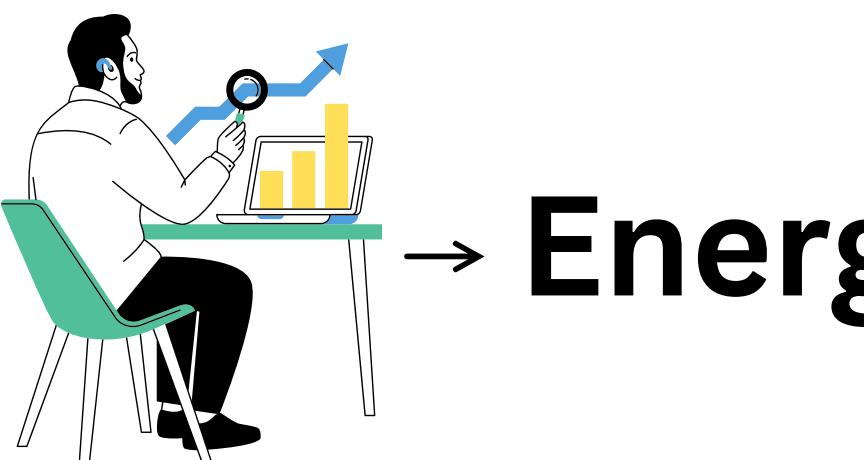


* SECTION C → G-15

DVA- MIDSEM



→ Energy & Power

Atharva Tiwari
Manas Saxena

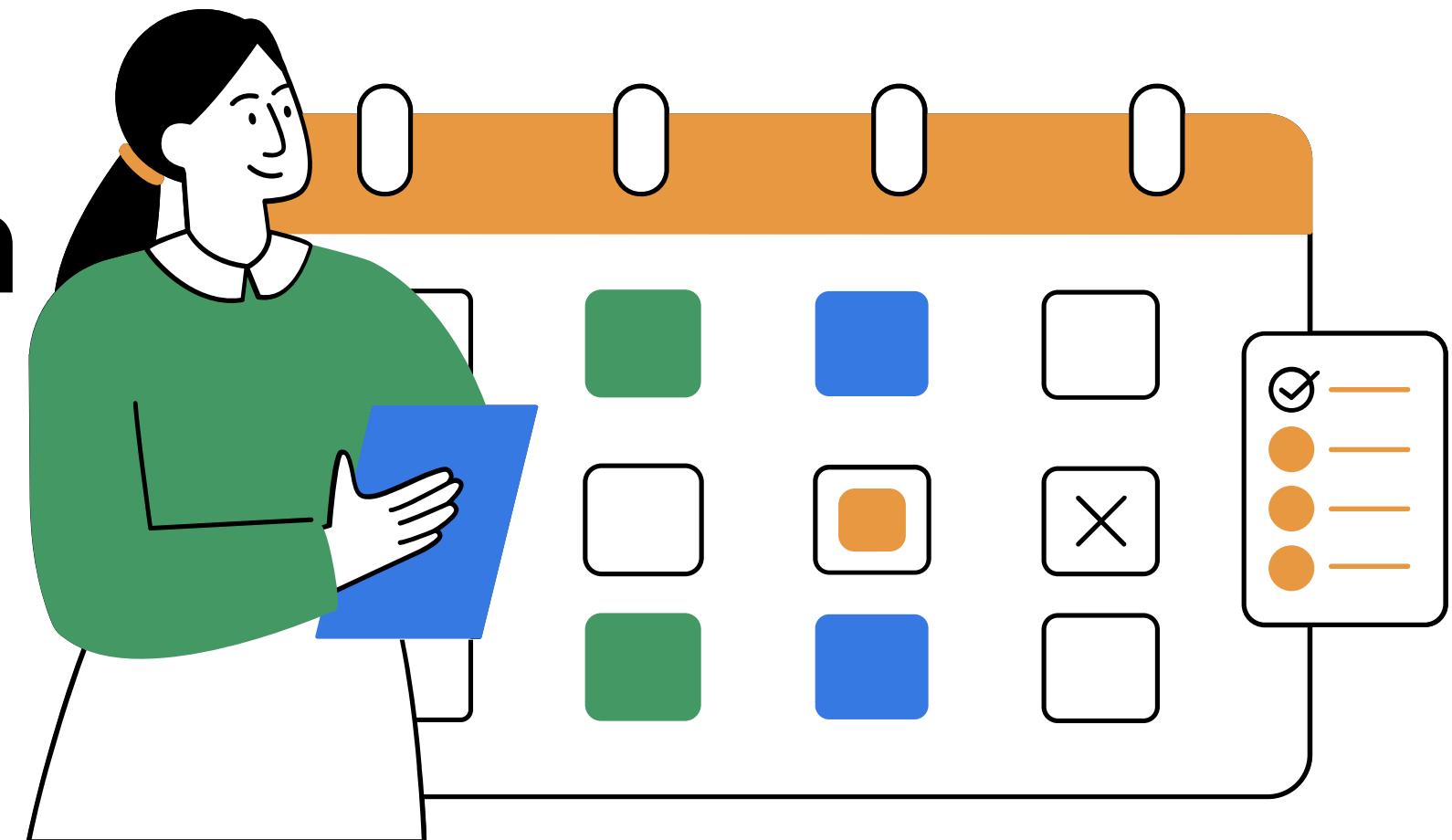
Ronit Singh
Tejas Tyagi



Mentor-Archit Raj



Business Context, Problem Statement & Objective



Sector Context

Coal is a critical resource for power generation, and maintaining adequate stock levels is essential for uninterrupted operations. Decision-makers need visibility into stock sufficiency, coverage duration, and supply dependency to ensure reliable plant performance



Problem Statement

The organization lacks a consolidated analytical view to evaluate whether stock levels meet required benchmarks, how coverage is changing over time, and how frequently operations fall into different risk categories. This results in reactive decision-making and unclear risk exposure.



Objective

To develop a data-driven dashboard that compares stock vs required levels, tracks coverage trends, analyzes dependency patterns, and highlights operational risk categories to support proactive planning and monitoring.



Data Engineering: From Raw Data to Analytical Dataset



Source

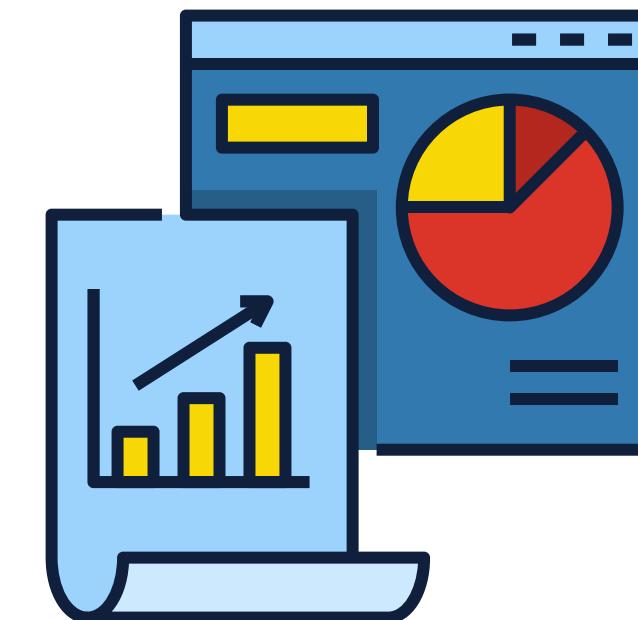
- Coal stock dataset covering plant capacity, total stock, normative requirement, domestic/import supply, and daily consumption across reporting periods (2023–2026).

- Data organized into sheets: Raw Dataset, Cleaning Log, and Cleaned Dataset.



Data Cleaning

- Converted numeric values stored as text into usable formats
- Removed blanks and inconsistencies across records
- Standardized categorical fields (Plant Type, Coal Source)



Feature Engineering

Key variables used:

- Total Stock, Normative Stock, Daily Requirement
- Domestic Stock, Imported Stock

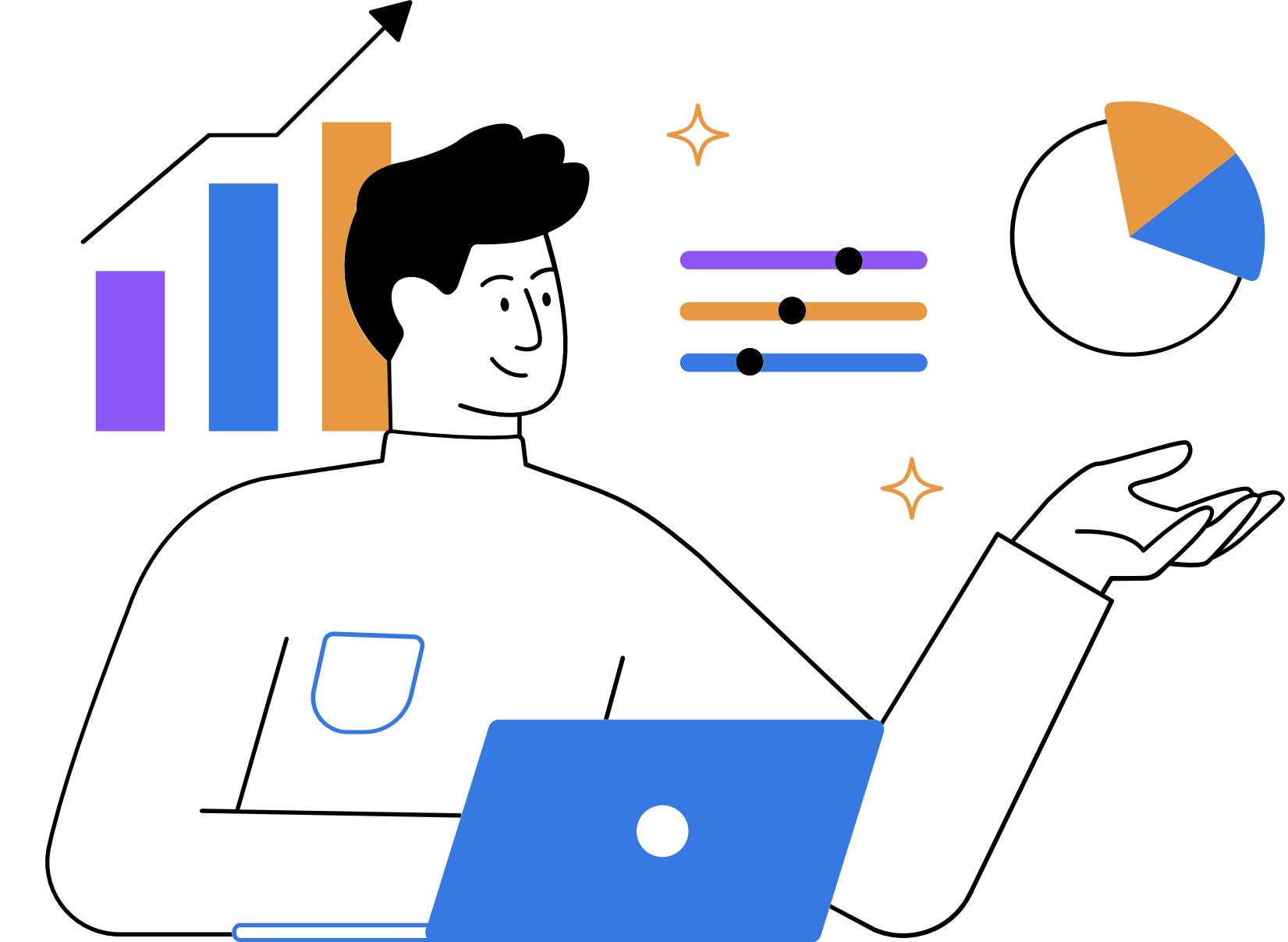
Derived metrics created:

- Stock Surplus / Deficit
- Days of Stock Available
- Dependency Ratios
- Risk Category

Key Performance Indicators

The analysis focuses on evaluating coal stock adequacy and operational stability using the following KPIs:

- Total Coal Stock vs Normative Requirement → Measures whether inventory meets required benchmarks
- Days of Stock Available → Indicates operational coverage duration
- Stock Surplus / Deficit → Identifies shortage or excess conditions
- Domestic vs Import Dependency → Evaluates supply reliance patterns
- Risk Category Distribution → Classifies operational risk levels



KPI & Metrics Framework: Measuring Stock Health and Risk

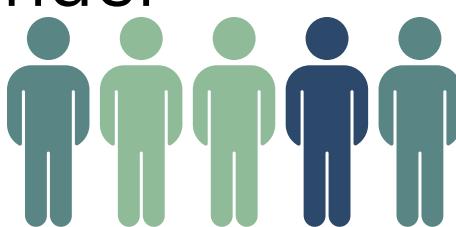
Why These KPIs

- Assessing stock sufficiency against required levels
- Tracking coverage performance over time
- Identifying operational risk exposure
- Supporting proactive inventory planning and monitoring



Key Insights: Exploratory Data Analysis

- Stock levels show significant variation across reporting periods, with multiple instances where total stock falls below normative requirements, indicating potential shortage risk.
- Days of Stock Available are improving each year, indicating better stability, but risk exposure still remains.
- Dependency on domestic coal remains dominant, but imported coal contributes during low-stock situations, indicating reliance on external supply during shortages.
- Risk category distribution reveals frequent moderate-to-high risk days, suggesting that operations are not consistently maintained within safe stock thresholds.
- Year-wise comparison indicates uneven improvement trends, showing that stock adequacy has not stabilized despite changes in supply levels.
- Surplus and deficit patterns highlight inefficiencies in inventory planning, where both under-stocking and over-stocking occur across periods.



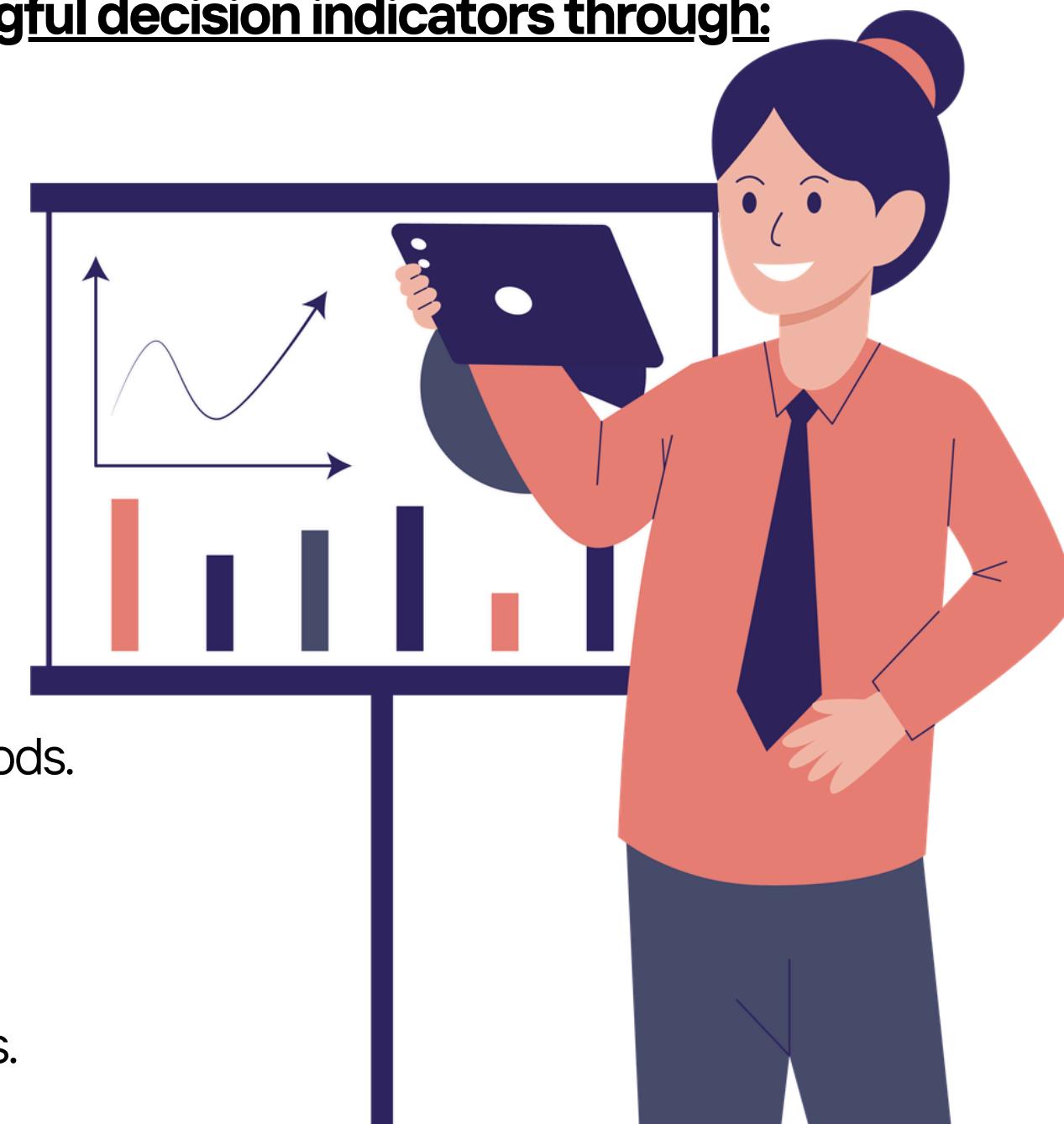
* Advanced Analysis: Risk Classification & Coverage Evaluation Analytical Approach

Advanced analysis was performed by transforming operational metrics into meaningful decision indicators through:

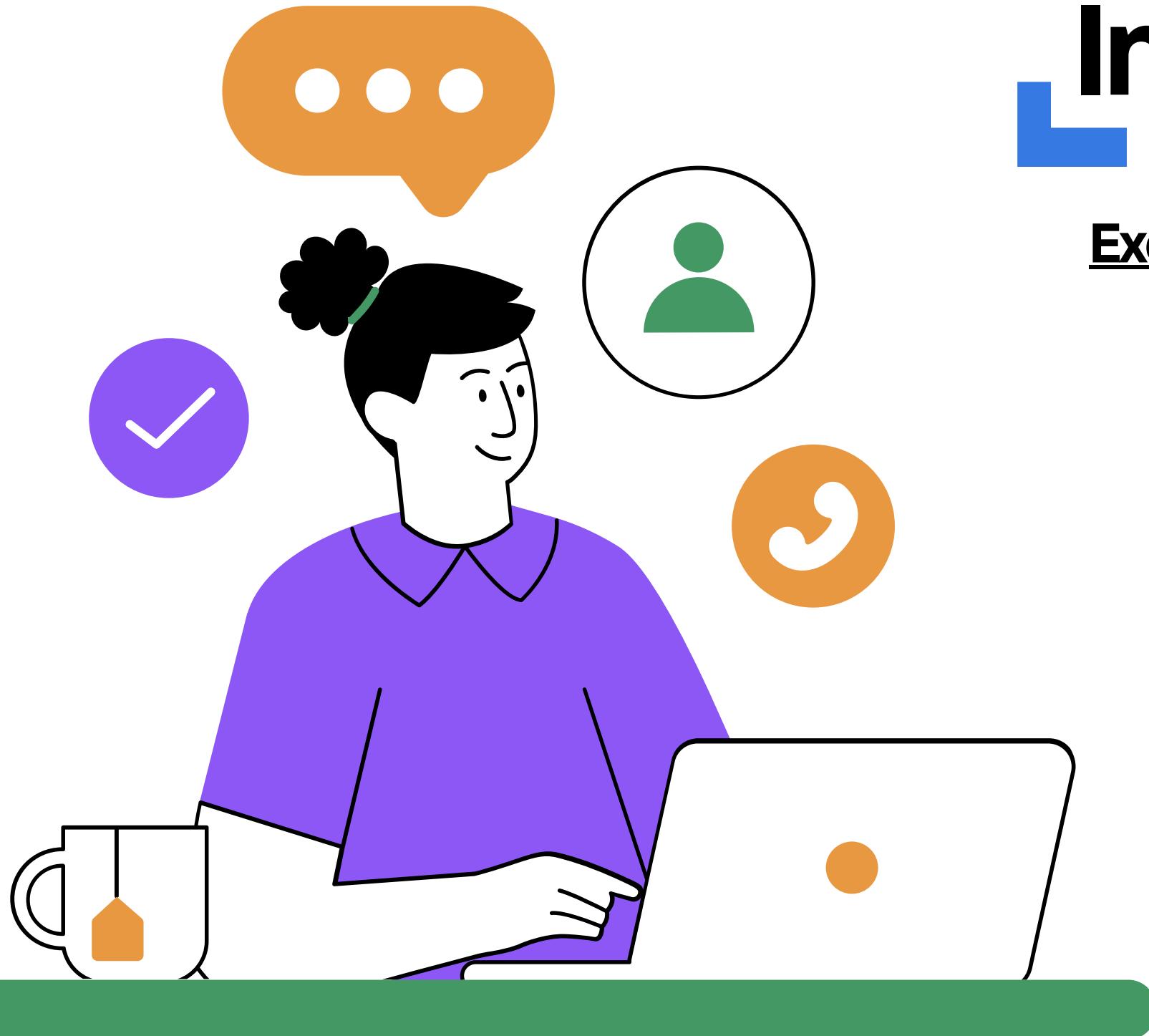
- Risk Category Classification based on stock coverage levels.
- Coverage Trend Analysis using Days of Stock Available over time.
- Dependency Analysis comparing Domestic and Imported coal contribution.

Key Understanding Generated

- Risk categorization enabled clear identification of low, moderate, and high operational risk periods.
- Coverage trend evaluation highlighted fluctuations in stock stability across reporting periods.
- Dependency analysis provided insight into supply reliance patterns during shortage conditions.
- This analysis moved beyond raw data reporting to provide actionable intelligence for operational planning and risk monitoring.



Dashboard Walkthrough: Executive & Operational Insights



Executive View

The dashboard provides a high-level overview of coal stock health through:

- Total Stock vs Normative Requirement comparison across reporting periods
- Days of Stock Available trends to evaluate coverage stability
- Risk Category distribution to understand operational exposure

This view enables quick assessment of whether inventory levels are sufficient and stable.



Operational View

Detailed analysis supports deeper monitoring through:

- Domestic vs Imported Stock contribution analysis
- Surplus and Deficit tracking across periods
- Time-based filtering for performance comparison

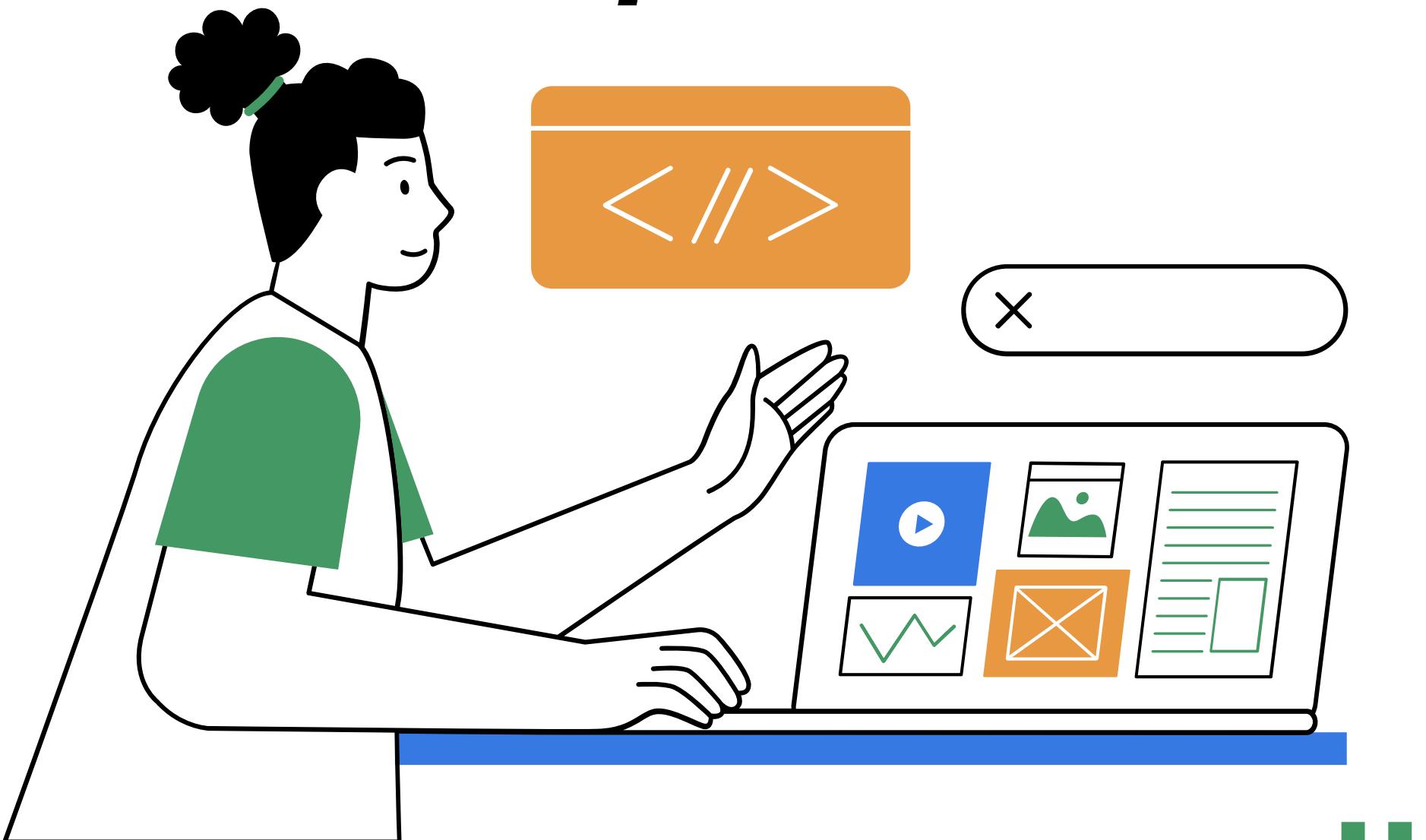
These drill-down capabilities help stakeholders identify specific periods of shortage, dependency changes, and risk fluctuations.

*The dashboard enables data-driven monitoring, faster decision-making, and proactive inventory management.

Recommendations:

Actionable Strategies for

Stock Optimization



Based on the analysis of stock adequacy, coverage trends, and risk distribution, the following recommendations are proposed:

Improve Stock Planning Against Normative Levels

- Ensure inventory levels are consistently aligned with required stock benchmarks to reduce shortage risk.

Strengthen Coverage Monitoring Mechanisms

- Track Days of Stock Available regularly to maintain adequate operational buffer and avoid sudden disruptions.

Optimize Supply Mix Between Domestic and Imported Coal

- Balance dependency to reduce vulnerability during supply fluctuations and logistics delays.

Implement Risk-Based Inventory Alerts

- Use risk category classification to identify moderate and critical periods early and trigger preventive actions.

Adopt Data-Driven Decision Dashboards

- Institutionalize dashboard monitoring for continuous evaluation and proactive planning instead of reactive responses.

***These improvements can further strengthen proactive planning and decision intelligence.**

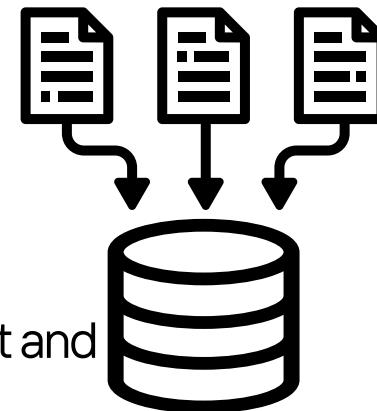


Impact & Value: Business Benefits



Operational Impact

- Improved visibility into stock adequacy vs required levels enables proactive inventory planning.
- Monitoring Days of Coverage helps maintain sufficient operational buffer and avoid shortages.
- Risk classification provides early identification of moderate and critical risk periods.



Efficiency & Decision Value

- Consolidated dashboard reduces manual analysis effort and improves decision speed.
- Year-wise comparison supports better planning and resource allocation.
- Dependency insights enable informed supply strategy adjustments.

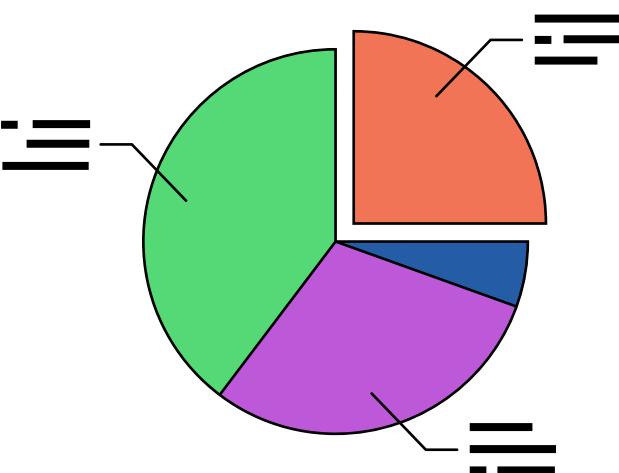
Strategic Value

By enabling data-driven monitoring of stock health, the solution supports:

- Reduced operational disruption risk
- Better inventory utilization
- More reliable supply planning

This provides strong justification for stakeholder adoption and long-term implementation.

*Limitations & Next Steps Limitations



- Analysis is limited to available historical stock and requirement data without external influencing factors such as demand variability, logistics delays, or supply disruptions.
- Risk classification is based primarily on coverage metrics and may not capture all operational uncertainties.
- The dashboard provides monitoring insights but does not include predictive forecasting models.

Next Steps

- Integrate additional data sources such as demand forecasts, transportation timelines, and supply constraints for deeper analysis.
- Implement predictive models to forecast stock shortages and coverage trends.
- Develop automated alerts for critical risk situations to support real-time decision-making.
- Expand the dashboard for plant-level or regional analysis to enhance operational control.



Thank You

SECTION C → G-15

