL study, theoretically, Afghanistan has the potential to produce about 1,408 million cubic meters (MCM) of biogas annually, based on the number of livestock in the country as of 2008-09. This volume is equivalent to about 32 trillion Btu. It is estimated that if only one quarter of this potential is developed, it could fulfill almost half of Afghanistan's current energy consumption of 18 trillion Btu. This study also evaluates the MSW resources in Afghanistan to illustrate its electricity generation potential. WTE and landfill gas-to-energy (LGE) facilities tend to be built at the landfills of large urban centers to ensure steady supply, although small-scale projects could be developed in rural areas. Therefore, the study estimates the WTE potential in major populated places in Afghanistan (those with more than 30,000 people). Afghanistan currently is in the process of becoming party to Kyoto protocol and these projects can attract investments for carbon credit and can become more attractive investment opportunities for private sector.

5.6 RESEARCH RELATING TO EMISSION FACTORS AND ACTIVITY DATA

There are no such activities or research going on with the objective of developing the emission factors in key sources for GHG emission activities. However the research work mentioned above on the renewable energy sources, and some of the planned activities on monitoring the forestry and rangelands can generate valuable information for developing emission factors in future.

5.7 CONSTRAINTS AND GAPS AND RESEARCH PRIORITIES

As a LDC country, Afghanistan has prepared the National Capacity Self-Assessment report and action plan for capacity building. According to the NCSA findings, aside from a small number of research initiatives being supported by international organizations, capacities of national institutions to undertake research into biodiversity, climate change and desertification are extremely limited. This situation is confounded by few researchers, lack of a strategic plan and funding for realizing research, absence of essential infrastructure and facilities, weak research-extension linkages, and limited accessibility to and knowledge of information technology. In NCSA, highest priority is provided in national capacity building both at all levels (systemic, institutional, and individual). The research starts with the development of strategic, incremental research plans that focus on specific priority issues. Where possible these can be linked directly to, and supported by, international research programmes. As research programmes and methodologies are identified and implemented, training is required at a local level in data collection and

management, use of information and communications technology, and packaging of information in a manner that can be easily understood, interpreted and used by policy and decision makers.

6 OTHER INFORMATION

6.1 TECHNOLOGY TRANSFER

Pursuant to decision 4/CP7,its annex, and the implementation of Article 4, paragraph 5, of the Convention, non-annex 1 Parties are encouraged, in the light of their social and economic conditions, to provide information on activities relating to the transfer of, and access to, environmentally sound technologies and know how, the development and enhancement of endogenous capacities, technologies and know how, and measures relating to enhancing the enabling environment for development and transfer of technologies. This section is prepared to provide all those information that are related to the above mentioned guidance.

6.1.1 ENABLING ENVIRONMENT FOR TECHNOLOGY TRANSFER IN AFGHANISTAN

At present, Afghanistan does not have the institutional arrangement to provide information and know how on the environmental sound technologies to get easy access by private companies and individuals. However, National Environmental Protection Agency (NEPA), Ministry of Agriculture, Irrigation and Livestock (MAIL), Ministry of Rehabilitation and Rural Development (MRRD), and Ministry of Energy and Water (MOEW) are promoting renewable energy technologies in Afghanistan. Many donor agencies, the World Bank, USAID, GIZ, and UN agencies are providing technical and financial support in the development of micro-hydro, solar home system, and installation of the bio-gas plant. Some INGOs also promoting ICS (improved cooking stoves) in some rural villages to reduce the pressure on forest and rangeland as well as have better indoor air quality. Although promotion of the renewable energy technologies and some energy efficiency technologies are being developed or transferred in Afghanistan, in absence of the institutions with the primary objectives of providing information and know how on environmental sound technologies, it is still in the very low scale.

National and sectoral policies of Afghanistan have the objectives of promoting cleaner and environmental sound technologies. Afghanistan's National Development Strategy has the objective of the ensuring environmental sustainability, and the energy sector strategy provides maximum focus on meeting the national demand of energy through the development of low carbon energy sources like hydro power, renewable energy for rural areas, and natural gas. Government of Afghanistan through the National Solidarity Program (NSP) and Energy for Rural Development Afghanistan (ERDA) under the MRRD is promoting micro-hydro projects, biogas projects and solar home system and communities only have to contribute the ten percent of total cost in kind.

The provisions of Environment Law of Afghanistan are also conducive for the promotion of environmental sound technologies. The law provides highest priority on pollution prevention and control and ensures that all the industries or facilities comply with the environmental requirements. As per the provisions of this law, government can introduce economic instruments to promote cleaner technologies; however it is yet to be introduced. GIRoA is now discussing on the Rural Renewable Energy Policy which has the strategy of promoting renewable energy technologies with the introduction of the economic instruments. However, the prevailing tax and the customs need to be reviewed to make them supportive for the transfer of EST in Afghanistan.

6.1.2 PROGRAMS AND PROJECTS PROMOTING RENEWABLE ENERGY TECHNOLOGY

NSP AND ERDA PROGRAMS OF MRRD ON RENEWABLE ENERGY PROMOTION

Under a World Bank-funded program called the 'National Solidarity Program (NSP)', which is working with local Community Development Councils (CDC's), and promoting micro-hydro, wind energy demonstration, biogas plants, and solar system under the programs since 2003, particularly focusing in small towns and villages. CDC's participation has involved operations and maintenance (O&M) and established viable systems of cost-recovery, in turn providing sustainability. As experience is generated, this model could be reviewed for potentially wider use. The achievements made so far include:

NSP have already installed 600 micro-hydro plants and 600 more are under implementation. Once all the 1200 micro-hydro plants come into operation, a total of 20 MW power will be generated and distributed in villages. Under the ERDA program, 60 micro-hydro power plants are established and 70 more are in process which will generate additional 2MW of electricity in villages.

NSP have already installed 150,000 Solar PV systems in 600 villages and over 6000 such systems are in the process; also 400 biogas plants are installed in villages. In Kabul alone, 3000 parabolic solar collectors and 200 flat plate water heaters are installed.

Solar system and wind mill in Afghanistan: **Demonstration of 2 KW wind powered water pump in Herat.**

Afghanistan Clean Energy Project (ACEP)

USAID supported ACEP has also made good progress towards promoting renewable energy technology and energy efficiency improvements in Afghanistan. Some of the key demonstrations include: solar system in health clinics; solar system to electrify schools, solar streetlights and trainings on various renewable energy technologies and energy efficiency improvements. Current activities include power generation (hydro, solar and wind power generators for homes, schools, clinics, irrigation pumps), energy efficiency improvements (improved management of utilities and power distribution system), feasibility

study on renewable energy integration into national system, capacity building, and demonstration of alternative energy projects including solar home system, solar street lights, solar and wind water pumps, solar lanterns to replace kerosene, and wind mills in northern and eastern Afghanistan.


Solar Lighting in Deh Sabz Clinic


Solar Water Pump in Al Buroni Univ


Solar Street Lighting in Faizabad

Technology Improvement in Power Distribution and Loss Minimization

There is significant loss in power distribution system, around 48%, North East-NEPS, Southern-SEPS, and Western Power System; and Rural Electrification Program, focuses on reducing losses in distribution system. NEPS on a priority basis, focus on the transmission lines that will transmit imported power from Uzbekistan, Turkmenistan, and Tajikistan to major urban centers in the North and East, in particular Kabul are being completed with the technology with minimum possible losses of energy, as saving a watt is equivalent to generation of watt. All other programs Southern Power System (SEPS), Western Power System (WEPS) and Rural Electrification program all have the component of having distribution technology or practices to promote minimum losses in power distribution.

Use of Indigenous Resources (Natural Gas and Coal) with Best Available Technologies

A 100 MW power plant in Sheberghan based natural gas reserves is under way installing the best available technology to have the maximum efficiency and longer life of the reserves. The estimated gas reserves available are 1197.17 billion cubic feet sufficient to support 100 MW power plants for 56 years.

Technology Transfer in the Agriculture Sector

The agriculture sector has been using improved technologies and for better productivity and efficient use of resources. These include: seed germination test; identification of purity of seeds and differentiating it with other varieties; seed cleaners; threshers; harvesting machines; drip irrigation and sprinkler irrigation; various mulches; sowing machines; green houses to produce vegetables in off seasons; establish *chela* systems on grapevines; sowing onions in lines to control herbicides; post-harvest sorting-packing. However, there are many constraints and gaps to facilitate the best practices in agriculture sector.

Community Based Natural Resources Management Program

The national natural resources management strategy gives highest priority to a community based natural resources management approach. In order to implement this UNEP, FAO, USAID, Aga Khan Foundation, many others have launched CBNRM programs to demonstrate the best practices with the objectives of providing livelihood to people and conservation of natural resources. More such programs are needed and MAIL is promoting them with donor support.

6.1.3 BARRIERS AND OPPORTUNITIES

The key weaknesses prevailing in Afghanistan for the promotion of technology transfer are the lack of human resources in the country, poor coordination amongst the institutions, and the low capacity of the committees formed to promote coordination (NCSA Report). Non-availability of information and know-know and absence of the institutional arrangement to collect and disseminate is absence. Very poor enforcement of the pollution control provisions of the legal system, traditional tax and customs without incentives for cleaner technologies, and lack of networking with regional institutions are the key barriers for smooth technology transfer in Afghanistan. Afghanistan has not been able to get the benefits provided by the MEAs which it is party. Huge opportunities are available through CDM and REDD+ to transfer cleaner technologies in Afghanistan. Also Basel convention provides good opportunities for environmentally sound technology transfer. Afghanistan need to be party to both Kyoto Protocol and Basel convention and it is in the process now.

6.2 EDUCATION, TRAINING AND AWARENESS

As a non-annex 1 Party to the UNFCCC and in accordance to the Article 6 of the convention, there is the need to report the activities that provide information on activities related to climate change education, training and public awareness. This is to facilitate the periodic review of the progress made towards the implementation of the Article 6 of the convention.

By the year 2020, Afghanistan will be “a society of hope and prosperity based on a strong, private-sector led market economy, social equity, and environmental sustainability”. This is one of the three visions of Afghanistan’s National Development Strategy. This clearly shows that the environmental protection and sustainable development is Afghanistan’s national priority.

ANDS recognizes that only well informed citizens can only contribute in the national efforts in the conservation and protection of environmental and natural resources. To promote environmental education and awareness, Government of Islamic Republic Afghanistan will establish the following rights of the public (individuals and their associations) with regard to the environment:

- The right of everyone to receive environmental information that is held by public authorities ("access to environmental information")
- The right of both women and men to participate in environmental decision-making ("public participation in environmental decision-making");
- The right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general ("access to environmental justice").

ANDS, which was introduced in 2008 as the vision 2020, which also serves as the Poverty Reduction Strategy Paper (PRSP) of Afghanistan, has environment as cross-cutting issue and improved environmental management, education and awareness as one of the focused areas for all sectoral ministries to integrate in their respective sectoral development initiatives.

6.2.1 INSTITUTIONAL FRAMEWORK FOR THE IMPLEMENTATION OF ARTICLE 6 OF THE CONVENTION

National Environmental Protection Agency

The National Environmental Protection Agency (NEPA) of Afghanistan, established in 2005, is the nodal agency for environmental management and also for mainstreaming climate change in Afghanistan. As an independent institutional entity, is responsible for coordinating and monitoring conservation and rehabilitation of the environment, and for the implementation of Environmental Law of Afghanistan. The Environment Law of Afghanistan legally mandates NEPA, as one of its functions (Article 9(18)) "develops and implements plans for environmental training, environmental education and environmental awareness-raising in cooperation with relevant ministries and public bodies". In the NEPA structure there is a separate division on Environmental Education, Training and Awareness which develops environmental education and awareness materials, coordinates with line ministries, media and NGOs, and provincial offices for the dissemination of such materials. In every line ministries there is either a division or section on education and public awareness for their own sectoral purposes

As per the provisions of the Law, GIRoA has established institutional framework to establish better coordination and cooperation amongst governmental bodies at centre and provincial levels, private sector, academia and non-governmental organizations, and local bodies, community and religious leaders with the objective of promoting awareness at various levels of decision making process in Afghanistan. These mechanisms are already presented in the National Circumstances chapter.

National Disaster Management Authority

Another institution with key mandate of dealing with impact of climate change is Afghanistan National Disaster Management Authority (ANDAMA) which has the coordinating role in developing early warning system and disaster risk reduction as well as post disaster risk management. At the central level National Disaster Management Council and at the provincial level Provincial Disaster Management Committees are established. One of the main objectives of ANDMA is to create awareness amongst the communities to deal with the disasters including climatic disasters.

Sectoral Ministries

Ministry of Communication and Information; Ministry of Religious Affairs; Ministry of Energy and Water; MAIL; Ministry of Women Affairs; MRRD all have institutional network at provincial and even at district level which can be used to promote environmental awareness at community level.

Academic Institutions

During the seventies, Afghanistan was known for its high standard education system in the region. Because of the decades' long conflict and war, education sector has also been severely damaged. In order to prepare the national human resources on environmental and climate change field, the role of Universities is very vital. There are four universities in Kabul (Medical, Kabul University, Polytechnic, and Education) and nine regional universities (Nangarhar, Khost, Kandahar, Herat, Bamyan, Mazar, Takhar, Badakhshan and Kapisa) in Afghanistan. In recent years, a number of private institutions are established and providing higher education. Ibnisena Higher Education Institution has created the

Department of Environmental Engineering for bachelors and masters level degrees, and also the recently established Iran Independent University is running Master's course in Environmental Engineering.

Agriculture Faculty of Kabul University has the Department of Forest and Natural Resource Management which runs only bachelors programs. The faculty has established Environmental Conservation Centre which runs many short-term or discussion programs related to environmental challenges including climate change. Recently Kabul University has created a Department of Environmental Protection and Disaster Management under the Geo-Science Faculty to particularly focus on environmental education. There is the need of continuous international support to strengthen Universities' institutional capabilities in conducting research and providing trainings as well as policy analysis support in various disciplines of environmental management.

Mass Media (Electronic and Paper)

In recent years there has been significant growth in electronic and print media in Afghanistan. As of 2011, there are thirty two television stations nationwide (twenty three in Kabul and nine in provinces) and much more radio stations. All these are the foundation to promote environmental awareness and with proper training on environmental issues as well as on ethics, they can be instrumental in generating public awareness. Some of the TV stations and radio stations have initiated programs on environmental issues and also live programs on current environmental problems bringing together the concerned officials, experts and general public.

Non-Governmental Organizations (NGOs):

There are over 300 international non-governmental organizations registered with Government in Afghanistan working in various fields and a few of them with environmental objectives. In recent years, there have been significant rise in the registration of NGOs in Afghanistan; however a very small number is working with environmental objectives. Among them, SEA and Green Club, Youth Initiatives (Kabul University), Sabzandishan (Green Thought), Green Tech (Private Sector- waste treatment) have made their recognition for promoting awareness on environmental issues amongst general public and government institutions.

6.2.2 LEVEL OF AWARENESS AND UNDERSTANDING OF CLIMATE CHANGE ISSUES

The level of understanding of the climate change issues in Afghanistan is comparatively low at all level. General public are aware of the environmental challenges they are facing and also on the changes taking place over the time including climatic variations and associated hazards (draught, floods, etc). But there is very limited knowledge of the understanding of the climate change, the climatic hazards, and the global initiatives towards adaptation and mitigation of the impacts of climate change.

Over the years, at policy making level, there have been significant rise in level of understanding of the climate change issues. This has been the result of NEPA's initiatives with regular briefing of the outcomes of the global and regional meetings on climate change attended by high level NEPA officials at High Level Ministerial Committee, High Level Commission on Air Pollution Control, and Committee for Environmental Coordination. Participation of all the sectoral ministries in the NAPA and NCSA preparation process, INC preparation process, and the discussion of challenges at CEC meetings have contributed a lot to have some understating on climate change issues, national obligations and opportunities as party to Rio Conventions, in sectoral ministries. However, this level of understanding is

at very basic level and there is the need to continuously launch awareness raising programs for sectoral ministries. Compared to many other developing and LDCs, the level of NGO working in the environmental field is at the lowest level.

6.2.3 IMPLEMENTED OR PLANNED INITIATIVES AND PROGRAMS FOR EDUCATION, TRAINING AND AWARENESS

United Nations Environment Program (UNEP) after conducting the post conflict environmental assessment in Afghanistan in 2002 and as per the recommendation started Capacity Building and Institutional Strengthening for Environmental Management in Afghanistan in 2003 and the third phase of this program is ongoing. Over the years, the main focus have been in designing training programs on environmental policies, legislations, multilateral environmental agreements, environmental assessment and pollution control, community based natural resources management, and protected areas management system and implement them at central level and provincial level. In all the training programs, public awareness has always been the focus, and numbers of posters on environmental conservation and pollution prevention and control were developed and distributed. UNEP has also provided a draft Environmental Education, Training and Public Awareness Strategies for Afghanistan and supported NEPA in the State of Environment in Afghanistan and a book on Islam and Environment; both are widely distributed through central office and provincial offices of NEPA.

Over the years, National Environmental Protection Agency, has made the celebration of the World Environment Day, Biodiversity Day, Desertification Day, Ozone Day, Earth Day, and others as part of its annual programs and use these days as a means to create awareness.

UNEP has worked closely with Kabul University especially the Faculty of Geo-Science and organized training programs to faculty members and students. UNEP together with UNDP and ICIMOD has helped the newly created Department of Environmental Protection and Disaster Management to have the Strategic Development Plan to seek further support from international agencies and run master's and doctoral level programs in future.

GAIN (Greening Afghanistan Initiatives) was launched in 2004 a country wide program to increase the green coverage of the country with financial and technical support from different UN agencies like UNAMA, FAO, WFP, UNOPS, and UNEP. Community involvement in the nursery establishment, public awareness on natural resources management and watershed management were the main components of the program which ended on 2009.

SEA and Green Club, Youth Initiatives (Kabul University), Sabzandishan (Green Thought), Green Tech (Private Sector- waste treatment) are now beginning to include climate change issues in their awareness raising programs.

With USAID support, ECODIT was involved in capacity building of NEPA in the management of natural resources through organizing various training programs at central and provincial levels to NEPA officials, and other sectoral ministries officials.

UNOPS/ACC with financial support from USDA has now established an Education Training Centre on Wildlife Conservation at Kol-e-Hashmat Khan wetland and regularly running training programs for government staffs, school teachers and children.

UNDP, FAO and UNEP are jointly implementing the Strengthening of Environmental (SAISEM) involving NEPA, MAIL and MRRD since 2009 is running many training programs to government, private sector, academia, media and others in many environmental issues including climate change.

NEPA and Ministry of Haj and Auqaf, Ministry of Education, Ministry of Higher Education, Ministry of Information and Culture, Municipality, also have regular programs on awareness creation including environmental issues but not directly on climatic change issues.

Future Programs on Education, Training and Awareness on Climate Change:

NEPA and UNEP will be implementing "Building Adaptive Capacity and Resilience to Climate Change in Afghanistan" under the LDCF fund which has a major component on trainings and awareness creations on the impact of climate change and adaptation to the impact of climate change. The trainings will be designed for policy makers and international negotiators and senior officials on sectoral ministries at central and provincial level and also some community level trainings on community based adaption measures in selected provinces. The results of the demonstration programs on adaptation to climate change will be disseminated through workshops, seminars and even from the mass media. In addition to this, in many donor supported programs and also nationally financed programs at NEPA and many other line ministries, environmental awareness will be prioritized to be included in such programs.

6.2.4 INSTITUTIONAL AND/OR LEGAL FRAMEWORKS FOR PUBLIC PARTICIPATION AND ACCESS TO INFORMATION

Article 15 of the Constitution of the Islamic Republic of Afghanistan is on the Protection of Environment, Forestry and Rangeland and the obligation of government. The Environment Law, 2007, the umbrella act on the environmental management in Afghanistan has provided general public the legal right to participate in the environmental decision making process and also ensured their right to the access to information. In Article 6 of Environmental Law, the state's right and duties are mentioned and as per the Article 6(4), Islamic Republic of Afghanistan "has the duty to provide the public with information and opportunities to participate in making decisions affecting human health, the environment, and natural resources". In addition to these, the Environmental Law and also the EIA Regulation of Afghanistan has made it mandatory for the proponents of big development projects to ensure the public participation in the environmental assessment procedures.

6.2.5 SUB-REGIONAL, REGIONAL AND INTERNATIONAL COOPERATION TO PROMOTE EDUCATION, TRAINING AND AWARENESS

Participation of Afghanistan in International, Regional and Sub-regional Meetings, Seminars, Workshops and Training Programs on Climate Change

As a Party to UNFCCC, Islamic Republic of Afghanistan is regularly participating on the Conference of Parties, Meetings of Parties, Regional Meetings, LDC Meetings, G77 and China, Ozone, Mountainous Countries Meetings and sharing knowledge and challenges. Further to this, Staffs of NEPA as well as staffs from other sectoral ministries, academia are participating in the seminars, workshops and training programs organized by UNFCCC Secretariat, UNEP, GEF and other regional agencies, and other MEA secretariats.

Regional and International Cooperation on Higher Education on Environment and Climate Change

Since 2001, Islamic Republic of Afghanistan is regularly sending many Afghans for higher education under various fellowship programs in many countries supporting Afghanistan in the reconstruction and development. As environment conservation and management is the multidisciplinary subject, these fellowships are helping to have human resources to deal with the environmental challenges.

Regional Cooperation Program on Climate Change Education, Training and Awareness

Afghanistan is member of Economic Cooperation Organization (ECO) and recently they agreed upon the Framework Plan of Action on Environmental Cooperation and Global Warming in ECO Member States, 2011-2015. One of the key action plans under the global warming is Climate Change Education, Training and Public Awareness. A project proposal has been developed for the implementation of the Action Plan, and the secretariat is exploring potential donors to support the Action Plan.

Islamic Republic of Afghanistan is also the member of SAARC and currently actively participating in the implementation of the Thimpu Declaration on Climate Change and in the implementation of SAARC Action Plan on Climate Change. One of the thematic areas of Action Plan is on Education and Awareness which will focus on: development of a tool kit on mass awareness raising on climate change; incorporating climate change awareness in educational curricula; and involvement of the mass media on climate change issues with adequate information.
In addition, the Thimpu Declaration on Climate Change has agreed to undertake sixteen different actions with regional cooperation and among them the following actions are particularly related to climate change education, training and awareness:

- Incorporate science-based materials in educational curricula to promote better understanding of the science and adverse effects of climate change;
- Establish institutional linkages among national institutions in the region to, among others, facilitate sharing of knowledge, information and capacity building programmes in climate change related areas;

6.2.6 GAPS, NEEDS AND PRIORITIES IN CLIMATE CHANGE EDUCATION, TRAINING AND PUBLIC AWARENESS.

Some of the key constraints and gaps that is hampering to have better education and awareness programs on environmental conservation including climate change include: decades of civil war and security problems; lack of policy and legal system; no climate change subjects in curricula; poverty, low income of people, low level of education, lack of technical human resources; lack of funding sources; lack of national research on clean energy and demonstration projects; lack of publication or posters on climate change; new issue for Afghanistan; and lack of coordination and information.

In order to create more knowledge and understanding and awareness about the climate change and its likely impacts, more focus is needed to have the subject of climate change from school level to higher education curriculum. Universities need to be strengthened to have special courses on climate change and conduct research. Climate mainstreaming and making the national and sectoral policies climate proof is very vital to create knowledge base. Demonstration of community based adaptation projects; demonstration of renewable energy projects; appropriate trainings and materials to mass media; and training to religious leaders on climate change issues all need to be prioritized.

6.3 CAPACITY BUILDING

THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE IN ITS DECISION 2/CP7 HAD INCLUDED THE FRAMEWORK FOR CAPACITY BUILDING. UNDER THE FRAMEWORK SCOPE OF CAPACITY BUILDING FOR DEVELOPING COUNTRIES AND SPECIFIC SCOPE FOR LEAST DEVELOPED COUNTRIES IS INCLUDED. IN ORDER TO IDENTIFY THE PRIORITY CAPACITY BUILDING NEEDS IN AFGHANISTAN UNDER THE SCOPE OF THE FRAMEWORK, GIROA HAS UNDERTAKEN THE NATIONAL CAPACITY SELF ASSESSMENT EXERCISE ALONG WITH THE NAPA PROCESS AND SUBMITTED TO THE UNFCCC.

Through consultation, a detailed analysis of the national strengths as well as constraints in meeting the various provisions of Articles on capacity building in UNFCCC was done. In order to overcome these constraints and fill the gaps, a detailed action plan is developed which is briefly heighted here.

6.3.1 NCSA ACTION PLAN

The NCSA Action Plan was developed according to seven broad areas of intervention derived from the cross-cutting analysis of capacity building needs and opportunities identified during the thematic assessments. The priority capacity needs of Afghanistan include:

- Institutional strengthening for full participation in the Rio Conventions through strengthening strategic planning, establishing effective mechanisms for inter- and intra-institutional coordination, and developing human resource capacities;
- Legal, policy and implementing frameworks improved through the development of new legislation related to natural resource management; human and institutional capacity building for the implementation of the new frameworks; and awareness raising activities, both within the Government itself and also between the Government and the general public.
- Education and public awareness improved through development of materials and realization of awareness raising activities.
- Sustainable land and resource management through the implementation of new natural resource legislation in a participatory manner that involves systems of adaptive learning and facilitates the development of synergies and exchange of experiences as implementation progresses.
- Research strengthened through the development of strategic incremental research plans that focus on specific priority issues together with training programmes in research design and implementation.
- Technical and managerial capacity for the implementation of the Rio Conventions strengthened by reviewing school and University curricula to integrate Rio Convention issues; preparation of training materials; and training of key actors in technical and legal aspects of the Conventions, negotiation skills, conflict resolution and management, participatory methodologies, monitoring and evaluation, community based natural resource management (CBNRM), communications, research and data management, policy and law development and analysis, and related issues specific to each of the three Rio Conventions.

7 CONSTRAINTS AND GAPS, AND RELATED FINANCIAL TECHNICAL AND CAPACITY NEEDS

7.1 INTRODUCTION

Afghanistan, being the least developed country, has identified the constraints and gaps and the financial, technical and capacity needs in the process of preparing the initiation national communication in order to enhance the national communication system and also in initiating fulfilling the other commitments made to the conventions. Afghanistan being amongst the most vulnerable countries in the world remains determined to deal with the climate change issue utilizing its limited resources and expects the necessary technical and financial support from developed country (Annex 1) parties in strengthening the national capacities to respond to the climate change issue. This chapter therefore provides the information on constraints and gaps associated with the preparation of the initial national communication as well as the needs to develop national capacity for the improvement of national communications on a continuous basis. As such a list of projects is included in this chapter. With more scientific understanding and increasing awareness, further areas of work could also be identified, including the continuing need for improving the quality of national GHG inventories, vulnerability assessment of various sectors at national and regional level and adaptation measures, assessment of mitigation potential with detailed cost-benefit analysis including exploring the opportunities for technology transfer, and enhancing the national capacities in doing climate change related research works with a systematic observation system in place, and making citizen more informed about the likely impacts of climate change and prepare with appropriate adaptations.

7.2 PREPARATION OF NATIONAL GREEN HOUSE GAS INVENTORY:

The 2006 IPCC Guideline for the National Green House Gas Inventories is the updated version of the revised 1996 guidelines and provides a clear concept on the inventories. Inventories rely on a few key concepts for which there is a common understanding. This helps ensure that inventories are comparable between countries, do not contain double counting or omissions, and that the time series reflect actual changes in emissions. With clear explanations on the anthropogenic emissions and removals, national territory, inventory year and time series, and inventory reporting as per the country's obligation with the transparent application of the most basic (or Tier I) estimation methodology. There are more gases listed in the greenhouse gases and tiers, a methodological complexity, are updated for key categories for consistency in reporting. The major constraints and gaps in Afghan GHG inventory estimation are now presented.

7.2.1 NON-AVAILABILITY OF RELEVANT AND ACCURATE DATA CONSTRAINTS

In Afghanistan, this is the prominent constraints where the time series data required for the estimation of GHG inventories are not available for all the key sectors. Accuracy of the data is also questioned because different sources have different data. For example, the data on population of Afghanistan published by Central Statistical Office is different from UN data base, and records on import of petroleum products reported differently which are the key data to estimate the time series inventory even to use the basic (tier 1) methodology. In the informal sector and less organized sector of the economy like agriculture, forestry, and small scale industries, the availability of data is another big constraints, the fulfilling the data gap is the biggest priority for quality assurance and quality control of time series GHG estimation in Afghanistan. This requires sustained commitment of resources and setting up of appropriate institutional frameworks.

7.2.2 NON-ACCESSIBILITY OF DATA CONSTRAINTS

Non accessibility of data is another peculiar problem in Afghanistan; it is often treated as proprietary. In the preparation of the second communication and subsequent communication using the tier II and tier III methodology, some of the data required will be considered confidential. There is the need to sensitize those organization or private firms about the purpose and data needs for the inventory reporting and refinement. Another constraint is the non-availability of data in electronic form. Priority needs is to sensitize the organization or firms on the importance of data for the purpose of fulfilling the national obligations in a competitive basis, and their participation in reporting data to the concerned authority preferably in electronic form.

7.2.3 ORGANIZATION OF DATA CONSTRAINTS

Use of the data for different tiers to estimate the inventories require different data quality. This requires considerable data organization, consistency checks and data management. Often there are differences in supply side reporting and demand side reporting of key data like import of diesel in the trade statistics and use of diesel by different sectors transport, energy, agriculture and others differ in accuracy. The reason may be due to aggregation error, or missing of some key sources, and often organization of data. In Afghanistan, different institutions use different format and report differently of their activities, there is the need to develop format as per the IPCC guideline and train sectoral ministries in developing format for the collection and organization of data and reporting to central statistical organization and NEPA. There is the need of resources for training and establishing the database most suitable for the use of IPCC methodologies in key sectoral organizations, CSO and NEPA. As there are important data missing for the key sectors like import of petroleum products, energy production, even for recent years, there is the need to fill this gap by identifying the sources to have reliable time series inventory development and more realistic projections.

7.2.4 REPRESENTATIVE EMISSION FACTORS CONSTRAINTS

No efforts have been made so far to have the nationally representative emission factors for Afghanistan. Only the IPCC default values are used in the estimation of GHG inventory. There are areas where the determination of national coefficients is very vital. For example, the rate of above-ground biomass (AGB) growth for different forest types, woody biomass volume for different forest types, land-use change matrix, and soil carbon density in Afghan forests on a fine gridded scale. Biomass used for energy purposes, methane emissions from enteric fermentation for different livestock and manure management, N_2O from different types of soils in Afghanistan are the areas where immediate initiation towards nationally representative coefficients development and continuous improvement are needed.

7.2.5 NEEDS FOR GHG INVENTORY DEVELOPMENT:

Similar to many developing and least developed countries needs for the GHG inventory estimation and continuous improvement, Afghanistan has broadly categorized the needs into three levels of needs:

- Data Needs (designing consistent data reporting formats, collecting data for formal and informal sector of economy, enhancing data quality to move to higher tier of inventory reporting, and conducing detailed measurements for Afghan specific emission coefficients)
- Capacity Development and Enhancement Needs, (capacity development needs are required both at individual level and institutional level; institutional capacity development requires financial support, technological support, instrumentation support, and networking; individual capacity development requires: training of national professional and sectoral staffs on methodologies, software, models, screening tools, reporting formats; involve national professionals in the measurement of national coefficients)
- Institutional Networking and Coordination Needs (institutional networking and coordination is a critical factor for establishing new data frameworks and reporting formats in various sectors; the INC process have contributed to initiate process to a very minimal level which need to be further strengthened)

As a party to the UNFCCC, Afghanistan is fully committed to have the national greenhouse gas inventory development system and reporting to the convention regularly in the required format and details. The sustained and timely financial and technological support from the developed country parties and also from multilateral and regional institutions including the GEF is very critical.

7.3 VULNERABILITY ASSESSMENT AND ADAPTION

Afghanistan presents a number of specific challenges in terms of climate change assessment. Climate projections for Afghanistan require significant refinement due to the lack of availability of reliable historic meteorological records. Complex topography in Afghanistan also means that local variations in response to global warming, particularly precipitation, are likely to be large and many areas may vary from the regional trends. In addition, sporadic and poor quality socio-economic data make econometric modeling or robust cost/benefit analysis of adaptation and mitigation policy nearly impossible. Poor national security also restricts the ability to undertake structured fieldwork to assess potential mitigation and adaptation options. During the NAPA process, the vulnerability assessment has been done using the regional models whose findings are presented in this report. NAPA process has identified the need to initiate further work to improve the resolution and accuracy of regional climate models. In particular, work should be undertaken on cleaning and refining available historic climate data to strengthen the ability to downscale projections to Afghanistan's complex topography. To this extent, work should be undertaken through NEPA to support Afghanistan Meteorological Authority (AMA) and universities to build local modeling capacity with links established to regional and international centers of excellence.

Afghanistan's National Development Strategy (ANDS) is also the poverty reduction strategy of the country and poverty reduction in the country is the ultimate objective of all sectoral plans and programs. They target for economic security, food security, water security, energy security, and the environmental security. Despite being amongst the most vulnerable countries list to the likely impact of climate change which presents a significant threat to cross sectoral development, climate change is not a consideration in the national or sectoral plans of the Government of Islamic Republic of Afghanistan (GIRoA). The phrase 'climate change' is not even mentioned in the ANDS, however, there are a number of measures contained within the strategies that might be classified as adaptive, but without clear assessments of climate thresholds, they may not be sufficient for the increased severity and frequency of impacts. Nowhere are these impacts analyzed in the context of a larger process. Linking of these priority concerns with climate change policies is the key to harmonizing sustainable development and climate change actions, and therefore ministries need to improve the 'climate awareness and resilience' of their development strategies. This will require the application of risk screening within individual sectors. Improved coordination between Ministries will also be required to meet the cross-sectoral challenges of climate change, especially in terms of linkages between water, agriculture and livelihoods.

As a LDC member country, Afghanistan has prepared the National Adaptation Program of Action and in the process has identified priority action programs on the most vulnerable sectors in Afghanistan. There is the urgent need to enhance the capacity of government and national experts and make them engage with wider regional planning and development bodies to ensure that the best practice climate assessments, adaptation approaches and low carbon development strategies developed elsewhere in Central and South Asia can be applied in Afghanistan. While mainstream climate change in development planning is important, the adaptation challenges facing Afghanistan are very significant in scope and scale. Climate Risk Screening Approaches are required to ensure that project activities implemented under the strategies lead to beneficial

adaptation outcomes. Afghanistan needs external investment and technical support to overcome these challenges. The most prioritized needs is national capacity building towards generating information, conducting scientific assessment and research on extreme weather events, communicating to the people in advance, participating in regional and global modeling, and ultimately able to undertake integrated assessments of climate change impacts on different sectors. Further the national capacity for mainstreaming climate adaptation and mitigation in the national and sectoral development strategies and able to perform climate risk screening to make the adaption programs and projects produces beneficial outcomes. Climate change is a long-term issue, and their impacts would continue to exacerbate over decades and centuries, and need for developing national capacities go in parallel.

7.4 MITIGATION ASSESSMENT AND TECHNOLOGY TRANSFER

Islamic Republic of Afghanistan is the least developed country and as non-annex 1 party to the UNFCCC does not have to set and meet the targets of GHG reductions. However, GIRoA sees conservation and management of natural resources, addressing environmental pollution problems both rural and urban, and meeting the demand of energy through abundantly available renewable resources, and development of mining sector in an environmentally friendly manner can been linked with the mitigation of greenhouse gases objectives and in the meantime country can explore globally allocated resources and benefit by transferring clean technologies in the country.

In chapter four (mitigation) of this report, efforts are made to look into the technological options available for mitigation in key sectors along with the prevailing barriers and opportunities to overcome the barriers. Mitigation potential includes physical potential, technological potential, socio-economic potential, economic potential and market potential. The main barriers or constraints are the limited availability of and knowledge about new technologies to promote the flow of new technologies. In addition to these, the misplaced incentives, vested interests and lack of effective regulatory body to enforce the environmental requirements are other barriers that demands needs to conduct research, development and demonstration of new technologies, and review of our environmental and economic policies to make sure that polluters are penalized and the economic incentive mechanism are available to promote cleaner technologies in the country.

Further, Afghanistan is yet to become the party to Kyoto protocol which is linked to many financial resources available and technology transfer opportunities through Clean Development Mechanism, REDD+ and the proposed Green Climate Fund. Building national capacity at NEPA and key sectoral ministries and in private sector in the assessment of mitigation potential of different activities (air quality improvement through infrastructure development, promoting better traffic management, promotion of cleaner vehicles, replacement of traditional brick technologies, energy efficiency promotion in SMEs, landfill sites development with methane recovery, wastewater collection, building trolley buses infrastructure, replacing diesel/coal power generation facilities with natural gas, transmission system improvement to reduce electricity loss

in distribution, design of reforestation and rehabilitation of degraded land, etc) is very important to overcome these constraints. Creating technology information centers in the country preferably in public private partnership with similar regional and international institutions and national system to disseminate the information to private sector and communities is also equally important. In order to prioritize better options and support policy makers, human resources development to utilize the available models and software in mitigation assessment, baseline and mitigation scenarios of different options, and present detailed cost benefit analysis is the priority need of Afghanistan. As a country with significant land area degraded during the time of conflict, REDD+ provides opportunities for livelihood improvements and forest conservation activities go together. And country with huge potential of generating renewable energy (solar, wind, biogas, micro-hydro, and geothermal), enhancing the national capacities in international negotiations related to various environmental conventions is equally important and prioritized.

7.5 RESEARCH AND SYSTEMATIC OBSERVATION

Climate change related research in the country is almost non-existing mainly due to inadequate technologies/instruments/facilities, financial resources and qualified human resources within the concerned government institutions as well as in the academic institutions. However, some research activities currently on-going and planned in the agriculture sector can be linked with the changing climate and its likely impacts. Lack of coordination in information sharing and planning and carrying activities in a coordinated way is almost non-existent in Afghanistan. Efforts are directed towards rehabilitation of the damaged weather and meteorological stations and add few new facilities, the constraints of not having adequate facilities for systematic observation of different climatic zones; particularly in high altitudes to monitor the glacier lakes are required. In many countries, universities play central role in conducting research and provide valuable inputs to the policy making body, this is completely lacking in Afghanistan and there is the challenge of strengthening the capacities of universities to make them capable of doing research as well as create human resources within the country. There is also the challenge of universities of Afghanistan building partnership with universities in the region and other parts and initiate joint research works in the likely impacts of climate change and potential adaption measures in most vulnerable sectors in Afghanistan. Country requires financial, technological and capacity building supports in this area from the developed country parties.

7.6 EDUCATION, TRAINING AND PUBLIC AWARENESS

None of the universities in Afghanistan have climate change subject in their curriculum. Neither it is included in school level books. Climate change activities should be incorporated into educational curricula at primary, secondary and tertiary levels in order to broaden public awareness of the issue. In this regard climate change needs to be seen as an integral part of modules on sustainable development. In recent years, there has been significant growth in mass

media (both electronic and print), and this can be instrumental in reaching to the communities with well-planned awareness programs on climate change and prepare communities for the community based adaption measures and disaster risk minimization. Another key elements of increasing capacity to deal with climate change issues is the need to promote integration of relevant aspects into the work of all government departments on the one hand and to encourage incorporation into business strategies on the other. Sector and topic specific programmes need to be developed to cover not only the specific issues relating to climate change but also to disseminate best practices in incorporating climate change into relevant planning activities.

7.7 PROJECT PROPOSALS FOR IMPROVEMENTS OF FUTURE NATIONAL COMMUNICATIONS

Government of Islamic Republic of Afghanistan is fully committed to fulfill its obligation as the party to the UNFCCC, and would like to strengthen the national communication system to the UNFCCC. The above discussed prevailing constraints and gaps faced in the preparation of the INC, there is the need to continuously provide efforts to overcome those constraints and fill the gaps so the national communications provide reliable, comparative and accurate information to the convention. In order to support these initiatives, the following projects are included here for future support through the financial mechanism and developed country parties.

7.7.1 PREPARATION OF NATIONAL COMMUNICATIONS

Afghanistan would immediately like to initiate the process of the preparation of second national communication as per its commitment to the UNFCCC and will seek GEF funding for the development of the project document proposal and undertaking the SNC. The title of the project and brief description of the project is presented below.

Project Title: Enabling activities for the preparation of Afghanistan's Second National Communication to the UNFCCC.

Description: The project will assist Afghanistan in undertaking the enabling activities to prepare the Second National Communication to the UNFCCC and to build capacity to fulfill its commitments to the Convention on a continuing basis.

7.7.2 GHG INVENTORY IMPROVEMENT

In order to overcome the data shortage and develop the national data reporting system using consistent reporting formats, a number of projects aiming to improve the inventory estimates are included here. These are the indicative and exhaustive listings of concepts. Along with the new understanding, knowledge development, resources and technology transfer will enhance Afghanistan's capacity to augment this list. Afghanistan needs financial and technical support in

converting these concepts into actual projects. A list of few project concepts most urgently felt necessary to start with are listed below.

Project Title: Data Format Preparation for GHG Reporting
Description: Presently the data being reported by the Central Statistical Organization and various ministries and departments at resources and sectors level shows some mismatch and the consistency cannot be easily verified. There is the need that the available data formats prescribed by IPCC Guidelines be reorganized for reporting data at intra and inter-ministerial levels in appropriate GHG inventory reporting formats.

Project Title: Strengthen the Activity Data for GHG Emission Estimates from Afghanistan's Transport Sector
Description: Analysis of the current vehicle types (age, mass standard also) and their distribution in various cities of the country and fuel use. Aviation and railways sector will also be covered

Project Title: Land Use Pattern Assessment of Afghanistan for GHG Inventory Estimation

Description: Periodically monitoring and estimating the area under different forest types as well as to prepare a land-use change matrix, describing the extent of land-use change from one category to another

Project Title: Improvement of the Activity Data on Waste Sector
Description: Generate the information on the type of wastes, composition of waste, management practices, in various cities of Afghanistan including the status of waste water generation, analysis, collection and treatment practices

Project Title: Improvement of Activity Data on Power Generation and Industrial Processes
Description: Generation of activity data on power generating facilities particularly diesel, coal, natural gas based power plants; activities data on biomass used in energy purposes; and activity data on industrial products and processes

Project Title: Improvement of Activity Data on Agriculture and Livestock
Description: Evaluation of sources and sinks of GHG related to agricultural activities at disaggregated level, including data collection and validation of age-wise livestock, water regime-wise rice paddy cultivation, sub-regional crop production, sub-regional synthetic fertilizer use.

7.7.3 VULNERABILITY ASSESSMENT

Goble and regional assessment of the likely impacts of the climate change in Afghanistan has found Afghanistan amongst the most vulnerable countries to the impact of climate change. More studies at national level with financial and technical supports are needed and following projects will help towards filling those gaps.

Project Title: Climatic Change Modeling
Description: Generation of high resolution regional climate change scenarios and investigating its impact on the Afghanistan's precipitation and on extreme climate events

Project Title: Institutional Capacity Building of AMA on Systematic Observation
Description: Expansion of the weather stations covering all climatic regions with particular focus on Hindu-Kush Himalaya

Project Title: Assessment of the Climate Change Impacts on Glacier Lakes of Afghanistan
Description: Develop inventory of the glacier lakes, monitor the status over the years, and develop determine the impact on different scenarios

Project Title: Development of Vulnerability Scenario in Afghanistan
Description: Develop sub-regional vulnerability scenarios for Afghanistan looking into cross linkages between different sectors of the economy congruent with Afghanistan climate change and emission scenario.

7.7.4 ADAPTATION PROJECTS

As already mentioned, Afghanistan has prepared the National Adaptation Program of Action and submitted to UNFCCC, the highly prioritized projects of NAPA needing financial support are reproduced here. The research oriented identified projects are presented in the following heading. Afghanistan needs financial and technical support in translating all these concepts into detailed project proposal and implementation with available adaptation funds or with support from developed country parties.

Project Title: Land and Water Management at the Watershed Level
Description: Land and water management at the watershed level. Community based forest management and afforestation projects in ways that conserve land, water resources and wood production; realize afforestation of catchment areas and stabilization of unstable slopes; soil conservation techniques

Project Title: Development of Horticulture

Description: Development of horticulture through use of improved varieties, establishment of nurseries and plant protection

Project Title: Improved Terracing, Agro-forestry and Agro-silvo Pastoral System
Description: Terracing, agro-forestry, and agro-silvo-pastoral system that reduce soil erosion and run off on steep slopes; conserve land, water resources and wood production; soil conservation techniques

Project Title: Rangeland Management
Description: Rangeland management including the development and implementation of system of rotational grazing and production of improved fodder along grazing routes (mixed grasses, legume)

Project Title: Improved Food Security
Description: Improving food security measures through diversification; promotion of households level industries, including chicken farms, beekeeping and silk farms; and development of market potentials for agriculture products

Project Title: Improved Livestock Production
Description: Improved livestock production through the creation of livestock unions, cooperatives and associations; introduction of improved species and veterinary services

Project Title: Creation of Off-farm Employment
Description: Create more off-farm or cash earning job opportunities for farmers who are affected by crop loss due to climate change effects

7.7.5 RESEARCH PROJECTS

Afghanistan is in very early stage of conducting research works and need to make good initiations with partnership with academic institutions which ultimately generates capable human resources in the country. Some of the research projects to initiate in Afghanistan are presented here, with increased knowledge base and understanding of the climate change, these lists will be augmented in coming years.

Project Title: Climate Related Research and Early Warning System
Description: Installation of Agro-Meteorological Stations, early warning system, hazard mapping; survey, assessment and projection of the impact of deep wells on the water table and future water supplies. Build capacity and expertise for assessment of climate change adaptation including technical capacity to monitor and analyze climate trends, plan and implement adaption activities, improve forecasts and inform policy makers

Project Title: Agriculture Research
Description: Research into draught resistance seeds, different varieties of plants and livestock and plant protection, including establishment of agricultural firms

Project Title: Climate Change and Crop Insurance
Description: Research to understand performance of various insurance models to develop comprehensive crop insurance packages for Afghan farmers

Project Title: Ecosystem Modeling
Description: Monitoring of vegetation response in Mountain Ecosystem with wide altitudinal gradient to changing climate, and establish linkages between vegetation characteristic and climate change variables

7.7.6 MITIGATION, TECHNOLOGY TRANSFER AND CAPACITY BUILDING

Afghanistan has not been able to explore all the benefits being party to the UNFCC can get through technology transfer linking and needs to develop national capacity to explore such opportunities and play more critical role in the international negations. The following projects are designed to support towards meeting these gaps and Afghanistan need financial and technical support in translating all these concepts into detailed project proposal and implementation.

Project Title: Technology Information Centre
Description: A detailed study on establishing technology information centre in Afghanistan with public private partnership and linkages with regional such centers

Project Title: Capacity Building of NEPA as Designated National Authority for CDM
Description: Capacity building activities for NEPA in project screening, evaluating sustainable criteria, evaluation of the CDM projects and makes recommendation

Project Title: Demonstration of Energy Recovery in Landfills
Description: Design and demonstrate the methane capturing in landfills and use of methane for electricity generation in one of the municipalities of Afghanistan

Project Title: Demand Side Management
Description: Energy efficiency improvement in residential, commercial and hotels in cities

Project Title: Enhancing of Negotiation Skills of Government
Description: Enhancing the understanding of the climate change impacts, vulnerability, adaptation and mitigation opportunities, and opportunities through various funds under UNFCCC and negotiate for the benefit of the country

Project Title: Carbon Credit from Renewable Project

Description: Conduct detailed study on the implementation of the renewable projects in selected province or region and introduce as a CDM project

Project Title: REDD+ in Afghanistan
Description: Conduct detailed assessment on the reforestation and rehabilitation of the degraded forest land as a REDD+ project

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Annex 1

A Composition of National Climate Change Committee on INC Preparation of Afghanistan

S. No.	Name	NCCC, Status	Designation	Organization
1	Mr. Ghulam Mohamad Malikyar	Chairperson	Deputy Director General	NEPA
2	Mr. Gul Baharam Halimi	Member	Advisor	MI&W
3	Mr.Eng. Ezatullah Sadiqi	Member	Chief, Industrial Parks	AISA
4	Mr.Prof. Naqshband Naseery	Member	Professor	Kabul University
5	Mr.Eng. Mohamad Pakfer	Member	Water and Sanitation Officer	Ministry of Urban Development
6	Mr. Mohamad Asif Ferogh	Member	Senator	Kabul Provincial Council
7	Mr.Eng. Ghulam Sarwar	Member	Petroleum Product Standard Expert	ANSA
8	Mr. Abdul Ghayas Safi	Member	Deputy Chief, Faculty of Geology	Kabul University
9	Mr. Sohila Barakzai	Member	Head, Agriculture Department	Ministry of Economy
10	Mr. Hafizulla Nooristani	Member	Chief, Administrative Division	Ministry of Trade
11	Mr. Enayatullah	Member	Head, Fire Control Division	Ministry of Interior
12	Mr. Mohd Hashim Barakzai	Member	Director General, Dept. of NRM	Ministry of
13	Mr.Dr. Sharif Amiri	Member	Chief, AIRD	MRRD
14	Mr. Noorulhaq	Member	Chief, Administrative Division	Ministry of Communication
15	Mr. Alhaj Ali Mohamaad	Member	Chief, Planning Division	Ministry of Labor
16	Mr. Waheed Jalal	Member	Director, Public Awareness Division	NEPA
17	Mr. Ghulam Hasan Amiry	Member	Chief, CC Division	NEPA
18	Mr. Naqibullah Nayel	Member	Focal Point, INC, CC Division	NEPA
19	Mr. Mohammad Yasin Noori	Member	Officer, CC Division	NEPA
20	Ms. Arya Niaesh	Member	Officer, CC Division	NEPA

21	Mr. Mohibullah Fazli	Member	Officer, Nat.Her Division	NEPA
22	Mr. Naqibullah Sadiqi	Member	Officer, CC Division	NEPA
23	Mr. Chiranjibi Gautam	Invitee	INC Task Officer	UNEP
24	Mr. Hamidullah Akbary	Invitee	INC Coordinator	UNEP

B National Study Team on National Circumstances and INC Report Preparation

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2	Mr. Wali Modaqiq	National Environmental Protection Agency	Deputy Director General
3	Mr. Waheed Jalal	National Environmental Protection Agency	Director
4	Prof. Saifulrahman Saifi	Afghanistan Meteorological authority	
5	Mr. Ghulam Ali Yaqubi	National Environmental Protection Agency	Ozone National Program Officer

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3	Mr. Ghulam Haider Haidery	Ministry of Agriculture, Irrigation and Livestock	Member
4	Mr. Mohammad Afzal Safi	Ministry of Rural Rehabilitation Development	Member
5	Mr. Sardar Mohammad Zurmati	Afghan National Disaster Management Authority	Member
6	Mr. Gul Bahram Haleemi	Ministry of Energy and power	Member
7	Mr. Abdul Ghias Safi	Kabul University	Member
8	Mr. Ghulam HassanAmiry	National Environmental Protection Agency	Member

D National Study Team on Green House Gas Inventory Development

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2	Mr. Nisar Ahmad Kohistani	Faculty of Agriculture	Member
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5	Mr. Mohammad Jawad	Ministry of Mines	Member
6	Mr. Shafiqullah Aman	Ministry of Agriculture, Irrigation and Livestock	Member
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E National Study Team on Measures to Mitigate Climate Change

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4	Mr. Abdul Qayum	Ministry of Interior	Member
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6	Mr. Abdul Sami Sakhi	Ministry of Agriculture, Irrigation and Livestock	Member
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2	Eng.Sarwar Fayaz	Ministry of Rural Rehabilitation Development	Member
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4	Mohammad Shafiq	Ministry of Energy and power	Member
5	Ahmad Zia Mirzada	Ministry of Agriculture, Irrigation and Livestock	Member
6	Mohammad Yasin Noori	National Environmental Protection Agency	Member

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4	Mr. Jalal Noorani	Ministry of information and Culture	Member
5	Mrs. Maryam Ahmadi	Kabul Provincial Council	Member
7	Mr. Naqibullah Nayil	National Environmental Protection Agency	Member

H List of People Present in the Validation Workshop

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2	Mr. Abdul Wali Modaqiq	DDG	NEPA
3	Mr. Mohammad Afzal Safi	Advisor	MRRD
4	Dr. Hassan Hamid	Head of the Environment	Polytechnic University
5	Mr. Abdul Qayum	Officer	Traffic Directorate
6	Mr. Mohamad Nazir	Officer	MoE
7	Mr. Abdul Wase	Thermal energy Specialist	MEW
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15	Mr.Wahid Jalal	Director	NEPA
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19	Mr.Noor Mohammad Fazli	EIA director	NEPA
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36	Mr. Sayed Enayatullah	Principal	Kabul provincial Council
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