Digital Egypt Pioneers Initiative - DEPI

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Introduction

This report presents the key performance indicators (KPIs) used to analyze power outage events, assess their impact on customers, and identify critical areas for infrastructure improvement and service response optimization. The analysis focuses on KPIs such as **ImpactScore**, **Outage Risk Index (ORI)**, **Event Severity Index (ESI)**, and other metrics, providing actionable insights to support better decision-making and resource allocation.

Key Performance Indicators (KPIs)

1. ImpactScore

- **Definition:** Measures the overall impact of power outages by calculating the product of demand loss and the number of customers affected.
- **Purpose:** This KPI will help quantify the overall impact of each outage by combining the lost energy (Demand Loss) and the number of customers affected. By evaluating this metric across events, you can assess which outages had the most significant consequences and prioritize preventive actions.
- **Insights:** Consistently high ImpactScores in a region indicate an urgent need for infrastructure upgrades or more reliable systems to mitigate future outages in those areas.
- **Formula:**

$$ImpactScore \ = \ Demand \ Loss \ (MW) \ x \ Number \ of \ Customers \ Affected$$

2. Event Severity Index (ESI)

- **Definition:** Weigh events based on their duration and the number of customers affected to provide a measure of impact.
- **Purpose:** This KPI measures the severity of an outage by weighing both its duration and the number of customers affected. It helps to evaluate how damaging each event was to the grid and the communities.
- **Insights:** High ESI scores can indicate that certain events caused long-lasting service interruptions to a large customer base. Department of Energy (DOE) could use this insight to improve emergency response protocols and shorten recovery times in future outages.
- **Formula:**

$$ESI \ = \ \frac{Duration \ in \ Hours \ x \ Number \ of \ Customers \ Affected}{Total \ of \ Customers \ Affected}$$

3. Outage Risk Index (ORI)

- **Definition:** Assesses the risk of outages in specific areas or regions based on historical data.
- **Purpose:** This KPI helps assess the risk of future outages in specific areas based on historical patterns of events, durations, and customer impact. It's critical for prioritizing areas for resource allocation and system upgrades.
- **Insights:** If ORI is particularly high in certain areas, the Department of Energy (DOE) could focus on reinforcing grid stability there to prevent further disruptions, which would also reduce the associated costs.
- **Formula:**

$$ORI = \frac{Number\ of\ Events\ in\ Region\ x\ Average\ Duration\ x\ Number\ of\ Customers\ Affected}{Total\ Events}$$

4. Energy Loss per Event

- **Definition:** Calculates the average energy lost per event to assess efficiency.
- **Purpose:** This KPI calculates how much energy is lost per outage event. It's useful for assessing the operational efficiency of the power grid and identifying where recovery efforts need improvement.
- **Insights:** If certain types of events or regions exhibit higher energy losses per event, DOE can investigate whether outdated equipment, poor grid design, or delayed responses contribute to the inefficiency.
- **Formula:**

$$Energy\ Loss\ per\ Event = \frac{Total\ Demand\ Loss\ (MW)}{Total\ Number\ of\ Events}$$

5. Total Customers Affected

- **Definition:** Total number of customers impacted by power outages.
- **Purpose:** This KPI gives a clear picture of how many customers were impacted across all events. It helps in understanding the broader community impact of outages.
- **Insights:** A high number of total customers affected across multiple events may indicate that certain regions or customer segments are more vulnerable to outages. This insight can help prioritize grid reinforcements or emergency response plans in areas with a large customer impact.
- **Formula:**

$$Total\ Customers\ Affected = \Sigma Number\ of\ Customers\ Affected$$

6. Average Event Duration

- **Definition:** Measures the average duration of power outages over a defined period.
- **Purpose:** This KPI measures how long outages typically last, which helps in identifying trends related to recovery times and evaluating the performance of recovery teams.
- **Insights:** A longer-than-average Event Duration in a particular region may suggest resource allocation issues, such as insufficient response teams or difficulties accessing affected areas. Addressing these issues can minimize downtime in future outages.
- **Formula:**

$$Average\ Event\ Duration\ =\ \frac{Total\ Duration\ Time}{Total\ \ Number\ of\ Events}$$

7. Total Demand Loss (MW)

- **Definition:** The total amount of demand loss in megawatts during power outages.
- **Purpose:** This KPI sums up the total energy lost across all events, providing a clear view of how much power was disrupted over time.
- **Insights:** A high Total Demand Loss over several years could suggest that certain regions are more prone to larger disruptions, requiring focused investments in improving grid stability or upgrading systems.
- **Formula:**

$$Total\ Demand\ Loss\ (MW)\ =\ \Sigma\ Demand\ Loss\ (MW)$$

8. Number of Events by Type

- **Definition:** Counts the number of events categorized by their type (e.g., natural disasters, operational failures).
- **Purpose:** This KPI categorizes events by type (e.g., natural disasters, operational failures) to identify which types of incidents occur most frequently and cause the most disruption.
- **Insights:** By identifying that operational failures happen more often than natural disasters, DOE could invest more in equipment maintenance and training to reduce these outages.
- **Formula:**

$$Number\ of\ Events\ by\ Type\ =\ Count\ of\ Events\ grouped\ by\ Event\ Type$$

9. Event Frequency by Area

- **Definition:** Tracks the number of events occurring in specific regions over a defined time frame.
- **Purpose:** This KPI tracks the number of outage events across different regions over a specified period, helping to pinpoint areas experiencing repeated disruptions.
- **Insights:** If certain areas show a high Event Frequency, it indicates the need for enhanced grid monitoring, upgrades, or preventive measures to reduce future occurrences.
- **Formula:**

$$Event\ Frequency\ by\ Area\ =\ Count\ of\ Events\ grouped\ by\ Area\ Affected$$