Presented By:
Chandan Kumar Ghosh
Director, Power System Operation Department
Nepal Electricity Authority

Best Practices on Transmission System Maintenance in Nepal

Present Scenario : Nepalese Power System

Generation Mix

- Generation Capacity : 4000+ MW (Approx.)

  - NEA Hydro: 581.93 MW
  - NEA Subsidiary: 706.4 MW
  - IPP Hydro: 2405 MW
  - Thermal: 53.41 MW
  - NEA Solar: 26.35 MW
  - IPP Solar: 116.94 MW

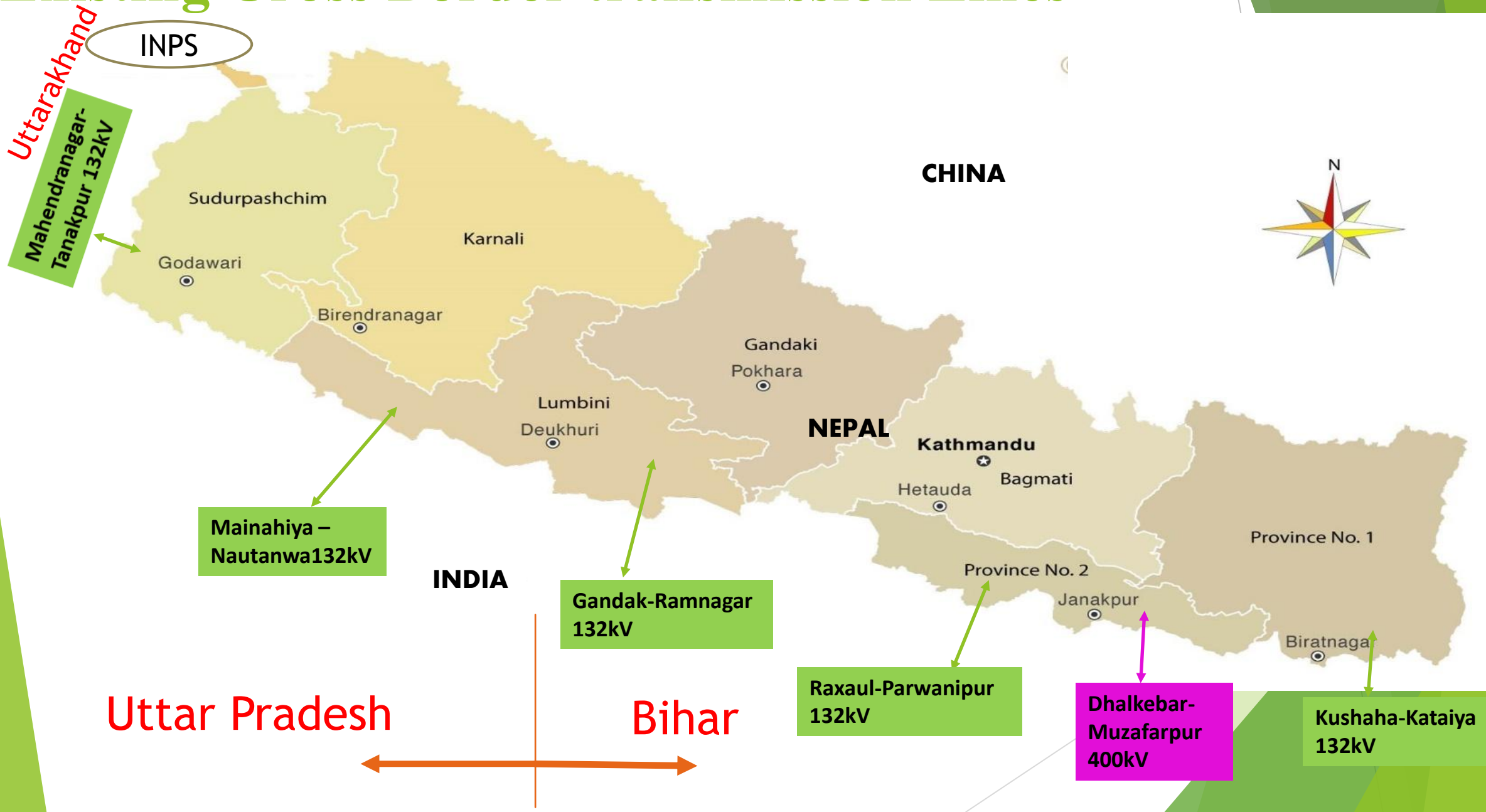
Present Scenario : Nepalese Power System

Transmission Sector:

- Substations Capacity : 14123 MVA

- Existing Transmission Lines:
  - 66 kV : 514.4 Circuit kM
  - 132 kV : 4005 Circuit kM
  - 220 kV : 1254 Circuit kM
  - 400 kV : 384 Circuit kM

Existing Cross Border transmission Lines



Objectives of Transmission Maintenance

- Ensure uninterrupted power Supply
- Ensure system reliability, safety and efficiency
- Prevent unexpected outages and equipment failures
- Reduce forced outages and emergency repairs
- Enhance safety of personnel and Grid equipment
- Optimize maintenance cost, enhance asset life and operational performance

Maintenance Practices in Nepal

1. Preventive Maintenance,
2. Condition-Based Maintenance (CBM) &
3. Emergency or break down Maintenance

Preventive Maintenance Practices

- Scheduled inspection of lines and substations

Preventive Maintenance Practices

- Tightening of connectors, Transformer Bushing and hardware

Preventive Maintenance Practices

- Cleaning of insulators and equipment

Preventive Maintenance Practices

- Vegetation management along transmission corridors


Pahalmanpur Attariya Tree Burned a
nd dead due to Frequent HV strike

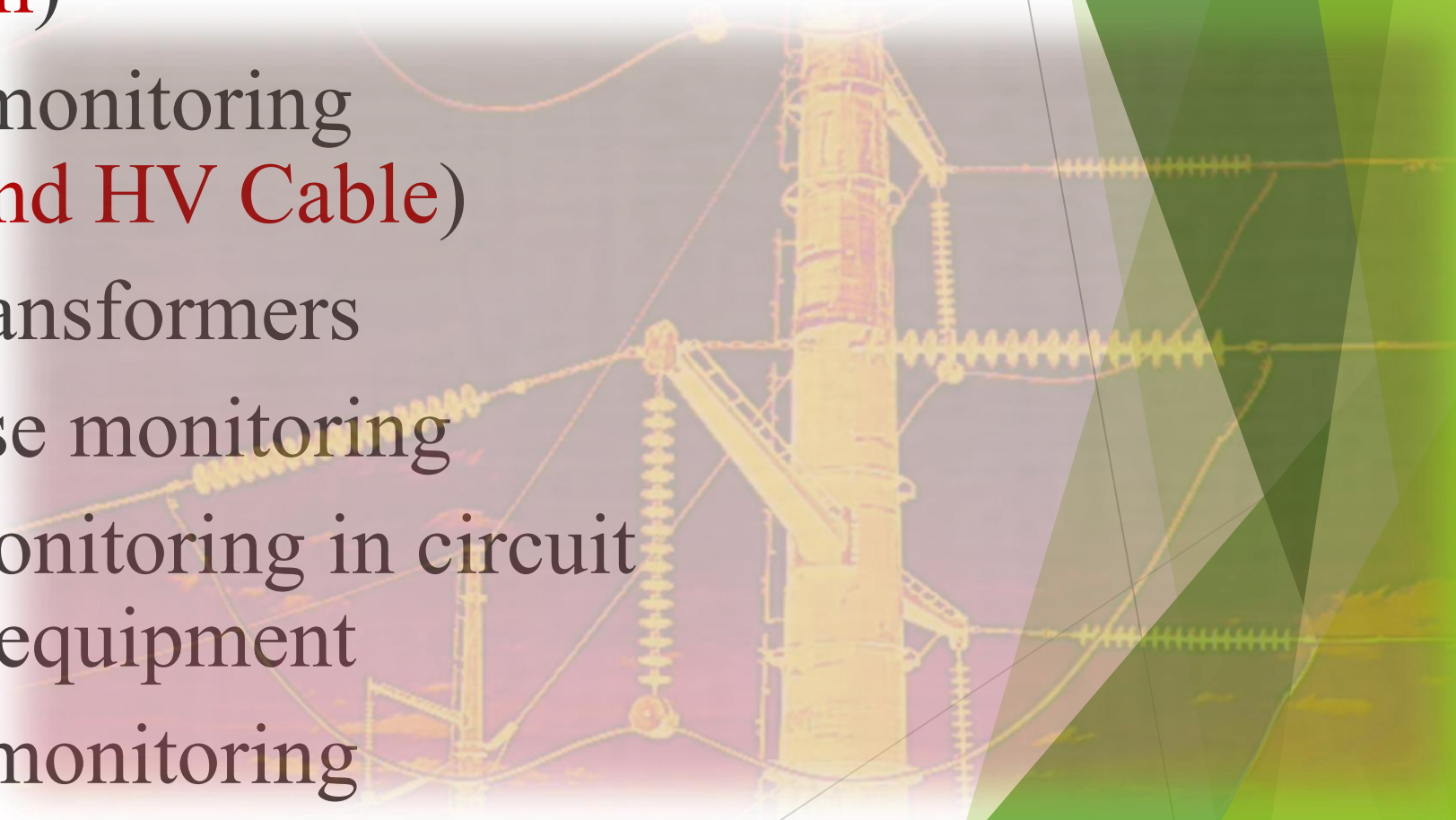

Before Tree Looping

Preventive Maintenance Practices

- Periodic testing of protection systems
- Inspection and Monitoring of tower foundation and Tower Structure
- Inspection and testing of Earthing System

Condition-Based Maintenance (CBM) Practices

- Thermographic inspection (Hot spot detection)
- Partial discharge monitoring (GIS Substation and HV Cable)
- Oil analysis for transformers
- Vibration and noise monitoring
- SF_6 gas density monitoring in circuit breakers and GIS equipment
- Online condition monitoring



break down Maintenance

- Connection of Broken Conductor and earth wires
- Jumper Connection
- Replacement of Blown Insulators
- Adjusting and greasing of Isolators
- Replacement and restoration of CT, PT and LA(sudden burst situation)
- Adjustment and Repairment of Spring Charging Mechanism of Circuit Breaker
- Clearing of fallen trees from the Transmission Line
- Line Shifting on ERS tower in case of tower collapse

Transmission Line Maintenance

- Patrol inspection manually
- Checking and Repairing conductor and Jumpers(Joining or armoring or Repair sleeves)
- Repairing and Maintaining Sag
- Tower foundation inspection and correction action (eg. Rusting, loss member fitting, tilting of leg and landslide)
- Insulator string checking and replacement
- Lightning protection and earthing inspection
- Checking and clearing vegetation encroachment in ROW

Substation Equipment Maintenance

- Repair and Maintenance of Circuit breakers and testing Isolator Maintenance
- Jumper Conductor and PG Clamp Repair and Maintenance
- Transformer Maintenance, inspection and testing
- CT/PT Testing, inspecting and tightening loose connection
- Busbar inspection and repairing
- Battery and DC system maintenance
- Inspecting, Tightening and Correcting wiring of CRP
- Updating firefighting system in Substations

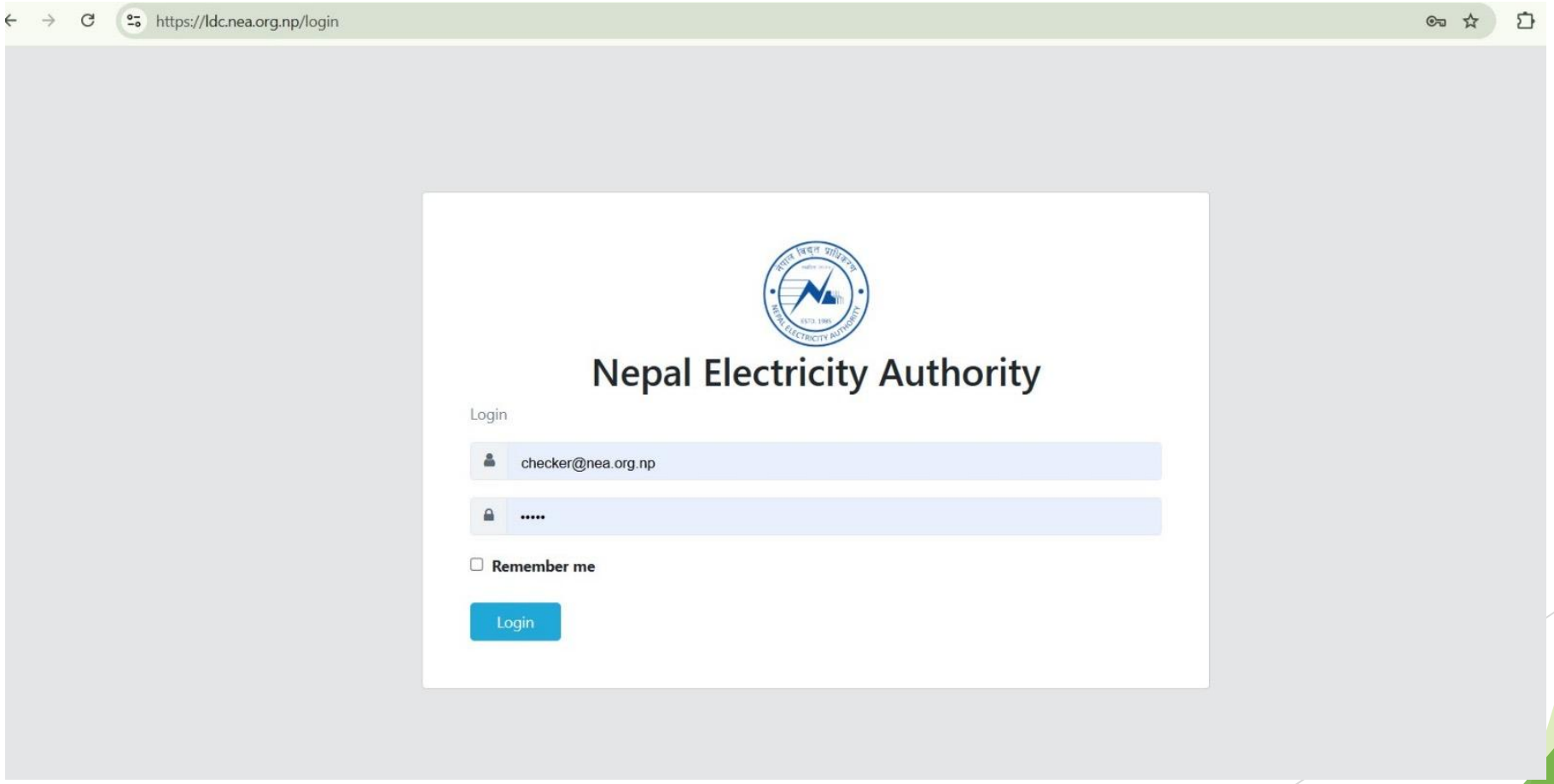
Maintenance of Protection and Control System

- Relay testing and coordination verification
- SCADA system health check
- Communication system inspection
- Firmware and settings verification
- Periodic functional testing

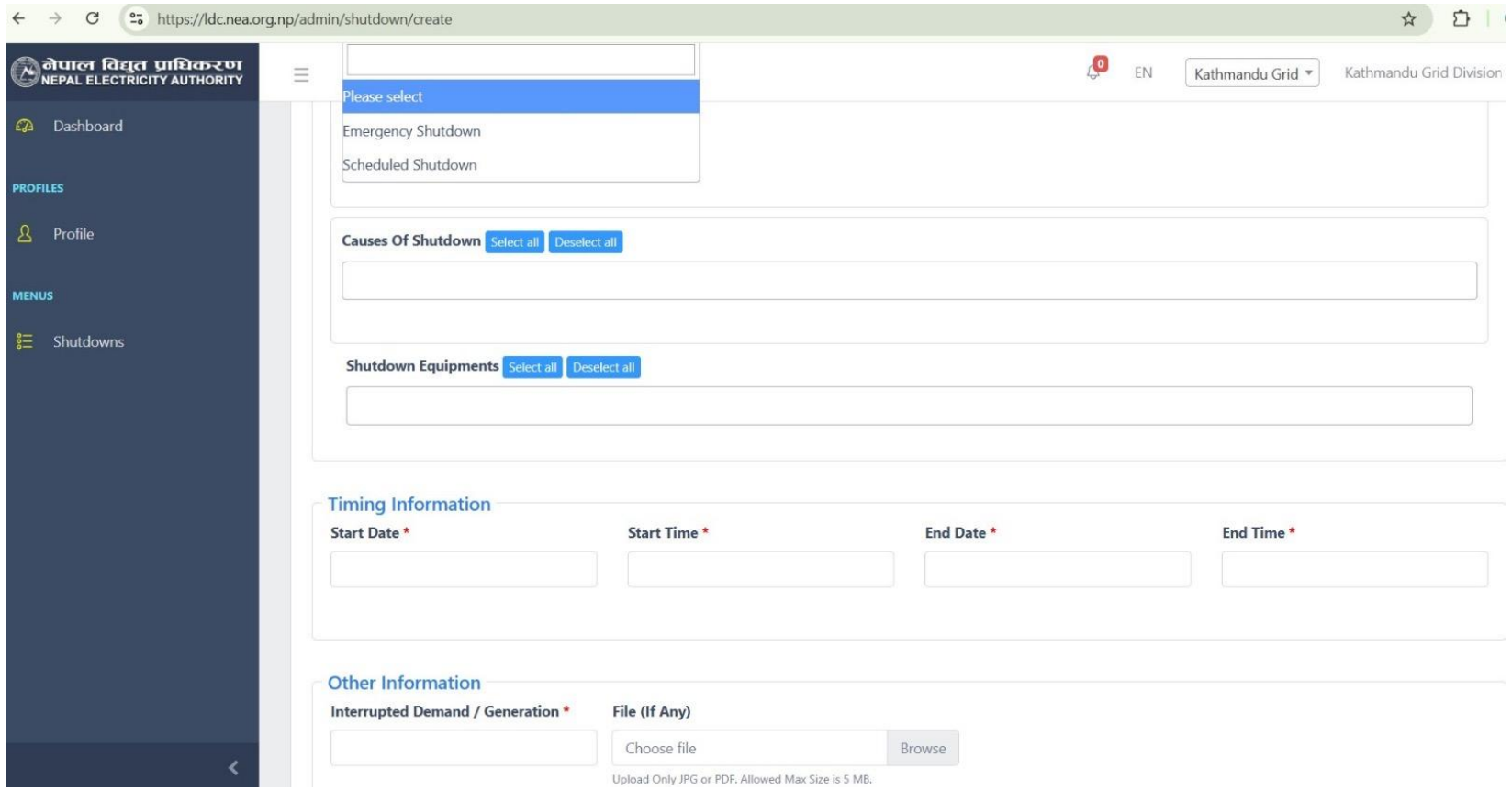
Safety Practices During Maintenance

- Proper Shutdown Management (via. Online Portal System)
- Proper isolation of the live part during maintenance. Use of personal protective equipment
- Proper grounding and discharge procedures
- Hotline stringing and maintenance of OPGW practice with proper Precaution
- Safety training and awareness

ONLINE SHUTDOWN MANAGEMENT



ONLINE FORM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Dashboard
PROFILES
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Shutdowns
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Kathmandu Grid Division
Please select
Emergency Shutdown
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Shutdown Equipments
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Start Date *
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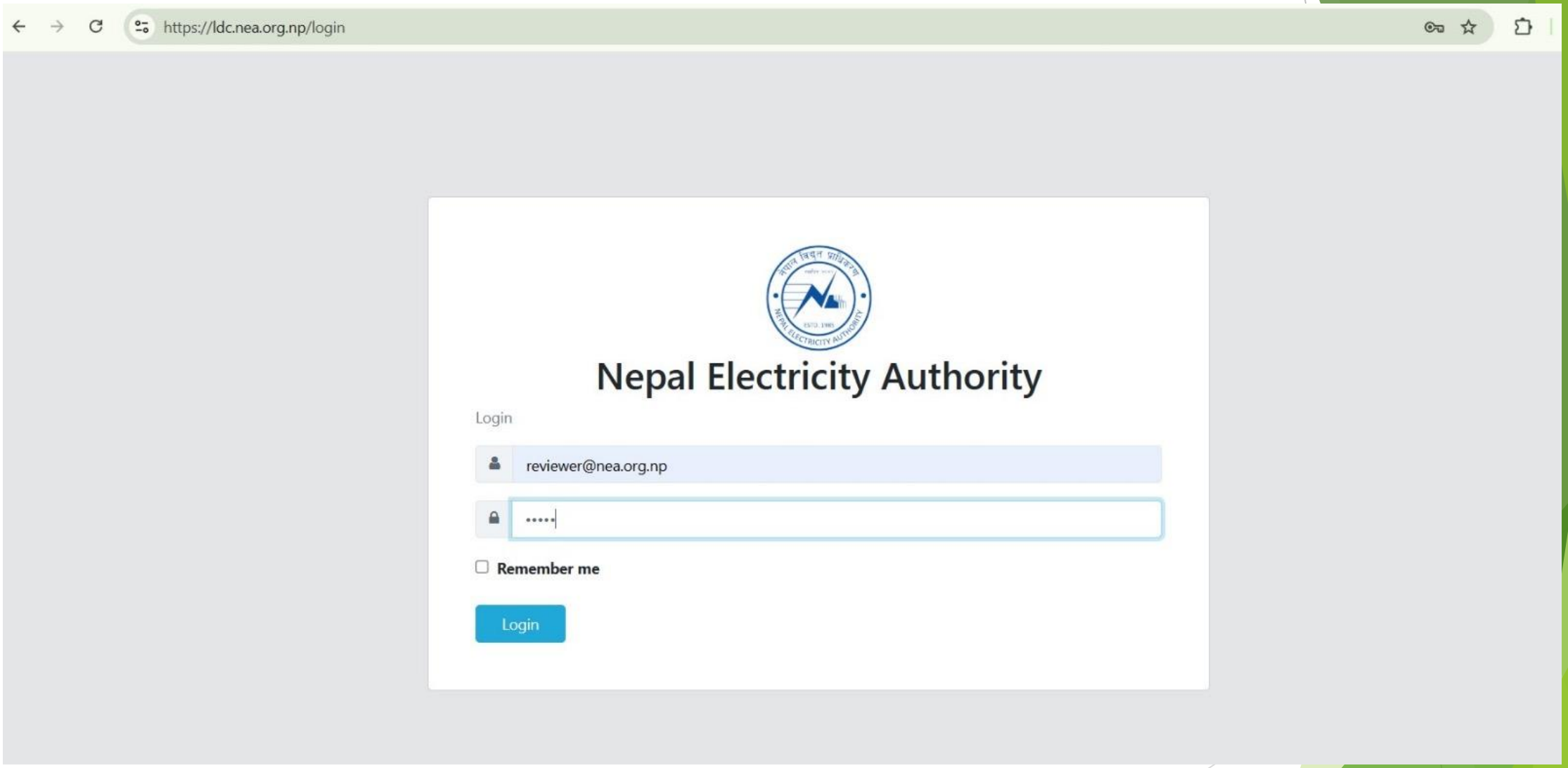
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Nepal Electricity Authority
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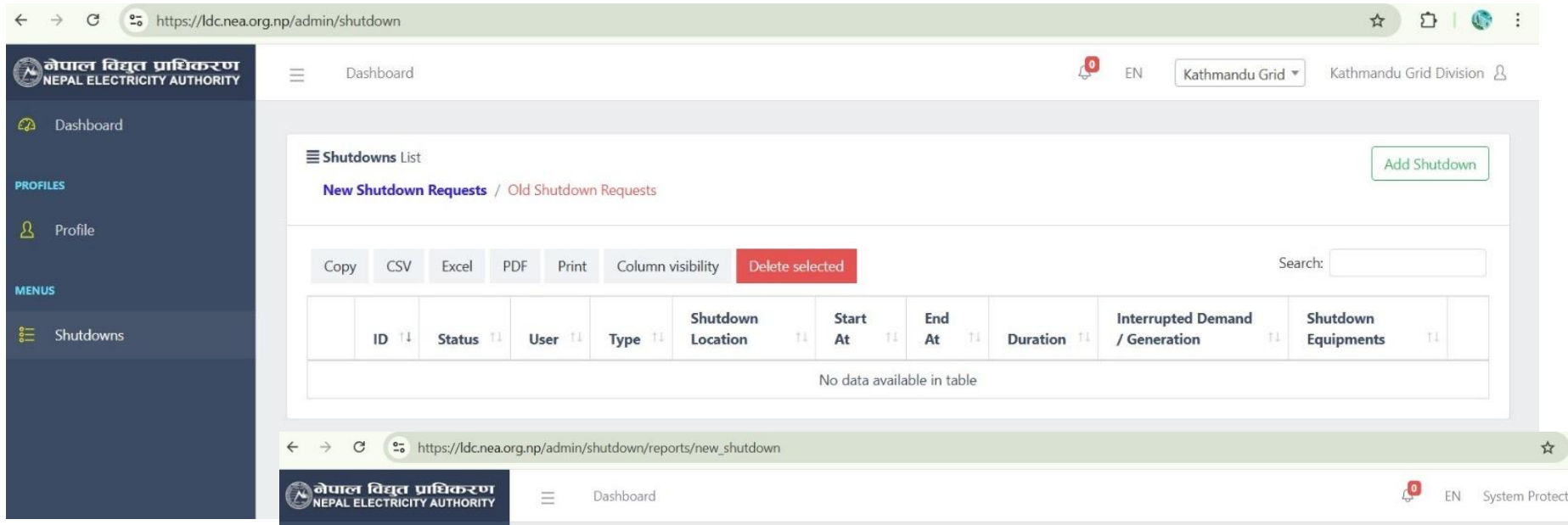
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Shutdowns
Shutdowns List
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End At
Duration
Interrupted Demand / Generation
Shutdown Equipments
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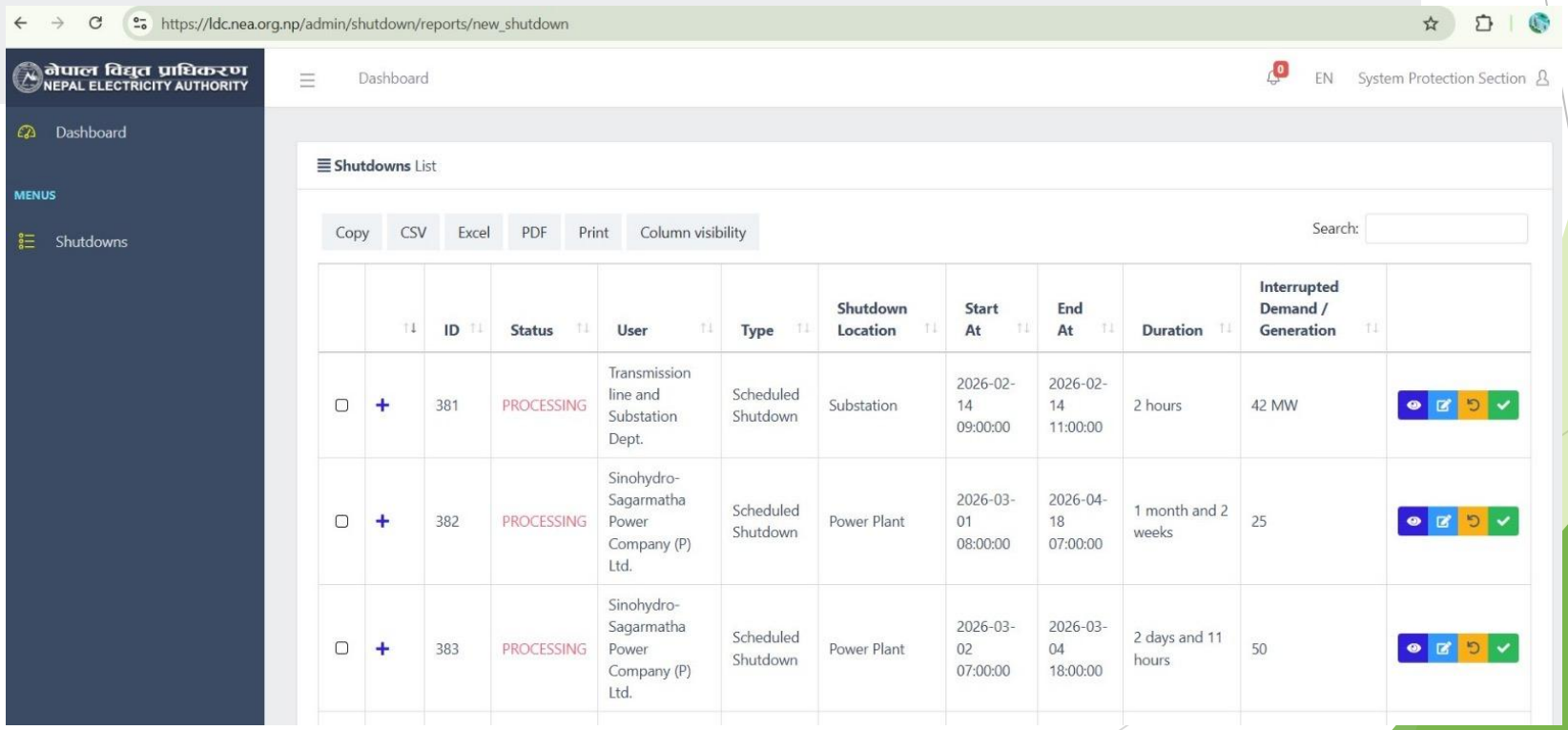
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ID
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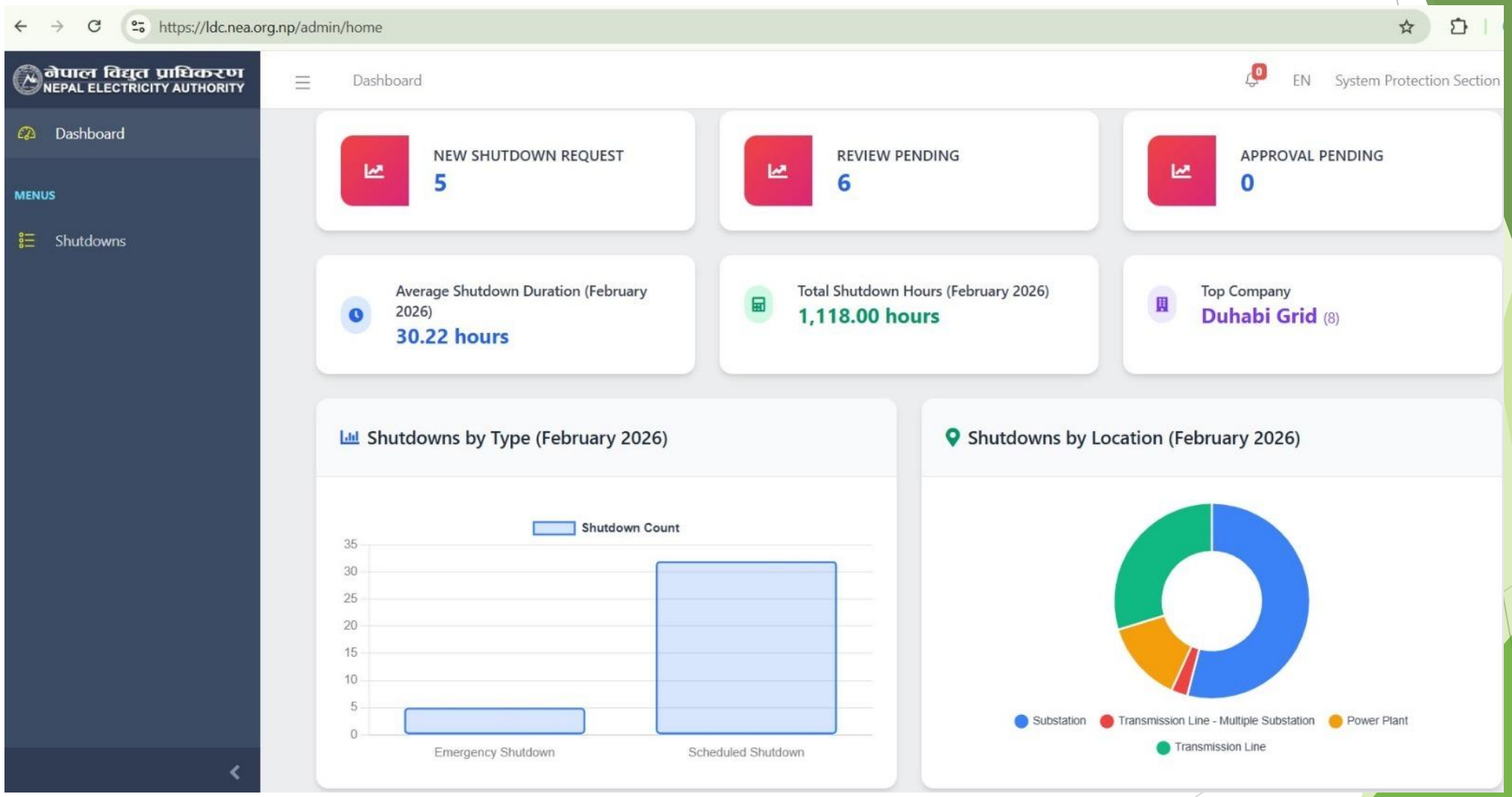
Shutdown Location
Start At
End At
Duration
Interrupted Demand / Generation
381 PROCESSING Transmission line and Substation Dept. Scheduled Shutdown Substation 2026-02-14 09:00:00 2026-02-14 11:00:00 2 hours 42 MW
382 PROCESSING Sinohydro-Sagarmatha Power Company (P) Ltd. Scheduled Shutdown Power Plant 2026-03-01 08:00:00 2026-04-18 07:00:00 1 month and 2 weeks 25
383 PROCESSING Sinohydro-Sagarmatha Power Company (P) Ltd. Scheduled Shutdown Power Plant 2026-03-02 07:00:00 2026-03-04 18:00:00 2 days and 11 hours 50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Dashboard
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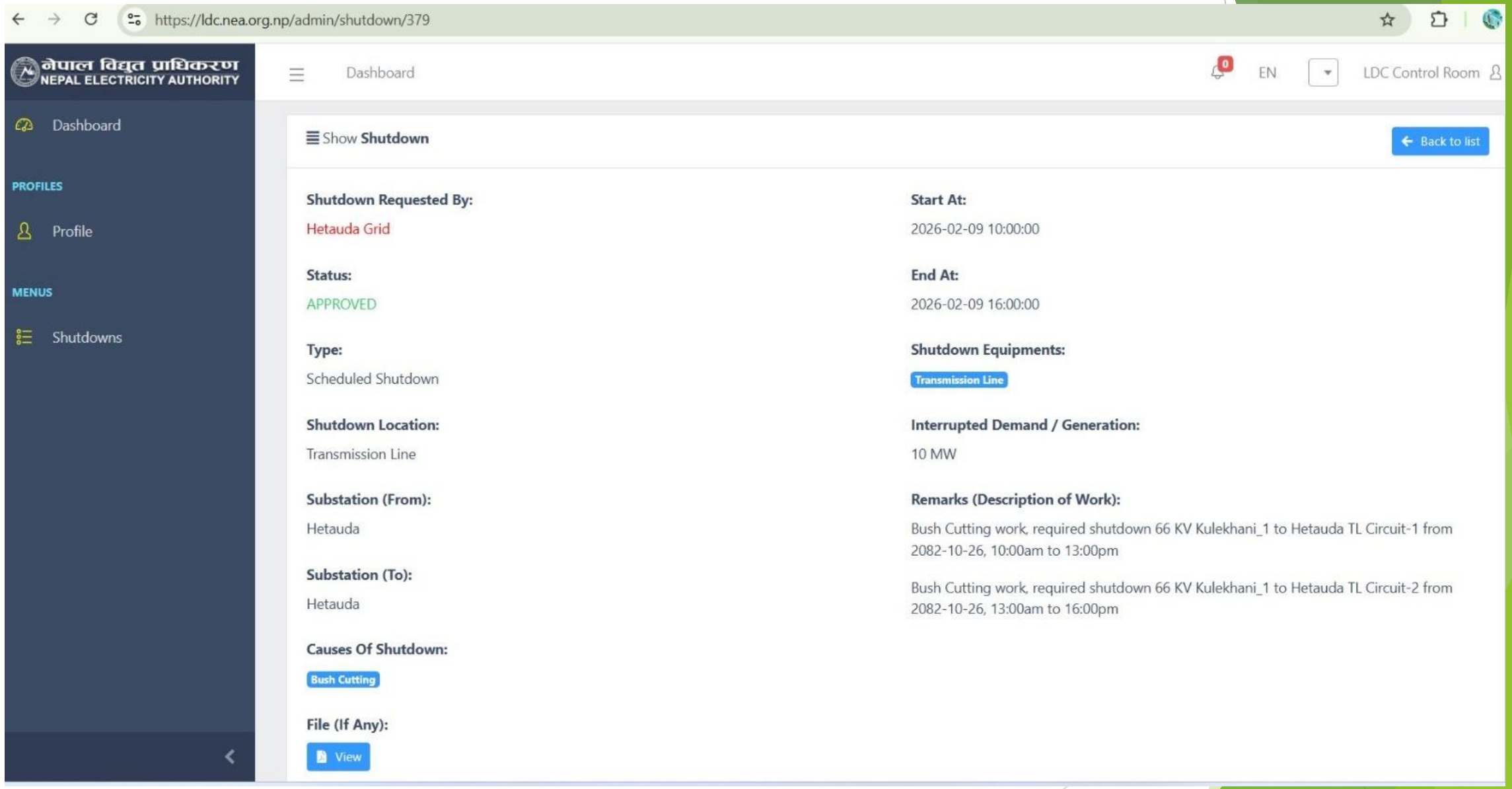
System Protection Section
Dashboard
MENUS
Shutdowns
NEW SHUTDOWN REQUEST
5
REVIEW PENDING
6
APPROVAL PENDING
0
Average Shutdown Duration (February 2026)
30.22 hours
Total Shutdown Hours (February 2026)
1,118.00 hours
Top Company
Duhabi Grid (8)
Shutdowns by Type (February 2026)
Shutdown Count
35
30
25
20
15
10
5
0
Emergency Shutdown
Scheduled Shutdown
Shutdowns by Location (February 2026)
Substation
Transmission Line - Multiple Substation
Power Plant
Transmission Line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नेपाल विद्युत प्राधिकरण
NEPAL ELECTRICITY AUTHORITY
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Dashboard
PROFILES
Profile
MENUS
Shutdowns
Show Shutdown
Back to list
Shutdown Requested By:
Hetauda Grid
Status:
APPROVED
Type:
Scheduled Shutdown
Shutdown Location:
Transmission Line
Substation (From):
Hetauda
Substation (To):
Hetauda
Causes Of Shutdown:
Bush Cutting
File (If Any):
View
Start At:
2026-02-09 10:00:00
End At:
2026-02-09 16:00:00
Shutdown Equipments:
Transmission Line
Interrupted Demand / Generation:
10 MW
Remarks (Description of Work):
Bush Cutting work, required shutdown 66 KV Kulekhani_1 to Hetauda TL Circuit-1 from 2082-10-26, 10:00am to 13:00pm
Bush Cutting work, required shutdown 66 KV Kulekhani_1 to Hetauda TL Circuit-2 from 2082-10-26, 13:00am to 16:00pm

Challenges in Nepal

- Rugged Topography: Managing Transmission Lines across steep Mountainous and Hilly regions i.e. difficult Terrain
- Climate Extremes: Lightning Prone zone, severe flooding and landslides during rainy season, and heavy snow fall in high-altitude zones

Challenges in Nepal

- Infrastructure Growth: Handling a network that has grown to over 6,000+ circuit kilometers (400 kV, 220 kV, 132 kV and 66 kV)
- Increasing demand & Lacking N-1 Contingency in all part of Network
- Resource constraints and lack of skilled worker

Documentation and Record Keeping

- Maintenance logs and reports
- Equipment history records (Specially History Cards of Critical equipment)
- Failure analysis documentation
- Inspection checklists with Grid Code Standards
- Maintenance scheduling records

Moving Towards

- Digital substations (SAS) and online monitoring System
- Asset management software
- Digital Inspection: Drone Inspection using high resolution and thermal cameras to inspect Insulators and Conductors with out shutdown
- LIDAR Mapping: ROW Monitoring, Line Sag and Structural Integrity of Transmission Towers
- Use of Helicopters for fault finding, repair and maintenance of Transmission Lines
- Hot Line Maintenance of High Voltage Transmission Lines

Conclusion

- Effective maintenance improves reliability and reduces costs
- Preventive and predictive approaches are essential
- Safety and documentation are key components
- Regular training of maintenance staff
- Required Standard operating procedures
- Integration of monitoring and data analytics

THANK YOU

Rastriya Prasaran Grid Company Limited (RPGCL)

Nagendra Chaudhary, Deputy Manager

Presentation Contents

1. Company Over View
2. Vision, Mission and Objectives
3. Current Status
4. Best Practices on Maintenance of Transmission System

1. Company: Introduction

राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड
Rastriya Prasaran Grid Company Limited

Established in 12 July, 2015 under the Company Act as a Full Undertaking of GoN with Mandate as:

- **Grid Owner:**
  - Owner of the high voltage backbone transmission systems
  - Maintaining adequate grid capacity as per the Grid Code (to be formulated)
- **System Operator:** Entity responsible for
  - Generation dispatch, ancillary services,
  - Operation and control to ensure safety, power quality, stability, reliability and security of grid (to be specified by the Grid Code).

1. Company: Introduction

राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड
Rastriya Prasaran Grid Company Limited

Capital Structure

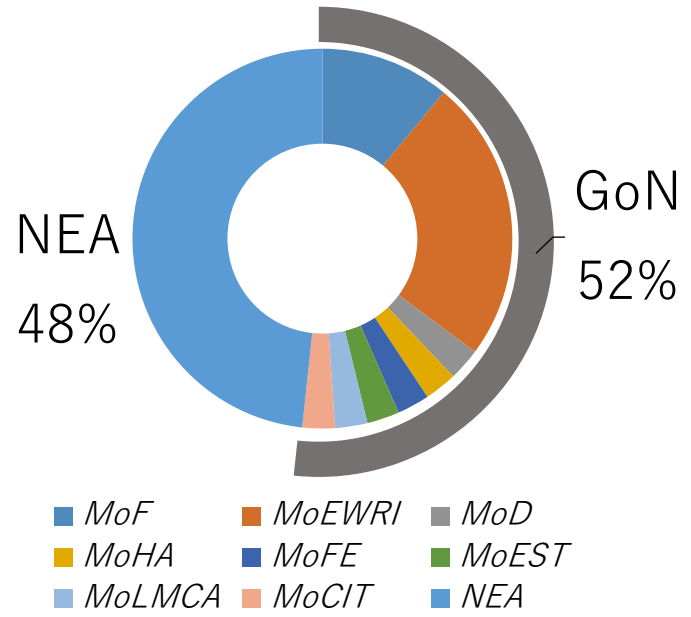
Company's Share Capital

- Authorized Capital: 25 Billion, NPR
- Paid Capital: 4.25 Billion, NPR

1. Company: Share Structure

राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड
Rastriya Prasaran Grid Company Limited

S. No.	Name of Organisation	%
1	Ministry of Finance	11.0
2	Ministry of Energy, Water Resources and Irrigation	24.1
3	Ministry of Defense	2.8
4	Ministry of Home Affairs	2.8
5	Ministry of Forest and Environment	2.8
6	Ministry of Education, Science and Technology	2.8
7	Ministry of Land Reform and Management	2.8
8	Ministry of Communication and Information Technology	2.8
9	Nepal Electricity Authority	48.3
Total		**100.0**



2. Company: Vision, mission & Objective

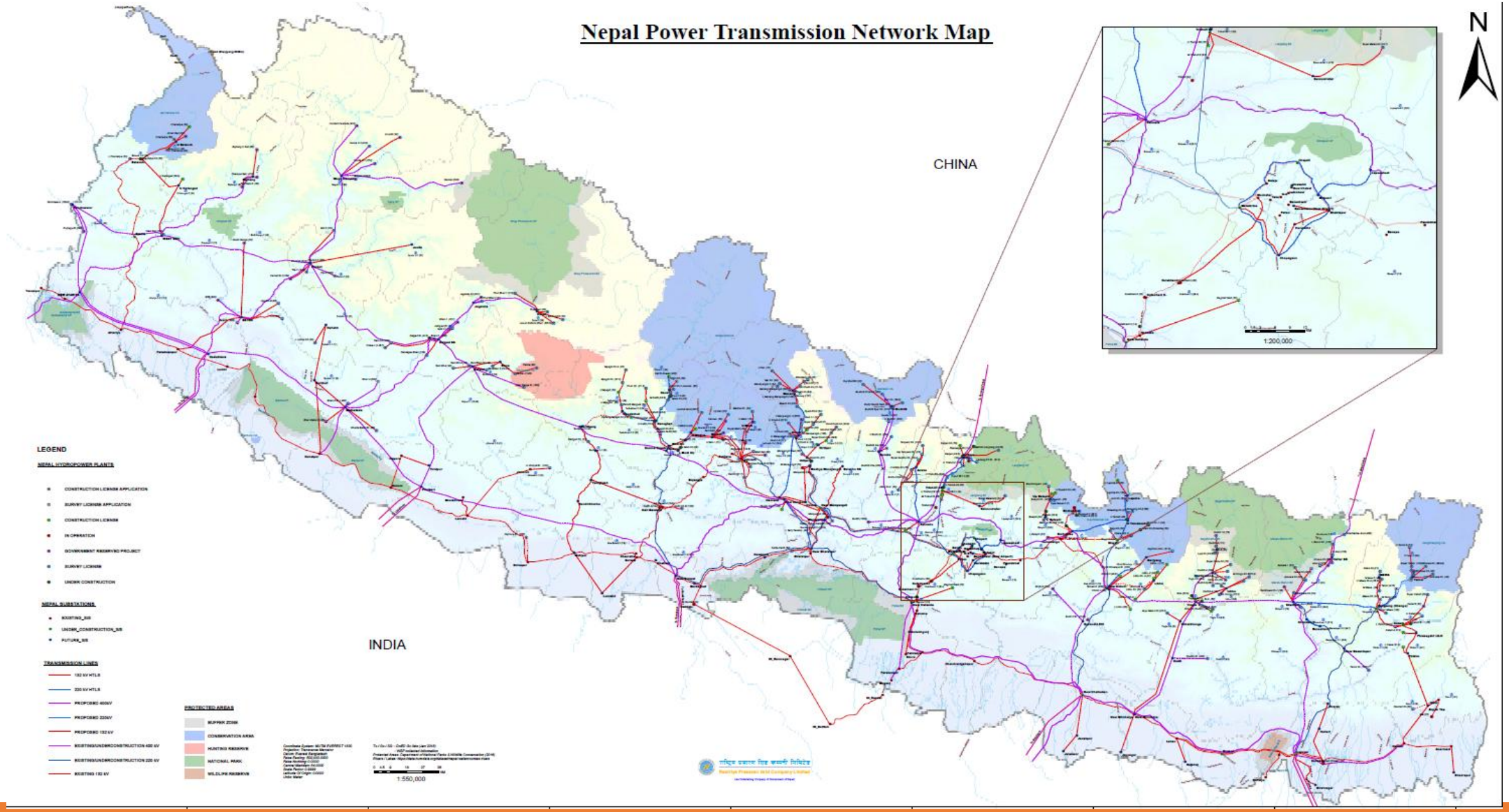
राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड
Rastriya Prasaran Grid Company Limited

Guided by Vision, Mission and Objectives

- Prepare and Implement Transmission System Master Plan (20+ years)
- Development of transmission infrastructures to facilitate the electricity market for the management of transmission grid to supply the reliable electricity.
- Construction, expansion and modernization of transmission lines, substation and Load Dispatch Centers.
- Evaluation, monitoring and control of grid system.
- Ensuring the access of grid transmission to the users.

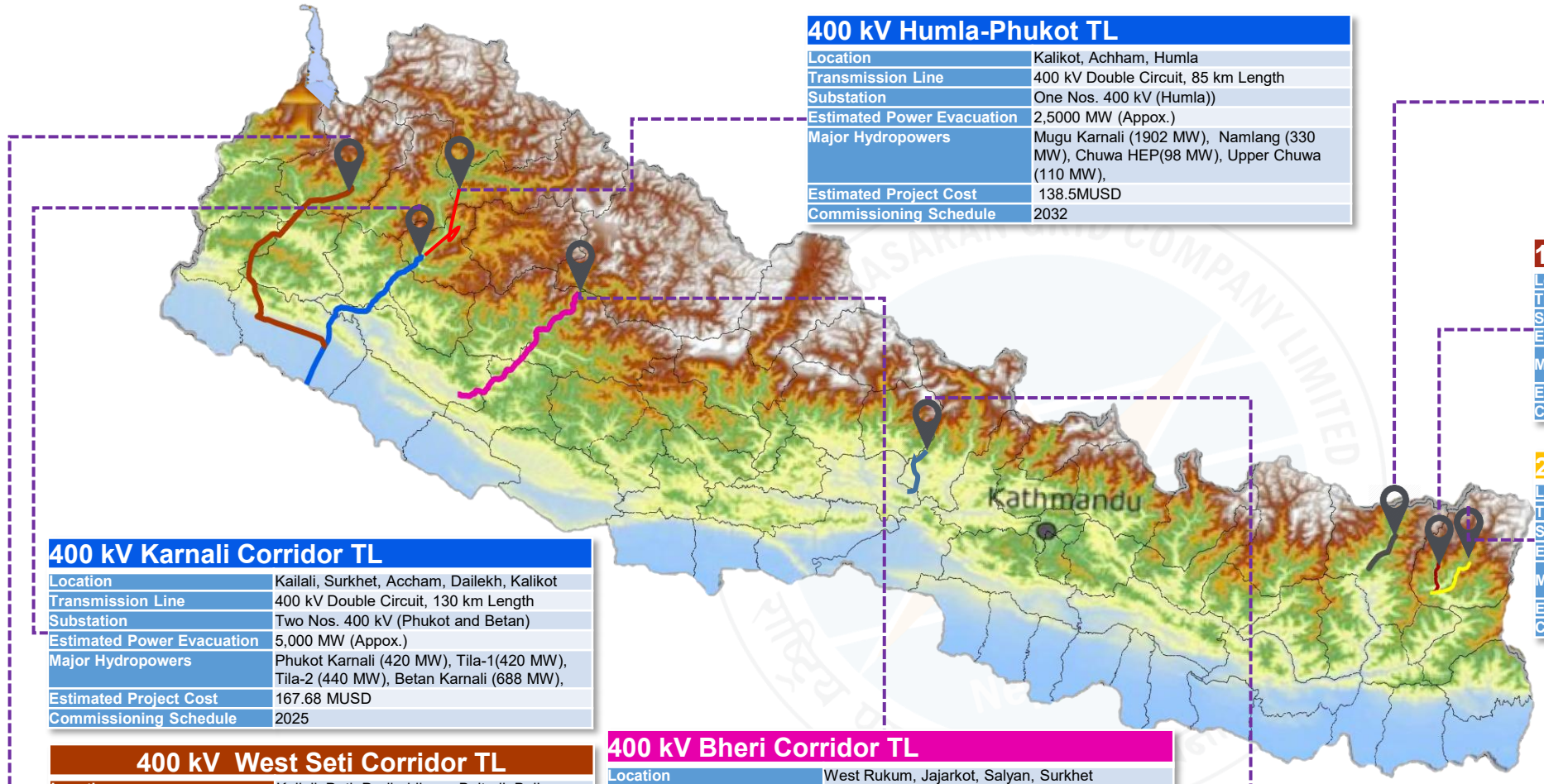
2. Transmission Master Plan

राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड
Rastriya Prasaran Grid Company Limited



3. Scope of Task: Ongoing Projects

राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड
Rastriya Prasaran Grid Company Limited



400 kV Humla-Phukot TL

Location	Kalikot, Achham, Humla
Transmission Line	400 kV Double Circuit, 85 km Length
Substation	One Nos. 400 kV (Humla))
Estimated Power Evacuation	2,5000 MW (Appox.)
Major Hydropowers	Mugu Karnali (1902 MW), Namlang (330 MW), Chuwa HEP(98 MW), Upper Chuwa (110 MW),
Estimated Project Cost	138.5MUSD
Commissioning Schedule	2032

400 kV Arun Corridor TL

Location	Sankuwasabha
Transmission Line	400 kV Double Circuit, 38 km Length
Substation	One Nos. 400 kV (Kimanthaka)
Estimated Power Evacuation	2,500 MW (Appox.)
Major Hydropowers	Kimanthanka Arun (434 MW), Upper Arun (335 MW)
Estimated Project Cost	48 MUSD
Commissioning Schedule	2025

132 kV Mewa - Dhungesaghu TL

Location	Taplejung
Transmission Line	132 kV Double Circuit, 25 km Length
Substation	One Nos. 132 kV (Mewa)
Estimated Power Evacuation	180 MW (Appox.)
Major Hydropowers	Middle Mewa (49 MW), Upper Mewa (28 MW), Union Mewa (23 MW), Siwa Khola (23 MW)
Estimated Project Cost	9 MUSD
Commissioning Schedule	2025

220 kV Tamor - Dhungesaghu TL

Location	Taplejung
Transmission Line	220 kV Double Circuit, 35 km Length
Substation	One Nos. 220 kV (Upper Tamor)
Estimated Power Evacuation	700 MW (Appox.)
Major Hydropowers	Super Tamor (155 MW), Tamor Mewa (101 MW)
Estimated Project Cost	37.5 MUSD
Commissioning Schedule	2025

400 kV Karnali Corridor TL

Location	Kailali, Surkhet, Accham, Dailekh, Kalikot
Transmission Line	400 kV Double Circuit, 130 km Length
Substation	Two Nos. 400 kV (Phukot and Betan)
Estimated Power Evacuation	5,000 MW (Appox.)
Major Hydropowers	Phukot Karnali (420 MW), Tila-1(420 MW), Tila-2 (440 MW), Betan Karnali (688 MW),
Estimated Project Cost	167.68 MUSD
Commissioning Schedule	2025

400 kV West Seti Corridor TL

Location	Kailali, Doti, Dadheldhura, Baitadi, Bajhang
Transmission Line	400 kV Double Circuit, 170 km Length
Substation	Two Nos. 400 kV (Bajhang and West Seti)
Estimated Power Evacuation	1,200 MW (Appox.)
Major Hydropowers	West Seti (750 MW), Chainpur Seti (210 MW)
Estimated Project Cost	194 MUSD
Commissioning Schedule	2025

400 kV Bheri Corridor TL

Location	West Rukum, Jajarkot, Salyan, Surkhet
Transmission Line	400 kV Double Circuit, 110 km Length
Substation	Three Nos. 400 kV (Tribeni, Nalgad, Maintada)
Estimated Power Evacuation	3,000 MW (Appox.)
Major Hydropowers	Nalgad(410MW), Bheri-1(617MW), Bheri-2(256 MW)
Estimated Project Cost	202.75 MUSD
Commissioning Schedule	2025

132 kV Daraudi- N.Marsyangdi TL

Location	Gorkha, Tanahu
Transmission Line	132 kV Double Circuit, 30 km Length
Substation	One Nos. 132 kV (Daraudi)
Estimated Power Evacuation	120 MW (Appox.)
Major Hydropowers	
Estimated Project Cost	9 MUSD
Commissioning Schedule	2025

4. Maintenance of Transmission System

- **Preventive and Routine Maintenance:** Regular, scheduled inspections of key components such as towers, conductors, and insulators are crucial to prevent failures in the Integrated Nepal Power System (INPS).
- **Right of Way (RoW) Management:** Ensuring strict clearance, specifically 9 meters on each side for 66 kV and 132 kV lines, is essential for safety and to prevent trees or structures from affecting lines.
- **Geographical Considerations:** Due to Nepal's terrain, maintenance plans must avoid earth slip zones, marshy areas, and steep, inaccessible hills.
- **Substation Modernization:** Implementing gas-insulated substations (GIS) and upgrading existing infrastructure to improve efficiency, particularly within the Kathmandu Valley.
- **Seasonal Maintenance Planning:** Alignments should be easily accessible during both dry and rainy seasons to ensure uninterrupted maintenance operations.
- **Technological Upgrades:** Leveraging automation and smart grid technologies for better monitoring and control of the transmission network.

4. Maintenance of Transmission System

Preventive and Routine Maintenance:

- **Preventive Maintenance(PM):**

Focuses on preventing major failures by addressing potential issues before they occur based on time or usage intervals. It includes more intensive, planned activities like calibrating machines, replacing worn parts, or checking systems.

4. Maintenance of Transmission System

Preventive and Routine Maintenance:

Routine Maintenance: Refers to regular, frequent, and often simpler tasks designed to keep equipment running smoothly in the short term, such as daily, weekly, or monthly cleaning or lubricating.

4. Maintenance of Transmission System

Focus Areas for Reliability:

- **Tower and Line Integrity:**
  Frequent checks for corrosion, insulator damage, and proper grounding.
- **Vegetation Management:**
  Clearing vegetation within the RoW to prevent outages caused by falling trees.
- **Safety Standards:**
  Adhering to technical standards for voltage level and structural stability to withstand harsh weather conditions.

Thank You