# Preparation of Disaster Management Plans for Electricity, Petroleum and Water Industries

**Final Report: PREPARATION OF DISASTER MANAGEMENT PLAN FOR CEYLON ELECTRICITY BOARD AND LANKA ELECTRIC COMPANY**

**Rev 1.0**

**(Revised incorporating comments of the Participants of National Consultation Workshop held on 08.07.2026 at PUCSL Auditorium)**

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# Acknowledgment

Development of Institutional Disaster Management Plan was initiated by the Public Utility Commission of Sri Lanka as mandated by the Public Utility Commission Act No 35 of 2002, with the objective of ensuring the provision of continuous supply of electricity to consumers even during emergency situations. The Plan was developed as provided in the Disaster Management Act No 13 of 2005 and as per guidelines issued by the Disaster Management Centre. Director General of PUCSL would like to thank the following agencies for the support given to develop the plan for Ceylon Electricity Board (CEB) and Lanka Electricity Company (Pvt) Ltd (LECO);

General Manager – CEB, Addl. GMs, DGMs, Chief Engineers and Engineers of various Divisions and Branches of CEB, General Manager – LECO, Addl. GMs, DGMs, Chief Engineers, engineers and all other the staff in both organizations for providing data, sharing past experiences and comments at various stages of development of the Plan and supporting throughout the process.

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Finally, to consultants for assisting PUCSL to develop the IDMP for CEB & LECO.

## Executive Summery

As an Island nation, Sri Lanka experienced extreme hydro-metrological events more frequently due to climate change. Thus, one of the significant challenges faces by the power sector in Sri Lanka is to provide reliable electricity supply to consumers even during disasters. The Power Sector of Sri Lanka is governed by Ceylon Electricity Board (CEB), a statutory organization formed under Ceylon Electricity Board Act No 17 of 1969 and Lanka Electricity Company (Pvt.) Ltd., registered under Companies Act No 17 of 1983). Both organizations are regulated by Public Utilities Commission of Sri Lanka, established as per the PUCSL Act no 35 of 2002and has issued licenses for CEB for Power Generation, Transmission and Distribution, while LECO responsible for power distribution in designated area only.

CEB and LECO has the responsibility to achieve SDG Goal 7- Ensure access to affordable, reliable, sustainable and modern energy for all by 2030. However, increasing trend in water related disasters disrupting plans of CEB and LECO to active targets by 2030.

CEB is manage by a Board, the Chairman and the General Manager supported by 6 Additional General Manages (Addl.GM) in operation division and 4 Addl.GM providing Support services, DGMs and Chief Engineers in Branches, Units and Sub-Units. LECO is managed by a Team consist of Board of Directors, Chairman, General Manager and 4 Additional General Manages responsible for Operation, Engineering, Finance and Human Resources Management divisions. Deputy General Managers and 7 Chief Engineers support the management team. Both organizations have registered contractors to assist during a disaster to maintain the supply.

Considering that the electricity has become one of the basic needs for the day-today life of the modern-day society, both electricity utility agencies (CEB and LECO) have established a response team at regional and local levels with decentralized authority to take immediate action to safeguard life of people, restore supply and bring the life of general public to normalcy during and after a disaster.

Public Utility Commission Sri Lanka, empowered to promote the interest of consumers support the CEB and LECO to develop an Institutional Disaster Management Plan as provided in the Disaster Management Act No 13 of 2005 to responding to any impending disasters and ensure uninterrupted electricity supply during emergencies.

Conducting a risk assessment of electricity supply schemes is a basic requirement to identify risk levels of infrastructures against hazards and develop mitigation, preparedness and response and recovery plans. Prioritization should be determined based on the likelihood or frequency of a hazard as well as the possible damage or consequence it poses to the industry.

Initially 15 hazards were ranked high to low impacts, 6 were identified mostly affecting electricity supply sector. PUCSL, in consultation with CEB and LECO, has informed that the following hazard have been selected for detail hazard exposure, vulnerability and risk analysis for this assignment. Consultant has agreed to include Coastal hazard and tsunami in addition to four selected by CEB though it is beyond the contractual obligation.

| CEB | LECO |
|---|---|
| Flood | Flood |
| Drought | High wind/ Cyclone |
| High wind/ Cyclone | Coastal Hazards (cover Coastal Erosion, Sea Surges and Sea Level Rise) |
| Landslide | Tsunami |

PUCSL in consultation with CEB has selected four hazards, floods, drought, landslides and chemical hazards for further analysis. Profile of four hazards were evaluated based on 8 characteristics and flood ranked highest followed by drought, chemical hazards and Landslide.

CEB and LECO agreed that power generation (Hydro, Thermal and renewable), Grid Sub Station of transmission and distribution are critical infrastructure of electricity supply schemes and considered for exposure, vulnerability and risk assessment. Hazard profiles developed by DMC, Irrigation Department, Meteorological Department and NBRO for Flood, drought, and landslides were collected with the assistance of PUCSL. Coordinates of identified element at risk provided by CEB and LECO were overlaid with the hazard layers respectively and exposure level of the critical infrastructure (element at risk) were identified. Temporal factor has not been considered in detail under this study due to unavailability of high-resolution data but it was taken in account using the data available in Desinventra database of DMC. Details of exposure levels of identified critical infrastructure are given in table 2.17-2.32.

The vulnerability assessment provides a framework for developing risk reduction options and associated costs. In the absence of vulnerability data of infrastructure, exposure, resistance and resilience of the infrastructure to different hazards, which were used to develop indicators to assess vulnerability, each group of elements at risk was evaluated based on the level of exposure identified and the sensitivity of each group of elements at risk to the respective hazards for the continuous power supply in qualitatively. Details of vulnerability assessment given in the Table 2.33- 2.35

The electricity sector's disaster response capacities involve a range of actions taken during and after a disaster to ensure continued power supply and safety. As the data is not available as per the table 2.35, risk assessment was conducted without considering the capacity of Ceylon Electricity Board and Lanka Electricity Company.

Compiling hazard, element at risk (Electricity generation, transmission, and distribution), level of exposure and vulnerability of electricity infrastructure risk of flood, drought, landslide and coastal hazards were assessed by districts. Detail risk assessment for floods, landslides, Drought, Cyclone/High Winds, Coastal Hazards and Tsunami are provided in tables 2.37-2.41.

Hazards are present in all electricity schemes, in varying degrees. Disaster mitigation is essential even when floods, droughts, landslides, and cyclone/high winds, coastal hazards and tsunami do not directly threaten, as accidents could damage the distribution lines and transformers and significantly impact service. Mitigation plan proposed encompasses risk management related best practices in design, construction and maintenance measures to optimize their utilization. CEB and LECO use different standards for the design of all structures in electricity supply system. In order to ensure resilience of structure to disasters, CEB and LECO may have to review design standards and incorporate Disaster Risk Reduction concepts

into design standards. Hazards, issues and impacts and possible mitigation measures related to critical infrastructure of electricity supply system are given in table 3.1-3.4.

Preparedness in the electricity sector is a critical component of ensuring reliable service delivery and the safety of personnel and the public during emergencies.

For effective operationalization, it is essential to systematically collect, validate, and maintain the relevant data and information to ensure availability for planning, decision-making, and response actions. Hazard type and impact focus, Institutional role and responsibility for preparedness, Command and coordination structure, Early warning, safe response to an emergency, Resources readiness are provided in the Table 4.1-4.6

Table 4.7- 4.31 indicate the data required to be collected at scheme level to develop a preparedness plan for response for each scheme.

The Emergency Response Plan (ERP) is primarily composed of procedures and protocols that must be activated to respond to a variety of hazards, including localized to large-scale floods, droughts, landslides, cyclone/ high winds, coastal hazard and tsunami. Officer responsible and Standard Operation Procedure (SOP) to implement risk reduction activity related to 6 hazards is given as sample**.**

Disaster damage and loss assessments estimate, first, the short-term government interventions required to initiate recovery and second, the financial requirements to achieve overall post-disaster recovery, reconstruction and disaster risk management or reduction. Detail damage and loss assessment process and format for collection of data required to as pre- and post-disaster activity are given in table 4.33-4.36.

A disaster recovery plan (DRP) is a formalized, structured approach that specifies how an organization can restart operations efficiently following a disaster, caused by natural or human intervention. Recovery plan will be competed in two stages, (i). data required to conduct loss and damage assessment could be collected before disaster strikes and disaster loss and (ii) damage assessment as post disaster activity. Damage and loss data will be used to complete the need assessment and budgetary requirement for rehabilitation of affected infrastructure.

Five training Modules are proposed in the Training Plan for electricity supply sector related to Disaster Risk Management to improve the capacity of officers engaged in DRR activities.

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| | |
|---|---|
| kW | Kilo watt |
| Addl.GM | Additional General Manger |
| ADB | Asian Development bank |
| BBB | Building Back Better |
| BCP | Business Continuity Plan |
| BIL | Basic Insulation Level |
| CBSL | Central Bank of Sri Lanka |
| CE | Chief Engineer |
| CEA | Central Environmental Authority |
| CEB | Ceylon Electricity Board |
| CERF | Central Emergency Response Fund |
| DAD | Department of Agrarian Development |
| DALA | Damage and Loss Assessment |
| DDMCU | District Disaster Management Unit |
| DGM | Deputy General Manager |
| DL | Distribution Licensee |
| DMC | Disaster Management Centre |
| DoM | Department of Metrology |
| DPRD | Disaster Preparedness and Response Division |
| DRF | Disaster Recovery Framework |
| DRM | Disaster Risk Management |
| DRP- | Disaster Recovery Plan |
| DRR | Disaster Risk Reduction |
| DS | Divisional Secretary |
| EOC | Emergency Operation Centre |
| ERP | Emergency Response Plan |
| EU | European Union |
| EWS | Early Warning System |
| FGD | Focus Group Discussion |
| FM | Finance Manager |
| GCRI | Global Climate Risk Index |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System or Gas Insulated Substation |
| GoSL | Government of Sri Lanka |
| GSS | Grid Sub Station |
| ICS | Incident Command System |
| ID | Irrigation Department |
| IDMP | Institutional Disaster Management Plan |
| IPCC | International Panel of Climate Change |
| IUCN | International Union on Conservation of Nature |
| KPI | Key Performance Indicator |
| LiDAR | Light Detection and Ranging |
| LKR | Sri Lanka Rupees |
| MASL | Mahaweli Authority of Sri Lanka |
| MDM | Ministry of Disaster Management |
| MoH | Ministry of Health, Nutrition and Indigenous Medicine |

| | |
|---|---|
| MWh | Mega Watt Hour |
| NBRO | National Building Research Organization |
| NCCAS | National Climate Change Adaptation Strategy |
| NCCP | National Climate Change Policy |
| NCDM | National Council for Disaster Management |
| NCP | North Central province |
| NDMCC | National Disaster Management Coordination Committee |
| NDRSC | National Disaster Relief Service Centre |
| NEOP | National Emergency Operation Centre |
| NGO | Non-Governmental organization |
| NP | Northern Province |
| NRMC | National Resource Management Crentre |
| NWP | North Western Province |
| NWSDB | National water Supply Drainage Board |
| OIC | Officer in Charge |
| PDNA | Post-Disaster Needs Assessment |
| PDRP | Post Disaster Recovery Planning |
| Po-DRP | Post Disaster Recovery Plan |
| Pr-DRP | Pre disaster Recovery Plan |
| PUCSL | Public Utility Commission of Sri Lanka |
| SDGs | Sustainable Development Goals |
| SOP | Standard Operation Procedure |
| TL | Transmission Lines |
| UDA | Urban Development Authority |
| UNDP | United Nations Development Programme |
| WB | World Bank |

# 1. Introduction

## 1.1 Background

Sri Lanka is increasingly affected by various hazards, including weather-related events such as cyclones, monsoonal rain, and subsequent flooding and landslides[1]. In addition, climate change brings unpredictable increases in hydro-meteorological hazards, both in their occurrences and intensity further aggravating the situation. During the last decade, the occurrence of disasters has increased by about 20% due to hydro-meteorological events[2].

Disaster risks, hazards and their impacts in Sri Lanka are on the increase due to a multitude of factors. Population dynamics, increasing demand for natural resources such as water and land, rapid and unplanned urbanization, and development planning devoid of disaster risks and exposure are some of the key contributory factors in this regard. A recent study done by the World Bank team estimated that 87% of Sri Lanka's population lives in moderate or severe hotspots for disasters[3]. The Global Climate Risk Index (GCRI) Report 2019 lists Sri Lanka in second place among the countries most affected by extreme weather events in 2017. However, later GCRI 2020 ranked Sri Lanka in the sixth position and in the year 2021 Sri Lanka ranked 30$^{th}$ place.[4]

Extensive disasters such as floods, landslides, droughts, and cyclonic winds could affect the country's development as much as a rare disaster event of catastrophic proportions such as tsunami. The Annual Average Loss (AAL) due to disasters in Sri Lanka was estimated at US$ 380 million[5]. The floods and landslides in 2016 and 2017 have caused damages and losses amounting to US$723 million and US$469 million, respectively. The estimated recovery costs were LKR 257.4 billion[6]. Damages and losses due catastrophic tsunami in 2004 were estimated at US$ 1200[7]million. Cumulative damages and losses in social, productivity and infrastructure sectors due to recurrent floods and landslides, since 2010, have exceeded the damages and losses caused by the Indian Ocean tsunami in 2004[8].

Sectors representing the lifeline services such as drinking water supply, electricity, and communication are severely damaged due to recurrent disasters.

Post Disaster Need Assessment (PDNA) of 2016 and 2017 floods and landslides showed that cumulative value of damages and losses in the electricity sector was 1313.45 million LKR.As an Island nation, Sri Lanka experienced extreme hydro-metrological events more frequently due to climate change. Thus, one of the significant challenges faces by the Ceylon Electricity Board (CEB) and Lanka Electricity Company (LECO) is the provision of uninterrupted electricity supply to consumers during disasters.

1 Ministry of Disaster Management Annual Report 2019
2 Sri Lanka DRM Status Report 2019
3 World Bank, South Asia's Hotspots: The Impact of Temperature and Precipitation Changes on Living Standards. South Asia Development Matters
4 Global Climate Risk Index Reports 2019, 2020 and 2021
5 Fiscal Disaster Risk Assessment and Risk Financing Options, Sri Lanka. World Bank Group (GFDRR). 2016
6 Ministry of Disaster Management & Ministry of National Policies and Economic Affairs. Sri Lanka Post Disaster Needs Assessment Floods and Landslides, 2016, 2017
7 ADB, JIBIC and WB- Preliminary estimate of tsunami 2004 (2007)
8 www.desinventar.lk

## 1.2 Profile of Power sector

### 1.2.1 Institutional and legal framework of CEB and LECO

Public Utility Commission of Sri Lanka (PUCSL), established as per the PUCSL Act no 35 of 2002, closely link with following key agencies to reduce the risk in utility services and facilitate the lifeline service provider as follows;

- **Disaster Management Centre** will be closely linked with PUCSL to develop Disaster management plans for utility industries, disseminate early warning messages on hazard situation and coordinate with other response agencies to manage the disaster impacts.

- **Agencies providing early warning and response.**
  PUCSL shall establish links with Irrigation Department, National Building Research Organization (NBRO), Meteorological Department etc. to obtain weather forecasts and early warning on probable hazards. PUCSL also would coordinate with armed forces and police to provide support to utility service delivery agencies to manage disaster impacts and reduce the interruption of services to consumers.

- **Project funding**
  CEB and LECO shall develop project proposals as per the new format introduced by the National Planning Department (NPD). Proposals to be submitted to the NPD through the line Ministry to seek funds

## 1.3 Power Sector Structure in Sri Lanka

### 1.3.1 Power Sector Organization and PUCSL

The Power Sector of Sri Lanka is governed by Ceylon Electricity Board (A statutory organization formed by an Act of Parliament, no.17 of 1969) and Lanka Electricity Company (Pvt.) Ltd. (registered under Companies Act), both are fully owned entities of the Government of Sri Lanka, regulated by Public Utilities Commission (PUCSL) of Sri Lanka.

The Power Sector interactions of State Institutions are indicated in the figure 1.1.

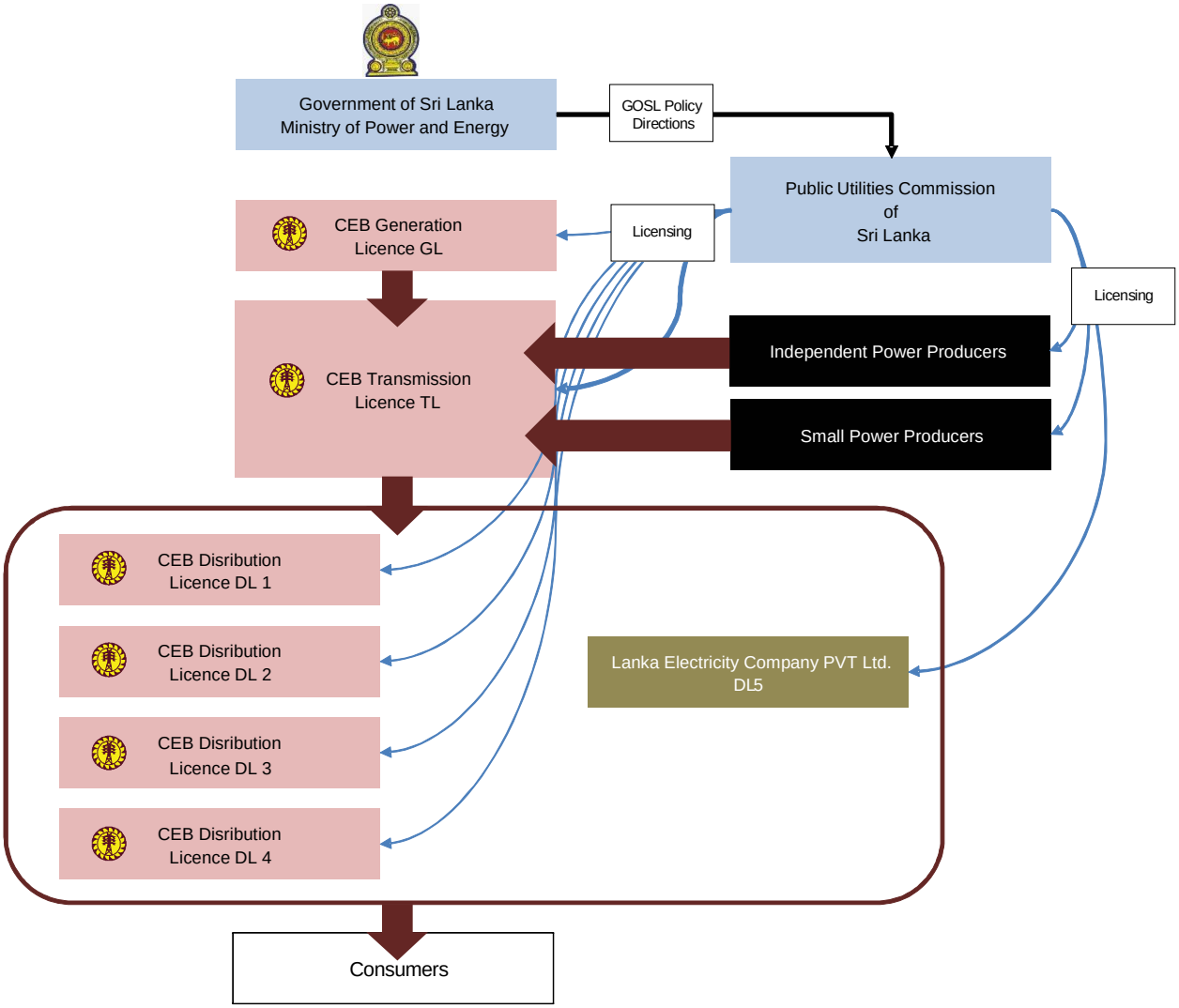



**Figure 1-1 Power Sector Organization in Sri Lanka**

Power sector is regulated by the Public Utilities Commission of Sri Lanka (PUCSL). CEB is vested with a Generation License (GL), a Transmission License (TL) and four (4) Distribution Licenses (DLs) by PUCSL.

Country's power Generation is carried out by CEB under Generation License *(CEB's own power plants)* and private independent power producers (IPPs) under generation licenses issued to them by the PUCSL. In addition, there are small scale power producers (eg. Solar PV) generating under license exempted provisions granted by PUCSL.

While Ceylon Electricity Board (CEB) is responsible for Power Generation, Transmission and Distribution, Lanka Electricity Company (Pvt.) Ltd. (LECO) is responsible for power distribution in designated area at 11kV level and below.

### 1.3.2 Ceylon Electricity Board

The Ceylon Electricity Board (CEB) has been established in 1969 as provided in the Act of Parliament, no. 17 of 1969. As per the Act, CEB is vested with responsibilities of development and co-ordination of the Generation, power transmission and Distribution of Electrical Energy.

CEB organization structure up to Divisions level is shown in figure 1-2.

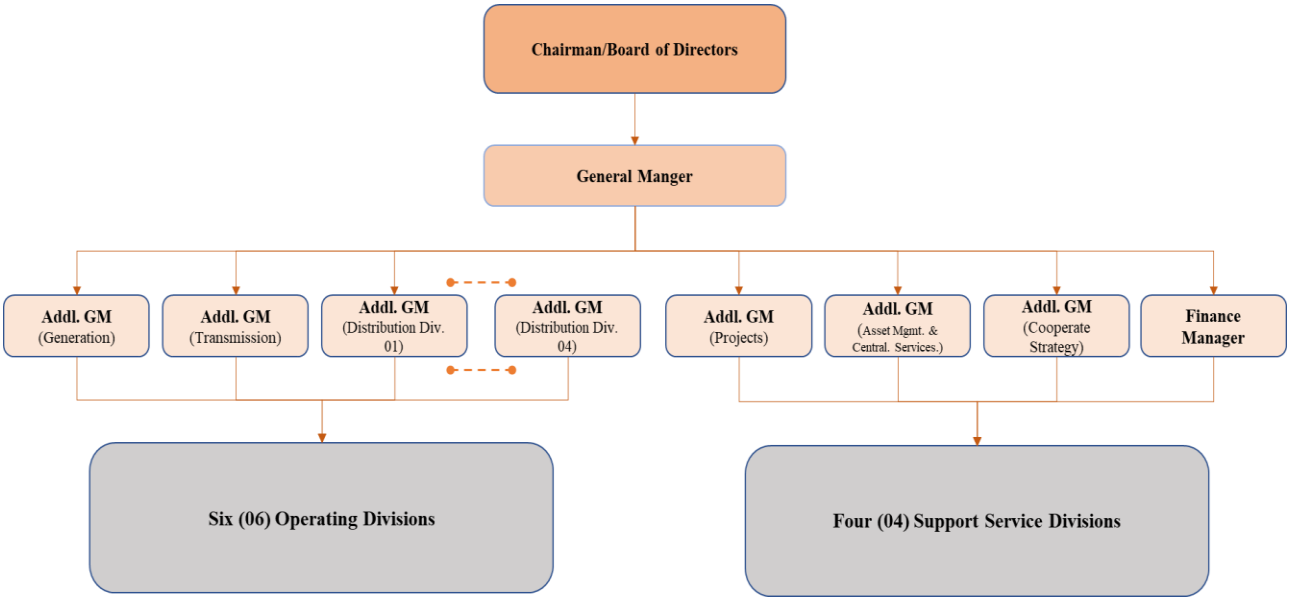
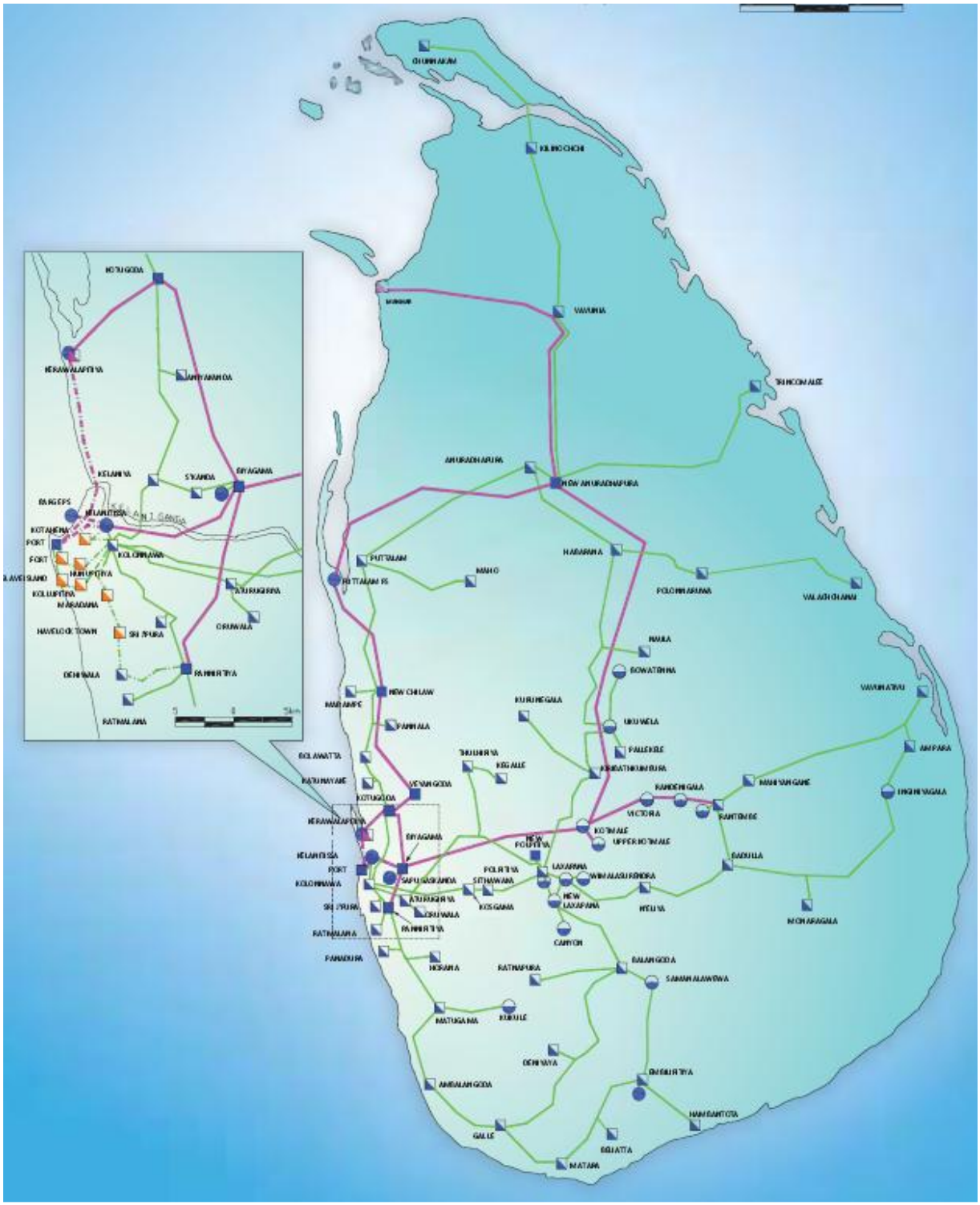



**Figure 1-2 Organization structure of the CEB as at end of 2022**

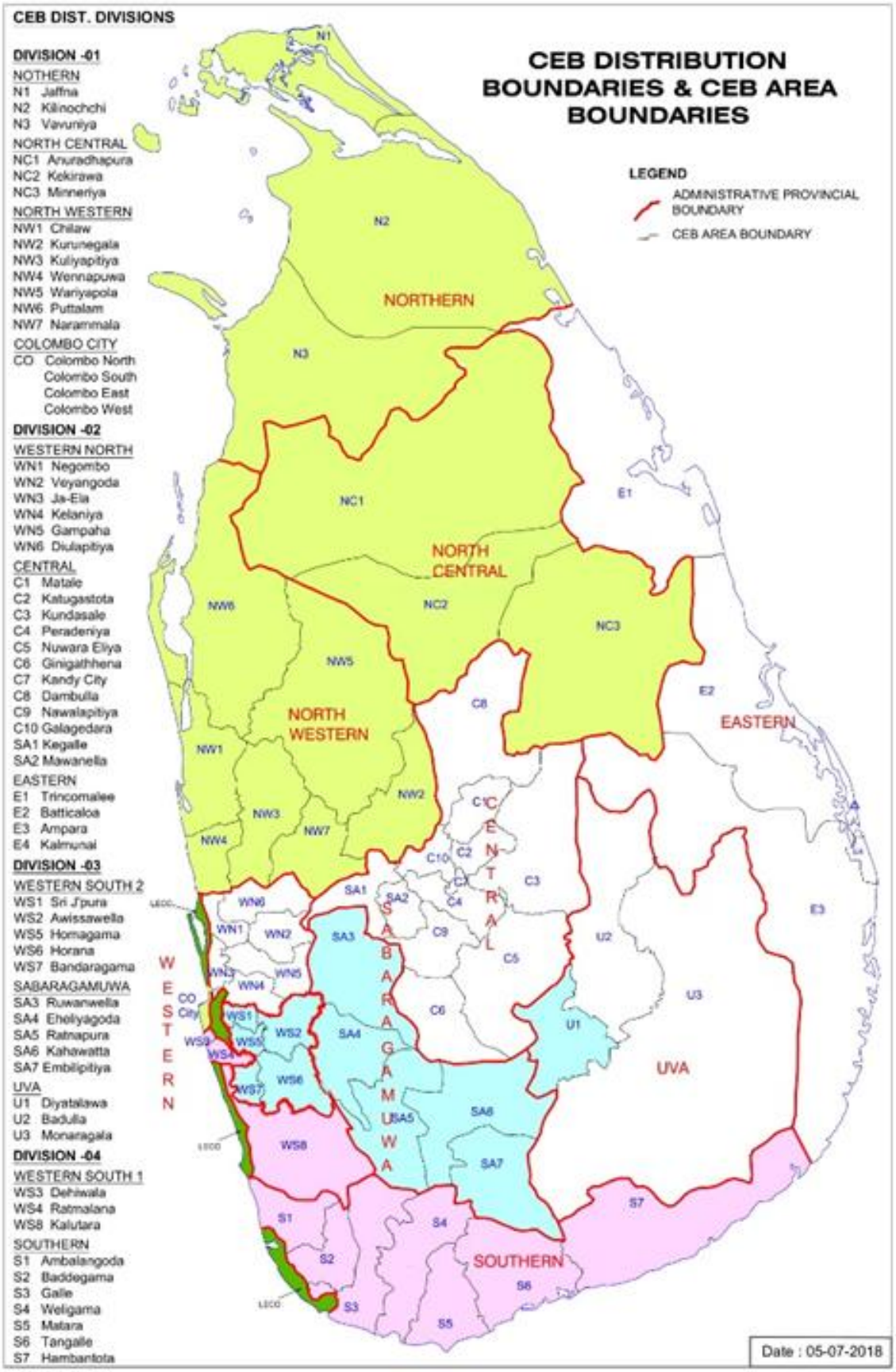
CEB is manage by a Board, the Chairman and the General Manager supported by six (6) Additional General Manages (Addl. GMM) in operation divisions and four (4) Addl. GMM providing Support services, DGMs and Chief Engineers in Branches, Units and Sub-Units.

CEB's transmission network is shown in figure 1-3 and area of power distribution show in figure 1.4.




*Source: CEB Statistical Digest 2019*

**Figure 1-3 Electricity Transmission Network**



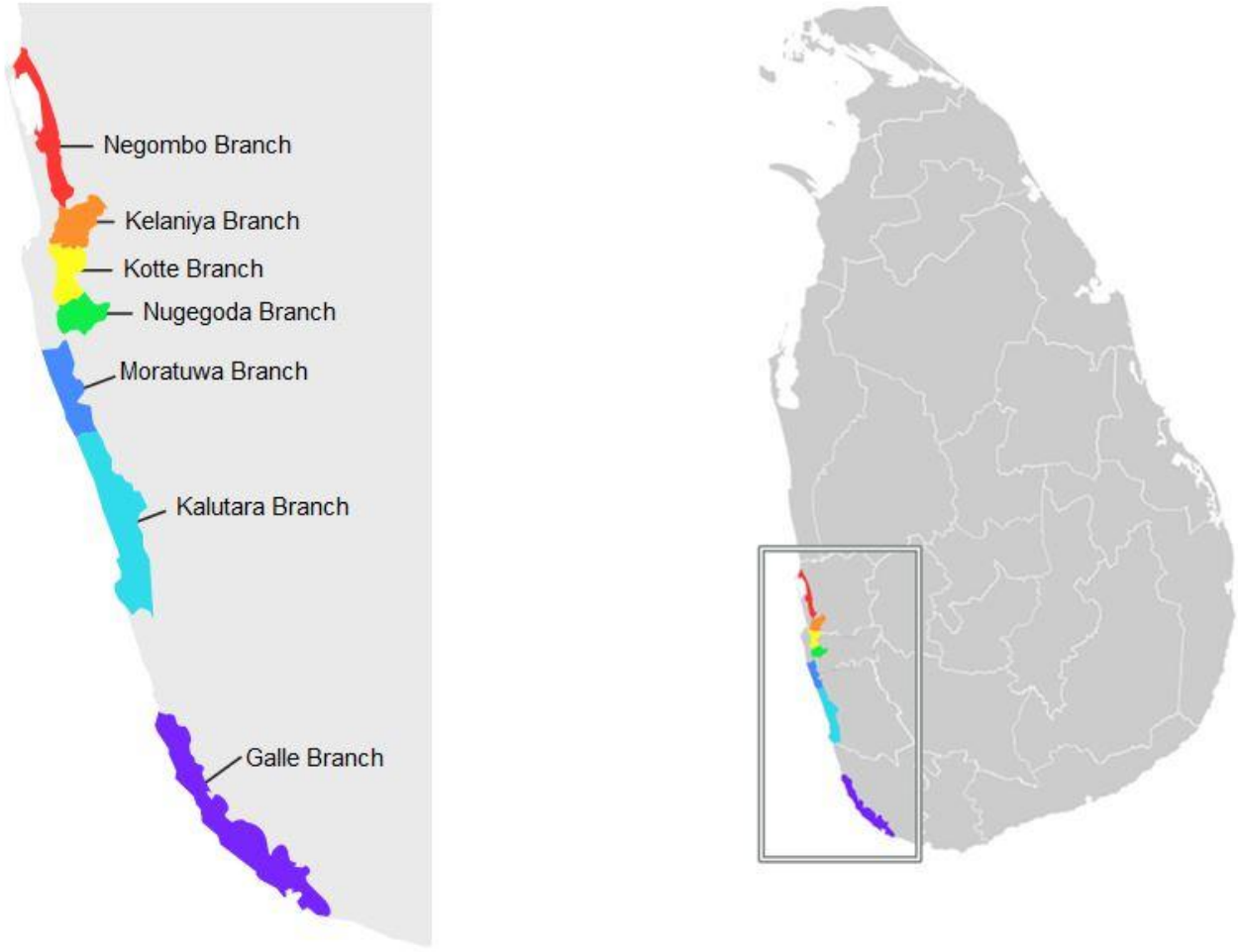

*Source: CEB Annual Report 2018*

**Figure 1-4 Power Distribution Areas of CEB**

### 1.3.3 Lanka Electricity Company (Pvt.) Ltd.

Lanka Electricity Company (LECO) was established as a state owned private limited liability company registered under Company Act no 17 in 1983. LECO was originally assigned the responsibility of operation electricity network once owned and operated by Local Authorities but subsequently some of the CEB distribution areas were vested with LECO for them to have a contiguous operating area for flexibility and economy of operations.

LECO purchase power in bulk from CEB at 11kV voltage through CEB's 33/11kV Primary Substations and distributes in its area through their 11kV and LV networks. Thus, LECO has no generation or transmission activities. Power distribution area of LECO is shown in figure 1-5.




*Source: LECO Statistical Digest 2022*

**Figure 1-5 Power Distribution Areas of LECO**

LECO is managed by a Team consist of Board of Directors, Chairman, General Manager and four (4) Additional General Manages responsible for Operation, Engineering, Finance and Human Resources Management divisions. Eight (8) Deputy General Managers, and seven (7) Chief Engineers support the management team. Area of operation of LECO is shown in fig. 1.5.

## 1.4 Arrangements in Place to Address an Emergency Situation

As already indicated in Section 1.1, the Electricity Utility Industry has faced numerous disasters, caused by natural events and human induced hazards, throughout the history. As Electricity has become one of the basic needs for the day-today life of the modern-day society, Electricity Utilities (CEB and LECO) have paid immediate attention to disasters & hazards and taken immediate action to safeguard life of people, restore supply and bring the life of general public to normalcy, in the past, successfully.

CEB's response during Cyclone in 1978 in Eastern Region, civil war in North and East 1982 - 2009, Civil unrest / insurrection in 1988-1989, Rathnapura flooding in 2003, Tsunami in 2004 and flooding in Kalutara districts in 2016, Covid-19 in 2020-2021 etc. testify their capacity to handle such situations. LECO too faced major disasters (Floods) in 2006, 2016, 2018 etc. and Covid-19 in 2020-2021. In the past, senior technical managers (ie. Engineers) in the affected area have taken the responsibility of responding to disasters. Other divisions / branches outside the disaster impacted area provided all necessary supports (such as man-power, equipment, machinery, spares etc.) to respond to the situation. Depending on the severity of the disaster, either Provincial Officer (DGM), Divisional Officer (Addl.GM) in CEB and Branch managers in LECO coordinated such activities. As required, in addition to their own (CEB, LECO) employees, registered contractors were also deployed for the supply restoration. In many cases of flooding / Tsunami, Landslides, the immediate response was to isolate the power distribution network in the affected area as soon as possible in order to ensure no electrocution occur due to disaster related situation (eg. flooding, landslides etc.), accidents or inadvertent operations. Thereafter, section by section power supply was restored ensuring the safety of public and users and safety of plant and equipment. If this process was delayed, it was mainly due to inaccessibility of the location (switchgear, line etc.) due to access roads being badly damaged or blocked. In fact, the response to a disaster really depended on type of disaster as utilities attempts were to maintain the supply as much possible as electricity / lighting was one of the basic commodities required by disaster response teams of other organizations.

Further, Corporate Managements in CEB and LECO supported the autonomy assumed by Senior Technical Managers / Officers since priority to public safety was that of over the administrative procedures. Meanwhile, local technical managers and technical officers coordinated with local government administrative authorities and other organizations (eg. RDA Engineers, Irrigation Engineer, District Secretariat, Grama Niladari etc.) to assess the situations, to get / render necessary assistances etc. Meanwhile, Senior Managers (Senior Engineers) outside the disaster area were coordinating with other branches/units and provided necessary supports. In addition, direct personnel level close interactions among senior managerial and middle level technical officers helped carrying out emergency operations on verbal communication while ensuring safety and coordination. Decentralized financial authorities in utilities helped further in taking quick actions when necessary. As Disaster Management Center or Government's Disaster Management mechanism was not established until late 2005, and no systematic procedure had been introduced, these disaster responses were initiated by the utility management on their own, and led to success with their experience.

However, as such Responding Procedures are not documented in CEB /LECO, the experience may go un-transferred to the next generation of staff. Also, the ever-increasing complexities of power sector may pose different unexpected issues with different hazards which may not have thought of. Hence, procedures, authority levels, resource allocations etc. need to be properly documented.

Following National Disaster Management Centre directives, CEB developed Operating Procedures for some selected hazards. Later during 2017-2019, CEB initiated a process of developing a comprehensive Functional Manual for 'Corporate Risk Management', developed Risk Management Policy Framework and Risk Assessment Matrix etc., and is now expanding to developing detailed operating procedures operating unit wise. The exercise is ongoing. The draft version of Functional Manual 'Corporate Risk Management' is yet to receive CEB Board approval.

The LECO too developed a 'Disaster Management Plan' in mid-2020 following DMC directives, in Conformity with Sri Lanka Disaster Management Act of May 2005 and National Policy. It outlines SOP for disaster response.

### 1.5 Economic Risk

Government of Sri Lanka has pledged its commitment in 2015 to achieve United Nations 17 Sustainable Development Goals (SDG) by 2030. Towards this, the government has enacted SDG Act No19 of 2017 to supervise the development of policies and strategies on SDG and facilitate all agencies to follow-up and monitor the implementation of 17 SDG and 169 Targets. Accordingly, CEB and LECO has the responsibility to achieve Goal 7- Ensure access to affordable, reliable, sustainable and modern energy for all by 2030.

However, increasing trend in water related disasters such as floods, drought, cyclones, landslides and coastal hazards during the last decade caused significant damages to infrastructure and substantial losses to agriculture, industry and commercial establishment. Development funds are frequently transferred to reconstruct damage infrastructure, relief recovery operations. Further the Climate change impacts have intensified the hydro meteorological hazards causing frequent severe cyclonic condition associated with flood, drought and landslides disrupting plans of CEB and LECO to active targets by 2030. Therefore, it is critical to mainstream disaster risk reduction concepts as outlined in Sendai Framework for Disaster Risk Reduction into development planning process of CEB and LECO to ensure the electricity supply sector is resilient to disaster impacts and achieve SDG target by 2030.

National Planning Department, in developing new format for formulation of project proposals, has informed all state sector agencies, expecting funds for sector development to align the project objective/s with the relevant SDGs and mainstream the Disaster Risk Reduction in to the relevant component of the project cycle. Disaster risk reduction is the core of sustainable development and economic risk could be minimized by mainstreaming DRR in to all sector development projects and programmes.

### 1.6 Objectives of the proposed IDMP

The efficient performance of the energy sector has a fundamental impact on economic development. Without an adequate power supply, basic services (such as piped water supply, health services), industrial and non-industrial operations, and access to information, communications, and digital connectivity will be adversely affected. Without access to electricity, it is difficult to maximize the income-generating activities that are essential to alleviate poverty in rural areas.

However, with the increasing number of disasters caused by natural hazards and climate change impacts in the country, as mentioned above, it has become a challenge to protect the electricity supply from disasters and to provide continuous services to the public with minimum disruption. The Public Utilities Commission of Sri Lanka (PUCSL), established as per Public Utilities Commission Sri Lanka Act no 35 of 2002, empowered to promote the interest of Consumers and safety and service delivery of public utility industries. Therefore, PUCSL has decided to improve the capacity of agencies providing utility services to prevent/mitigate hazards, respond and recover from disasters with minimum impact to the industry and consumers. Therefore, PUCSL and initiated action to assist the CEB and LECO to formulate Institutional Disaster Management Plan (IDMP), which includes emergency response, restoration plans, and mitigation plan to maintain customer-related electricity supply service without any hindrance.

As per the section 4 (h) and section 10 of Disaster Management Act No 13 of 2005, every Ministry, Government Department, Public Cooperation (here after known as Institutions) required to prepare a Disaster Management Plan in conformity with the National Policy on Disaster Management, National Disaster Management Plan (NDMP), guidelines laid down by the National Council for Disaster Management (NCDM) and the technical assistant provided by the Disaster Management Centre (DMC).

As per Section 12(2) of the DM Act, it shall be the duty of every Ministry, Government Department or public corporation, to take all measures necessary for the immediate implementation of their Disaster Management Plans prepared under section 10 of the Act within their respective Ministry, Department, or Corporation, as the case may be to counter the effect of the disaster or the impending disaster or to mitigate the effect of such disaster or impending disaster.

The Institutional Disaster Management Plan (IDMP) covers:

- Preparedness plan to minimize/mitigate disaster impacts and to prevent occurrence of future disasters including mainstreaming disaster risk reduction into the development process,
- Plan to respond to disasters at all levels,
- Plan to providing relief and implement post disaster recovery and rehabilitation measures,
- Planning for physical, financial, and human resource to facilitate the above three components,
- Improved standard operational procedures incorporating Disaster Risk Reduction measures.

## 1.7 Scope of the Assignment and Methodology Adopted

### 1.7.1 Scope of the Assignment

This report presents the Institutional Disaster Management Plan (IDMP) for the Ceylon Electricity Board (CEB) and Lanka Electricity Company (Pvt.) Ltd. (LECO). It has been prepared in accordance with the Terms of Reference issued by PUCSL, provisions in the Sri Lanka Disaster Management Act No. 13 of 2005, the National Disaster Management Plan and relevant guidelines issued by the Disaster Management Centre.

The report covers disaster risk assessment, mitigation, preparedness, emergency response, supply restoration, recovery and reconstruction, resource mobilization, training and continuous improvement. The report provides a common electricity-sector framework while recognizing the different mandates of the two utilities. Utility-specific responsibilities, arrangements and procedures should therefore be applied separately where necessary.

The study principally covers assets, facilities, functions and services owned, operated or managed by CEB and LECO. These include power-generation facilities, transmission and distribution substations, overhead and underground networks, control and communication facilities, stores, workshops, depots, offices and operational support resources. Detailed asset-level spatial assessment is mainly based on information provided by CEB and LECO.

The report principally reflects the legal, organizational, administrative, asset and disaster information available up to early 2024, unless otherwise stated. Subsequent revisions of the report to incorporate comments should not be interpreted as confirmation that all underlying information was updated to the revision date.

### 1.7.2 Hazards Covered by the Report

The disaster events identified in the Sri Lanka Disaster Management Act and other hazards relevant to electricity-sector operations were initially considered. The preliminary screening assessed historical frequency, potential consequences, damage to electricity infrastructure, interruption of supply, public and employee safety, effects on critical customers, restoration difficulty and possible future changes associated with climate change.

The clause 25 of Sri Lanka Disaster Management Act No. 13 of 2005 lists 21 disaster events, viz. (a) a landslide (b) a cyclone (c) a flood (d) a drought (e) an industrial hazard (f) a tsunami (seismic wave) (g) an earthquake (h) an air hazard (i) a maritime hazard (j) a fire (k) an epidemic (l) an explosion (m) air raids (n) civil or internal strife (o) chemical accident (p) radiological emergency (q) oil spills including inland and marine oil spills (r) nuclear disaster (s) urban and forest fire (t) coastal erosion; and (u) tornados, lightning strikes and severe thunder storms. Based on the screening, six hazards were proposed for consideration: floods, landslides, drought, cyclones/high winds, coastal hazards and tsunami. The PUCSL in consultation with CEB and LECO, subsequently selected four hazards for detailed assessment and preparation Institutional Disaster Management Plan, in accordance with the TOR.

The hazards selected for CEB were flood, drought, cyclone/high winds and landslide. Those selected for LECO were flood, cyclone/high winds, coastal hazards and tsunami.

Detailed exposure, vulnerability and risk assessments, together with specific mitigation, preparedness, response, restoration and SOP provisions, have therefore been developed mainly for these hazards. Nevertheless, the command, coordination, communication, safety, resource mobilization, damage assessment, business continuity and recovery arrangements established under the IDMP are intended to operate on an all-hazards basis. CEB and LECO should progressively develop additional annexes and SOPs for other relevant hazards.

With reference to the comments at the workshop held on 2026-07-08; Dam breach is not a natural Hazard and caused by operational or technical error or human activity. Floods triggered by dam breach therefore was not considered in the consultancy. Urban fire and forest fire listed

as hazards in the DM Act. TOR require Consultants to identify six hazards and PUCSL to select 4 hazards for further analysis. Fire was not included in the selected hazards.

### 1.7.3 Assessment Methodology

The IDMP was prepared using a combination of document review, historical analysis, stakeholder consultation, hazard assessment, GIS-based spatial analysis and qualitative institutional and vulnerability assessments.

The principal steps comprised:

i. Review of applicable legislation, national policies, DMC guidance, electricity-sector requirements and institutional mandates.
ii. Review of past disasters, utility responses, damage, outages, restoration experience and lessons learned.
iii. Review of existing disaster-management plans, emergency procedures, operating instructions, safety procedures and risk-management arrangements.
iv. Consultation with CEB, LECO, PUCSL, DMC and relevant technical agencies to obtain data, operational experience and recommendations.
v. Preliminary identification and prioritization of hazards using historical records, available hazard profiles, utility experience and potential consequences for electricity-service continuity.
vi. Identification of electricity-sector elements at risk, including generation, transmission and distribution infrastructure.
vii. GIS overlay of available asset coordinates with flood, landslide, drought, cyclone/high-wind, tsunami and coastal-hazard maps to determine exposure.
viii. Qualitative assessment of vulnerability based on exposure, asset sensitivity, likely damage, operational importance, accessibility, alternative supply arrangements and restoration requirements.
ix. Review of organizational, human, technical, logistical, communication and resource capacities required for preparedness, response and recovery.
x. Assessment of risk by considering the hazard, elements at risk, exposure and vulnerability, followed by development of mitigation, preparedness, response, restoration, recovery, training and SOP provisions.

The resulting risk classifications are intended primarily as strategic screening and prioritization tools. They do not replace detailed site-specific engineering, structural, hydrological, geotechnical or operational risk assessments for critical facilities.

### 1.7.4 Stakeholder Consultation and Validation

The preparation of the IDMP was supported by meetings, discussions, workshops, data requests, presentations and review comments involving PUCSL, CEB, LECO, DMC and other relevant agencies.

The consultation process was used to obtain asset and disaster information, understand existing practices, document past experience, identify institutional and resource gaps, select priority hazards, and develop mitigation, preparedness, response and restoration arrangements. It also provided a mechanism for reviewing draft proposals and incorporating stakeholder comments.

### 1.7.5 Geographical and Organizational Levels

The IDMP is intended to operate at national, provincial or regional, and local or field levels, depending on the scale and consequences of the event.

National-level arrangements apply to disasters affecting several regions, major generation or transmission facilities, nationally important customers, or events requiring extensive inter-agency coordination and resource mobilization. Regional or Provincial arrangements apply where several divisions, branches, districts or operating units must coordinate personnel, contractors, materials and equipment. Local arrangements apply where the affected power station, substation, branch, depot / CSC or field unit can manage the event using delegated authority and locally available resources.

The arrangements should allow timely escalation and de-escalation and should clearly define authority for plan activation, incident command, communication, public information, resource requests, expenditure approval and transition from emergency response to recovery.

### 1.7.6 Structure and Intended Use of the IDMP

The report follows the disaster-management cycle. It includes hazard and risk assessment; mitigation measures; preparedness and emergency-response arrangements; restoration, damage and loss assessment; recovery and reconstruction; and training and capacity development.

The IDMP is intended to serve as:

- management framework for CEB and LECO;
- reference for corporate, regional and field personnel;
- basis for utility, facility and location-specific emergency plans;
- framework for detailed SOPs, checklists and resource inventories;
- basis for prioritizing disaster-risk-reduction investments;
- guide for drills, simulations and training; and
- framework for coordination with PUCSL, DMC and other agencies.

The Plan should be treated as a living document and reviewed periodically, after major disasters, significant organizational or system changes, amendments to legislation, or the availability of improved risk information. Although detailed hazard-specific assessment is limited to the four selected hazards for each utility, the overall institutional framework should remain applicable to all emergencies.

# 2. Hazard Identification

## 2.1 Introduction

Power Sector is one of the most important infrastructures of the country, as growth of this sector is directly correlated with the economic growth of the country as it is the major input for the social and economic welfare of the society. The natural disasters or man-made disasters always involve losses and damage of infrastructure of the life line services of the country. Any disruption in Power System due to natural or manmade disaster creates hardship to the human beings, as every aspect of human life is directly or indirectly associated with electricity.

However, reliability of electricity supply in Sri Lanka faces serious challenges from natural and human induced hazards. Due to severe drought 2015, generation of hydropower was curtailed as the water level of reservoirs has dropped below 20% capacity. In 2022 drought condition significantly reduced hydro-power generation in the country and power regulator has warned of impending power cuts if the water levels in the hydro power reservoirs do not improve (in fact, Electricity was considered a byproduct of Mahaweli Scheme and Irrigation was the top priority. Drinking water supply from the Kelani River is a high concern for Laxapana Hydropower schemes).

As uninterrupted electricity supply service from industry to domestic user is one of the indicators which correctly measure the development of the country, in order to eliminate or if not possible, to minimize damages which cause disruption in generation, transmission and distribution of electricity sector, it becomes extremely important to evolve disaster management plan followed by the disaster risk assessment for the sector.

Hence the main objective of the study is to identify the risk associated with frequently occurring hazards on electricity sector to ensure that risks are eliminated or reduced to tolerable level in order to ensure uninterrupted service leading to achieve sustainable development goals.

The main objective is facilitated by five basic objectives for risk assessment as follows:

- Identification and quantification of hazards that can affect the power supply system, whether they are natural or derive from human activity;
- Estimation of the susceptibility to damage of components that are considered essential (critical Infrastructure) to provide electricity in case of disaster;
- Definition of measures to be included in the mitigation plan, such as: retrofitting projects, improvement of watersheds, and evaluation of foundations and structures, improving awareness of consumers to minimize wastage of electricity.
- These measures aim to decrease the physical vulnerability of a system's components;
- Identification of measures and procedures for developing an emergency response and operation plan. This will assist the CEB and LECO to supplement services in emergencies**;**
- Evaluation of the effectiveness of the mitigation and emergency plans, and implementation of training activities, such as simulations, seminars, and workshops.

## 2.2 Hazard Identification

Sri Lanka has experienced many natural hazards such as drought, flood, landslide and cyclones during the past. It has also experienced human induced hazards such as, bomb explosions, strikes, fires, chemical hazards etc. The vulnerability to disasters caused by natural, as well as

human-induced hazards are in varying degrees on account of its unique geo-climatic topographic features, environmental degradation, population growth, urbanization, industrialization, non-scientific development practices and socio-economic conditions.

Hazards and disasters are two sides of the same coin neither can be fully understood or explained from the standpoint of either physical science or social science alone nor are inextricably linked to the ongoing environment changes at global, regional and local levels. Environmental hazards exist at the interface between the natural events and human systems. With respect to the frequency and consequence of the frequent hazards, Flood, drought, Landslide, Cyclone and Tsunami have been identified for further study. The impacts of these hazards and their multiplier effects on economy, national development and severity of affected infrastructures are well known but needs to be adequately quantified. Disasters such as flood, drought, landslide cyclones/high wind, tsunamis etc., need to be scientifically and statistically studied with details hazard assessment followed by the exposure, vulnerability and capacity assessment of the electricity sector of the country.

Hazards may occur or be introduced throughout the electricity supply system, from generation to consumers. Effective risk management, therefore, requires identification of all potential hazards, their sources, possible hazardous events and an assessment of the risk presented by each.

Depending on their origin, hazards can be of two types:

a) Those related to natural events, i.e., physical phenomena arising in nature;
b) Those caused by human activity.

This classification cannot be employed rigidly, since we often find interactions between natural phenomena and human actions. For instance, a landslide may be caused by erosion as a result of deforestation, by failures in channeling runoff or wastewater, or by settlements in unstable areas.

Another method of classifying hazards is based on their mode of occurrence;

a) Sudden onset, as in the case of earthquakes;
b) Gradual (Slow) onset, as in the case of drought.

The various types of hazards manifest themselves as events that can have adverse effects and can potentially lead to an emergency or even reach the level of a disaster. However, it is common for the classifications above to be applied to disasters.

### 2.2.1 Hazard Prioritization

Hazard prioritization is the process of identifying all hazards that impact the industry and determining which ones are the most severe so that they can be addressed first. Prioritization should be determined based on the likelihood or frequency of a hazard as well as the possible damage or consequence it poses to the industry.

The Hazard prioritization identifies the hazards and examines the risks that pose a threat to the people, property, environment and economy of the country particularly focusing the electricity supply. This assessment is a critical part of the preparation of disaster preparedness plans for the electricity supply of the country. Identified hazards should be used in mitigation strategies, preparedness programs, emergency response plan, and training & awareness programs in the electricity supply to ensure the resilience of the sector.

### 2.2.2 Objectives of Hazard Prioritization

The prime objective of 'hazard prioritization is to evaluate hazards, then prevent occurrence of the hazard or minimize the level of its risk by adding control measures, as necessary.

The major objective will be accomplished through the following sub-objectives as follows:

- To identify high impact hazard to the electricity supply of the country.
- To select four hazards, as required by the TOR of the assignment; for in-depth risk assessment and to formulate mitigation strategies, preparedness programs, emergency response plan exercises, and training and awareness programs related to disaster risk management in the electricity supply industry.

### 2.2.3 Data Used for the Hazard Prioritization

The hazard prioritization utilized data and information from the following sources;

- 'Desinventra' Database of Disaster Management Center
- The data and information provided by Ceylon Electricity Board and Lanka Electricity Company Ltd. and PUCSL
- Damage and Loss Assessment Report 2010 Flood, Post Disaster Need Assessment Reports of 2016 and 2017 flood and landslides report,
- Damage and Loss Assessment reports of Disaster Management Center
- Disaster study reports published by UN Agencies such as IUCN, UNDP, WFP, etc.

During the analysis approximation and assumptions were made as the existing data set was associated with numerous limitations;

### 2.2.4 Limitations

- Following the return periods of the particular hazards, the frequency of hazards has no t been documented by responsible agencies.
- Terminologies of the 'Desinventra' database have not been customized based on the country context.
- Detailed information / Data on damages and losses are not recorded in any of the databases

### 2.2.5 Assumption

- Assume the impacted population is proportionatelyto the affected Consumers of electr icity supply
- Assume a positive correlation between the data on destroyed houses (Fully Damaged) and damaged infrastructure of CEB, and LECO
- Data was grouped assuming the different disaggregation recorded in Desinventra (Eg. Data recorded under; flood, rain, storms were grouped as flood and data on high winds and cyclone in one group, slope failures, movement of earth surface, rock falls as landslides).
- The frequency of hazards was calculated based on the number of data cards recorded during the last 30 years in the DesInventar database.

### 2.2.6 Hazard Prioritization Methodology

For the ranking of hazards, the following criteria were applied:

- Frequency/ probability of occurrence: based on historical observation, how often the type or level of hazard will occur.
- Impact on the Public: based on historical observation and demographic information and study, how the type or level of hazard would affect the general public and their daily lives (no. of people affected/ no. of Housing damage) Impact on Responder to save lives and minimize property damages, based on historical observation and study, how the type or level of hazard would affect responders 'ability to save lives, protect property.
- Impact on continuity of operations / program operations: based on historical observation and study, how the type or level of hazard would affect the operation of facilities and execution of services in support of disaster and daily operations.
- Impact on property, facilities, and infrastructure: based on historical observation, study, how the type or level of hazard would affect county facilities, critical infrastructure, and other structures.
- Impact on delivery of services: based on historical observation and study, how the type or level of hazard would affect the public or private delivery of essential services to the affected or neighboring population.
- Impact on the environment: based on historical observation, and study, how the type or level of hazard would affect the environment, and associated effects
- Impact on the economic condition: based on historical observation, study, how the type or level of hazard would affect the economic success and viability of local, state, and national enterprises, and longer-term impacts to supply chain or commodity requirements.

This hazard prioritization also looked at current hazards through the lens of climate change. In anticipation of the impact of climate change in the country, this analysis also projected which hazards could occur more frequently or become more extreme in the future.

The hazard prioritization is to determine which criteria to use to rank the hazards. Criteria may include factors such as the probability of an emergency, the level of vulnerability of people or property, or both, the degree of manageability, and whether the hazard may worsen and how quickly. In this study, these indicators were asses using proxies developed based on the assumptions such as;

- No. of Affected population having a direct relationship with the impact on the electricity sector.
- No. of housing, damage is directly related to the damage to Low Voltage electricity supply infrastructures.

All the hazards mentioned in the Sri Lanka Disaster Management Act were considered for the analysis. However, the availability of data for each hazards vary dramatically. Data was standardized to ensure the accuracy of the analysis.

In order determine the relative weight assigned to each hazard, two approaches were used.

1) First approach: Data and information recorded in the 'DesInventar' database of DMC were used to evaluate the frequency of occurrence and severity adopting the assumption

explained above to overcome the limitations of the paucity and quality of historical recorded data. As the data fields recorded in DesInventar database having different definitions, (Eg. landslide, slope failures, slips, soil Collapse etc.), data and information recoded under following terms were grouped as summarized in table 2.1 below:

**Table 2-1 Summery of Disaster Groups for the Study**

| Terms | Group Terms |
|---|---|
| Landslides, Slope Failures, Slips, Soil Collapse, Cutting Failure | Landslide |
| Floods, Heavy Rains, Flash Floods, Urban Floods | Flood |
| Storm surge, Coastal Erosion, Sea Level Rise, | Coastal Hazards |
| Natural Drought, Agricultural Drought | Drought |
| Cyclone, Strong Winds, Gale, Storm, Tornado | Cyclone |

2) The second option would be to conduct an expert elicitation exercise using techniques such as the Delphi method.

The prioritization process in this assessment comprises the following steps:

Step 1. Identification of the hazard
Step 2. Identification and definition of the criteria by which each selected hazard/ will be quantified.
Step 3. Assignment of criterion-based values to the hazard
Step 4. Normalization of these values to make them comparable between criteria.
Step 5. The weighting of the criteria reflects their relative importance.
Step 6. Combining the weighted normalized values for each hazard to produce a score and ranking of the scores to obtain the order of priority.
Step 7. Reporting

### 2.2.7 Analysis and Results of Hazard Prioritization

After identifying the frequency and the consequence of particular hazards all the data was standardized and categorized as illustrated in the following table 2.2.

**Table 2-2 Frequency and Consequence Ranking**

| Scale of Severity or the consequence | Category |
|---|---|
| <1 | Insignificant |
| 1-2 | Minor |
| 3-5 | Moderate |
| 6-8 | Major |
| >8 | Catastrophic |

| Scale of Frequency or likelihood | Category |
|---|---|
| <1 | Very unlikely |
| 1-2 | Unlikely |
| 3-5 | Possible |
| 6-8 | Likely |
| >8 | Very Likely |

Using the above matrix risk or the impact of each hazard were identified and categorized qualitatively as given in the table 2.3.

**Table 2-3 Hazard Ranking**

| Scale of Ranking (Frequency X Consequence) | Category |
|---|---|
| <1 | Low |
| 1-4 | Low- Medium |
| 5-25 | Medium |
| 26- less than 64 | Medium- High |
| >64 or equal | High |

All the hazards were plotted Probability/livelihood (frequency) against the Impact / severity(consequences) and the results are illustrated in Table 2.5.

### 2.2.8 Evaluation of Hazard Profile based on the Hazards Characteristics

Data for analysis of was collected from the Desinventra Database of DMC for the years from 2000 to 2020. Six characteristics such as Magnitude, Frequency, Duration, on set speed, spatial extend and predictability were identified for evaluation. Data was available for magnitude and frequency and evaluation was based only two sets of data common to all hazards. Total score given in the Table 2.4

**Table 2-4 Evaluation of Hazard based on Hazard characteristics**

| Hazard Characteristics | Flood | Landslide | Drought | Cyclone /High wind | Coastal Hazards | Tsunami |
|---|---|---|---|---|---|---|
| **Magnitude** | 8 | 5 | 7 | 4 | 5 | 8 |
| **Frequency** | 8 | 6 | 5 | 6 | 3 | 1 |
| **Duration** | | | | | | |
| **Onset Speed** | | | | | | |
| **Spatial Extended** | | | | | | |
| **Predictability** | | | | | | |
| **Total** | 64 | 30 | 35 | 24 | 15 | 8 |
| **Category** | High | Medium High | Medium High | Medium | Medium | Medium |

The Duration, Onset speed, Spatial extended, Predictability etc. were not used at this stage due to lack of reasonably accurate data related to these features. However, in future, Utilities may collect such data, validate them and use in Hazard evaluations.

Results of the evaluation of depicted in the hazard Matrix Figure 2-5, given below.

**Table 2-5 Hazard Probability Against Impacts**

| | | Impact or severity | | | | |
|---|---|---|---|---|---|---|
| | | Negligent (1)<br><1 | Minor (2)<br>1-2 | Moderate (3)<br>3-5 | Major (4)<br>6-8 | Catastrophic (5)<br>>8 |
| **Probability or Likelihood** | Very Likely (>8) | Low Medium | Medium | Medium high<br>Drought<br>Landslides | High | High<br>Floods |
| | Likely (6(-8) | Low Medium<br>Fire | Low Medium | Medium | Medium high<br>Drought | High |
| | Possible (3 – 5) | Low<br>Marine Hazards<br>Lightening | Low Medium | Medium<br>Coastal hazards | Medium high | Medium High |
| | Unlikely (1 -2) | Low<br>Air Hazards | Low Medium<br>Nuclear hazards<br>Radiological Emergencies | Low Medium | Medium<br>Cyclone/ High winds | Medium-High |
| | Very Unlikely (<1) | Low<br>Epidemics<br>Air Raids | Low | Low Medium | Medium | Medium<br>Tsunami |

The hazard prioritization summary provides a list of the hazards ranked into five categories as given in table 2.6

**Table 2-6 The Hazard Prioritization Summary**

| Category | Types of Hazards |
|---|---|
| High | Flood |
| Medium-High | Drought |
| Medium | Landslides, coastal Hazards, Cyclone/High winds and Tsunami |
| Low -Medium | Pollution, Industrial and chemical hazards, Nuclear hazards, Radiological Emergency |
| Low | Air Raids |

Based on the above analysis following six hazards were selected and submitted to PUCSL with a request to select for hazard for further analysis.

1. Floods
2. Landslide,
3. Coastal Hazard
4. Drought,
5. High wind, /Cyclone,
6. Tsunami

### 2.2.9 Prioritized Hazards

It is expected that the hazard ranking report will serve as a base document for in depth risk analysis required to be done for this study. Based on the available data, the result of final raking is Flood, Landslide, Coastal Hazard, Drought, High wind, /Cyclone and Tsunami.

PUCSL, in consultation with CEB and LECO, has informed that the following hazard have been selected for detail hazard exposure, vulnerability and risk analysis. Table 2.7;

**Table 2-7 Hazards Selected for Risk Analysis**

| CEB | LECO |
|---|---|
| Flood | Flood |
| Drought | High wind/ Cyclone |
| High wind/ Cyclone | Coastal Hazards (cover Coastal Erosion, Sea Surges and Sea Level Rise) |
| Landslide | Tsunami |

## 2.3 Hazard Assessment

Sources and the details of data used for the Hazard Assessment are given in the table below.

**Table 2-8 Details of Hazard Layers**

| Hazard | Sources | Scale | Area Covered | Remarks |
|---|---|---|---|---|
| Flood | Disaster Management Centre, Irrigation Department | 1:50,000 | All Island | Map compiled with 100 years return period flood map published by CRIP project -Ministry of irrigation and Water Management for 10 river basins with remote sensing Data extracted timely during flood events. |
| Landslide | National Building Research Organization | 1:50,000 | All landslide prone areas | Map depicts landslide susceptibility areas |
| Drought | Disaster Management Centre | 1:50,000 | Island wide | Maps prepared based on the Agro-Ecological Zones and categorized as high, moderate and low. Hazard profiles published by DMC |
| High winds Cyclone | Meteorological Department/ Disaster Management Centre | | | Hazard profiles published by DMC |
| Coastal hazards, Sea level Rise Sea surges | Disaster Management Centre | 1:50,000<br><br>1:50,000 | Covering whole coastal areas | Hazard profiles published by DMC |
| Tsunami | Disaster Management Centre | 1:50,000 | Cover coastal belt 2 km into the land | Hazard profiles published by DMC |

### 2.3.1 Floods

Floods are caused by extreme rainfall, unusually high sea levels, or the failure of dams and dikes. Floods are becoming increasingly common as a result of human activity that causes environmental deterioration, deforestation, and unsuitable land use. However, certain floods are caused by the geomorphology and climatology of water catchment areas. The extent of flood effects is determined by the water's level, pace, and geographical region covered.

The average Annual rainfall in Sri Lanka is approximately 2000 mm with significant variation across the country. The wet zone South western region of the country received 2500 mm of rainfall while the dry zone received 1750 mm rainfall during the northeast monsoon period. Most of the floods occur during these Southwest and North East monsoon period and are usually associated with tropical storms or depressions, active monsoon conditions and break monsoon situations.

The main effects of floods on electricity supply systems are the following:

- Total or partial destruction of water intakes to power house;
- Blockage of components due to excessive sedimentation;
- Inundation of Power transmission grid network
- Floating debris (uprooted trees or floating logs) could damage the distribution network including electricity poles located in low lying areas
- Flood water could damage the electricity distribution system
- Flooding of Grid Sub stations

Spatial distribution of the maximum experienced flood in the country is given in figure 2.1

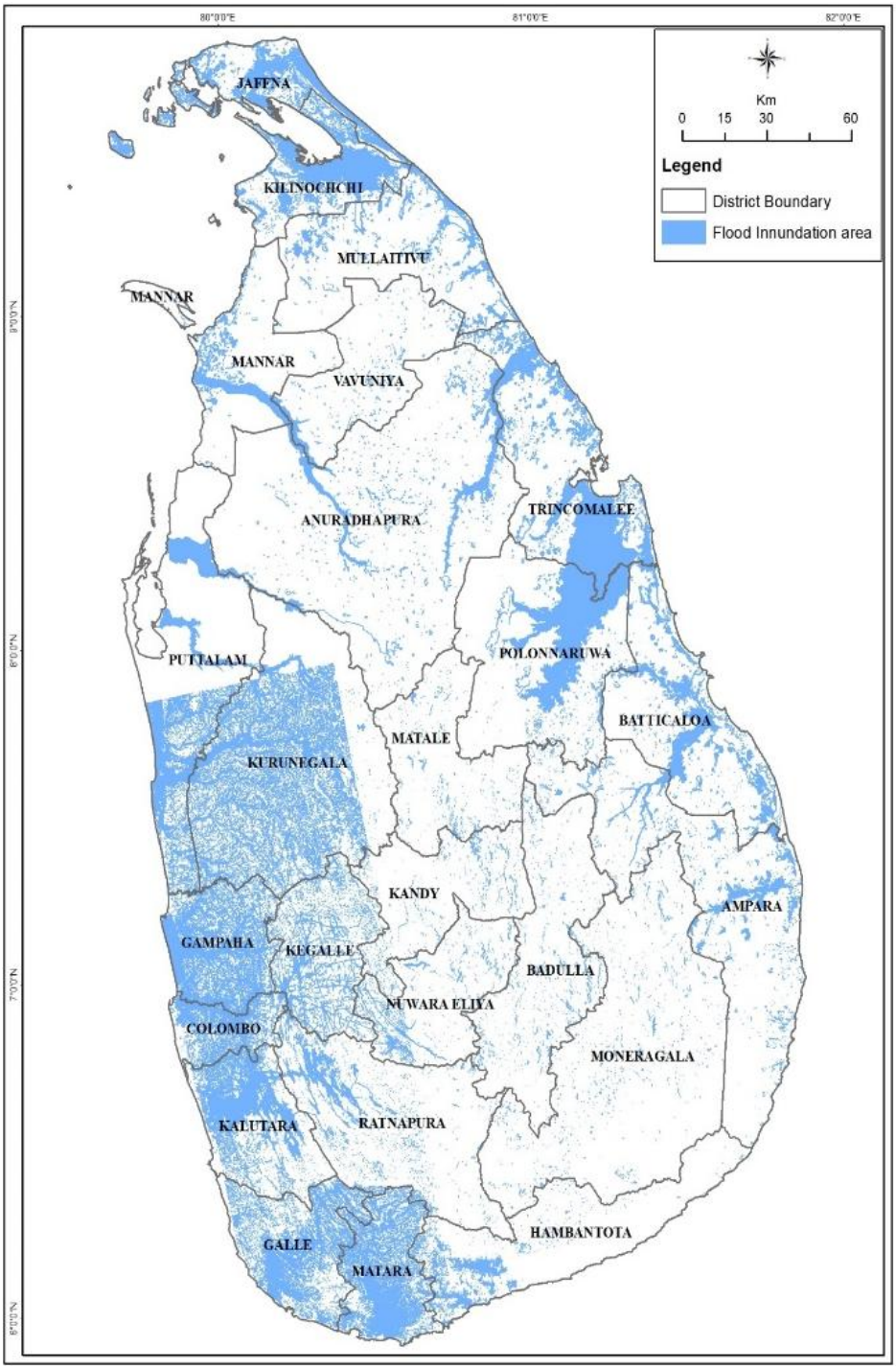
Spatial distribution of flood situation of the entire country is given in Figure 2.1 (Irrigations Department has prepared flood maps covering inundation areas and not depth). About 17.37% of the country affected by flood in varying degrees. Severe flooding areas belongs to the South and Western part of the country which represent 14.12 %.

List of major flood events experience during 2010-2024 in the country has been summarized in table 2.9 below;

**Table 2-9 Major Flood Events experience during 2010-2024 in the Country**

| SN | Name of the event | Period/ Year | Area affected | General impact with specific Impact to Electricity Sector |
|---|---|---|---|---|
| 1. | South west monsoon Floods, Kelani, Kalu, Gin Nilwala ganga and Attanagalu Oya | May 2010 | Colombo, Kalutara, Gampaha, Galle Matara districts | Damaged to infrastructure mainly household distribution system) Rs 9.3 million and losses Rs 6 million due non-payments of bills. |
| 2. | South west monsoon Floods, Malwathu oya, Kelani, Kalu ganga Attanagalu Oya, Daduruoya, | May 2016 | Anuradhapura, Colombo, Gampaha, Kegalle, Puttalum, Rathnapura | Power supply in 19 districts interrupted. Highest number of damages in Kaduwela divisional Secretariat.<br>Bulk supply meters, transformers, MCCB, Distribution lines, MCCB cutouts, Energy meters and few stores. CEB |

| | | | | |
|---|---|---|---|---|
| | | | | damages- Rs.154.67 mns<br>Losses - Rs 314,48 mns<br>LECO<br>damages- Rs.52.97 mns<br>Losses - Rs 109.7 mns |
| 3 | South west monsoon flood | 2017 May 25 June 6 | Galle, Matara, Hambantota, Rathnapura, Kalutara districts. Highest damages recorded in Kotapola DS division in Matara district.<br>Serious damages recorded in Kalawana, Ayagama and Kalutara DS divisions. | Matara Grid Substation was completely inundated.<br>The cost of damages to the Matara GSS was estimated to be LKR 48.49 million.<br>Due to interruption of power supply 330,000 people were affected.<br>Power disconnected to 143,371 consumers in Rathnapura town, Elapatha, Kiriella, Ayagama and Kalawana.<br>In Kalutara district 79,000 consumers were affected. Total Damages and losses to power sector was Rs 652.46 mns. CEB damages and losses were Rs 474.32 mns and Rs 178 mns respectively. LEO incurred a damages and losses of Rs 0.31 mns and Rs. 0.15 mns respectively. |




*(Sources: Data from DMC and Dept. of Irrigation, 2016-2017)*

**Figure 2-1 Spatial Distribution of the Maximum Experienced Flood in the Country**

### 2.3.2 Landslides

Landslides occur when the composition, structure, hydrology, or vegetation of a sloping terrain change abruptly or gradually. They are frequently linked to major dangers such as earthquakes and water saturation induced by storms or heavy rains. Leaks in the irrigation channels located in hilly terrain as well as leaks water supply distribution systems could cause excessive moisture in the soil leading to landslides. When drinking water is supplied without sufficient

sewage, the situation can deteriorate quickly. The magnitude of a landslide's impact is determined by the volume and speed of the mass in motion, as well as the extension of the unstable zone and the mass's fragmentation. Landslides are generally predictable since they are preceded by fissures and undulations in the terrain as;

- Total or partial destruction of the works, particularly intake and transmission components in the path of active landslides
- Footing of transmission towers located in hilly slopes could be affected
- Indirect impacts due to the blocking of roads and the disruption of power and communications;

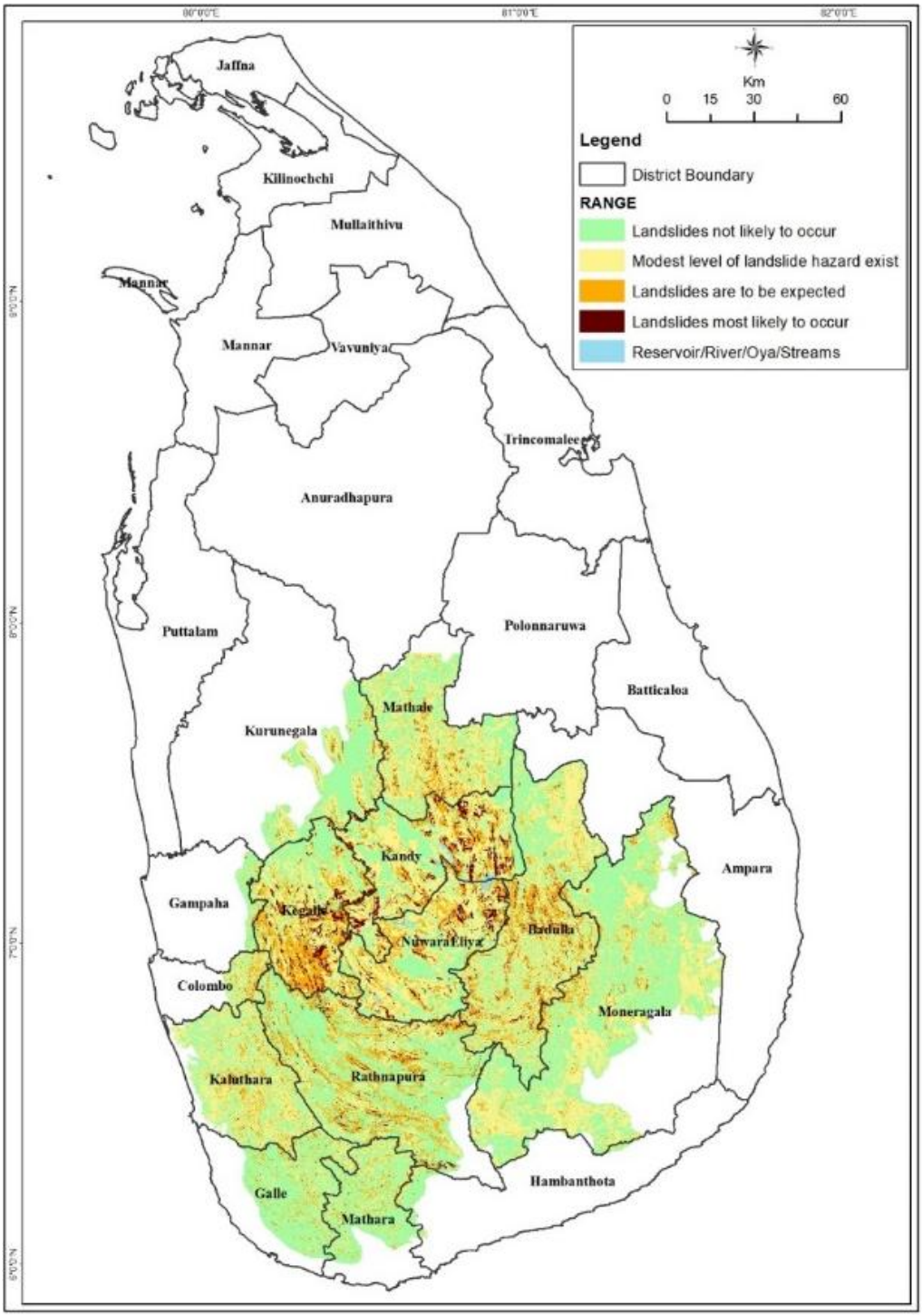
As shown in the Figure 2.2 Kandy, Matale, Kegalle, Rathnapura, Galle, Matara, Hambanthota, Kalutara, Badulla, NuwaraEliya, Badulla, Moneragala, Gampaha and Colombo have been identified as possible district for landslides and slope failures but details of the probability for occurrence of landslide or slope failures not available.

Landslide susceptibility map (Figure 2.2) depicts in the figure and the landslide hazard zonation were categorized as; Not likely, Modest, Expected and Most likely following qualitative assessment by national Building Research Organization (NBRO). Moreover, flow path of the landslides is also not available.

List of major landslide events experience in the country has been summarized in table 2.10 below;

**Table 2-10 Major Landslide events experienced 2000-2024**

| No. | Name of the event | Period/Year | Area | General impact with specific Impact to Electricity Sector |
|---|---|---|---|---|
| 1 | Devastating Landslides due to heavy precipitation exceeding 250mm /day | 2003 January | Rathnapura, Matara, Hambantota | 157 people dead due collapse of houses. Distribution lines providing power to the village was damaged. Revenue losses reported. |
| 2 | Slope failures and landslides | Jan 2007 | Walapane, Nuwaraeliya and Matara district | 23 people lost their lives, 350 houses destroyed. No major damages to distribution system |
| 3 | Landslides due to heavy rainfall exceeding 250 ml per day | May 2010 | Matale, Nuwara Eliya, Badulla, Ratnapura, Kegalle, Kalutara, Matara and Galle districts | Damages to distribution systems and house hold connections |
| 5 | Landslides due to torrential rain | Rain May 14 – 16, 2016 | Homes of 72 families in the villages of Siripura, Pallebage and Elagipitya. Kegalle and Rathnapura districts were damaged | Damages to houses connections, meters, switch gear. |
| 6 | Landslides due to heavy precipitation exceeding @500-300 mm /day | 25 may 2017 | Kalatuwawa are in Colombo district. | Power supply to Water Pumping Stations at Labugama/ Kalatuwawa affected due to earth slip at Thummodara, interrupting water supply in Colombo District. |




(Data Source: NBRO, 2010)

**Figure 2-2 Landslide Susceptible Map of Sri Lanka**

### 2.3.3 Drought

Droughts are long, dry periods that occur during natural climatic cycles and are caused by a complex set of hydrometeorological variables that affect both the soil and the atmosphere. They do not necessarily start when it stops raining, because enough water may have been stored in reservoirs or in the ground to maintain hydric equilibrium for a while. A deficit of rainfall below the annual average cause's dry spells and a prolonged deficit could trigger slow-onset

drought conditions. Droughts have resulted in significant economic, environmental, and social impacts causing revenue losses increase expenditure in energy sector.

The potential impact of drought on electricity systems includes the following effects:

- Partial or total shutdown of generation of Hydro power
- Increasing power demand due to dry weather condition
- Increasing use of fossil fuel to balance the losses from hydro power

Spatial distribution of drought which has developed by DMC is shown in figure 2.3with three zones as High, moderate and Low considering dry spells and the drinking water distribution data and information. Hence usage of the map having limitation as it does not reflect the total drought types such as meteorological, hydrological, social etc.

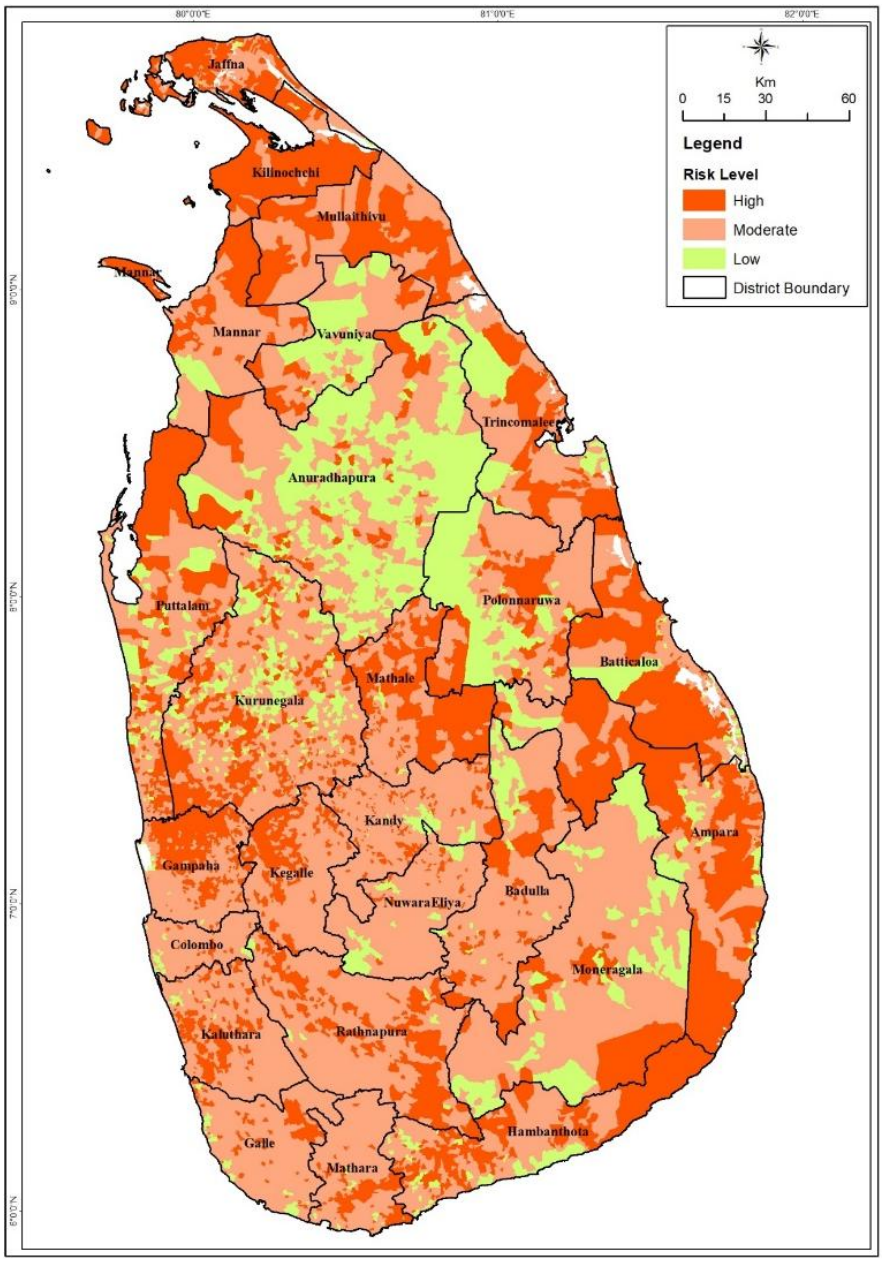
List of major drought events experience in the country has been summarized in table 2.11 below;

**Table 2-11 Major Drought Events Experience in the Country**

| S.N | Name of the event | Period/ Year | Area | General impact with specific Impact to Electricity Sector |
|---|---|---|---|---|
| 1 | Metrological, hydrological and agricultural drought | 2000 | Primarily Kurunegala Hambantota district. | Less precipitation in catchment areas limiting hydropower generation. More than 1.3 million people were affected. |
| 2. | Metrological, hydrological and agricultural drought | 2001 | Mainly impacted in Ampara, Badulla, Hambantota, Moneragala, Rathnapura and Puttalam districts | Drought continued for nearly six months. Sri Lanka faced, electricity crisis following a severe drought and water levels in hydro reservoirs dropping drastically. Initially one-and-a-half-hour power cuts was introduced extending to even seven hours per day lately.[9] More than 2.14 million people were affected. Priority was given to provide drinking water. |
| 3 | Metrological, hydrological and agricultural drought | 2004 | Anuradhapura, Badulla Kurunegala, Puttalam, Hambantota, Monergala, Polonnaruwa, Puttalam Rathnapura | Reduction of hydropower generation led the CEB to purchase power from private operator of thermal power plants. |
| 4 | Metrological, hydrological and agricultural drought | 2014 | Ampara, Anuradhapura, Batticaloa, Hambantota, Polonnaruwa, Jaffna, | Drought mainly impacted agriculture drinking water supply in NCP and NWP. The |

9 History repeating itself-Sri Lanka electricity crisis, EIU Nov 2022, http://www.chambers.lk

| | | | | |
|---|---|---|---|---|
| | | | Trincomalee, Puttalam Rathnapura, Kalutara, Mannar, Kilinochchi | drought reduced water levels in reservoirs, forcing a reduction in hydropower generation and leading to power cuts. |
| 5 | Metrological, hydrological and agricultural drought | 2016 | 19 Districts were affected. More than 50,000 people were affected in Ampara, Anuradhapura, Batticaloa, Gampaha and Hambantota districts | Generation hydropower reduced as the priority was given to provided drinking water. |
| 6 | Metrological, hydrological and agricultural drought | 2017 | Puttalam, Kurunegala, Trincomalee Hambantota. Impact has been island wide. A total of 21 districts affected. | Low water levels in the reservoir's catchment areas, limited the generation of hydropower. |
| 7 | Metrological, hydrological and agricultural drought | 2018 | Out of 13 districts affected, more than 100,000 people were affected in Batticaloa, Kilinochchi, Kurunegala, Mannar and Puttalam districts | In 2018 Sri Lanka experienced a significant drought, particularly impacting the dry and intermediate zones of the island |
| 8 | Metrological, hydrological and agricultural drought | 2019 | 15 Districts were affected. Amapara, Batticaloa, Jaffna, Kilinochchi, Kurunegala, Mannar, Moneragala, Puttalam and Matale districts more than 50000 people affected. | |




*(Data Source: DMC)*

**Figure 2-3 Drought Distribution Areas, Year 2015**

### 2.3.4 High Winds/ Cyclones

A large proportion of cyclones are generated in the Bay of Bengal and the Arabian Sea. Because of the geographical location of the island, tropical cyclone path of the Bay of Bengal lies in the vicinity to the East and Northeast coastal areas. Cyclones that have gone through the island since 1900 are shown in Table 2.12. Most cyclones do not make landfall in Sri Lanka as its relative proximity of Sri Lanka to the equator. Of the 450 cyclones that formed in the Bay of Bengal during the period from 1891 to 2000, only 4% (Sixteen cyclonic or severe cyclonic storms) have made landfall in Sri Lanka. Severe cyclonic storms, in particular, have resulted in the loss of lives of the order of several hundred as well as considerable damage to housing and other infrastructure due to both the surge and the high winds.

**Table 2-12 Cyclones that have passed through Sri Lanka from 1891-2000**

| No. | Year/Month | Situation | Origin |
|---|---|---|---|
| 1 | 1906 January | Cyclone Storm | 07.5N, 84.5E |
| 2 | 1907 March | Severe Cyclone Storm | 08.5N, 86.5E |
| 3 | 1908 December | Cyclone Storm | 07.5N, 83.5E |
| 4 | 1912 December | Cyclone Storm | 05.5N, 82.5E |
| 5 | 1913 December | Cyclone Storm | 06.5N, 85.5E |
| 6 | 1919 December | Cyclone Storm | 08.0N, 86.0E |
| 7 | 1922 November | Severe Cyclone Storm | 08.5N, 88.5E |
| 8 | 1925 March | Cyclone Storm | 05.0N, 78.5E |
| 9 | 1931 December | Severe Cyclone Storm | 07.5N, 82.5E |
| 10 | 1964 December | Severe Cyclone Storm | 04.9N, 93.0E |
| 11 | 1966 November | Cyclone Storm | 08.0N, 84.5E |
| 12 | 1967 December | Cyclone Storm | 04.0N, 89.0E |
| 13 | 1978 November | Severe cyclone storm | 06.5N, 92.5E |
| 14 | 1980 December | Cyclone Storm | 10.5N, 91.5E |
| 15 | 1992 December | Severe Cyclone Storm | 07.5N, 87.2E |
| 16 | 2000 December | Severe Cyclone Storm | 07.5N, 90.0E |

*Source: Hazard Profile Sri Lanka*

The spatial Distribution of cyclones in eastern and north central provinces are shown in figure 2.4 revealed that Batticaloa**,** Hambantota, Matara, Galle, Gampaha, Kalutara, Rathnapura and Badulla are most impact districts**.** In 1978 cyclone impacted eastern province of Sri Lanka destroyed over 130 $Km^{10}$of electrical lines resulted in a substantial number of people being left without electricity in the eastern province for some months.

10 Wikipedia

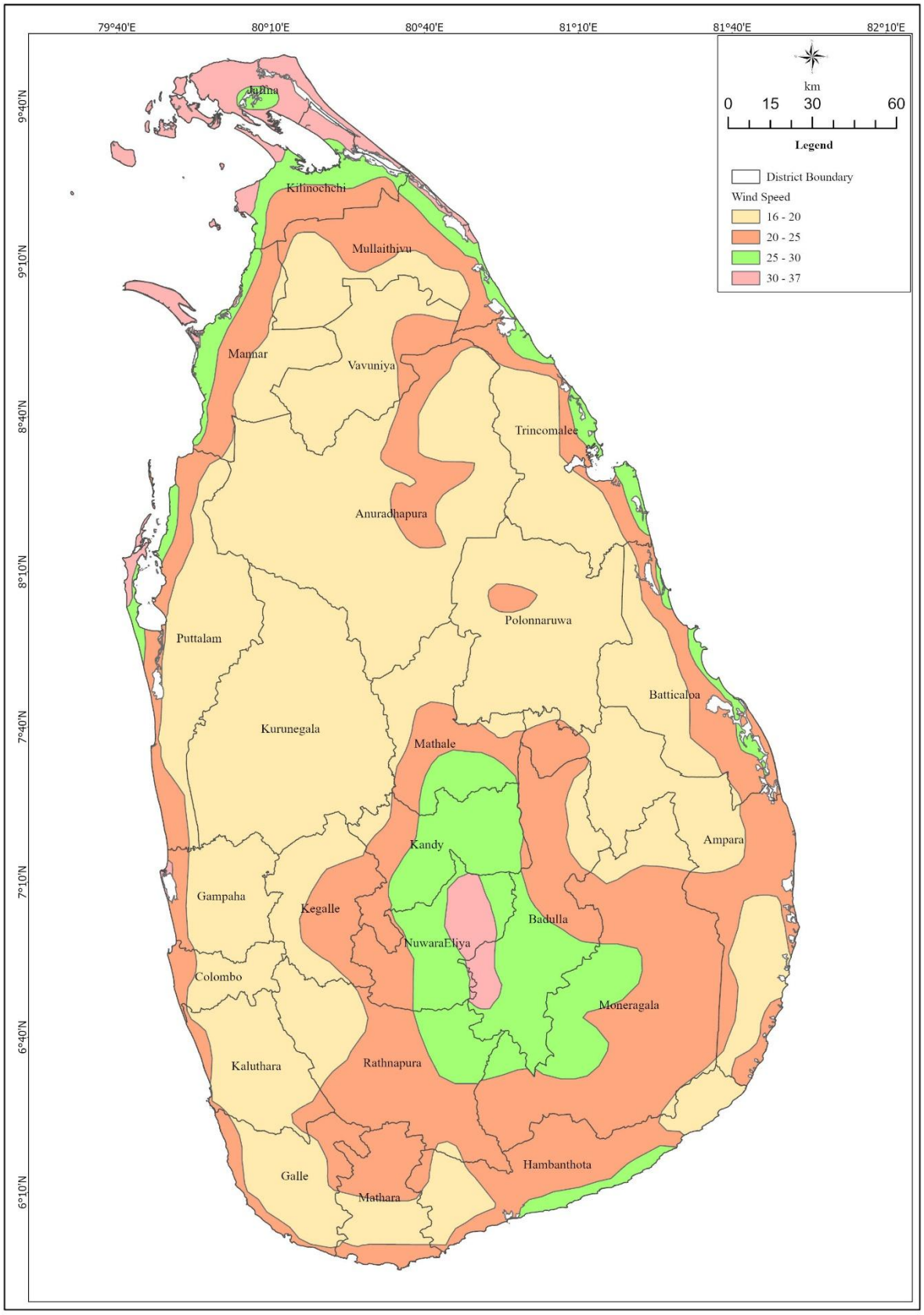



**Figure 2-4 Spatial Distribution of Cyclone/High Wind in Sri Lanka**

List of major Cyclone/high wind events experience in the country has been summarized in table 2.13 below;

**Table 2-13 Major Cyclone/high Wind Events Experience in the Country**

| S.N. | Name of the event | Period/Year | Area | General impact with specific Impact to Electricity Sector |
|---|---|---|---|---|
| 1 | Cyclone | Nov 1978 | Batticaloa district | 130 km of electrical distribution lines including poles were destroyed. |
| 2 | High wind Cyclone | 2000 Feb 04<br>2000 Dec 26 | Mostly affected Anuradhapura, Batticaloa and Trincomalee. | The 2000 cyclone had a significant impact on Sri Lanka's electricity distribution system, causing widespread disruptions and damage. Strong winds and heavy rainfall led to power outages and damaged electrical systems in many areas. Several areas were left without power for days. Fallen trees damaged distribution lines. |
| 3 | High wind | 2012 December 18th and 19th | Mostly affected was Batticaloa district | Total number of people affected was 197,437 of which 195,189 were from Batticaloa district. Local distribution system was affected. Some damages caused by fallen trees |
| 4 | High winds | 2017 December | Matara, Kalutara, Galle and Colombo districts were mostly affected. | Total of 126531 people affected. 34,105 houses damaged. Only the distribution lines in affected districts were damaged due fallen trees. |
| 5 | High winds caused by Cyclonic affect | 2020 December | Jaffna district mostly impacted. Colombo and Gale are other districts affected. | Out of 173,540 people affected 62,840 from Jaffna district. 14,125 houses were also damaged |

### 2.3.5 Tsunami

In 2004, a massive earthquake registering 9.0 on the Richter scale struck off the coast of Sumatra, Indonesia triggering a tsunami impacted several countries including Sri Lanka. More than 31,000 people in Sri Lanka were dead and approximately 6,300 remained missing. Coastal areas from Chillaw to Jaffna via Galle (part of western coast, south, eastern and northern coastal areas) were affected in varying digress across thirteen districts as shown in Figure 2.5. The waves penetrated inland areas up to 500 meters in many places, leaving behind few intact structures. Coastal infrastructure, including roads and railways, power, communications, water supply and sanitation facilities, and fishing harbors have all been severely damaged.

Displaced person exceeded 400,000, and nearly 2 million people were affected. Estimates stand at 443,000, while the affected population were estimated between one and two million. More than 130,000 houses were damaged of which nearly 99,000 were completely destroyed.

Despite the unprecedented loss of human life, it appears that the impact of the tsunami disaster on the power sector is rather limited and marginal. The damage is largely confined to the medium and low voltage distribution lines and transformers located in coastal areas, while

other infrastructure (such as grid-substations, major transmission lines, and power plants) was not directly damaged by the tsunami. The number of households in the Ceylon Electricity Board (CEB) operating area to which electricity supply was interrupted is approximately 62,500 (about 2 percent of total CEB household customers) and more than 7,800 in Lanka Electricity Company Ltd. (LECO) operating area (more than 2 percent of total LECO household customers). About 48 km of medium voltage distribution lines (11kV and 33kV) and 405 km of low voltage distribution lines (400V) were destroyed and had to be replaced. About 70,000 sets of household energy meters and service wires connected to households were also damaged, as the tidal wave washed away houses, distribution poles, and wires. A total of 88 sub-stations located in the distribution networks were also damaged. The total cost of damage to the assets owned by the CEB and LECO, according to the preliminary estimate, is approximately LKR 1.04 billion ($10.0 million)[11].

[11] Sri Lanka 2005 Post-Tsunami Recovery Program Preliminary Damage and Needs Assessment, Asian Development Bank Japan Bank for International Cooperation and World Bank Colombo, Sri Lanka January 10 – 28, 2005.

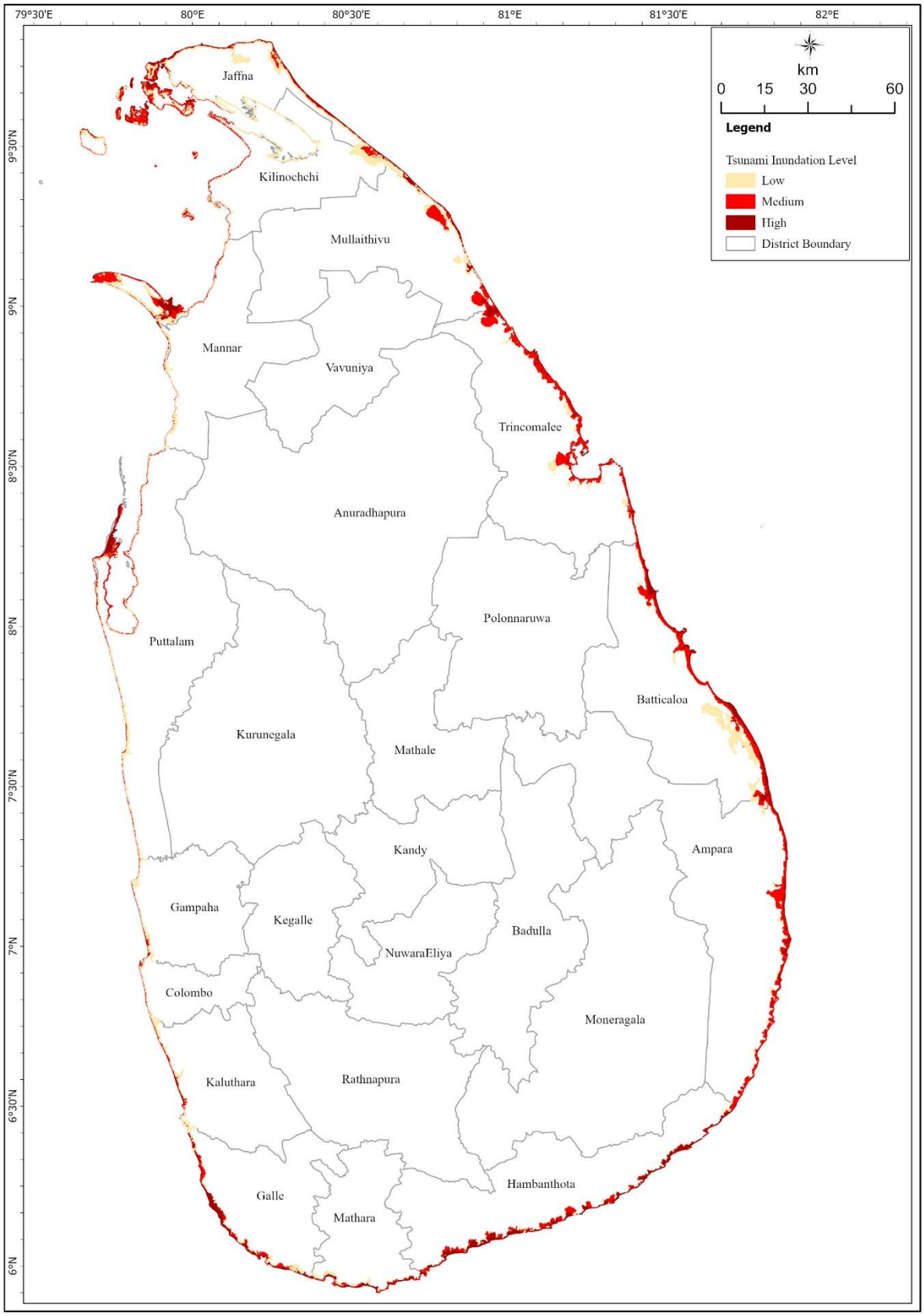



**Figure 2-5 Tsunami Inundation Map, 2004**

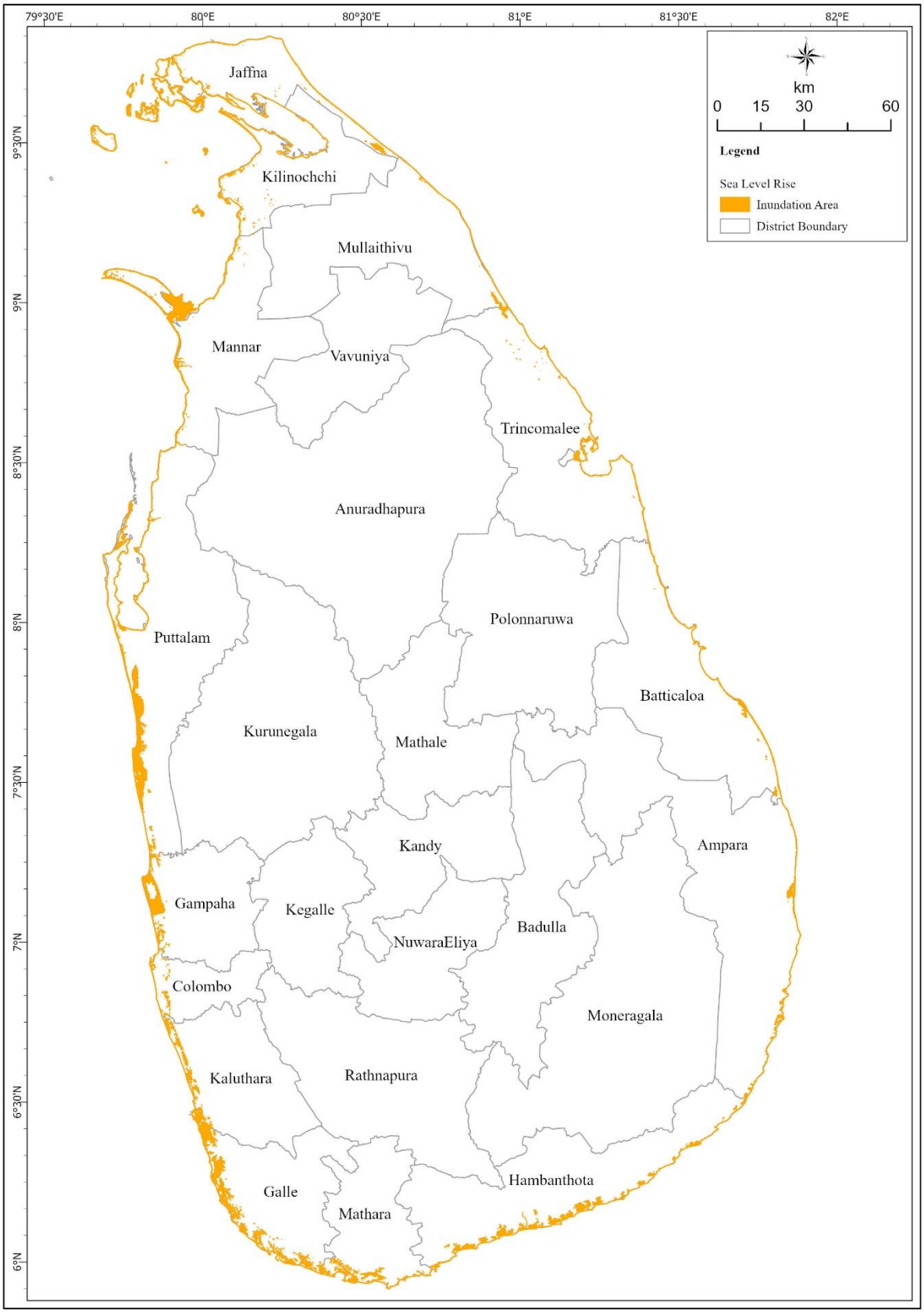



**Figure 2-6 Sea Level Rise Map, year 2010**

### 2.3.6 Costal Hazards (Sea Level Rise & Sea Surge)

#### *2.3.6.1 Sea Level Rise*

The Intergovernmental Panel on Climate Change (IPCC) has predicted in 2007 that coastal area is vulnerable to sea level rise and in its 1997 report has stated for the tropical area that "Coastal lands are particularly vulnerable to sea level rise and under the worst condition sea level could rise 59cm in 100 years (Fig. 2.6). Thermal expansion of ocean waters as they warm and Increase in the ocean mass, principally from land-based sources of ice (glaciers and ice caps, and the ice sheets of Greenland and Antarctica) are two main reasons for sea level rise.

Hazard profile provides four scenarios of predicted change of sea level, compared to datum established in 2000. High tide and the sea level rise due to climate change are considered predicting the final level and as given below.

**Table 2-14 Sea Level Rise Predications**

| Year | Above present MSL |
|---|---|
| 2025-year sea level rise | 0.508 m |
| 2050-year sea level rise | 0.658 m |
| 2075-year sea level rise | 0.808 m |
| 2100-year sea level rise | 0.95 m |

Most affected coastal areas are in Puttalam, Colombo, Gampaha, Kalutara, Galle, Matara, Hambantota, Mannar and Jaffna districts.

#### *2.3.6.2 Sea Surges*

Abnormal rise in sea water level due to high wind or cyclones results in inundating low-lying areas in the coastal belt. Depending on the topographical features of the coastal belt, wind speed and other factors, sea waives could rise several meters above the present level.

Hazard profile has shown that the north and east coasts are more prone to the cyclone induced storm surge hazard (Fig. 2.7) with the north-western coastline including the coastal areas of Mannar and Jaffna peninsula particularly exposed.

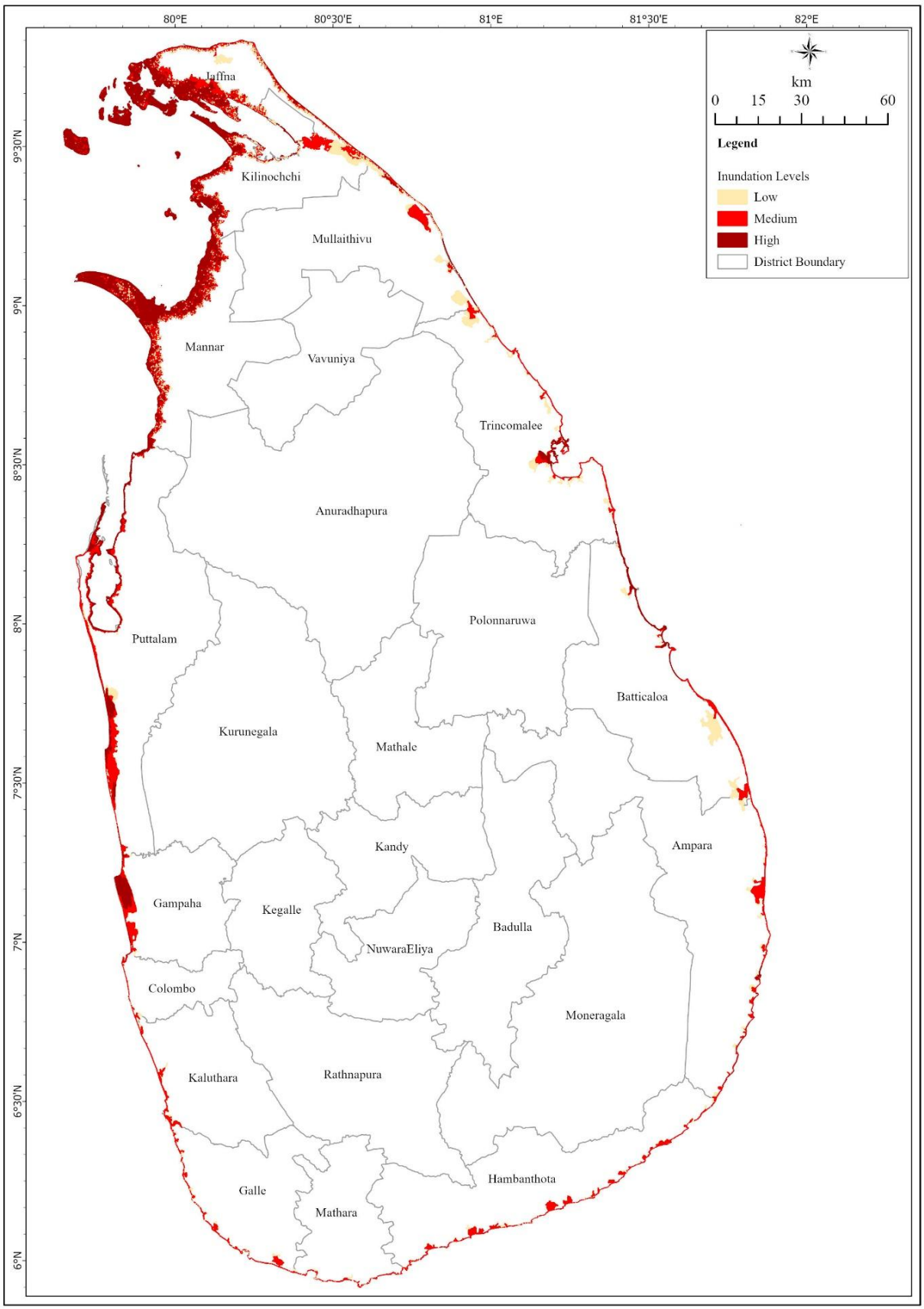



**Figure 2-7 Sea Surge Map, year 2010**

**Table 2-15 Multi Hazards at District Level**

| District | Total Area (km2) | Area Cover under each Hazards (km2) | | | | | | | | | | | | | | % Area Cover under each Hazards | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Drought | | | Landslide Susceptibility | | | | Cyclone/High Wind | | | | Tsunami | Sea Level Rise | Sea Surge | Flood | Drought | | | Landslide Susceptibility | | | | Cyclone/High Wind | | | | Tsunami | Sea Level Rise | Sea Surge |
| | | | Low | Moderate | High | 1 | 2 | 3 | 4 | 16-20 | 20-25 | 25-30 | 30-37 | | | | | Low | Moderate | High | 1 | 2 | 3 | 4 | 16-20 | 20-25 | 25-30 | 30-37 | | | |
| Ampara | 4485.03 | 263 | 372.142 | 1486.31 | 2606.54 | | | | | 2731.5 | 1687.7 | 0.005 | | 124.5 | 21.2 | 59.6 | 5.86 | 8.30 | 33.14 | 58.12 | | | | | 60.90 | 37.63 | 0.00 | | 2.78 | 0.47 | 1.33 |
| Anuradhapura | 7212.23 | 385 | 3553.03 | 2921.29 | 736.928 | | | | | 6172.9 | 1038.3 | | | | | | 5.34 | 49.26 | 40.50 | 10.22 | | | | | 85.59 | 14.40 | | | | | |
| Badulla | 2871.96 | 19.9 | 250.917 | 2021.52 | 599.831 | 947.33 | 1361.7 | 466.22 | 78.571 | 306.14 | 1091.6 | 1275 | 199.24 | | | | 0.69 | 8.74 | 70.39 | 20.89 | 32.99 | 47.41 | 16.23 | 2.74 | 10.66 | 38.01 | 44.40 | 6.94 | | | |
| Batticaloa | 2489.19 | 433 | 260.842 | 777.458 | 1444.88 | | | | | 1379.8 | 924.03 | 185.3 | | 241.9 | 23 | 84.7 | 17.40 | 10.48 | 31.23 | 58.05 | | | | | 55.43 | 37.12 | 7.44 | | 9.72 | 0.92 | 3.40 |
| Colombo | 679.727 | 202 | 37.7468 | 609.166 | 33.9411 | 74.699 | 114.59 | 36.337 | 3.4606 | 536.9 | 144.2 | | | 9.9 | 9.6 | 4.5 | 29.72 | 5.55 | 89.62 | 4.99 | 10.99 | 16.86 | 5.35 | 0.51 | 78.99 | 21.21 | | | 1.46 | 1.41 | 0.66 |
| Galle | 1615.66 | 317.9 | 64.8147 | 1354.99 | 195.171 | 754.06 | 205.54 | 92.517 | 5.1148 | 1079.3 | 534.51 | | | 61.7 | 30.9 | 20 | 19.68 | 4.01 | 83.87 | 12.08 | 46.67 | 12.72 | 5.73 | 0.32 | 66.80 | 33.08 | | | 3.82 | 1.91 | 1.24 |
| Gampaha | 1385.98 | 519.8 | 15.345 | 766.207 | 601.662 | 111.26 | 31.28 | 12.86 | 0.6839 | 1182.8 | 186.71 | | 15.83 | 12.8 | 50.5 | 83.6 | 37.50 | 1.11 | 55.28 | 43.41 | 8.03 | 2.26 | 0.93 | 0.05 | 85.34 | 13.47 | | 1.14 | 0.92 | 3.64 | 6.03 |
| Hambantota | 2623.59 | 122 | 208.145 | 1239.11 | 1173.37 | 122.19 | 32.463 | 9.129 | 0.5276 | 890.42 | 1471.6 | 254 | | 112.5 | 65.7 | 45.5 | 4.65 | 7.93 | 47.23 | 44.72 | 4.66 | 1.24 | 0.35 | 0.02 | 33.94 | 56.09 | 9.68 | 0.00 | 4.29 | 2.50 | 1.73 |
| Jaffna | 1012.01 | 417.8 | 16.5672 | 372.941 | 600.862 | | | | | | | 83.61 | 888.28 | 245.8 | 77.5 | 525 | 41.28 | 1.64 | 36.85 | 59.37 | | | | | 0.00 | 0.00 | 8.26 | 87.77 | 24.29 | 7.66 | 51.88 |
| Kalutara | 1646.45 | 414 | 19.8753 | 1271.69 | 353.934 | 606.36 | 739.57 | 149.33 | 8.6463 | 1441.7 | 203.78 | | | 21.3 | 30.5 | 16.8 | 25.15 | 1.21 | 77.24 | 21.50 | 36.83 | 44.92 | 9.07 | 0.53 | 87.57 | 12.38 | | | 1.29 | 1.85 | 1.02 |
| Kandy | 1924.03 | 16 | 104.449 | 1589.63 | 224.451 | 546.28 | 827.81 | 318.06 | 183.64 | 122.25 | 521.53 | 1281 | 0.0084 | | | | 0.83 | 5.43 | 82.62 | 11.67 | 28.39 | 43.02 | 16.53 | 9.54 | 6.35 | 27.11 | 66.56 | 0.00 | | | |
| Kegalle | 1661.26 | 158 | 25.4779 | 1444.69 | 533.434 | 461.59 | 595.74 | 447.23 | 153.46 | 885.68 | 776.64 | | | | | | 9.51 | 1.53 | 86.96 | 32.11 | 27.79 | 35.86 | 26.92 | 9.24 | 53.31 | 46.75 | | | | | |
| Kilinochchi | 1263.4 | 456 | 2.18417 | 166.805 | 1085.8 | | | | | | 517.81 | 477 | 254.57 | 39.2 | 24.5 | 243 | 36.09 | 0.17 | 13.20 | 85.94 | | | | | 0.00 | 40.99 | 37.75 | 20.15 | 3.10 | 1.94 | 19.19 |
| Kurunegala | 4904.48 | 601 | 825.523 | 2860.33 | 1209.67 | 627.33 | 286.67 | 72.782 | 9.9039 | 4904.5 | 0.4101 | | | | | | 12.25 | 16.83 | 58.32 | 24.66 | 12.79 | 5.85 | 1.48 | 0.20 | 100.00 | 0.01 | | | | | |
| Mannar | 1997.86 | 213.5 | 142.909 | 1208.59 | 649.713 | | | | | 757.73 | 774.87 | 309.2 | 140.02 | 61.3 | 24.6 | 424 | 10.69 | 7.15 | 60.49 | 32.52 | | | | | 37.93 | 38.79 | 15.48 | 7.01 | 3.07 | 1.23 | 21.21 |
| Matale | 2057.82 | 14.5 | 18.1806 | 853.556 | 1185.88 | 754.26 | 871.89 | 198.78 | 23.315 | 909.12 | 709.62 | 438.9 | | | | | 0.70 | 0.88 | 41.48 | 57.63 | 36.65 | 42.37 | 9.66 | 1.13 | 44.18 | 34.48 | 21.33 | | | | |
| Matara | 1309.94 | 385 | 19.7927 | 1058.41 | 231.39 | 609.48 | 219.62 | 78.369 | 4.6466 | 498.28 | 810.55 | | | 23.8 | 23 | 2.7 | 29.39 | 1.51 | 80.80 | 17.66 | 46.53 | 16.77 | 5.98 | 0.35 | 38.04 | 61.88 | | | 1.82 | 1.76 | 0.21 |
| Monaragala | 5752.25 | 31 | 1195.88 | 3833.87 | 722.323 | 2348.7 | 1638.7 | 226.66 | 15.351 | 565.15 | 4058 | 1129 | | | | | 0.54 | 20.79 | 66.65 | 12.56 | 40.83 | 28.49 | 3.94 | 0.27 | 9.82 | 70.55 | 19.63 | | | | |
| Mulaithiu | 2682.97 | 192.5 | 0.53285 | 1298.95 | 1274.36 | | | | | 1087.1 | 1115.6 | 245.6 | 68.294 | 108 | 8.2 | 84.5 | 7.17 | 0.02 | 48.41 | 47.50 | | | | | 40.52 | 41.58 | 9.15 | 2.55 | 4.03 | 0.31 | 3.15 |
| Nuwara Eliya | 1745.35 | 47 | 182.024 | 1500.12 | 61.0777 | 472.67 | 846.91 | 269.52 | 104.49 | | 434.88 | 899 | 409.33 | | | | 2.69 | 10.43 | 85.95 | 3.50 | 27.08 | 48.52 | 15.44 | 5.99 | 0.00 | 24.92 | 51.51 | 23.45 | | | |
| Polonnaruwa | 3446.32 | 770.5 | 1119.04 | 1629.87 | 716.944 | | | | | 3319.7 | 146.11 | | | | | | 22.36 | 32.47 | 47.29 | 20.80 | | | | | 96.33 | 4.24 | | | | | |
| Puttalam | 3160.84 | 558 | 438.292 | 1456.24 | 1266.3 | | | | | 2075.7 | 810.53 | 156.9 | 74.794 | 54 | 134 | 203 | 17.65 | 13.87 | 46.07 | 40.06 | | | | | 65.67 | 25.64 | 4.97 | 2.37 | 1.71 | 4.24 | 6.43 |
| Ratnapura | 3288.7 | 162 | 39.1196 | 2316.59 | 933.073 | 1534.1 | 807.37 | 573.68 | 91.046 | 913.42 | 1824.1 | 551.3 | | | | | 4.93 | 1.19 | 70.44 | 28.37 | 46.65 | 24.55 | 17.44 | 2.77 | 27.77 | 55.47 | 16.76 | | | | |
| Trincomalee | 2643.62 | 881.5 | 533.32 | 1261.73 | 847.514 | | | | | 1694.5 | 605.25 | 335.4 | | 138.4 | 20.7 | 56.8 | 33.34 | 20.17 | 47.73 | 32.06 | | | | | 64.10 | 22.89 | 12.69 | | 5.24 | 0.78 | 2.15 |
| Vavuniya | 1896.19 | 72.5 | 757.299 | 1010.37 | 237.638 | | | | | 1680.6 | 324.72 | | | | | | 3.82 | 39.94 | 53.28 | 12.53 | | | | | 88.63 | 17.12 | | | | | |

## 2.4 Element at Risk

All objects, people, activities, and processes that may be adversely affected by hazardous phenomena in a specific area, whether directly or indirectly, are considered elements at risk in the disaster risk assessment. This includes structures, facilities, human resources, equipment, economic operations, public services, and the environment. The element at risk can be detailed based on the level of risk assessment. For example, if a project-specific risk assessment is necessary, more data about the element at risk must be considered because they raise the certainty of the risk assessment and allow for more accurate risk-based decisions. Easily it would be accomplished using the assert management registry of particular entity.

There are numerous sorts of elements at risk, as well as numerous classification schemes. The table is an example of such a classification.

**Table 2-16 Example of Classification of Element at Risk**

| Element at risk | Required Details |
|---|---|
| Building | construction types, building height, building age, total floor space, replacement costs |
| Human Resources | No of human resources Staff and customers approximately, distribution in space, distribution in time, age distribution, gender distribution, handicapped |
| Essential Facilities | Transport, Equipment, Stores, generation Sources, etc. |
| Databases | Technical, Financial, Customer details etc. |
| Environment of the location | Electricity distribution characteristic's (Highly urbanized, Industrialized etc.) |

The electricity sector includes interdependent functions that are potentially competitive, such as generation and supply, and noncompetitive, such as provision of transmission and distribution networks. Hence, the selection of the list of elements at risk for the study followed by the process of delivering electricity which a chain;

- Transformation of the energy source (fossil fuels, renewable natural resources, or nuclear) into electricity (generation);
- Transportation to large load centers and balancing supply with demand, since storage of large quantities of electricity is still unfeasible (transmission);
- Network to reliably connect and supply to end customers (distribution);

The summery of the element at risk considered for the study is given in Table below.

**Table 2-17 Summery of Element at Risk Electricity Sector**

| District | Generation | | | Transmission | | | | Distribution | |
|---|---|---|---|---|---|---|---|---|---|
| | Power Generation | | | Grid sub stations | | 132 or 220 kV line Towers | | Primary Sub Stations | |
| | Hydro No. | Thermal include coal. No | Rene-wable | CEB | LECO | CEB | LECO | CEB | LECO |
| Ampara | | | | 01 | | 282 | | | |
| Anuradhapura | | | | 04 | | 997 | | | |
| Badulla | | | | 02 | | 442 | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Batticaloa | | | | 02 | | 221 | | | |
| Colombo | | 01 | | 19 | | 642 | | | 20 |
| Galle | | | | 02 | | 292 | | | 10 |
| Gampaha | | 02 | | 07 | | 695 | | | 14 |
| Hambantota | | | | 02 | | 175 | | | |
| Jaffna | | 01 | | | | 98 | | | |
| Kalutara | | 01 | | 04 | | 345 | | | 10 |
| Kandy | 04 | | | 03 | | 643 | | | |
| Kegalle | 01 | | | 03 | | 516 | | | |
| Kilinochchi | | | | 01 | | 134 | | | |
| Kurunegala | | | | 04 | | 527 | | | |
| Mannar | | | | 02 | | 157 | | | |
| Matale | 02 | | | 01 | | 601 | | | |
| Matara | | | | 02 | | 241 | | | |
| Monaragala | 03 | | | 01 | | 174 | | | |
| Nuwara Eliya | 07 | | | 03 | | 87 | | | |
| Polonnaruwa | | | | 01 | | 522 | | | |
| Puttalam | | 01 | | 03 | | 292 | | | |
| Ratnapura | 03 | | | 04 | | 693 | | | |
| Trincomalee | | | | 02 | | 438 | | | |
| Vavuniya | | | | 01 | | 152 | | | |

## 2.5 Exposure Assessment

Exposure assessment is used to determine the contact of element at risk with a potentially hazardous event and, if so, level of exposure (Spatial Factor) and the duration of exposure (Temporal Factor) based on the length of hazard event).

In order to assess the level of exposure of the element at risk in against each hazards map over laying was applied using Arc GIS software. Coordinates of identified element at risk provided by CEB and LECO were overlaid with the hazard layers respectively and exposure level of the critical infrastructure (element at risk) were identified. Temporal factor has not been considered in detail under this study due to unavailability of high-resolution data but it was taken in account using the data available in Desinventra database of DMC.

### 2.5.1 Flood Exposure

Flood maps provided by Irrigation Department and DMC were merged with respect to the attribute data of the shape files. Since data on the severity of flood or the return periods are not available flood exposure of the element at risk was assessed following the inundation areas. Hence catchments exposure was based on the spatial extend of inundation and other elements at risk. Exposure was assessed based on the following indicator ***"Element at risk is located in inundation area Yes/No"*** and the exposed elements are summarized in the tables below.

**Table 2-18 Level of Exposure of Power Stations to Flood Hazard**

| District | Name of Element at Risk | Owner-ship | Type | Energy Source | Exposed to Flood (Yes/No) |
|---|---|---|---|---|---|
| Colombo | Kelanitissa | CEB | Thermal | Oil | **Yes** |
| Gampaha | Sapugaskanda PS | | Thermal | Oil | No |
| | Kerawalapitiya | | Thermal | Oil | **Yes** |
| Jaffna | Chunnakam | | Thermal | Oil | No |

| | | | | | |
|---|---|---|---|---|---|
| Kalutara | Kukule | | Hydro | Water | No |
| Kandy | Kotmale | | Hydro | Water | No |
| | Nilambe | | Hydro | Water | No |
| | Rantembe | | Hydro | Water | No |
| | Randenigala | | Hydro | Water | No |
| Kegalle | Broadlands | | Hydro | Water | No |
| Matale | Ukuwela | | Hydro | Water | No |
| | Bowatenna | | Hydro | Water | No |
| Moneragala | Udawalawa 2 | | Hydro | Water | No |
| | Uma Oya | | Hydro | Water | No |
| | Inginiyagala PS | | Hydro | Water | No |
| Nuwara Eliya | Canyon | | Hydro | Water | No |
| | Wimalasurendra | | Hydro | Water | No |
| | New Laxapana | | Hydro | Water | No |
| | Laxapana | | Hydro | Water | Yes |
| | Polpitiya | | Hydro | Water | No |
| | Upper Kotmale | | Hydro | Water | No |
| | Victoria | | Hydro | Water | No |
| Puttalam | Lak Wijaya Coal | | Thermal | Coal | No |
| Ratnapura | Embilipitiya ACE Power | | Thermal | Oil | No |
| | Udawalawa 1 | | Hydro | Water | No |
| | Samanalawewa | | Hydro | Water | No |

**Table 2-19 Level of Exposure of Grid Sub Stations to Flood Hazard**

| **District** | **Name** | **Category** | **Ownership** | **Exposed to flood (Yes/No)** |
|---|---|---|---|---|
| Ampara | Ampara | GSS | CEB | No |
| Anuradhapura | Habarana | GSS | | No |
| | New Habarana GSS | GSS | | No |
| | New-Anuradhapura | GSS | | No |
| | Anuradhapura | GSS | | No |
| Badulla | Badulla | GSS | | No |
| | Mahiyanganaya GSS | GSS | | No |
| Batticaloa | Vavunativu | GSS | | No |
| | Valachchanai | GSS | | No |
| Colombo | Kesbewa GSS | GSS | | **Yes** |
| | Ratmalana | GSS | | No |
| | Pannipitiya | GSS | | No |
| | Dehiwala | GSS | | No |
| | Padukka GSS | GSS | | No |
| | Oruwala GSS | GSS | | No |
| | Sri Jayawardanapura | GSS | | **Yes** |
| | Sub A-Havelock Town | GSS | | No |
| | Athurugiriya | GSS | | No |
| | Sub E-Kollupitiya | GSS | | No |

| | | | | |
|---|---|---|---|---|
| | Sub N-Hunupitiya | GSS | | No |
| | Sub M-Slave Island | GSS | | No |
| | Sub I-Maradana | GSS | | No |
| | Sub F-Fort | GSS | | No |
| | Kolonnawa | GSS | | **Yes** |
| | Sub B- Pettah | GSS | | No |
| | Kosgam | GSS | | No |
| | Sub C-Kotahena | GSS | | **Yes** |
| | Seethawaka | GSS | | No |
| Galle | Galle | GSS | | No |
| | Ambalangoda GSS | GSS | | No |
| Gampaha | Sapugaskanda GSS | GSS | | No |
| | Kelaniya GSS | GSS | | **Yes** |
| | Biyagama | GSS | | No |
| | Aniyakanda GSS | GSS | | **Yes** |
| | Kotugoda | GSS | | No |
| | Katunayake | GSS | | **Yes** |
| | Veyangoda | GSS | | No |
| Hambantota | Beliatta | GSS | | No |
| | Hambantota | GSS | | No |
| Kalutara | Matugama | GSS | | No |
| | Kaluthara GSS | GSS | | No |
| | Panadura | GSS | | No |
| | Horana GSS | GSS | | **Yes** |
| Kandy | Nawalapitiya GSS | GSS | | No |
| | Kiribathkumbura | GSS | | No |
| | Pallekele GSS | GSS | | No |
| Kegalle | Maliboda GSS | GSS | | No |
| | Kegalle GSS | GSS | | No |
| | Thulhiriya | GSS | | No |
| Kilinochchi | kilinochchi | GSS | | No |
| Kurunegala | Pannala | GSS | | No |
| | Kurunegala | GSS | | No |
| | New Chilaw GSS | GSS | | No |
| | Maho Grid Substation | GSS | | No |
| Mannar | Mannar GSS | GSS | | No |
| | Nadukkuda | GSS | | No |
| Matale | Naula GSS | GSS | | No |
| Matara | Matara | GSS | | **Yes** |
| | Deniyaya | GSS | | No |
| Moneragala | Monaragala GSS | GSS | | No |
| Nuwara Eliya | Nuwara Eliya | GSS | | No |
| | New Polpitiya GSS | GSS | | No |
| | Ragala GSS | GSS | | No |
| Polonnaruwa | Polonnaruwa GSS | GSS | | No |
| Puttalam | Bolawatta | GSS | | No |

| | | | | |
|---|---|---|---|---|
| | Madampe | GSS | | No |
| | Puttalam | GSS | | No |
| Ratnapura | Embilipitiya | GSS | | No |
| | Balangoda | GSS | | No |
| | Ratnapura | GSS | | No |
| | Wewalwatta GSS | GSS | | No |
| Trincomalee | Kappalthurai | GSS | | No |
| | Trincomalee | GSS | | No |
| Vavuniya | Vavunia | GSS | | No |

**Table 2-20 Level of Exposure of Transmission and Distribution System to Flood Hazard**

| **District** | **Element at Risk** | | | | **Element at Risk Exposed to flood** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Total No of Transmission 132 or 220 kV line Towers** | | **Primary Stations** | | **No of Transmission 132 or 220 kV line Towers** | | | **Primary substations** | | |
| | CEB | LECO | CEB | LECO | CEB | LECO | Total | CEB | LECO | Total |
| Ampara | 282 | No | | | 60 | | 60 | | | |
| Anuradhapura | 997 | | | | 44 | | 44 | | | |
| Badulla | 442 | | | | 0 | | 0 | | | |
| Batticaloa | 221 | | | | 18 | | 18 | | | |
| Colombo | 642 | | | 20 | 600 | | 600 | | 8 | |
| Galle | 292 | | | 10 | 74 | | 74 | | | |
| Gampaha | 695 | | | 14 | 639 | | 639 | | 6 | |
| Hambantota | 175 | | | | 32 | | 32 | | | |
| Jaffna | 98 | | | | 74 | | 74 | | | |
| Kalutara | 345 | | | 10 | 275 | | 275 | | 1 | |
| Kandy | 643 | | | | 1 | | 1 | | | |
| Kegalle | 516 | | | | 57 | | 57 | | | |
| Kilinochchi | 134 | | | | 116 | | 116 | | | |
| Kurunegala | 527 | | | | 178 | | 178 | | | |
| Mannar | 157 | | | | 28 | | 28 | | | |
| Matale | 601 | | | | 0 | | 0 | | | |
| Matara | 241 | | | | 238 | | 238 | | | |
| Moneragala | 174 | | | | 0 | | 0 | | | |
| Mullaitivu | 87 | | | | 4 | | 4 | | | |
| Nuwara-Eliya | 522 | | | | 5 | | 5 | | | |
| Polonnaruwa | 292 | | | | 96 | | 96 | | | |
| Puttalam | 693 | | | | 112 | | 112 | | | |
| Ratnapura | 438 | | | | 11 | | 11 | | | |
| Trincomalee | 152 | | | | 70 | | 70 | | | |
| Vavuniya | 331 | | | | 8 | | 8 | | | |

### 2.5.2 Exposure of Element at Risk to Landslide Hazard

1;50,000 scale landslide susceptible map provided by the National Building Research Organization (NBRO) was used to understand the level of exposure of the element at risk (Power generators, Grid sub stations, transmission pylon (Tower) lines, distribution system). Landslides maps have categorized level of susceptibility to occur landslide in geographical area as Not Likely, Modest, Expected and Most Likely. But the maps have not been validated based on the actual historical record on landslide and the landslide flow paths have not been identified. Hence the degree of certainty of maps is questionable. Summary of the element at risk exposed to landslide is given in Tables below. Thermal Power plants are not located in Landslides prone areas.

**Table 2-21 Level of Exposure of Power Stations to Landslide Hazard**

| District | Name of Element at Risk | Ownership | Exposed to Landslide | | | |
|---|---|---|---|---|---|---|
| | | | Not likely | Modest | Expected | Most likely |
| Kalutara | Kukule | CEB | × | | | |
| Kandy | Kotmale | | | | | × |
| | Nilambe | | × | | | |
| | Rantembe | | Near water body | | | |
| | Randenigala | | | × | | |
| Kegalle | Broadlands | | | × | | |
| Matale | Ukuwela | | | × | | |
| | Bowatenna | | | | × | |
| Moneragala | Udawalawa 2 | | × | | | |
| | Uma Oya | | × | | | |
| | Inginiyagala PS | | × | | | |
| Nuwara Eliya | Canyon | | | × | | |
| | Wimalasurendra | | Near water body | | | |
| | New Laxapana | | | × | | |
| | Laxapana | | | × | | |
| | Polpitiya | | | × | | |
| | Upper Kotmale | | | × | | |
| | Victoria | | × | | | |
| Ratnapura | Samanalawewa | | × | | | |

**Table 2-22 Level of Exposure of Grid Substations to Landslide Hazard**

| District | Element at Risk GSS | Ownership | Exposed to Landslide | | | |
|---|---|---|---|---|---|---|
| | | | Not likely | Modest | Expected | Most likely |
| Badulla | Badulla | CEB | × | | | |
| Badulla | Mahiyanganaya GSS | | × | | | |
| Colombo | Kosgam | | × | | | |
| Colombo | Seethawaka | | | × | | |
| Kalutara | Matugama | | | × | | |
| Kalutara | Kaluthara GSS | | × | | | |
| Kalutara | Panadura | | | × | | |
| Kalutara | Horana GSS | | | × | | |
| Kandy | Nawalapitiya GSS | | | × | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Kandy | Kiribathkumbura | | × | | | |
| Kandy | Pallekele GSS | | × | | | |
| Kegalle | Maliboda GSS | | | × | | |
| Kegalle | Kegalle GSS | | × | | | |
| Kegalle | Thulhiriya | | × | | | |
| Kegalle | Thulhiriya | | × | | | |
| Kurunegala | Kurunegala | | × | | | |
| Matale | Naula GSS | | | × | | |
| Matara | Deniyaya | | | × | | |
| Moneragala | Monaragala GSS | | × | | | |
| Nuwara Eliya | Nuwara Eliya | | | × | | |
| Nuwara Eliya | New Polpitiya GSS | | | × | | |
| Nuwara Eliya | Ragala GSS | | | | | × |
| Ratnapura | Balangoda | | × | | | |
| Ratnapura | Ratnapura | | × | | | |
| Ratnapura | Wewalwatta GSS | | | × | | |

**Table 2-23 Level of Exposure of Trans. and Distribution System to Landslide Hazard**

| **District** | **Total No of Transmission system 132 or 220 kV line Towers** | | | | **Primary Substations** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Not likely | Modest | Expected | Most likely | Not likely | Modest | Expected | Most likely | Not likely |
| Badulla | 162 | 220 | 52 | 6 | No | | | | |
| Colombo | 38 | 52 | 10 | 2 | | | | | |
| Galle | 66 | 4 | 3 | 1 | | | | | |
| Gampaha | 10 | 2 | | | | | | | |
| Hambantota | 4 | 1 | | | | | | | |
| Kalutara | 142 | 138 | 28 | 2 | | | | | |
| Kandy | 242 | 281 | 63 | 41 | | | | | |
| Kegalle | 147 | 210 | 125 | 39 | | | | | |
| Kurunegala | 120 | 28 | 3 | | | | | | |
| Matale | 252 | 216 | 32 | 2 | | | | | |
| Matara | 75 | 37 | 6 | | | | | | |
| Moneragala | 123 | 49 | 2 | | | | | | |
| Nuwara Eliya | 117 | 299 | 61 | 24 | | | | | |
| Ratnapura | 188 | 83 | 57 | 1 | | | | | |

### 2.5.3 Exposure to Drought Hazard

Sri Lanka has constructed 16 major hydro power plants, which have capacity to generate 1074 MW. All hydro power plants are located in Central and Sabaragamuwa provinces. As of 2017, just under 30% of Sri Lanka's gross electricity generation came from hydropower[12]. In 2019 total hydropower generation was reduced to 15% of the generating capacity due to drought

**12** Climate Risk Country Profile Sri Lanka-WB Group- ADB 2021

impact. Since the water scarcity is the issue associated with drought, hydro power stations were considered for drought exposure analysis under high, moderate and low categories. Hazard map published by the DMC and DesInventar data base used for analysis. Summary given in Table 2.23. Udawalawe and Umaoya Hydro power plants are highly exposed to drought. Wimalasurendra and Upper Kothmale power plants indicate low exposure. Other 19 PS are located in moderately expose areas. Chunnakam Thermal power plant of Jaffna district require arrangement to get water for cooling system during drought.

**Table 2-24 Level of Exposure of Power Stations to Drought Hazard**

| District | Name of Element at Risk | Ownership | Exposed to Drought | | |
|---|---|---|---|---|---|
| | | | High | Moderate | Low |
| Colombo | Kelanitissa | CEB | | × | |
| Gampaha | Sapugaskanda PS | | | × | |
| | Kerawalapitiya | | | × | |
| Jaffna | Chunnakam | | × | | |
| Kalutara | Kukule | | | × | |
| Kandy | Kotmale | | | × | |
| | Nilambe | | | × | |
| | Rantembe | | | × | |
| | Randenigala | | | × | |
| Kegalle | Broadlands | | | × | |
| Matale | Ukuwela | | | × | |
| | Bowatenna | | | × | |
| Moneragala | Udawalawa 2 | | | × | |
| | Uma Oya | | × | | |
| | Inginiyagala PS | | | × | |
| Nuwara Eliya | Canyon | | | × | |
| | Wimalasurendra | | | | × |
| | New Laxapana | | | × | |
| | Laxapana | | | × | |
| | Polpitiya | | | × | |
| | Upper Kotmale | | | | × |
| | Victoria | | | × | |
| Puttalam | Lak Wijaya Coal | | | × | |
| Ratnapura | Embilipitiya ACE Power | | | × | |
| | Udawalawa 1 | | | × | |
| | Samanalawewa | | | | |

Level of exposure of transmission and distribution to drought has not been investigated as it does not show substantial impact to infrastructures in those sectors.

### 2.5.4 Exposure to Cyclones and High Winds

Trees fallen due to high winds/cyclone could damage the poles in electricity distribution systems disrupting power supply. As example, high winds which brought down trees, have cut off power to 467,500 electricity users in May 2024[13].

**13** Economy next 17. Sept. 2024

**Table 2-25 Level of Exposure of Power Stations to Cyclones and High Winds Hazard**

| District | Name of Power Plant (Element) at Risk | Ownership | Wind speed (m/s) | | | |
|---|---|---|---|---|---|---|
| | | | 16 - 20 | 20 - 25 | 25 - 30 | 30 - 37 |
| Colombo | Kelanitissa | CEB | | × | | |
| Gampaha | Sapugaskanda PS | | × | | | |
| | Kerawalapitiya | | | × | | |
| Jaffna | Chunnakam | | | | | × |
| Kalutara | Kukule | | × | | | |
| Kandy | Kotmale | | | | × | |
| | Nilambe | | | | × | |
| | Rantembe | | | | × | |
| | Randenigala | | | | × | |
| Kegalle | Broadlands | | × | | | |
| Matale | Ukuwela | | | × | | |
| | Bowatenna | | × | | | |
| Moneragala | Udawalawa 2 | | | × | | |
| | Uma Oya | | | | × | |
| | Inginiyagala PS | | × | | | |
| Nuwara Eliya | Canyon | | | × | | |
| | Wimalasurendra | | | × | | |
| | New Laxapana | | | × | | |
| | Laxapana | | | × | | |
| | Polpitiya | | | × | | |
| | Upper Kotmale | | | | × | |
| | Victoria | | | | × | |
| Puttalam | Lak Wijaya Coal | | | | × | |
| Ratnapura | Embilipitiya ACE Power | | | × | | |
| | Udawalawa 1 | | | × | | |
| | Samanalawewa | | | | × | |

**Table 2-26 Level of Exposure of Grid Sub Stations to Cyclones and High Winds Hazard**

| District | Name | Category | Ownership | Wind speed (m/s) | | | |
|---|---|---|---|---|---|---|---|
| | | | | 16 -20 | 20 -25 | 25 - 30 | 30 - 37 |
| Ampara | Ampara | GSS | CEB | × | | | |
| Anuradhapura | Habarana | GSS | | × | | | |
| | New Habarana GSS | GSS | | × | | | |
| | New-Anuradhapura | GSS | | × | | | |
| | Anuradhapura | GSS | | × | | | |
| Badulla | Badulla | GSS | | | | × | |
| | Mahiyanganaya GSS | GSS | | | × | | |
| Batticaloa | Vavunativu | GSS | | | × | | |
| | Valachchanai | GSS | | | × | | |
| Colombo | Kesbewa GSS | GSS | | × | | | |
| | Ratmalana | GSS | | | × | | |
| | Pannipitiya | GSS | | × | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Dehiwala | GSS | | | × | | |
| | Padukka GSS | GSS | | × | | | |
| | Oruwala GSS | GSS | | × | | | |
| | Sri Jayawardanapura | GSS | | | × | | |
| | Sub A-Havelock Town | GSS | | | × | | |
| | Athurugiriya | GSS | | × | | | |
| | Sub E-Kollupitiya | GSS | | | × | | |
| | Sub N-Hunupitiya | GSS | | | × | | |
| | Sub M-Slave Island | GSS | | | × | | |
| | Sub I-Maradana | GSS | | | × | | |
| | Sub F-Fort | GSS | | | × | | |
| | Kolonnawa | GSS | | | × | | |
| | Sub B- Pettah | GSS | | | × | | |
| | Kosgama | GSS | | × | | | |
| | Sub C-Kotahena | GSS | | | × | | |
| | Seethawaka | GSS | | × | | | |
| Galle | Galle | GSS | | × | | | |
| | Ambalangoda GSS | GSS | | | × | | |
| Gampaha | Sapugaskanda GSS | GSS | | × | | | |
| | Kelaniya GSS | GSS | | | × | | |
| | Biyagama | GSS | | × | | | |
| | Aniyakanda GSS | GSS | | × | | | |
| | Kotugoda | GSS | | | × | | |
| | Katunayake | GSS | | | × | | |
| | Veyangoda | GSS | | × | | | |
| Hambantota | Beliatta | GSS | | × | | | |
| | Hambantota | GSS | | | × | | |
| Kalutara | Matugama | GSS | | | × | | |
| | Kaluthara GSS | GSS | | × | | | |
| | Panadura | GSS | | × | | | |
| | Horana GSS | GSS | | × | | | |
| Kandy | Nawalapitiya GSS | GSS | | | × | | |
| | Kiribathkumbura | GSS | | | × | | |
| | Pallekele GSS | GSS | | | | × | |
| Kegalle | Maliboda GSS | GSS | | × | | | |
| | Kegalle GSS | GSS | | × | | | |
| | Thulhiriya | GSS | | × | | | |
| Kilinochchi | kilinochchi | GSS | | | × | | |
| Kurunegala | Pannala | GSS | | × | | | |
| | Kurunegala | GSS | | × | | | |
| | New Chilaw GSS | GSS | | × | | | |
| | Maho Grid Substation | GSS | | × | | | |
| Mannar | Mannar GSS | GSS | | | | × | |
| | Nadukkuda | GSS | | | | | × |
| Matale | Naula GSS | GSS | | | × | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Matara | Matara | GSS | | × | | | |
| | Deniyaya | GSS | | × | | | |
| Moneragala | Monaragala GSS | GSS | | | | × | |
| Nuwara Eliya | Nuwara Eliya | GSS | | | | | × |
| | New Polpitiya GSS | GSS | | | × | | |
| | Ragala GSS | GSS | | | | | × |
| Polonnaruwa | Polonnaruwa GSS | GSS | | × | | | |
| Puttalam | Bolawatta | GSS | | | × | | |
| | Madampe | GSS | | | × | | |
| | Puttalam | GSS | | × | | | |
| Ratnapura | Embilipitiya | GSS | | | × | | |
| | Balangoda | GSS | | | | × | |
| | Ratnapura | GSS | | × | | | |
| | Wewalwatta GSS | GSS | | | × | | |
| Trincomalee | Kappalthurai | GSS | | | × | | |
| | Trincomalee | GSS | | | | × | |
| Vavuniya | Vavunia | GSS | | × | | | |

**Table 2-27 Level of Exposure of Trans. and Dist. to Cyclones and High Wind Hazard**

| **District** | **Total No of Transmission system 220 or 132 kV line towers** | | | | **Primary Stations** | | | |
|---|---|---|---|---|---|---|---|---|
| Wind speed **(m/s)** | **16 -20** | **20 - 25** | **25- 30** | **30 -37** | **16 -20** | **20 - 25** | **25 -30** | **30 -37** |
| Ampara | 191 | 91 | | | | | | |
| Anuradhapura | 950 | 47 | | | | | | |
| Badulla | 25 | 116 | 276 | 25 | | | | |
| Batticaloa | 117 | 104 | | | | | | |
| Colombo | 492 | 150 | | | 1 | 19 | | |
| Galle | 266 | 26 | | | | 10 | | |
| Gampaha | 595 | 100 | | | 3 | 10 | | 1 |
| Hambantota | 73 | 102 | | | | | | |
| Jaffna | | | 27 | 70 | | | | |
| Kalutara | 345 | | | | 3 | 7 | | |
| Kandy | 13 | 387 | 244 | | | | | |
| Kegalle | 266 | 250 | | | | | | |
| Kilinochchi | | 27 | 34 | 66 | | | | |
| Kurunegala | 527 | | | | | | | |
| Mannar | 33 | 35 | 35 | 53 | | | | |
| Matale | 278 | 286 | 37 | | | | | |
| Matara | 81 | 160 | | | | | | |
| Moneragala | 4 | 122 | 48 | | | | | |
| Mullaitivu | 10 | 77 | | | | | | |
| Nuwara Eliya | | 284 | 174 | 64 | | | | |
| Polonnaruwa | 261 | 31 | | | | | | |
| Puttalam | 595 | 72 | 25 | | | | | |
| Rathnapura | 32 | 266 | 140 | | | | | |
| Trincomalee | 103 | 35 | 14 | | | | | |
| Vavuniya | 331 | | | | | | | |

### 2.5.5 Exposure to Tsunami

The Indian Ocean Tsunami in 2004 significantly disrupted Sri Lanka's electricity supply, causing widespread outages and damage to infrastructure. The disaster destroyed coastal power plants and transmission lines, leaving many areas without power for extended periods. The impact also extended to the distribution network, as the tsunami's force damaged substations and power poles.

The tsunami's destructive power directly impacted power infrastructure along the coast, including power plants, substations, and transmission lines. Coastal power plants, crucial to Sri Lanka's electricity grid, were either destroyed or severely damaged, leading to immediate and widespread blackouts. The force of the tsunami also snapped power lines and caused damage to some transmission infrastructure, disrupting the flow of electricity to other parts of the country. Substations which are essential for regulating voltage and distributing power were also damaged or destroyed, further hindering the restoration of power supply. The tsunami's impact on the electricity grid had long-term consequences, requiring significant efforts to repair and rebuild the damaged infrastructure and restore power supply to affected areas.

**Table 2-28 Level of Exposure of Power Stations to Tsunami Hazard**

| District | Name of Element at Risk | Ownership | Exposed to Tsunami Hazard | | |
|---|---|---|---|---|---|
| | | | High | Moderate | Low |
| Colombo | Kelanitissa | CEB | No | No | No |
| Gampaha | Sapugaskanda PS | | No | No | No |
| | Kerawalapitiya | | No | No | No |
| Jaffna | Chunnakam | | No | No | No |
| Kalutara | Kukule | | No | No | No |
| Puttalam | Lak Wijaya Coal | | No | No | No |

**Table 2-29 Level of Exposure of Grid Sub Stations to Tsunami Hazard**

| District | Element at Risk | Ownership | Exposed to Tsunami Hazard | | |
|---|---|---|---|---|---|
| | | | High | Moderate | Low |
| Ampara | Ampara | CEB | No | No | No |
| Batticaloa | Vavunativu | | No | No | No |
| | Valachchanai | | No | No | No |
| Colombo | Kesbewa GSS | | No | No | No |
| | Ratmalana | | No | No | No |
| | Pannipitiya | | No | No | No |
| | Dehiwala | | No | No | No |
| | Padukka GSS | | No | No | No |
| | Oruwala GSS | | No | No | No |
| | Sri Jayawardanapura | | No | No | No |
| | Sub A-Havelock Town | | No | No | No |
| | Athurugiriya | | No | No | No |
| | Sub E-Kollupitiya | | No | No | No |

| | | | | | |
|---|---|---|---|---|---|
| | Sub N-Hunupitiya | | No | No | No |
| | Sub M-Slave Island | | No | No | No |
| | Sub I-Maradana | | No | No | No |
| | Sub F-Fort | | No | No | No |
| | Kolonnawa | | No | No | No |
| | Sub B- Pettah | | No | No | No |
| | Kosgam | | No | No | No |
| | Sub C-Kotahena | | No | No | No |
| | Seethawaka | | No | No | No |
| Galle | Galle | | No | No | No |
| | Ambalangoda GSS | | No | No | No |
| Gampaha | Sapugaskanda GSS | | No | No | No |
| | Kelaniya GSS | | No | No | No |
| | Biyagama | | No | No | No |
| | Aniyakanda GSS | | No | No | No |
| | Kotugoda | | No | No | No |
| | Katunayake | | No | No | No |
| | Veyangoda | | No | No | No |
| Hambantota | Beliatta | | No | No | No |
| | Hambantota | | No | No | No |
| Kalutara | Matugama | | No | No | No |
| | Kaluthara GSS | | No | No | No |
| | Panadura | | No | No | No |
| | Horana GSS | | No | No | No |
| Kilinochchi | kilinochchi | | No | No | No |
| Mannar | Mannar GSS | | No | No | No |
| | Nadukkuda | | No | No | No |
| Matara | Matara | | No | No | No |
| | Deniyaya | | No | No | No |
| Puttalam | Bolawatta | | No | No | No |
| | Madampe | | No | No | No |
| | Puttalam | | No | No | No |
| Trincomalee | Kappalthurai | | No | No | No |
| | Trincomalee | | | × | |

**Table 2-30 Level of Exposure of Transmission and Distribution System to Tsunami Hazard**

| **District** | **Total No of Transmission system 220 or 132 kV line Towers** | | | **Primary Stations** | | |
|---|---|---|---|---|---|---|
| | High | Moderate | Low | High | Moderate | Low |
| Ampara | | | | | | |
| Batticaloa | | | | | | |
| Colombo | | | | | | 1 |
| Galle | | | | | 3 | 1 |
| Gampaha | | | 2 | | | |
| Hambantota | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Jaffna | | | | | | |
| Kalutara | | | | 1 | | 2 |
| Kilinochchi | | | | | | |
| Mannar | | 4 | 1 | | | |
| Matara | | | | | | |
| Mullaitivu | | | | | | |
| Puttalam | | 11 | | | | |
| Trincomalee | | 2 | | | | |

### 2.5.6 Exposure to Sea Level Rise and Sea Surge

Sea level rise in Sri Lanka poses significant risks to electricity supply, primarily through the degradation of power infrastructure and increased vulnerability to saltwater intrusion and flooding. This impacts both generation and transmission systems additionally. Coastal power plants and transmission lines are at risk of damage from inundation and saltwater intrusion, leading to disruptions in electricity supply.

Impacts on sea level rise in electricity sector include followings;

- Climate change, including rising sea levels, can lead to changes in rainfall patterns and increased evaporation, reducing the water available for hydropower generation in reservoirs.
- Rising sea levels can directly damage power stations in coastal areas through inundation and increased erosion, impacting their ability to store and generate electricity.
- As sea levels rise, saltwater may intrude into freshwater reservoirs and rivers, contaminating them and rendering them unsuitable for power generation.
- Coastal power plants and transmission lines are vulnerable to flooding and inundation due to sea level rise, leading to power outages and system disruptions.
- Saline water can corrode and damage electrical equipment, further reducing the reliability and longevity of power infrastructure.
- Sea level rise exacerbates the risk of coastal storms and flooding, which can cause significant damage to power infrastructure and lead to widespread power outages.

**Table 2-31 Level of Exposure of Power Stations to Sea Level Rise and Sea Surge Hazard**

| **District*** | **Name of Element at Risk** | **Ownership** | **Exposed to Sea Level Rise and Sea Surge Hazard** | | |
|---|---|---|---|---|---|
| | | | **High** | **Moderate** | **Low** |
| Colombo | Kelanitissa | CEB | No | No | No |
| Gampaha | Sapugaskanda PS | | No | No | No |
| | Kerawalapitiya | | No | No | No |
| Jaffna | Chunnakam | | No | No | No |
| Kalutara | Kukule | | No | No | No |
| Puttalam | Lak Wijaya Coal | | No | No | No |

* Only power plants close to sea are considered

**Table 2-32 Level of Exposure of Grid Substations to Sea Level Rise and Sea Surge Hazard**

| District | Element at Risk | Ownership | Exposed to Sea Level Rise and Sea Surge Hazard | | |
|---|---|---|---|---|---|
| | | | High | Moderate | Low |
| Ampara | Ampara | CEB | No | No | No |
| Batticaloa | Vavunativu | | No | No | No |
| | Valachchanai | | No | No | No |
| Colombo | Kesbewa GSS | | No | No | No |
| | Ratmalana | | No | No | No |
| | Pannipitiya | | No | No | No |
| | Dehiwala | | No | No | No |
| | Padukka GSS | | No | No | No |
| | Oruwala GSS | | No | No | No |
| | Sri Jayawardanapura | | No | No | No |
| | Sub A-Havelock Town | | No | No | No |
| | Athurugiriya | | No | No | No |
| | Sub E-Kollupitiya | | | | **Yes** |
| | Sub N-Hunupitiya | | No | No | No |
| | Sub M-Slave Island | | | | **Yes** |
| | Sub I-Maradana | | No | No | No |
| | Sub F-Fort | | No | No | No |
| | Kolonnawa | | No | No | No |
| | Sub B- Pettah | | No | No | No |
| | Kosgam | | No | No | No |
| | Sub C-Kotahena | | No | No | No |
| | Seethawaka | | No | No | No |
| Galle | Galle | | No | No | No |
| | Ambalangoda GSS | | No | No | No |
| Gampaha | Sapugaskanda GSS | | No | No | No |
| | Kelaniya GSS | | No | No | No |
| | Biyagama | | No | No | No |
| | Aniyakanda GSS | | No | No | No |
| | Kotugoda | | No | No | No |
| | Katunayake | | No | No | No |
| | Veyangoda | | No | No | No |
| Hambantota | Beliatta | | No | No | No |
| | Hambantota | | No | No | No |
| Kalutara | Matugama | | No | No | No |
| | Kaluthara GSS | | No | No | No |
| | Panadura | | No | No | No |
| | Horana GSS | | No | No | No |
| Kilinochchi | kilinochchi | | No | No | No |
| Mannar | Mannar GSS | | No | No | No |
| | Nadukkuda | | No | No | No |
| Matara | Matara | | | | **Yes** |
| | Deniyaya | | No | No | No |

| | | | | | |
|---|---|---|---|---|---|
| Puttalam | Bolawatta | | No | No | No |
| | Madampe | | No | No | No |
| | Puttalam | | No | No | No |
| Trincomalee | Kappalthurai | | No | No | No |
| | Trincomalee | | No | No | No |

**Table 2-33 Level of Exposure of Trans. and Dist. to Sea Level Rise and Sea Surge Hazards**

| **District** | **Total No of Transmission system 220 or 132 kV line Towers** | | | **Primary Substations** | | |
|---|---|---|---|---|---|---|
| | High | Moderate | Low | High | Moderate | Low |
| Ampara | | | | | | |
| Batticaloa | | | | | | |
| Colombo | | | 9 | | | |
| Galle | | | 34 | | | 5 |
| Gampaha | | | 32 | | | |
| Hambantota | | | | | | |
| Jaffna | | | | | | |
| Kalutara | | | | | | 4 |
| Kilinochchi | | | | | | |
| Mannar | | | 4 | | | |
| Matara | | | 68 | | | |
| Mullaitivu | | | | | | |
| Puttalam | | | 52 | | | |
| Trincomalee | | | | | | |

## 2.6 Vulnerability Assessment

Technically, vulnerability assessment can be done through following steps namely:

- Defining system with elements or element set considered for analysis.
- Identifying the hazards and threats on the element.
- Modelling hazard environment and fixing the damage scale to measure the adverse consequences.
- Analyze the element for similar hazard environment (mostly simulated) using technical tools.
- Post-process the amount of damage in analyzed element with respect to predefined damage scale
- Declare element's risk as a fragility/vulnerability function with intensity of hazard considered and updating the same. The power structures & building in areas prone to multi hazards should be designed taking into consideration all the hazards.

Apart from that vulnerability of any system or an element at risk could be evaluated as a function on exposure and sensitivity which lead to the impact of the sector. Hence vulnerability of each group of elements at risk was evaluated based on the level of exposure identified and the sensitivity of each group of elements at risk to the respective hazards for the continuous power supply in qualitatively.

**Table 2-34 Vulnerability of Power Plants**

| District | Power Plants (Generation) | Exposure | | | | | Sensitivity | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Drought | Landslide | Tsunami | Coastal Hazards | Flood | Drought | Landslide | Tsunami | Coastal Hazards |
| Colombo | Kelanitissa | Yes | Yes | | No | No | Yes | Yes | | No | No |
| Gampaha | Sapugaskanda PS | | Yes | | | | | Yes | | | |
| | Kerawalapitiya | Yes | Yes | | | | Yes | Yes | | | |
| Jaffna | Chunnakam | | Yes | | | | | Yes | | | |
| Kalutara | Kukule | | Yes | | | | | Yes | | | |
| Kandy | Kotmale | | Yes | Yes | | | | Yes | Yes | | |
| | Nilambe | | Yes | | | | | Yes | | | |
| | Rantembe | | Yes | | | | | Yes | | | |
| | Randenigala | | Yes | Yes | | | | Yes | Yes | | |
| Kegalle | Broadlands | | Yes | Yes | | | | Yes | Yes | | |
| Matale | Ukuwela | | Yes | Yes | | | | Yes | Yes | | |
| | Bowatenna | | Yes | Yes | | | | Yes | Yes | | |
| Moneragala | Udawalawa 2 | | Yes | | | | | Yes | | | |
| | Uma Oya | | Yes | | | | | Yes | | | |
| | Inginiyagala PS | | Yes | | | | | Yes | | | |
| Nuwara Eliya | Canyon | | Yes | Yes | | | | Yes | Yes | | |
| | Wimalasurendra | | Yes | | | | | Yes | | | |
| | New Laxapana | | Yes | Yes | | | | Yes | Yes | | |
| | Laxapana | Yes | Yes | Yes | | | Yes | Yes | Yes | | |
| | Polpitiya | | Yes | Yes | | | | Yes | Yes | | |
| | Upper Kotmale | | Yes | Yes | | | | Yes | Yes | | |
| | Victoria | | Yes | | | | | Yes | | | |
| Puttalam | Lak Wijaya Coal | | Yes | | | | | Yes | | | |
| Ratnapura | Embilipitiya ACE Power | | Yes | | | | | Yes | | | |
| | Udawalawa | | Yes | | | | | Yes | | | |
| | Samanalawewa | | Yes | | | | | Yes | | | |

**Table 2-35 Vulnerability of Grid Substations**

| District | Transmission Grid Substation | Exposure | | | | | Sensitivity | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Drought | Landslide | Tsunami | Coastal Hazards | Flood | Drought | Landslide | Tsunami | Coastal Hazards |
| Ampara | Ampara | | | | | | | | | | |
| Anuradhapura | Habarana | | | | | | | | | | |
| | New Habarana GSS | | | | | | | | | | |
| | New-Anuradhapura | | | | | | | | | | |
| | Anuradhapura | | | | | | | | | | |
| Badulla | Badulla | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mahiyanganaya GSS | | | | | | | | | | |
| Batticaloa | Vavunativu | | | | | | | | | | |
| | Valachchanai | | | | | | | | | | |
| Colombo | Kesbewa GSS | Yes | | | | | Yes | | | | |
| | Ratmalana | | | | | | | | | | |
| | Pannipitiya | | | | | | | | | | |
| | Dehiwala | | | | | | | | | | |
| | Padukka GSS | | | | | | | | | | |
| | Oruwala GSS | | | | | | | | | | |
| | Sri Jayawardanapura | Yes | | | | | Yes | | | | |
| | Sub A-Havelock Town | | | | | | | | | | |
| | Athurugiriya | | | | | | | | | | |
| | Sub E-Kollupitiya | | | | | Yes | | | | | Yes |
| | Sub N-Hunupitiya | | | | | | | | | | |
| | Sub M-Slave Island | | | | | Yes | | | | | Yes |
| | Sub I-Maradana | | | | | | | | | | |
| | Sub F-Fort | | | | | | | | | | |
| | Kolonnawa | Yes | | | | | Yes | | | | |
| | Sub B- Pettah | | | | | | | | | | |
| | Kosgam | | | | | | | | | | |
| | Sub C-Kotahena | Yes | | | | | | | | | |
| | Seethawaka | | | Yes | | | | | Yes | | |
| Galle | Galle | | | | | | | | | | |
| | Ambalangoda GSS | | | | | | | | | | |
| Gampaha | Sapugaskanda GSS | | | | | | | | | | |
| | Kelaniya GSS | Yes | | | | | Yes | | | | |
| | Biyagama | | | | | | | | | | |
| | Aniyakanda GSS | Yes | | | | | Yes | | | | |
| | Kotugoda | | | | | | | | | | |
| | Katunayake | Yes | | | | | Yes | | | | |
| | Veyangoda | | | | | | | | | | |
| Hambantota | Beliatta | | | | | | | | | | |
| | Hambantota | | | | | | | | | | |
| Kalutara | Matugama | | | Yes | | | | | Yes | | |
| | Kaluthara GSS | | | | | | | | | | |
| | Panadura | | | Yes | | | | | | | |
| | Horana GSS | Yes | | Yes | | | Yes | | Yes | | |
| Kandy | Nawalapitiya GSS | | | Yes | | | | | Yes | | |
| | Kiribathkumbura | | | | | | | | | | |
| | Pallekele GSS | | | | | | | | | | |
| Kegalle | Maliboda GSS | | | Yes | | | | | Yes | | |
| | Kegalle GSS | | | | | | | | | | |
| | Thulhiriya | | | | | | | | | | |
| Kilinochchi | kilinochchi | | | | | | | | | | |
| Kurunegala | Pannala | | | | | | | | | | |
| | Kurunegala | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | New Chilaw GSS | | | | | | | | | | |
| | Maho Grid Substation | | | | | | | | | | |
| Mannar | Mannar GSS | | | | | | | | | | |
| | Nadukkuda | | | | | | | | | | |
| Matale | Naula GSS | | | Yes | | | | | Yes | | |
| Matara | Matara | Yes | | | | Yes | Yes | | | | Yes |
| | Deniyaya | | | Yes | | | | | Yes | | |
| Moneragala | Monaragala GSS | | | | | | | | | | |
| Nuwara Eliya | Nuwara Eliya | | | Yes | | | | | Yes | | |
| | New Polpitiya GSS | | | Yes | | | | | Yes | | |
| | Ragala GSS | | | | | | | | | | |
| Polonnaruwa | Polonnaruwa GSS | | | | | | | | | | |
| Puttalam | Bolawatta | | | | | | | | | | |
| | Madampe | | | | | | | | | | |
| | Puttalam | | | | | | | | | | |
| Ratnapura | Embilipitiya | | | | | | | | | | |
| | Balangoda | | | | | | | | | | |
| | Ratnapura | | | | | | | | | | |
| | Wewalwatta GSS | | | | | | | | | | |
| Trincomalee | Kappalthurai | | | | | | | | | | |
| | Trincomalee | | | | Yes | | | | | Yes | |
| Vavuniya | Vavunia | | | | | | | | | | |

**Table 2-36 Vulnerability of Trans. Lines (220 or 132 kV Towers) and Primary Substations**

| **District** | **No. of Transmission 220 or 132 kV Towers** | **Distribution Primary Substations** | **Exposure** | | | | | **Sensitivity** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Flood** | **Drought** | **Landslide** | **Tsunami** | **Coastal Hazards** | **Flood** | **Drought** | **Landslide** | **Tsunami** | **Coastal Hazards** |
| Ampara | 282 | | Yes | | | | | Yes | | | | |
| Anuradhapura | 997 | | Yes | | | | | Yes | | | | |
| Badulla | 442 | | No | | Yes | | | | | Yes | | |
| Batticaloa | 221 | | Yes | | | | | Yes | | | | |
| Colombo | 642 | 20 | Yes | | Yes | | Yes | Yes | | Yes | | Yes |
| Galle | 292 | 10 | Yes | | Yes | | Yes | Yes | | Yes | | Yes |
| Gampaha | 695 | 14 | Yes | | Yes | Yes | Yes | Yes | | Yes | Yes | Yes |
| Hambantota | 175 | | Yes | | Yes | | | Yes | | Yes | | |
| Jaffna | 98 | | Yes | | | | | Yes | | | | |
| Kalutara | 345 | 10 | Yes | | Yes | | | Yes | | Yes | | |
| Kandy | 643 | | Yes | | Yes | | | Yes | | Yes | | |
| Kegalle | 516 | | Yes | | Yes | | | Yes | | Yes | | |
| Kilinochchi | 134 | | Yes | | | | | Yes | | | | |
| Kurunegala | 527 | | Yes | | Yes | | | Yes | | Yes | | |
| Mannar | 157 | | Yes | | | Yes | Yes | Yes | | | Yes | Yes |
| Matale | 601 | | No | | Yes | | | | | Yes | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Matara | 241 | | Yes | | Yes | | Yes | Yes | | Yes | | Yes |
| Moneragala | 174 | | No | | Yes | | | | | Yes | | |
| Mullaitivu | 87 | | Yes | | | | | Yes | | | | |
| Nuwara-Eliya | 522 | | Yes | | Yes | | | Yes | | Yes | | |
| Polonnaruwa | 292 | | Yes | | | | | Yes | | | | |
| Puttalam | 693 | | Yes | | | Yes | Yes | Yes | | | Yes | Yes |
| Ratnapura | 438 | | Yes | | Yes | | | Yes | | Yes | | |
| Trincomalee | 152 | | Yes | | | Yes | | Yes | | | Yes | |
| Vavuniya | 331 | | Yes | | | | | Yes | | | | |

## 2.7 Capacity Assessment

The electricity sector's disaster response capacities involve a range of actions taken during and after a disaster to ensure continued power supply and safety. These capacities include organizing plant shutdowns, prioritizing emergency maintenance, ensuring safety equipment is available, and facilitating evacuation of personnel and materials. Additionally, they involve activating emergency operations plans, providing emergency response, rescue services and recovery efforts coordinating with disaster management and responding authorities such as DMC & Military.

### 2.7.1 Indicators for Capacity Assessment

Capacity assessment of electricity sector shall be carried out using indicators given in following table. As the data is not available, the risk assessment was conducted without considering the capacity of Ceylon Electricity Board and Lanka Electricity Company. The data shall be collected using the format given in Table 2-37 for future assessment.

**Table 2-37 Indicators for Capacity Assessment**

| **District** | **Indicators for Capacity Assessment** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Emergency Operations** | | | | **Emergency Maintenance and Repair** | | | **Evacuation and Support** | | **Communication and Coordination** | **Long-term Recovery** | | |
| | **Plant Shutdown** | **Support Services** | **Task Force** | **EOC** | **Priority Maintenance** | **Safety Equipment** | **Emergency First Aid** | **Evacuation** | **Rescue and Search** | | **Damage Assessment** | **Restoration** | **Mitigation and Preparednes** |
| Ampara | | | | | | | | | | | | | |
| Anuradhapura | | | | | | | | | | | | | |
| Badulla | | | | | | | | | | | | | |
| Batticaloa | | | | | | | | | | | | | |
| Colombo | | | | | | | | | | | | | |
| Galle | | | | | | | | | | | | | |
| Gampaha | | | | | | | | | | | | | |
| Hambantota | | | | | | | | | | | | | |
| Jaffna | | | | | | | | | | | | | |
| Kalutara | | | | | | | | | | | | | |
| Kandy | | | | | | | | | | | | | |
| Kegalle | | | | | | | | | | | | | |
| Kilinochchi | | | | | | | | | | | | | |
| Kurunegala | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mannar | | | | | | | | | | | | | |
| Matale | | | | | | | | | | | | | |
| Matara | | | | | | | | | | | | | |
| Moneragala | | | | | | | | | | | | | |
| Mullaitivu | | | | | | | | | | | | | |
| Nuwara-Eliya | | | | | | | | | | | | | |
| Polonnaruwa | | | | | | | | | | | | | |
| Puttalam | | | | | | | | | | | | | |
| Ratnapura | | | | | | | | | | | | | |
| Trincomalee | | | | | | | | | | | | | |
| Vavuniya | | | | | | | | | | | | | |

### 2.7.2 Utility Capacity and Resilience Assessment

CEB and LECO shall undertake a formal capacity and resilience assessment for natural and human induced hazard response at national, regional, depot, branch, and field-unit levels.

The assessment shall determine the capability of each operating unit to prepare for, respond to, and recover from floods, landslides, cyclones/high winds, droughts, tsunami, coastal hazards, lightning, and other climate-related events.

**Table 2-38 Utility Capacity and Resilience Assessment**

| Subject | Minimum Requirement |
|---|---|
| Emergency crews | Availability of engineers, supervisors, linesmen, operators, and support staff. |
| Contractors | Registered contractors available for rapid mobilization. |
| Vehicles | Lorries, cranes, bucket trucks, 4WD vehicles, boats, and transport support. |
| Emergency materials | Poles, conductors, transformers, RMUs, fuses, insulators, joints, terminations, meters, service wires, cable accessories and temporary supply materials. |
| Temporary supply | Mobile generators, portable transformers, temporary LV/MV supply arrangements and priority temporary supply procedures. |
| Communication | Mobile phones, radio communication, satellite phones where required, and emergency contact directories. |
| Stores | Regional emergency stock locations, minimum stock levels, and replenishment time. |
| Fuel | Fuel availability for vehicles, generators and field operations. |
| Access | Alternative access routes to substations, depots, power stations and affected feeders. |
| Safety | PPE, rescue equipment, first-aid, isolation tools, portable earthing devices and flood-response safety equipment. |

The outcome of the capacity assessment shall be used to update the risk rating of each region and asset group. Formats provided in the preparedness plan Table 4.7- 4.31 could be used to collect data required to assess utility capacity and resilience.

## 2.8 Risk Assessment

Compiling hazard, element at risk (Electricity generation, transmission, and distribution), level of exposure and vulnerability of electricity infrastructure risk of flood, drought, landslide and coastal hazards were assessed by districts.

### 2.8.1 Risk Assessment- Flood

**Table 2-39 Risk Assessment- Flood**

| District | Flood Risk (Hazard x Element at Risk X Exposure x Vulnerability) | | |
|---|---|---|---|
| | **Generation** | **Transmission** | **Distribution** |
| Ampara | No Generation | No Exposure | Moderate |
| Anuradhapura | No Generation | No Exposure | Low |
| Badulla | No Generation | No Exposure | No Exposure |
| Batticaloa | No Generation | No Exposure | Moderate |
| Colombo | High | High | High |
| Galle | No Generation | No Exposure | High |
| Gampaha | High | High | High |
| Hambantota | No Generation | No Exposure | Moderate |
| Jaffna | No Generation | No Exposure | High |
| Kalutara | No Generation | High | High |
| Kandy | No Generation | No Exposure | Low |
| Kegalle | No Generation | No Exposure | Moderate |
| Kilinochchi | No Generation | No Exposure | High |
| Kurunegala | No Generation | No Exposure | Moderate |
| Mannar | No Generation | No Exposure | Moderate |
| Matale | No Generation | No Exposure | No Exposure |
| Matara | No Generation | High | High |
| Moneragala | No Generation | No Exposure | No Exposure |
| Mullaitivu | No Generation | No Exposure | No Exposure |
| Nuwara-Eliya | Moderate | No Exposure | Low |
| Polonnaruwa | No Generation | No Exposure | High |
| Puttalam | No Generation | No Exposure | Moderate |
| Ratnapura | No Generation | No Exposure | Low |
| Trincomalee | No Generation | No Exposure | High |
| Vavuniya | No Generation | No Exposure | Low |

The table 2.39 outlines the flood risk to Sri Lanka's electricity infrastructure by district, considering Generation, Transmission, and Distribution components. Risk levels vary significantly depending on the presence of facilities and their exposure to flooding.

1. **High-Risk Districts for All Three Components**

   Colombo and Gampaha: Both districts face high flood risk across generation, transmission, and distribution. This reflects the concentration of critical infrastructure and dense urban exposure.

2. **High Transmission & Distribution Risk (No Generation)**

   Kalutara, Matara: Both districts show high risk for transmission and distribution but have no generation facilities.

   Galle, Jaffna, Kilinochchi, Polonnaruwa, Trincomalee: Identified as high distribution risk zones, despite lacking generation and transmission exposure.

3. **Moderate Risk Districts**

   Ampara, Batticaloa, Hambantota, Kegalle, Kurunegala, Mannar, Puttalam: Marked with moderate flood risk mainly in distribution, highlighting localized vulnerabilities.

   Nuwara Eliya: Presents moderate generation risk but low distribution risk, indicating potential localized hazards to generation infrastructure.

4. **Low Risk Districts**

   Anuradhapura, Kandy, Ratnapura, Vavuniya: Registered low flood risk, limited primarily to distribution.

5. **Minimal or No Exposure Districts**

   Badulla, Matale, Moneragala, Mullaitivu: Indicate no significant flood exposure across all three components, suggesting relatively safer conditions for electricity infrastructure.

### 2.8.2 Risk Assessment- Drought

**Table 2-40 Risk Assessment- Drought**

| District | Drought Risk for Power Generation (Hydro) |
|---|---|
| Ampara | No Element at Risk |
| Anuradhapura | No Element at Risk |
| Badulla | No Element at Risk |
| Batticaloa | No Element at Risk |
| Colombo | No Element at Risk |
| Galle | No Element at Risk |
| Gampaha | No Element at Risk |
| Hambantota | No Element at Risk |
| Jaffna | No Element at Risk |
| Kalutara | Moderate |
| Kandy | Low |
| Kegalle | Moderate |
| Kilinochchi | No Element at Risk |
| Kurunegala | No Element at Risk |
| Mannar | No Element at Risk |
| Matale | High |
| Matara | No Element at Risk |
| Monaragala | Moderate |
| Mullaitivu | No Element at Risk |
| Nuwara Eliya | Low |
| Polonnaruwa | No Element at Risk |
| Puttalam | No Element at Risk |
| Ratnapura | High |
| Trincomalee | No Element at Risk |
| Vavuniya | No Element at Risk |

The table 2.40 assesses the exposure of hydroelectric power generation to drought risk across districts in Sri Lanka. Since hydro generation depends heavily on water availability, only districts with significant hydro resources show measurable risk.

1. **High-Risk Districts**

   Matale, Ratnapura: Classified as high drought risk zones due to their heavy reliance on river-based hydro generation. Reduced rainfall or prolonged dry spells could critically impact hydro capacity here.

2. **Moderate-Risk Districts**

   Kalutara, Kegalle, Monaragala: Exposed to moderate drought risk, reflecting their hydro dependency balanced with alternative supply or moderate exposure to prolonged dry conditions.

3. **Low-Risk Districts**

   Kandy, Nuwara Eliya: Categorized under low drought risk despite being key hydro catchment areas. Their diversified reservoirs and geographical conditions help mitigate the severity of drought impacts.

4. **No Element at Risk**

   Majority of Districts (e.g., Ampara, Anuradhapura, Colombo, Galle, Gampaha, Hambantota, Jaffna, Kurunegala, Puttalam, Trincomalee, Vavuniya, etc.): Indicate no direct risk since they do not host significant hydropower facilities.

### 2.8.3 Risk Assessment- Landslide

**Table 2-41 Risk Assessment- Landslide**

| District | Landslide Risk | | |
|---|---|---|---|
| | **Generation** | **Transmission** | **Distribution** |
| Badulla | No Element at Risk | Moderate | High |
| Colombo | No Exposure | Low | Low |
| Galle | No Element at Risk | No Exposure | Low |
| Gampaha | No Exposure | No Exposure | Low |
| Hambantota | No Element at Risk | No Exposure | Low |
| Kalutara | Moderate | Moderate | Moderate |
| Kandy | High | High | High |
| Kegalle | No Exposure | High | High |
| Kurunegala | No Element at Risk | Moderate | Low |
| Matale | No Exposure | High | Moderate |
| Matara | No Element at Risk | Low | Low |
| Monaragala | Low | Moderate | Low |
| Nuwara Eliya | High | High | High |
| Ratnapura | Moderate | High | Moderate |

The table 2.39 evaluates landslide-related risks to electricity infrastructure, covering power generation, transmission, and distribution across selected districts. Landslides are concentrated in hilly and mountainous areas, with significant variations by district and infrastructure type.

**1. High-Risk Districts**

Kandy & Nuwara Eliya: These are the highest risk districts with high exposure across generation, transmission, and distribution. Their mountainous terrain and reliance on hydro generation make them highly vulnerable.

Kegalle: Although it has no generation facilities, transmission and distribution are highly exposed, reflecting its central role in power grid connectivity.

**2. Moderate-to-High Risk Districts**

Badulla: No generation facilities, but moderate transmission risk and high distribution risk, highlighting threats to local networks.

Ratnapura: Moderate risk in generation and distribution, but high in transmission, due to steep terrain and weather sensitivity.

Kalutara: Classified as moderate risk across all three components, showing balanced exposure.

Matale: High transmission risk and moderate distribution risk, although no generation assets exist.

**3. Moderate Risk Districts**

Monaragala: Low generation and distribution risk, but moderate transmission risk due to localized landslide-prone areas.

Kurunegala: Moderate transmission and low distribution risk, though generation is not exposed.

### 2.8.4 Risk Assessment- Cyclone/High Wind

**Table 2-42 Risk Assessment- Cyclone/High Wind**

| District | Risk of Cyclones and High Winds | | |
|---|---|---|---|
| | **Generation** | **Transmission** | **Distribution** |
| Ampara | No Generation | Low | Low |
| Anuradhapura | No Generation | Low | Low |
| Badulla | No Generation | High | High |
| Batticaloa | No Generation | Moderate | Moderate |
| Colombo | Low | Low | Low |
| Galle | No Generation | Low | Low |
| Gampaha | High | Moderate | Moderate |
| Hambantota | No Generation | Low | Moderate |
| Jaffna | High | No Element at Risk | High |
| Kalutara | Low | Low | Low |
| Kandy | High | Moderate | Moderate |
| Kegalle | Low | Moderate | Moderate |
| Kilinochchi | No Generation | Moderate | High |
| Kurunegala | No Generation | Low | Low |
| Mannar | No Generation | High | High |

| | | | |
|---|---|---|---|
| Matale | Moderate | Moderate | Moderate |
| Matara | No Generation | Low | Moderate |
| Monaragala | Moderate | Moderate | Moderate |
| Mulaithiu | No Generation | No Element at Risk | Moderate |
| Nuwara Eliya | Moderate | High | Moderate |
| Polonnaruwa | No Generation | Low | Low |
| Puttalam | High | Moderate | High |
| Ratnapura | Moderate | Moderate | Moderate |
| Trincomalee | No Generation | Moderate | Moderate |

This table 2.40 evaluates the exposure of electricity infrastructure to cyclones and high-wind hazards across districts. Risks vary based on geographical location, coastal proximity, and infrastructure vulnerability.

**1. High-Risk Districts**

Badulla: Despite no generation, both transmission and distribution face high risks, reflecting exposure of grid infrastructure in elevated, wind-prone terrain.

Gampaha: High generation risk, with moderate transmission and distribution risks, indicating significant vulnerability due to urban infrastructure density and windstorms.

Jaffna: High generation and distribution risk, reflecting its coastal exposure to cyclones. Transmission shows no element at risk.

Mannar: High risk in transmission and distribution, though no generation exists, due to its exposed coastal location.

Puttalam: High generation and distribution risks, with moderate transmission exposure, aligning with coastal vulnerability and presence of major power facilities.

**2. Moderate-Risk Districts**

Batticaloa, Kilinochchi, Matale, Monaragala, Nuwara-Eliya, Ratnapura, Trincomalee: These districts show moderate risks across most components, with variations depending on terrain and coastal exposure.

Hambantota, Matara: Low risks in generation (where applicable), but moderate risks in distribution, reflecting wind impacts on extended grid lines.

Kandy & Kegalle: Both show moderate transmission and distribution risks, with high generation risk in Kandy.

**3. Low-Risk Districts**

Ampara, Anuradhapura, Colombo, Galle, Kalutara, Kurunegala, Polonnaruwa: These districts show low cyclone and high-wind risk across most components, due to either inland positioning, lower cyclone exposure, or absence of major generation facilities.

**4. Special Cases**

Mullaitivu: No generation or transmission elements at risk, but moderate distribution risk, reflecting rural coastal exposure.

### 2.8.5 Risk Assessment Costal Hazards (Tsunami, Sea Level Rise & Sea Surge)

**Table 2-43 Risk Assessment Costal Hazards (Tsunami, Sea Level Rise & Sea Surge)**

| District | Tsunami | | | Sea Level Rise & Sea Surge | | |
|---|---|---|---|---|---|---|
| | Generation | Transmission | Distribution | Generation | Transmission | Distribution |
| Ampara | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | No Exposure |
| Anuradhapura | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Badulla | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Batticaloa | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | No Exposure |
| Colombo | No Exposure | No Exposure | No Exposure | No Exposure | No Exposure | Low |
| Galle | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | Moderate |
| Gampaha | No Exposure | No Exposure | Low | No Exposure | No Exposure | Moderate |
| Hambantota | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | No Exposure |
| Jaffna | No Exposure | No Exposure | No Exposure | No Exposure | No Exposure | No Exposure |
| Kalutara | No Exposure | No Exposure | Low | No Exposure | No Exposure | No Exposure |
| Kandy | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Kegalle | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Kilinochchi | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | No Exposure |
| Kurunegala | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Mannar | No element at Risk | No Exposure | Moderate | No element at Risk | No Exposure | low |
| Matale | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Matara | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | Moderate |
| Monaragala | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Mulaithiu | No element at Risk | No Exposure | No Exposure | No element at Risk | No Exposure | No Exposure |
| Nuwara Eliya | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Polonnaruwa | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Puttalam | No Exposure | No Exposure | Moderate | No Exposure | No Exposure | Moderate |
| Ratnapura | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |
| Trincomalee | No element at Risk | No Exposure | Moderate | No element at Risk | No Exposure | No Exposure |
| Vavuniya | No hazard | No hazard | No hazard | No hazard | No hazard | No hazard |

The table 2.43 highlights the risk of power sector infrastructure (generation, transmission, distribution) to tsunami and sea-level-related hazards across districts. The risks are localized mainly to coastal areas, with inland districts showing no significant hazard.

**1. High- and Moderate-Risk Districts**

Puttalam: While no generation or transmission is exposed, distribution shows moderate risk for both tsunami and sea-level rise. This reflects vulnerability of coastal grid infrastructure and settlements to flooding and surges.

Mannar: Distribution faces moderate risk from tsunami and low risk from sea-level rise, though no generation is present. Coastal exposure and island geography increase sensitivity.

Trincomalee: Distribution faces moderate tsunami risk, though sea-level rise does not currently pose a distribution hazard. Presence of major ports and coastal communities drive exposure.

Galle: Distribution faces moderate sea-level rise risk, though tsunami exposure is minimal. Coastal lowlands are at risk of inundation.

Matara: Distribution shows moderate risk from sea-level rise, with minimal tsunami-related exposure.

**2. Low-Risk Districts**

Colombo: Distribution faces low risk from sea-level rise, reflecting gradual exposure in urban coastal areas. Tsunami exposure is negligible.

Gampaha: Distribution has low tsunami risk and moderate sea-level rise risk, due to exposure along the Negombo coastal belt.

Kalutara: Distribution shows low tsunami risk, with no significant sea-level rise hazard recorded.

**3. No-Risk or No-Exposure Districts**

Ampara, Batticaloa, Hambantota, Jaffna, Kilinochchi, Mullaitivu: Despite being coastal districts, no generation or transmission exposure is reported, with distribution risk generally minimal.

Inland districts (Anuradhapura, Badulla, Kandy, Kurunegala, Matale, Monaragala, Nuwara Eliya, Polonnaruwa, Ratnapura, Vavuniya): These show no hazards, as they are outside tsunami and sea surge impact zones.

## 2.9 Strengthening Institutional Capacity for Risk assessment

Considering the increasing trend in extreme hazard events due to climate change its impacts to power sector, CEB and LECO shall develop the capacity to undertake disaster risk assessment. Establishing data base including hazard maps indicating flood inundation area, landslide susceptibility areas, cyclone/high-wind zones; tsunami inundation areas, coastal erosion and sea surge areas; drought-affected catchments, lightning-prone areas. Further information on vulnerability of access roads, and locations of critical customers need to be mapped.

The GIS system shall be used for identifying exposed assets, prioritizing mitigation investments, planning emergency crew deployment, pre-positioning stores and materials,

identifying safe access routes, supporting restoration planning, and regularly reporting risk exposure to senior management and PUCSL.

A system developed under a Senior Manager could provide additionally predictive outage analysis, crew dispatch optimization and resilience planning.

Integrated Utility GIS Disaster Platform shall be developed and the GIS database shall be updated periodically and after every major disaster event. The database and plan shall contain, among other things, feeder-wise hazard overlays (flood maps, landslide maps, cyclone exposure maps etc.), vegetation risk maps and critical consumers. This is essential for predictive outage analysis, crew dispatch optimization, and resilience planning. Given current technology, GIS is now a necessity, not an option.

# 3. Disaster Mitigation Plan for CEB and LECO

## 3.1 Introduction

The electricity supply system of Sri Lanka, managed primarily by Ceylon Electricity Board (CEB) and Lanka Electricity Company (LECO), is highly vulnerable to both natural and man-made hazards. Floods, droughts, landslides, cyclones/high winds, and tsunamis, along with technical failures and accidents, can severely disrupt power generation, transmission, and distribution.

This mitigation plan outlines measures to reduce risks, enhance system resilience, and ensure continuity of supply. It emphasizes vulnerability analysis of physical infrastructure, organizational management, and financial resources, while proposing design, construction, and operational strategies.

## 3.2 Objectives of the Mitigation Plan

The overarching objective of this mitigation plan is to strengthen the resilience of Sri Lanka's electricity supply system against disaster risks. Specific objectives are to:

1. Protect critical power infrastructure against natural and technological hazards.
2. Ensure continuity of electricity supply during and after disasters to minimize socio-economic disruption.
3. Integrate risk reduction into the design, construction, and operation of all new and existing energy projects.
4. Promote sustainable and climate-resilient energy sources to reduce dependency on vulnerable hydro resources.
5. Strengthen institutional, technical, and financial capacity of CEB and LECO for disaster risk management.
6. Enhance coordination with government agencies, local authorities, and communities to ensure effective mitigation and preparedness.

## 3.3 Mitigation Strategies by Hazard and Infrastructure

### 3.3.1 Introduction

The Disaster Risk Mitigation Plan for CEB and LECO is designed as a comprehensive framework to safeguard Sri Lanka's electricity generation, transmission, and distribution systems against a wide range of natural and man-made hazards. Recognizing that hazards such as floods, droughts, landslides, cyclones, high winds, and tsunami as well as accidents and technical failures—can severely disrupt energy supply and adversely affect socio-economic stability, the plan emphasizes both preventive and corrective measures.

It integrates vulnerability assessments, risk-informed planning, and multi-stakeholder coordination, ensuring that the resilience of the power sector is enhanced at every stage from design and construction to daily operations and long-term maintenance. The plan focuses not only on protecting physical assets such as power plants, substations, transmission poles, and

distribution networks but also addresses institutional and financial vulnerabilities that could undermine effective disaster response.

### 3.3.2 Mitigation measures are structured into clear phases

- Design phase actions such as site selection, hazard mapping, climate-proof engineering, and catchment protection.
- Construction phase measures including slope stabilization, robust structural standards, and avoidance of high-risk zones.
- Operational phase practices such as monitoring hazard forecasts, early warning dissemination, rapid response protocols, and rehabilitation of affected infrastructure.

Cross-cutting strategies such as institutional strengthening, capacity building, financial preparedness, community partnerships, and the use of advanced technology (e.g., GIS mapping, SCADA monitoring, and climate projections) form the backbone of the plan. These measures ensure that mitigation is not limited to physical resilience, but also builds organizational efficiency and adaptive capacity.

The plan ultimately aims to:

1. Safeguard public and utility staff and workmen attending to restoration works
2. Safeguard critical electricity infrastructure from hazard impacts.
3. Ensure uninterrupted power supply (or restoration of supply) to essential services, households, industries etc. during crises.
4. Minimize recovery time and economic losses.
5. Mainstream disaster risk reduction and climate resilience into all future energy projects.

By adopting this integrated approach, CEB and LECO will be better equipped not only to reduce disaster-related disruptions but also to contribute to national resilience, energy security, and sustainable development.

### 3.3.3 Mitigation Measures for Hydro and Thermal Power Plants

**Table 3-1 Possible mitigation measures for hydro and thermal power plants**

| Hazard | Issues and Impact | Possible mitigation measures |
|---|---|---|
| Floods | • Hydro and thermal power plants are highly exposed to a range of hazards. Floods reduce the effectiveness of reservoirs and pose risks to water intakes. | **In the design phase;**<br>Conduct a comprehensive risk assessment (considering deferent flood scenarios and dam breach scenarios) to identify high flood risk areas and established proper adequate early warning systems for communities and decision makers to ensure the safety of the downstream people, property, development and environment<br>**Operation phase** |

| | | |
|---|---|---|
| | | • Automatic gate-clearing systems should be installed to prevent blockages. During operations, coordination with the Irrigation Department (ID), Mahaweli Authority (MASL), DMC and the Armed Forces is vital to ensure timely clearing of intakes and dissemination of early warnings to downstream communities.<br><br>• Enhance coordination among all relevant stakeholders enabling to get relevant information appropriately (Rainfall data, Weather reports and warning, Flood information and warning, water release and utility information etc.). As example EW messages issued by ID specially those at four power stations exposed to floods as given Table 16 in Risk assessment report |
| Drought | • Drastic reduction of the water levels of reservoirs limiting generation or/ completely shutting down of hydro power plants. Losses were compensated by switching to thermal power plant increasing cost of production.<br><br>• Reduction of the surface water flow in to reservoirs during dry season due to the clearance of trees /vegetation in catchment areas<br><br>• Risk assessment study has identified several hydro power plants highly and moderately exposed to drought. | **In the design phase:**<br><br>• A long-term strategy should diversify generation sources, particularly wind and solar energy, to compensate for reduced hydro output during droughts (Long Term Generation Expansion Plan prepared by CEB shall address these issues). Climate change projections must be incorporated into new renewable energy plant designs. (Details of hydro power stations exposed to drought given in Table 24 of Risk Assessment Report)<br><br>**In the operational phase, consider:**<br><br>• Water resources should be managed in collaboration with the Mahaweli Authority, National Water Supply and Drainage Board (NWSDB) and ID to optimize allocation between electricity and essential services. (Details of hydro power stations exposed to drought given in Table 24 of Risk Assessment Report).<br><br>• Appropriate Demand Side Management (DSM) measure shall be adopted with Distribution Utilities. |

| | | |
|---|---|---|
| Landslides | • Kothmale power station is most likely exposed to landslides. Bowathenna Power station at Naulla divisional secretary division is located at landslides expected land.<br>• Level of exposure is identified in the risk assessment study.<br>• If any Penstock structures lying on the surface could be damaged by falling boulders during rainy season (data not available to identify lines) | **In the design phase, take into account:**<br>• Detailed hydro-geological studies are required for plants located in landslide-prone areas such as Kotmale and Bowathenna. Mitigation includes slope stabilization through reforestation, construction of drainage ditches, and installation of protective structures for penstocks. Rehabilitation and relocation of affected facilities should be prioritized if risks become unmanageable<br>**In the construction phase, take into account:**<br>• Ensure stability of soil at the site before any earth work commences.<br>**In the operational phase, consider:**<br>• Monitor and maintain all piezometers and other earth monitoring system to identify any land movement in the nearby areas. |
| Cyclones/ High Winds | • Fallen trees could damage the power station and penstock lying on the surface.<br>• Roof of the buildings (Permanent or temporary) at the power station could be blown off due to high wind. | **In the design phase, take into account:**<br>• In design and construction, roofing structures must be properly tied and secured, with wind direction and speed considered in building design.<br>**In the operational phase, consider:**<br>• In the operational phase, advance warnings must trigger preventive action such as pruning trees and strengthening exposed structures. |

### 3.3.4 Mitigation Measures for Grid Substations

Grid substations are critical for the stability of the transmission system. Ten (10) substations have already been identified as exposed to floods, while others are vulnerable to landslides and cyclonic activity. Loss of substations due to disasters could lead to widespread blackouts

**Table 3-2 Mitigation Measures for Grid Substations**

| Hazard | Issues and Impact | Possible mitigation measures |
|---|---|---|
| Floods | • Road leading to GSS could be inundated denying access to GSS | **In the design phase, take into account:**<br>• Substations should be constructed only on land assessed for flood |

| | | |
|---|---|---|
| | | safety, with filed equipment and control room elevated above maximum predicted water levels.<br>• GIS (Gas Insulated Substation) substations in urban flood zones<br>• N-1 and N-2 contingency resilience for transmission lines and the GSS<br>**In the operational phase, consider:**<br>• During floods, staff mobility must be ensured through the provision of boats and safe access routes, and substations should be switched off in extreme cases to prevent damage.<br>• Prevention of water entering control room by laying sand-bags, pumping out water (cable trenches) inside control room |
| Landslides | • Total or partial destruction of the structures lying in the path of the landslide.<br>• Equipment at the GSS could be damaged | **In the design phase, take into account:**<br>• Site selection must be informed by geotechnical investigations, with slope stabilization and vegetation cover integrated into project design.<br>**In the operational phase, consider:**<br>• In operation, alternative access routes should be planned, and coordination with the National Building Research Organization (NBRO) is essential for receiving early warnings. |
| Cyclones/<br>High Winds | • Fallen trees could damage the equipment at GSS<br>• Roof of the buildings (Permanent or temporary) at the GSS could be damaged due to high wind. | **In the design phase, take into account:**<br>• Construction near large trees must be avoided, and roofing materials must be robust.<br>**In the operational phase, consider:**<br>• Regular removal of unstable branches is necessary, and spare equipment should be stored on-site for immediate repair. |

| | | |
|---|---|---|
| Tsunami | • Heavy flooding due to Tsunami, damages to Substation infrastructure and threat to public safety | **In the design phase, take into account:**<br>• Rerouting of Transmission lines, locating the Grid substation away from Tsunami affected zone.<br>**In the operational phase, consider**<br>• Rapid isolation arrangements for coastal feeders and other measures as for Flooding |

### 3.3.5 Mitigation Measures for Transmission Lines

Although not directly affected by floods or droughts, transmission towers are vulnerable to landslides and wind damage. Historical data shows significant exposure in Gampaha, Kegalle and Kandy districts.

**Table 3-3 Mitigation Measures for Transmission Lines Towers and Equipment**

| Hazard | Issues and Impact | Possible mitigation measures |
|---|---|---|
| Landslides | • A total of 442 poles in 8 districts are located in most likely areas exposed to landslides. Highest number of poles mostly exposed are in Kegalle (39) and Kandy (22) districts. (ref. Table 23) | **In the design phase, take into account:**<br>• Distribution Line routes should avoid unstable terrain where possible. Detailed geotechnical studies should be undertaken, and slope stabilization techniques, including retaining measures, drainage systems and reforestation, should be implemented.<br>**In the operational phase, consider:**<br>• Footings should be regularly inspected for signs of instability. |
| Flood | • Poles footings may get disturbed if landslide destabilized the soil close to the footing,<br>• MV Equipment (Overhead and Underground) | **In the design phase, take into account:**<br>• Elevated locations, proper route selection, double-pole construction in critical location, pole base concreting as required<br>**In the operational phase, consider:**<br>• Footings should be regularly inspected for signs of instability.<br>• Elevated plinths for substations, RMUs, LV panels, battery systems and control equipment; flood-resistant layouts and |

| | | |
|---|---|---|
| | | drainage around substations., Overhead equipment installation on double pole structures in flood prone areas |
| Cyclones/ high winds | • Fallen trees could damage the lines | **In the design phase, take into account:**<br>• design improvements to withstand high wind speeds. Review the stay arrangements and pole-top hardware / bracings.<br>**In the operational phase, consider:**<br>• The risk of falling trees damaging transmission lines can be reduced through preventive tree removal. |
| Drought | • Heavy sessional demand increase due to high ambient temperature | **In the operational phase, consider**<br>• Appropriate Demand Side Management (DSM) measure shall be adopted in consultation with Generation and Transmission Divisions. |
| Tsumani | • Heay flooding due to Tsunami, damages to power distribution infrastructure | **In the design phase, take into account:**<br>• Rerouting of lines, Insulated conductors (MV and LV ABC), Underground distribution system if economically feasible.<br>**In the operational phase, consider**<br>• Rapid isolation arrangements for coastal feeders and substations; elevated or protected control and communication equipment in exposed areas |

### 3.3.6 Mitigation Measures for Medium and Low Voltage Power Distribution System

Distribution systems are most exposed to household-level hazards, with floods, cyclones, and tsunamis causing widespread damage in the past. Mitigation measures for Medium and Low voltage distribution system for houses, high consumers (such as industries, hotels, housing complexes, etc. are appended below.

**Table 3-4 Mitigation Measures for Power distribution system, Installations, consumers**

| Hazard | Issues and Impact | Possible mitigation measures |
|---|---|---|
| Floods | • Consumers located in low lying areas could be affected and houses/buildings may get inundated. | **In the design phase, take into account:**<br>• Transformers should be elevated above maximum flood levels,<br>**In the operational phase, consider:**<br>• and power supply should be disconnected from inundated households to prevent electrocution. |
| Landslides | • Supply lines installed in landslide prone areas could get affected | **In the design phase, take into account:**<br>• Distribution poles and transformers must be located away from unstable slopes, with safe site identification incorporated into design. |
| Cyclone and High winds | • Fallen trees could damage the power distribution lines<br>• 1978 cyclone damage almost all power distribution system in Batticaloa district depriving power supply to consumers for few months. . | **In the design phase, take into account:**<br>• Design standards for local power distribution lines should be revised to withstand gust wind speeds.<br>**In the operational phase, consider:**<br>• Preventive pruning of trees is essential before monsoon seasons, and operation staff should be guided by clear preparedness plans. |
| Tsunami | • Distribution lines located within 2 km belt from the shore affected by Tsunami. Worst affected was from Galle to Negombo | • Coastal distribution networks should have automatic disconnection mechanisms linked to tsunami early warning systems. After an event, systematic damage assessments and recovery plans must be implemented. |

# 4. Preparedness for Emergency Response Plan

## 4.1 Introduction

Sri Lanka's electricity sector faces increasing hazard exposure (floods, cyclones, landslides, drought, heat, wildlife/third-party incidents and grid failures) and a policy environment actively pushing for renewable expansion and sector reforms. Applying Build Back Better (BBB) means recovery activities should not only restore power but deliberately increase resilience through risk-informed planning, greener/decentralized systems, stronger standards, social protections and financing that reduces future vulnerability. This report lays out risk assessment priorities, preparedness and emergency response measures, and short-to-long term recovery actions (with institutional, legal and financing recommendations) tailored to Sri Lanka's national context and internationally proven BBB guidance.

This electricity sector emergency response plan establishes the framework for coordinated preparedness, response, and early recovery actions across Sri Lanka's electricity sector to ensure the continuity, safety, and resilience of electricity generation, transmission, and distribution during and after emergency events.

## 4.2 Disaster Preparedness, response and recovery

The Risk Preparedness Plan contains both a national and regional risk assessment related to uninterrupted supply of electricity. Building on the identified electricity crisis scenarios, it identifies existing and planned measures to prevent, prepare for and manage electricity crises both on a national and a regional level.

### 4.2.1 Purpose and Objectives

The purpose and objectives of the Electricity Sector Emergency Response and Recovery Plan are to establish a coordinated and systematic framework to manage emergencies affecting Sri Lanka's electricity generation, transmission, and distribution systems.

The plan primarily aims to protect human life and ensure the safety of staff and the public by promoting a culture of preparedness, clear safety protocols, and well-trained response teams. It seeks to maintain or rapidly restore electricity supply to critical and priority customers, including hospitals, water supply systems, communication networks, and other essential services, to safeguard public welfare and continuity of operations. The plan provides mechanisms to coordinate effective sector-level response and recovery activities among the Ministry of Power and Energy, CEB and LECO, to ensure timely decision-making, efficient resource mobilization, and information sharing. Furthermore, it emphasizes measures to protect vital electricity infrastructure and assets from further damage through rapid assessment, preventive reinforcement, and resilient design standards. By enabling the sector to minimize economic and social disruption, the plan contributes to stabilize livelihoods, industries, and essential services during emergencies.

Importantly, it integrates the Build Back Better principles to ensure that recovery and reconstruction efforts not only restore pre-disaster functionality but also enhance the long-term resilience, reliability, and sustainability of Sri Lanka's electricity sector in the face of future hazards.

### 4.2.2 Legal Framework for the Emergency Preparedness for Response and Recovery Plan

The Preparedness for Emergency Response Plan (ERP) for Sri Lanka's electricity sector, jointly developed by the Public Utilities Commission of Sri Lanka (PUCSL), Ceylon Electricity Board (CEB), and LECO, provides a structured framework to guide electricity supply utilities in preparing for, responding to, and recovering from emergencies in compliance with the Ceylon Electricity Board Act, No. 17 of 1969, the Sri Lanka Electricity Act, No. 20 of 2009, the Public Utilities Commission of Sri Lanka Act, No. 35 of 2002, and the Sri Lanka Disaster Management Act, No. 13 of 2005. This Plan is formulated under the broader National Emergency Operation Plan (NEOP) issued by the Disaster Management Centre (DMC) and operates within the national Incident Command System (ICS) framework with the coordination of the National Emergency Operation Centre (NEOC), ensuring structured command, control, and communication for sectoral and national emergency response activities. Legal provisions underpinning the ERP include Section 4(2)(b) of the Sri Lanka Electricity Act No. 20 of 2009, which mandates that CEB and LECO ensure the availability and continuity of electricity supply, and Clause 6(c) of the regulations under Section 54 of the same Act, which requires the utilities to take measures to safeguard equipment commensurate with the nature and class of risk.

Furthermore, the Disaster Management Act No. 13 of 2005 obliges all public corporations to prepare disaster management plans to mitigate the impact of disasters or pending emergencies. Consequently, the ERP serves as a critical instrument for the uninterrupted delivery of electricity services, encompassing strategies, resources, plans, and procedures to respond effectively to incidents whether natural or man-made that threatens life, property, or the environment. It addresses hazards ranging from localized to large-scale floods, droughts, landslides, cyclones, high winds, and tsunamis affecting coastal areas.

The ERP incorporates the establishment of an institutional response structure, personnel recall procedures, and notifications to external agencies such as the DMC, Police, Fire Department, and first responders including the Tri-Forces. It defines position-based emergency roles and responsibilities for staff and emphasizes the prompt documentation of expenditures, decisions, and actions taken, which is essential for cost justification and potential post-incident reimbursement. The Plan's development was guided primarily by the Institutional Disaster Management Plan guidelines issued by the DMC, ensuring alignment with national disaster management policies and sectoral resilience objectives.

### 4.2.3 Preparedness options followed by Hazard and Risk

Preparedness in the electricity sector is a critical component of ensuring reliable service delivery and the safety of personnel and the public during emergencies. Some of these preparedness activities shall be incorporated into design and construction process (eg. designing of equipment and lines etc.) while others are to be implemented just before the disaster (eg. disconnection of supply). The sector faces a range of hazards, each posing distinct risks that require targeted mitigation and planning.

**Table 4-1 Hazard type, Impact and Preparedness Focus**

| Hazard Type | Likely Impacts on Electricity Sector | Preparedness Focus |
|---|---|---|
| Floods | Substation inundation, tower collapse, short-circuits | Elevate substations / control cubicles, waterproof critical control panels, installing drainage systems around critical infrastructure, sealing of trenches of GSS etc, facilitation of pumping out water |
| Cyclones / High Winds | Transmission line failure, roof loss, disruption of coal supply for thermal (Coal) power plant at Norochchole | Design to wind load standards, tree trimming, ensure sufficient coal supply to cover cyclone/high wind period. |
| Landslides | Tower/line base failure | Relocate assets, slope stabilization |
| Drought | Reduced hydro output, overheating transformers | Diversify energy mix, cooling management, and maintain emergency fuel supplies |
| Lightning | Equipment failure, outages | Ensure Lightning arrestors properly grounded, improved equipment BIL ratings at specification stages, grounding upgrades. |
| Coastal Hazards (Sea level rise, Sea surge) | Disruption to distribution system at house hold level, short-circuits | Relocate coastal substations or critical equipment to elevated locations; reinforce coastal transmission lines; develop rapid shutdown and isolation procedures, Disconnect the supply lines, |
| Tsunami | Disruption to distribution system at house hold level, short-circuits | Relocate coastal substations or critical equipment to elevated locations; reinforce coastal transmission lines; develop rapid shutdown and isolation procedures, Disconnect the supply lines, |

### 4.2.4 Institutional Roles and Responsibilities for the Preparedness of Electricity Sector

Effective emergency preparedness in Sri Lanka's electricity sector relies on clearly defined institutional roles and responsibilities to manage hazards such as floods, droughts, landslides, cyclones, high winds, coastal erosion, tsunami, and lightning. Table 4.2.

**Table 4-2 Institutional responsibility to manage hazards**

| Institution | Key Responsibility |
|---|---|
| Ministry of Power and Energy | Policy direction, resource mobilisation, liaison with Cabinet and DMC |
| CEB | Overall coordination, incident command, activation of response tiers |
| Transmission Division | System restoration, protection coordination, damage assessment |
| Generation Division | Safe shutdown/start-up, maintaining generation balance, fuel management |
| Distribution Divisions (CEB / LECO) | Field-level restoration, public safety, communication |
| PUCSL | Regulatory coordination, safety oversight, monitoring service continuity |

| | |
|---|---|
| DMC | National coordination, resource mobilisation, situational reporting |
| Local Authorities / Police / Armed Forces | Access control, logistics, safety assistance |
| Media / Communication Units | Dissemination of official updates and safety messages |

### 4.2.5 Command and Coordination Structure

A robust command and coordination system is essential for effective emergency preparedness, response, and recovery in Sri Lanka's electricity sector, ensuring that all stakeholders act in a timely, organized, and coordinated manner during disasters. The proposed system operates within the national Incident Command System (ICS) framework under the guidance of the Disaster Management Centre, to integrate sectoral actions with national disaster response.

At the top of the hierarchy, the Minister of Power and Energy provide overall policy direction and approves strategic decisions during emergencies. The Emergency Operations Centre, located at the CEB and LECO headquarters, functions as the primary coordination hub, with an Incident Commander responsible for sector-level decision-making and operational oversight. Supporting the Incident Commander are designated Chiefs of Operations, Planning, Logistics, Safety, and Public Information, each responsible for specific functional areas.

Regional office and District Disaster Management Coordinating Units of DMC ensure decentralized command, rapid situational awareness, and field-level operational control, enabling prompt deployment of crews, equipment, and resources in collaboration with district and divisional administrational set up.

The system incorporates formalized communication channels among CEB, LECO, independent power producers, PUCSL, DMC, local authorities, and first responders such as Police, Fire Services, and Tri-Forces, ensuring that emergency alerts, status reports, and restoration priorities are efficiently shared.

Pre-established mutual aid agreements, clear escalation protocols, and structured decision-making processes allow for rapid response, effective allocation of resources, and prioritization of critical infrastructure restoration. This command and coordination framework ensures that electricity sector operations are resilient, responsive, and capable of sustaining service continuity while protecting personnel and infrastructure during floods, droughts, landslides, cyclones, high winds, tsunamis, coastal hazards and lightning events. Regional Manager, General Manager and Chairman CEB with Secretary of the Energy Ministry are authorized to activate response at local, provincial and national levels respectively. Refer Table 4.3.

**Table 4-3 Disaster Activation Levels**

| Level | Description | Activation Authority |
|---|---|---|
| **Level 1 – Routine Alert** | Localised incidents manageable within division | Regional Manager |
| **Level 2 – Sector Emergency** | Major outage in one province, inter-regional assistance required | General Manager (CEB) |
| **Level 3 – National Emergency** | Widespread multi-provincial impact or national grid threat | Chairman CEB/ Secretary, Ministry of Power & Energy |

### 4.2.6 Emergency Communication and Public Information

CEB and LECO shall maintain reliable emergency communication arrangements for disaster response.

The communication system shall cover communication between head office and regional offices; communication with grid substations and power stations; communication with field crews; communication with DMC, Meteorological Department, Irrigation Department, NBRO, district secretariats, police, armed forces and local authorities; communication with hospitals, water supply agencies, telecom operators and other critical customers; and public communication on unsafe electrical conditions and restoration progress.

Backup arrangements shall include radio communication, satellite phones for high-risk regions, emergency contact directories, alternative contact points, and pre-approved public warning messages.

Public safety messages shall include warnings on fallen conductors, flooded electrical installations, submerged service wires, private generator back feed, damaged poles and unsafe reconnection attempts.

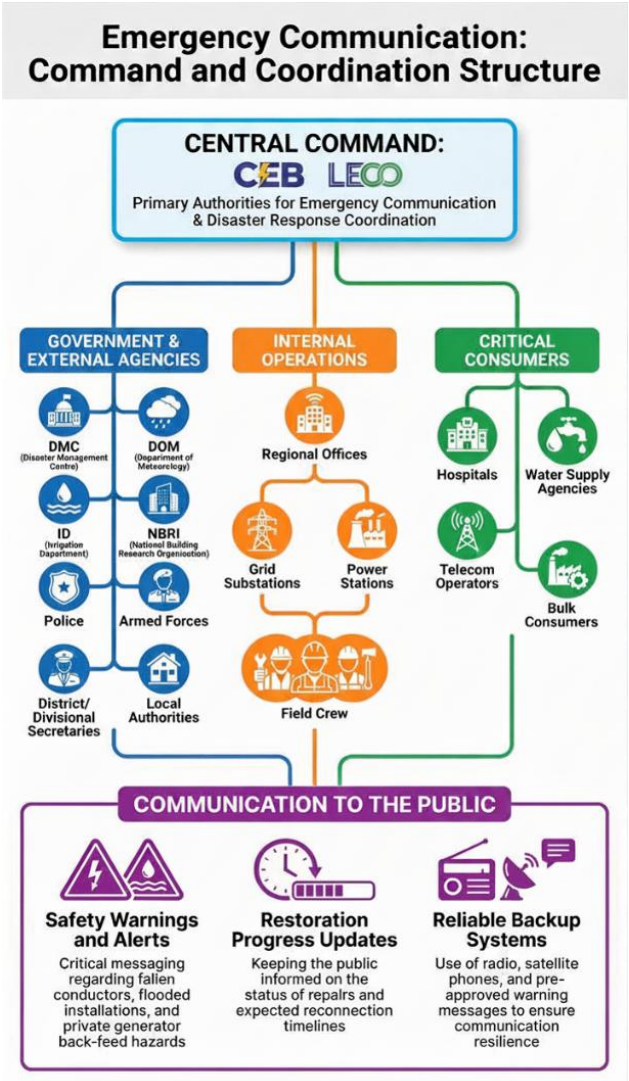



**Figure 4-1 Simplified Diagram of Command and Coordination Structure**

### 4.2.7 Preparedness measures

#### *4.2.7.1 Early warning integration*

Establish direct link with DMC's Early Warning System and the technical agencies responsible to generate early warning are as follows;

**Table 4-4 Technical agencies responsible for formulating and providing EW messages**

| Type of Hazard | Technical Agency |
|---|---|
| Flood | Department of Irrigation, Sri Lanka Land Development Cooperation |
| Drought | Meteorological Department. Sri Lanka Mahaweli Authority |
| Cyclone/ high wind | Meteorological Department |
| Landslide | National Building Research Organization |
| Coastal hazards<br>Coastal Erosion<br>Sea surges<br>Sea Level rise | Coast Conservation and Coastal Development Department<br>Meteorological Department<br>Disaster Management Centre<br>National Aquatic Research Agency |
| Tsunami | Meteorological Department, Geological Surveys and Mines Bureau |
| Lightning | Meteorological Department |

Consequently, the establishment of robust early warning dissemination mechanisms within the CEB and LECO is a critical component of emergency preparedness, enabling timely and coordinated actions to protect personnel, infrastructure, and customers during disasters such as floods, droughts, landslides, cyclones/high winds, tsunamis, and lightning events.

Within the institutions, dedicated Early Warning Units are responsible for continuously monitoring alerts from the Disaster Management Centre (DMC), the Meteorological Department, and other relevant national authorities as explain in above Table 4.4. These units ensure rapid internal communication of hazard information through multiple channels, including email alerts, SMS notifications, mobile apps, internal intranet systems, and emergency broadcast lines, enabling management, operational teams, and field crews to activate predefined response protocols immediately.

For external stakeholders, the mechanism is designed to disseminate timely warnings to critical customers, industrial users, hospitals, bulk water users, and the general public via SMS alerts, official websites, social media platforms, automated voice messages, and media announcements, providing guidance on protective actions, anticipated power interruptions, and restoration timelines. The system incorporates tiered messaging, ensuring that information is tailored to the type and severity of the hazard, and prioritizes messages for high-risk areas and critical infrastructure.

Regular tests, drills, and system audits are conducted to ensure the reliability, redundancy, and effectiveness of the early warning dissemination network, while coordination with local authorities and emergency services ensures that messages are reinforced at the community level. By integrating both internal and customer-focused communication, these mechanisms enhance situational awareness, enable proactive operational adjustments, minimize damages, and strengthen overall sector resilience.

For effective risk communication in the electricity sector, it is essential that separate communication modes and up-to-date contact details are prepared and readily available for use during emergencies. This approach ensures that messages can reach the appropriate personnel and stakeholders rapidly, without bottlenecks or delays, regardless of the nature or scale of the hazard. Within the institution, dedicated channels—such as email alerts, SMS notifications, internal phone trees, mobile apps, intranet platforms, and emergency radio networks—should be established to communicate with management, operational teams, field crews, and support staff. Each channel must have verified and current contact details, including phone numbers, email addresses, and alternate contacts for all staff members, ensuring that critical instructions, hazard warnings, or operational directives reach personnel even if primary communication modes fail. Similarly, separate channels should be designated for external communication, targeting critical customers, industrial users, hospitals, municipal authorities, and the general public, using SMS alerts, automated voice messages, social media updates, websites, and traditional media outlets. Maintaining these distinct communication modes allows for simultaneous and targeted messaging, reducing confusion, prioritizing messages for vulnerable or high-risk groups, and enabling timely dissemination of protective measures, service interruptions, and restoration updates. Regular verification, testing, and updating of contact lists and communication channels are essential to ensure reliability and resilience, particularly during crises when rapid, accurate, and continuous information flow is critical for safeguarding lives, protecting infrastructure, and maintaining public trust.

Personal protection during Emergency response is need to be focused on the safe response to an emergency and covers Evacuation Procedures, Assembly Areas/Staff Accountability, Shelter Locations, and First Aid Equipment. Collect information using Table 4.5.

**Table 4-5 Safe response to an emergency**

| | **Activity** | **Responsibility** |
|---|---|---|
| 1. | Evacuation procedure | Head of the local Department / Sub-Department / Office / Safety officer or Delegated officer |
| 2. | Assembly areas | Pre-determined assembly area as per the type of disaster |
| 3. | Responsibility of personal safety | Head of the local Department / Sub-Department / Office / Safety officer or Delegated officer |
| 4. | Safety Shelter location | Pre-determined assembly area as per the type of disaster |
| 5. | First Aid equipment | Head of the local Department / Sub-Department / Office / Safety officer or Delegated officer |

Head of the local Department / Sub-department or Office / Safety Officer (e.g. CE of Area Engineer's office, ES of Consumer Service Center, ES of field work site, CE of Power Station, ES of Grid Substation, DGM of System Control center etc. in CEB and Branch Manager, OIC of Distribution Control Centre etc. in LECO) shall assign himself or delegate officer for the responsibility of each activity. For each type of disaster, assembly areas and safety shelter locations shall be pre-determined and all employees shall be informed of these locations.

### **4.2.8** Resource Readiness for Preparedness

CEB and LECO shall maintain pre-planned emergency stores and logistics arrangements for disaster response. This shall include:

#### *4.2.8.1 Critical Spares, Labour and Equipment Management*

A. Maintain a detailed and regularly updated **database of critical spares**, including transformers, switchgear, protective devices(fuses) , insulators, and conductors. emergency stock of poles, RMUs, cables, joints, meters and service wires;

b) Stockpile **mobile generators, portable transformers, fuel reserves, and repair kits** for rapid deployment during emergencies.

c) R**egional emergency stores in high-risk districts** strategically established across provinces to have pre-arranged cranes, transport, boats, excavator and vegetation-clearing support, emergency fuel arrangements and contractor mobilization lists to reduce response times in disaster-affected areas.;

d) Conduct **pre-disaster stock verification before** south west, north east monsoon period and cyclone prone periods or at least every six months to ensure readiness and functionality of all equipment. Emergency stock levels shall be reviewed before the southwest monsoon, northeast monsoon and cyclone-prone periods.

e) Inter-regional crew support arrangements; CEB-LECO mutual support arrangements where applicable;

f) Establish coordination with police, armed forces, RDA, district secretariat and local authorities for access and safety.

**Table 4-6 Infrastructure Protection and Hazard-Specific Preparedness**

| **Hazard** | **Preparedness measures** |
|---|---|
| **Floods** | Elevate substations, waterproof control panels, reinforce foundations, and install drainage systems around critical infrastructure. |
| **Droughts** | Diversify energy mix with non-hydro generation options, monitor reservoir levels, implement transformer cooling strategies, and maintain emergency fuel supplies |
| **Tsunami** | Relocate coastal substations or critical equipment to elevated locations; reinforce coastal transmission lines; develop rapid shutdown and isolation procedures. |
| **Cyclone / High Winds** | Strengthen transmission towers and poles to wind-load standards, trim trees near power lines, and secure roofs and facility enclosures. Ensure sufficient stocks of Coal for thermal Plant at Norichchole to cover cyclone period. |
| **Coastal hazards** | develop rapid shutdown and isolation procedures. |
| **Lightning** | Install lightning arrestors, improved equipment BIL ratings at specification stages, improve grounding systems, and implement surge protection measures for critical control and communication equipment |

#### *4.2.8.2 Workforce and Operational Readiness for Preparedness*

i. Maintain **emergency staff rosters**, including on-call personnel and clear protocols for recall during disasters.

ii. Train crews for hazard-specific interventions, including **substation safety during floods, line restoration after wind damage, and hydro unit adjustments during droughts**.

iii. Conduct **regular drills and simulations** at regional and national levels to test deployment of personnel, equipment, and emergency response procedures.

#### *4.2.8.3* *Communication and Coordination for Preparedness*

i. Establish robust **internal communication networks** (SMS, Radio communication, mobile apps, intranet) for rapid alerts to operational teams.

ii. Maintain **external communication channels** (SMS, websites, social media, media announcements) to inform critical customers and the public of outages, restoration timelines, and safety measures.

iii. Ensure **contact lists for internal and external stakeholders** are updated and accessible for immediate use during emergencies.

#### *4.2.8.4* *Management Facilitation, Resource Mobilization and Mutual Aid for Preparedness*

i. Develop **mutual aid agreements** with neighboring regions, private sector operators / contractors, and contractors for emergency equipment and personnel sharing.

ii. Pre-position **logistics supports** such as vehicles, boats (for flood areas), and fuel tankers to ensure rapid response.

iii. Maintain **emergency financial provisions** for procurement and rapid mobilization of resources.

iv. Develop Administrative procedures and Authority levels for temporary recruitments, enhance procurement limits, Enhance administrative/disciplinary authorities etc.

v. Develop standardized procedures for damage / loss estimation, repair/replacement costs etc.

#### *4.2.8.5* *Monitoring and Early Action for Preparedness*

i. Integrate **early warning systems** for floods, cyclones, high winds, lightning, and drought alerts into operational planning.

ii. Adjust grid operations proactively, including **load redistribution, sectionalization, and controlled shutdowns** to protect infrastructure.

iii. Conduct **periodic audits** to ensure that emergency equipment is functional and ready for deployment.

#### *4.2.8.6* *Documentation and Post-Disaster Review for Preparedness*

i. Document **all actions, expenditures, and resource deployment** during disasters to support post-event analysis and insurance claims.

ii. Conduct **after-action reviews** to identify gaps in resource readiness and update emergency preparedness plans accordingly.

### 4.2.9 Emergency Preparedness

**Training and Awareness in the Electricity Sector**

Emergency preparedness in the electricity sector critically depends on systematic training and awareness programs for internal staff and external stakeholders to ensure continuity of electricity services during disasters.

#### *4.2.9.1 Internal Staff Training*

- Conduct annual national-level simulation exercises combining tabletop discussions with field operations, coordinated with the DMC.
- Exercises help personnel practise incident response, decision-making, and coordination under realistic disaster scenarios.
- Conduct quarterly regional restoration drills to familiarise field teams with:
    - Hazard-specific interventions
    - Resource mobilisation
    - Rapid repair procedures
- Ensure operational readiness for hazards such as floods, droughts, cyclones, high winds, lightning, landslides, and tsunamis**.**

#### *4.2.9.2 Community and Stakeholder Engagement*

- **Conduct awareness sessions for:**
    - Local government officials
    - Hospitals and Humanitarian services
    - Industries and other critical service providers
- **Provide information on:**
    - Power restoration priorities
    - Safety protocols
    - Coordination procedures
- **Maintain a public hotline and complaint mechanism for:**
    - Timely reporting of outages
    - Communication with customers
    - Guidance during emergencies

### 4.2.10 Preparedness Measures for Continuous Service in Disasters

To ensure continuous electricity service during disasters, the CEB (and LECO) must operationalize preparedness measures focused on alternative power sources. This includes maintaining mobile generators and portable transformers that can be rapidly deployed to provide electricity to critical customers such as hospitals, water treatment facilities, communication centers, and emergency shelters. Additionally, these resources should be pre-positioned strategically across regions that are most vulnerable to hazards such as floods, cyclones, droughts, high winds, lightning, landslides, and tsunamis, allowing for immediate activation when normal infrastructure is disrupted. Regular checks and maintenance of these alternative power assets are essential to ensure they remain operational during emergencies, and staff must be trained in their rapid deployment and integration with existing grid systems. By implementing these measures, CEB and LECO can maintain service continuity, protect critical infrastructure, and support emergency response operations effectively, even under extreme disaster conditions.

For effective operationalization, it is essential to systematically collect, validate, and maintain the relevant data and information to ensure availability for planning, decision-making, and response actions.

**(a) For Power Generation Division and National Dispatch Centre**

**Table 4-7 Water Intakes of Hydro power plants**

| Name of the water Source/ reservoir | Depth/ location | Available Yield | Remarks |
|---|---|---|---|
| | | | |

**Table 4-8 Penstock**

| Name of power plant | Location of penstock | Type Pipe or canal | Length |
|---|---|---|---|
| | | | |
| | | | |

**Table 4-9 Hydro power generators**

| Name of power plant | Location | Generating Capacity MW | Maximum and Average generation per year MW max / MWavg |
|---|---|---|---|
| | | | |
| | | | |

**Table 4-10 Thermal power plant**

| Name of power plant / Type of Fuel | Location | Generating Capacity MW | Maximum and Average annual generation MW max / MWavg |
|---|---|---|---|
| | | | |
| | | | |

**Table 4-11 Coal Power plant**

| Name of power plant | Location | Type of fuel used | Generation Capacity MW | Maximum and Average annual generation MW max / MWavg |
|---|---|---|---|---|
| | | | | |
| | | | | |

**(b) For Transmission Division**

**Table 4-12 Grid sub-Station**

| Name of the GSS | Location | No of Transformers with capacity | Any other critical equipment |
|---|---|---|---|
| | | | |
| | | | |

**Table 4-13 Transmission lines - High voltage**

| Name of the Line, kV From-To | Length of the line | Number of Towers | Comments (eg. locations of critical towers) |
|---|---|---|---|
| | | | |
| | | | |

**(c) For Distribution Divisions**

This information shall be collected and kept with Divisional HQ, Provincial and Area / Branch offices.

**Table 4-14 Distribution lines medium voltage**

| Prov./Area/CSC | Name of the Line (From-To), Voltage | Length of the line | No of poles | Important Customers (Dist. Transf.) connected - SIN | Comments |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

**Table 4-15 Distribution SS and LV lines**

| Prov/Area /CSC | SIN /Name of Dist. SS | Name of the LV Feeder | Length of the line | Number of poles | Important Customers connected | Total no. of Customers | Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |

**Table 4-16 Important (critical) Electricity Supply Connections / Customers**

| Name / Type of consumer | Type of connection Single /Three Phase and Contract Demand | Location (MV Feeder, SIN/Dist. SS, LV Feeder, Location) | Comments |
|---|---|---|---|
| | | | |
| | | | |

### *4.2.10.1 Purchase of Electricity*

In the event of drought or any other calamity where demand exceeds the CEB capacity, CEB will have to purchase extra required amount from private vendors maintain uninterrupted supply.

This information shall be collected by the Distribution Divisions and copy shall be forwarded to Utility (CEB/LECO) Disaster Management Centre as and when required.

**Table 4-17 Purchase of electricity in the event of drought or any other disaster**

| Provider's Name and Contact Info | Location(s) | Amount to be purchased daily MW | Cost Rs | Remarks |
|---|---|---|---|---|
| | | | | |
| | | | | |

### *4.2.10.2 Preparedness for Electricity System Contingencies & Priorities*

**Electricity Usage**

To ensure the efficient and reliable operation of the electrical supply during emergencies, this section focuses on optimizing resource allocation and defining electricity utilization priorities within the service area. The accompanying chart delineates the hierarchy of electricity uses, assesses the required supply for each category, and specifies the methodology for maintaining service levels classified as high, medium, or low priority."

**Table 4-18 Evaluation of Electricity Needed**

| | System Capacity | | | | | |
|---|---|---|---|---|---|---|
| | **2021** | | **2022** | | **2023** | |
| **Demand MWh, MW** | MWh Per day | % Purchased from private vendors | MWh Per day | % Purchased from private vendors | MWh Per day | % Purchased from private vendors |
| Average Daily | | | | | | |
| Maximum Daily | | | | | | |
| Minimum Daily | | | | | | |

**Prioritization**

This information shall be collected by the Distribution Divisions and copy shall be forwarded to Utility (CEB/LECO) Disaster Management Centre as and when required.

**Table 4-19 Prioritization**

| Use Category | Priority (High, Medium, Low) | Daily Electricity Demand MW and (MWh) | Method of Sustaining Use / Emergency Contingencies Beyond Standard Response |
|---|---|---|---|
| Sensitive Populations- Hospitals, Pumping units of sewerage system, | | | |
| Large scale Industrial/Commercial users | | | |
| Airports, Tourist industry | | | |

### 4.2.11 Resource Inventory

#### *4.2.11.1 Physical Plant Resources*

The purpose of this section is to provide a concise overview of the inventory of available resources, including power generators with private venders, equipment, and supplies, that are accessible off-site. Additionally, this section furnishes contact information for purveyors who offer emergency services, parts and equipment

#### *4.2.11.2 Auxiliary Power Sources*

The auxiliary power capabilities provide adequate auxiliary power to provide uninterrupted power supply in the event of an emergency. Information could be recorded in following tables.

**Table 4-20 Fixed Auxiliary Power Sources**

| **Prov/Area or Branch /CSC and Location address,** | **Power Sources: (***facility and/or equipment***)** | **Details** *(Type/Capacity/Fuel & Rate of Consumption)* | **Specific Instructions** *(Location of manual/exercise schedule/etc.)* | **Address of location, contact person, tel. no etc.** | **Inventoried** |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

**Table 4-21 Portable Auxiliary Power Sources**

| **Prov/Area or Branch /CSC and Location address** | **Capable of Power source: (***facility and/or equipment***)** | **Details** *(Type/Capacity/Fuel & Rate of Consumption)* | **Specific Instructions** *(Location of manual/exercise schedule/etc.)* | **Address of location, contact person, tel. no etc.** | **Inventoried** |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Auxiliary power sources should be inventoried to determine voltage, phase configuration, horsepower/amperage and other requirements.

**Table 4-22 Auxiliary Fuel Storage**

| **Type** | **Tank Capacity** | **Location** |
|---|---|---|
| | | |

**Table 4-23 Pumping Equipment /Spare Pump Parts**

| **Type/Manufacturer** | **Service Capabilities** | **Location** |
|---|---|---|
| | | |
| | | |

**Table 4-24 Distribution Components**

| Part | Location |
|---|---|
| | |
| | |

**Table 4-25 Spare Parts**

As applicable

| Part | Location |
|---|---|
| | |
| | |

**Table 4-26 Contact Information for Equipment Repair, Supplies & Services**

| Supply/Service category * | Name/Contact/ Contract | Phone (day) | Phone (24/7) |
|---|---|---|---|
| Electrician | | | |
| Generator operators | | | |
| Excavator/Backhoe Operator | | | |
| Equipment Rental or Cooperative (e.g., heavy equipment) | | | |
| Equipment Repair | | | |
| Transformer supplies | | | |
| Supplies of electric cables | | | |
| Suppliers of Concrete poles | | | |
| Subcontractor for clearing obstructions of distribution lines (branches, trees) | | | |
| Primary Fuel Supplier (s | | | |
| Alternate Fuel Supply | | | |

***** *Note: Above are examples. Each Division / Prov/Area or Branch / CSC shall prepare a list of the documents related to them***.**

### 4.2.12 Documentation/Guidance

Documents that establish the daily operational protocols, such as routine operation and management procedures and operational monitoring requirements, are listed in this section. In the event of an emergency, the individual who has been designated should be capable of executing the requisite procedures to guarantee the continuity of operations. Information on Manuals, report and plans, user advisories and Public Notices and distribution methods could be recorded in following tables:

**Table 4-27 Operational manuals and reports**

| Item * | Location |
|---|---|
| Generator start up manuals | |
| Daily Operator Reports | |
| Technical Manuals | |
| Business Continuity Plan (Essential Functions/Resources) | |
| Lockout-Tag out Manual | |
| Other | |

***** *Note: Above are examples. Each Division / Prov/Area or Branch / CSC shall prepare a list of the documents related to them.*

**Electricity Use Advisories/Public Notices**

**Table 4-28 Templates for electricity Use Advisories**

*(Include here or reference where they may be found)*

| Detail of advisories | Location |
|---|---|
| | |
| | |

**Table 4-29 Distribution Methods: (Protocols for Email, newspaper, door to door, etc.)**

| Detail of material for distribution | Method of distribution |
|---|---|
| | |
| | |

## 4.3 Emergency Response

### 4.3.1 Major Steps for Emergency Response

The objectives of emergency response and management are to:

- Evaluate the emergency situation,
- Take necessary steps to protect public from electric shocks while the emergency is being evaluated
- Confirm the emergency,
- Remediate the electricity supply system, if necessary,
- Return the system to safe, normal operation as soon as possible.

The response to a disaster/emergency must be promptly managed in order to achieve these objectives. A variety of steps, actions, and decision factors are involved in disaster/emergency response and management. The most critical information in this chapter is the comprehension of these critical components and the process of moving from one decision point to the next in order to accomplish these goals. The following is a concise summary of the primary components of disaster/emergency response:

**Step 1:** Determine whether a catastrophe or emergency is "possible," implement the necessary preliminary response measures to safeguard the infrastructure of electricity supply schemes.

**Step 2:** Establish contact with technical agencies issuing Early Warning messages. GM to name a senior level officer to coordinate with these agencies.

**Table 4-30 Responsibility Matrix**

| Hazard | Decision making on Possible disaster/emergency | Responsibility |
|---|---|---|
| Flood | Collect information disseminated from Meteorological Department/Irrigation Department/ Sri Lanka Land Development Corporation, Disaster Management Centre (DMC), Mahaweli Authority Sri Lanka (dg@mahaweligov.lk), Department of Agrarian Development (info@agrariandept.gov.lk), Etc.,<br>Monitor localized rainfall and wind visually and provide information to GM<br><br>Analyze all data/information collected on weather forecasting and review past experience of the electricity supply infrastructure (Sources, generation, penstock, grid substation, Transmission/Distribution System etc.) assess the level risk<br><br>Inform GM the developing situation<br><br>Risk information to be disseminated to Addl. GM Generation, Addl. GM distribution. | Person in charge of EW function at Head Office under GM<br><br>Area / Branch Engineer of distribution system<br>Person in charge of EW function at Head Office under GM.<br><br>---Do -<br><br>GM |
| Drought | Drought is a slow onset hazard and information on rainfall at local level, water levels of rivers, reservoirs where water used for hydropower generation intakes, to be collected from local office of ID, Mahaweli Authority, DAD and disseminated to GM<br><br>Collect information on seasonal weather forecasting and water management from relevant agencies, (Information disseminated from Meteorological Department/Irrigation Department/ Sri Lanka Mahaweli Authority, Disaster Management Centre, Department of Agrarian Development (DAD), National Resource Management Centre (NRMC) info@agrariandept.gov.lk), http//www.doa.gov.lk/nrmc/en/, review past experience of the electricity supply at highly affected areas and determine the risk level.<br><br>Disseminate formation to officers at provincial, regional and local level.<br><br>Maintain communication continuously with ID, MASL, DAD and | Engineer in charge of local level distribution and generation units<br><br>Person in charge of EW function at Head Office under GM.<br><br>Do –<br><br>Do - |
| Landslide | Regularly visit locations where critical structures located within landslide high risk zones and report any changes | Engineer in charge of local level |

| | | |
|---|---|---|
| | Study the information available on weather forecasting and landslide field indicators, review past experience of the landslide prone areas with respective to the critical infrastructure and information from engineer at local level. Assess the risk and inform Addl. GM Generation and Distribution. Collect information disseminated from Meteorological Department/National Building Research Organization, Disaster Management Centre Etc., also. | distribution system and generation units<br><br>Person in charge of EW function at Head Office under GM. |
| Cyclone/ high winds<br><br><br><br><br>Tsunami | Collect EW messages issue by Meteorological department on developing cyclone and wind situation.<br><br>Analyze the satiation and disseminate the EW messages to Addl.GM Generation and Distribution.<br><br>Collect EW messages issued by Meteorological department and other international agencies monitoring development of tsunami hazard<br><br>Disseminate EW messages to Head of Operation and Engineering | Person in charge of EW function at head office under GM<br><br>GM<br><br>Person in charge of EW function at head office under GM<br><br>GM |

**Step 3:**

Determine the credibility of a "possible" disaster/emergency by consulting with DMC, other hazard-specific technical agencies, the Department of Health, etc., and other relevant agencies. If it is "credible," notify the relevant agencies and the public, implement the appropriate response measures to safeguard people and electricity supply schemes and infrastructure, and then proceed to

**Table 4-31 Initial Assessment for Credible Disaster/Emergency**

| Hazard | Decision making credible disaster/emergency | Responsibility * |
|---|---|---|
| Flood | Consult Meteorological Department/Irrigation Department/ Sri Lanka Land Development cooperation, Disaster Management Centre (DMC) Ministry of Health Etc. | GM CEB*<br>GM LECO |
| Drought | Study the seasonal weather forecast issued by Meteorological Department, International Water Management Institute and the rainfall in catchment areas to determine the impact on electricity generation.<br>Continuously monitor water levels at the intake (River, reservoir, etc.) and report to provincial and national level authorities. | Person in charge of EW function at GM office CEB<br><br>Engineer in charge of the generation unit. |
| Landslide | Consult Meteorological Department/National Building Research Organization, Disaster Management Centre Etc. | GM CEB |
| Cyclone/High winds<br>Tsunami | Consult Meteorological Department and Disaster Management Centre Etc., | GM CEB<br>GM LECO<br>GM CEB<br>GM LECO |

| | | |
|---|---|---|
| | Consult Meteorological Department and Disaster Management Centre Etc., Collect EW messages issued by international agencies | |

* *GM may delegate his functions to a senior office at GM's office.*

**Step 4:** Confirm a "credible" threat, which results in a "confirmed hazard incident." Activate the response plan and other response actions to safeguard public and electricity supply schemes, and then proceed to

**Table 4-32 Confirmation of Hazards Events and Incidents**

| Hazard | Decision making credible disaster/emergency | Responsibility * |
|---|---|---|
| Flood | Evaluate all information received, identify infrastructure exposed to floods and local level distribution system that could be affected by flood.<br>Disseminate information to Addl. GMs Generation and Distributions provincial to activate the response plan<br>Disseminate information to Regional Engineer to activate the response plan | GM CEB<br>GM LECO<br>GM CEB<br>GM LECO |
| Drought | The drought is a slow onset hazard and develop over a long period of time. Continuously evaluate information collected and determine to what extent generation of electricity would be affected. The risk assessment report provides information on highly and moderately exposed infrastructure.<br>Disseminate information to Addl. GMs Generation and Distribution | GM<br>GM CEB |
| Landslide | NBRO issue LS early warning in three stages; alert, warning and evacuation. Officers in charge of Critical infrastructure in the electricity supply system such as water intakes, generating units, grid substations, Transmission towers, local distribution systems identified in the study as highly and moderately exposed to be more vigilant. In the event LS threat is imminent implement the LS Response plan. | Engineers in charge of Generations and distribution |
| Cyclones/high winds<br><br>Tsunami | Be alert to the Early warning messages issued by the Met Dept., on the formation cyclonic condition in the Bay of Bengal in the east or in Arabian sea in the west well in advance.<br>Officers in charge of Critical infrastructure in the electricity supply system such as water intakes, generating units, grid substations, Transmission lines and towers, local distribution systems identified on the path of cyclone high wind areas to be more vigilant. If the cyclonic threat or high wind situation is imminent, implement response plan.<br>Met dept., issue early on the formation of tsunami conditions. Collect information from global level institutions monitoring earthquakes and predicting tsunami hazard<br>If the tsunami threat is imminent, inform regional engineers to implement emergency response plan. | GM CEB<br>GM LECO<br>Engineers in charge of generation and distribution.<br>Engineer in the region in charge of distribution LECO<br>GM/LECO<br>GM/LECO |

* *GM may delegate his functions to a senior office at GM's office*

**Step 5:** Invokes the remediation of the electricity system.

**Step 6:** invokes the restoration of the electricity supply system to its normal, secure operation (recovery).

In order to ensure the safety of customers and staff operating the electrify supply and distribution system, it is essential to take precautionary measures before connecting the supply to the distribution system act to achieve the tasks listed in the Table 4.33 which will cover all aspects of ERP which will pave the way to prepare the ERP for national and regional level layers of CEB and LECO.

**Table 4-33 Responsibility to Take Decision and Activities for ERP**

| No. | Tasks to be fulfilled for effective and efficient emergency response in electricity sector | Officer responsible | |
|---|---|---|---|
| | | CEB | LECO |
| 1 | Decide on the level of response and who will be in charge of response operations | | |
| 2 | Decide on the level of personal protection required by responders in order to ensure their safety? | | |
| 3 | Provide information on emergency/disaster support and advocacy. | | |
| 4 | Identify officers who make disaster/emergency response decisions. | | |
| 5 | Conducting disaster Damage and Loss assessment<br>i. Decide on the framework of assessment (Rapid assessment or Detail assessment or Recovery& Reconstruction assessment) and the time frame for conducting the assessment<br>ii. Appointment of teams for conducting damage and loss assessment at national and regional level<br>iii. Training of assessment team on the methodology for conducting assessment | | |
| 6 | i. Who will manage remediation and recovery activities?<br>ii. Decide on the level of repair/recovery activities | | |

### 4.3.2 Standard Operation Procedure (SOP) for specific Hazard

#### *4.3.2.1 Flood Response*

**Before the Flood**

**Keep flood Water Out**

| Item | Activity | Officer responsible |
|---|---|---|
| 1. | Sand bag, if possible, around structures and at building entrances located in the flood prone areas. | Engineers in charge |

**Surface Water Intake and generators preparations**

| Item | Activity | Responsibility |
|---|---|---|
| 2. | During a flood event, debris often increases within associated surface water bodies. Surface water intakes are at risk of becoming damaged or blocked. Ensure water storage tanks are filled to capacity and make provisions for temporary intakes in case the intake requires flushing or is completely blocked. | Engineers in charge of Generation |
| 3. | Impact of flood water on penstock is minimal. However, if the penstock or open channel taking water to generating units are within the flood inundation areas, prevent floating debris damaging penstock pipes or blocking channel.<br>In designing thermal power plant maximum flood water level has been considered. Therefore, impact of flood water could be minimal. However, due to unusual devastating floods caused by climate change could affect the generating units. Erecting temporary barriers using sand bags could prevent flood water inundating generators and other equipment. | Engineers in charge of Generation<br><br>Engineers in charge of Generation |

**Grid Substations Response**

| Item | Activity | |
|---|---|---|
| 4. | In designing grid sub stations max flood water level in the area is considered. However, due to impacts of climate change there could be a significant increase in the intensity of rainfall which could create flood and inundate sub stations. Consider protecting the area over the water line using sand bags. | Engineers in charge of distribution |
| 5. | If access roads are inundated, make arrangements to move staff using boats. | Engineers in charge of distribution |

**Secure Electrical Assets**

| Item | Activity | |
|---|---|---|
| 6. | Remove portable generators and motors not in use to a safe location and make preparations for quick removal of those in service. It is recommended that generators and motors be | Regional Engineers generation CEB |

| | | |
|---|---|---|
| | equipped to accommodate quick removal with disconnect fittings rather than conventional pigtails. | |
| 7. | If flood waters are anticipated to inundate areas where electronic controls are housed, shutdown system components, programmable controllers, computers, and other field instruments. Shutdown any backup uninterruptible power supply (UPS) systems also because the UPS could maintain sufficient current to the equipment to destroy the instrumentation package when inundated by the flood waters. If household level distribution system affected shutdown the supply to prevent electrocution. | Regional engineers CEB and LECO |

**Secure Other Assets**

| Item | Activity | Officer responsible |
|---|---|---|
| 8. | Move mobile equipment to higher ground, identified in advance as a preparedness measure, to prevent damaged by flood waters or debris. | Regional Engineers CEB /LECO |

**Customer Notification**

| Item | Activity | Officer responsible |
|---|---|---|
| 9. | In order to ensure the electricity supply system is prepared to issue the notice as soon as possible, a precautionary preparedness need to be taken including public awareness prior to the flood event occur. However, it is essential to issue customer notification on the status of the electricity supply together with precautionary measures to ensure the safety of the consumers. | GM CEB LECO |
| 10. | Contact officers from National Relief Services Center at divisional level to identify location of safe centers established and electricity supply required. | Regional engineers CEB/LECO |

**During and After the Flood**

| Item | Activity | Officer responsible |
|---|---|---|
| 11. | Once the flooding has subsided, responsible officers of the distribution system need to inspect area and ensure that the supply system of household, industrial and commercial is not affected by floods before providing connection<br>If affected inform customers to attend to required repairs before | Engineers responsible CEB/LECO<br><br>Engineers responsible CEB/LECO giving connection. |
| 12. | If intake was inundated ensure that the generators were not affected by flood water before re starting generators | Regional Engineers generation |
| 13. | Take action to recover cost of electricity supply to evacuation centers during flood. | Finance Manager regional CEB/LECO |

### *4.3.2.2 Drought*

**Before Drought**

| Item | Activity | Officer responsible |
|---|---|---|
| 1. | Establish a drought monitoring cell under the Addl, GM (Generation) CEB to continuously monitor the development of drought condition impact of power generation. | GMCEB / Addl.GM (Gen) |
| 2. | Disseminate drought warning messages to Engineers in charge of power plants highly and moderately exposed to drought. | GM CEB / Addl.GM (Gen) |
| 3. | Assess power deficiency to meet the consumer needs and inform GM. | Engineer Generation |
| 4. | Estimate total deficiency and additional cost to power supply during drought.<br>Identify priority customers who need continuously supply and Summaries total requirement of the Country<br>Install a generator to provide power to priority customers in the event the drought condition prevails for longer period | GM CEB / Addl.GM (Gen)<br>GM CEB<br><br>Engineer Distribution |

**Customer Notification**

| Item | Activity | Officer responsible |
|---|---|---|
| 5. | Prepare to issue public notices about impending drought condition and precautionary preparedness needs before drought. | GM CEB |
| 6. | Develop guidelines to improve public awareness on the expected drought situation and customer responsibility to minimize power use for essential services minimize wastages (Eg shutting down air conditioning system). Use public address system to disseminate the messages to customers | GM CEB |
| 7. | It is essential to issue customer notification on the status of the electricity supply and possibility of limiting supply hours. | GMCEB<br>GM LECO |

**During and After Drought**

| Item | Activity | Officer responsible |
|---|---|---|
| 8. | Reduce the power purchase from private producers based on the improvement of water levels in reservoirs.<br>Provide electricity to priority customers using the portable generators. | FM Regional level\<br><br>Regional Engineers CEB and LECO |

### *4.3.2.3 Landslide*

**Before Landslide**

| Item | Activity | Officer responsible |
|---|---|---|
| 1. | Nominate an officer at national and regional level to receive and disseminate EW messages | GM CEB<br>GM LECO |
| 2. | Register the Name and contact numbers of the officer at National level with EOC/DMC | GM CEB<br>GM LECO |
| 3. | Check the communication system is established to receive and disseminate early warning messages and other communication from DMC/NBRO/DoM | Officers nominated by CEB and LECO |
| 4. | Record the EW messages (watch, alert and evacuation) on landslides send by DMC | Officers nominated by CEB |

| | | |
|---|---|---|
| 5. | Confirm the receipt of relevant EW messages and record the time and mode of communication | Do - |
| 6. | Verify the messages from NBRO | Do - |
| 7. | Inform GM record the time and mode of communication | Do - |
| 8. | Disseminate the EW messages to regional engineers. Record the time & mode of communication | Do- |
| 9. | If officer not contactable inform the next senior officer. | Do - |
| 10. | Confirm receipt of messages. Record the time and mode of communication. | Regional engineer |
| 11. | Verify from local NBRO office and the GN in the area latest information on LS. | Regional Engineer |

**During and After Landslide**

| **Item** | **Activity** | Officer responsible |
|---|---|---|
| 12. | Record the EW messages (watch, alert and evacuation) on landslides send by DMC | Regional Engineer CEB |
| 13. | Confirm the receipt of relevant EW messages and record the time and mode of communication | Do - |
| 14. | Verify the messages from NBRO | Do - |
| 15. | Verify from local NBRO office and the GN in the area latest information on LS. | Regional Engineer CEB |
| 16. | Continuously monitor the distribution lines of the electricity supply system exposed to landslide, restore electricity supply to consumers who are returning after ensuring safety. | Regional Engineer CEB |
| 17. | Acknowledge the all-clear messages received from DMC | GM office |
| 18. | Disseminate the message to regional office generation and distribution | -do- |
| 19. | Support the team of officers appointed to conduct the damage and loss assessment | Regional Engineer CEB |
| 20. | Release all hired vehicles and equipment when the emergency phase is over. | Regional Engineer CEB |

### *4.3.2.4 Cyclone/ high winds*

**Before Cyclone/high winds**

| Item | **Activity** | **Person responsible** |
|---|---|---|
| 1. | Inspect distribution system and identify and trees and branches that could fall on the distribution lines | Regional engineer Distribution |
| 2. | Cut and remove overhanging branches and trees that could damage to distribution system. | Regional engineer Distribution |
| 3. | Check all buildings and stores for loose roofing sheets fix those to the roof and building so that strong will not blow the roof off. | Regional engineer Distribution |
| 4. | Made arrangements to receive EW messages issue by Met Department. Keep DMC inform of process. | Regional engineer Distribution |
| 5. | Procure electrical poles and wire of required sizes to attend to and damaged distribution lines without delay.<br><br>Cancel leave of technical staff keep them inform of the developing situation and be ready to mobilize with short notice. | Regional engineer Distribution |
| 6. | Identify additional staff from other regions not affected by cyclone/high winds to call for help. | Regional engineer Distribution |

**After Cyclone/high winds**

| Item | **Activity** | **Person responsible** |
|---|---|---|
| 7. | **Personal Precautions** | |
| 8. | Immediately disconnect the supply to transmission lines and distribution system in the affected area.<br><br>Assess the damages to transmission lines, grid sub stations and distribution system and inform GM CEB and LECO<br>Repair transmission lines damaged and restore supply to distribution system | Regional engineer Distribution CEB/LECO<br>Regional engineer Distribution CEB and LECO<br>Regional engineer Distribution CEB/LECO |
| 9. | Conduct detail loss and damage assessment submit summaries data to GM CEB and LECO | Regional engineer Distribution CEB/LECO |
| 10. | Summaries the damages and losses at National Level and submit to the Ministry | GM/CEB and LECO |

### 4.3.3 Emergency Electrical Safety and Public Protection

During natural disasters, public safety and worker safety shall take precedence over restoration of supply.

CEB and LECO shall prepare emergency safety procedures covering:

- isolation of flooded areas;
- isolation of damaged MV and LV lines;
- isolation of substations and transformers exposed to floodwater;
- prevention of electrocution in flooded streets, houses, shops and public buildings;
- safe restoration after tsunami or sea surge;
- inspection of landslide-affected poles, towers, cables and foundations;
- safe removal of fallen trees from live or suspected-live lines;
- control of back-feed from standby generators and solar PV systems;
- contractor safety during emergency restoration;
- PPE and earthing requirements for emergency crews.

No submerged, mechanically damaged, contaminated or unstable equipment shall be energized until inspected and cleared by authorized technical personnel.

### 4.3.4 Emergency Recording

Keeping records of each hazard is also essential and following format is recommended for the purpose

**Emergency situation: _____**

**Recovery Time Assessment: _____**

**Action Plan:**

- **Assessment:**
- **Immediate Actions**:
- **Notifications:**
- **Follow up:**
- **Review:**

### 4.3.5 Critical Asset and Critical Customer Prioritization

CEB and LECO shall prepare and maintain a register of critical electricity assets and critical customers for disaster response and restoration planning.

Critical electricity assets shall include hydro power stations, thermal power stations, grid substations, primary substations, major transmission lines, key 33 kV and 11 kV feeders, distribution substations supplying essential services, control centres, and communication facilities required for electricity restoration.

Critical customers shall include hospitals, water supply and sewerage pumping stations, emergency operation centers, defense and police facilities, airports and ports, telecom facilities, evacuation centers, major public health facilities, and essential government offices.

Restoration priority shall be based on the following order, subject always to public safety, worker safety and system stability:

- safety of the public and utility staff;
- system stability;
- restoration of supply to critical customers;
- restoration of bulk transmission and grid substations;
- restoration of major urban and industrial loads;
- restoration of remaining distribution areas.

No restoration activity shall proceed until the affected section is confirmed safe for energization.

### 4.3.6 Critical Infrastructure Classification Framework

Critical Electricity infrastructure shall be listed down with priority assigned so that during supply restoration, they can be restored with high priority. The CEB and LECO shall list down the relevant infrastructure in detail. As an example, following infrastructure are listed;

**Table 4-34 Critical Electricity infrastructure List**

| Priority | Asset Type |
|---|---|
| Priority 1 | National Control Centre, Divisional and Provincial Control Centers |
| | Grid substations supplying critical loads such as hospitals, Health services, Water supply pumping stations and similar humanitarian services |
| Priority 2 | GSS supplying Urban feeders with critical / important PSS / bulk substations and urban LV system |
| Priority 3 | Rural MV feeders, LV System |

### 4.3.7 Damage, loss and need assessment

Assessments estimate, first, the short-term government interventions required to initiate recovery and second, the financial requirements to achieve overall post-disaster recovery, reconstruction and disaster risk management or reduction.

#### *4.3.7.1 Preliminary Damage Assessment*

Preliminary Damage Assessment important after an emergency to quickly assess the extent of the damage and the need for repair, replacement or recovery of facilities. Results of preliminary assessment will help to find out funds required to attend to urgent repairs before people are resettled at the original places of residence. Preliminary assessment Form in Table given below could be used to enter the assessment results

#### *4.3.7.2 Preliminary Damage Assessment*

Preliminary Damage Assessment important after an emergency to quickly assess the extent of the damage and the need for repair, replacement or recovery of facilities.

**Table 4-35 Preliminary assessment Form**

| **Power Generating units (Name …)** | **Yes** | **No** | **N/A** |
|---|---|---|---|
| Physical damage | | | |
| Failure of generating unit | | | |
| Damage to intakes | | | |
| Damage to penstock | | | |
| **Transmission Lines (Name, From/To kV etc.)** | | | |
| Physical damage to Line | | | |
| Tower Footings | | | |
| Tower body | | | |
| Conductors | | | |
| Insulator strings | | | |
| Other (Specify) | | | |
| **Grid Substation (Name, Voltage, Cap ..)** | | | |
| Physical damage | | | |
| Equipment operating properly | | | |
| Transformers operating properly | | | |
| Other (Specify) | | | |
| **Distribution Line MV (Name, From/To kV etc.)** | | | |

| | | | |
|---|---|---|---|
| Physical damage to Line | | | |
| Pole / Tower Footings | | | |
| Pole /Tower body | | | |
| Conductors | | | |
| Insulator strings | | | |
| Other (Specify) | | | |
| **LV Distribution Line (Dist. Transf., SIN, Feeder ID, etc.)** | | | |
| Physical damage to Line | | | |
| Pole Footings | | | |
| Pole body | | | |
| Conductors | | | |
| Insulator strings | | | |
| Other (Specify) | | | |
| **Other system damage (e.g., Portable generators, vehicles, etc.)** | | | |
| Description of Damage | | | |
| Estimated Cost to Repair Damage | | | |
| Estimated time to repair and restoration services | | | |

#### *4.3.7.3 Detail Damage, Loss and need Assessment*

The objective of the Damage and Loss Assessment (DALA) in the electricity sector is to quantify the physical damages and economic losses resulting from disaster impacts, to inform recovery planning, financial mobilization, and the prioritization of "Build Back Better" (BBB) reconstruction efforts. The assessment provides evidence-based inputs for decision-making by the Ceylon Electricity Board (CEB), Lanka Electricity Company (LECO), the Ministry of Power and Energy, the Disaster Management Centre (DMC), and the National Planning Department.

#### *4.3.7.4 Assessment Framework*

**A. Phases of Assessment**

The DALA process is implemented through three distinct phases:

1. **Rapid Assessment (0–72 hours):**
   Conducted immediately after a disaster to identify the extent of service disruption, critical infrastructure damage, and emergency restoration needs.
2. **Detailed Assessment (within 2–3 weeks):**
   Involves a systematic evaluation of physical and functional impacts on generation, transmission, and distribution infrastructure.
3. **Recovery and Reconstruction Assessment:**
   Determines long-term repair and reconstruction costs, incorporating Build Back Better (BBB) and climate-resilient design principles.

**B. Methodological Steps**

**Step 1: Establish Assessment Teams**

- Teams are led by the **CEB and LECO Disaster Management Units** in coordination with the **DMC** and **District Disaster Management Coordinating Units (DDMCUs)**.

- Each team should include engineers, GIS and remote-sensing experts' financial analysts, and field inspectors.
- Coordination with the **National Emergency Operations Centre (NEOC)** ensures information consistency and policy alignment.

**Step 2: Define Assessment Scope**

- Identify affected regions and infrastructure categories (generation plants, substations, transmission lines, transformers, MV / LV distribution lines (poles, conductors, equipment etc.) and customer service).
- Specify the hazard type (flood, drought, landslide, cyclone/high wind, tsunami, or lightning) and its geographic extent, impacts and what to focus Table 4.34
- Determine the time frame and data needs for each assessment phase.

**Step 3: Data Collection and Verification**

Data should be collected from multiple validated sources to ensure accuracy and consistency.

- **Field Surveys:** Use standardized inspection forms and mobile GIS applications (e.g., Kobo Toolbox, ArcGIS Survey123).
- **Remote Sensing and GIS Mapping:** Apply satellite imagery, LiDAR, or drone technology for spatial analysis of affected assets.
- **Operational Data:** Obtain outage logs, SCADA data, system load reports, and maintenance records from CEB and LECO.

**Table 4-36 Impacts and assessment Focus**

| Hazard | District | Typical Impacts | Assessment Focus |
|---|---|---|---|
| **Floods** | | Substation inundation, short circuits, tower base erosion, equipment damages, pole / line collapsing, equipment damages /corrosion, Service connection/equipment damages | Inspect substation waterproofing, foundation stability, and asset replacement cost |
| **Cyclones / High Winds** | | Tower collapse, broken conductors, roof loss, pole / line / equipment damage | Evaluate wind load performance, structural damage, and conductor failures |
| **Landslides** | | Tower base failure, pole displacement, access road damage | Assess geotechnical stability, slope reinforcement needs |
| **Drought** | | Reduced hydropower output, equipment overheating | Quantify generation losses, cooling equipment failures |
| **Tsunami and Coastal hazards** | | Coastal infrastructure destruction, saltwater corrosion | Estimate total replacement cost, assess corrosion mitigation requirements |
| **Lightning** | | Transformer burnouts, control panel failure | Assess grounding, arrester effectiveness, and equipment loss |

- **Stakeholder Inputs:** Include observations from Divisional / Provincial / Regional engineers and other stake holders

**Step 4: Damage Assessment (Physical Impacts)**

Quantify the direct physical damage to electricity infrastructure across the value chain.

**Key Damage Indicators:**

- Number and type of assets damaged or destroyed.
- Cost of repair or replacement per asset category.
- Estimated duration of service outage and restoration priority.

**Step 5: Loss Assessment (Economic and Functional Impacts)**

Economic losses are assessed by estimating the reduced electricity supply, additional costs, and downstream economic effects.

**Components include:**

- Revenue loss due to service interruption.
- Cost of emergency power supply (e.g., mobile generators, diesel use).
- Increased operational and maintenance expenses.
- Economic impact on industries, hospitals, water utilities, and households.

**Loss Calculation Example:**

$$Loss = (Expected\ Output - Actual\ Output) \times Average\ Tariff$$

**Step 6: Indirect and Social Impact Assessment**

Assess the broader consequences of electricity disruption:

- Impact on essential services (healthcare, education, water supply, telecommunications).
- Livelihood losses and reduced productivity.
- Social impacts such as safety risks and access to emergency services.

**Step 7: Data Consolidation and Reporting**

- Compile results into a **Damage and Loss Assessment Report** detailing asset-level damage, financial losses, and recommended recovery actions.
- Submit the report to the **DMC**, **Ministry of Power and Energy**, and **National Planning Department** for integration into the **Post-Disaster Needs Assessment (PDNA)**.
- Store assessment data in the **National Disaster Loss and Damage Database** for long-term analysis and policy use.

**Institutional Coordination**

- **Lead Agency:** Ceylon Electricity Board (CEB) / LECO
- **Supporting Agencies:** Sustainable Energy Authority, PUCSL, DMC, and the Ministry of Power and Energy.
- **Coordination Mechanism:** Operates within the **Incident Command System (ICS)** framework under the **National Emergency Operations Centre (NEOC)**.
- **Information Flow:** Field data → Regional control centers → Sector Emergency Operations Centre → NEOC.

**Integration of Build Back Better (BBB) Principles**

DALA findings should directly inform reconstruction and resilience-building measures, ensure sustainability and reduce future risk. Recommended actions include:

- Relocating substations away from flood-prone or coastal areas.
- Reinforcing towers and poles to meet cyclone/wind load standards.
- Upgrading grounding and lightning protection systems.
- Incorporating renewable and decentralized generation systems for redundancy.
- Using durable, climate-resilient materials and environmentally sustainable designs.

**Electricity supply system operated by CEB**

The Electricity supply is characterized by a system of processes (from elasticity generation, transmission and distribution) where electricity is supplied to individual households for a certain amount of fee paid to the CEB and LECO, Table 4.42

**Table 4-37 Baseline information on assets of CEB in the Area**

| **Name of Area** | | | | |
|---|---|---|---|---|
| **Number of consumers/Employees** | | | | |
| | | | | |
| **Types of Users** | **Number of Clients** | **Daily Demand** | **Annual Demand** | **Rate of supply** |
| | | **KW hours day** | **Hours/Year** | **LKR/KWh** |
| *Residential* | | | | |
| *Commercial* | | | | |
| *Industrial* | | | | |
| *Others* | | | | |
| **Total** | | | | |
| **Average Income Per Year (LKR)** | | | | |
| **Assets** | | | | |
| **Components** | **Average Replacement Cost (LKR)** | | **Average Repair Cost(LKR)** | |
| **Power Plants** | | | | |
| *Generators of different capacity* | | | | |
| *Hydro* | | | | |
| *Thermal*<br>*Coal*<br>*Wind*<br>*Solar* | | | | |
| **Sub stations** | | | | |
| *Structures* | | | | |
| *Equipment* | | | | |
| *Others* | | | | |
| **Transmission lines** | | | | |
| *Towers*<br>*Transmission lines,*<br>*MV Distribution Lines*<br>*Distribution Transformer* | | | | |

| | | |
|---|---|---|
| *low voltage*<br>*Service connection and Metering* | | |
| *Control Equipment* | | |
| *Others* | | |
| **Main Office** | | |
| *Structures* | | |
| *Equipment* | | |
| *Inventories* | | |
| *Vehicles* | | |
| *Others* | | |

***Notes in filling out Table:***

- *It is possible that electricity supply system located in one area serves the needs of other / Areas or even the whole Province. In such a case, the assets of the electricity supply system may be located in several /Areas. The assessment team must be cautious about the possibility of double counting.*
- *For the structures and equipment, the table can be expanded to include all the types of structures or buildings and equipment, especially those that are vital in the operation of the electricity supply system.*
- *Year 1 and Year 2 refer to the estimated electricity demand after the current year.*

**Electricity supply distribution system operated by LECO**

LECO provide electricity to consumers in certain portions of Urban areas in Gampaha, Colombo, Kalutara, Galle and Matara districts. LECO maintain overhead distribution lines erected on concrete poles at 11kV lines and low voltage, distribution transformers and associated equipment, service drops up to customer service metering and Baseline information need to be collected before disaster occur.

**Table 4-38 Baseline Information of Distribution System of LECO in the Districts**

| **Name of Branch:** | | |
|---|---|---|
| **Type of Supply** | **Average Replacement Cost (LKR)** | **Average Repair Cost (LKR)** |
| *Distribution lines 11kV / low voltage* | | |
| *Distribution Transformer* | | |
| *Distribution lines low voltage* | | |
| *Single phase meters* | | |
| *Three phase meters* | | |
| *Electricity poles* | | |
| *Others* | | |

# 5. Recovery and Reconstruction Plan

## 5.1 Introduction

Every community recognizes the significance of secure and consistent power supply. Disaster recovery planning is a critical component of electricity system management. The infrastructures of electricity supply system are susceptible to natural and man-made hazards, which result in minor to severe scale damages. Consequently, the electricity supply to the communities or customers is disrupted. The effects of each catastrophe are distinct and affect various components of an electricity supply system. Disaster recovery planning for power sector is a process that assists CEB and LECO in enhancing long-term resilience by integrating disaster risk reduction measures into the recovery process. This is achieved by adhering to the Build Back Better principles, which include the restoration and improvement of facilities as appropriate during the recovery and reconstruction phases.

## 5.2 Disaster Recovery Plan

Recovery can be accomplished by providing electricity to the disaster-affected population at the same rates or tariffs, in the same quantity and quality, as they were prior to the disaster. Furthermore, the process of reconstruction is not complete until all physical assets that were devastated have been rebuilt and are operational, with the goal of achieving disaster risk reduction and resilience standards. The restoration of institutional governance in relation to system operation is a unique concern that must be addressed. Recovery needs encompass the financing requirements necessary to cover the higher-than-average cost of operating electricity supply systems from the time of the catastrophe until complete recovery and reconstruction take place. This may involve the transient expense of distributing electricity using thermal generators during the emergency, and the increased cost of purchasing power from private generators. The government may be obligated to introduce or increase subsidies until reconstruction is complete in order to guarantee the financial stability of the utility.

Key steps of Recovery and Reconstruction is illustrated as follows for drinking water sector with additional requirements for disaster recovery

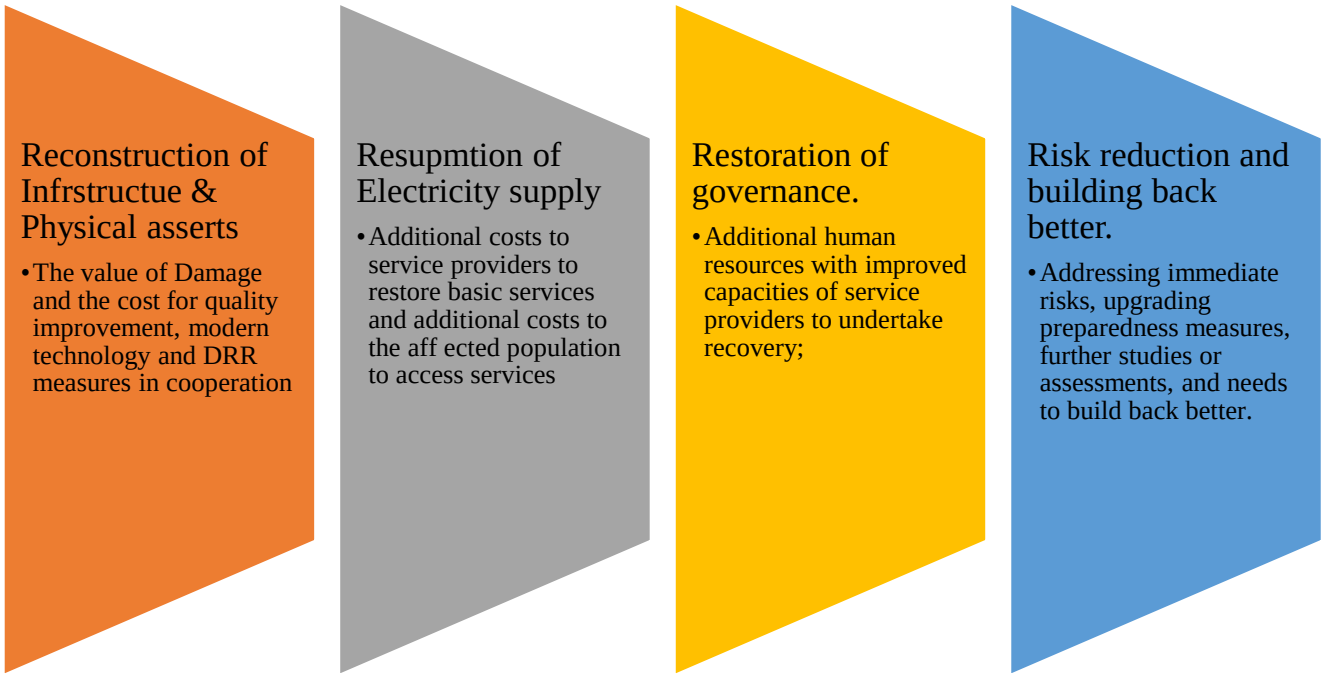



**Figure 5-1. Key steps of Recovery and Reconstruction**

### 5.2.1 Recovery for Small disaster Event

The DRF will fluctuate in accordance with the magnitude of the disaster, as the requirements and procedures will be altered. In general, after carrying out damage estimation within the institution following its own method, the annual budget allocation for the rehabilitation vote of CEB /LECO could be utilized for small-scale annual disasters, and the implementation could be conducted in accordance with the standard rehabilitation and maintenance procedures of CEB/LECO

### 5.2.2 Recovery for Catastrophic Events

It is imperative to have a comprehensive disaster recovery plan in place following a calamitous disaster event, as the damages cannot be repaired using the organization's own resources or, in some cases, the internal budget. However, it may be necessary to solicit assistance from external sources during the interim period following the catastrophic event. In these circumstances, it is necessary to adhere to the internationally accepted procedures and methods for the identification of recovery needs and the assessment of post-disaster damage.

The recovery plan could be prepared in collaboration with the DMC, as the electricity sector has been identified as an important service sector. It is crucial to adhere to the Post Disaster Need Assessment, which includes a detailed damage and loss assessment of the sector. The DRP could then be formulated based on this assessment.

Given that it is impossible to plan during or immediately following a calamitous event, even pre-disaster recovery planning must be completed in advance of disasters. The entire staff must be informed of the recovery process, procedures, responsibilities, and funding mechanism well in advance.

### 5.2.3 Business Continuity for Natural Disaster Operations

CEB and LECO shall maintain business continuity arrangements to ensure that essential utility functions continue during natural disasters. The plan shall include:

- alternate control room arrangements;
- alternate office arrangements for affected regional offices;
- backup power for control centers, call centers, stores and communication facilities;
- continuity of customer call centers (backup or diversified locations for call centres);
- continuity of emergency procurement and stores release;
- continuity of banking arrangements, payroll and contractor payment for emergency works;
- protection of drawings, asset registers, GIS data and customer records (backup/mirror sites for electronic media);
- staff availability during floods, cyclones, landslides and access restrictions (facilitating staff retained, basic essentials like food, restrooms, medical facilities for continuous employment etc.);
- emergency transport for essential staff;
- manual operating procedures where normal office systems are unavailable.

## 5.3 Process of Disaster Recovery Planning

A disaster recovery plan (DRP) is a formalized, structured approach that specifies how an organization can restart operations efficiently following a disaster caused by natural or human intervention. The purpose of disaster recovery planning is to minimize the impact of disasters on Electrify Supply operation and provide electricity to consumers without or minimum interruption.

Disaster Recovery planning could be in two stages.

Stage 1: Pre-Disaster recovery planning
Stage 2. Post disaster recovery planning

### 5.3.1 Pre-Disaster Recovery Planning (PrDRP)

PrDRP is an endeavor to enhance disaster recovery initiatives, planning, and outcomes by preparing for them prior to the occurrence of a disaster. The concepts of PrDRP are predicated on the idea that numerous beneficial aspects can be established prior to a disaster in order to enhance recovery outcomes and facilitate Post-Disaster Recovery Planning (PoDRP).

PrDRP would prevent or mitigate the hurried decisions that result from post-disaster exigencies and enable development of a more comprehensive and effective Disaster Recovery Plan (DRP). It is a cyclical process that is continually enhanced by new information and experience of the situation. In addition, the process may involve the simultaneous execution of certain actions and steps, which enables the simultaneous execution of numerous PrDRP-related actions without the need to wait for the completion of certain previous steps.

Pre-disaster planning does not negate the necessity of post-disaster planning. Conversely, the pre-disaster planning process should be incorporated into the post-disaster recovery planning process. PrDRP guarantees that sufficient time and attention are allocated to the determination of critical recovery strategies and actions in the more difficult and demanding post-disaster

conditions. PrDRP is also an effective method for integrating post-disaster lessons from previous disaster events into the PoDRP of future hazard events.

#### *5.3.1.1 Pr-DRP in principle would include followings*

- **Designating and identifying the divisions, regional offices, and officials (Staff) who are responsible for the planning and implementation of recovery.**

  It is crucial to Identify the lead section or division within the institution in CEB and LECO, as well as the personnel within each agency who are designated to participate in various phases of Post Disaster Recovery Planning (PDRP), such as pre-disaster data management, Damage and loss data collection, and the production of Post Disaster Need Assessment (PDNA) and Disaster Recovery Framework (DRF). Conducting refresher training programme for those identified for conducting loss and damage assessment will facilitate the timely completion of post disaster assessment process.

- **Institutionalizing recovery and rehabilitation roles and responsibilities**. Incorporate recovery-related functions into the CEB/LECO policies and incorporate recovery responsibilities into the job descriptions of designated staff. Develop an intuitive organizational chart that includes the recovery process and/or generate an organizational chart for recovery planning and implementation. Establish systems and procedures to facilitate the institutionalization of PrDRP and Post Disaster Recovery Planning (PoDRP) for specific infrastructure that are assigned to each division and regional office. This would entail the establishment of data management systems to acquire and update the baseline status of the respective assigned electricity supply infrastructure. These actions will reinforce the sense of ownership in the recovery process, and the designated staff will be more comfortable engaging in PodRP and implementation in the event of a disaster.

- **Acquiring political commitment and validation**: The recovery's success is contingent upon political ownership at all levels. Sensitization and awareness-raising among identified key actors, as well as ongoing communication and dialogue, are essential components of pre-disaster recovery measures. The GM or any other senior officer responsible for emergency response actions should provide comprehensive briefing to the Minister and the Secretary under whose purview the subject of electricity supply and convince them of the significance of the recovery framework and its implementation. They must be updated on a regular basis to ensure that they can inform the Cabinet of Ministers and the treasury, as well as to allocate the necessary resources for recovery.

- **Building capacity:** Evaluate the capabilities of the designated divisional and regional offices and personnel to manage disaster recovery, and develop or improve their capabilities. Financial systems are included in capacity building to expedite the recovery process. Training can be technical, such as the development of data management systems, including the design of databases, the identification of data sets, the frequency of updates, and the Post Disaster Need Assessment (PDNA) methodology, as well as the drafting of DRFs.

- In addition to **coordination and negotiations with stakeholders**, individuals involved in PDRP and implementation should also comprehend the role of communication, donor requirements, and the use of and management of recovery finance. Trainings can also serve as opportunities to establish baseline databases, establish pre-disaster data collection and updating mechanisms, and implement rapid data collection and assessment methodologies to expedite PDNAs, among other things.

- **Establish post-disaster procurement arrangements**: the development of recovery-related standards and protocols during the pre-disaster phase will expedite the recovery process, including data collection, assessments, prioritization, planning, and implementation. i.e., the establishment of common standards for reconstruction, the adaptation of standards to the local context, the reporting of changes and the related budgeting, monitoring, and evaluation, as well as the training of the appropriate personnel.

- **Training and enhancing the capacity of designated personnel**: Recovery planning is designed to reconstruct the existing infrastructure to reduce risks, incorporate DRR measures to make it more resilient, and equip it with efficient technologies (through BBB measures) to better meet the needs of the people and ensure uninterrupted services are provided. The planning and implementing capacities of the key designated staff of the CEB/LECO will be enhanced by the implementation of properly planned training and capacity development.

- **Establishing a coordination system:** One of the primary strategies of DRP/PDNA is the establishment of common platforms for coordinated action within the various divisions' regional offices. This enables effective coordination with the primary disaster recovery framework, which is coordinated by the Disaster Management Centre.

- **Stakeholder engagement and validation**: It would be preferred to establish a validation team within the CEB /LECO

- **Updating baseline data**: The absence of pre-established baseline data is a significant obstacle to the efficient conduct of a PDNA and the development of a sound DRF. In order to ensure that baseline data or the status of infrastructure prior to disasters is accessible, the designated division should have systems in place to collect and update it.

The following measures must be taken to ensure the effective and efficient implementation of the entire process when establishing the DRF within the CEB/LECO

#### *5.3.1.2 Develop Capacity to Implement Disaster Assessments*

- Determine the most suitable assessment tool for disaster scenarios in accordance with the CEB's and LECO’s specifications. Designate the divisions/sections or regional office that are responsible for the preparation and execution of post-disaster assessments in advance.

- Create training programs that replicate real-world conditions and offer examples of effective practices and lessons learnt in the context of assessments.

- Formulate rapid assessment methodologies to expedite PDNAs.

- Develop the pre-disaster (baseline) database (national and sectoral) to facilitate its rapid mobilization following the disaster.

- Develop recovery frameworks in advance of a disaster to enhance resilience.

#### *5.3.1.3 Prepare Recovery Frameworks Prior to a Disaster to Improve Resilience*

- Define the vision and guiding principles of recovery processes.
- Clarify the roles and responsibilities of all potential of responsible officials in a recovery,
- Define pre-established coordination mechanisms.
- Share standards for reconstruction.
- Standardize reporting tools, whether they are related to budgeting or monitoring and evaluation.
- Define standards of eligibility of government assistance for the affected communities.
- Define sectoral standards for Building Back Better (BBB).

#### *5.3.1.4 Develop Predictable Financing Arrangements*

- Prioritize the key policy objectives and identify in advance the post-disaster spending priorities.
- Build an aid-tracking mechanism that enables the lead agency to manage, disburse, and account for funds with local implementers.
- Consider disaster risk insurance mechanisms to increase the financial response capacity of national and subnational governments and secure cost-effective access to adequate funding for emergency response, reconstruction, and recovery.

### 5.3.2 Post Disaster Need Assessment and Full-Scale Recovery & Reconstruction

The CEB/LECO can decide to conduct a more comprehensive evaluation of damages, losses, and requirements in the afflicted sectors and geographical regions, contingent upon the severity of the disaster. Depending on the national context and the nature and size of the disaster, assessments can take on a variety of forms. In order to deploy qualified teams on the ground to conduct the assessment once the disaster strikes, it is crucial that CEB/LECO develop their capacity with regard to the various assessment methodologies prior to a disaster. The Post-Disaster Needs Assessment (PDNA) is a standardized methodology that was jointly developed by the EU, UN, and World Bank to assist governments in evaluating the damages, losses, and recovery requirements.

The DRF will establish realistic corresponding measures and available resources to implement the recovery in accordance with the requirements identified in a PDNA.

Major Steps in the PDNA is illustrated below Figure 5.2

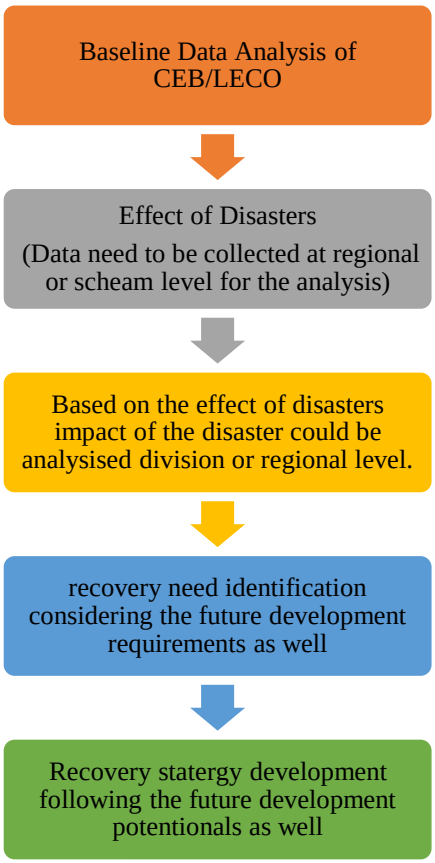



**Figure 5-2 The five components of the PDNA methodology**

## 5.4 Resource mobilization and implementation of DRP

The mobilization of resources necessary for recovery is predicated on a well-crafted recovery strategy/DRF. Consequently, the recovery strategy/DRF that is developed during the PoDRP must either generate resource mobilization plans or revise and enhance the ones that were developed during the PrDRP. The NPD and the NBD will receive guidance and a strategy from the DRF to rebuild following the calamity. The PDNA Team should present the objectives and anticipated outcomes of the DRF's resource mobilization strategy, which should be subsequently approved by the government. Advocacy and communication should also be incorporated into the resource mobilization strategy to increase awareness among policy makers, potential donors, the media, and key population groups.

Depending on the circumstances, public funding may be prioritized for urgent recovery. DRF may contemplate donor assistance, such as the organization of donor conferences, to mobilize balance resources when internal national resources appear insufficient to support the recovery that is prioritized by DRF.

## 5.5 Restoration Targets and Service Continuity Indicators

CEB and LECO shall establish measurable restoration targets for natural disaster events. Indicative targets may be as follows and shall be refined by the utility in agreement with PUCSL, based on hazard severity, geography, safe access, system constraints and available resources.

**Table 5-1 Restoration Activities and Targets**

| Activity | Indicative Target |
|---|---|
| Emergency operation centre activation | Within 1 hour of major event declaration. |
| Regional crew mobilization | Within 3 hours. |
| Initial field damage assessment | Within 6-12 hours after safe access. |
| Critical hospitals and Humanitarian Requirements | Restore or provide temporary supply within 12 hours where technically possible. |
| Water pumping stations | Restore or provide temporary supply within 12-24 hours. |
| Major grid substations | Restore within 24-48 hours, subject to damage severity. |
| Major urban feeders | Restore within 24-72 hours. |
| Rural feeders | Restore within 3-7 days depending on access and damage. |
| Public restoration updates | Every 6 hours during major events. |
| Post-event technical report | Within 30 days. |

Where targets cannot be achieved due to flooding, landslide risk, damaged roads, unsafe access, shortage of materials or system instability, the responsible officer shall record the reason and required support.

## 5.6 Post-Disaster Review and Lessons Learned

After every major disaster event, CEB and LECO shall conduct a structured post-disaster review. The review shall include:

- event chronology;
- early warnings received;
- actions taken before the event;
- assets damaged;
- customers interrupted;
- critical customers affected;
- restoration sequence and Targets achieved;
- safety incidents;
- material shortages;
- access problems;
- contractor performance;
- communication effectiveness;
- cost of damage and restoration;
- lessons learned;
- required improvements to design standards, SOPs, stock levels and training.

The review report shall be completed within 60 days and submitted to senior management and PUCSL. Corrective actions shall be tracked until closure.

# 6. Training Plan for Electricity supply Sector related to Disaster Risk Management

Training Schedule for Electricity Supply Sector (CEB/LECO) related to Disaster risk Management is indicated as four (4) modules.

## 6.1 Module 1 - Introduction and Concept of Disaster Risk Reduction (DRR)

This module is on Introduction and Concept of Disaster Risk Reduction (DRR), Development in Electricity Supply Sector Including Key Concepts, Frameworks and Terminologies.

| | |
|---|---|
| **Session 1.1** | **Understanding and definition of hazards, risks, vulnerabilities, capacities and disasters** |
| Content | i. Understanding and definition of hazards, risks, vulnerabilities, capacities and disasters<br>ii. Classification and categories of disasters<br>iii. Types of vulnerabilities<br>iv. Disaster and human misery<br>v. Vulnerabilities and disaster risks<br>vi. Link between risks, vulnerability<br>vii. From relief to preparedness and mitigation<br>viii. Risk Reduction<br>ix. Question and Answer Session |
| Methodology | Power Point Presentation, Open house discussion interactive session |
| Duration | 60 minutes |
| Target Group | Officers engaged in DRR activities |

| | |
|---|---|
| **Session 1.2** | **Energy sector Development and Disaster Management** |
| Content | i. Development and Disaster Management<br>ii. Definition and Relationship<br>iii. Disaster – Development linkages<br>iv. Development, sustainable development, climate change and disasters<br>v. Question and Answer Session |
| Methodology | Power Point Presentation, Open house discussion interactive session |
| Duration | 60 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers, Sociologist. |

**Session 1.3 Overview of Disaster Context in Electricity supply**

Content
i. Overview of Disaster Context in electricity supply sector
ii. Recent major disaster events and impact to electricity supply sector
iii. Disasters caused by natural hazards and Human interventions
iv. Hazard proneness of electricity supply sector – different hazards
v. Risk Ranking and risk matrix for electricity supply sector
vi. Climate Change and Climate induced disasters – trends and impacts
vii. Question and Answer Session

Methodology Power Point Presentation, Open house discussion interactive session

Duration 60 minutes

Target Group Engineers at Operational level, Planning and Design Engineers.

## 6.2 Module 2 - Mainstreaming DRR in Development Planning Process for Electricity Sector

**Session 2.1 Mainstreaming DRR into Electricity Supply Sector Planning**

Content
i. Mainstreaming DRR into electricity supply Sectoral Planning
ii. What is mainstreaming?
iii. Why mainstreaming is important?
iv. Multi-stakeholder involvement - why involvement of other stakeholders in planning and implementation should be prioritized and be a part of the planning process
v. Development, sustainable development and disaster risk reduction
vi. Global initiatives, experiences and debates
vii. Sendai Framework for Disaster Risk Reduction and why and what activities are required for integration of DRR into electricity supply sectoral developmental plans
viii. Why mainstreaming DRR in to development planning process is cost effective and how it will ensure sustainable development keeping in mind the increasing disaster risks in the national contexts
ix. Approaches for mainstreaming DRR in the developmental planning process in electricity supply
x. Guidelines for mainstreaming Disaster Risk Reduction in electricity supply sector Planning
xi. Case study of a selected national flagship programme and how it can be
xii. Tracking public investment on DRR: Case Studies from CEB/LECO
xiii. Groups exercise to analyses risks, their ranking,
xiv. Type of investment required for enhancing resilience and risk governance in electricity supply

Methodology Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration 240 minutes

Target Group Engineers at Operational level, Planning and Design Engineers

**Session 2.2 Mainstreaming DRR into Electricity supply sector development Plan**

| | |
|---|---|
| Content | i. Impact of unplanned electricity supply development projects with unplanned urbanization & city Development<br>ii. Mainstreaming DRR in environment planning and city development plans and Electricity supply sector development: case studies and discussion |
| Methodology | Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise |
| Duration | 90 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers |

**Session 2.3 Issues related to women, children, elders, marginalized/Disadvantaged and underprivileged sections of the society, differently-able, youths in mainstreaming DRR in National and sub-national plans on electricity supply enhancement**

| | |
|---|---|
| Content | i. Issues related to women, children, elders, marginalized/ disadvantaged and underprivileged sections of the society, differently-able, youths in mainstreaming DRR in National and sub-national plans |
| Methodology | Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise |
| Duration | 60 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers |

**Session 2.4 Climate Change and DRR – need for integration**

| | |
|---|---|
| Content | i. Climate Change and DRR – need for integration historical Risks, Future Threats" and follow-up discussion on the impact of climate change on communities living in Sri Lanka<br>ii. Integration of DRR and CCA and Mitigation into Development Planning<br>iii. Why and how • Ecosystem Based Adaptation – Rationale and Process<br>iv. Need for innovation, pilot projects and strategies for up scaling |
| Methodology | Power Point Presentation, Open house discussion interactive session |
| Duration | 90 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers. |

**Session 2.5 Incorporation of DRR and CCA into Sectoral Plans**

| | |
|---|---|
| Content | i. Incorporation of DRR and CCA into Sectoral Plans |

ii. Linkage between National and provincial Climate Change Plan of Action and the DM Act, Policy and Plan
iii. Analyzing sectoral hazard and risk data and risk ranking
iv. Cost benefit ratio in terms of reduced per capita (unit) expenditure on response and recovery, deceased dependence on borrowings and subsidies and realization of planned targets
v. Priority areas/sectors of integration
vi. Types of intervention for ensuring reduction in disaster loss, increasing resilience
vii. Group exercise on strategy for integrating DRR and CCA and mitigation into sectoral plans
viii. Group exercise to develop plans for f the sector

Methodology Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise

Duration 60 minutes

Target Group Engineers at Operational level, Planning and Design Engineers.

## 6.3 Module 3 - Tools and Processes to Mainstream DRR and CCA into Developmental Planning, Financing, Incentives and Sustainability Issues for Mainstreaming

**Session3.1 Mainstreaming DRR in electricity supply sector development planning: issues and challenges**

Content
i. Mainstreaming DRR in electricity supply sector development planning: issues and challenges-
ii. Mainstreaming DRR into electricity supply sector national and sub-national planning national flagship programmes
iii. Group work for incorporating and mainstreaming issues and priorities of women, children, senior citizens, differently abled persons into electricity supply sector plans

Methodology Power Point Presentation Open house discussion interactive session Plenary for Group Presentation

Duration 120 minutes

Target Group Engineers at Operational level, Planning and Design Engineers.

**Session3.2 Challenges in mainstreaming DRR in key Divisions at CEB/LECO**

Content
i. Challenges in mainstreaming DRR in electricity supply sector
ii. Instruments and incentives for mainstreaming DRR in electricity supply sector development
iii. Developing partnerships and advocacy for mainstreaming DRR into electricity supply sector
iv. Coordination and synergy across sector and levels, including the national and sub-national level for mainstreaming DRR -a panel discussion

v. Initiatives and programmatic approaches for mainstreaming DRR – an in-depth analysis of selected national flagship programmes

Methodology Panel discussions by 2 selected representatives from each group of exercise

Duration 90 minutes

Target Group Engineers at Operational level, Planning and Design Engineers,

**Session3.3 Financing, strategic learning and action planning**

Content

i. Financing, strategic learning and action planning
ii. Management Approach to DRR focusing on drinking water supply sector
iii. Financing options and budgetary allocations for mainstreaming DRR into electricity supply sector
iv. Hazard specific or multi-hazard mitigation through developmental plans for specific ecosystem/location, communities, local governance and other institutions at different levels at electricity supply section
v. Hazard specific or multi-hazard prone mitigation plans specific ecosystem/location, communities, local governance and other institutions at different levels for (a) structural – roads, irrigation, flood embankments, landslide control walls, housing, plantation for soil stabilization, etc., bio-engineering interventions, etc.; and (b) non-structural – improvement in capacity building, training, incorporation DRR and climate change issues/challenges in education and health programme, advocacy, improved coordination
vi. Monitoring and evaluation as an exercise in strategic learning and action for mainstreaming DRR in electricity supply sector development, including development of indicators for measuring outcomes
vii. 2 Group exercises
    a) Exploring specific opportunities for DRR budget allocation for various Government schemes
    b) Developing outcome indicators

Methodology Plenary Session Group Presentation and summary of the presentation and its key learnings Plenary Session

Duration 90 minutes

Target Group Engineers at Operational level, Planning and Design Engineers

**Session 3.4 Tools to be used for the Exercise**

Content

i. Tools to be used for field exercise – Group Exercise
ii. Detailing tools like Sectoral Checklists, mapping tools, etc. for integration of DRR/CCA into sectoral plans and schemes
iii. Group Exercises
iv. Group Presentation

| | |
|---|---|
| Methodology | Power Point Presentation Open house discussion interactive session Plenary for presentation of group exercise |
| Duration | 90 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers |

**Session 3.5 Partnerships for mainstreaming DRR into electricity Supply sector development**

| | |
|---|---|
| Content | i. Successful partnership between national agencies at various levels as well as between national and external development agencies. |
| Methodology | Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise |
| Duration | 90 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers |

**Session 3.6 Group Exercise for Revision and final preparation of the suggested sector plans**

| | |
|---|---|
| Content | i. Group Exercise for Revision and final preparation of the electricity supply sector plans with brief methodology,<br>ii. Budgets, source of finance, monitoring indicators and linkages with existing (or proposed) schemes based on field experience Strategic action planning<br>iii. Preparation of road map for mainstreaming DRR<br>iv. Responsibility Sharing Matrix Role of different stakeholders for facilitating and improving upon the efforts to mainstream DRR into electricity supply sector planning |
| Methodology | Power Point presentation Open house discussion interactive session Plenary for presentation of group exercise |
| Duration | 90 minutes |
| Target Group | Engineers at Operational level, Planning and Design Engineers |

## 6.4 Module 4 - Post Disaster Need Assessment and Recovery Planning

**Session4.1 Understand the Post Disaster Need Assessment**

| | |
|---|---|
| Content | i. Concepts and definition of Post Disaster need assessment<br>ii. Conceptual framework on Resilient Recovery<br>iii. Inter sector linkages<br>iv. Cross cutting issues |
| Methodology | Power Point presentation Open house discussion interactive session |
| Duration | 60 minutes |
| Target Group | WSP Team members, planning and Design Engineers. |

**Session 4.2** **Pre-disaster base line Data for CEB/LECO to conduct a PDNA efficiently**

Content
i. Overview of Pre-Disaster Data Sets (PDBD) focusing on CEB/LECO
ii. Why PDBD is required and how it will facilitate the Post Disaster Damage and Loss Assessment process.
iii. Present the Case study on developing a data set for CEB/ LECO regarding the damage and loss assessment process.

Methodology Power Point presentation, Group exercise based on the case study and Plenary for presentation of group exercise

Duration 60 minutes

Target Group Engineers at Operational level, Planning and Design Engineers

**Session 4.3** **Post Disaster Need assessment focusing CEB/LECO**

Content
i. Introducing the case study.
ii. Estimating Disaster Lossless and Damages based on the case study Data sets developed during training session 4.2
iii. Introduction of formats for collection and assessing the losses and damages in the electricity sector
iv. How to assess the recovery needs based on the disaster damages assessed above.
v. Building Back Better Concept and how to develop a disaster recovery plan
vi. How and from where to mobilize resources to implement recovery plan

Methodology Power Point presentation. Hand on exercise on assessing the needs based on damages in water sector due to the disaster. Presentation, Open house discussion interactive session Plenary for presentation of group exercise

Duration 90 minutes

Target Group Engineers at Operational level, Planning and Design Engineers