

Riley Furlong, Sara Aly, Andrew Michael, Kevin Klaskala, Juan Carmona, Nila Addo,
Anthony Pastor

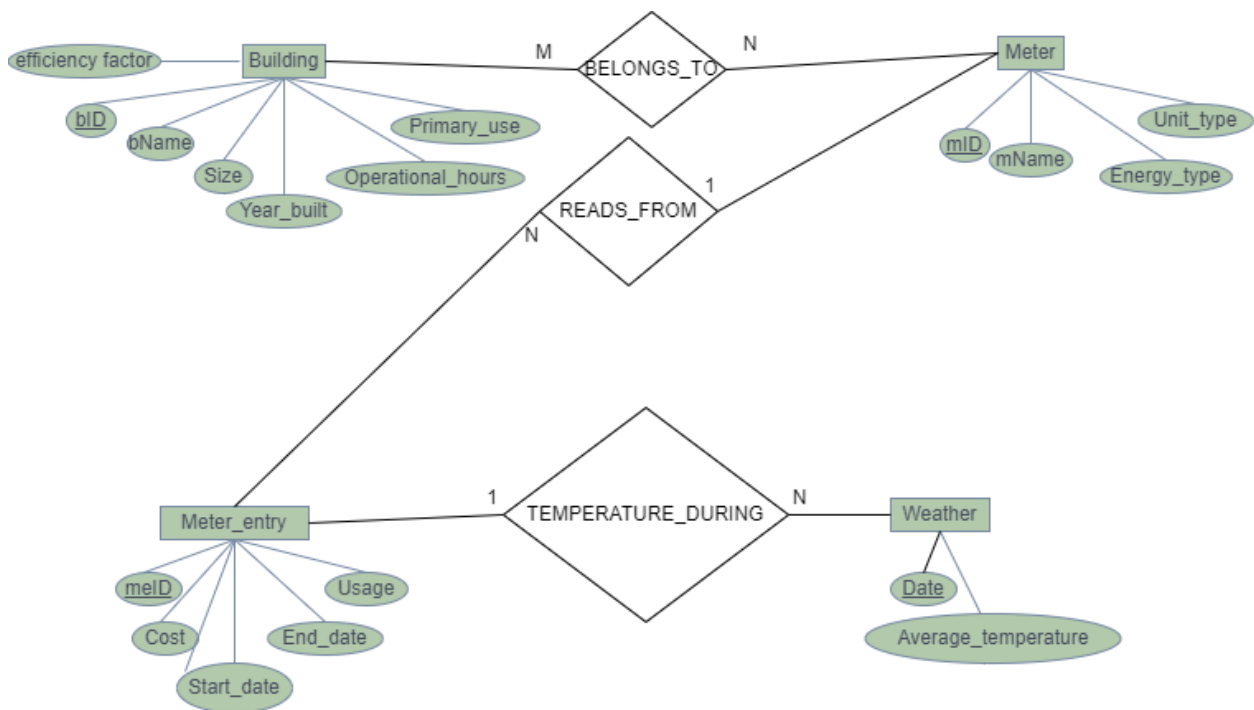
27 March 2022

Energy Demanded. 2-2

Stage IV

- Updated Models

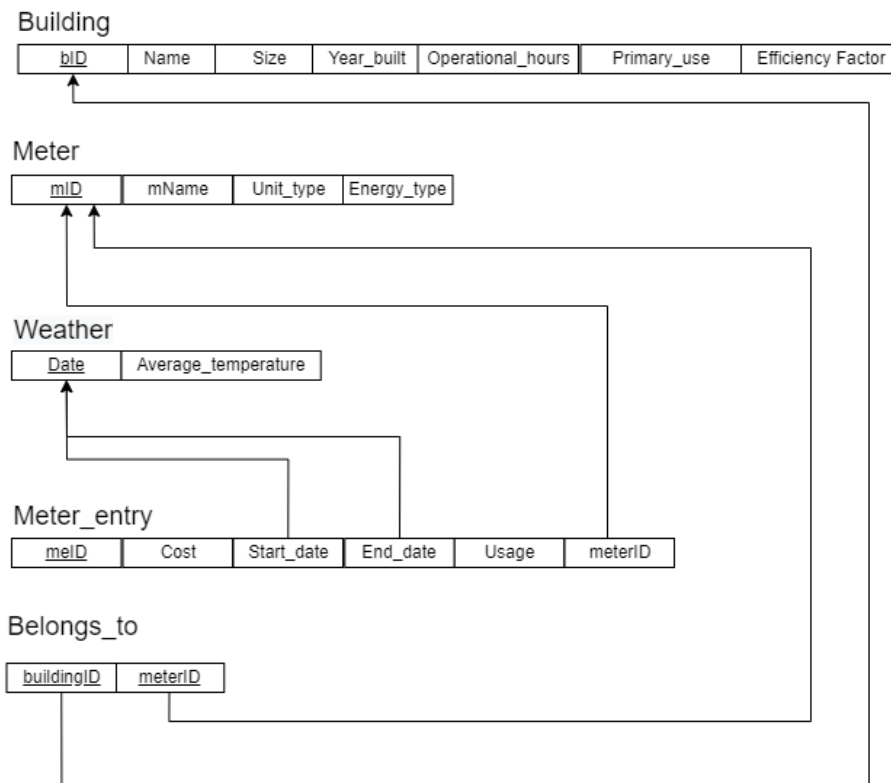
- Updated ER Diagram:



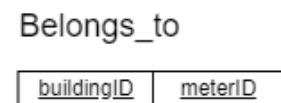
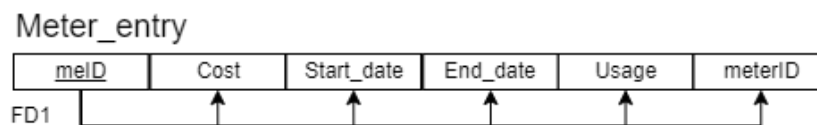
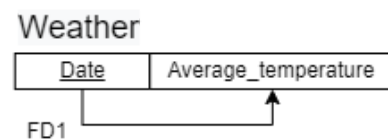
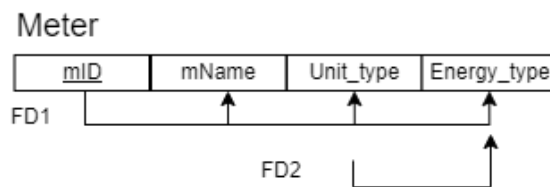
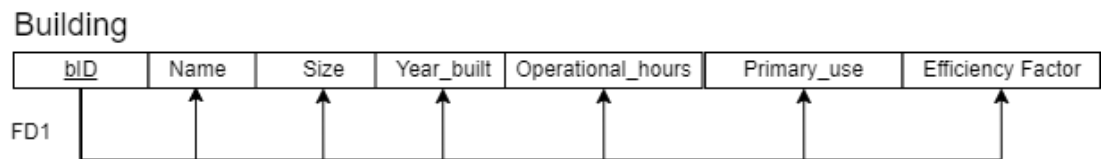
After receiving stakeholder feedback, we modified our ER diagram. Initially, we wanted to manually determine which meters belonged to which buildings since this data was missing in the excel sheets. However, we were advised not to because of the level of difficulty it might be. Thus, we took inspiration from the other Energy Demand group and combined this with some of our own ideas. We decided to implement an efficiency factor which we will manually determine

for all 48 buildings, determined by factors such as year-built and use. Thus, we changed the relation to M:N cardinality since each meter will belong to each building, and vice versa. This inturn changed our schema.

- Updated Relational Schema:



- Normalizing all relations into Boyce-Codd Normal Form
 - We started by mapping all the functional dependencies:

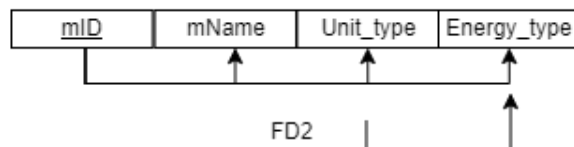


- Determining if each relation is in BCNF
 - Building: Yes, because every non-prime attribute is fully functionally dependent on bID, there are no transitive dependencies, and bID is a superkey.
 - Meter: No, because there exists a transitive dependency. Observe that Unit_type is functionally dependent on mID, and Energy_type is a part of

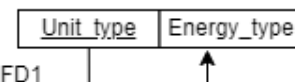
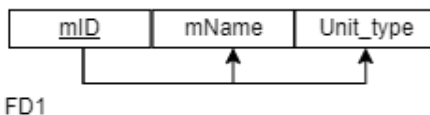
a separate functional dependency with Unit_type. So Meter is only in 2NF, not 3NF and consequently not BCNF.

- Weather: Yes, because every non-prime attribute is fully functionally dependent on Date, there are no transitive dependencies, and Date is a superkey.
 - Meter_entry: Yes, because every non-prime attribute is fully functionally dependent on meID, there are no transitive dependencies, and meID is a superkey.
 - Belongs_to: Yes, there are no functional dependencies, so the relation vacuously follows BCNF.
- Normalizing Meter relation to BCNF: We got rid of the transitive property by moving Energy_type into a new relation with what it is dependent on.

Meter



Meter



- **Views (Virtual Tables):**

- Below we created two views for two of two of our earlier use cases. We picked Summary Statistics, where a user picks a building and is given its statistics, and Energy Demanded, where a user picks a building and a year and is given the energy used by that building in that year. Some examples of Summary Statistics include “Cromwell” and “Bliss Hall”. Any building would be a valid query. Some examples of Energy Demanded include “Cromwell 2010” and “Bliss Hall 2020”.
- Below are the views as well as the SQL queries.

Summary Statistics:

```
SELECT * FROM Building WHERE id = ?;
```

BUILDING

bID	Name	Size	Year_Built	Operational_hours	Primary Use	Efficiency Factor
6151490	Art & IMM	70580	2010	7:00a.m. - 10:00p.m.	College/ University	0.03
6151495	Biology Building	77893	2001	7:00a.m. - 10:00p.m.	College/ University	0.04
6151517	Bliss Hall	35915	1935	7:00a.m. - 10:00p.m.	College/ University	0.03
...

Energy Demanded:

```
SELECT SUM(Usage) WHERE Start_date >= '????-01-01' AND End_date  
<= '????-12-31';
```

// where ???? is the year represented in 4 digits that the user
wants the energy demanded during.

SUM
26498441