Tables of Contents:

Abstract Code(AC) with SQL queries:

Main menu

Abstract code:

- Click on ***Enter my household info*** link – Jump to the **Household** task
- Click on ***View reports/query data*** link – Jump to **Reports** task

Household

Abstract Code:

User enters email address ('$Email Address') and postal code ('$Postal Code') in the input fields. Validate postal code by ensuring it exists in the Postal_Code table.

```
SELECT 1
FROM Postal_Code
WHERE Postal_Code = $Postal Code;
```

- If data validation is successful for both email address and postal code input fields, then:
    - User choose household type ('$Household type') and enters square footage ('$Square footage') value
    - Then user enters the thermostat setting for heating ('$Thermostat Heating') and cooling ('$Thermostat Cooling'), user will also have No heat and No cooling option to choose
    - If public utilities exist for a particular user:
        - User will select from Electric ('$Electric), gas('$Gas'), steam ('$Steam') and fuel ('$Fuel) oil options
    - Else:
        - Leave it unchecked
- Else:
    - When user email address is not matching with postal code entered in the database, go back to **Household** task, with the error message.
- Click the ***Next button*** to save the information in the database – Jump to **Appliance** task.

```
INSERT INTO Household (Email_Address, Square_footage, Household_Type, Heating, Cooling, Postal_Code)
VALUES( $Email Address, $Square footage, $Household type, $Heating, $Cooling, $Postal Code);
```

Table of Content

Appliance

Abstract Code:

User should first enter add appliance form

- If appliance type entered is Air handler:
    - User will enter the manufacturer('$Manufacturer') and model's name ('$Model name')
    - Then User will have options to select from Air conditioner, Heater and Heat pump.
    - User enters energy efficiency ratio ('$Energy efficiency ratio') and the energy source ('$Energy source')
    - Once user add all the information it will Add more option
- Else (When appliance type is Water heater):
    - User will input the manufacturer('$Manufacturer') and model's name ('$Model name')
    - Then User will have options to select from Air conditioner, Heater and Heat pump.
    - User will input energy source ('$Energy Source'), capacity ('$Capacity'), BTU ('$BTU rating') and temperature ('$Temperature')
- Once data is entered, it will save to the database when saving from the screen.

INSERT INTO Appliance (Email_Address, Manufacturer_Name, Model_Name, BTU_Rating, Appliance_Type)

VALUES($Email Address, $Manufacture, $Model name, $BTU_Rating, $Appliance Type);

If appliance type is Air Handler:

INSERT INTO Air_Handler(Email_Address, Appliance_ID, Heating_Cooling_Method)

VALUES($Email Address, $Appliance_ID, $Heating_Cooling_Method);

If appliance type is Water Heater:

INSERT INTO Water_Heater (Email_Address, Appliance_ID, Capacity, Temperature, Energy_Source

VALUES($Email Address, $Appliance_ID, $Capacity, $Temperature, $Energy Source);

If appliance type is Heater:

INSERT INTO Heater(Email_Address, Appliance_ID, Energy_Source)

VALUES($Email Address, $Appliance_ID, $Energy Source);

Table of Content

If appliance type is Heat Pump:

```
INSERT INTO Heat_Pump(Email_Address,  Appliance_ID,
Heating_Seasonal_Performance_Factor, Seasonal_Energy_Efficiency_Rating)

VALUES( $Email Address, $Appliance_ID, $Heating_Seasonal_Performance_Factor,
$Seasonal_Energy_Efficiency_Rating);
```

If appliance type is Air Conditioner:

```
INSERT INTO Air_Conditioner(Email_Address, Appliance_ID, Energy_Efficiency_Ratio)

VALUES( $Email Address, $Appliance_ID, $Energy_Efficiency_Ratio);
```

- Click ***Add*** button - Jump to the **Appliance Listing** task

Appliances Listing:

Abstract Code:

- User will see the list of each appliance's number ('$Appliance ID'), Appliance type ('$Appliance Type'), manufacture ('$Manufacturer') and model name('$Model')

```
SELECT Appliance_ID, Manufacturer_name, Model_Name, Appliance_Type
FROM Appliance;
```

- Then user will get three options on the screen
  - ***Add another appliance*** link
  - ***Delete*** link
  - ***Next*** button
- Click ***Add another Appliance*** link - Jump to **Add Appliance** task.
- If details are entered incorrectly:
  - Click **delete** link - To delete that particular appliance
- If all appliances are deleted, the user cannot leave **Appliance Listing** task until at least one appliance has been added

```
DELETE FROM Appliance

WHERE Appliance_ID='$Appliance_ID';
```

- Click ***Next*** - Jump to **Add Power generation** task.

Table of Content

Add Power Generation

Abstract Code:

On Add Power Generation form

- If the household is off-the-grid:
  - Details like type (‘$Type’), Monthly (‘$Monthly kWh’), Storage (‘$Storage kWh’)(Optional detail) should be entered.

    INSERT INTO Power_Generator (Generation_Type, Average_ Monthly_KWpH, Battery_Storage_ Capacity)

    VALUES ($Type, $Monthly kWh, $Storage kWh);

  - Click ***Add*** button - Jump to **Power Generation listing** task
- Else:
  - Click ***Skip*** button to finish submitting the form – Jump to **Wrapping up** page

Power Generation listing

Abstract Code:

- All the added power generation methods will be displayed with details ‘$Power generator ID’, ‘$Type’, ‘$Monthly kWh’, ‘$Battery kWh’

  SELECT Generation_Type, Average_ Monthly_KWpH, Battery_Storage_ Capacity

  FROM Power_Generator;

- Click ***Delete*** button to delete that particular added power generation method
  - If all the generators are deleted and household is off-the-grid:
    - At least one generator needs to be added.
- Click ***Add more power*** - Jump to **Add Power Generation** task
- Click ***Finish*** button - Jump to **Wrapping up** task

Wrapping up

Abstract Code:

- Thank you, message will be displayed
- Click ***Return to the main menu*** link - Jump to **Main Menu** task

Table of Content

Reports

Abstract Code:

- User clicked on ***View Reports/Query Data*** link from Main Menu
- Upon:
  - Click ***Top 25 Manufactures*** button - Jump to **Top 25 Manufacturers** task
  - Click ***Manufacturer/Model Search*** button - Jump to **Manufacture/Model Search** task
  - Click ***Heating/Cooling Method Details*** button - Jump to **Heating/Cooling Method Details** task
  - Click ***Water Heater Statistic by State*** button - Jump to **Water Heater Statistic by State** task
  - Click ***Off-the-grid Household Dashboard*** button - Jump to **Off-the-grid Household Dashboard** task
  - Click ***Household Averages by Radius*** button - Jump to **Household Averages by Radius** task
- Click ***Return to the main menu*** link - Jump to **Main Menu** task

Top 25 Popular Manufacturers

Abstract Code:

- User clicked on ***Top 25 Manufacturers*** from View Reports/Query Data page
- Run the ***Top 25 Manufactures*** task: query information for manufacturer name and raw count of appliances filtered to return 25 highest raw count of appliances and sorted in descending order.

```
SELECT TOP 25 Manufacturer_name , COUNT (*) as TotalApplianceCount

FROM Appliance GROUP BY Manufacturer_name

ORDER BY TotalApplianceCount DESC;
```

  - For each manufacturer returned, display Manufacturer, Total Appliance Count
  - Each manufacturer in the table will be a button linking to the **Manufacturer Drilldown** task.
    - Click the ***manufacturer's*** button to run the **Manufacturer Drilldown** task: query types of appliances and count of each appliance type for the chosen manufacturer.
    - Display the drilldown table underneath the top 25 manufacturer table. Table will have rows for each appliance. Row will be Appliance Type, Appliance Count where Appliance Type rows will be will be:
      - Water Heater

```
SELECT  Manufacturer_name, COUNT(*) as AppCount
FROM Appliance A, Water_Heater W
WHERE A.Appliance_ID=W.Appliance_ID
AND A.Manufacturer_name=$Manufacturer_name
GROUP BY  Manufacturer_name;
```

      - Air_Handler

```
SELECT  Manufacturer_name, COUNT(*) as AppCount
FROM Appliance A, Air_Handler H
WHERE A.Appliance_ID=H.Appliance_ID
AND A.Manufacturer_name=$Manufacturer_name
GROUP BY  Manufacturer_name;
```

Table of Content

- Air_Conditioner
```
SELECT  Manufacturer_name, COUNT(*) as AppCount
FROM Appliance A, Air_Conditioner C
WHERE A.Appliance_ID=C.Appliance_ID
AND A.Manufacturer_name=$Manufacturer_name
GROUP BY  Manufacturer_name;
```
- Heater
```
SELECT  Manufacturer_name, COUNT(*) as AppCount
FROM Appliance A, Heater H
WHERE A.Appliance_ID=H.Appliance_ID
AND A.Manufacturer_name=$Manufacturer_name
GROUP BY  Manufacturer_name;
```
- Heat_Pump
```
SELECT  Manufacturer_name, COUNT(*) as AppCount
FROM Appliance A, Heat_Pump H
WHERE A.Appliance_ID=H.Appliance_ID
AND A.Manufacturer_name=$Manufacturer_name
GROUP BY  Manufacturer_name;
```

- Click ***Return to the reports*** link - Jump to ***reports*** task

Manufacturer/Model Search

Abstract Code:

- User clicked on ***Manufacturer/Model Search*** from View Reports/Query Data page
- When a user enters a string into the textbox and clicks the ***Submit*** button, information from the text box Search('$Search') will be sent to the **Manufacturer/Model Search** task which will query for the model and/or manufacturer where the submitted text is a substring match and returns all entries of [Model, Manufacturer]. If the manufacturer matched then the query will return all pairs of manufacturers, models containing that manufacturer. If the model matched, the query will return the manufacturer and model details.
    - Entries will appear in a table. For each Manufacturer, add table entry Manufacturer, Model
    - If there's a search string match in either, highlight the search string

```
SELECT Manufacturer_name, Model_Name

FROM Appliance A

WHERE A.Manufacturer_name LIKE '%$search%'

OR A.Model_Name LIKE '%$search%'

ORDER BY Manufacturer_name ASC, Model_name ASC;
```

- Click ***Return to the reports*** link - Jump to ***reports*** task

Table of Content

Heating/Cooling Method Details

Abstract Code:

- User clicked on ***Heating/Cooling Method Details*** from View Reports/Query Data page
- Run **Heating/Cooling Report Query** task: query for the following grouped by household type:
  - count of air conditioners, average air conditioner BTU, average EER,

```
SELECT Household_Type, COUNT(*) as AirConditionerCount,
ROUND(avg(BTU_Rating),0) as AvgAirConBTU,
ROUND(avg(Energy_Efficiency_Ratio), 1) as AvgEER
FROM Appliance A, Air_Conditioner C , Household H
WHERE A.Appliance_ID = C.Appliance_ID
AND Appliance.Email_Address = H.Email_Address
GROUP BY Energy_Source;
```

  - count of heaters, average heater BTUs, most common energy source

```
SELECT Household_Type, COUNT(*) as HeaterCount, ROUND(avg(BTU_Rating),0) as AvgHeaterBTU, Energy_Source_Max as MostCommon
FROM Appliance A , Heater H, Household O, (SELECT Z.Household_Type, Z.Energy_Source as Energy_Source_Max, MAX(count_of_source) FROM (SELECT Household_Type, Energy_Source,COUNT(Energy_Source) AS count_of_source FROM Household X, Heater Y WHERE X.Email_Address=Y.Email_Address GROUP BY Household_Type, Energy_Source) Z ) M
WHERE A.Appliance_ID = H.Appliance_ID
AND A.Email_Address = O.Email_Address
AND M.Household_Type = O.Household_Type
GROUP BY Household_Type;
```

  - count of heat pumps, average heat pump BTUs, average SEER, average HSPF

```
SELECT Household_Type  COUNT(*) as HeatPumpCount,
ROUND(avg(BTU_Rating),0) as AvgHeatPumpBTU,
ROUND(avg(Seasonal_Energy_Efficiency_Rating), 1) as AvgSEER,
ROUND(avg(Heating_Seasonal_Performance_Factor), 1) as AvgHSPF
FROM Appliance A, Heat_Pump P, Household H
WHERE A.Appliance_ID = P.Appliance_ID
AND A.Email_Address = H.Email_Address
GROUP BY Household_Type;
```

- Display air conditioner information grouped by household type:
  - For each household display: Air Conditioner, Avg Air Conditioner BTU, Avg EER
- Display heater information grouped by household type:

Table of Content

    - For each household display: Heater, Avg Heater BTU, Most Common Energy Source
- Display heat pump information grouped by household type:
    - For each household display: Heat Pump, Avg Heat Pump BTU, Avg SEER, Avg HSPF
  - Click ***Return to the reports*** link - Jump to ***reports*** task

Table of Content

Water Heater Statistics by State

Abstract Code:

Run the ***Water Heater Statistics by State*** task:

- Query the desired table and display the water heater details grouped by State name.
    - Display average water heater capacity.
    - Display the average water heater BTU.
    - Display average water heater temperature setting.
    - Display count of water heater where no temperature setting given.

```
SELECT State, AVG(Capacity), AVG(BTU_Rating), AVG(Temperature),
COUNT(Appliance_ID) AS NoOfWaterHeaterWithoutTemperature
FROM Postal_Code P, Household H, Appliance A, Water_Heater W
WHERE P.Postal_Code = H.Postal_code
AND A.Email_Address = H.Email_Address
AND A.Appliance_ID = W.Appliance_ID
AND Temperature IS NULL
GROUP BY State, Temperature ;
```

    - Display count of water heater where temperature setting given.

```
SELECT State, AVG(Capacity), AVG(BTU_Rating), AVG(Temperature),
COUNT(Appliance_ID) AS NoOfWaterHeaterWithoutTemperature
FROM Postal_Code P, Household H, Appliance A, Water_Heater W
WHERE P.Postal_Code = H.Postal_code
AND A.Email_Address = H.Email_Address
AND A.Appliance_ID = W.Appliance_ID
AND Temperature IS NOT NULL
GROUP BY State, Temperature ;
```

- Each State in the table will be a button linking to ***State Drilldown*** task.

  Upon:

    - Click the State button – Jump to ***Water heater statistics by selected State*** task.

Table of Content

- Query the database for given state-name ${State}, and get the result (as HTTP request, response).

```
SELECT Energy_Source , ROUND(MIN(Capacity),0), ROUND(AVG(Capacity),0),
ROUND(MAX(Capacity),0), ROUND(AVG(Temperature),1),  ROUND(MIN(Temperature),1),
ROUND(MAX(Temperature),1)

FROM Postal_Code P, Household H, Appliance A, Water_Heater W

WHERE P.Postal_Code = H.Postal_code

AND A.Email_Address = H.Email_Address

AND A.Appliance_ID = W.Appliance_ID

AND State="CA" and Appliance_Type="Water Heater"

GROUP BY Energy_Source;
```

Display State as Table Header

- Display min – max- average water heater capacity grouped by energy source.
- Display min-max-average temperature setting grouped by energy source.

- Click ***Return to the reports*** link - Jump to ***reports*** task

Table of Content

Off-the-Grid Household Dashboard

Abstract Code:

Run the ***Off-Grid Household Dashboard*** tasks:

- Display state name along with count of most off-the-grid household.

```
SELECT X.*, State, Max(CountOfHouses)
FROM (SELECT State, COUNT(Email_Address) as CountOfHouses
FROM Household H, Public_Utilities U, Postal_Code P
WHERE  H.Email_Address = U.Email_Address
AND H.Postal_Code = P.Postal_Code
AND Email_Address NOT IN (select  Email_Address from Public_Utilities)
GROUP BY State) as X);
```

- Display average battery storage capacity for all off-grid households.

```
SELECT Email_Address, ROUND(AVG(Battery_Storage_Capacity),0)
FROM Household H, Public_Utilities P, Power_Generator G
WHERE H.Email_Address =P.Email_Address
AND H.Email_Address = G.Emai_ID
AND Email_Address NOT IN (select  Email_Address from Public_Utilities)
GROUP BY Email_Address;
```

- Display average water heater gallon capacity for all off-grid and on-grid households in parallel.

For on-grid households:

```
SELECT AVG(Capacity)
FROM Household H, Public_Utilities P, Water_Heater W
WHERE H.Email_Address = P.EmailI_ID
AND W.Email_Address = H.Email_Address
AND(Email_Address IN (select Email_Address from Public_Utilities))
GROUP BY Email_Address;
```

Table of Content

For off-grid households:

```
SELECT AVG(Capacity)
FROM Household H, Public_Utilities P, Water_Heater W
WHERE H.Email_Address = P.EmailI_ID
 AND W.Email_Address = H.Email_Address
AND (Email_Address NOT IN (select Email_Address from Public_Utilities))
GROUP BY Email_Address;
```

- Display percentage of each power generation type (solar, wind etc).

```
SELECT Generation_Type, ROUND((Average_Monthly_KWpH * 100/ (SELECT
SUM(Average_Monthly_KWpH) FROM Power_Generator ),1) AS
PercentContributionOfEachGenerationType
FROM Public_Utilities P, Household H, Power_Generator G
WHERE H.Email_Address = P.Email_Address
AND H.Email_Address = G.Email_Address
AND (Generation_Type IN (“wind”, “solar”))
AND (Email_Address NOT IN (select  Email_Address from Public_Utilities))
GROUP BY Generation_Type , Email_Address;
```

- Display min, max and average BTU for all off-grid households grouped by appliance type.

```
SELECT Appliance_Type,ROUND( MIN(BTU_Rating),0),ROUND( MAX(BTU_Rating),0),
ROUND(AVG(BTU_Rating),0)
From Household H, Appliance A, Public_Utilities P
WHERE H.Email_Address = A.Email_Address
AND P.Email_Address = H.Email_Address
AND Email_Address NOT IN (select Email_Address from Public_Uitilities)
Group by Appliance_Type;
```

- Click ***Return to the reports*** link - Jump to ***reports*** task

Table of Content

Household Averages by Radius

Abstract Code:

Run the ***Household Averages by Radius Task***: query for information about the postal code ${postal-code} and radius (selected from drop down choices inbuilt) ${radius} using HTTP protocols.

If data validation is successful for Postal Code field, then:

- Display postal code.
- Display search radius.

```
SELECT Postal_Code, distance
        FROM (
        SELECT Postal_Code,
        P.distance_unit
                *DEGREES(ACOS(LEAST(1.0, COS(RADIANS(P.latpoint))
                  *COS(RADIANS(Z.latitude))
                  *COS(RADIANS(P.longpoint) – RADIANS(Z.longitude))
                  + SIN(RADIANS(P.latpoint))
                  *SIN(RADIANS(Z.latitude))))) AS distance

                FROM Postal AS P
                JOIN (
                        Select 2
                        3.43 AS latpoint, -30.24 AS longpoint, 5.0 AS radius,          60.49
AS distance_unit
                        ) AS P

                WHERE Z.latitude
                        BETWEEN
                        P.latpoint – (P.radius/P.distance_unit)
                        AND             P.latpoint + (P.radius/ P.distance_unit)
AND Z.longitude
                        BETWEEN
```

Table of Content

```
                P.longpoint – (P.radius / (P.distance_unit *
                COS(RADIANS(P.latpoint))))
                AND P.longpoint + (P.radius/(P.distance_unit * COS (
                RADIANS(P.latpoint))))
) AS d
        WHERE distance <= radius
```

- Display count of households in that radius.

```
SELECT COUNT(Email_Address)
FROM Household H, Postal_Code P
WHERE H.Email_Address = P.Email_Address
AND Radius= $given
GROUP BY Postal_Code;
```

- Display count of households for each household type.

```
SELECT Household_type, COUNT(Email_Address)
FROM Household H, Postal_Code P
On H.Email_Address = P.Email_Address
WHERE Radius= $given
GROUP BY Household_type;
```

- Average square footage.

```
SELECT AVG(Square_footage)
FROM Household H, Postal_Code P
WHERE H.Email_Address = P.Email_Address
AND Radius= $given;
```

- Average heating temperature

```
SELECT AVG(Heating)
FROM Household H, Postal_Code P
WHERE H.Email_Address = P.Email_Address
AND Radius= $given;
```

Table of Content

- Average cooling temperature

```
SELECT AVG(Heating)
FROM Household H, Postal_Code P
WHERE H.Email_Address = P.Email_Address
AND Radius= $given;
```

- Public utilities used [displayed in single cell separated by comma]

```
SELECT Public_Utilites
FROM Household H, Postal_Code P, Public_Utilities U
WHERE H.Email_Address = P.Email_Address
AND H.Email_Address = U.Email_Address;
```

- Display count of off-grid home.

```
SELECT COUNT(Email_Address)
FROM Household H, Public_Utilities U, Postal_Code P
WHERE H.Email_Address = U.Email_Address
AND H.Email_Address = P.Email_Address
AND Radius=$given
AND Email_Address NOT IN (select Email_Address from Public_Utilities);
```

- Count of households with power generation.

```
SELECT COUNT(Email_Address)
FROM Household H, Power_Generator G, Postal_Code P
WHERE H.Email_Address = G.Email_Address
AND H.Email_Address = P.Email_Address
AND Radius = $given
AND Email_Address IN (select Email_Address from Power_Generator);
```

Table of Content

- Most common generation method.

```
Select X.*, MAX(NoOfTypes)
FROM(Select COUNT(Generation_Type) AS NoOfTypes
FROM Household H, Power_Generator G, Postal_Code P
WHERE H.Email_Address = G.Email_Address
AND H.Email_Address = P.Email_Address
AND Radius = $given
AND Email_Address IN (select Email_Address from Power_Generator)
    ) X;
```

- Average monthly power generation.

```
SELECT Average_ Monthly_KWpH
FROM Household H, Power_Generator G
WHERE H.Email_Address = G.Email_Address
AND Radius = $given
AND Email_Address IN (SELECT Email_Adress from Power_Generator);
```

- Count of household with battery storage.

```
SELECT Email_Address, COUNT(Battery storage capacity)
FROM  Household H, Power_Generator G
WHERE H.Email_Address = G.Email_Address
AND Radius = $GIVEN
AND Email_Address IN (SELECT Email_Adress from Power_Generator)
GROUP BY Email_Address;
```

- Click ***Return to the reports*** link - Jump to ***reports*** task

Else, postal code input invalid, display View Report page with Error message.

- Click ***Return to the reports*** link - Jump to ***reports*** task

Table of Content