



Intended Nationally Determined Contributions

Ministry of Mahaweli Development and Environment

Sri Lanka

April 2016

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 resubmit its Intended Nationally Determined Contributions (INDCs) in accordance with Decisions 1/CP.19 and 1/CP.20 of the Conference of Parties of the UNFCCC. We believe the INDCs submitted by the countries will support to achieve the set objectives of the Paris Agreement. Sri Lanka is confident that a fair and ambitious Agreement is an imperative for countries to reach the long-term temperature and Sustainable Development Goals.

Sri Lanka is pleased to take part in the efforts of tackling current and projected climate change challenges by implementing INDCs. The INDCs have been formulated based on 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 formulation of the country's INDCs.

2. National Context

Sri Lanka, a country highly vulnerable to climate change impacts presents the INDCs 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 Haritha 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 finalized, 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 enrichment of forest cover.

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 those 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 formulation of 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 under the Ministry of Mahaweli Development and Environment in 2008. In order to implement INDCs, a National Climate Change and a Climate Change Commission will be established.

3. Intended Nationally Determined Contributions (INDCs) 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 INDCs 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 limit the temperature increase to 1.5⁰C above pre-industrial level.

The INDCs will play a vital role in the Post 2020 period and the global climate agreement (Paris Agreement), which shall aim to limit adverse impacts of climate change and prevent irreversible consequences that would be faced by the world.

3.1 Timeframe and Periods of Implementation

Base year 2010 as per Business-As-Usual scenario

Target period 2021-2030

3.2 Scope and coverage

Sri Lanka's INDCs 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 given due priority.
- **Loss and Damage** - In order to address issues related to losses and damages occurred by extreme weather events, a local mechanism will be developed in accordance with the Warsaw International Mechanism for Loss and Damage.
- **Means of Implementation**- External supports in Finance, Technology Development and Transfer, and Capacity Building for the above sectors are considered in the implementation process of the INDCs 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 INDCs, Sri Lanka puts forwards ambitious and progressive delinking of GHG emissions in its efforts for economic growth. Sri Lanka puts forward fair and ambitious mitigation approaches, while facing the challenges of progressively increasing adaptation demands, and climate induced loss and damages.

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 factors and 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 the mitigation that greenhouse gas emission could be reduced. They are Energy (electricity generation), Transport, Industry, Forests and Waste sectors. Possible emission reduction actions have been identified in each sector, which are to be implemented during the period of 2020 to 2030.

INDCs for Mitigation intends to reduce the GHG emissions against Business-As-Usual (BAU) scenario by 20% in 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

National energy balance (2014) in Sri Lanka comprise of 52% renewable energy sources (42% biomass, 8% major hydro and 3% new renewable energy sources including solar energy and small / mini hydro energy) and 48% non renewable imported fossil fuel sources (40% petroleum and 8% coal). Meantime major portion (62%) of electricity generation is based on fossil sources (including petroleum fuels and coal) and balance (38%) fulfils from renewable sources (hydro, solar and wind).

National electricity demand increases at a growth of 452 GWh per annum and expected to be double by year 2030 (considering the base year as 2010). Fulfilling the increasing national electricity demand and considering bundling potential of additional renewable (hydro, solar and wind) sources in combination with conventional fossil source based energy sources; a detail electricity generation expansion plan has been developed (Long term Generation Expansion Plan 2015-2034 (draft)). This plan will expect contribute substantially to move away from the BAU high emission contribution scenarios. This plan was developed taking in to account the minimum national economical and technological strengths levels but plan will be able to further strengthen with introducing additional efforts such as national demand management strategies aiming higher emission reduction targets but subjected to the availability of external resources.

Power generation aspect has been considered in preparation of Energy Sector INDCs due to increasing of heavy use of fossil fuels. According to the National Greenhouse Gas (GHG) Inventory of 2nd National Communication in Sri Lanka, CO₂ emission from fossil fuel combustion is the major source of emissions and it has shown a growth 5,447 Gg in 1994 to 10,430 Gg in 2000 and CO₂ emissions have been increased from 304 kg to 545 kg respectively.

Power sector mitigation scenario describes in correspondence with National Energy Policy and Strategy (NEPS) and Long term Generation Expansion Plan 2015-2034 (draft). The NEPS anticipates increasing of Non-Conventional Renewable Energy (NCRE) from 2009-2022 and upward. Further NEPS has encouraged the private sector involvement in energy generation through revising its tariff structure so as to enable purchasing of power at a price based on the technology used and cost incurred in its development which motivates private sector investment in the wind, biomass and solar based power generations. Further it is expecting to reduce energy losses 12% by improving of energy distribution infrastructure and energy saving through introduction of Demand Side Management (DSM) by 2030.

Proposed INDCs are to suggest further actions and sub actions those could directly or indirectly influence to reduction of GHG emission in the energy sector by modifying, adapting and applying new technology in the field.

- **Emission reduction from Energy sector:**

Sri Lanka expects to reduce 20% GHG emission (approximately 36,010.2 Gg) in energy sector by 2030 against the Business-As-Usual scenario as unconditionally 4% (approximately 7,202.04 Gg) and conditionally 16% (approximately 28,808.16 Gg).

5.1.1 Energy Sector INDCs

1. Establishment of large scale wind power farms of 514 MW.
This could replace the equivalent of energy generation from planned thermal power plants.
2. Broadening the solar power electricity generation capacity of the country with participation of private sector and adapting of advanced technology available. Solar power plants with the capacity of 115 MW will be established.
3. Promote use of biomass (fuel wood) and waste (municipal waste, industrial and agricultural waste) by elevating its use in the power generation as a modern and convenient energy source of Sri Lanka, which will be adding 104.62 MW in 2025.
4. Promote Mini and Micro Hydro Power generation projects as an environmental friendly power generation option to national economy. Mini hydro power plants with the capacity of 176 MW will be established.
5. Introduction of Demand Side Management (DSM) activities in order to improve the load factor of the system and to upgrade the efficiency at consumer end such as increase efficiency of fans, pumps, motors, compressors, refrigerators and Building Management System (BMS) for the commercial, government and domestic sector.

6. Further, Government of Sri Lanka has given more priority for sustainable energy policies, which are enforced to absorb more Non-Conventional Renewable Energy (NCRE) to the system at least 50% by 2030.

5.2. Emission Reduction from Other Sectors

Sri Lanka intends to reduce its GHG emissions from the sectors of Transport, Waste, Industries and Forest in total 10% as 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

The transport sector is one of the major GHG emitting sources of Sri Lanka. This sector includes Road, Railway, Air and Sea transportations.

In preparation of INDCs for transport sector, the nature of fuel consumption and their impact on GHG emission within the sector has been considered. In 2000, the recorded total vehicle fleet was about 1,165,000 which is about 1.9 times than in 1991. The per capita petrol consumption has increased from 12.7 litres to 15.9 litres, and diesel consumption from 28.7 litres to 54.7 litres in 1991 and 2000 respectively. This shows that per capita diesel consumption has increased by 91%, while per capita petrol consumption has increased only by 25% indication a sharp change in the fleet mix. These trends have aggravated the air pollution related problems in the urban sector. It has been observed that the daily emission levels depend on the type of vehicle, age of vehicle, quality of fuel consumed, and the condition of the road system.

The proposed INDCs in transport sector would directly or indirectly influence in reduction of GHG emission in transport sector by modifying, adopting and applying with climate smart technology during the period of 2020-2030.

Transport Sector INDCs

1. Establishment of energy efficient and environmentally sustainable transport systems by 2030.
 - a. Lanching of Electric Buses as a Pilot Project.
 - b. Introduction of BRT system to encourage public transport.
 - c. Introduction of ITS (Intelligent Transport System) based bus management system.
2. Upgrading of Fuel Quality Standards in order to reduce GHG emission.
3. Reducing unproductive transport systems from current usage.
 - a. Reduce unproductive vehicles by 25% in 2025 with unconditionally and this could increase 50% with conditions.

- b. Development of Urban Transport Master Plans (UTMP) to improve transport system in line with Megapolis Plan that currently being finalized into other main urban areas of the country.
- 4. Shifting of passengers from private to public transport modes.
 - a. Introduce Park & Ride system
 - b. Introduce the BRT system for Galle Road Corridor
 - c. Rehabilitation of Kalani valley Railway line
- 5. Enhancing the efficiency and quality of public transport and Economic instruments to environment friendly transport modes.
 - a. Electrify railway from Weyangoda to Panadura.
- 6. Enhancing the efficiency and quality of public transport and Economic instruments to environment friendly transport modes.
 - a. Purchase new rolling stock for Sri Lanka Railway.
- 7. Electrification of three - wheelers to reduce emissions.
- 8. Introduce electrified boat service using inland water canal for public transportation to reduce the congestion in roads as well as GHG emission.
- 9. Implement international laws and regulations on Maritime Safety and Security in collaboration with Merchant Shipping Secretariat
- 10. Maintain international standards in maritime transportation.
- 11. The new vehicle emission standards will be implemented.
- 12. Following activities are continuously carried out to minimize emissions from vehicles that emit excessive smoke on the road.
 - a. Heavy smoke vehicles spotter programme
 - b. Road side vehicle emission testing programme
 - c. Inspection and monitoring of Vehicle Emission Testing Centers
- 13. Encourage and introduce low emission vehicles such as Electric and Hybrid into the system.

5.2.2. Industrial sector:

Industrial sector is considered as one of the GHG emission contributor which 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 are generated from several sources such as, biomass, petroleum oil and electricity. It is noted that most of the industries are using very old and high energy consuming technologies which need to be reviewed and improved with new technology.

Proposed INDCs in industry sector are suggesting further actions and sub actions those could directly and indirectly influence in reduction of GHG emission in industrial sector by modifying, adopting and applying new technology available in the field targeting 2020-2030.

Industrial Sector INDCs

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-Text 1000 garment and textile industry, HACCP (Hazard Account Critical Control Points) or ISO 22000/25 certification etc...)
2. Fuel switching to Biomass in Industries will be continued.
3. Industrial energy/water/ raw materials efficiency will be improved.
4. Introduce and Promote tax structures to promote the sustainable technologies.
5. Encouraging industries to reduce GHG emissions through introduction of rewarding system.
6. Establishment of Eco-industrial Parks (EIPS) and villages.
7. Implementing National Green Reporting System of Sri Lanka.
8. Applying Eco-efficiency and Cleaner Production.
9. Greening the Supply Chain through introducing Life Cycle Management and Industrial Symbiosis to managing zero waste.
- 10 Introducing high efficient motors for the entire industrial sector.

5.2.3. Forestry Sector:

Forest is now overwhelming acknowledged as fundamentally important for efforts to combat the climate change threat by curbing the increasing trend of average surface temperature. The vital role that trees play is 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 atmosphere as carbon sink. However, once trees are cut down, this process contraries most of sequestered carbon is again emitted to the atmosphere. Therefore deforestation and forest degradation has been identified as one of major sector that contribute 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 more emissions than the entire global transportation put together.

Proposed INDCs in sector are directly or indirectly influence in reduction of GHG emission in forest sector by increasing forest cover in the country up to healthy level and manage deforestation and enriching and use by introducing perennial crops targeting 2020-2030.

1. Increase forest cover of Sri Lanka from 29% to 32% by 2030.
2. Improvement of the quality of growing stock of Natural Forests and Forest plantations.
3. Restoration of degraded forests and hilltops (shrubs, grasslands and state lands)
4. Increase river basin management for major rivers of Sri Lanka.
5. Forestation of underutilized private lands and marginal Tea lands.
6. Urban forestry (Tree planting along roadside, temple lands, schools and other govt. lands)
7. Establishment/ reactivating of National Forest Monitoring System (NFMS).
8. Promote private and public sector companies for investment in environmental conservation projects through CSR programs.

5.2.4. Waste Sector:

Greenhouse Gas emission from solid waste is depending on the disposal methods. Waste collecting and disposing have become major issues in waste sector today. The main waste collection and disposal systems currently 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 has become a serious problem in Sri Lanka with the expansion of urban population and rapid changes of the consumption pattern. Local Authorities are responsible for municipal solid waste management in Sri Lanka however the capacity of Local Authorities in general is not sufficient to manage all waste generated within the local authority limit and only 40% waste is regularly collected. Only limited Local Authorities are running sanitary land filling practices currently.

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 or 8 tons of CO₂, equivalent GHG). Providing solutions to solid waste management issue solves the multifaceted dimensions on health hazard, environment pollution and GHG emission reduction.

The proposed INDCs for waste sector are directly or indirectly influence in reduction of GHG emission in waste sector by modifying, adopting and applying appropriate technology during the period of 2020-2030.

Waste Sector INDCs

1. Introduce source separation system at household level and a proper collection mechanism.
2. Improve Introduce compost preparation system for each local authority and increase organic fertilizer to agricultural purposes by providing facilities to control quality of compost and introduce a market for produces compost.
3. Introducing energy generation by Waste (waste to energy programmes).
4. Improve waste collection mechanism.
5. Comprehensive Solid Waste Management Strategies for 40%-60% Local Authorities are designed and implemented 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 intended national contributions and targets at any point of time and consider its INDCs to be a living document that should be integrated with changed/modified national development goals and targets.

6. Climate Change Adaptation and Adaptation INDCs

Adaptation is only the key strategy that a country which has a negligible green house gas emission can choose for meeting the adverse effects of climate change. Climate adaptation is widely defined as actions taken to moderate, cope or take advantage of experienced or anticipated changes in climate.

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 in December 2015 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 minimise the losses and damages while creating a conducive environment for low carbon development. The Adaptation INDCs 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 identified such as:

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 capitalising on mitigation co-benefits of adaptation actions.

The most vulnerable sectors to adverse effects of climate change identified for developing Adaptation Sector INDCs are Health, Food Security (Agriculture, Livestock and Fisheries), Water and Irrigation, Coastal and Marine, Biodiversity, Urban infrastructure & human settlement and Tourism & recreation.

6.1. INDCs for Health Sector

Health is an area that climate change can create 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 disasters. Sri Lanka has reported relatively high achievements in the health sector compared with other developing nations. In spite of that, 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 a 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 highlighted 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.

Health Sector INDCs

1. Establish clinical waste (solid and liquid) disposal systems to all hospitals in Sri Lanka in collaboration with relevant agencies.
2. Control of vector borne and rodent borne diseases (dengue, malaria, leptospirosis etc.)
3. Control of food borne and water borne diseases and including Non Communicable Diseases (NCD) such as Chronic Kidney Disease of Unknown origin (CKDU), Mental diseases and cancers due to dehydration due to extreme heat and drought.

6.2 INDCs for Food Security Sector

Sri Lanka's INDCs for Food Security comprise of three major areas; Agriculture, Livestock and Fisheries. Climate change will affect those entire sectors in terms of food security, food availability, food accessibility, food utilization and food system stability. It will have an impact on human life in many ways, on human health, livelihoods 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 those are already vulnerable to food security face immediate risk of increase 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 for sustainability of aquatic ecosystem for fisheries and aquaculture are highly adverse.

6.2.1 Agriculture Sector INDCs

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 year-to-year 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. Therefore, 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. 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 INDCs have been identified;

1. Promote/introduce/develop Integrated Pest Management (IPM) practices to minimize pest damages to improve environmental impacts and health.
2. Develop/introduce varieties resistant/tolerance to biotic and abiotic stresses arising from climate change.
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 Soil and water conservation practices for other marginal areas to minimize land degradation and to improve the land and water productivity.
 - 4.1. Adoption of Soil Conservation Act to sustain land productivity.
 - 4.2. Introduce water harvesting technologies.
 - 4.3. Introduce and practice on-farm efficient water management practices.
 - 4.4. Introduce and practice on and off farm drainage for agriculture/efficient water management practices.
 - 4.5. Introduce and practice on and off farm damage.
 - 4.6. Restoration of marginal lands.
 - 4.7. Efficient use of crops rotation to improve soil nutrition status and reduce the use of chemical fertilizers.
 - 4.8. Develop and promote climate smart villages for different farming situation as an adaptation measure to climate change.

6.2.2. Livestock Sector INDCs

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. There is an increase of milk production by 12.14 % from 333 million liters in 2014 to 374 million liters in 2015. Collection of milk also has increased from 215.93 million liters in 2014 to 219.16 million liters 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. On the other hand, 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 following INDCs for Livestock sector in order to build resilience in the livestock sector to meet adverse impacts of climate change.

1. Introduction of improved feeding practices.
2. Establishment of proper waste disposal facilities for all livestock farms.
3. Introduce the enhanced soil fertility by proper livestock management.
4. Introduce heat tolerant breeds.
5. Enhance existing capacity of managing and diagnosis of livestock and poultry diseases related to climate change.
6. Introduction of early warning system and network for exchange information on extreme weather and climate changes associated with hazard to livestock and poultry.

6.2.3. Fisheries Sector-INDCs

The fisheries sector plays an important role in the economy of Sri Lanka by providing livelihood for more than 2.5 million coastal communities as well as providing more than 50% of animal protein requirement of people in the country. The sector can be divided into coastal, offshore/deep sea, and inland and aquaculture sub sectors.

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 existence 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 programmers. 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.
2. Cryopreservation for stocking fish sperms for artificial breeding.
3. Convert existing open breeding facilities into indoor facilities and design same as at inception of construction to control temperature impacts.

4. Appropriate fish fingerlings stocking programme for stock enhancement for culture fisheries.
5. Develop temperature tolerant species to aquaculture and promote mari-culture.
6. Minimize the aquatic pollution due to water scarcity in lagoons and inland water bodies.
7. Increase the production capabilities of fisheries, aquatic resources in Lagoons.

6.3 INDCs for Water Sector

Water resources are important to both society and ecosystems survival. Reliable and clean drinking water is a necessity to sustain good health. In the same time 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 balance would challenge water managers to simultaneously meet the needs of growing communities and sensitive ecosystems.

The adverse impacts of climate change highly affect the inland water bodies such as prolonged droughts, flash floods and sea level rise. This vulnerability could be minimized through precautionary actions. Following INDCs for water sector have been identified as such precautionary actions;

Water Sector INDCs

1. Establishment of erect sand bags across the river during the drought season to prevent saline water intrusion wherever intakes are subjected saline water intrusion.
2. New water supply projects and schemes will be implemented in the water scarcity areas.
 - 2.1. Assess the water scarcity areas of the country and map.
 - 2.2. Exploration of new water sources, Identify alternative sources, Implementation of schemes, designing quantification, qualitative analysis etc.
3. Water safety Management Plans for entire Sri Lanka to overcome pollution and climate change issues.
4. Improve protection and conservation measures in all drinking water catchment areas.
5. Permanent water supply method will be implemented with pipeline system through new water supply scheme.
6. Mobile laboratories to be established in order to ensure safe during water supply.
7. Establishment of monitoring and recording for saline water intrusion into drinking water source during the drought period.
8. Establishment of safety of water management facilities and minimize disturbances to water supply due to extreme weather events.

6.4 INDCS for Irrigation Sector

Water management is a crucial task that needs to be adapted to face both climate change impacts and socio-economic pressures in 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 to be adapted that increase the productivity of irrigation water and it may provide significant adaptation potential for all land production systems. At the same time improvements in irrigation efficiency are critical to ensure the availability of water both for 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 recharge, thus 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 dry zone where water scarcity exists.

Irrigation Sector INDCs

1. Restoration and Rehabilitation of all abandoned tanks and irrigation canals of Sri Lanka.
2. Establishment of water flow and sediment loads monitoring system in selected streams in the Central Highlands.
3. Introduce boreholes/tube wells as a drought intervention for domestic water supply.
4. Enhance productivity of irrigation water use by introducing improved on-farm water application technologies.
5. Assess river floods and mitigation measures and early warning system for possible flash floods.
6. Develop water resource management plans and strategies for selected major rivers adopting traditional knowledge and new technology.
7. Adoption of water-efficient technologies to 'harvest' water, conserve solid 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 for irrigation tanks and canals to ensure sustainable water supply.

6.5 INDCs for 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 pattern 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.

Coastal and Marine sector INDCs

1. Establishment of accurate sea level rise forecasting system for Sri Lanka.
 - 1.1. Re-establish the existing Mean Sea Level (MSL).
 - 1.1.1 Establish required database with historical sea level.
 - 1.1.2 Commence 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 with assessing vulnerability to the sea level rise along the coastal belt.
 - 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 mapping of coastal habitats (Coral, Sea grass, Mangroves and Sand Dunes) for entire coastal region, on Survey Department compatible method.
 - 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 with mapping with 0.5m contour intervals and take appropriate actions.
 - 4.1 Prepare vulnerability database for the coastal zone with mapping with 0.5m contour intervals
 - 4.2 Establishment of Digital Elevation Model (DEM) for the entire coastal zone (2km landward).
- 5. Establishment of 1000 ha of coastal forests and green belt along the island.

6.6 INDCs for Biodiversity Sector

Sri Lanka is one among 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, it is known very little about what changes have already taken place or where the ensuing changes would eventually lead. Hence, biodiversity and ecosystems are areas where Sri Lanka needs special attention when it comes to adaptation to climate change.

Biodiversity Sector INDCs

1. Restoration of degraded areas inside and outside the protected area network to enhance resilience.
2. Increasing connectivity through corridors, landscape/matrix improvement and management.
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. the Dry Zone
5. Promotion of traditional methods of biodiversity conservation for increased resilience in ago ecosystems.
6. Implementation of community driven conservation projects and programmes

6.7 INDCs for Urban, City Planning and human Settlements

Today most of the dwellers in urban and cities 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.

Urban, City Planning and Human Settlement sector INDCs

1. Mainstream climate reliance in physical and urban planning and incorporate them into development projects.
2. Promote climate resilience building designing and alternative materials for construction.
3. Minimize the impacts on human settlements and infrastructure due erratic changes in population.
4. Enhance the resilience of human settlements and infrastructure to extreme weather event.
 - 4.1. Infrastructure facilities giving due consideration to contour line & soil conservation methods particularly in hilly areas
 - 4.2. Design & maintenance of infrastructure giving due consideration to the runoff system & flooding
5. Minimize the impact of sea level rise on coastal settlements and infrastructure.
 - 5.1. Design infrastructure & structures to face sea level rise
 - 5.2. Shifting urban densification inward
 - 5.3. Demarcate protection areas from sea level
6. Reduction of the urban-rural gap in terms of housing in the physical environment along with other amenities.
7. Housing for all in 2025 through implementation of Low Income Housing.
8. Greening cities by introducing Urban Forest Parks, roof top gardens, vertical gardens, wetland parks and road side planting

6.8 INDCs for Tourism and Recreation

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 in great extent. In the process of INDCs preparation it needs special attention 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 those attractions, simultaneously creating problems for operational undertaking of travelling and leisure activities. Besides, it can affect infrastructure facilities of 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 incidence of climate hazards, needs adopting carefully planned adaptation measures.

Improving nature based tourism and recreational activities would encourage local community to protect their environment as they provide livelihoods for many people. Stakeholders in tourism sector in Sri Lanka may have to take actions into consideration environmental friendly ways to preserving ecosystem and sharing responsibilities with other national and local agencies in managing ecosystem for a longer run.

In this context adaptation options to be explore in Tourism and recreational sector to curb ongoing tourism trend into more sustainable energy consuming environment friendly way rather increasing waste generation and over exploitation of resources around.

Tourism and Recreation Sector INDCs

1. Adjustment of tourism and recreation industry to altered conditions of the destinations.
2. Increase the preparedness of tourism and recreation operation to extreme weather conditions.
3. Assess the current promotional strategies with connection to emerging scenarios of climate change; beach tourism and nature destinations.
4. Improve energy efficiency in tourism establishments by using available best alternative environmental friendly energy sources, solar and wind power, biomass.
5. Introduce resources management mechanism into the tourism sector in order to minimize damages to the existing ecosystem by contributing in waste management, solid and waste water, in tourism destinations which could affect to the ecosystem.

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

7. Loss and Damage

The 19th session of Conference of Parties (COP19) established the 'Warsaw International Mechanism on Loss and Damage which mean to address losses and damages associated with adverse impacts of climate change.

However, developing country like Sri Lanka is facing greater concern on losses and damages which have aggravated due to climate change related extreme whether events. As per the National Disaster Relief Services Centre records, the total relief expenditure for the period of 2007-2011 was SLR 1,786 million (US\$12.75million) and that amount borne by the Consolidated Fund. Nevertheless, this calculation has been done without considering of infrastructure and other physical damages. According to the Integrated Post Flood Assessment in May 2010 by the Disaster Management Centre of the Ministry of Disaster Management, Sri

Lanka, carried out after the floods occurred in the Western and Southern Provinces, the total flood damages and losses amounted over SLR 5,000 million (US\$ 35.71 million).

As the experiences of both disaster risk reduction (DRR) and Climate Change Adaptation (CCA), there is an increasing recognition that these two fields share a common phenomenon that increasing resilience of communities to ensure the sustainable development of the country is the must.

With the changes of climate, Sri Lanka is facing 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.

INDCs for Loss and Damage

1. Improvement of forecasting capabilities –at all-time scales.
2. Improvement of weather forecasting capabilities – extended range forecasting (longer period) and Seasonal Forecasting.
3. Analysis of total losses and damages of climate induced disasters from 1990 and the gap that was not compensated / recovered. Further, make recommendations to establish the Warsaw International Mechanisms for Loss and Damage in effective and efficient manner.
4. Strengthening existing national mechanism to recover the losses and damages in maximum possible extent.
5. Introduction of possible insurance schemes to recover the losses and damages on livelihood, properties, infrastructure, agriculture and fisheries, and other affected sectors due to climate change adverse impacts.

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

8. Means of Implementation

The means of implementation of INDCs of Sri Lanka requires three pre-conditions.

- **Finance** – Finance is a crucial factor in achieving the set targets. The Sri Lanka government is willing to contribute its finances to achieve the target but the level of ambition will always be high 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.
- **Technology** - Predominantly mitigation technology transfer and scaling up adaptation technologies are required without burdening the country's socio-economic development. The INDCs can be attained with the right mix of access, affordability and scale of technologies.
- **Capacity Building** - (Human Resource Development and Institutional mechanism)
Sri Lanka needs to develop appropriate institutional mechanisms to ensure climate change is mainstreamed into development process. This will ensure higher degree of deviation from the BAU emission projections while resilience that will reduce loss and damage. Proper institutional mechanisms 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 acted as a barrier for Sri Lanka as of many other developing country parties in the INDC development process.

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