Low Level Design Document

Introduction

This Low Level Design (LLD) document outlines the implementation details for **EcoPulse - Energy Consumption Trends**. The project aims to deliver a Power BI dashboard that visualizes energy consumption trends over time for different regions or facilities, utilizing line and area charts for trend analysis.

---

1. System Components

Component	Description	Key Responsibilities
Data Source	Raw energy consumption data (CSV/DB/API)	Provide historical and current consumption
Data Transformation	Power Query (ETL)	Clean, aggregate, and format data
Data Model	Power BI Data Model	Define tables, relationships, measures
Visualization Layer	Power BI Reports/Dashboards	Render charts, filters, and KPIs
User Interaction	Power BI Slicers/Filters	Enable region/facility/time selection

---

2. Class/Interface Overview

Class/Interface	Description	Key Methods/Attributes
DataIngestor	Loads data into Power BI	`loadData(source)`
DataTransformer	Cleans and aggregates data	`cleanData()`, `aggregateByRegion()`, `aggregateByFacility()`, `calculateTrends()`
DataModel	Defines schema and relationships	`Region`, `Facility`, `Date`, `Consumption`
TrendVisualizer	Renders charts in Power BI	`renderLineChart()`, `renderAreaChart()`
FilterController	Manages user filters/slicers	`applyRegionFilter()`, `applyDateFilter()`

---

3. Data Structure Overview

Table/Entity	Fields/Attributes	Description
Consumption	Date, Region, Facility, ConsumptionValue (kWh)	Main fact table for energy data

Region	RegionID, RegionName	Lookup for regions
Facility	FacilityID, FacilityName, RegionID	Lookup for facilities
Date	Date, Year, Month, Day	Date dimension for time-based analysis

---

4. Algorithms/Logic

Data Transformation & Trend Calculation (Pseudocode):

```
For each record in Consumption:
    Validate and clean data fields
    Map Facility to Region
    Aggregate ConsumptionValue by [Date, Region, Facility]
    Calculate moving average/trend as needed
```

Visualization Logic:

- Use Power BI to create:
  - Line chart: X-axis = Date, Y-axis = ConsumptionValue, Legend = Region/Facility
  - Area chart: Same as above for cumulative/stacked trends
- Enable slicers for Region, Facility, and Date

---

5. Error Handling

Scenario	Handling Approach
Missing/Corrupt Data	Exclude from analysis, log issue in Power Query
Data Source Unavailable	Display error message in dashboard
Invalid User Filter Selection	Show “No Data Available” message
Data Type Mismatch	Attempt conversion, else flag in data view

---

End of Document