Solar Performance Analysis- Database Documentation

1. Introduction

This document provides detailed information about the Solar Data Analysis Database. It includes an overview of the database schema, table descriptions, relationships, and instructions for importing and using the database.

2. Database Overview

- Database Name: solar_analysis
- Purpose: Stores solar performance data for three sites, supporting analysis of energy generation, power factor trends, and system health. It contains 3 tables for 3 sites and one sites_metadata table for storing metadata.
- Structure:
    - The database contains cleaned tables with normalized data for energy analysis.
    - Tables are designed to enable efficient querying and reporting.

3. Tables and Schema

Table Name	Description
solar_data_site1	Contains energy and system metrics for Site 1.
solar_data_site2	Contains energy and system metrics for Site 2.
solar_data_site3	Contains energy and system metrics for Site 3.
site_metadata	Metadata about the sites

4. Table Descriptions

- site1_data (example):
    - Purpose: Stores energy and system data for Site 1.
    - Columns:

Column Name	Data Type	Description
indregTC1_timestamp	TIMESTAMP	Date and time of record.
indregTC1_Energy_kWh_sum	FLOAT	Energy generated in kWh.
indregTC1_Voltage_LL_V_avg	FLOAT	Voltage at the site (in volts).
indregTC1_Power_Factor_avg_avg	FLOAT	Power factor during the timestamp.

- site_metadata:
    - Purpose: Stores site-specific information.
    - Columns:

Column Name	Data Type	Description
site_id	SERIAL	Unique identifier for the site.
site_name	VARCHAR	Name of the site.

5. Relationships

- The database uses foreign keys to link data:
    - site_metadata.site_id is referenced in each site's data table to link site details to their respective metrics.
    - Example: solar_data_site1.site_id → site_metadata.site_id.
- The database uses uses primary key as ‘timestamp’ column for all 3 site tables.

6. Import Instructions (using pgAdmin)

- Open pgAdmin and connect to your server.
- Right-click the target database where you want to restore the dump.
- Select Restore from the context menu.
- In the dialog box:
    - Choose Restore options > Format: Custom.
    - Browse and select the solar_analysis_dump file.
- Click Restore.

7. Query Examples

- Query 1: Total energy of all sites

```
SELECT sm.site_name AS site,
    SUM(sd.energy_sum) AS total_energy
FROM site_metadata sm
LEFT JOIN (
  SELECT 1 AS site_id, "indregTC1_Energy_kWh_sum" AS energy_sum FROM solar_data_site1
  UNION ALL
  SELECT 2 AS site_id, "indregTC2_Energy_kWh_sum" AS energy_sum FROM solar_data_site2
  UNION ALL
  SELECT 3 AS site_id, "indregTC3_Energy_kWh_sum" AS energy_sum FROM solar_data_site3
) sd ON sm.site_id = sd.site_id
GROUP BY sm.site_name
ORDER BY sm.site_name;
```

- Query 2: Average power factor of all sites

```
SELECT sm.site_name AS site,
    AVG(sd.power_factor_avg) AS avg_power_factor
FROM site_metadata sm
LEFT JOIN (
  SELECT 1 AS site_id, "indregTC1_Power_Factor_avg_avg" AS power_factor_avg FROM solar_data_site1
  UNION ALL
  SELECT 2 AS site_id, "indregTC2_Power_Factor_avg_avg" AS power_factor_avg FROM solar_data_site2
  UNION ALL
  SELECT 3 AS site_id, "indregTC3_Power_Factor_avg_avg" AS power_factor_avg FROM solar_data_site3
) sd ON sm.site_id = sd.site_id
GROUP BY sm.site_name
ORDER BY sm.site_name;
```

- Query 3: Hourly energy generated by all sites

```
SELECT sm.site_name AS site,
    sd.hour,
    SUM(sd.hourly_energy) AS hourly_energy
FROM site_metadata sm
LEFT JOIN (
  SELECT 1 AS site_id, DATE_PART('hour', "indregTC1_timestamp") AS hour, "indregTC1_Energy_kWh_sum" AS hourly_energy FROM solar_data_site1
  UNION ALL
  SELECT 2 AS site_id, DATE_PART('hour', "indregTC2_timestamp") AS hour, "indregTC2_Energy_kWh_sum" AS hourly_energy FROM solar_data_site2
  UNION ALL
  SELECT 3 AS site_id, DATE_PART('hour', "indregTC3_timestamp") AS hour, "indregTC3_Energy_kWh_sum" AS hourly_energy FROM solar_data_site3
) sd ON sm.site_id = sd.site_id
GROUP BY sm.site_name, sd.hour
ORDER BY sm.site_name, sd.hour;
```