TATA
TATA POWER

BSES
BSES Rajdhani Power Limited

BSES
BSES Yamuna Power Limited

NPCL
NOIDA POWER COMPANY LIMITED

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India SMART UTILITY Week 2025

Deep Dive Session on AI, ML and Robotics Use Cases for Utilities

Unlocking Efficiency and Reliability in Electric Power Digitalization by Developing AI/ML Use Cases

Presented By

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PLN possess **a wide range of business lines**, from power generation to retail and beyond kWh. Therefore, **PLN needs breakthroughs to objectify its vision in every business line. Yet, PLN faces challenges in energy cost volatility, supply-chain disruptions, rising of load demands for clean energy, and the need for customer experiences.**

Generation

Transmission

Distribution

Retail & Beyond kWh
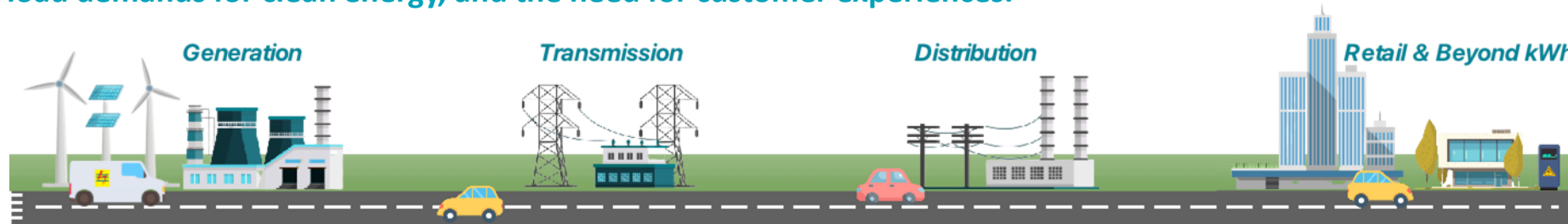
Generating electricity through various types of power plants such as hydroelectric, coal-fired, gas-fired, solar, diesel power plants, and others.

Transmitting electricity from power plants to relay stations through Extra High Voltage (EHV) transmission lines with 500 & 275 kV voltage levels and High Voltage (HV) transmission lines with 150 & 70 kV voltage levels.

Distributing electricity from relay stations to customers through medium voltage (MV) networks with 20 kV and low voltage (LV) networks with 220V.

Selling electricity with goals to achieve a **high level of customer satisfaction** by focusing on customer requirements and **expanding the new business models beyond electricity**

PESTEL Analysis of AI Readiness

Politics
- Supportive Government Policies
- Public Sector Expectations

Economics
- Cost of Implementation
- Operational efficiency

Social
- Digital Literacy
- Safety Culture

Technology
- AI and AR Integration
- Infrastructure Readiness

Environmental
- Waste Management Policy
- Consumer Environmental Awareness

Legal
- Compliance with Indonesian regulation Standards (Data Sovereignty)
- Data Privacy and Security

6.760 Units
Power Plants in Indonesia (2021)

289.471 GWh
Total Electricity Produced (2021)

64.870 kms
Total Transmission Line Length (2021)

1.022.124 kms
Total Distribution Line Length (2021)

257,63 TWh
Total Electricity Sales (2021)

82.543.980
Total Customer (2021)

Assets

Revenue

Profit

Employee

$106,31 Billion
Assets (2021)

$24,25 Billion
Revenue (2021)

$856,86 Million
Net Profit (2021)

51.477 employees
PLN's Employees (2022)

Source: Copyrights of PT PLN (Persero)

Key Enablers in PLN's AI Aimed to Support Smart Grid

Key Enablers

☁ Data Infrastructure

Smart Meters & IoT Devices
Collect real-time data from customers and network infrastructure for predictive analytics

Advanced Data Analytics
Manage the generated big data to support data-driven decisions

🔄 Financial Investment

Funding for Innovation
Requires Investments in new technology development, infrastructure updates, and AI implementations

Cost-Benefit Analysis
Measuring the financial impact of long-term AI adoption on efficiency and cost savings

⊚ Digital Workforce & Upskilling

Human Capital Development
In house Training set up for PLN employee who would operate and utilize AI technology

Collaboration with AI Experts
Cooperation with external parties to accelerate technology adoption and improve internal capabilities

*** Cyber Security Network

Data Protection
Develop robust security systems to protect sensitive data from customers and network operations

Resilient Infrastructure
Securing IT/OT networks from cyber threats to maintain operational continuity

Prioritization of PLN's AI Use Cases

AI use cases in PLN's business processes is prioritized on each value chain based on corporate needs that supporting the implementation of Smart Grid gaining for efficiency and sustainability

Generation
- ★ • Soot Blower Optimization in thermal power
- ★ • Predictive Maintenance based on historical
- ★ • Hydro Assistant in hydro power plant
- ★ • Heat Exchanger

Transmission
- ★ • Demand Forecasting (load and weather)
- ★ • Smart Vegetation Management
- ★ • Dashboard Transmission Monitoring System

Distribution
- ★ • Dispatch Optimization (weather, load)
- ★ • Intelligent Distribution Solutions (IDS) Smart Grid Distribution

Retail
- ★ • Optical Character Recognition (OCR) for meter reading
- ★ • Load prediction for electricity consumption in prepaid meter scheduler
- ★ • Chatbot in PLN Mobile apps

★ Implemented   ★ Proof of Concept

Source: Copyrights of PT PLN (Persero)

#1

Hydrology assistant: Predict inflow into dams using weather forecast to prevent overflow and ensure system can keep up

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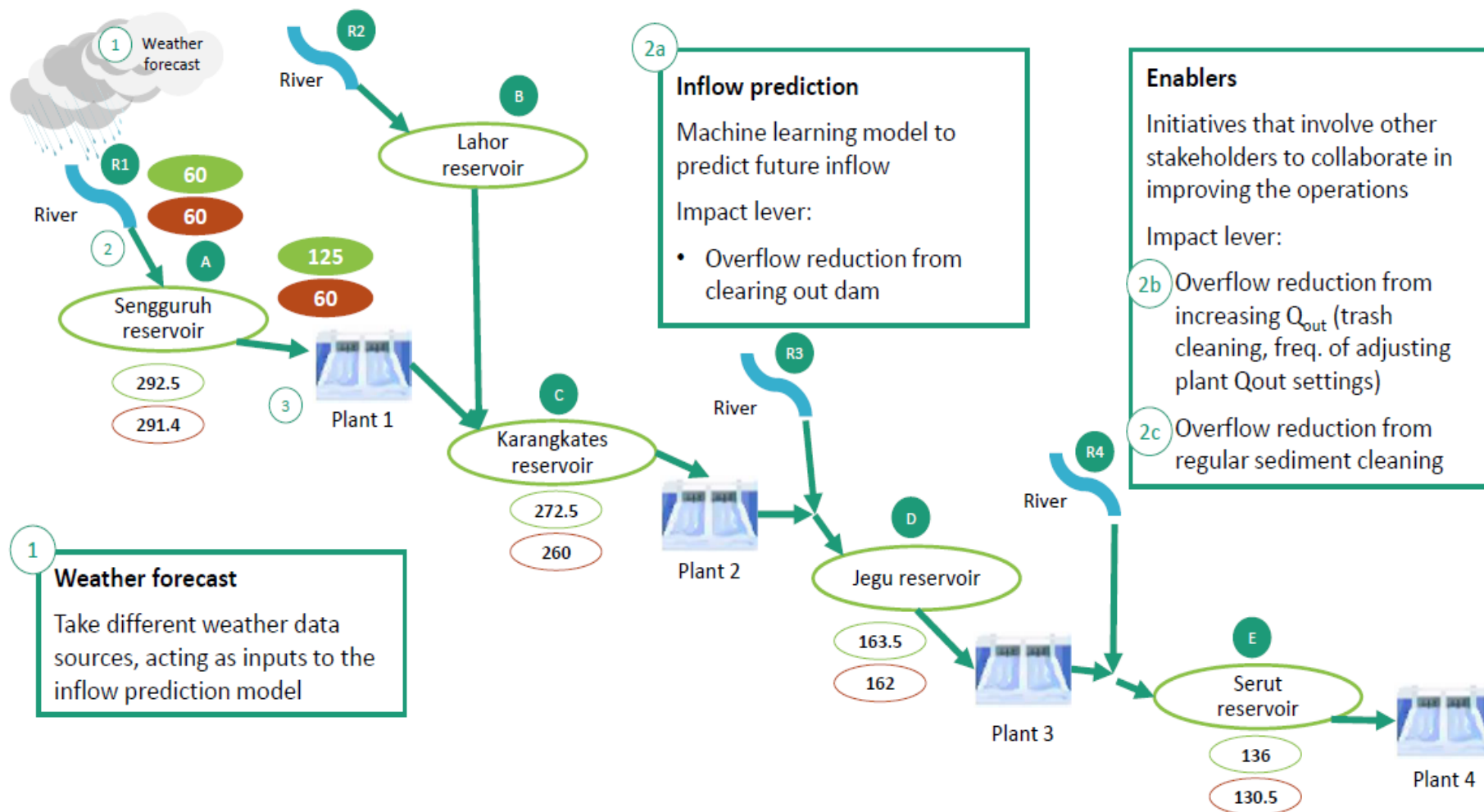
1. Maximum flow rates based on pipe size constraint or actual flow from river
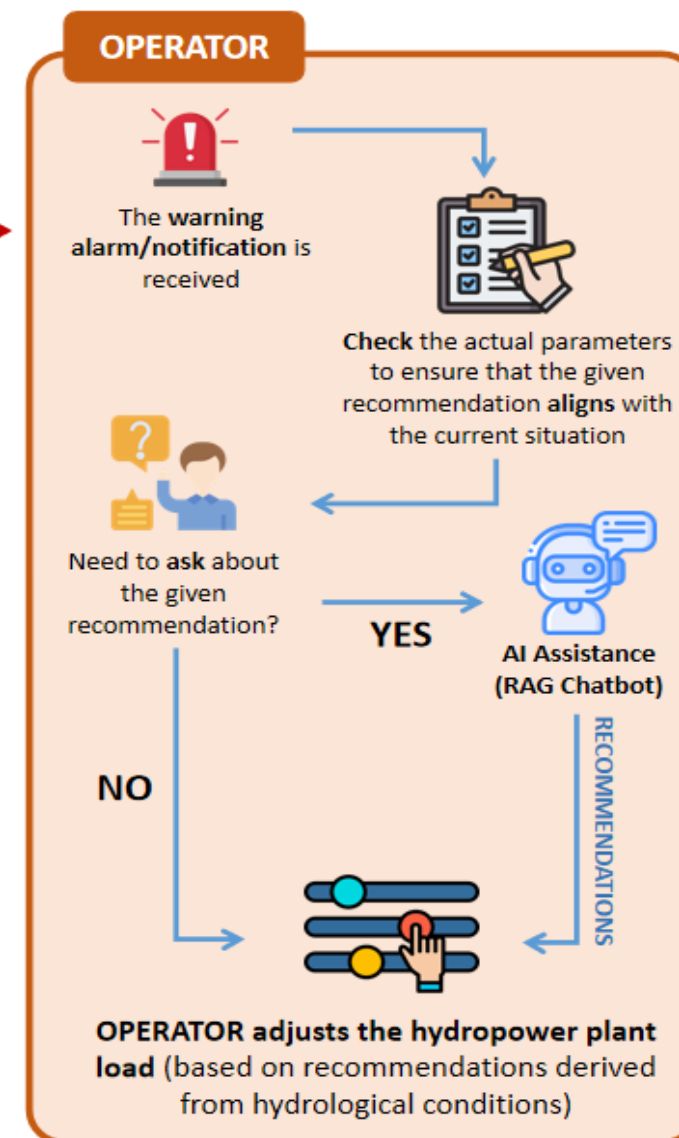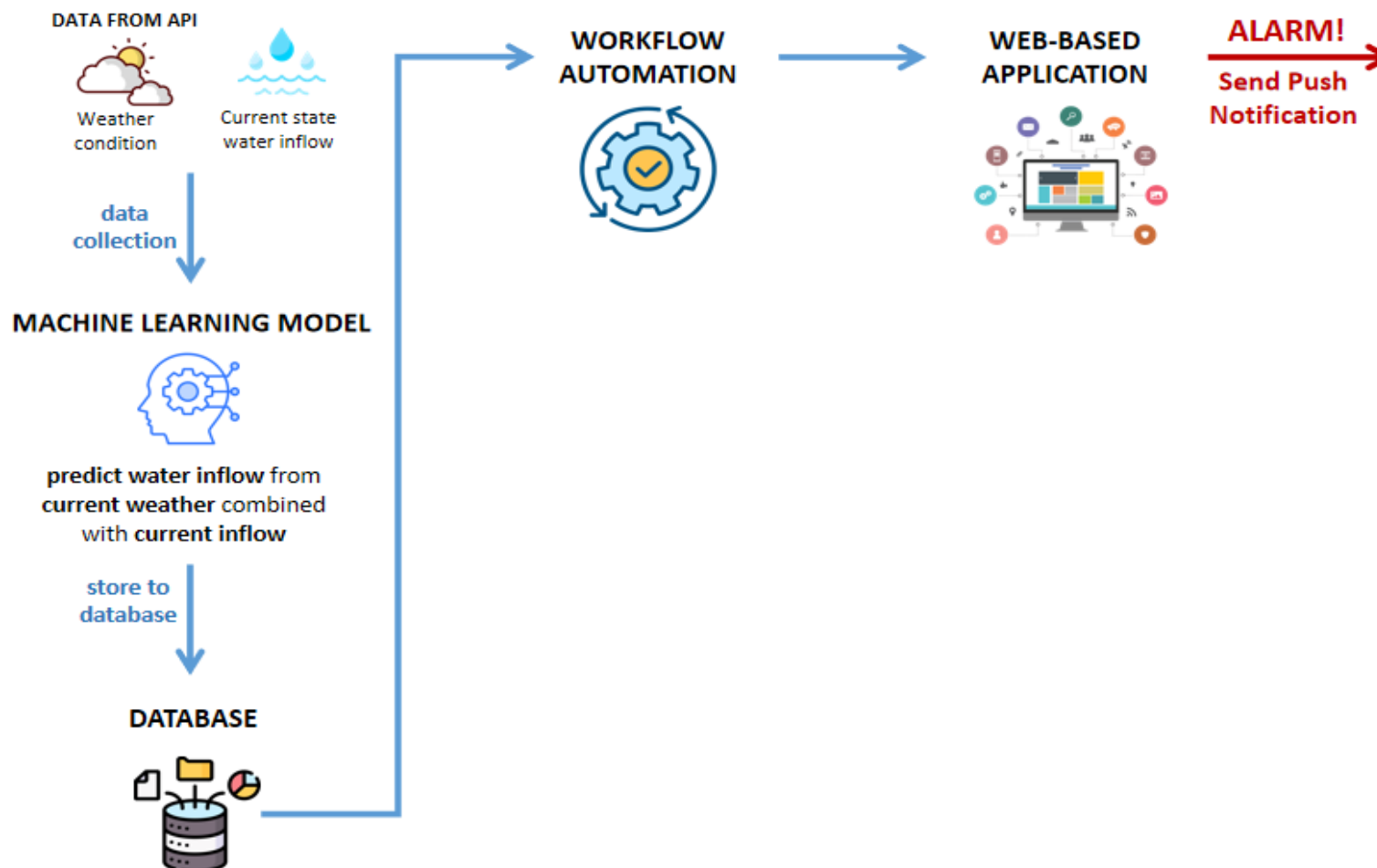2. Average annual flow rate that goes into the reservoir between 2022-2023

Source: Copyrights of PT PLN (Persero)
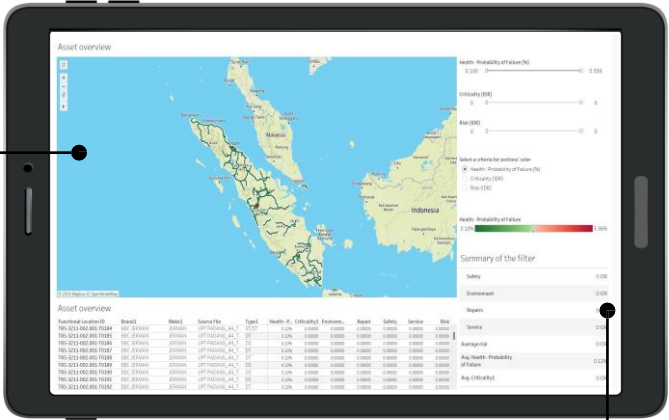
The Flow of Hydro Assistant to Manage Power Plant

Source: Copyrights of PT PLN (Persero)

Proposed design for visualization tool in Tableau
Analyses of health model results that obtained from work order representing critical transmission area

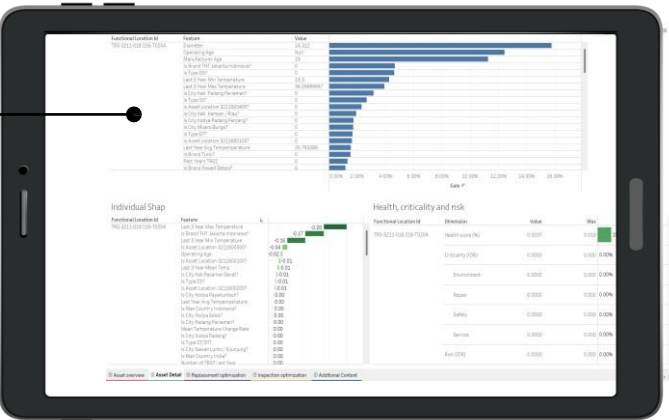**Optimization scenarios comparison, selection and extraction**

CAPEX & OPEX Optimization

CAPEX Optimization

Asset Overview

Geographical distribution of health with the ability to track down the specific asset

Results summary of the model and filters

Selection of generated scenarios

Suggested assets replacements
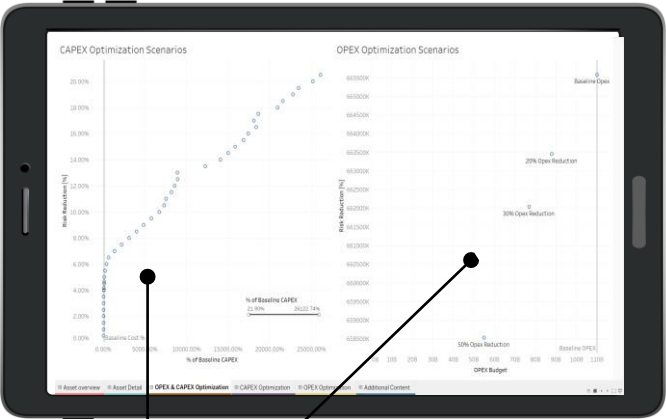
Risk vs cost analyses for several maintenance scenarios

Model detail

OPEX Optimization

Plan KPIs: costs and reliability in baseline vs optimized plan

Results for selected asset, including key drivers, SHAPs, health score and other important info
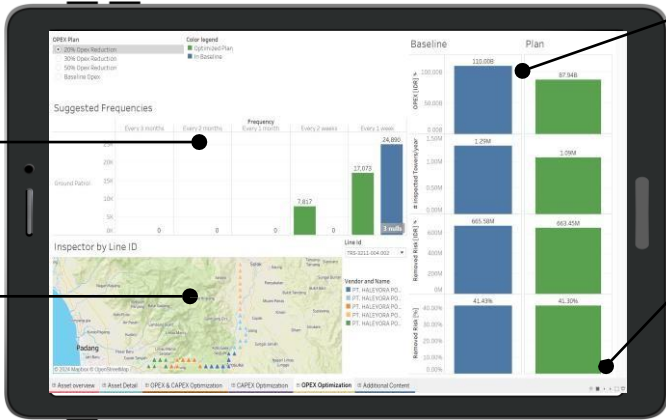
Suggested ground patrols frequency vs baseline plan

Plan can be extracted for its analyses and implementation

Map indicating towers in each ground patrol groups by vendor and name

Source: Tableau dashboards for master data (PST, including structural and weather information)

Source: Copyrights of PT PLN (Persero)

KEY TAKEAWAYS / RECOMMENDATIONS

1. Digitalization in PLN is undergoing digital transformation, which AI/ML use cases are developed to support sustainable, customer-focused, and resilient operations.

2. Identify the Right Use Cases by prioritizing which potential of AI as testbench and initiating next phase : migration to production.

3. Utilities can employ AI capabilities to pinpoint exactly to perform asset inspections, and preventive maintenance

4. Leveraging Data-Driven Insights: PLN strive toward data-driven insights to understand their operations and develop as decision support system.

5. AI use cases in PLN's business processes is prioritized which can promoting the implementation of Smart Grid project for efficiency, reliability and sustainability.

THANK YOU

For discussions/suggestions/queries email: isuw@isuw.in

www.isuw.in

Links/References (If any)