



Nationally Determined Contributions

Ministry of Mahaweli Development and Environment

Sri Lanka

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1. Introduction

The Ministry of Mahaweli Development and Environment in Sri Lanka as the National Focal Point to the United Nations Framework Convention on Climate Change (UNFCCC) is pleased to submit its Nationally Determined Contributions (NDCs) in accordance with Decision 1/CP.21 of the 21st session of the Conference of the Parties to the UNFCCC. We are in confident that the NDCs submitted by the Parties to the UNFCCC will support in achieving the set objectives of the Paris Agreement. Sri Lanka believes that a fair and ambitious Agreement is an imperative for countries to reach the long-term temperature and Sustainable Development Goals, and is pleased to take part in the efforts of tackling current and projected climate change challenges by implementing Sri Lanka's NDCs.

The NDCs have been formulated based on previously submitted INDCs following the principle of common but differentiated responsibilities and respective capabilities. The information presented in this submission is based on the data available at the time of preparation of country's NDCs.

2. National Context

Sri Lanka, a country highly vulnerable to adverse effects of climate change and very lower greenhouse gas, presents the NDCs to strengthen the global efforts of both mitigation and adaptation. In response to challenges posed by climate change, Sri Lanka has taken several positive steps by introducing national policies, strategies and actions in order to address climate change induced impacts, amongst which are the *National Climate Change Policy of Sri Lanka*, *National Climate Change Adaptation Strategy for Sri Lanka in 2010*, the *Climate Change Vulnerability Profiles; Water, Health, Agriculture and Fisheries, Urban Development, Human Settlements and Economic Infrastructure in 2010*, the *Technology Needs Assessment and Technology Action Plans for Climate Change Adaptation and Mitigation in 2014*, the *National Action Plan for Hariitha Lanka Programme in 2009* and *Urban Transport Master Plan 2032* based on the *National Transport Policy in 2009*.

Further, *National Adaptation Plan (NAP) for Climate Change Impacts in Sri Lanka* has been developed, Nationally Appropriate Mitigation Action (NAMA) on Energy Generation and End Use Sectors is being implemented, and the NAMA on Transportation is being prepared. In addition to the aforementioned, the *Long Term Electricity Generation Expansion Plan 2015-2032* and the *National Solid Waste Management Strategy 2000*, the *Corporate Plan 2014-2018* by the Central Environmental Authority and various legal amendments made by government entities related to environment are being implemented. In addition, *Forestry Sector Master Plan 1995-2020*, National REDD+ Strategy are two important initiatives towards enhancing the forest cover in the country.

As a small island in the Indian Ocean, the coastal region of Sri Lanka is susceptible to changes in sea level. The 2004 tsunami has indicated that low-lying plains in the coastal zone are vulnerable to any future rise in sea level and important sectors of the economy such as tourism and fisheries could be affected badly due to impacts of sea level rise. A significant population of the country is dependent on livelihoods connected to agriculture. Studies show that the food security of the

nation can also be adversely affected due to impacts of climate change. Besides, a substantial share of the foreign income is generated through export crops which are highly sensitive to fluctuations of weather.

Emerging evidence from various sources suggest that climate change could alter natural systems connected to the water cycle, the ecosystems and the bio-diversity of the country. This could lead to decline of various ecosystem services which are indispensable for the welfare of human population. In addition, impacts of climate change appear to have significant repercussions on health of the citizens and human settlements of the country.

Sri Lanka has taken several steps to strengthen the country's capabilities to face the challenges of climate change, especially by formulating overarching policies, national level plans and strategies. In order to address the issues in climate change a separate dedicated institution titled the Climate Change Secretariat (CCS) was created in 2008. In order to implement NDCs, a National Climate Change Commission will be established.

3. Nationally Determined Contributions (NDCs) of Sri Lanka

As per the outcome of the 19th Conference of Parties (COP19) in Warsaw in 2013, all Parties were invited to prepare INDCs. This is as part of the work of the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) that was established at COP 17 in Durban to "Develop a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties".

As a result, the Paris Agreement was reached and the NDCs shall make it possible to track progress and achieve a collective ambition level sufficient to limit global warming to well below 2°C relative to pre-industrial levels and pursue to limit the temperature increase to 1.5 °C above pre-industrial level.

Sri Lanka submitted its Intended Nationally Determined Contributions (INDCs) in October 2015, and improved version of INDCs in April 2015, at the time of signing the Paris Agreement. NDCs of Sri Lanka were prepared based on the *Readiness Plan for the Implementation of the Intended Nationally Determined Contributions (INDCs) 2017-2019*.

Readiness Phase 2017-2019

The readiness phase till 2020 is for allowing the country to prepare for the full-scale implementation of chosen NDCs. A host of groundwork and preparations need to be carried out to ensure successful implementation of NDCs to achieve the set GHG emission reduction targets by 2030.

A Readiness Plan for the Implementation of the INDCs of Sri Lanka has been developed in consultation with relevant stakeholders, led by line ministries that cover the 14 sectors identified in the NDCs of Sri Lanka, The sector specific line Ministries and other stakeholders have provided information and recommendations on the implementation of the NDCs, need of

identifying policy gaps, institutional gaps, the need for improvements in human and technical capacity, as well as financial and technical support to implement the NDCs by 2020.

3.1 Timeframe and Periods of Implementation

Base year 2010 as per Business-As-Usual scenario and Target period 2021-2030

3.2 Scope and coverage

Sri Lanka's NDCs comprise of following four areas;

- **Mitigation** - Reducing the GHG emissions against the Business-As-Usual (BAU) scenarios in the sectors of energy (electricity generation), transportation, industry, waste and forestry. The key contributors to GHG are Carbon Dioxide (CO₂), Methane (CH₄) and Nitrous Oxide (N₂O).
- **Adaptation** - Building resilience in most vulnerable communities, sectors and areas to adverse effects of climate change. Adaptation will focus on human health, food security (agriculture, livestock and fisheries), water and irrigation, coastal and marine, biodiversity, urban infrastructure and human settlement, tourism and recreation. Adaptation initiatives that derive mitigation co-benefits will be prioritized.
- **Loss and Damage** - In order to address issues related to losses and damages resulting from extreme weather events, a local mechanism will be developed in accordance with the Warsaw International Mechanism for Loss and Damage.
- **Means of Implementation**- External support for Finance, Technology Development and Transfer, and Capacity Building for the above sectors are considered in the implementation process of the NDCs of Sri Lanka.

4. Fairness and ambition

Sri Lanka is a developing country that is highly vulnerable to the adverse impacts of climate change. However, despite its vulnerabilities Sri Lanka is committed to address global climate change and aims to channel the development into a low carbon pathway through sustainable development. The country's total GHG emission represents less than 0.1% of global emissions and the per capita emission is 0.6tCO₂e. Through the NDCs, Sri Lanka puts forward an ambitious and progressive delinking of GHG emissions in its efforts for economic growth. Sri Lanka proposes fair and ambitious mitigation approaches, while facing the challenges of progressively increasing adaptation demands, and climate induced loss and damage.

Sri Lanka intends to launch an ambitious strategy of mainstreaming climate change adaptation across all economic drives where capacity building and locally appropriate institutional mechanisms will be crucial and key elements. The finance and human resource development to implement the strategy will be challenging for these ambitious targets, and the domestic contribution to this end will be very significant.

Sri Lanka will also take steps to ensure internal equity by maintaining inclusivity. Inclusivity will be focused through the participation of groups such as gender, youth, vulnerable communities, and providing opportunities to these groups to engage, benefit from the ambitious targets.

5. Mitigation Strategies

Sri Lanka being a developing country, anticipates achieving the development objectives while moving in a low carbon development pathway. **Mainly five sectors** have been identified under mitigation for reducing greenhouse gas emissions. These are sectors of **energy** (electricity generation), **transport, industry, forests and waste**. Possible emission reduction actions have been identified in each sector, which are to be implemented during the period of 2020 to 2030.

NDCs for Mitigation intends to **reduce the GHG emissions against BAU scenario by 20% in the energy sector (4% unconditionally and 16% conditionally) and by 10% in other sectors (transport, industry, forests and waste) by 3% unconditionally and 7% conditionally by 2030.**

5.1. Energy Sector-Electricity generation

Sri Lanka has realized almost 100% electrification through the national grid. Current total installed power generation capacity of the country is 3,888 MW. This includes 900 MW from coal power, 1,128 MW through oil generated thermal power and 1,860 MW from renewable energy. The contribution from renewable energy is 1377 MW from large hydro, 328 MW from small hydro, 128 MW from wind, 25 MW from biomass and 1.36 MW from solar power. Out of the total annual electricity generation for the national grid, more than 50% is met using renewable energy resources. In addition to this, solar rooftop systems operated under net-metering scheme contribute to a capacity of 28 MW.

Sri Lanka's annual electricity demand is approximately 13,227 GWh. This demand is created 37% from households, 29% from industries, 24% from commercial enterprises, and the rest being created by religious organizations and street lighting. The overall annual demand for electricity is expected to increase by an average of 4%, and future electricity generation expansion programmes are expected to meet this demand in growth.

5.1.1 Addition of Sustainable Energy Sources in Future Generation Expansion

Sri Lanka is on the path to becoming an internationally recognised middle-income country. Under the country's development drive, energy will be a key necessity, and energy towards a sustainable future an imperative.

Further, it is important to generate electricity using the most economical energy sources such as the several sources of renewable energy which could be used to satisfy the energy demand of the country. This will help address issues of energy security as well as facilitate a move towards environmentally friendly technology, that will help the country to reach its maximum potential for expanding electricity generation.

5.1.2 The NDCs of Energy Sector

GHG emissions in the energy sector in Sri Lanka have recently been on a trend of increasing due to the use of petroleum based fuels for energy generation. In order to achieve emission reduction targets specified in the NDCs of Sri Lanka, the contribution from the power generation sector is vital.

Energy sector has a 20% GHG emission reduction target in the NDCs, which amounts to 39,383Gg of the total GHG emissions (196,915Gg for the period 2020-2030 as per the BAU scenario of the *Long Term Generation Expansion Plan 2013-2032* published in October 2013). The reduction of emissions includes 4% (9,173Gg) unconditional and 16% (30,210Gg) conditional reduction.

The NDCs for the energy sector include:

- NDC 1: Establishment of large scale wind power plants of 514 MW
- NDC 2: Establishment of 115 MW of solar power plants
- NDC 3: Establishment of 105 MW of biomass power plants
- NDC 4: Establishment of 176 MW of mini hydro power plants
- NDC 5: Introduction of Demand Side Management (DSM) activities
- NDC 6: Strengthening sustainable energy related policies with a view to increasing the share of renewable energy from the existing 50%, to 60% in 2020. (The level of 60% expected to be reached in 2020 will be maintained at the same level, until further developments in renewable energy technology allow for increased share of electricity generation from the renewable energy sources.)
- NDC 7: Converting existing fuel oil based power plants to LNG (newly proposed INDC)

5.1.3 Present Initiatives

Sri Lanka has recently taken strong initiatives to implement efficient and effective sustainable energy programmes, as well as eliminating the introduction of coal power plants (with the capacity of 4700 MW or more) from the national electricity system by 2030. The initiatives further includes introducing renewable energy sources, and introducing LNG for thermal power generation in lieu of solid and liquid petroleum fuels.

Under the renewable energy sources of which energy generation will be enhanced, the available hydro power generation potential will be absorbed. The initiatives will also focus on available solar and wind resources which will form the larger part of future expansion of renewable energy based power generation.

Current interventions in renewable energy generation include:

- (a) Development of hydro power based to its maximum potential through large hydro power plants (Uma Oya, Ginganga, Broadlands) and small hydro power plants (the overall potential of these will be in the range of 500 MW.)
- (b) Wind parks: The power generation will focus mainly on the Mannar islands recognised as one of the sites with the best potential in the South Asian region for generating energy

through wind power. In parallel to this, other potential sites will be developed. The ones identified include the Northern areas of Sri Lanka with the potential to generate approximately 300 MW of wind power based energy.

- (c) Promotion of solar power generation has been initiated through different modalities such as solar rooftops and solar parks. This will provide approximately 500 MW in the short term and has the potential to expand to a considerably high level by 2030.
- (d) Power generation through biomass will also be added to the sources of power generation with an expectation of a reasonable contribution to the total demand for energy in the country.

Sri Lanka has decided to shift the existing fuel oil based power plants to LNG and 6 power plants with a cumulative capacity of above 500 MW are expected to be subjected to this change.

In addition to the interventions concerning power generation, the Government has also identified DSM as one of the priority areas, and a Presidential Task Force has been appointed for implementing an island wide DSM programme encompassing all the related sectors.

Note

In earlier documents, separate targets have been given for NCRE, however, at present NCRE and large hydro are commonly included as renewable energy and the targets are given accordingly.

5.2. Emission Reduction from Other Sectors

Sri Lanka intends to reduce 10% of its GHG emissions from the sectors of transport, waste, industry and forestry. This will be 3% unconditional and 7% conditional against BAU scenarios. However, BAU emission scenarios have to be estimated in details and detailed emission reduction plans for these sectors are yet to be developed.

5.2.1. Transport Sector

In Sri Lanka, the transport sector is one of the major GHG emitting sources. This sector includes road, railway, air and sea transportations. The annual passenger transport is approximately 130 billion passenger-km, and freight transport is approximately 7 million ton-km.

The current active vehicle fleet of Sri Lanka is calculated to be approximately 5 million, which indicates a three-fold increase with respect to year 2000. This is caused by the increase in the number of three wheelers and two wheelers, where the increase is by 8 times and 4 times, respectively. The cars, dual-purpose vehicles and land vehicles have increased by approximately 2 to 2.5 times, while the number of buses has not increased significantly, thereby indicating a shift from public transport modes to using private vehicles. At present, about 51% of the active vehicle fleet consists of motor cycles, 22% motor tricycles and 11% motor cars. Although buses are less than 1% of the active vehicle fleet, it contributes to about 50% of the passenger transport.

Increase in private vehicles has resulted in increased traffic congestion, reduction in fuel economy and higher emissions. The vehicles are primarily powered by imported petroleum oil

(crude and refined). About 70% of the petroleum is consumed by the transport sector, which is about 3 billion litres per annum, where the main fuel is diesel. Gasoline contributes to about 65%. Per capita petroleum oil consumption per annum has increased from approximately 50 litres in 1990 (where 73% is diesel) to 90 litres in 2000 (where 82% is diesel) and 150 litres in 2015. The average fuel economy of road transport is about 0.025 litre/passenger-km. Some indicative values for the fuel economy in passenger transportation of different vehicle categories could be estimated based on average values for transport distance, occupancy and fuel consumption as 0.01 for buses, 0.05 for cars, 0.04 for motor tricycles, 0.02 for motor cycles and 0.03 for dual-purpose vehicles. These data provide the potential for the reduction of fuel consumption of GHG emissions in the road transport sector by switching to public (or mass) transport modes from private vehicles.

The high expenditure for the importation of petroleum has become a major factor adversely affecting the economy of the country. Presently, the total expenditure for petroleum imports is about 6% of gross domestic product (GDP) of the country. This further indicates that the improvement of energy efficiency/fuel economy in the transport sector is a national priority.

Under the above circumstances, synergistic approaches are required to realize GHG mitigation targets in the transport sector. GHG emissions in the transport sector can be reduced by:

- Avoiding/reducing journeys: Densifying urban landscapes, sourcing localized products, internet shopping, restructuring freight logistics systems, and utilizing advanced information and communication technologies (ICT);
- Modal shifting: Lower-carbon transport systems, encourage increasing investment into public transport, walking and cycling infrastructure, modifying roads, railways, airports, ports, making waterways and other mentioned modes more attractive for users, minimize travel time and distance;
- Improve energy efficiency of transport modes and vehicle technologies: Improving fuel-economy of transport (litre/passenger-km or litre/ton-km) by enhancing vehicle and engine performance, using lightweight materials, increasing freight load factors and passenger occupancy rates, deploying new technologies such as electrification of vehicles.
- Improve fuel quality: Reducing carbon intensity of fuels ($\text{CO}_{2\text{eq}}/\text{MJ}$) by substituting petroleum-based products with natural gas, bio-methane, bio fuels, electricity or hydrogen produced from low GHG sources.

It is important to harmonize the GHG mitigation options and related transport policies with other national development programmes and related policies, while mobilizing resources and expertise of all related stakeholders and institutions.

The NDCs of Transport Sector

The set of NDCs proposed for the transport sector has gone through a number of amendments, and the following are the key activities listed in the most recent version:

1. Establishment of energy efficient and environmentally sustainable transport systems by 2030.
 - 1.1 Develop Urban Transport Master Plans (UTMP) to improve the transport system in line with the Megapolis Plan that is currently being finalized, and integrated into key urban areas of the country,

- 1.2 Introduce an Intelligent Transport System (ITS) based bus management system,
- 1.3 Introduce a canal transport system
2. Upgrade of Fuel Quality Standards (FQS) to reduce harmful emissions that cause environmental pollution and health hazards.
 - 2.1 Introduce 95 octane petrol.
3. Reduce unproductive transport systems from current usage.
 - 3.1 Reduce unproductive vehicles by 25% in 2025 unconditionally. This could be increased by 50% with conditions.
4. Shift passengers from private to public transport modes.
 - 4.1 Introduce park & ride system,
 - 4.2 Establish bus depots next to railway stations
5. Enhance the efficiency and quality of public transport modes.
 - 5.1 Electrification of the railway system from Veyangoda to Panadura,
 - 5.2 Purchase new rolling stock for Sri Lanka Railway,
 - 5.3 Rehabilitate the Kelani Valley railway line.
6. Reduction of GHG emissions in the maritime sector.
 - 6.1 Implement international laws and regulations on maritime safety & security related to climate change,
 - 6.2 Maintain international standards related to climate change in maritime transportation.
7. Gazette new emission standards to reduce GHG emissions
 - 7.1 Improve vehicle emission testing programme, and spot testing for all vehicles,
 - 7.2 Introduce a heavy smoke vehicles spotter programme
 - 7.3 Introduce a road side vehicle emission testing programme
 - 7.4 Inspect and monitor vehicle emission testing centres
8. Encourage and introduce low emission vehicles such as electric and hybrid.
 - 8.1 Introduce electrified three - wheelers to reduce emissions,
 - 8.2 Introduce electrified boat service,
 - 8.3 Introduce electric buses,
 - 8.4 Introduce other electrified vehicles such as cars
9. Reduce traffic congestion in order to reduce GHG emission.
 - 8.1 Introduce canal transport systems
 - 8.2 Introduce Centralized Traffic Management Systems (CTMS)
 - 8.3 Establish highways
 - 8.4 Transport of heavy loads by railway
10. Reduction of GHG emissions in the aviation sector.
 - 10.1 Identify the current profile of GHG emissions from Sri Lankan operators (Sri Lankan Airline and FITS Aviation) in international operations and domestic operators
 - 10.2 Forecast the BAU future emissions from the above operators
 - 10.3 Identify GHG mitigations options
 - 10.4 Identify implementation mechanisms and resource requirements for the implementation of mitigation options
11. Establishment of a database management system for monitoring NDCs of transport sector.
 - 11.1 Establishment of a separate unit for the implementation of NDCs
 - 11.2 Software development
 - 11.3 Capacity development

5.2.2. Industrial Sector

Industrial sector includes energy consuming industries, technology intensive industries, small and medium enterprises and micro industries. Apart from emissions generated from energy consumption, the key industries contributing to GHG emissions are Cement, Manufacture and Lime production. Energy required for industrial purposes is generated from several sources such as biomass, petroleum oil, and electricity. It is noted that most of the industries use very old and high energy consuming technologies which need to be reviewed and improved with new technologies.

The proposed NDCs for the industry sector are suggesting further actions and sub actions which could directly and indirectly influence in reducing GHG emission in the industrial sector by modifying, adopting and applying new technology available in the field for the period of 2020-2030.

The NDCs of Industrial Sector

The NDCs of the industrial sector include:

1. Modernizing and facilitating industries to follow recognized standards related to GHG emission reduction (Environmental Management System such as ISO 14000, ISO 14040 series, ISO 14062 - Design for Environment, ISO 14064 - Greenhouse emission, standards co-Tex 1000 garment and textile industry, Hazard Account Critical Control Points (HACCP) or ISO 22000/25 certification etc...)
2. Continue fuel switching to biomass in industries.
3. Improve efficiency of industrial energy/water/ raw materials.
4. Introduce and promote tax structures to promote the sustainable technologies.
5. Encourage industries to reduce GHG emissions through introduction of a rewards' system.
6. Establish Eco-industrial Parks (EIPS) and villages.
7. Implement the National Green Reporting System of Sri Lanka.
8. Apply eco-efficient and cleaner production.
9. Greening the supply chain through introducing the life cycle management and industrial symbiosis to maintain zero waste.
10. Introduce high efficient motors for the entire industrial sector.

5.2.3. Forestry Sector

Forests are a fundamental and important element in the efforts to combat the adverse effects of climate change. The vital role that trees play in removing carbon from air through a process referred to as carbon sequestration has now been recognized globally as a potent way to remove rapidly increasing atmospheric carbon. Forests in particular help to remove larger amounts of carbon dioxide from the atmosphere and function as a carbon sink. Given the key contribution

that forests make in absorbing the high levels of carbon in the atmosphere, deforestation and forest degradation are identified as one of the key contributions to global warming.

The Intergovernmental Panel on Climate Change (IPCC) estimated that deforestation and forest degradation account for 12% of earth's human induced carbon emission, which is higher than the total emissions from the transport sector at the global level.

Proposed NDCs in this sector directly or indirectly influence in reduction of GHG emission by increasing the forest cover in the country to a healthy level, managing deforestation and enriching usage by introducing perennial crops targeting 2020-2030.

The NDCs of Forestry Sector

1. Increase the forest cover of Sri Lanka from 29% to 32% by 2030.
 - 1.1 Identify land for reforestation/forestation (suitable non forest land for forestry by conducting land use planning at national scale).
2. Improve quality of growing stock of natural forests and forest plantations.
 - 2.1 Complete boundary demarcation
 - 2.2 Conserve to increase non-carbon benefits
 - 2.3 Demarcate boundaries including buffer zones
 - 2.4 Develop plantation management plans for sustainable forest management practices for productive and protective purposes
3. Restoring degraded forests and hilltops (shrubs, grasslands and state lands)
4. Increase river basin management for major rivers of Sri Lanka.
 - 4.1 Multi hazard prioritization of catchment/ river basins
 - 4.2 Preparing catchment management plans
 - 4.3 Demarcation and protection of riverine vegetation
 - 4.3 Implement protective measures
5. Forestation of underutilized private lands and marginal Tea lands.
 - 5.1 Promote forestation/afforestation through non carbon benefit/payment for ecosystem service mechanism.
6. Urban forestry (roadside planting, urban parks and other state lands).
7. Establish a functional National Forest Monitoring System (NFMS).
8. Promote investment of private and public sector companies in environmental conservation projects through CSR programs.

5.2.4. Waste Sector

Greenhouse Gas emission from solid waste depends on the disposal methods. Waste collecting and disposing have become major issues in waste sector today. The main waste collection and disposal systems currently in practice in Sri Lanka are composting, recycling, sanitary land filling, open dumping, waste burning through incineration (for clinical waste) and waste water treatment.

Waste collection and disposal have become a serious concern in Sri Lanka with the expansion of urban population and rapid changes of the consumption pattern. Local Authorities (LAs) are responsible for municipal solid waste management in Sri Lanka, however the capacity of LAs in

general is not sufficient to manage all the waste generated in the limit of LAs. Only 40% of the waste is regularly collected and only limited LAs run sanitary land filling practices at present.

The generation of Methane from landfill sites is likely to be an acute problem. In almost all the Municipal Councils, landfill sites are located within the respective city limits, amidst the highly populated residential areas. One ton of biodegradable waste gives 300 liters of Methane (0.4 tons of Methane more than 8 tons of CO₂, equivalent GHG). Providing solutions to the issue of solid waste management solves the issues of health hazards, environment pollution and addresses GHG emission reduction. The proposed NDCs for waste sector directly or indirectly influence the reduction of GHG emissions in waste sector by modifying, adopting and applying appropriate technology during the period of 2020-2030.

The NDCs of Waste Sector

The NDCs for the waste sector include:

1. Introducing a source separation system at the household level and a proper collection mechanism.
2. Improving the compost preparation system for each local authority and increasing the supply of organic fertilizer to agricultural purposes by providing facilities to control quality of compost and introduce a market for the compost fertilizer production.
3. Introducing energy generation by waste (waste to energy programmes).
4. Improving the waste collection mechanism.
5. Designing and implementing comprehensive solid waste management strategies for 40% to 60% of LAs before 2030.
6. Monitoring of waste management activities.
7. Systematic management of industrial/hazardous and clinical waste management.

Sri Lanka reserves the right to revise its Nationally Determined Contributions (NDCs) and targets at any point of time and consider its NDCs to be a living document that should be integrated with changed/modified national development goals and targets.

6. NDCs of **Adaptation to adverse effects of Climate Change**

Adverse effects of climate change are becoming more frequent and intense and all countries are facing increased climate risks and adaptation needs. The negotiations at the new climate agreement, the Paris Agreement presented an unparalleled opportunity to elevate and advance climate adaptation. The Paris Agreement encouraged all parties to strengthen their cooperation on enhancing action on adaptation, taking into account Cancun Adaptation Framework (CAF)

which could establish a clearer global vision for adaptation under the Convention; provide a framework for presenting national adaptation contributions to catalyze adaptation actions, streamline and enhance UNFCCC institutions; and mobilize resources to help particularly vulnerable developing countries to cope with climate impacts.

Adaptation measures are required to address the potential impacts of climate change. Proper adaptation can minimize the losses and damages while creating a conducive environment for low carbon development. The adaptation NDCs of Sri Lanka have been developed in consultation with relevant stakeholders, based on the National Climate Change Adaptation Strategy (NCCAS) and the National Adaptation Plan for Climate Change Impacts in Sri Lanka (NAP). Consequently five major broader adaptation targets are identified:

1. Mainstreaming climate change adaptation into national planning and development.
2. Enabling climate resilient and healthy human settlements.
3. Minimizing climate change impacts on food security.
4. Improving climate resilience of key economic drives.
5. Safeguarding natural resources and biodiversity from climate change impacts.

In the process of meeting these adaptation commitments, Sri Lanka will make extra efforts to build synergies between adaptation and mitigation while capitalizing on **mitigation co-benefits** of adaptation actions.

The most vulnerable sectors to adverse effects of climate change identified for developing the adaptation NDCs are from the sectors of health, food security (agriculture, livestock and fisheries), water and irrigation, coastal and marine, biodiversity, urban infrastructure & human settlement, and tourism & recreation.

6.1. Health Sector

Health is an area where impacts of climate have significant impacts. Studies around the world have revealed the possibility of increasing health hazards with the changing climate patterns. Life cycles of biological agents associated with diseases are highly sensitive to weather and climate related parameters. Several countries have reported a rising number of fatalities due to heat waves.

The country has recently experienced outbreak of diseases those are closely connected with environment and weather patterns, and seasonal outbreaks of dengue are a prime example of this. Spread of vector borne diseases into new areas with changing patterns of local climate is a potential health hazard that needs to be allocated close attention. Sri Lanka has a history of such epidemics in the past such as periodic outbreaks of malaria. In addition, extreme weather conditions can lead to disasters causing injuries and fatalities.

Besides, living and health comfort can directly be affected by gradual rise in temperature, and sudden uncharacteristic and extreme changes in weather parameters. Literature highlights that Sri Lanka has an ageing population which would particularly be vulnerable to climate related health

hazards. Hence, serious efforts towards adaptation against potential health hazards associated with climate change are an utmost priority for Sri Lanka.

The NDCs of Health Sector

1. Establish clinical waste disposal systems in all hospitals in collaboration with relevant agencies
 - 1.1 Establish solid clinical waste disposal systems
 - 1.2 Establish liquid clinical waste disposal systems
2. Control of vector borne and rodent borne diseases (dengue, malaria, and leptospirosis)
 - 2.1 Control of dengue
 - 2.1.1 Improvement of solid waste management systems by local authorities including recycling of non-degradable items
 - 2.1.2 Implementation of integrated vector control methods
 - 2.1.3 Redesigning of housing structures to prevent breeding of mosquitoes
 - 2.1.4 Strengthening of diseases and vector surveillance systems
 - 2.2 Maintenance of malaria free status
 - 2.2.1 Surveillance and screening of all forms of migrants from malaria endemic areas
 - 2.2.2 Establish an early and rapid response system in the event of outbreaks.
 - 2.3 Control of Leptospirosis
 - 2.3.1 Continue prophylactic treatment for farmers
 - 2.3.2 Continue farmer education on prevention and prophylactic treatment
 - 2.3.3 Continue a surveillance system including GPS.
 - 2.4 Establishment of an early warning system for vector borne and rodent borne diseases using, and networking for information exchange on extreme weather events to reduce climate induced health impacts (in highly vector borne disease prone areas)
3. Control of food borne and water borne diseases including Non Communicable Diseases (NCD) such as Chronic Kidney Disease of Unknown origin (CKDU) and mental diseases which can increase due to extreme heat and drought.
 - 3.1 Strengthening/ establishing of a laboratory system for analysis of chemicals including agrochemical residues and microbiology.
 - 3.2 Strengthen the water quality surveillance system and strengthen the disease surveillance system

6.2 Food Security Sector

Sri Lanka's NDCs for Food Security comprise of three major areas; agriculture, livestock and fisheries. Climate change will affect these sectors regarding food security, food availability, food accessibility, food utilization and food system stability. This will have impacts on human life in many ways, on human health, livelihood assets, food production and distribution channels as well as changing purchasing power and market flow. Impacts would be both short term and long term. More frequent short term impacts and extreme weather events, and long term impacts caused by changing temperature and precipitation patterns.

Sri Lanka as an agriculture based country faces greater consequences of extreme weather events due to temperature rise in the dry zone, and higher precipitation in the wet zone and changing of seasonal rainfall pattern on both zones, dry and wet zones. Livelihood systems already vulnerable to food security face immediate risk of increased crop failure, net pattern of pests and diseases, lack of appropriate seeds and planting materials and loss of livestock.

Coastal communities depending on fisheries and fish farmers who are involved in aquaculture are already profoundly affected by climate change; rising sea levels, ocean acidification and floods are among impacts of climate change. Climate change is modifying the distribution and productivity of marine and fresh water species and is already affecting biological processes and altering food webs. The consequences felt on sustainability of aquatic ecosystem for fisheries and aquaculture is highly adverse.

6.2.1 The NDCs of Agriculture Sector

More than 2,500 years, Sri Lanka has been an agrarian based society and agriculture still remains a key component of the economy as well as the island's cultural base. Climate change involves long-term slow changes in climate, short-term annual climatic variability and unpredictable extreme climatic events. Agriculture, (especially crop production,) is highly dependent on the prevailing weather conditions and therefore is highly sensitive to climate change, both short-term and long-term. It is imperative that a well-coordinated and sustained effort is set in motion to increase the capacity of Sri Lankan agriculture to adapt to short and long-term climate change impacts.

Adaptation involves measures to minimize the impacts of climate change. At present, implementation of climate change adaptation measures in Sri Lanka is piecemeal and lacks co-ordination and direction. Hence, a clear policy framework identifying the measures to be pursued and the roles of different stakeholders is needed for allocating and channeling the necessary financial and human resources for successful adaptation to climate change. Consequently, following NDCs have been identified;

1. Promote/introduce/develop Integrated Pest Management (IPM) practices to minimize pest damages to improve environmental impacts and health
 - 1.1 Introduce environmentally friendly bio-degradable pesticides for IPM.
 - 1.2 Introduce /promote/develop suitable bio pesticides and bio control agents for IPM.
 - 1.3 Introduce/promote/develop post-harvest management with environmentally friendly technology packages.
2. Develop/introduce varieties resistant/tolerance to biotic and abiotic stresses arising from climate change
 - 2.1 Introduce/promote/develop heat tolerant varieties
 - 2.2 Introduce/promote/develop drought tolerant varieties
 - 2.3 Introduce /promote/ develop flood tolerant varieties
 - 2.4 Introduce /promote/ develop salt tolerant varieties
 - 2.4 Develop and promote maturity varieties

3. Re-demarcating Agro Ecological Regions (AERS) maps of Sri Lanka with current climate and future climate, and recommend appropriate crops for different areas to reduce vulnerability to climate change impacts.
4. Introduce suitable land and water management practices for central highlands and other marginal areas to minimize land degradation and to improve land and water productivity.

6.2.2. The NDCs of Livestock Sector

Livestock is an integral part of agricultural economy in Sri Lanka and it ensures food security, helps in reducing malnutrition and poverty. There are approximately 560,000 families directly engaged in livestock sector, i.e. dairy, poultry, goat, swine and other livestock. Dairy industry is earmarked as the priority area for investment and development in the livestock sector. The development programs launched by the Ministry of Rural Economic Affairs enabled the country to reach 42% self-sufficiency in local milk production in 2015. A major driving factor of livestock dynamics in Sri Lanka appears to be climatic variability. The rising temperature and uncertainties in rainfall associated with global warming are likely to increase the frequency and magnitude of climate variability and extremes.

Furthermore, changes in climate would also increase the risk of unexpected changes in nature and environment. The key risks from climate change to livestock are increased incidence of drought, flood and heat. In this context, Sri Lanka identified the following NDCs for the livestock sector in order to build resilience in the livestock sector to meet adverse impacts of climate change.

1. Identification of vulnerability in the livestock sector
 - 1.1 Identification of vulnerabilities in livestock species
 - 1.2 Identification of vulnerabilities in agro-climate areas
 - 1.3 Identification of vulnerabilities in farming communities
 - 1.4 Identification of vulnerabilities in production systems
 - 1.5 Identification of vulnerabilities in processing pathways
2. Introduction of adoptive measures to avoid or minimize the adverse effects
 1. Identification of adverse impacts on animal production systems
 2. Collection and conservation of traditional knowledge and practices
 - 2.1 Establishment and dissemination of surveyed results to stakeholders
 3. Introduction of technological innovations
 - 3.1 Encouragement of innovations
 - 3.2 Dissemination of knowledge on technological innovation through extension
3. Introduction of alternative measures to minimize adverse effects of climate change
4. Identification of potential clean and renewable energy sources for livestock related activities
5. Adaptation of integrated waste management systems
6. Promotion of responsible consumption and sustainable production
 1. Promotion of green livestock procedures & processing techniques
 2. Promotion of consumption of green livestock products
7. Enhancement of education, awareness and capacity building
 1. Conduct awareness & educational programmes on smart green livestock activities

2. Promotion of emerging green technologies
3. Encouragement of exchanging of novel technologies

6.2.3. The NDCs of Fisheries Sector

The fisheries sector plays an important role in the economy of Sri Lanka by providing livelihoods for more than 2.5 million coastal communities as well as providing more than 50% of the animal protein requirement of people in the country. It is clear that fishers, fish farmers and coastal inhabitants will bear the full force of climate change induced impacts through less stable livelihoods, changes in the availability and quality of fish for food, and rising risk to their health, safety and homes.

Many fisheries-dependent communities are already live in a precarious and vulnerable situation because of poverty and their lack of social services and essential infrastructure. The well-being of these communities is further undermined by overexploitation of fisheries resources and degraded ecosystem due to human and natural phenomenon. As fisheries rely heavily on adequate quality and quantity of water and land resources, development within these sectors should take into account the ramifications of already felt and potential climate change, and strategically adopt relevant adaptation measures in their respective sectoral programmes. Proper adaptation can prevent losses and damages while creating a conducive environment for low carbon development.

1. Establishment of fish barricade devices for each perennial reservoir to prevent fish escape, in consultation with Irrigation Department.
 - 1.1 Identification of vulnerable perennial reservoirs
 - 1.2 Identification of barricades and planning
2. Cryopreservation for stocking fish sperms for artificial breeding.
 - 2.1 Identification of the suitable species
 - 2.2 Storage facilities for Cryopreservation
3. Convert existing open breeding facilities into indoor facilities and design constructions to control temperature impacts.
 - 3.1 Identification of the suitable place
 - 3.2 Development of the facilities
4. Appropriate fish fingerlings stocking programme for stock enhancement for culture fisheries.
 - 4.1 Identification of new reservoirs
 - 4.2 Capacity development for fingerling breeding suitable to environmental impacts
5. Develop temperature tolerant species to aquaculture and promote mari-culture.
 - 5.1 Identification of suitable species
 - 5.2 Capacity development for research & development
6. Minimize the aquatic pollution due to water scarcity in lagoons and inlands water bodies.
 - 6.1 Identification of present status of aquatic pollutants
 - 6.2 Identification of possible vulnerable pollutants
 - 6.3 Capacity building for research & development
 - 6.4 Design and conduct of awareness programmes
7. Increase the production capabilities of fisheries, aquatic resources in lagoons.
 - 7.1 Stock assessment of lagoons

- 7.2 Carrying capacity assessment
- 7.3 Assessment of primary productivity
- 7.4 Assessment of water quality
- 7.5 Awareness creation programmes

6.3 Water Sector

Water resources are the most important source for the survival of both the man-kind and the ecosystems. Reliable and clean drinking water is a necessity to sustain good health. Further, water is a prime requirement for agriculture, energy generation, navigation, recreation and manufacturing. Many of these uses put pressure on water resources and in many areas, climate change is likely to increase water demand while shrinking water supplies. This shifting of balance would challenge the management of water to simultaneously meet the needs of growing communities and sensitive ecosystems. The adverse impacts of climate change highly affect the inland water bodies resulting in prolonged droughts, flash floods and sea level rise. This vulnerability could be minimized through precautionary actions. Following NDCs for water sector have been identified as such precautionary actions.

The NDCs of Water Sector

1. Establish and erect sand bags across the river during the drought season to prevent saline water intrusion where saline water intrusion is a concern.
 - 1.1. Identification of areas, designing implementation & monitoring plans
2. New water supply projects and schemes will be implemented in the areas where water scarcity.
 - 2.1. Assess and map areas with water scarcity
 - 2.2. Explore new water sources and identify alternative sources.
3. Prepare water safety management plans for entire country to overcome pollution and climate change impacts.
4. Improve protection and conservation measures in all drinking water catchment areas.
 - 4.1. Establish island-wide surface & ground water monitoring networks i.e. for long term monitoring of water level flow patterns, water quality
 - 4.2. Enforcement of laws & regulations
5. Permanent water supply schemes can be implemented with pipeline systems through new water supply schemes.
 - 5.1. Identification of safe water sources qualitatively & other alternatives such as desalinization
6. Establish mobile laboratories to ensure safety during water supply.
 - 6.1. Onsite water quality monitoring systems for more adequate measurement on toxicity, pesticide etc.
7. Establish monitoring and recording for saline water intrusion into drinking water sources during the drought period.
8. Establish safety of water management facilities and minimize disturbances to water supply due to extreme weather events.
9. Introduce a new management system focusing on community awareness creation programs and water supply plans.

6.4 Irrigation Sector

Water management is a crucial task that needs to be adapted to face both climate change impacts and socio-economic pressures in the coming decades. Changes in water availability, changes in water demand from land, as well as from other competing sectors including urban and industrial development are some of them. The best water management practices need to be used to increase the productivity of the irrigation water that may provide significant adaptation potential for all land production systems. Improvements in irrigation efficiency are equally critical to ensure the availability of water for both food production and for competing human and environmental needs with future climate change risks.

Sri Lanka's inland waters are the most important supplier of water for agriculture, where irrigation waters are vital for enhancing productivity of the sector. The impacts of temperature increase on water availability include increased rates of evaporation and vapors-transpiration. Thus, during drought periods water availability for irrigation will be affected due to high evaporation rates. This is especially true for tanks and rivers in the dry zone. Increased evaporation and transpiration can also reduce soil moisture, stream flow and groundwater re-charge, resulting in reducing water available for food production, and increasing the irrigation requirement. Adaptation measures in this context are critical for Sri Lanka as more than 65% of agricultural lands are located in the dry zone where water scarcity exists.

The NDCs of Irrigation Sector

1. Restoration and rehabilitation of all abandoned tanks and irrigation canals in Sri Lanka.
2. Establishing the water flow and sediment loads monitoring system in selected streams in the central highlands.
3. Introduce boreholes/tube wells as an intervention to address droughts for domestic water supply.
4. Enhance productivity of irrigation water use by introducing improved on-farm water application technologies.
 - 4.1 Introduce water saving applications like water micro irrigation system (sprinkle) & water saving crops.
 - 4.2 Farmer training & awareness raising programmes on water saving applications
5. Assess river floods and mitigation measures and early warning systems for possible flash floods.
 - 5.1 Collecting the rainfall data & river flow
 - 5.2 Preparation of digital elevation maps
 - 5.3 Capacity building programs for new technological applications
 - 5.4 Introducing flood mitigation structures
6. Develop water resource management plans and strategies for selected rivers in Sri Lanka adopting traditional knowledge and new technology.
7. Adopt water-efficient technologies to 'harvest' water, conserve soil moisture (e.g. crop residue retention) and reduce siltation and saltwater intrusion.
8. Modification of irrigation techniques, including amount, timing or technology.
9. Introduce conservation measures to irrigation tanks and canals to ensure sustainable water supply.

6.5 Coastal and Marine Sector

Sri Lanka is an island nation surrounded by a low-lying coastal belt. Around a third of the country's population lives in the coastal belt. The impact of climate change on sea level rise and ocean warming are crucial for Sri Lanka in several aspects. Being an island, sea level rise will pose many challenges to coastal communities, their livelihoods, and coastal ecosystems. With this rise, coastal systems and low-lying areas will experience adverse impacts such as submergence, coastal flooding, saltwater intrusion and coastal erosion. In many regions, changing precipitation patterns and melting of snow/ice are altering hydrological systems, affecting water resources of the ocean in terms of quantity and quality. There is evidence that many marine species have shifted their geographic ranges, seasonal activities, migration patterns, and relative abundance and species interactions in response to climatic changes.

Sea level rise, a major physical effect associated with climate change is likely to create significant impacts over the coastal zone. Besides, rising incidence of extreme and unpredictable weather events have created uncertainties over coastal livelihoods sometimes even causing life and property damages. Therefore, proper adaptation can prevent losses and damages while creating a conducive environment for low carbon development. Coastal and marine sector is one of the most vulnerable sectors to the adverse effects of climate change.

The NDCs of Coastal and Marine sector

1. Establish an accurate sea level rise forecasting system for Sri Lanka.
 - 1.1. Re-establish the existing Mean Sea Level (MSL).
 - 1.1.1 Establish the required database with historical sea level data
 - 1.1.2 Start the required long term data collection programme, including wave measurements sediment transport study.
 - 1.2. Establish additional sea level stations, in addition to the existing stations.
 - 1.3. Acquire globally available technology for prediction and forecasting.
2. Mapping of inundation prone areas assessing vulnerability to the sea level rise.
 - 2.1 Re-assess inundation maps according to the sea level rise forecast
 - 2.2 Periodically validate and update inundation maps according to the revised forecast
3. Restoration, conservation and managing coral, sea grass, mangroves and sand dunes in sensitive areas.
 - 3.1 Survey and map coastal habitats (coral, sea grass, mangroves and sand dunes) in the entire coastal region, based on a method that is compatible with the survey department methods.
 - 3.2 Scientifically identify suitable sites for conservation, rehabilitation and restoration
 - 3.3 Conduct pilot projects at high prioritized sites
4. Prepare risk maps for the coastal zone mapping with 0.5m contour intervals and take appropriate actions.
 - 4.1 Prepare vulnerability databases for the coastal zone mapping with 0.5m contour intervals
 - 4.2 Establish the Digital Elevation Model (DEM) for the entire coastal zone (2 km landward).
5. Establish 1000 ha of coastal forests and green belt along the coastal line of the island.

6.6 Biodiversity Sector

Sri Lanka is one among the 35 biodiversity hotspots in the world. The country is endowed with truly remarkable bequest of biodiversity and ecosystems. This includes both fauna and flora resources. Furthermore, Sri Lanka's endowments cover terrestrial, aquatic as well as marine ecosystems. Impacts of climate change could be multifaceted with both negative and positive impacts. Despite the potential impacts, very little is known about what changes have already taken place or where the ensuing changes due to impacts of climate change and other factors would eventually lead. Due to these reasons biodiversity and ecosystems are areas where Sri Lanka needs to allocate special attention concerning climate adaptation related initiatives.

The NDCs of Biodiversity Sector

1. Restoration of degraded areas inside and outside the Protected Area (PA) network to enhance resilience.
 - 1.1 Identify degraded areas outside the PA network
 - 1.1.1 Map the degraded areas
 - 1.1.2 Reforestation of identified areas
 - 1.2 Identify degraded areas inside the PA network
 - 1.2.1 Map the areas
 - 1.2.2 Habitat enrichment
 - 1.2.3 Control of invasive species
2. Increase connectivity through corridors, landscape/matrix improvement and management.
 - 2.1 Minimise human-animal conflict
3. Improve management, and consider increasing the extent of protected areas, buffer zones and create new areas in vulnerable zones.
4. Identify biodiversity hotspots in Sri Lanka and upgrade them.
 - 4.1. Conduct baseline surveys to identify the status of the biodiversity hotspot
 - 4.2. Upgrade legal status
5. Promote traditional methods of biodiversity conservation for increased resilience in agro-ecosystems.
 - 1.1 Promote traditional methods and indigenous knowledge
 - 1.2 Promote non-traditional methods which are in harmony with nature
6. Implement community driven conservation projects and programmes.
7. Establish and implement ex-situ conservation programs

6.7 Urban, City Planning and Human Settlements Sector

Today the most of Sri Lankans living in urban and city areas struggle with the consequences of unsustainable physical growth expansion. Urban, city planning and human settlements are closely connected areas that come under the direct influence of climate change impacts. Local Authorities and their inhabitants are faced with droughts, floods, air pollution, land degradation, deforestation and rising sea levels. These impacts have direct repercussions on basic living standards of the population. In Sri Lanka, city planning and human settlements are two areas that received limited attention despite their importance with connection to climate change adaptation.

The NDCs of Urban, City Planning and Human Settlement Sector

1. Mainstream climate adaptation in physical and urban planning and incorporate them into planning in development projects.
 - 1.1 Incorporate mechanisms to improve urban macro/micro climatic conditions.
 - 1.2 Conserve wet lands and water bodies close to urban and settlement areas.
 - 1.3 Protect and enhance green cover, green corridors in urban and settlement planning.
 - 1.4 Improve air circulation when planning urban areas
2. Develop disaster prevention and environment friendly mechanisms especially for floods in Western Province and incorporate them into planning of development projects
3. Promote climate resilient building designing and alternative materials for construction.
 - 3.1. Design based on green building guidelines
 - 3.2. Incorporate disaster prevention guidelines
 - 3.3. Incorporate low cost environment friendly materials
4. Minimize the impacts on human settlements and infrastructure due to erratic changes in population.
 - 4.1. Follow NPPD and NBRO guidelines
 - 4.2. Enforce rules and regulations to prevent unauthorized settlements
5. Enhance the resilience of human settlements and infrastructure to extreme weather events
 - 5.1. Give due consideration to infrastructure facilities, contour line and soil conservation methods particularly in hill areas
 - 5.2. Design and maintain infrastructure giving due consideration to the runoff system and flooding
6. Minimize the impact of sea level rise on coastal settlements and infrastructure.
7. Greening cities by introducing urban forest parks, roof top gardens, vertical gardens, wetland parks and road side planting.

6.8 Tourism and Recreation Sector

According to the Davos Declaration signed during the second International Conference on Tourism and Climate Change; tourism is estimated to contribute at least 5% of global CO₂ emissions. The sector contributes to the global economy as well as local economy to a great extent.

In the process of preparing NDCs special attention needs to be paid to reduce negative impacts of the GHG emission and change the path way into sustainable tourism. Being a tropical island nation, Sri Lanka is an attractive destination for tourists. Among the country's attractions are scenic and sunny beaches, cultural heritage, ecological endowments of rich biodiversity, opportunities for nature recreation (e.g. whale watching, beach surfing, wildlife watching) as well as comfortable climate zones. Climate change can affect desirable characteristics associated with each of these attractions, simultaneously creating problems for operational undertaking of travelling and leisure activities. Besides, it can affect infrastructure facilities of the tourism industry making them vulnerable to various hazards.

Tourism industry, by its nature, is highly sensitive and susceptible to disturbing conditions such as disasters and violence. Hence, maintaining Sri Lanka's position as an attractive destination

and ensuring efficient operation of the industry under rising incidents of climate hazards, needs carefully planned adaptation measures. Improving nature based tourism and recreational activities would encourage the local community to protect their environment as they provide livelihoods for many people. Stakeholders in the tourism sector in Sri Lanka may have to take into consideration environmental friendly ways to preserve ecosystems and share responsibilities with other national and local agencies in managing ecosystems.

In this context adaptation options need to be identified and implemented to be explored the tourism and recreation sector to transform the ongoing tourism trend to a more sustainable energy consuming environment friendly one in order to address the impacts to environment, and mitigate and adapt to climate change impacts.

The NDCs for the Tourism and Recreation Sector

1. Adapt and alter conditions and destinations of the tourism and recreation sector.
2. Increase the preparedness of tourism and recreation operation to extreme weather conditions.
3. Assess the current promotional strategies with connections to emerging scenarios of climate change; beach tourism and nature destinations.
4. Improve energy efficiency in tourism based establishments by using available best alternative environmental friendly energy sources, solar and wind power, biomass.
5. Introduce resource management mechanisms into tourism to minimize damage to the existing ecosystem. This will focus on waste management, solid and waste water, in areas prioritised for tourism areas which could affect to the ecosystem.

Total cost of implementing the above Adaptation NDCs have not been estimated and the national capacity (unconditional) and external supports (conditional) to be identified in consultation with all the agencies and affiliated institutions to each NDC.

7. Loss and Damage

Following the requests by the developing world for the need to focus on loss and damage from climate impacts, COP 19 of the UNFCCC held in Warsaw, established the 'Warsaw International Mechanism on Loss and Damage with the objective to address losses and damages associated with adverse impacts of climate change at the international level.

The changes of climate and impacts of climate change subject Sri Lanka to new challenges and risks. Recent decades have seen significant growth in the number and severity of reported climate induced disasters. Climate change is altering the face of disasters, not only through increased weather-related and other hydro-climatologically risks, but also through increased risks on social, economic, and environmental vulnerabilities.

Sri Lanka is facing losses and damages due to impacts of climate change, which cost the country a lot of finances in addressing each year. According to the data provided by the National Disaster Relief Services Centre, the total relief expenditure for the period of 2007-2011 was SLR 1,786 million (US\$12.75million) which was borne by the Consolidated Fund of Sri Lanka. Nevertheless, this calculation has been done without considering the damages to infrastructure as well as other physical damages. According to the Integrated Post Flood Assessment in May 2010 carried out after the floods in the Western and Southern provinces by the Disaster Management Centre of the Ministry of Disaster Management, the total damages and losses from the floods amounted to over SLR 5,000 million (US\$ 35.71 million).

The NDCs of Loss and Damage

1. Improve the forecasting capabilities at all-time scales
 - 1.1. Enhance the existing automated observational network
 - 1.2. Implement the lightning detection network
 - 1.3. Improve the numerical weather prediction capacity with data assimilation.
 - 1.4 Improve the weather forecasting capabilities - extended range forecasting (longer period) and seasonal forecasting.
2. Analysis of total loss and damage of climate induced disasters from 2000 and the gap that was not compensated/recovered. This includes making recommendations to establish a mechanism at the national level which will contribute to the Warsaw International Mechanisms for Loss and Damage in an effective and efficient manner.
3. Establish a local mechanism in line with the Warsaw International Mechanism for Loss and Damage.
4. Strengthen the existing national mechanism to recover the loss and damage to the maximum possible.
5. Introduction of possible insurance schemes to recover the loss and damage to livelihood, properties, infrastructure, agriculture and fisheries, and other affected sectors due to adverse impacts of climate change.

Sri Lanka intends to join hands to develop a fully-fledged Warsaw International Mechanism on Loss and Damage to address issues related to loss and damage and in parallel develop an appropriate local mechanism.

8. Means of Implementation

The means of implementation of NDCs of Sri Lanka require three pre-conditions.

Finance – Finance is a crucial factor in achieving the set targets. The Sri Lankan government is willing to contribute its finances to achieve the targets but the level of ambition will be higher with supported actions. As a developing nation, the enhanced finance for adaptation and low carbon development will be a necessity to achieve the set intended conditional targets.

There needs to be a methodology set up to address the needs of finances, measuring of the financial needs for each sector and the divisions of contribution at the national budgetary level, and the evaluation of the feasibility and the availability of international funding.

In the implementation of the NDCs, and resource mobilization for their implementation, a transparent and accountable means of monitoring and reporting, as well as verification needs to be set up. This could be developed at the country level to reflect the international standards of MRV as set up in the Paris Agreement, and adapted to the countries needs and capacity of implementation.

Technology - **Predominantly mitigation technology transfer** and scaling up adaptation technologies are required without burdening the country's socio-economic development. The NDCs can be attained with the right mix of access, affordability and scale of technologies.

In addressing countries technological needs for the implementation of the NDCs, a technology needs assessment for each sector for the implementation of the contributions will be needed, and the financial and technical support needed for this will need to be assessed and incorporated to the needs for financial support requested at the national and international level for the implementation of NDCs.

Further there needs to be an evaluation of the technology available at the national level, and the level at which international technological support is needed. This will be done in partnership with the relevant line ministries and coordination with by the Ministry of Mahaweli Development and Environment and, led by the relevant department.

In utilizing technology that will contribute to the implementation of Sri Lanka's NDCs, it is vital that local technology is prioritized, used when available and promoted for use and supported for development, and used in implementation of the NDCs in Sri Lanka. Relevant line ministries will be invited and requested to lead the process of assessing the availability, the suitability, and ways to promote and facilitate the development of local technologies for the implementation of NDCs in Sri Lanka.

Capacity Building - (Human Resource Development and Institutional Mechanism)

Climate change impacts are not limited to impacts of infrastructure, they impact humans and ecosystems. It is important that Sri Lanka develops appropriate institutional mechanisms to ensure climate change is mainstreamed into development processes, while focusing on infrastructure development and human resource development, and also the resilience building of individuals to adapt to adverse effects of climate change.

Investing time and resources in capacity building to address the adverse impacts of climate change will ensure a higher degree of deviation from the BAU emission projections and increase resilience that will empower the population to adapt to climate change impacts, as well as reduce loss and damage.

An appropriate institutional mechanism needs to be set up, and will be addressed in consultation with the relevant sectoral ministries, as well as with the engagement of multiple-stakeholders. In the capacity building efforts, different actors will be contacted for contributions based on their expertise. This will focus on multiple stakeholders including, but not limited to policy makers, private sector, CSOs, academia, media, as well as individual experts in sectoral and cross cutting themes.

Capacity building in a structured and institutionalized manner will help to execute the integrated plans and utilize the finances effectively and efficiently. The institutional mechanisms encompass coordination bodies, engagement platforms and communication channels. Lack of capacities in terms of data act as a barrier for Sri Lanka as in the case for many other developing country Parties in the INDC development process, and in the readiness activities of each sector the need for data collection and resource mobilization for data collection will be included.

In order to effectively and gradually implement the capacity building on climate change, and address the capacity needs of Sri Lanka to implement the proposed NDCs of Sri Lanka, an independent institutional mechanism is proposed to be set up, with multiple stakeholders listed to be included, and with an operationalization mechanism which will fall within the scope of the proposed Climate Change Commission Act.

Implementation Mechanism

NDCs of Sri Lanka will be implemented under the guidance of the Climate Change Commission of Sri Lanka, in coordination with the relevant ministries. A coordinating body consisting of relevant ministries will provide input to the implementation of NDCs, while the monitoring, reporting and verification component of the NDCs implementation is entrusted to the Climate Change Commission of Sri Lanka of the Ministry of Environment and Mahaweli Development of Sri Lanka.

The Commission will implement the NDCs based on the Climate Change Commission Act of Sri Lanka, which is to be established for the purpose of setting up the Commission, and will also be governed as applicable by the international laws and agreements including and not limited to the Paris Agreement on climate change, UNFCCC, Kyoto Protocol, Hugot Framework on Disaster Risk Reduction, and other relevant international laws and regional agreements relevant and applicable to climate change adaptation and mitigation.

Integrated planning is the key means of implementation. Sri Lanka has already taken initiatives of integrated planning through the NAP and the Energy Planning processes which should be extended to other sectors vertically and horizontally.
