CS 340

Project Step 1

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Project proposal for a Global Energy Accessibility Database

The Global Energy Accessibility Database (GEAD) aims to address the issue of information fragmentation and lack of comprehensive data regarding energy usage and accessibility across the globe. Currently, data on energy types, providers, and consumers, particularly at the city or town level, are scattered across various sources making it difficult for policymakers, researchers, and energy companies to get a holistic view of energy distribution and consumption. By consolidating this information into a single, structured database, GEAD can provide insights into energy consumption patterns, availability of different energy types, and the capacity of providers in various regions. This could help in identifying energy accessibility gaps, planning for infrastructure development, creating effective energy policies, and strategizing for more equitable energy distribution, ultimately contributing to the global efforts towards sustainable and accessible energy for all. GEAD would track the *Energy\_Types* distributed by 350 *Providers* to over 14,000 municipal *Consumers* spanning more than 100 *Countries* worldwide.

Here is an outline of the database:

**Countries**: Records details about different countries around the world.

* *countryID*: int, auto\_increment, unique, not NULL, PK. This is the unique identifier for each country.
* *countryName*: varchar, unique not NULL. The official name of the country.
* *globalRegion*: varchar, not NULL. The geographical region in which the country is located.
* *population*: bigint, not NULL. The total population of the country.
* *currencyID*: int, not NULL, FK. Unique identifier of national currency -- points to Currencies table.
* *GDP*: decimal, not NULL. The Gross Domestic Product of the country in national currency.
* Relationships: A 1:M relationship with both the Consumers and Providers entities. 1:1 relationship with Currencies.

**Energy\_Types**: Stores data about different forms of energy being used (solar, wind, coal, nuclear, etc.).

* *energyTypeID*: int, auto\_increment, unique, not NULL, PK. A unique identifier for each type of energy.
* *energyName*: varchar, not NULL. The name of the type of energy.
* *description*: text, not NULL. A brief description of the energy type.
* *emissionsRate:* int, not NULL. Tonnes of CO2 - equivalent emissions per gigawatt-hour at average power plant.
* *deathRate*: decimal, not NULL. Death rate from accidents and pollution per terawatt-hour of production.
* Relationships: Two M:N relationships the Providers entity -- one through the Provided\_Energy intersection table and one through the Provider\_Energy\_Type intersection table -- and a M:N relationship with the consumers entity.

**Consumers**: Records data about energy consumers, represented as local municipalities.

* *consumerID*: int, auto\_increment, unique, not NULL, PK. A unique identifier for each municipality.
* *municipality*: varchar, not NULL. The name of the municipality.
* *population*: bigint, not NULL. The population of the municipality.
* *countryID*: int, not NULL, FK. The identifier for the country in which the municipality is located.
* *region*: varchar, not NULL. The region in which the municipality is located.
* *annualConsumption*: decimal, not NULL. The total energy consumed by the municipality each year in MW\*h.
* *annualSpending*: decimal, not NULL. The total money spent on energy by the municipality each year in local currency.
* *currencyID*: int, not NULL, FK. Unique identifier of national currency -- points to Currencies table.
* *totalProviders*: int, not NULL. The total number of energy providers serving the municipality.
* Relationships: A M:N relationship with the Providers entity, and M:N relationship with the Energy\_Types entity, both through the Provided\_Energy intersection tables. An additional M:N relationship with the Energy\_Types table through the Consumed\_Energy table. The former intersection represents an yearly transactions with a specific energy type, and the latter the multiple energy types each provider has potential to supply.

**Providers**: Contains information about energy providers.

* *providerID*: int, auto\_increment, unique, not NULL, PK. A unique identifier for each provider.
* *providerName*: varchar, not NULL. The name of the provider.
* *orgType*: varchar, not NULL. The type of the provider (public, private, cooperative, etc.).
* *countryID*: int, not NULL, FK. The identifier for the country in which the provider is located.
* *energyTypeID*: int, not NULL, FK. The identifier for the type(s) of energy provided.
* *capacity*: decimal, not NULL. The total energy output capacity of the provider in megawatts (MW) for a given point in time..
* Relationships: A M:N relationship with the Consumers and Energy\_Types entities through the Provided\_Energy intersection table, and a M:N relationship with the Energy\_Types through the Provider\_Energy\_Types table.

**Currencies**: Contains up-to-date information about currencies used in energy provision transactions.

* *currencyID:* int, auto\_increment, unique, not NULL, PK. A unique identifier for each currency.
* *currencyName*: varchar, unique, not NULL. Name of currency.
* *exchangeRate*: decimal, not NULL. Value of base unit in USD.
* relationships: 1:M with Countries. A country will have one national currency, but a currency can be used in multiple countries.

**Provider\_Energy\_Type** (intersection table): Records a type of energy provided by the provider.

* *providerID*: int, not NULL, FK. The identifier for the Provider providing energy type.
* *energyTypeID*: int, not NULL, FK. The identifier for the energy type.
* Relationships: Implements the M:N relationship between Providers and Energy\_Types, as a provider can have multiple energy types, and each energy type has multiple providers.

**Provided\_Energy (Intersection Table)**: Records the provision of Energy\_Type from Providers to Consumers.

* *providerID*: int, not NULL, FK. The identifier for the Provider supplying the energy.
* *consumerID*: int, not NULL, FK. The identifier for the municipality consuming the energy.
* *energyTypeID*: int, not NULL, FK. The identifier for the Energy\_Type provided.
* *currencyID*: int, not NULL, FK. identifier pointing to the used currency type in Currencies table.
* *year*: int, not NULL. The year of recorded provision.
* *totalProvisionForYear*: decimal, not NULL. The amount of energy (MW\*h) provided in specified year.
* *costForYear:* decimal, not NULL. The total annual cost of the provision in used currency.
* Relationships: Serves to implement the M:N relationship between the Providers, Energy\_Types, and Consumers entities. This allows for tracking of which providers supply energy to which consumers, the type of energy, the amount provided, and the cost for a given year.

**Consumed\_Energy (Intersection Table)**: Records the consumption of an energy type between Consumers and Energy\_Types entities.

* *consumerID*: int, not NULL, FK. The identifier for the municipality consuming the energy.
* *energyTypeID*: int, not NULL, FK. The identifier for energy type consumed.
* *currencyID*: int, not NULL, FK. identifier pointing to the used currency type in Currencies table.
* *year*: int, not NULL. The year of recorded provision.
* *totalConsumptionForYear*: decimal, not NULL. The amount of energy (MW\*h) provided in specified year.
* *costForYear:* decimal, not NULL. The total annual cost of the provision in used currency.
* Relationships: Serves to implement the M:N relationship between the Consumers and Energy\_Types tables. Represents a Consumer's consumption of a specific energy type, possible from multiple providers, for a given year.