A synthesis report on opportunities and constraints for integrating the requirements of the Paris Agreement with the SDGs and the Sendai Framework in the context of built environment in coastal regions

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Contents

List of Abbreviations

CCA	Climate Change Adaptation
CCS	Climate Change Secretariat
COP	Conference of the Parties
CRIP	Climate Resilience Improvement Project
DIA	Disaster Impact Assessment
DMC	Disaster Management Centre
DRR	Disaster Risk Reduction
EIA	Environmental Impact Assessment
EU	European Union
GEF-	Global Environment Facility
GFDRR	Global Facility for Disaster Risk Reduction
GHG	Green House Gases
IPCC	Intergovernmental Panel on Climate Change
MCUDP	Metro Colombo Urban Development Program
MoI	Ministry of Industries
MoT	Ministry of Technology
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NBRO	National Building Research Organization
NCDM	National Council for Disaster Management
NDC	Nationally Determined Contributions
NDRSC	National Disaster Relief Services Centre
NDRSC	National Disaster Relief Services Centre
NEOP	National Emergency Operations Plan
NGO	Non-Governmental Organizations
NRIFAP	National REDD+ Investment Framework and Action Plan
NSDI	National Spatial Data Infrastructure
SDCSL	Sustainable Development Council of Sri Lanka
SDGs	Sustainable Development Goals
SFDRR	Sendai Framework for Disaster Risk Reduction
SLCDMP	Sri Lanka Comprehensive Disaster Management Program
SLDRN	Sri Lanka Disaster Resource Network
SLR	Sea Level Rise
SLSI	Sri Lanka Standard Institute
UDA	Urban Development Authority
UNDP	United Nations Development Program
UNFCC	United Nations Framework Convention on Climate Change
UNSDF	United Nations Sustainable Development Framework

1 Introduction

Aligning national-level policy processes with the 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction (SFDRR) can help countries achieve climate-resilient development by increasing coherence, efficiency, and effectiveness (Dazé, Terton, & Maass, 2018). There are clear synergies between policy processes linked to sustainable development, climate change adaptation, and disaster risk management in Sri Lanka, allowing for alignment. In the context of climate change, the built environment associated with coastal cities is vulnerable to various natural and climate change-related risks (Kumar & Taylor, 2015). On the other hand, coasts, which are densely populated and serve as hubs for trade, fishing, and tourism, become critical to the economy of any place with a coastline. Direct inundation, flood and storm damage, loss of wetlands, erosion, saltwater intrusion, and rising water tables are all physical and ecological effects of climate change-induced sea-level rise on coastal systems. Therefore, the requirement of integrated application of the three global agendas on climate change and DRR is of utmost importance in the coastal built environment in Sri Lanka. This report further discusses the country progress of each agenda in detail and the constraints and opportunities in the integrated application of the three agendas in Sri Lankan context.

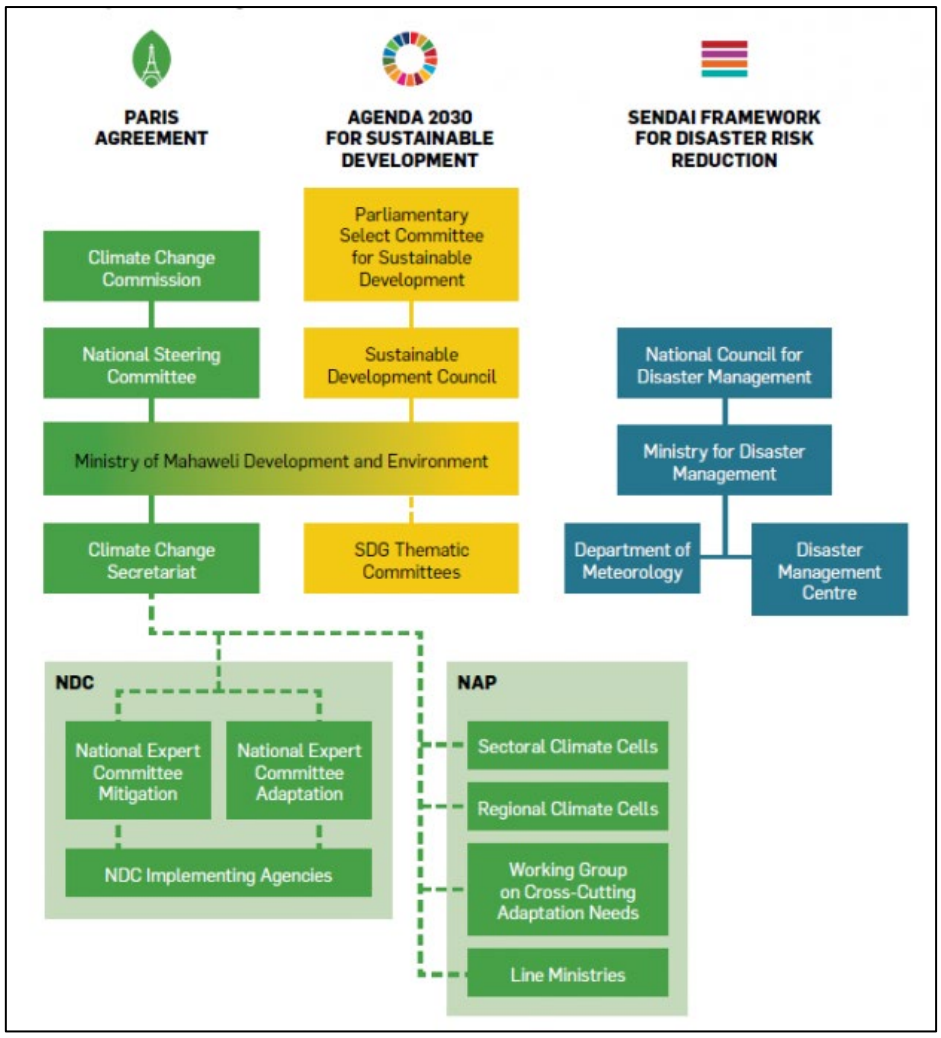

Figure 1 Sri Lanka's institutional arrangements related to the 2030 Agenda for Sustainable Development, Paris Agreement and Sendai Framework for Disaster Risk Reduction (NAP,2019)

2 The Paris Agreement

2.1 Country statement of commitment to the agreement

The Paris Agreement is a legally binding international climate change treaty adopted by 196 parties at COP 21 in December 2015 and entered into force in November 2016 (UNFCC, 2021). The main goal of the agreement is to limit global warming to below 2 or preferably to 1.5 degrees Celsius, compared to pre-industrial levels (UNFCC, 2021). The agreement recognizes that this would significantly reduce risks related to climate change, increase the ability to adapt to the adverse impacts of climate change and foster climate resilience. This agreement is implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities in understanding different national circumstances (United Nations, 2015). It is said that although developed countries have contributed most to climate change, developing countries are expected to face the most adverse effects of climate change because there are high amounts of populations living in conditions of low socio-economic development within their borders (Demel et al., 2019). Therefore, social justice and equity are essential aspects of climate discourse (IPCC, 2018). The Convention aims to strengthen the global response to the threat of climate change in the context of sustainable development and efforts to eradicate poverty (United Nations, 2015). Sri Lanka ratified the United Nations Framework Conversation on Climate Change (UNFCCC) in November 1993 and the Paris Agreement on 22nd April 2016 and submitted its initial Nationally Determined Contributions (NDCs), detailing how the country was planning to implement the Paris agreement in September 2016 (Ministry of Environment, 2021). Since 1993, Sri Lanka has made a substantial contribution to improving national policy and building legal and institutional capabilities to carry out internationally adopted framework's responsibilities (Climate Change Secretariat, 2017).

2.2 Institutional structure/mechanisms responsible for implementing the Paris Agreement

Sri Lanka has taken several steps to address climate change by introducing national policies, strategies and actions. Figure 1 presents such key national policies introduced by Sri Lanka(Ministry of Environment, 2021).

National policies regarding climate change seek to mainstream climate change sector-wise, and some sectors have already integrated climate change risks and commitments to their agendas. These key sectors include power, Urban planning, Waste, transport, industry, coastal and marine, forestry, water, health, tourism and recreation, biodiversity, agriculture, livestock and fisheries(Climate Change Secretariat, 2016; Ministry of Environment, 2021). Climate change risk and commitments have already been included in several of the above key sectors to achieve the Paris Agreement's targets through strategic plan/ action plan or policies. Some of the important strategies are as follows(Ministry of Environment, 2021).

- National Energy Policy & strategies of Sri Lanka (2019)
- Long-Term Electricity Generation Expansion Plan 2018-2037
- The National Policy on Waste Management 2019
- The National Policy on Sustainable Consumption and Production for Sri Lanka 2019
- Coastal Zone and Coastal Resource Management Plan 2018
- National REDD+ Investment Framework and Action Plan (NRIFAP) 2017
- Strategic Action Plan for Adaptation of Irrigation and Water Resources Sector for Climate Change 2018
- National Policy on Natural Gas 2019
- National Policy on Disaster Management 2013
- Sri Lanka Disaster Management Plan 2018-2030

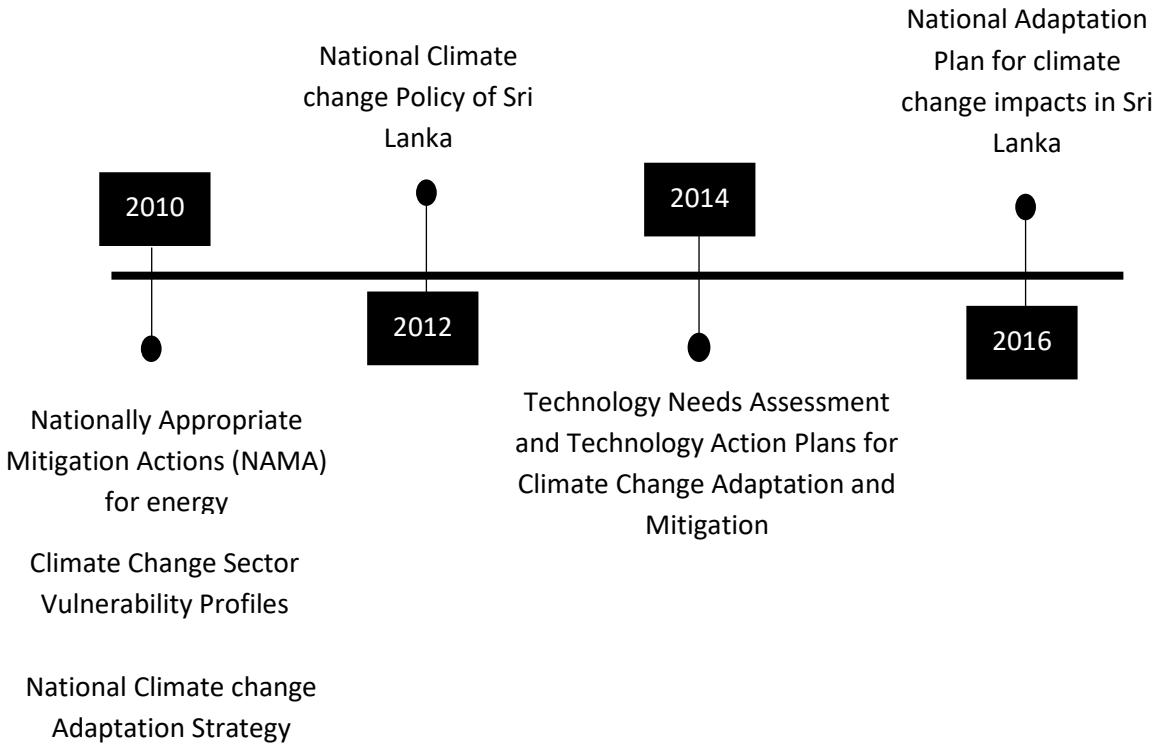

Figure 2 National Policies introduced by Sri Lanka in response to climate change

The following institutes, programmes and centres are specifically dedicated to addressing Climate Change in Sri Lanka:

1. In 2002, the Ministry of Environment received funding from GEF to implement a climate change capacity building programme for young scientists.
2. In 2008, the establishment of the Climate Change Secretariat (CCS) at the Ministry of Environment. CCS is the national focal point on climate change-related matters and

takes the lead to liaise with stakeholders from public, private and civil society (Pallawala, 2018).

3. National Expert Committees: CCS has established two expert advisory committees comprised of sector experts to provide advisory guidance to CCS and the ministry.
4. In 2010, the Ministry of Environment implemented the first National Climate Change Strategy 2011-2016 (Ministry of Environment, 2010).
5. In 2012, Sri Lanka introduced the first National Policy on Climate Change (Ministry of Mahaweli Development & Environment, 2012).
6. Inter-Ministerial Coordination Committee: CCS facilitated the establishment of the Inter-Ministerial Coordination Committee on climate change to coordinate among other line ministries. This committee provides a platform to coordinate national-level climate change-related matters. Since then, this committee has been renamed as Inter-Agency Coordination Committee (Pallawala, 2018).

From the above key initiatives, CCS, established in 2008, is the focal point for coordinating and mainstreaming the actions towards climate change(Climate Change Secretariat, 2016; Government of the Democratic Socialist Republic of Sri Lanka, 2018; The Climate Change Secretariat of Sri Lanka, 2014). Moreover, CCS is responsible for developing NDC and NAP (*Climate Change Secretariat*, n.d.; Daze, 2019; The Climate Change Secretariat of Sri Lanka, 2014). The CCS has the following objectives and functions(*Climate Change Secretariat*, n.d.),

- Objectives: -
    - Provide a national platform to address climate change issues at the national level to incorporate them into the development process.
    - Function as a dedicated institutional mechanism to undertake climate change responses, including developing relevant policies and programs.
    - Liaise with line agencies at national and sub-national levels for identifying priorities and developing mechanisms to implement national policies on climate change.
    - Facilitate climate change-related research and distribution of research outcomes to trigger policy reforms and actions.
    - Liaise with the Secretariat to the UNFCCC and be responsible for preparing documentation in connection with Sri Lanka's participation at COP meetings and other climate change-related forums.
    - Provide a one-stop facility to disseminate information relating to the implementation of the decisions taken at meetings of UNFCCC-COP, Kyoto Protocol and Paris Agreement.
    - Serve as Designated Authority for different climate change-related bodies

- Functions: -
    - National Focal Point to the UNFCCC, Kyoto Protocol and Paris Agreement.
    - Designated National Authority for Clean Development Mechanism (CDM).

- National Designated Authority for Green Climate Fund (GCF).
- National Designated Entity for Climate Technology Center and Network (CTCN).
- Formulation of policies on climate change and facilitation for implementation
- Facilitation for implementing appropriate adaptation measures to meet adverse effects of climate change
- Initiation of measures that would mitigate emissions of GHG and enhance sinks and reserves
- Submission of national communications and Biennial Update Reports (BURs) on climate changes to the UNFCCC
- Development of national inventories on GHG emissions and baselines
- Promotion of technology transfers in all relevant sectors
- Promotion of scientific, technological, socio-economic, and other research on climate change
- Dissemination of information and knowledge on climate change and capacity buildings

For each of the sectors mentioned in the NAP, members of the CCS coordinate sectoral climate groups. Stakeholders from the government, private sector, Non-Governmental Organizations (NGOs) and community Organizations are forming the groups(Climate Change Secretariat, 2016; Daze, 2019). They aimed to coordinate, implement and monitor the sectoral adaptation actions in accordance with the NAP. In addition, government ministries such as the Ministry of Agriculture and the Ministry of Irrigation and Water Management are delegated to implement adaptation measures in their respective sectors(De Zylva, 2017; Ministry of Mahaweli Development and Environment, 2016a). A national working group for identifying and implementing cross-cutting adaptation needs is also led by CCS. Also, regional groups are being established at the sub-national level and a forum for civil society organizations to coordinate community-based interventions (Daze, 2019). Figure 3 demonstrates the coordination relationship of the CCS with NDC and NAP.

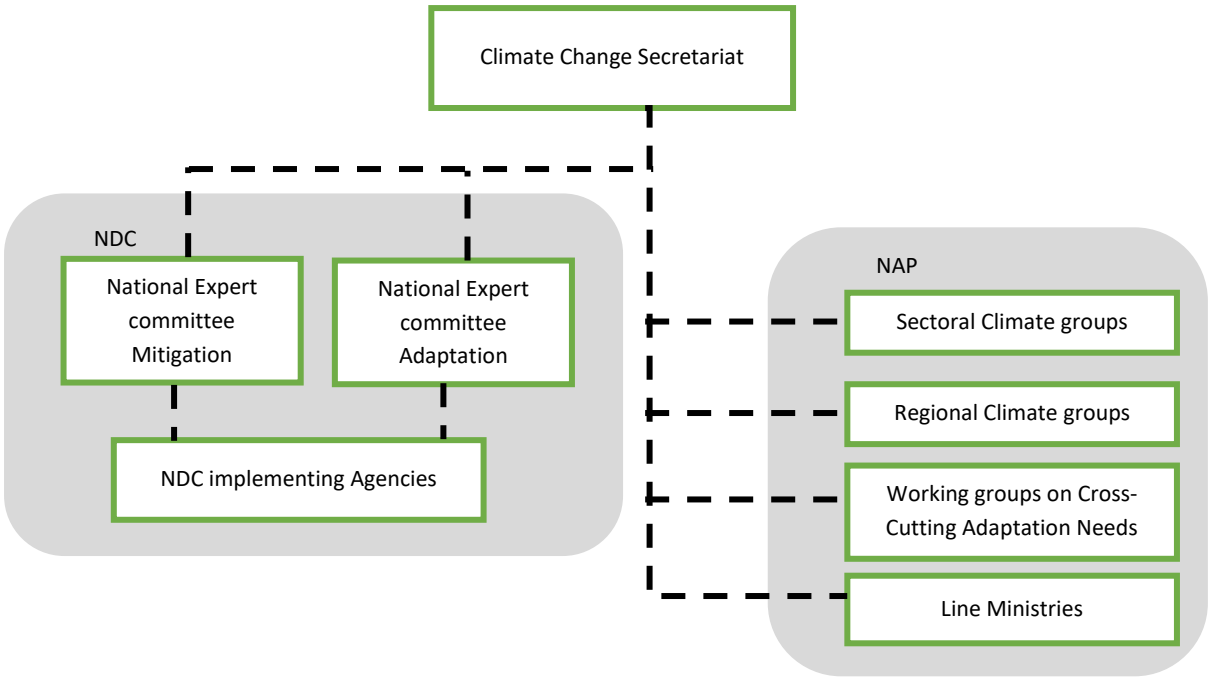

Figure 3 Coordination relationship of the CCS corresponds to implementing NDC and NAP (Adopted from: (Daze, 2019))

Sri Lanka submitted its first nationally determined contributions (NDCs) in 2016. In 2020, the Climate Change Secretariat created an updated version of the NDCs to be submitted to the United Nations Framework Convention on Climate Change prior to the 26th Conference of Parties (Ministry of Environment, 2021). As per the first NDC, several initiatives have been identified in four major areas targeting the Paris Agreement's objectives (Ministry of Mahaweli Development and Environment, 2016b). Table 1 summarizes the main four areas. These NDCs present opportunities by developing partner-supported initiatives on low carbon development pathways for key sectors such as power, transport, industry, waste, and agriculture (Ministry of Environment, 2021). NDCs also outline financial, technology transfer, and capacity building requirements which are in line with Article 2 of the Paris Agreement, in order to adopt a resilient and low-carbon development pathway to upper-middle-income status (Ministry of Environment, 2021).

Table 1 Summary of the four areas addressed by Sri Lanka's NDC (Adopted from; (Ministry of Mahaweli Development and Environment, 2016b))

Focus areas of NDC	Summary
Mitigation	Reduction of GHG emission in energy, transportation, industry, waste and forestry compared to the Business-As-Usual (BAU) scenarios
Adaptation	Increasing climate change resilience in the most vulnerable communities, sectors, and locations. Human health, food security (agricultural, livestock, and fisheries), water and irrigation, coastal and marine, biodiversity, urban infrastructure and human

	settlement, tourism, and recreation will all be prioritized in the adaptation process. Prioritization is given to adaptation projects that have mitigating co-benefits.
Loss and Damages	A local mechanism is designed in accordance with the International Mechanism for Loss and Damage to address concerns relating to losses and damages caused by extreme weather events.
Means of Implementation	The execution of Sri Lanka's NDCs takes into account external help for finance, technology development and transfer, and capacity building in the above sectors.

2.3 National statement on progress in implementing the Paris Agreement

The updated version of the NDCs is supposed to steer development, especially post-Covid economic recovery and livelihood needs, along a low-emission trajectory, focusing on reaching high income and human development in the next decade (Ministry of Environment, 2021). The NDCs are built upon recent studies on climate risks and vulnerability, including the third draft of National Communication, a draft of Climate Change Risk in Sri Lanka – Sector Risk Profile, Marginal Abatement Cost Curves analysis for energy, a draft of Low-Carbon Development Strategy, a draft of National Disaster Management Plan and the National REDD+ Investment Framework and Action Plan (Ministry of Environment, 2021). The conceptualization of low emission and high income, and high human development has been very thorough and consistent with the country's necessities.

However, there are not many studies on the implementation of the formulated policies and their results. Especially, Policy changes on renewable energy need strong monitoring to ensure expected benefits and may otherwise lead to losses. Financing needs for adaptation are enormous and cannot be borne solely through public investment. Sri Lanka has in the past accessed climate financing from climate funds, bilateral and multilateral agencies (Ministry of Environment, 2021). However, this funding has not met the country’s demand. The indications of financing requirements for adaptation sector resilience building are expected to be indicated in National Adaptation Plan (NAP) and NDC costing exercises in the future (Ministry of Environment, 2021). It is important that such efforts highlight the costs related to built environment needs such as wind turbines, solar panels, and power grids for storage. The NDCs highlight that the power sector has already enabled private investment in renewable energy by supportive policy instruments such as feed-in tariffs, net metering and net accounting (Ministry of Environment, 2021). Energy efficiency has been incentivized and been supported through financial incentives (Ministry of Environment, 2021). In key municipalities, waste-to-energy investments and waste composting measures have substantially increased (Ministry of Environment, 2021). Regulatory restrictions have been put in place to force large-scale waste producers to invest on in-site waste treatment and management (Ministry of Environment,

2021). It is mentioned that some larger industrial production facilities are going for “carbon-neutrality”, and the industrial sector has pledged to adopt “green or eco” concepts when investing in new industrial parks (Ministry of Environment, 2021).

2.4 Specifics of the Paris Agreement and the built environment

The Paris Agreement relates to the built environment in many ways. Furthermore, manmade structures constitute the built environment, often the weakest linkages and the most dangerous sites during disasters. Especially in the coastal environment, the built environment and the surrounding physical infrastructure, coastal industries, and marine ecosystem are the main victims of climate change. On the other hand, the built environment becomes an agent of enhancing climate change through emissions and land use moderations. The updated NDCs of Sri Lanka (2021) recognizes the importance of low emission adaptations within the built environment industry. There are several sectors where the stated adaptation priorities contribute towards Green House Gas (GHG) emissions reduction (Ministry of Environment, 2021). These include the urban planning and human settlement sector, water sector and the tourism sector, where aspects such as sustainable and green building design, sustainable raw material for building, increased tree cover, energy efficiency and reduced pumping minimize damage to both environment and the climate (Ministry of Environment, 2021). Sri Lanka proposes establishing eco-industrial parks and villages from 2021-2030 and transforming existing industrial parks, incorporating green industrial concepts (Ministry of Environment, 2021). NDCs outline plans to incentivize GHG reduction of clinker production in the cement industry, make amendments to standards of the Sri Lanka Standard Institute (SLSI) for cement production, and facilitate industries in selected sub-sectors to adopt relevant ISO systems that focus on GHG emissions reduction (Ministry of Environment, 2021). They also plan to introduce tax incentives to promote the acquisition of sustainable technologies, a national policy to address siting of industrial parks and stand-alone industries, and new concepts like circular economy, industrial ecology, and digitalization (Ministry of Environment, 2021). Sri Lanka also seeks climate financing and technology transfer support towards switching to the usage of renewable energy resources. This may include expanding energy storage systems, upgrading its electricity distribution network, efficient and effective waste to energy systems, modernizing public transportation, upgrading road and railway networks, among many other changes (Ministry of Environment, 2021).

The Government has taken multiple measures to address climate risk and vulnerability through investments in developing and fortifying the eroding coastline, expanding irrigation and trans-basin diversions to moderate drought and developing meteorological capacity and early warning capacity for floods/landslides (Ministry of Environment, 2021). The coastal areas of Sri Lanka are exposed to Sea Level Rise (SLR) and coastal erosion and also contain many industries and industrial hubs that could be destroyed by extreme climatic events (Nianthi& Shaw, 2015).

The coastal areas of Sri Lanka are also densely populated, with many of the urban cities, including the capital city of Colombo been located there (Nianthi & Shaw, 2015; Baba, 2010). Scholars have also pointed out certain gaps in early warning, mitigation and mechanisms to build the resilience of coastal communities (Jayasiri et al., 2018; Perera et al., 2020; Hettiarachchi et al., 2018). Studies and surveys have revealed that communication networks and mechanisms of early warning are poor, gaining less trust of the people (Perera et al., 2020). The NDCs mention overall plans to assess river floods and mitigation measures and adopt optimal shoreline management with solutions to prevent coastal erosion in areas most vulnerable to SLR (Ministry of Environment, 2021). Restoration of coastal ecosystems is among the proposed solutions (Ministry of Environment, 2021).

NDCs also list plans to restore small tank cascades and individual tanks, apply soil conservation measures, and enhance early warning and risk management mechanisms (Ministry of Environment, 2021). According to the UNFCCC, there are three forms of climate change-induced population movement: displacement, migration, and planned relocation (Ministry of Environment, 2021). Migration related analysis should be included in adaptation sectors including health, and urban settlements (Ministry of Environment, 2021). There is ongoing resettlement of communities living in landslide and flood-prone areas. Moreover, disaster exposure and vulnerability are increasingly factored into the design and implementation of development projects such as roads, reservoirs and new settlements (Ministry of Environment, 2021). NDCs also mention plans to upgrade passenger transport systems, including the long ailing railway and expressway network, and to introduce modern conveyance systems in congested urban centres (Ministry of Environment, 2021). NDCs also propose to improve the quality of the growing stock of natural forests and plantations (Ministry of Environment, 2021).

2.5 Carbon emissions and the building industry – policy and action

Figure 3 and Figure 4 show GHG emissions and CO2 in Sri Lanka during 1990-2018. As it can be noted, the major CO_2 and GHG emitters in Sri Lanka are energy, electricity, transport, industry, waste, forestry, and agriculture. Therefore, mitigations mentioned in NDCs are concerned more with reducing GHG and CO_2 in these key sectors (Ministry of Environment, 2021; Ministry of Mahaweli Development and Environment, 2016b). The following sections discuss the above sectoral policy and actions related to energy and electricity, transport, industry, waste and forestry sectors that have been considered to mitigate the climate actions.

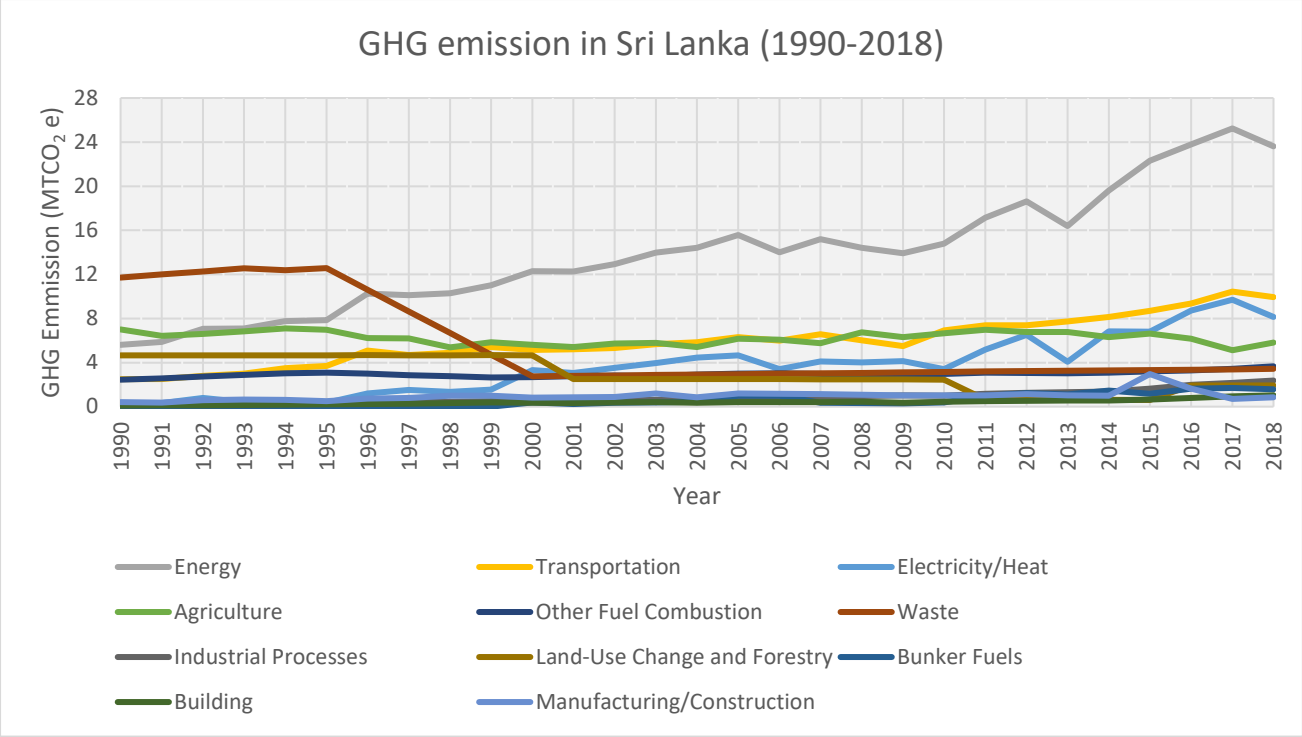

*Figure 4 Historical GHG Emission in Sri Lanka (Source: (*Data Explorer | Climate Watch*, n.d.))*

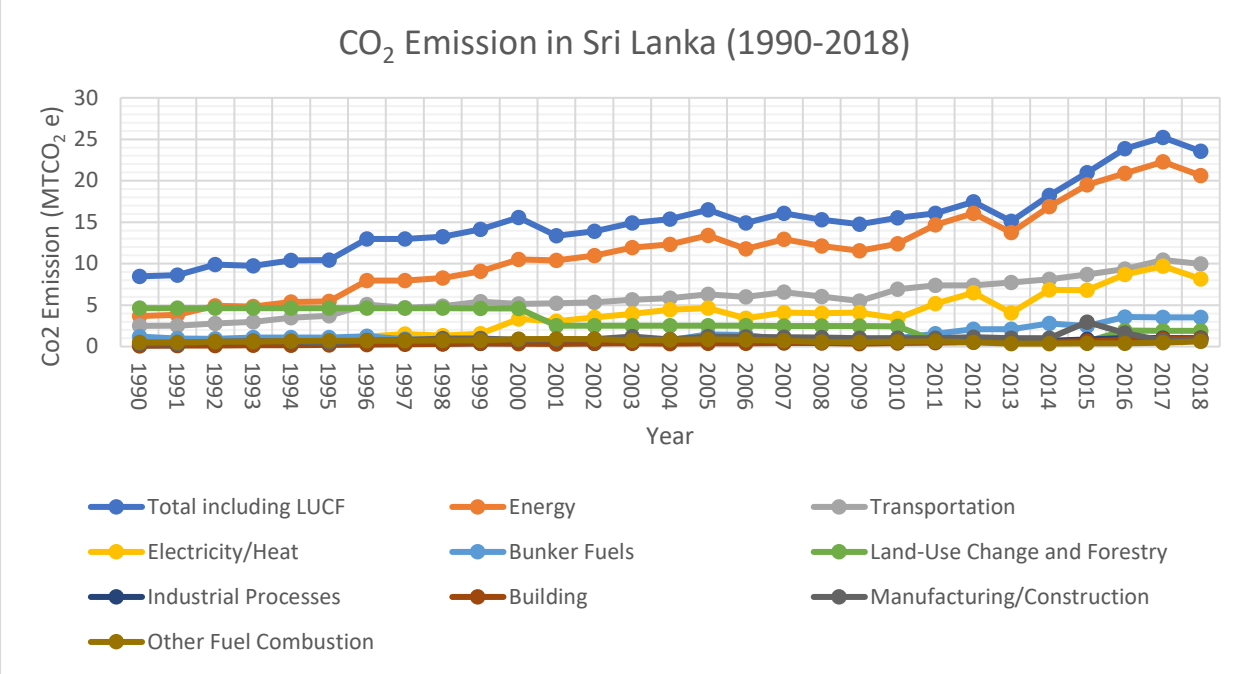

*Figure 5 Historical CO_2 emission in Sri Lanka (source: (*Data Explorer | Climate Watch*, n.d.))*

2.5.1 Electricity and Energy sector: -

As aforementioned, the energy and electricity sectors account for the major portion of total CO2 emissions in Sri Lanka. Recently, Sri Lanka has taken several initiatives to create sustainable energy programs. National Energy Policy & strategies of Sri Lanka, 2019, is the key principal policy that guides the country toward sustainable energy(Ministry of Environment, 2021; Ministry of Power, 2019). The Energy Policy (2019) includes key principles that direct the government to maximize the development of indigenous renewable energy sources, diversify the generation mix, and reduce reliance on imported fossil fuels(Ministry of Power, 2019). The Long-Term Electricity Generation Expansion Plan 2018-2037, developed by Ceylon Electricity Board, accounts for the GHG and CO2 emission for future electricity generation and distribution development(Ceylon Electricity Board, 2018). Following the above policies and actions, the following key interventions have been planned to implement for reducing GHG emissions up to 2030(Ceylon Electricity Board, 2018; Ministry of Environment, 2021; Ministry of Power, 2019).

- Developing new large and small hydropower facilities to expand the hydro-power base to its full capacity
- Developing new wind power generation facilities in several coastal areas
- Developing solar power generation facilities utilizing different methods (e.g., Solar rooftops, small- and large-scale solar PV power plants)
- Use of biomass and municipal solid waste as an energy source for power generation
- To aid increased renewable energy integration, facilitate pilot-scale projects that employ novel renewable energy sources that have not yet reached commercial maturity and additional grid supporting infrastructures (e.g., Behind the Meter (BtM) and grid-scale energy storage systems.
- To handle a higher level of intermittent and weather-dependent renewable energy in the power generating system, pursue the development of pumped storage hydropower plants.
- Continuous improvement initiatives for the loss reduction in transmission and distribution network
- Reducing the usage of fossil fuel by converting existing fuel oil-based combined cycle power plants to use natural gas
- Developing new natural gas plants as an alternative to coal power plants
- Implement Demand Side Management activities through a five-year national Energy Efficiency Improvement and Conservation (EEI&C) programme
- To accelerate the implementation of renewable energy development and energy efficiency improvement programs, introduce supportive policy measures (e.g., tax incentives, low-interest financing)
- Participating in effective carbon trading arrangements to encourage the transition to renewable energy sources.

As stated in the" Sri Lanka Updated NDCs," these interventions reduce the GHG emissions against the BAU scenario by 25% in the electricity and energy sector. Figure 5 presents the forecasted reduction of GHG emissions for 2021-2030.

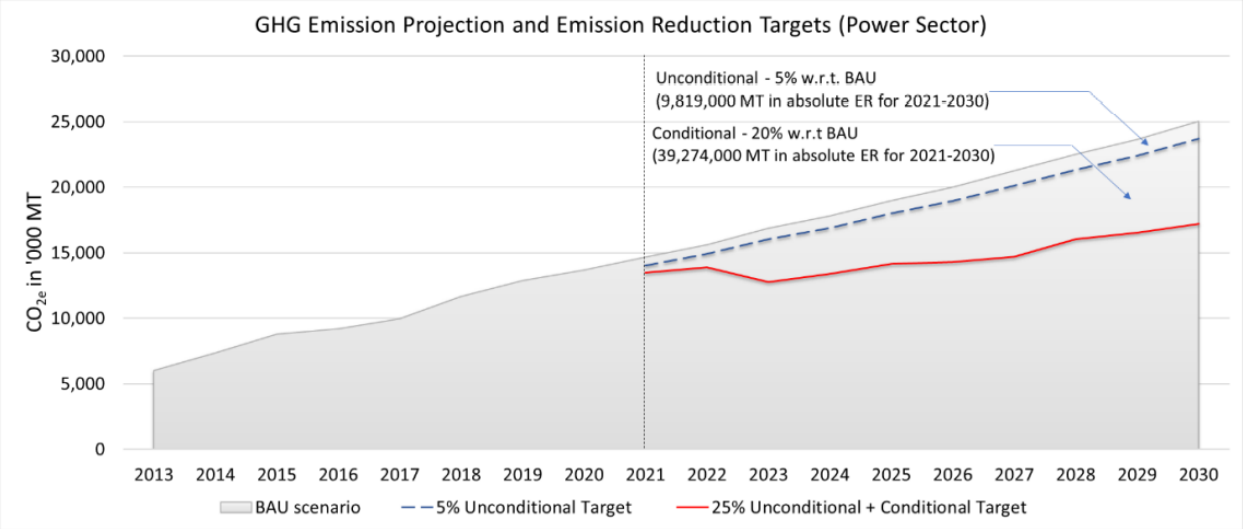

Figure 6 Emission reduction projections in the Electricity and energy sector (Adopted from: (Ministry of Environment, 2021))

2.5.2 Transportation Sector: -

The transport sector is one of the major GHG emitters in Sri Lanka. Road, railways, Air and Sea Transportation are major modals in the transportation sector in Sri Lanka. In light of the foregoing, synergistic approaches to achieving GHG mitigation targets in the transportation sector are required. In the transportation sector, GHG emissions can be decreased by:

- Avoiding/reducing Journey
- Modal Shifting towards lower carbon transport systems
- Improve the energy efficiency of transport modes and vehicle technologies
- Improve fuel quality by reducing the carbon intensity of fuels(Ministry of Mahaweli Development and Environment, 2016b).
- Following the Paris Agreement, Sri Lanka has implemented a set of initiatives towards achieving Carbon Neutrality in the context of Transportation infrastructure as follows (Climate Change Secretariat, 2017; Ministry of Environment, 2021; Ministry of Mahaweli Development and Environment, 2016a),
- Establishing the following transportation system by 2030
    - Urban Transport Master Plans
    - Intelligent Transport Systems based bus management system
    - Canal transport system
- Upgrading the fuel quality standards
- Reducing unproductive transport systems from current usage
- Shift passengers from private to public transport modes and enhance the efficiency and quality of public transport modes

- Implementation of international laws and regulations on maritime safety and security related to climate change and maintaining international standards related to climate change in maritime transportation
- Adopting new emission standards to reduce GHG emissions
- Shifting to electric and hybrid vehicles
- Adopting methods to reduce traffic congestion (Canal transportation systems, Centralized traffic management systems, highways, Transporting heavy loads by railway)

As stated in the" Sri Lanka Updated NDCs," these interventions reduce the GHG emissions against the BAU scenario by 4% in the transportation sector. Figure 6 presents the forecasted reduction of GHG emissions for 2021-2030.

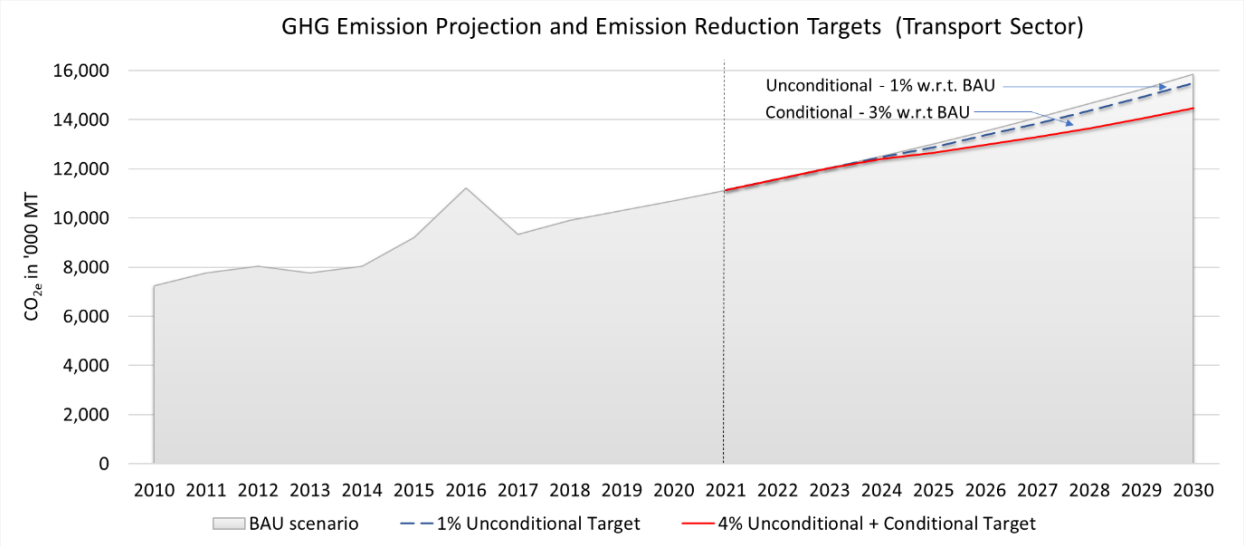

Figure 7 Emission reduction projections in the Transportation sector in Sri Lanka (Adopted from (Ministry of Environment, 2021)

2.5.3 Industrial Sector: -

The industry sector in Sri Lanka significantly contributes to the country's GDP. Textile, Apparel, and tea manufacturing are the most significant export-oriented sub-sectors in the industry sector. By adopting the Paris Agreement, Sri Lanka focuses on creating an industry sector with a minimal adverse impact on the Environment. Cement, manufacture, and lime production are the major contributors to GHG emissions, aside from those caused by energy consumption. Industrial energy is derived from various sources, including biomass, petroleum oil, and electricity(Ministry of Mahaweli Development and Environment, 2016b). It should be emphasized that most industries employ outdated and high-energy-consuming technology that should be examined and replaced with newer technologies(Ministry of Environment, 2021). Sri Lanka has determined national contributors in the context of the industrial sector towards achieving the Paris agreement as follows,

- Modernizing and facilitating industries to follow recognized standards related to GHG emission reduction

- Continue fuel switching to biomass in industries
- Improve the efficiency of industrial energy/water/ raw materials
- Introduce and promote tax structures
- Implementing reward system to encourage the industries to reduce GHG emission
- Eco-Industrial Parks (EIPS)
- Adopting the National Green Reporting system
- Application of cleaner and eco-efficient production
- Introducing highly efficient motors

With these contributions, Sri Lanka is expected to reduce GHG emissions by 7% in the industry sector, as presented in Figure 7.

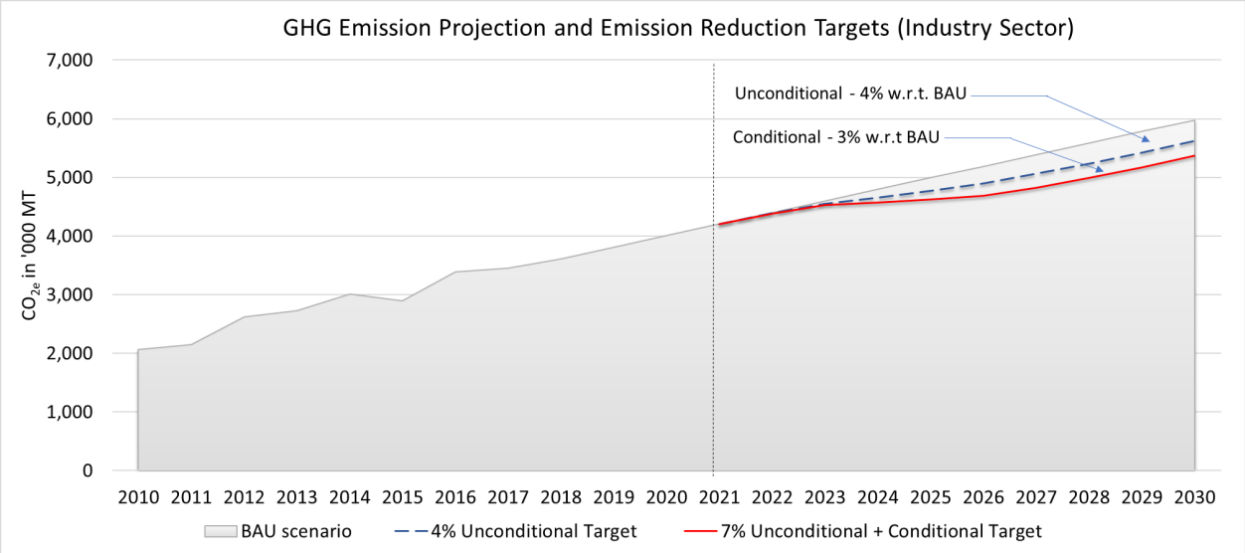

Figure 8 Emission reduction Projection in the Industry sector (Adopted from: (Ministry of Environment, 2021))

2.5.4 Forestry Sector: -

The ecosystem plays a vital role in combatting the adverse effects of climate change(Rakopyan, 2021). The critical function that trees play in taking carbon from the atmosphere through a process known as carbon sequestration is now widely acknowledged as a viable method of reducing rapidly rising atmospheric carbon(Anjali et al., 2020). Forests, in particular, aid in the removal of enormous amounts of CO2 from the atmosphere and serve as a carbon sink. Deforestation and forest degradation have been identified as major contributors to global warming due to forests' important role in absorbing high levels of carbon in the atmosphere(Anjali et al., 2020; Rakopyan, 2021). Sri Lanka has proposed many regulatory frameworks and actions aiming to reduce GHG emissions by increasing the forest cover in the country(Climate Change Secretariat, 2014; Ministry of Environment, 2021; Ministry of Mahaweli Development and Environment, 2016b). As stated in the NDCs, these actions include,

- Increasing forest cover from 29% to 32%
- Improve the quality of natural forests and forest plantations' growth stock.

- Restoration of degraded forest
- Increasing river basin management in major rivers
- Forestation of unused private properties and tea plantations on the outskirts of town
- Integrating green spaces into urban areas
- Launching efficient forest monitoring systems

Implementing the above initiatives in the forestry sector is assumed to gain the 7% increment of carbon sequestration capacity against the BAU, as presented in Figure 8 (Ministry of Environment, 2021).

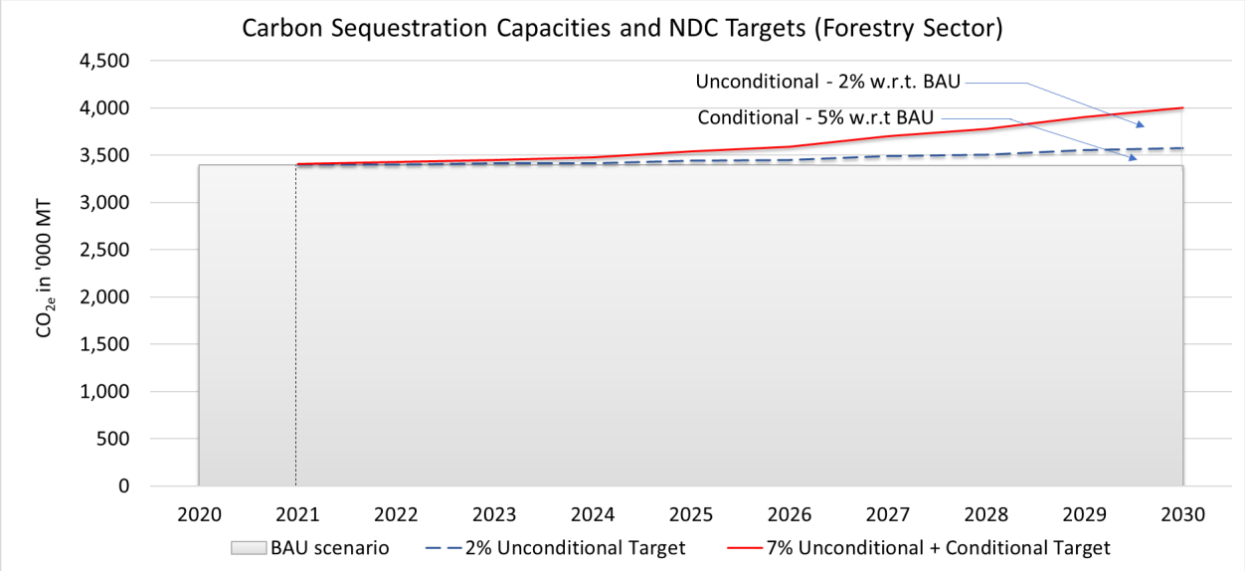

Figure 9 Carbon Sequestration capacity projection in the forestry sector(Adopted from: (Ministry of Environment, 2021))

2.5.5 Waste Management

During the next decade, the generation of municipal solid waste in Sri Lanka is anticipated to increase due to population growth, the rapid development of infrastructure, urbanization, growth in the industry, increment in income per capita, high living standards and transformation of lifestyle(Climate Change Secretariat, 2015; Ministry of Environment, 2011). Therefore, this calls for a rigid national action plan toward solid waste management. Sri Lanka has a political and regulatory structure for waste management(Ministry of Mahaweli Development and Environment, 2016a). It includes environmental policies, plans, and standards. Waste management technologies and processes are widely accepted. However, technological innovations and tactics to streamline and modernize existing waste management practices have yet to be implemented(Ministry of Environment, 2021; Ministry of Mahaweli Development and Environment, 2016a). In order to achieve the Paris Agreement's target, Sri Lanka has planned several initiatives in the context of waste management.

- Implementing a proper collection mechanism at the household level
- Implementing waste to energy program
- Implementing production of organic fertilizer programs using waste

- Upgrading the waste collection mechanism
- Monitoring of waste management activities
- Systematic management of the different types of waste(Ministry of Mahaweli Development and Environment, 2016b)

By initiating these actions, Sri Lanka expected to reduce the GHG emission in the waste sector by 11% against the BAU to assist in achieving the Paris Agreement (Ministry of Environment, 2021).

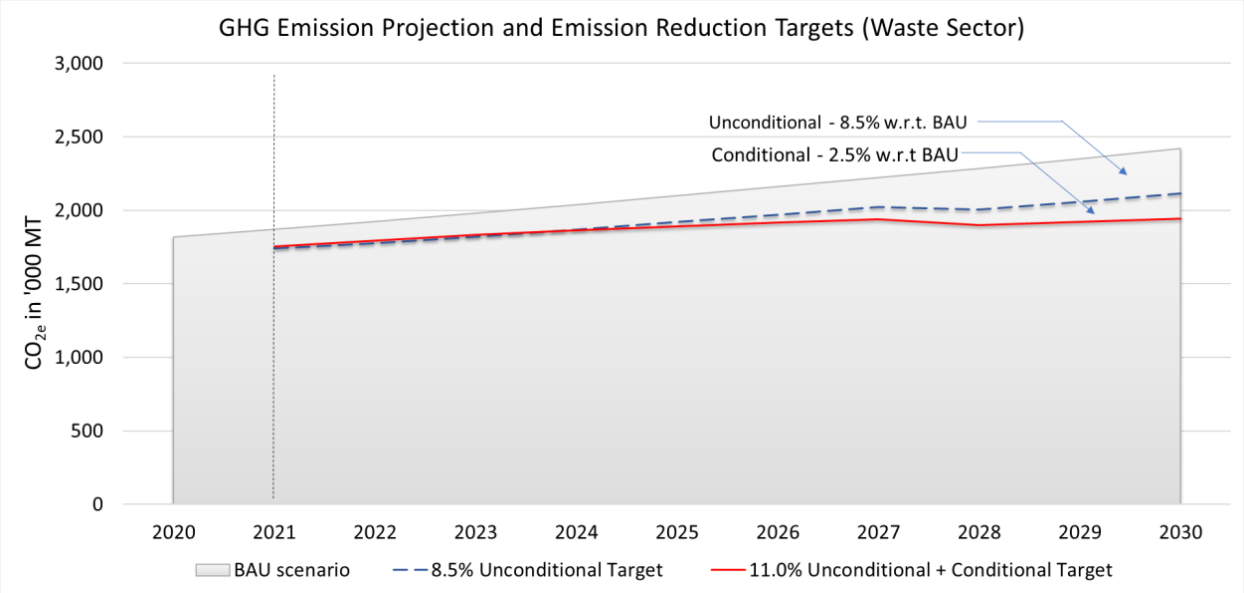

Figure 10 Emission reduction projection in waste sector(Adopted from: (Ministry of Environment, 2021))

2.6 Opportunities and constraints of implementing the Paris Agreement

The Paris Agreement's goals of keeping global mean temperature rise well below 2 0C above pre-industrial levels and pursuing efforts to limit warming to even 1.5 0C necessitate a rapid reduction in greenhouse gas emissions around the world. Hence, the Paris Agreement has brought developed and developing country participants many opportunities on various levels(Key Aspects of the Paris Agreement | UNFCCC, n.d.). As a developing country, Sri Lanka has many opportunities to implement Paris Agreement. However, the GHG emission in Sri Lanka is not significant compared to other countries(Climate Change Secretariat, 2017, this figure will increase significantly with development. Therefore, making proactive strategies to avoid GHG emissions at present undoubtedly assist in reducing anticipated GHG emissions(Climate Change Secretariat, 2016; Ministry of Power, 2019).

On the other hand, according to the Global Climate Risk Index 2019, Sri Lanka was ranked second among the countries most impacted by climate change in 2017(Eckstein et al., 2018). Furthermore, Sri Lanka is considered vulnerable to climate change impacts due to various political, geographic, and social factors, ranking 100th out of 181 countries in the 2017 ND-GAIN Index(World Bank Group & The Asian Development Bank, 2020). The ND-GAIN Index assigns

a ranking to 181 countries based on their vulnerability to climate change and other global threats, as well as their readiness to boost resilience(World Bank Group & The Asian Development Bank, 2020). Also, the other objective of the Paris agreement is Climate Change Adaptation. As aforementioned, Sri Lanka experienced many adverse effects due to climate change. Therefore, CCA is crucial for Sri Lanka. Hence, there are many opportunities for implementing Paris Agreement on various dimensions social, economic, environmental, and technical(Climate Change Secretariat, 2015, 2016; Nianthi & Shaw, 2015; Ranasinghe & Jongejan, 2018).

As highlighted above, NDCs by the Sri Lankan government highlight key changes for a green and sustainable economy centred on the wellbeing of people. If implemented correctly, it could provide solutions to many economic, environmental and social issues faced by the country. However, there is a noticeable gap between the outlining of policies and the actual implementation of these policies across most sectors in Sri Lanka. The lack or weak implementation of proposed changes in the NDCs would be tragically negligent of the wellbeing of Sri Lankans as well as the ecosystem. Research done by Asia-Pacific Network for Global Change Research (2019) has noted that gaps in policies and laws, institutions and coordination, capacities and awareness, finance, and technology, as well as socioeconomic and other factors, have emerged in the implementation of NDCs in Bangladesh, Nepal, and Sri Lanka. This research highlights the need for enhanced coordination with sectoral ministries and entities for the implementation of NDCs (Asia-Pacific Network for Global Change Research, 2019). It is further noted that there seems to be a lack of an overarching coordinating body and coordination in the implementation of laws and policies (Asia-Pacific Network for Global Change Research, 2019). Another notable factor is the lack of policies and lack of implementation of policies and laws to prevent unauthorized construction and land use, and marine crimes (Asia-Pacific Network for Global Change Research, 2019). Although there are laws including the Forest Conservation Ordinance 1908 amended by Act 65 of 2009 and the Fauna and Flora Protection Ordinance 1938 amended by Act no. 49 of 1993, loss of forest cover amounts to 50% to 40% of forest cover in approximately 50 years (Asia-Pacific Network for Global Change Research, 2019). The increase and demand for land for industries and settlements have reduced the forest cover and prevented the effective implementation of existing laws (Asia-Pacific Network for Global Change Research, 2019).

The research also highlights the need to build capacity and enhance the mainstreaming of climate action in ministries and the need for coordination between authorities and local stakeholders such as farming or coastal communities (Asia-Pacific Network for Global Change Research, 2019). Consultations and interviews have pointed towards a lack of a coherent coordination body for coastal mapping and issues like coordination for pesticide poisoning and crop insurance (Asia-Pacific Network for Global Change Research, 2019). In the meantime, the overlapping of institutions and the duplication of laws make the implementation of NDCs more difficult (Asia-Pacific Network for Global Change Research, 2019). This is in addition to the lack of proper research, financial and technological gaps, absence of data or data sharing mechanisms in many sectors (Asia-Pacific Network for Global Change Research, 2019). The APN (2019) suggests leveraging additional private sector funding and enhancement of public-

private partnerships as solutions. The researchers have also suggested that Sri Lanka and the other two countries could benefit from regional cooperation and the exchange of lessons learned. Therefore, the implementation of the Paris Agreement can be looked at as an opportunity for sub-regional, regional, and global cooperation, as it is a mechanism to address climate change.

3 The Sustainable Development Goals

3.1 Country statement of commitment to the SDGs

UN member states, including Sri Lanka, universally accepted the 17 sustainable development goals (SDG) and the 2030 Agenda in 2015 (Presidential Expert Committee, 2019). Within this framework, all countries were expected to set out their vision for 2030 (Presidential Expert Committee, 2019). Sri Lanka was better positioned to successfully implement and achieve the SDGs because it has reflected its performance under Millennium Development Goals, especially regarding health, education, and poverty. Also, the conclusion of the three-decades-long conflict has paved a solid foundation for the country's sustainable development (Ministry of Sustainable Development, 2018). The Sustainable Sri Lanka 2030 Vision laid out a strategic document during the tenure of President Maithripala Sirisena in 2017 (Presidential Expert Committee, 2019). This report envisioned that Sri Lanka would become a sustainable, upper-middle-income Indian Ocean hub (Presidential Expert Committee, 2019). The document outlined the need for a “Balanced Inclusive Green Growth”, a consistent policy framework and systems for efficient implementation of such policy (Presidential Expert Committee, 2019).

Sri Lanka has taken several initiatives to facilitate and advance the implementation of the SDGs since the endorsement of the 2030 agenda. Reflecting the country’s commitment to the SDGs at its highest legislative body, a Parliamentary Select Committee on Sustainable Development has been established to coordinate the parliament's activities with respective ministries and provide expert advice. Furthermore, the Ministry of Sustainable Development and Wildlife was established in 2015 as the line ministry for sustainable development, which acts as the focal point for coordinating, facilitating, and reporting on SDG implementation in Sri Lanka. With the enactment of the Sustainable Development Act No. 19 of 2017, the foundation for a well-organized institutional mechanism has been laid utilizing the existing public institution system to implement the SDGs (Ministry of Sustainable Development, 2018).

Some of Sri Lanka’s policy frameworks, such as Vision 2025, PIP 2017-2020, and the ‘Blue Green’ Budget of 2018, further reflects the country’s adherence to sustainable development principles. The PIP 2017-2020 provides for the implementation of social protection schemes

for all necessary segments in the country. It has identified environmental management as a priority area, emphasizing the need to facilitate economic growth while also taking appropriate measures to ensure the quality of the environment. The Vision 2025 envisions the transformation of Sri Lanka as a knowledge-based, competitive, social market economy and identifies the environment as a development priority under the theme of agriculture and sustainable development; the 'Blue Green' Budget of 2018 emphasizes the Government's vision to explore the full economic potential of the oceans while adopting an environmentally sustainable development strategy (Ministry of Sustainable Development, 2018).

"Sri Lanka NEXT - A Blue Green Era" programme launched in January 2016 has also demonstrated commitment to both the Paris Agreement on Climate Change and Sustainable Development Goals (The Climate Change Secretariat Sri Lanka, 2019). The programme expects to promote sustainable development in Sri Lanka through Blue Green Economic initiatives while creating awareness among key stakeholders and the general public to actively participate in achieving economic and environmental sustainability (The Climate Change Secretariat Sri Lanka, 2019). The incumbent Central Government of Sri Lanka (GoSL), formed in August 2020, released a National Policy Framework titled "Vistas of Prosperity and Splendour", in which the Sustainable Development Goals (SDGs) are referenced under Chapter 02. It strategized to restructure the cabinet ministries and to formulate a systematic plan to achieve the SDGs (The Sustainable Development Council Sri Lanka, 2021). The Sustainable Development Council of Sri Lanka (SDCSL) released the draft for the "National Policy and Strategy on Sustainable Development" in 2020 (The Sustainable Development Council Sri Lanka, 2021).

3.2 Reflections on Goal 9 – nationally and in coastal zones if applicable with a focus on opportunities and constraints of meeting the goal's targets

Goal 9 of the SGDs seeks to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Two Cabinet Ministries, namely the Ministry of Technology (MoT) and the Ministry of Industries (MoI), are directly aligned with SDG 9. The Sustainable Sri Lanka 2030 Vision report envisioned a pollution-free, clean and green environment with high quality of life for its people and inclusive green growth (Presidential Expert Committee, 2019). It promotes sustained economic growth that is socially equitable and ecologically sound with peace and stability (Presidential Expert Committee, 2019). The Blue-Green Development Strategy is highlighted as a pathway to such visions (Presidential Expert Committee, 2019). The targets established included the shift to renewable energy, planning for pollution-free transport in the long term with long-range transport systems, implementation of zonal arrangements as per the UDA plan for siting industries, and effective land use in setting up housing schemes, condominiums and commercial areas (Presidential Expert Committee, 2019). The implementation of green building guidelines for public sector buildings, proposed green public procurement plan and development of eco villages are also

proposed (Presidential Expert Committee, 2019). The report highlighted that the need to replace certain non-renewable raw materials and energy sources with greener materials and energy offer opportunities to open new lines of production and service provision (Presidential Expert Committee, 2019). Sustainable resource extraction causes less damage to the environment, thereby contributing to the resilience of such environments.

The updated NDCs of Sri Lanka seek to enhance the resilience of human settlements and infrastructure through the mainstreaming of climate change adaptation into national, sub-national and local level physical planning (Ministry of Environment, 2021). The NDC proposal to establish a climate-resilient built environment includes details such as reviewing and updating climate-resilient design strategies, updating and enforcing existing rules and regulations to prevent built environments in vulnerable areas to climate change, and including sustainable built environment concepts into Architecture and Engineering curricular (Ministry of Environment, 2021). To minimize the impact of SLR and erosion on coastal settlements and infrastructure, the NDCs suggest designs that consider future SLR, demarcation of protected areas to facilitate for shifting urban densification and the implementation of risk management plans for existing coastal infrastructure and settlements (Ministry of Environment, 2021). The Sustainable Sri Lanka 2030 Vision report also pointed out that lack of access to social security and increasing costs of health, education, and transport creates a sense of social exclusion and relative deprivation for the informal sector workers (Presidential Expert Committee, 2019). It recommends evidence-based social policies backed by adequate funding to address issues of social insecurity and social exclusion (Presidential Expert Committee, 2019). The report highlights the need for constitutional reforms to devolve governance responsibilities to provincial and local authorities to reduce centralized control (Presidential Expert Committee, 2019). Addressing existing disparities and marginalization may prove beneficial to sustainable development and industrialization in Sri Lanka.

3.3 Reflections on Goal 11 - nationally and in coastal zones if applicable with a focus on Opportunities and constraints of meeting the goal's targets

Goal 11 of the SGDs seeks to make cities and human settlements inclusive, safe, resilient and sustainable. Threats from climate change to urban populations include higher temperatures creating urban heatwaves and heat islands, increased energy consumption for cooling, and increased frequency of weather-related disasters, including flood, drought and landslides (Ministry of Environment, 2021). Drinking water schemes in Sri Lanka are highly vulnerable to SLR (Ministry of Environment, 2021). Studies show that salinization of soil, agricultural lands and freshwater fishing locations are also problems faced by coastal communities due to SLR (Perera et al., 2018). The pandemic revealed many weaknesses in planning human settlements in Sri Lanka, especially congestion in urban settings and lack of waste management. Economic development is inevitably associated with urbanization and this gradual transformation results

in an increased demand for land, water and resources (Presidential Expert Committee, 2019). Sri Lanka has a National Level Plan to guide its physical developments (Presidential Expert Committee, 2019), but there is less awareness of the National Physical Plan which was prepared in 2007 (Presidential Expert Committee, 2019). However, the National Physical Planning Department, as per the mandate given by the Town & Country Planning (Amended) Act of 2000, is updating the National Physical Plan in order to facilitate the development objectives of the Government (Presidential Expert Committee, 2019). This Plan is formulated on four broad policies including:

1. Conservation of the critical land and related resources with their unique landscapes

2. Optimization of the utility of available resources and the infrastructure

3. Direct settlement development into the areas with the highest liveability

4. Exploration of new potentials and the enhancement of the existing (Presidential Expert Committee, 2019)

The NDCs promotes the Guideline for Climate Resilient Human Settlement and Infrastructure developed by the CCS and suggest the incorporation of DRR into urban and human settlement planning (Ministry of Environment, 2021). They further suggest designing infrastructure by giving due consideration to the runoff system, slope stability, soil conservation measures, and disaster risks (Ministry of Environment, 2021). Introducing adaptation measures such as urban zoning, incorporating disaster risk, forest parks, ground water recharge, air passages/wind corridors, and wise wetland management may build resilience in urban areas (Ministry of Environment, 2021).

3.4 Concluding statement on the SDGs

After 2021, Sri Lanka ranked as 87 from 165 countries based on the overall performance with a 68.1/100 country score and 72.6/100 Statistical Performance Index (*Sustainable Development Report*, 2021). IPCC has suggested that sustainable development has the potential to significantly reduce systemic vulnerabilities, enhance the adaptive capacities of people, and promote livelihood security for poor and disadvantaged populations (IPCC, 2018). Oliver-Smith has noted that if hazards and disasters are viewed as integral parts of environmental and human systems, they become a test of societal adaptation and sustainability (Oliver-Smith, 1996). Scholars have noted the necessity to integrate concepts such as DRR(DRR) and Climate Change Adaptation (CCA), as both are used to reduce vulnerability and thereby contribute to the creation of a resilient environment (Dias, Dilanthi, & Haigh, 2018; Dias et al., 2019). The integration of SGDs with the implementations of DRR and CCA seems sensible as addressing existing weaknesses in sustainability and inclusivity would

also increase the resilience of societies and communities. Research by the APN (2019) promotes the strengthening of the integration of SDGs and NDCs to create synergies between both processes and to interlink climate action and development.

4 The Sendai Framework (2015-2030)

4.1 Country statement of commitment to the Sendai Framework

Asia is home to 80% of the world's natural disasters, and countries across the region are embracing the Sendai Framework's shift in emphasis from disaster management to disaster risk management, with the goal of eliminating or reducing the impact of underlying risk drivers like poor urban planning, non-compliance with building codes, and destruction of eco-systems (DMC, 2019). The Sendai Framework for DRR 2015-2030 was the first significant agreement to commit to take concrete steps to protect development elements and gains from disaster risks. It was accepted during the United Nations' Third World Conference on Disaster Risk Reduction in Sendai, Miyagi, Japan, in 2015. Delegates from 187 nations signed the Sendai Framework for Action at the end of the conference, a blueprint that would aid governments and local governments in developing disaster response strategies. The Sendai Framework works in tandem with other agreements in the 2030 Agenda, such as the Paris Climate Agreement, the Addis Ababa Action Agenda on Financing for Development, the New Urban Agenda and ultimately, the Sustainable Development Goals. This framework allows countries to implement a clear, succinct, and straightforward DRR approach in the post-2015 period (UNDRR 2019).

In 2016, the United Nations Secretary-General announced "The Sendai Seven Campaign" to promote the seven goals over seven years. The selected target for the year 2021 is to "substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030," and the International Day for Disaster Risk Reduction (IDDDRR) was commemorated on October 13th, 2021 under the theme "ONLY TOGETHER... WE CAN SAVE THE PLANET."

Over the past few years, Sri Lanka has been affected by the most devasting events creating more losses and damages to the built environment. As per the IPCC recent report, the frequency and intensities of devastations are going to increase with climate change(Working Group| Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 2021). The necessity for future interventions to be aligned with national and local strategic plans produced based on the post-2015 global frameworks has been pushed by the lessons learned from previous stand-alone disaster risk management interventions(Iizuka, 2020; Saja et al., 2020). The Sendai Framework (SFDRR 2015–2030) emphasized the importance of collaborative, coordinated, and inclusive risk-informed decision making, investments, and action strategies as one of the core guiding principles for achieving the expected outcomes and goal of implementing Sendai priorities of actions from national to community levels. As a developing country, Sri Lanka believes that the Sendai Framework for

DRR is a leading example of how to achieve disaster risk reduction, which is one of the most sustainable strategies to achieve the country's development. The country is primarily focused on DRR rather than disaster management. In light of the Sendai Framework (UNSDF 2018–2022), Sri Lanka has already taken appropriate steps to prepare a national action plan to examine the existing legal and institutional framework. As a result of this review process, the country's next National Disaster Management Plan has been developed in accordance with the Sendai Framework. The "Sri Lanka Comprehensive Disaster Management Program," which is currently in effect, is also mainstreaming DRR into the sectorial development plans of several ministries and agencies. Based on its four key themes, the Sendai Framework's application for DRR in Sri Lanka can be examined further as follows.

4.2 Brief statement on the country's meeting of the framework's four priorities

4.2.1 Priority 1. Understanding disaster risks.

As the first priority in the Sendai Framework for disaster risk reduction, understanding DRR is much important. Since the policies and practices pertaining to disaster risks are compiled based on the understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, an understanding of disaster risks is of utmost importance.

In relation to this priority, a risk profile has been compiled with technical support from concerned agencies, including technical institutions and academia focusing mainly on 5 hazards - floods, drought, landslides, cyclones and coastal hazards (tsunami, sea surges, sea-level rise and coastal erosion) in Sri Lanka. Hazard profiles have further been developed to cover hazards such as landslides by preparing maps: by National Building Research Organization (NBRO), coastal hazard profile: by Coast Conservation and Coastal Resources Management Department, flood hazard maps: by the Irrigation Department, and drought and cyclone hazard profiles: by the Agriculture Department, University of Peradeniya and Department of Meteorology (DMC, 2015). Sri Lanka Disaster Resource Network (SLDRN) has been improved and updated with the intention of establishing a data hub for risk assessments and impact analyses to determine risk trends in the future (DMC, 2014). RiskInfo or Sri Lanka Disaster Risk Information Platform, an open online portal to host the country's geospatial data and interactive maps of multiple hazards, was launched under the Open Data for Resilience Initiative (OpenDRI), with support from GFDRR and the World Bank. This is a major milestone for systematically compiling geospatial hazard data from different government agencies and stakeholders in a uniform format.

These risk data sources are also utilized as decision-making aids and introduce National Spatial Data Infrastructure (NSDI) (DMC, 2017). In the case of landslides, rigorous research and field study on landslide risk were carried out under several initiatives, with the NBRO serving as the technical lead as the designated national focal point for landslide risk management. Vulnerability databases have also been provided to assist in the estimation and measurement of disaster impacts on people. Appropriate strategies for generating local hazard maps have

been established at the local level. A total of 100 settlements that are vulnerable to Tsunamis, floods, and landslides have been given local hazard maps (The World Bank & GFDRR, 2012).

In addition, the World Bank-funded Climate Resilience Improvement Project (CRIP) is now developing a comprehensive flood and drought risk model in ten river basins. The development of basin-level flood and drought risk mitigation investment strategies are facilitated by comprehensive river-basin risk information (Ministry of Agriculture, 2019)

4.2.2 Priority 2. Strengthening disaster risk governance to manage disaster risks.

Sri Lanka has strengthened its efforts to construct a comprehensive multi-hazard disaster management system since the 2004 Indian Ocean tsunami. The Tsunami prompted extensive reforms, culminating in the passage of the Disaster Management Act of 2005. The National Council for Disaster Management (NCDM) and its operational headquarters, the Disaster Management Centre, were also mandated (DMC). Since then, the country's policies have been updated on a regular basis. Table 2 summarises the adopted national policy framework for Sri Lanka. The National Disaster Management Coordination Committee was formed in 2007 to help with the execution of the Hyogo Framework for Action (Friedrich, 2017), and the National Disaster Management Policy was issued in 2010 to serve as the primary governing framework for disaster management. It takes into account essential factors such as local government participation, encourages multi-stakeholder methods, and establishes response and relief requirements. Between 2006 and 2016, the effort was mostly led by Sri Lanka's overall development goal, "MahindaChintana," a ten-year policy framework that prioritized sustainable, private-sector-driven economic growth, major social development, and proper natural resource management (Department of National Planning, 2006).

Table 2 Summary of the policy and legislation introduced in Sri Lanka ((Siriwardana et al., 2018; UNDRR Regional office for Asia and the pacific, 2019)

Implementation	Legislations/Policy	Scope	Purpose
NDMC, Disaster Management Centre and the Ministry of Disaster Management	Disaster Management Act (2005)	National, Provinces districts	The formation of the NDMC and the DMC was mandated. The goal of the act is to improve disaster response by coordinating stakeholders and localizing operations.
Disaster Management Centre	The Roadmap for Disaster Risk Management (2006-2016)	National, provinces, districts	Shifting the emphasis from reactive to proactive actions regarding preparedness, response, mitigation, and risk reduction
Ministry of Disaster	National Policy on Disaster	National	To achieve "how things should be," it is intended to supplement the

Management, Disaster Management Centre	Management (2010)		essential parts of other Acts and plans for various Ministries, departments, and local governments (such as land-use planning).
Disaster Management Centre, Stakeholders, Private sector	Sri Lanka National Disaster Management Plan (2013-2017)	National, Provinces, Districts, NGOs, CSOs, Community leaders	Continuation of the 2006-2016 strategy, with the goal of establishing a multi-sectoral, inter-ministerial, and inter-agency DRM framework based on all stages of disasters and taking international accords into account as well as frameworks
Disaster Management Centre, Stakeholders	National Emergency Operation Plan (NEOP) (2013)	National, Provinces, Districts	NEOPs, which were created as part of the 2013-2017 plan, are meant to specify and identify the roles of key stakeholders in various response scenarios to improve coordination.
Partnership Strategy	Comprehensive Disaster Management Programme (2014-2018)	National, provinces, NGOs, Private sector	Concentrate on risk reduction and the creation of conducive settings. The interventions are based on multi-hazard risk data and follow international guidelines.
The government, private sector, community-based organizations	National Adaptation Plan for climate change impacts in Sri Lanka (2016-2025)	National, Provinces, Districts and communities	Based on risk data, identifies sectoral climate adaptation needs and the overarching national plan, roles, cross-cutting concerns, and important players. A National Adaptation Fund (NAF) is also being considered.
Partnership Strategy	National Disaster Risk Management Plan (2018-2030)-Draft version	National, Provinces, Districts, Communities, Non-governmental organizations, Private sectors, Community	Based on many of the same ideas as the 2014-2018 program, but with a greater emphasis on actual, concrete implementation at all levels and monitoring and assessment. The importance of participation is emphasized.

		Based organizations	

Sri Lanka has also approved the Sustainable Development Strategy and established a National Council for Sustainable Development to promote socially fair and environmentally sustainable economic growth through poverty eradication, social development, and competitiveness (Ministry of Environment and Renewable Energy, 2011). The Sri Lanka Comprehensive Disaster Management Program (SLCDMP) for 2014-2018 was approved by the NCDM in 2014 to ensure Sri Lanka's security by reducing disaster and climate risks while minimizing impacts on people, property, and the economy by creating an enabling environment for participatory DRM based on multi-hazard assessments (Ministry of Disaster Management, 2014). The MahindaChintana, Development Policy Framework and Public Investment Strategy of 2014-2016 have led it, while the Disaster Management Policy, National Climate Change Adaptation Strategy for Sri Lanka 2011-2016, and the National Action Plan for Disability provided necessary assistance.

4.2.3 Priority 3. Investing in disaster risk reduction for resilience.

For Sri Lanka, which is a country prone to flooding, droughts, and landslides, investing in strengthening resilience against hydrological-meteorological hazards is critical. Investments have so far been focused on creating reliable systems for hydrological and meteorological hazard monitoring as well as supporting hazard modelling, better forecast capability, and data analysis for timely early warning. As evidenced by various ongoing programs with financing support from foreign aid agencies, investing in flood and drought prevention has become critical in spatial planning and area development plans. The incorporation of flood risk considerations into urban development is demonstrated through mega-development projects such as the economic and physical regeneration of the Metro Colombo area through the Metro Colombo Urban Development Program (MCUDP). Through their participation in the program, such initiatives are also important to build the capacities of concerned agencies, primarily the Ministry of Defense and Urban Development, the Urban Development Authority (UDA), and development practitioners working with risk-sensitive infrastructure planning and urban facility development.

Similarly, the GFDRR-supported program on Mainstreaming Disaster Risk Management at the Urban Level is an investment in human resources that builds the government's technical capacity to conduct flood and landslide risk assessments while aiding in integrating risk reduction into urban planning (GFDRR, 2014). District and divisional officers have been given capacity building and training to increase their technical knowledge of disaster risk assessment and integrate DRM themes into development planning (The World Bank & GFDRR, 2012). 300 local government officials were trained on integrating DRR into the local government sector in 2015 (DMC, 2015). The continuation of such efforts demonstrates a commitment to investing in human resources, which is critical when integrating DRR into local development.

The National Disaster Management Plan 2013-2017, which directs concerned agencies on feasible DRR mainstreaming actions, calls for integrating DRR across sectors. This includes disaster-sensitive physical design and regional structural planning, development control by the UDA and local governments, Disaster Impact Assessment (DIA) for new developments, mainstreaming DRR during disaster reconstruction, and DRR through Natural Resource Control. This is a practical guide for development practitioners in all industries and at all levels.

4.2.4 Priority 4. Enhancing disaster preparedness for effective response to "Build Back Better" in recovery, rehabilitation and reconstruction.

Institutional procedures for early warning systems are put in place, with coverage across the country. The system consists of technical agencies (such as the Meteorological Department, Geological Survey, and Mines Bureau) that are responsible for hazard monitoring and early warning through the DMC's Emergency Operation Centre, as well as Provincial Councils, Districts Divisions, Local Authorities GN Divisions, local police and military, local volunteers, and CBOs. A system has been established for localised hazards that use a bottom-up and top-down citizen-centred approach for hazard alerts and early warnings, utilizing networks of local stakeholders such as local government, private sector, Red Cross, NGOs, and civil society (DMC, 2014).

The National Emergency Operations Plan (NEOP), which was developed with UNDP Sri Lanka's technical assistance, outlines management arrangements, incident command systems, operations practices, and coordination mechanisms for effective disaster or emergency response, as well as the roles and responsibilities of various stakeholders in disaster scenarios (DMC, 2017). The National Disaster Relief Services Centre (NDRSC) was established to provide relief services, while the Ministry of Economic Development is responsible for infrastructure restoration and reconstruction. The National Policy for Disaster Risk Management (DRM) (2013) has placed special emphasis on the immediate restoration of vital services as well as the "build-back-better" strategy for medium- and long-term rebuilding and rehabilitation (DMC, 2014). The Sri Lanka Red Cross, which has branches in all 25 districts and works alongside the army and navy troops to support search and rescue operations, plays a critical role in emergency response and relief. In 2016 and 2017, the Ministry of National Policies and Economic Affairs and the Ministry of Disaster Management collaborated to conduct Post-Disaster Needs Assessments (PDNA) for major disasters such as floods and landslides, with support from international partners as UNDP, the EU, and the World Bank.

4.3 . Brief statement on the country's meeting of the framework's seven targets

The Sendai Seven Campaign –"7 targets, 7 years" was launched in 2016 by the United Nations Secretary-General, with the main objective of promoting the seven targets of the Sendai Seven Campaign over seven years. This is an advocacy initiative to encourage the implementation of the Sendai Framework to save lives, reduce disaster losses, and improve the management of disaster risk. Each of the seven targets of the Sendai Framework for disaster reduction is designated for each year of the campaign.

• 2016 – Target (a): Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020- 2030 compared to the period 2005-2015

• 2017 – Target (b): Substantially reduce the number of people affected globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020- 2030 compared to the period 2005-2015;

• 2018 – Target (c): Reduce direct disaster economic loss in relation to the global gross domestic product (GDP) by 2030;

• 2019 – Target (d): Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030;

• 2020 – Target (e): Substantially increase the number of countries with national and local DRR strategies by 2020.

• 2021 – Target (f): Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030;

• 2022 – Target (g): Substantially increase availability and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

The global targets may be clustered in two groups: targets from (a) to (d) concern specific outcomes; targets from (e) to (g) concern inputs or enablers. Together, they assess progress toward achieving the Sendai Framework's expected outcome and developing the necessary tools and means to achieve it.

4.4 Implications of implementing the Sendai Framework on risk reduction in coastal zones

As identified in the country-specific report in output 01, the coastal zone in Sri Lanka is extremely vulnerable to climate change-related hazards. Especially the 2004 Indian ocean Tsunami demonstrated the vulnerability of the coastal belt line in Sri Lanka. The coastal areas of Sri Lanka that are vulnerable to coastal intrusion are densely populated, with much of the urban cities, including Colombo capital city, located there. Moreover, many industries and industrial hubs that cloud be more vulnerable to climate change-related hazards are located along the coastal belt zone.

The success of Sri Lanka's DRR and climate change adaptation depends on reducing sectoral vulnerabilities and strengthening people's capacity, particularly among the poor (Ministry of Mahaweli Development and Environment, 2016). As several Studies stated, coastal cities and communities are significantly vulnerable to the negative impacts of climate change(Hippola et al., 2018; R. U. Jayasekara et al., 2021; Perera et al., 2020; Pitigala Liyana Arachchi et al., 2021;

D. K. Rathnayake et al., 2020; K. D. Rathnayake et al., 2019; W. K. D. Rathnayake et al., 2021; I. Shehara et al., 2020; P. L. A. I. Shehara et al., 2020)

Furthermore, these vulnerabilities are more exacerbated by many various factors. These factors include,

- Lack of trust in authorities who disseminate Early Warning
- Limited knowledge of evacuation routes and shelters in residential areas
- Lack of efficient and sustainable resilience mechanisms focused on the coastal communities
- Lack of efficiencies and effectiveness of national policies and frameworks related to coastal hazards and lack of alignment with the post-2015 global standards.
- Lack of capacity and preparedness of the coastal communities
- Lack of exposure and awareness to the modern technology
- The administration process also disregards indigenous knowledge regarding the EW mechanism
- Lack of interest of the coastal communities in evacuation planning and safety drill

Furthermore, several studies have pointed out the role of social media in disseminating the Early Warnings (EWs) and the applicability of social media into the Multi Hazards Early Warnings (MHEW) mechanism (Abeysinghe et al., 2020; Hippola et al., 2018; Jayasooriya et al., 2018; Perera et al., 2020; I. Shehara et al., 2020). Also, another study by Jayasiri et al. 2018, shows Sri Lanka lacks an efficient and sustainable resilience mechanism that focuses on the coastal community(Jayasiri et al., 2018). Furthermore, it is stressed out that training and public awareness campaigns, efficient funds, properly maintained hierarchy, and concern to the coastal ecosystems would enable the building of coastal resilience and thereby reduce the vulnerability(Jayasiri et al., 2018). Also, it is pointed out the importance of the people-centred MHEW mechanisms, multi-stakeholder and multi-agency cooperation and coordination for exchanging the data and updating the multi-hazard map to enhance the community resilience (Abeysinghe et al., 2020; Hippola et al., 2018; Jayasooriya et al., 2018; K. D. Rathnayake et al., 2019). Therefore, In the implementation of the Sendai Framework on DRR in coastal zones, priority should be given to the setting up of early warning systems and evacuation methods for the people before a disaster. Since most disasters in coastal areas such as Tsunami are catastrophic, implementation of the Sendai Framework under a better monitoring process is of utmost importance.

However, there are also gaps in institutional capacity and technology and a growing need for knowledge and information on the effects of climate change and disasters on the most vulnerable people. Due to the government's lack of budgets for climate adaption activities, resource mobilization is one of the issues.

Relocation, on the other hand, is not an easy way to reduce environmental exposure. According to a study conducted in the district of Akuressa, people have grown accustomed to high risks, perceive their ability to cope with annual flooding as adequate, "have a sense of place" due to family ties and social cohesion, and perceive the financial constraints of relocation as too great,

(Askman, et al., 2018). While poverty is frequently cited as the most significant impediment to reducing exposure and vulnerabilities, some people may be unwilling to leave their homes, posing another hurdle to risk reduction efforts.

There is also a need to harmonize disaster management infrastructure, policies, frameworks, and strategies to achieve common goals, all of which are in line with the Sustainable Development Goals, Climate Action, and the Sendai Framework for Disaster Risk Reduction. The current institutional issues stem from a plethora of policies, overlapping tasks and the ensuing job confusion, particularly during response stages. Furthermore, due to a lack of resources, human ability, and technological know-how, the implementation of actual policies at the local level has been a problem.

4.5 Summary of opportunities and constraints

Sri Lanka is extremely vulnerable to various hazards such as weather events, cyclones, monsoonal rain and subsequent flooding and landslides(Disaster Management Centre, 2015; UNDRR, 2019). Moreover, droughts have become frequent due to climate change (Climate Change Secretariat, 2016; Disaster Management Cent, 2014). Moreover, other hazard includes lightning strikes, coastal erosion, epidemics, and pandemic(Iizuka, 2020; The World Bank & GFDRR, 2012). The novel Covid-19 Pandemic has also significantly affected Sri Lanka(Fernando et al., 2021; J. H. P. R. U. Jayasekara et al., 2022). With this background, disaster management and DRR have become a key priority within the country(Disaster Management Cent, 2014; Disaster Management Centre, 2017; Randil et al., 2020; K. D. Rathnayake et al., 2019; UNDRR, 2019). So, there is a great opportunity to implement the SFDRR and thereby reduce existing issues related to DRR and disaster management(UNDRR, 2019).

Due to the growing frequency of hydro-meteorological hazard occurrences, disaster preparedness and response plans should be developed for all districts down to the smallest administrative unit. At the local level, an inclusive and well-coordinated preparedness and response architecture is also required. To promote disaster and climate risk-sensitive local planning, best practices for drafting local DRR plans should be created (ADPC, 2018). Disparities between national DRR activities and the extent to which they are executed and rolled out by local governments must also be addressed.

For DRR, regulatory frameworks, policies and plans related to disaster management play a significant role(Disaster Management Cent, 2014; Disaster Management Centre, 2015, 2017). The alignment of these key governance instruments with the global agendas is crucial for efficient DRR (Climate Change Secretariat, 2016; Daze, 2019). As Siriwardana et al., 2018 concluded that there exist minor alignments of the local disaster management framework and policies with the global agendas(Siriwardana et al., 2018). Furthermore, institutional arrangement for disaster management activities is also vital for effective disaster risk reduction(Abeysinghe et al., 2020; Randil et al., 2020; K. D. Rathnayake et al., 2020). The issues that arise due to the plethora of policies and unclear roles and responsibilities during the response phase within the institutions are dominant and have become another limiting factor

for the successful implementation of SFDRR(W. K. D. Rathnayake et al., 2021; Siriwardana et al., 2018). Another constraint for implementing SFDRR is the technical capacity. As a developing nation, Sri Lanka is developing its technical capacities for reducing the adverse effects of the disaster throughout each phase of the disaster management cycle (i.e. Preparedness, response, recovery and mitigation). In addition, an inadequate disaster risk governance system is also led to deficiencies in implementing SFDR (Amaratunga et al., 2019; Ginige et al., 2013; Malalgoda et al., 2013) R. These deficiencies include inadequate institutional mechanisms for DRR at the local level, inadequate communication of national-level decisions, lack of involvement of local governments in national-level decision-making, and a lack of clarity regarding duties and responsibilities are identified as issues (Malalgoda et al., 2016).

Data gaps (especially in terms of data availability) must be met to monitor and evaluate the country's SFDRR progress systematically. A database with vulnerability parameters (including poverty, disaster profiles, housing condition, and damage history) is yet to be developed to support risk assessments and relief assistance. There is also a need for scientific data collection for slow on-set disasters (NDRSC, 2018).

Improving early warning systems and promoting the use of hazard maps for land use planning, area development and construction projects, and revamping and optimizing the use of planning tools such as Environmental Impact Assessment (EIA) should be emphasized. Furthermore, incorporating disaster risk elements into development planning is also among the key priorities. Also, as has been evidenced throughout this report, many of the vulnerabilities follow the lack of (or lack of access to) resources, insurance, adequate housing, opportunities, education and income. Thus, poverty reduction and enhanced equity should be among the foremost priorities for the government. However, poverty reduction should be explored from many angles, including risk transfers, social welfare and subsidies to guarantee that the most vulnerable (low-income farmers and those dependent on the environment) are adequately protected and prepared for the impacts of adverse events. Often, social protection and insurance schemes are not available to those who would be in most need of such services – thus, further investments could be beneficial to safeguard the population.

5 Conclusion

The three global agendas, Paris Agreement, Sustainable Development Goals (SDGs) and the Sendai Framework, become three main policy-making constitutes in the post-2015 era all over the world. The Paris agreement which is on the response to climate change; mitigation, adaptation and finance, SDGs; which highlights the global agenda towards sustainable development and the Sendai Framework; which is the global framework to guide the multi-hazard management of disaster risk, should always create an integrated approach in responding to climate change and the DRR scenarios. While the Paris Agreement makes no explicit mention of the SDGs or the Sendai Framework, the global goal on adaptation, which calls for "enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to

climate change with a view to contributing to sustainable development," provides an umbrella for integrated actions. As a developing nation, Sri Lanka has met with different opportunities and constraints in adapting this integrated approach in the DRR in the coastal built area concerning climate change (UNCCS, 2017).

While each of the post-2015 frameworks retains its autonomy, the increased coherence of action to implement the three frameworks can save money and time, improve efficiency, and allow for more adaptation action. Both "resilience" and "ecosystems" can serve as motivators for such integration. Policy coherence can be facilitated by state and non-state actors operating across multiple sectors and scales ranging from local to global, and vulnerable people and communities can benefit from and initiate effective bottom-up, locally driven solutions that contribute to multiple policy outcomes simultaneously. Coordination and coherence on an ending quest scale will be required in proper coordination of the three agendas interactively. Building capacity for it will aid in the clarification of duties and responsibilities and encourage collaborations among a diverse range of actors. Data availability and resolution, including climate and socioeconomic data, remain an issue, particularly in countries like Sri Lanka. It is also necessary to improve data management, make more informed policy decisions, and increase the capability to overcome the constraints in the integrated approach of the three mentioned global agendas in the Sri Lankan context (UNCCS, 2017). It is critical to have long-term funding for adaptation initiatives from public, private, international, and national sources. Access to financial capital and technological development, transfer, and capacity-building assistance is crucial, especially for developing countries like Sri Lanka. Accordingly, it is much clear that developing and implementing NAPs can successfully promote the execution of enhanced adaptation action as well as the creation of integrated adaptation, sustainable development, and DRR approaches.

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