

**Team members:**  
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### **Feedback by the peer reviewer**

(Highlighted portions responded to below)

- Does the overview describe what problem is to be solved by a website with DB back end?
  - I really enjoy the topic/problem you have decided to address with your DB! The problem is well described and how the DB will solve it is clear.
- Does the overview list specific facts?
  - The overview lists clear facts
- Are at least four entities described and does each one represent a single idea to be stored as a list?
  - Yes, there are at least 4 entities each representing a single idea to be stored as a list.
- Does the outline of entity details describe the purpose of each, list attribute data types and constraints and describe relationships between entities?
  - Purpose of each entity is listed
  - Attributes with constraints are listed
  - Relationships between entities are listed
- Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database?
  - 1:M are correct
  - At least one M:M
- Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?
  - I am unsure if this is required, but I may make your intersection tables plural. It could be just the normal Entity tables that need this but just in case especially because you add other attributes other than the FKs.
  - All attributes are singular

- Capitalization is consistent
- Other:
  - Question: Is the Sust\_Rating attribute under the Energy\_Types entity a descriptive rating? I would assume it would be a number so an INT rather than VARCHAR rating so maybe specify the rating system (this is just nitpicky btw, I was just wondering how things are rated)
  - You might consider adding a “Year” attribute under Consumed\_Energy and Provided\_Energy tables as you mention “Annual\_Cost” and “Annual\_Amount” unless this is an average value rather than per year. Basically what I'm asking is are you recording Consumed\_Energy and Provided\_Energy per year for each Consumer or just once but updating the average consumption annually as the figures are provided? Furthermore, for Consumers, is Annual\_Consumption an average or is this for one specific year? Just something to think about.

*Does the overview describe what problem is to be solved by a website with DB back end?*

- The summary is extremely descriptive and detailed, covering the problems of “information fragmentation” and energy usage/accessibility and how leveraging a structured database and web application can help overcome these issues.

*Does the overview list specific facts?*

- Yes the overview lists specific facts (350 energy providers, 14,000 customer, and 100 countries). In short, the scope and scale of the project is well-documented and thought out.

*Are at least four entities described and does each one represent a single idea to be stored as a list?*

- Yes, there are four entities (Countries, Providers, Consumers and Energy\_Types). Each entity is distinct in its reach and necessary to the overall implementation of the project.

*Does the outline of entity details describe the purpose of each, list attribute data types and constraints and describe relationships between entities?*

- Yes the outline clearly illustrates the entities, their details, attributes, constraints and relationships. It is thorough in its description and reflects effort and time drafting the project. As an aside, and not sure this entirely matters for the outline, you have ordering and syntax like “int, FK, not Null.” When it should be INT, not Null, FK. That is, data type, constraints and then key reference.

*Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database?*

- There are two listed M:M relationships and the ERD presents a logical view of the database, with well thought out intersection tables. As far as the 1:M relationships are formulated, while the formulation appears correct, the one question I did have was the implementation of energy types to providers 1:M. That is, I could envision an energy provider having natural gas and oil,

or solar and wind, etc. In that sense, it seems to lend itself to “there are many providers, and each provider can supply many types of energy). My understanding may be incorrect with how you will implement the DB, but maybe some clarification on that would benefit the outline.

*Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?*

There is consistency in naming between overview and entity/attributes. Entities are plural and capitalized as instructed, and all attributes are singular. However, the attributes are also capitalized and use snake case. I realized upon review that the module SQL FAQ asked us to use camelCase and lowercase, just a heads up!

- \* Does the overview describe what problem is to be solved by a website with DB back end?
  - \* Your idea is very well thought out, I enjoyed reading it! I have nothing I can think of to improve it aside from one note I have listed under the other section.
- \* Does the overview list specific facts?
  - \* There are specific facts throughout and they are very well defined.
- \* Are at least four entities described and does each one represent a single idea to be stored as a list?
  - \* Yes
- \* Does the outline of entity details describe the purpose of each, list attribute data types and constraints and describe relationships between entities?
  - \* Purpose of each entity is listed
  - \* Attributes with constraints are listed
  - \* Relationships between entities are listed
- \* Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database?
  - \* 1:M relationships are correct
  - \* There is at least one M:M relationship present
- \* Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?
  - \* Entities are plural
  - \* Attributes are singular
  - \* Capitalization and naming are consistent
- \* Other:
  - \* Will this database only cover a year's worth of data or will it be expanded? If so, maybe a year attribute should be added so things can be tracked per annum over multiple years. Other than that your draft looks fantastic!

Very interesting idea - praises sent your way on thinking of a unique concept to use for your database!

The overview provides a concise and accurate overview of the problem will solve for - by providing a single back-end DB to review and analyze different energy consumption patters from different countries of the world. The project team also did a thorough job of painting a picture of what could be gleaned from this database and how others could benefit in the long run. The overview listed specific facts the scope of countries, providers, and consumers that was helpful for the reader to understand how expansive this project could be and the size of the entities.

Four entities were provided and clearly explained. The associated attributes also make sense in relation to the related Entity.

Overall, superb job on the outline as you explained the purpose, attributes, constraints, and relationships. Below are my comments on the outline of entities:

### **Countries:**

- **Country\_Name:** *Should this be classified as unique as to ensure a country is not entered in accidentally as duplicate, making it difficult to establish which is the "real" country?*

### **Energy\_Types:**

- **Sust\_Rating:** *Is this going to be a numerical or alphabetical rating? It may be difficult to sort or rank if it is varchar (string) and they are stored as numbers (0-100, %...). If it is an authoritative sustainability standard, will it be universal across countries or will it be dependent on individual countries or coalitions they are a part of?*

### **Consumers:**

- **Municipality:** *How will you determine on what scale to measure and/or if the area will overlap (such as a town or city; Austin, TX & Cedar Park Tx. : 2 separate areas but Austin is used to capture the larger metro areas including Cedar Park)*
- **Annual\_Consumption:** *What unit of measurement will this be?*
- **Annual\_Spending:** *What unit will this be given the expanse of countries? Will there be some converted base used to compare various countries & currencies?*

### **Providers:**

- **Capacity:** *What unit will this be measured in?*

### **ERD Diagram Feedback:**

There are no 1:Many relationships, and numerous 1:M & M:M relationships; see below for comments. A logical view is present for the ERD Diagram.

### **Countries & Providers:**

- *The relationship is stated 1 to many, and the ERD diagram shows 1 to many. Should this be many to many if a provider can expand multiple countries, or will each provider have an account specific to the country they service? Ex: Repsol serves UK, Spain, Brazil, and Libya among others (Repsol may not be the best example - but wanted to provide something tangible).*

### Providers & Energy\_Types:

- *The relationship is stated 1 to many, and the ERD diagram shows 1 to many. Should this be many to many if a provider can expand multiple energy types, or will each provider have an account specific to the country they service? Ex: Shell offers petroleum, wind, solar, and hydrogen (Shell may not be the best example - but wanted to provide something tangible).*

### Providers to Consumers:

- *No feedback - great job!*

### Consumers to Energy\_Types:

- *No feedback - great job!*

The ERD diagram and naming convention follows database requirements and guidelines - no issues from my observation on capitalization, spacing, or consistency. Way to go on keeping information clear and easy to decipher.

Really cool project! Appreciate the opportunity to review the draft - feel free to push back on feedback about the various entities and attributes if they don't fully fit in the scope or mechanics of the database goal.

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### Actions based on the feedback

- "I am unsure if this is required, but I may make your intersection tables plural. It could be just the normal Entity tables that need this but just in case especially because you add other attributes other than the FKs."
  - We did so in our revision.
- "Question: Is the Sust\_Rating attribute under the Energy\_Types entity a descriptive rating? I would assume it would be a number so an INT rather than VARCHAR rating so maybe specify the rating system (this is just nitpicky btw, I was just wondering how things are rated)"
- "Sust\_Rating: Is this going to be a numerical or alphabetical rating?"
  - To address these points, we replaced Sust\_Rating with emissionsRate and deathRate, both quantifiable and descriptive.
- "You might consider adding a "Year" attribute under Consumed\_Energy and Provided\_Energy tables as you mention "Annual\_Cost" and "Annal\_Amount" unless this is an average value rather than per year"
- "Will this database only cover a year's worth of data or will it be expanded?"
  - We implemented a "year" attribute into these two tables and plan to record one consumption and one provision transaction per year.

- you have ordering and syntax like “int, FK, not Null.” When it should be INT, not Null, FK. That is, data type, constraints and then key reference.
    - We fixed this as recommended.
  - "one question I did have was the implementation of energy types to providers 1:M. That is, I could envision an energy provider having natural gas and oil, or solar and wind, etc."
  - **"Providers & Energy\_Types:** The relationship is stated 1 to many, and the ERD diagram shows 1 to many. Should this be many to many if a provider can expand multiple energy types, or will each provider have an account specific to the country they service?"
    - We implemented a M:N relationship between Providers and Energy\_Types to address this.
  - "attributes are also capitalized and use snake\_case"
    - Per convention, we switched all attributes to camelCase.
  - "Country\_Name: Should this be classified as unique"
    - Yes. Done.
  - "How will you determine on what scale to measure and/or if the area will overlap"
    - A fair question, but we feel this will not be an issue since we are tracking energy use per *municipality*, the entity which most often coordinates energy provision for an area. It's not a perfect approach, but it should result in the least amount of overlap.
  - "Annual\_Consumption: What unit of measurement will this be?"
  - "Capacity: What unit will this be measured in?"
    - In all descriptions of energy amounts, we have included the appropriate watt and watt-hour units.
  - "Annual\_Spending: What unit will this be given the expanse of countries? Will there be some converted base used to compare various countries & currencies?"
    - We've addressed this by creating a Currencies table which functions as a conversion hub for the local currency used in each transaction.
  - **"Countries & Providers:** The relationship is stated 1 to many, and the ERD diagram shows 1 to many. Should this be many to many if a provider can expand multiple countries, or will each provider have an account specific to the country they service?"
    - This is a good point, but for the sake of reducing complexity, we will treat multinational providers as separate providers for each country in which they operate: i.e. Shell Spain, Shell Italy, etc.
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## Upgrades to the Draft version

We did not implement any upgrades that were not based on feedback.

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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, unique, not NULL. The geographical region in which the country is located.
- *population*: bigint, not NULL. The total population of the country.
- *gdp*: decimal, not NULL. The Gross Domestic Product of the country in national currency.
- *currencyID*: int, not NULL, FK. Unique identifier of national currency -- points to Currencies table.
- 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.

- *emissionsRate*: int, not NULL. Tonnes of CO<sub>2</sub> - 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.
- *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.
- *totalProviders*: int, not NULL. The total number of energy providers serving the municipality.
- *countryID*: int, not NULL, FK. The identifier for the country in which the municipality is located.
- *currencyID*: int, not NULL, FK. Unique identifier of national currency -- points to Currencies table.
- 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.
- 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 Types (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.

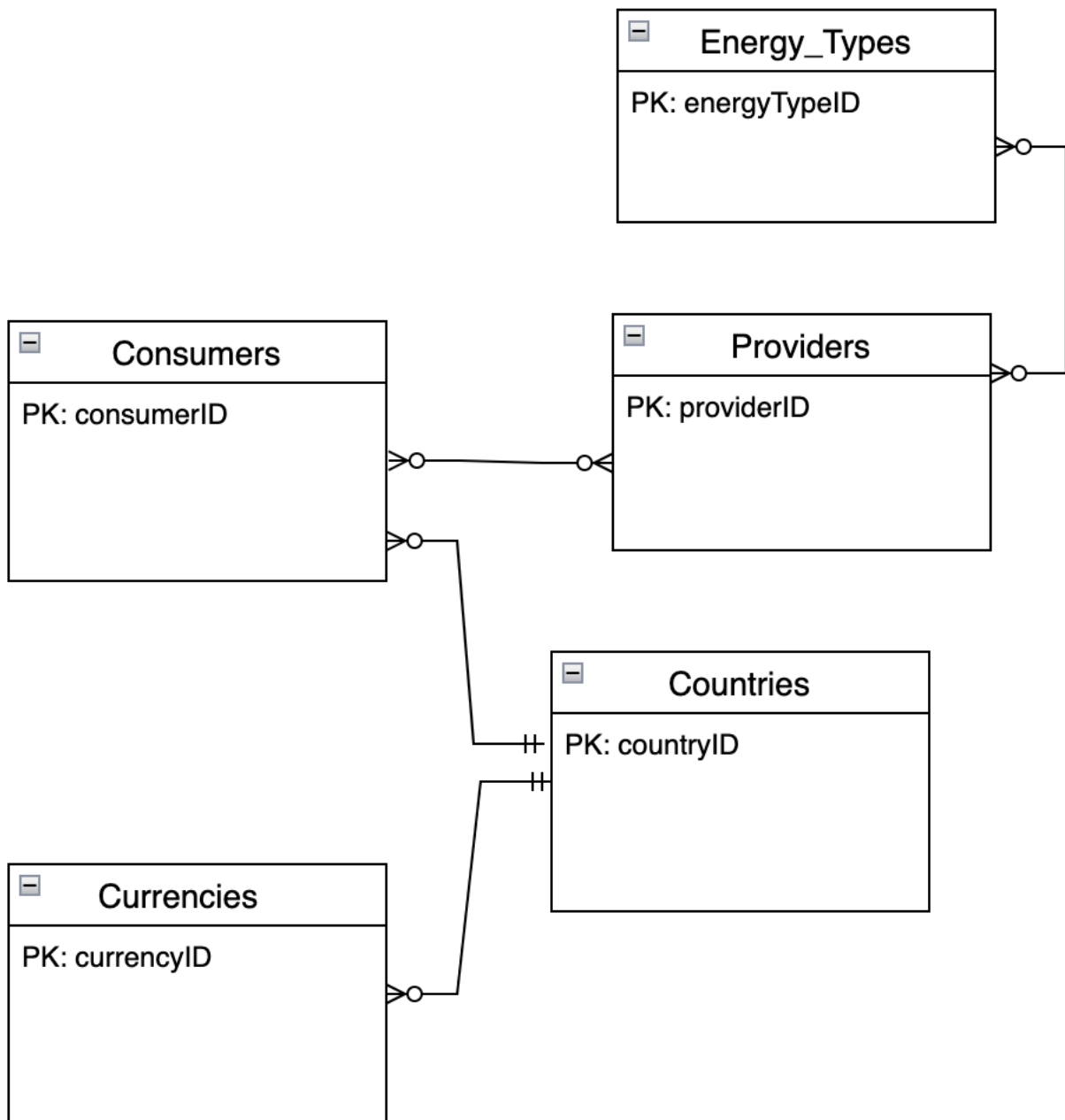
**Provided Energies (Intersection Table)**: Records the provision of Energy\_Type from Providers to Consumers.

- *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.

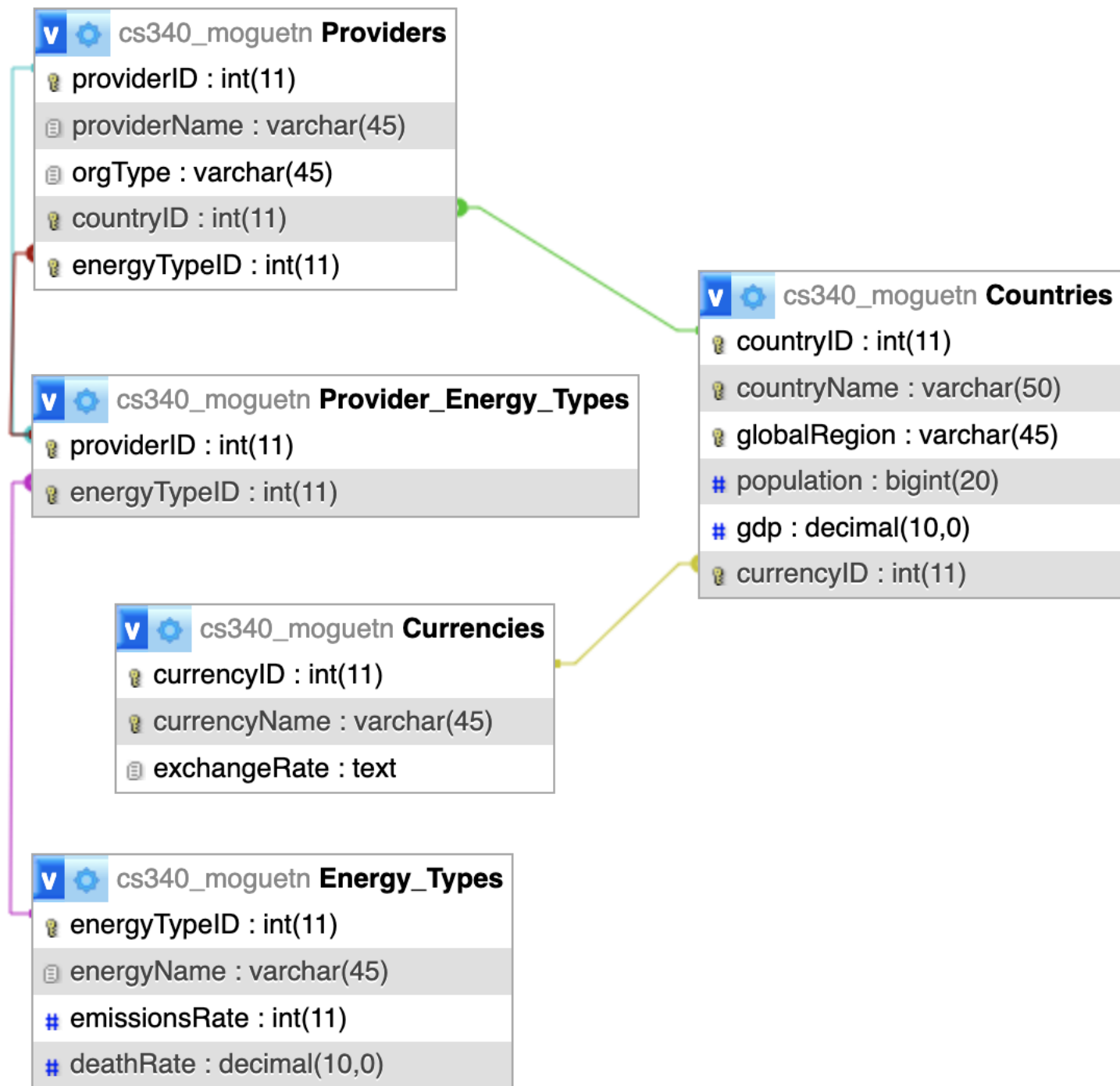
**Consumed Energies (Intersection Table)**: Records the consumption of an energy type between Consumers and Energy\_Types entities.

- *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.

## Entity Relationship Diagram



## Schema



## Sample Data

### Consumers

<u>consumerID</u>	<u>municipality</u>	<u>population</u>	<u>region</u>	<u>annualConsumption</u>	<u>annualSpending</u>
1	Los Angeles	3,849,000	California	65,374,000	\$ 15,6
2	London	8,982,000	London	97,432,000	£ 1
3	Bogota	7,181,000	Bogota	14,509,200	COP 10,388,
4	Seoul	9,776,000	Seoul	48,529,980	₩ 7,074,
5	Sydney	5,312,000	New South Wales	23,737,200	AUD 7,

### Countries

<u>countryID</u>	<u>countryName</u>	<u>globalRegion</u>	<u>population</u>	<u>gdp</u>
1	United States	North America	331,900,000	\$ 23,320,000,
2	England	Europe	55,980,000	£ 2,230,625,
3	Columbia	South America	51,520,000	COP 1,263,032,000
4	South Korea	Asia	51,740,000	₩ 2,290,371,700
5	Australia	Oceania	25,690,000	AUD 2,277,940,

### Providers

<u>providerID</u>	<u>providerName</u>	<u>orgType</u>	<u>countryID</u>	<u>energyTypeID</u>
274	Edison Utility Company	Private	1	4
783	Schneider Electric	Private	2	1
1789	Santander	Private	3	1
1022	Korea Electric Power Corporation	Public	4	1
987	Origin Energy Australia	Private	5	4

### Currencies

<u>currencyID</u>	<u>currencyName</u>	<u>exchangeRate</u>
1	United States Dollar	1.00
2	British Pound	0.76
3	Colombian Peso	4016.00
4	Korean Won	1265.00
5	Australian Dollar	1.47

### Energy Types

<u>energyTypeID</u>	<u>energyName</u>	<u>emissionsRate</u>	<u>deathRate</u>
1	coal	820	24.6
2	hydro	34	1.3
3	wind	4	0.04
4	oil	720	18.4
5	nuclear	3	0.03
6	solar	5	0.02
7	biomass	152	4.6
8	gas	490	2.8