**SDG Selection**

* **SDG Chosen**: SDG 7: Affordable and Clean Energy
* **Rationale**: SDG 7 aims to ensure access to affordable, reliable, sustainable, and modern energy for all. Energy is a crucial enabler of economic growth, social development, and environmental sustainability. However, access to clean and affordable energy remains a significant challenge, particularly in rural and remote areas of many developing countries. Addressing this goal is vital as it directly impacts health, education, and economic opportunities, reducing inequalities and driving sustainable development.

**Step 2: Problem Definition**

* **Specific Problem**: Unequal access to clean energy in rural areas, leading to a reliance on non-renewable and harmful energy sources such as kerosene, firewood, and charcoal.
* **Problem Significance**:
  + **Health Impacts**: The use of non-renewable energy sources, such as kerosene and firewood, produces indoor air pollution, leading to respiratory illnesses and other health issues.
  + **Environmental Impacts**: Reliance on firewood and charcoal contributes to deforestation, environmental degradation, and increased carbon emissions.
  + **Economic Impacts**: High costs associated with non-renewable energy sources place a financial burden on low-income households. The lack of reliable energy access also limits opportunities for income-generating activities.
  + **Educational Impacts**: Insufficient lighting and power sources impact students' ability to study in the evenings, affecting educational outcomes.
* **Objective**: To use data-driven approaches to identify gaps in clean energy access, analyze the factors contributing to these disparities, and propose targeted solutions that can improve energy accessibility and affordability for rural households.

**Data Requirements**

To effectively address the problem of unequal access to clean energy, the following data is required:

* **Population and Demographic Data**:
  + Details on population size, distribution, and demographics of rural areas, including income levels and household sizes. This data helps in understanding the scale of the energy access challenge and tailoring solutions to specific community needs.
* **Current Energy Sources and Usage Patterns**:
  + Information on the types of energy sources currently used by households, such as kerosene, firewood, solar, or wind. Data on daily energy consumption, cost of energy, and availability of different energy sources in rural areas.
* **Cost, Accessibility, and Availability of Clean Energy Solutions**:
  + Data on the cost, accessibility, and availability of clean energy solutions, such as solar panels, wind turbines, and other renewable energy technologies. This includes data on government incentives, subsidies, and market prices for clean energy technologies.
* **Impact Metrics**:
  + Data on health outcomes related to energy use (e.g., incidence of respiratory diseases), educational impacts (e.g., hours of study enabled by clean lighting), and economic impacts (e.g., savings from using cheaper energy sources or income from energy-dependent businesses). These metrics will help assess the broader impact of energy access on the community.

**Database Design**

**Design an Entity-Relationship Diagram (ERD)**

* **Entities**:
  + **Households**: Household\_ID, Location, Household\_Size, Income\_Level.
  + **Energy\_Sources**: Source\_ID, Source\_Type (e.g., Solar, Wind, Kerosene), Cost, Availability.
  + **Energy\_Usage**: Usage\_ID, Household\_ID, Source\_ID, Daily\_Usage (kWh), Monthly\_Cost.
  + **Impact\_Assessment**: Assessment\_ID, Household\_ID, Health\_Impact, Education\_Impact, Economic\_Impact.

**Create Database Schema**

CREATE TABLE Households (

Household\_ID INT PRIMARY KEY,

Location VARCHAR(255),

Household\_Size INT,

Income\_Level VARCHAR(50)

);

CREATE TABLE Energy\_Sources (

Source\_ID INT PRIMARY KEY,

Source\_Type VARCHAR(50),

Cost DECIMAL(10, 2),

Availability BOOLEAN

);

CREATE TABLE Energy\_Usage (

Usage\_ID INT PRIMARY KEY,

Household\_ID INT,

Source\_ID INT,

Daily\_Usage DECIMAL(10, 2),

Monthly\_Cost DECIMAL(10, 2),

FOREIGN KEY (Household\_ID) REFERENCES Households(Household\_ID),

FOREIGN KEY (Source\_ID) REFERENCES Energy\_Sources(Source\_ID)

);

CREATE TABLE Impact\_Assessment (

Assessment\_ID INT PRIMARY KEY,

Household\_ID INT,

Health\_Impact VARCHAR(255),

Education\_Impact VARCHAR(255),

Economic\_Impact VARCHAR(255),

FOREIGN KEY (Household\_ID) REFERENCES Households(Household\_ID)

);

**Step 6: Populate Database with Sample Data**

* Insert sample data into your tables:

sql

INSERT INTO Households (Household\_ID, Location, Household\_Size, Income\_Level)

VALUES (1, 'Village A', 5, 'Low');

INSERT INTO Energy\_Sources (Source\_ID, Source\_Type, Cost, Availability)

VALUES (1, 'Solar', 100.00, TRUE);

INSERT INTO Energy\_Usage (Usage\_ID, Household\_ID, Source\_ID, Daily\_Usage, Monthly\_Cost)

VALUES (1, 1, 1, 3.5, 50.00);

INSERT INTO Impact\_Assessment (Assessment\_ID, Household\_ID, Health\_Impact, Education\_Impact, Economic\_Impact)

VALUES (1, 1, 'Reduced respiratory issues', 'Improved study time', 'Lower energy costs');

**Part 3: SQL Programming**

**Step 7: Data Retrieval**

* Write SQL queries to retrieve relevant data:

-- Retrieve all households using non-renewable energy sources

SELECT H.Household\_ID, H.Location, ES.Source\_Type

FROM Households H

JOIN Energy\_Usage EU ON H.Household\_ID = EU.Household\_ID

JOIN Energy\_Sources ES ON EU.Source\_ID = ES.Source\_ID

WHERE ES.Source\_Type NOT IN ('Solar', 'Wind');

**Step 8: Data Analysis**

* Perform analysis to generate insights:

-- Analyze the impact of clean energy on households

SELECT H.Location,

COUNT(H.Household\_ID) AS Number\_of\_Households,

AVG(EU.Monthly\_Cost) AS Avg\_Monthly\_Cost,

SUM(CASE WHEN IA.Health\_Impact = 'Reduced respiratory issues' THEN 1 ELSE 0 END) AS Improved\_Health

FROM Households H

JOIN Energy\_Usage EU ON H.Household\_ID = EU.Household\_ID

JOIN Impact\_Assessment IA ON H.Household\_ID = IA.Household\_ID

GROUP BY H.Location;