Session 4

Emerging Technologies for Net Zero Power Sector

AI Application for Utilities

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L&T Digital Energy Solutions

Introduction to Digital Energy Solutions

Digitizing PT&D's Value chain. Revolutionizing power Infrastructure.

We are part of Larsen & Toubro (L&T), a global, multi-billion-dollar technology, engineering, construction, and financial services conglomerate specializing in engineering, procurement, and construction (EPC) projects, high-tech manufacturing, digital transformation and technology services.

L&T Digital Energy Solutions is an integrated service provider that delivers fast, reliable, secure, and smart digital solutions for mission-critical power applications. Our advanced technology integration platform supports the effective exchange of information between your electrical installations and decision platforms, creating smarter, safer, and more efficient energy systems. Let us put our cutting-edge technologies to work for you.

Digital Energy Solutions
Power Transmission & Distribution

Need for AI and Advanced Analytics

The several sources of data in smart grids include

Market data,

Equipment data,

Geography and

Power System Data

Through data it is possible to

Predict states,

Provide situational awareness,

Analyze stability,

Detect faults and

Provide advance warning.

AI in the power grid makes the grid to be intelligent, efficient, and productive.

Digital Energy Solutions
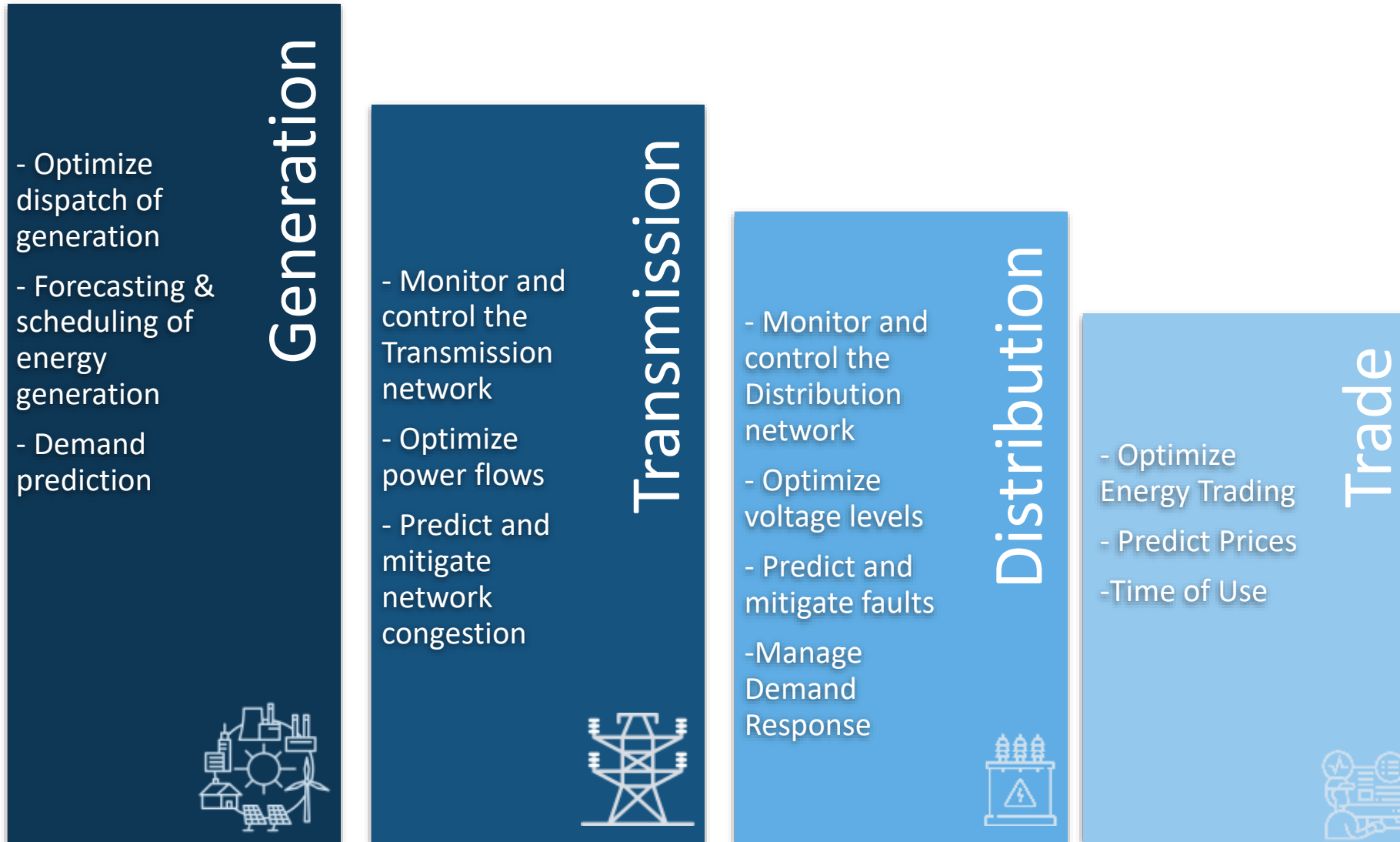Power Transmission & Distribution

Operator Screen

RAS-AFAS Dashboard

Real time View

Asset Performance Management

Decoding your assets. Delivering Operational Excellence.

AI & Advanced Analytics

Generation
- Optimize dispatch of generation
- Forecasting & scheduling of energy generation
- Demand prediction

Transmission
- Monitor and control the Transmission network
- Optimize power flows
- Predict and mitigate network congestion

Distribution
- Monitor and control the Distribution network
- Optimize voltage levels
- Predict and mitigate faults
- Manage Demand Response

Trade
- Optimize Energy Trading
- Predict Prices
- Time of Use

The Asset Maintenance Challenge: Bringing down the Maintenance cost

Asset intensive organizations generally tend to face the below common challenges

Inefficient diagnostics

Alarms that are invalid, leading to Reliability issues, Energy loss, production loss and process issues

Disjointed Systems

Multiple legacy, manual, interoperable and disjointed systems restricting holistic decision making

Tribal knowledge

Knowledge locked with the experts. Losing expertise when they retire. Hard to transfer the skills to others

Compliance & Regulatory

Increasing compliance and regulatory demand

* MC - Maintenance Cost
* RAV - Replacement Asset Value

We are here to make your journey towards the worlds best maintenance practitioners by integrating the industry best **Asset Performance Management solutions**

MC* vs RAV* is ≥ 3%
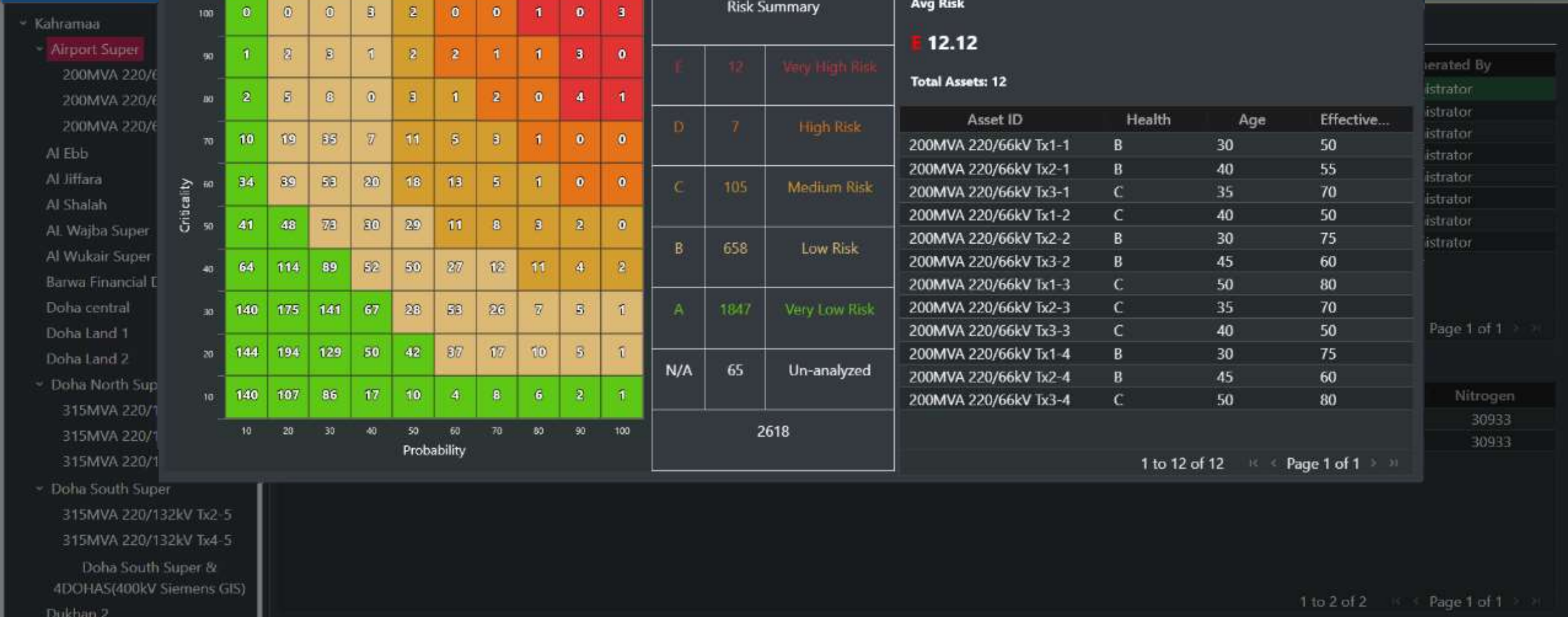Your asset maintenance program needs a new strategy as it is impacting the bottom-line

→

MC vs RAV down to 2%
You will be one of the worlds best maintenance practitioners

→

MC vs RAV down to 1%
You will be THE worlds best maintenance practitioners

SMART CONDITION MONITORING SYSTEM · Total Alerts: 31 · Administrator · Logout

Asset Risk Dashboard

Risk Summary

E	12	Very High Risk
D	7	High Risk
C	105	Medium Risk
B	658	Low Risk
A	1847	Very Low Risk
N/A	65	Un-analyzed
	2618	

Avg Risk

E 12.12

Total Assets: 12

Asset ID	Health	Age	Effective...
200MVA 220/66kV Tx1-1	B	30	50
200MVA 220/66kV Tx2-1	B	40	55
200MVA 220/66kV Tx3-1	C	35	70
200MVA 220/66kV Tx1-2	C	40	50
200MVA 220/66kV Tx2-2	B	30	75
200MVA 220/66kV Tx3-2	B	45	60
200MVA 220/66kV Tx1-3	C	50	80
200MVA 220/66kV Tx2-3	C	35	70
200MVA 220/66kV Tx3-3	C	40	50
200MVA 220/66kV Tx1-4	B	30	75
200MVA 220/66kV Tx2-4	B	45	60
200MVA 220/66kV Tx3-4	C	50	80

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Risk heat map (Criticality vs Probability):

Criticality \ Probability	10	20	30	40	50	60	70	80	90	100
100	0	0	0	3	2	0	0	1	0	3
90	1	2	3	1	2	2	1	1	3	0
80	2	5	8	0	3	1	2	0	4	1
70	10	19	35	7	11	5	3	1	0	0
60	34	39	53	20	18	13	5	1	0	0
50	41	48	73	30	29	11	8	3	2	0
40	64	114	89	52	50	27	12	11	4	2
30	140	175	141	67	28	53	26	7	5	1
20	144	194	129	50	42	37	17	10	5	1
10	140	107	86	17	10	4	8	6	2	1

Side navigation:

- Kahramaa
  - Airport Super
    - 200MVA 220/6...
    - 200MVA 220/6...
    - 200MVA 220/6...
  - Al Ebb
  - Al Jiffara
  - Al Shalah
  - AL Wajba Super
  - Al Wukair Super
  - Barwa Financial D...
  - Doha central
  - Doha Land 1
  - Doha Land 2
  - Doha North Sup...
    - 315MVA 220/1...
    - 315MVA 220/1...
    - 315MVA 220/1...
  - Doha South Super
    - 315MVA 220/132kV Tx2-5
    - 315MVA 220/132kV Tx4-5
    - Doha South Super & 4DOHAS(400kV Siemens GIS)
  - Dukhan 2

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Digital Energy Solutions — Power Transmission & Distribution

Realtime Analytics Dashboard- Asset Performance Management System

Transmission Line Asset Health Management (TL-AHM)

Advanced analytics and AI to maintain your transmission assets

TL-AHM Architecture

Video acquisition using drones and satellite images processing on NVIDIA TX2

Vision based algorithm detects transmission line equipment and forward each equipment to the defect analyzer

Power line detection algorithm detects the power lines and pass them to the defect analyzer

Images of defected equipment are analyzed for potential defects independently

| Damaged strand | Tower Plate | Insulator Defects | Cotter pins | Corrosion | Corona Discharge |

L&T Cloud

Asset Monitoring

Alerts & Notifications

Vegetation Management Using AI

Understand and get deep insights of your transmission assets. Ensure sustained performance

AI/ML T&D Operation Data Analytics & Store Suite

Image acquisition

Supervised vision-based model

Vegetation Risk Mapping

Drones

Satellite

Vegetation Management
Intelligent System

Vegetation Segmentation

Situation alterness
along with power lines

Vegetation Status:
- Negligible
- Minor
- Moderate
- Severe

Tree Density Index
Map (TDP)
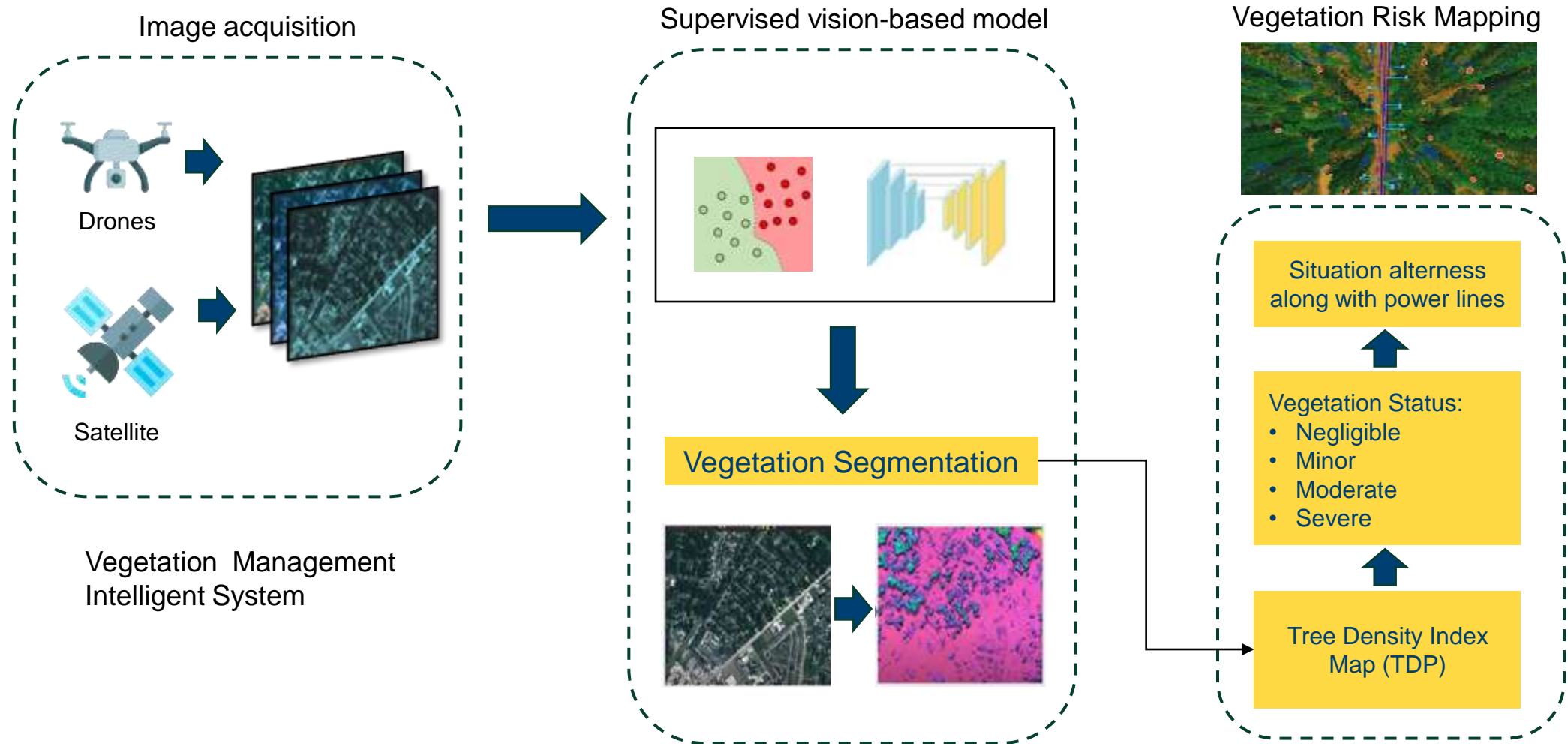
Use Cases

Use Case 1:

Vegetation Encroachment in power line corridors

Impact	• Power Outages • Fire Hazards
Expected Benefits	• Mitigate threats to Power Lines. • Controls periodic field inspection. • Determine the Right of Way surrounding vegetation.

Use Cases

Use Case 2:

Vegetation Height Segmentation

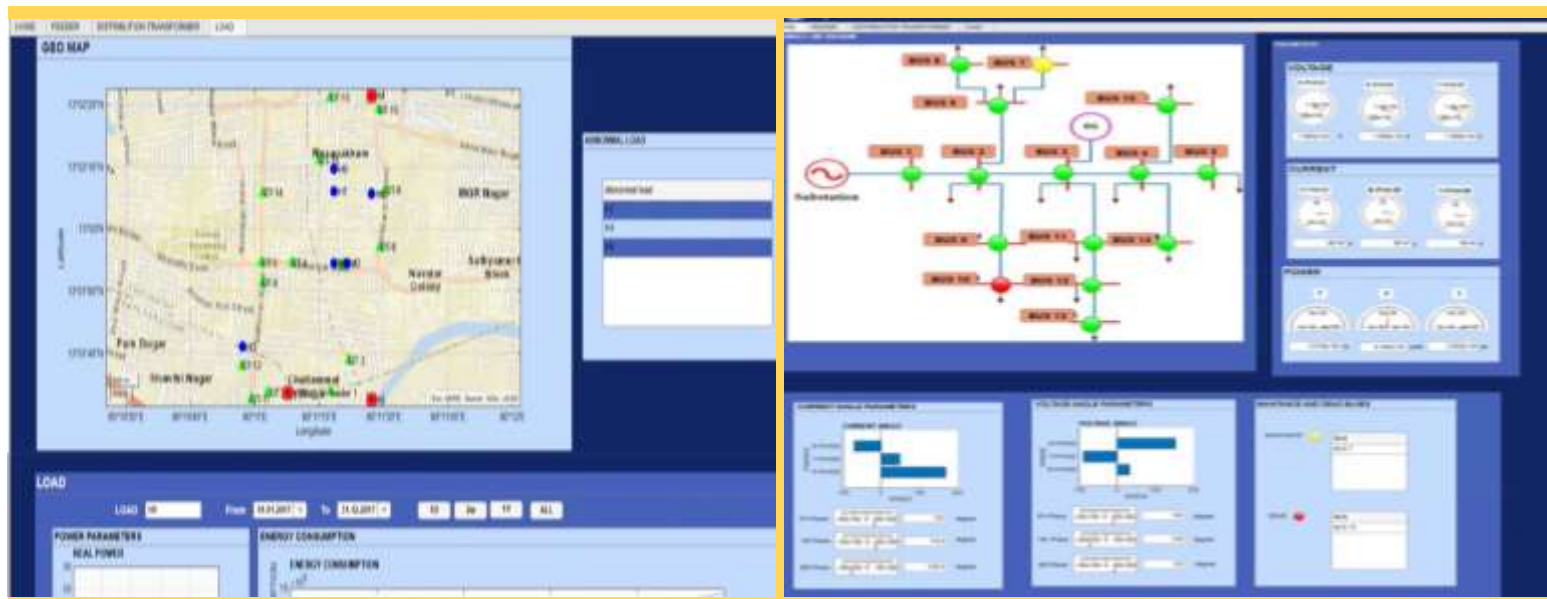|	
Impact	• Power Outages • Fire Hazards • Safety risks
Expected Benefits	• Potential vegetation encroachment areas where the vegetation might overlap with powerlines • Valuable insights to assist experts in making informed T&D Operation Data Analytics & Store decisions.

A. Satellite Image

B. Segmented Image
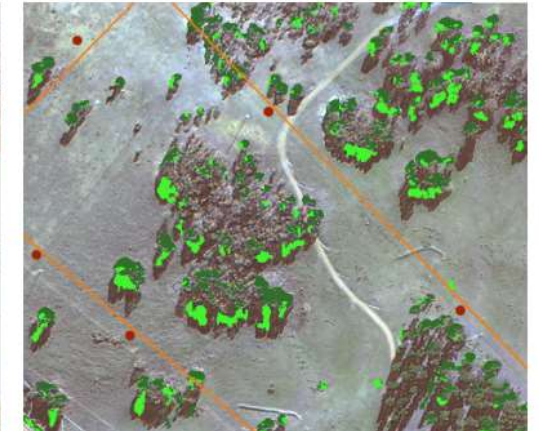
● Poles   ■ Vegetation 1-5m   ■ Vegetation > 5m

AI/ML Based Power Theft Analytics

L&T Power Theft Management

- Electricity theft users pay fewer electricity charges by reducing the meter readings and making them lower than the actual electricity consumption.

- AI based analytics identifies suspicious patterns in consumption, billing, and payments.

- Spikes in usage and comparisons to historical consumption at the premise can identify changes in behaviors and thus activity at the premise.

Power Theft Detection
- Detection of power theft in the network.
- Load parameters are taken as inputs for the Machine Learning model.
- The Machine Learning model detects the anomaly and indicates the abnormal load.

**Primary/Secondary parameter monitoring**
- Primary/Secondary side voltage, and current for all three phases monitored over a period.
- Real and Apparent power tracking on both sides of the Distribution Transformer.

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Anomaly Detection

Use case:.

- Identify **abnormal energy consumption patterns** or unexpected variations in energy.

- Anomalies may indicate **equipment malfunctions**, **operational inefficiencies**, or wasteful practices that can be addressed to reduce costs.

- Make use of **Machine Learning techniques** to identify the anomaly which is a more reliable approach than conventional statistical models.

- Helps in the improvement of **overall efficiency** of the system.
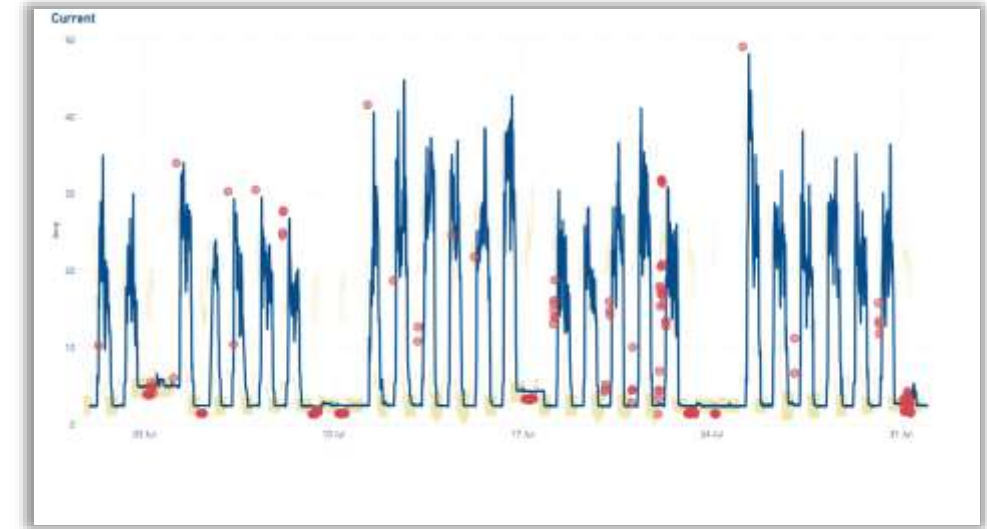
Fault Detection
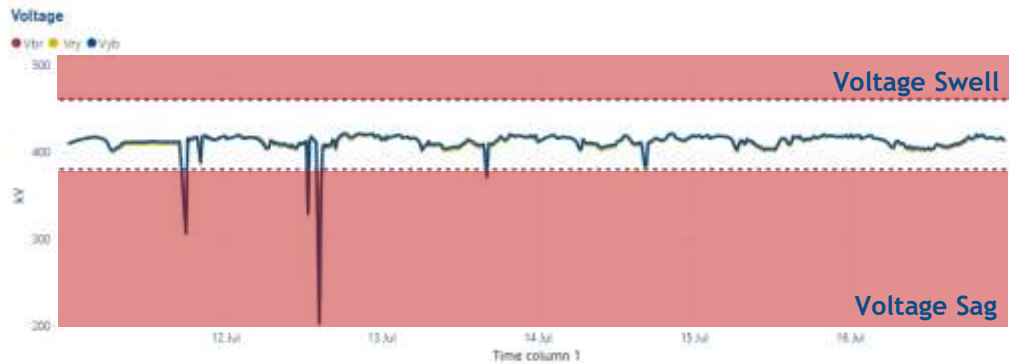
Use case:

- **Reliability Improvement**
    - Predict fault occurrence
    - Outage Management strategies
    - Identifying fault location with more accuracy

- **Predictive Maintenance**
    - avoid costly outages

- **Power Quality Monitoring**
    - Anomaly detection in electrical parameter to ensure high quality power delivery
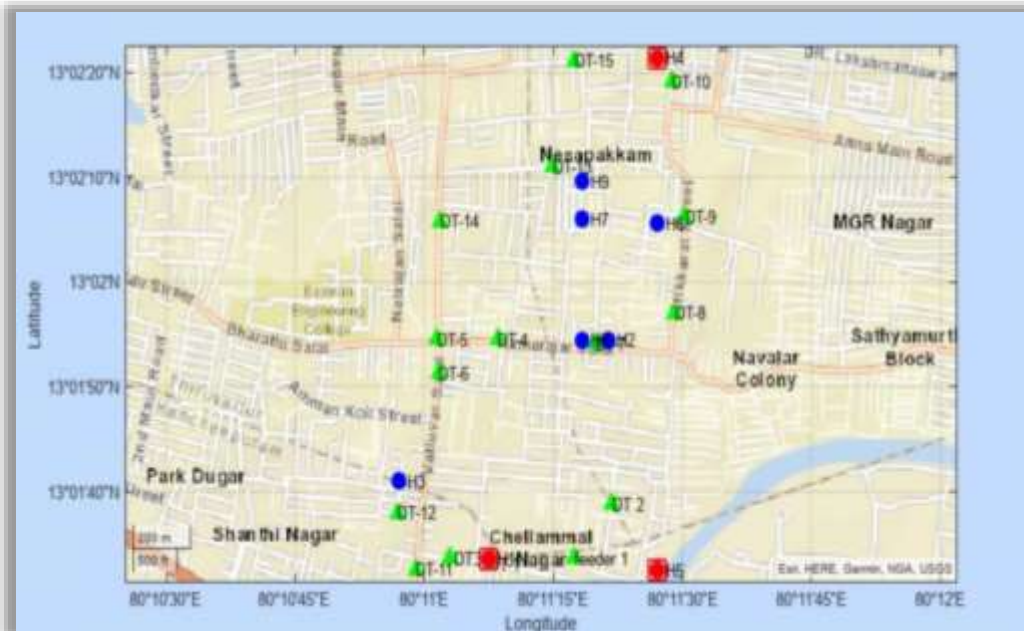
THANK YOU

For discussions/suggestions/queries email: **dum@indiasmartgrid.org**

www.dumindia.in

Links/References (If any)

Distribution Utility Meet | 14 - 15 November 2024 | www.dumindia.in