**Project Team 12 - Electricity Billing System**

Team Members:

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**Context:**

The Electricity Billing System will give a single platform to customers through which they can pay and view their bills of any service provider listed in the system

**Objective:**

The main objective of the project is to develop a database system that will help a customer to register under a service provider, view and pay electricity bill. Apart from this a customer can also change service provider, upgrade to use solar net metering, view historic payments, peak and off peak hours and billing cycle.

**Scope:**

1. **Customer Registration**: Customer register under the system under a specific service provider for smart meter or solar net meter.
2. **View and Pay bills**:
3. Customer can pay and view historic bills.
4. Customer can check the unit consumption of the selected period.
5. Customer can view the off peak and peak hours for the area.
6. **Stop or Change the connection**: Customer can switch to other service provider and customer can deregister from the system.
7. **Admin can add Service Provider/ Customer:** Admin can add any new service provider or new customer.
8. **Admin modify the tariff rates:**

a. Admin can modify the tariff rates of any service provider.

b. Admin can modify the peak and off peak hours corresponding to any service provider in any area.

## **ENVIRONMENT SETUP:**

We are using MySQL Database management System. For making connection to MySQL server we are using mysql-workbench-community-8.0.12-winx64 client. For user interface and database connectivity we are using javax.swing api and jdbc.odbc 7.0 version. We will use Java 8 for our project.

## **HIGH LEVEL REQUIREMENTS:**

**Initial User Roles:**

|  |  |
| --- | --- |
| **Role** | **Description** |
| Customer | New customer can register under a service provider for the electricity billing system. Existing customer can view and pay electricity bills, change service provider, can see unit consumption, can see peak and off peak hours for any specific area. |
| Admin | System admin who can modify the tariff rate, Register/Deregister a customer, Register/Deregister a Service Provider. |

### **Initial user story descriptions:**

|  |  |
| --- | --- |
| **Story ID** | **Story Description** |
| US1 | As a customer I want to register under a service provider. |
| US2 | As a registered customer I want to view bill of any selected month. |
| US3 | As a registered customer I want to pay the bills. |
| US4 | As a customer I want to view the tariff rates of any area offered by various service providers already listed. |
| US5 | As a customer I want to change a service provider. |
| US6 | As a customer I want to deregister. |
| US7 | As an admin I want to change the tariff rates of service provider. |
| US8 | As an admin I want to add a customer in the electricity billing system. |
| US9 | As an admin I want to remove a customer from the electricity billing system. |
| US10 | As an admin I want to add a service provider. |

**High level conceptual design:**

**Entities:**

Customer

Admin

Service\_Provider

Electricity\_Bill

Tariff\_Details

**Relationships:**

Customer has connection under a single Service\_Provider.

Customer pays Electricity\_Bill.

Customer changes a Service\_Provider.

Admin updates Tariff\_Details.

Service\_Provider maintains area specific Tariff\_Details.

# **Sprint 1**

## ***REQUIREMENTS:***

|  |  |
| --- | --- |
| **Story ID** | **Story Description** |
| US1 | As a customer I want to register under a service provider. |
| US2 | As a customer I want to login into the system. |
| US3 | As a registered customer I want to view all electricity bills. |
| US4 | As an admin I want to view all registered customers. |
| US5 | As a customer I want to view number of units consumed. |
| US6 | As a registered customer I want to view bill of any selected month. |
| US7 | As a registered customer I want to pay the bills. |
| US8 | As a customer I want to view the tariff rates of any area offered by various service providers already listed. |
| US9 | As a customer I want to change a service provider. |
| US10 | As a customer I want to deregister. |
| US11 | As an admin I want to change the tariff rates of service provider. |
| US12 | As an admin I want to add a customer in the electricity billing system. |
| US13 | As an admin I want to remove a customer from the electricity billing system. |
| US14 | As an admin I want to add a service provider. |

## 

## ***CONCEPTUAL DESIGN***

Entity:**Customer**

Attributes:

customer\_id

login\_email\_id

login\_password

ssn

name[composite]

first\_name

last\_name

address[composite]

address\_line\_1

address\_line\_2

city

state

zipcode

phone\_number[multivalued]

service\_provider\_name

register\_date

meter\_type

customer\_id- this customer id is generated whenever a user registers under a service provider.

Entity: **Electricity\_Billing\_Details**

Attributes:

electricity\_bill\_id

bill\_generated\_date

bill\_due\_date

billing\_cycle\_start\_date

number\_of\_billing\_days

payment\_amount

amount\_due

last\_meter\_reading

present\_meter\_reading

Note:

last\_meter\_reading and present\_meter\_reading are in kWH

Entity: **Admin**

Attributes:

login\_id[Email id of Admin]

login\_password

name[composite]

first\_name

last\_name

address[composite]

address\_line\_1

address\_line\_2

city

state

zipcode

phone\_no[multivalued]

Relationship: **Customer** has **Electricity\_Billing\_Details**

Cardinality: One to Many

Participation:

Customer has partial participation

Electricity\_Billing\_Details have total participation

***LOGICAL DESIGN***

Table: **Customer**

Columns:

customer\_id

login\_email\_id

login\_password

ssn

first\_name

last\_name

address\_line\_1

address\_line\_2

city

state

country

zipcode

phone\_number\_primary

phone\_number\_secondary

service\_provider\_name

register\_date

meter\_type

Table: **Electricity\_Billing\_Details**

Columns:

electricity\_bill\_id

customer\_id [foreign key;references customer\_id of Customer table]

bill\_generated\_date

bill\_due\_date

billing\_cycle\_start\_date

number\_of\_billing\_days

payment\_amount

amount\_due

last\_meter\_reading

present\_meter\_reading

Note:

last\_meter\_reading and present\_meter\_reading are in kWH

Table: **Admin**

Columns:

login\_id[Email id of Admin]

login\_password

first\_name

last\_name

address\_line\_1

address\_line\_2

city

state

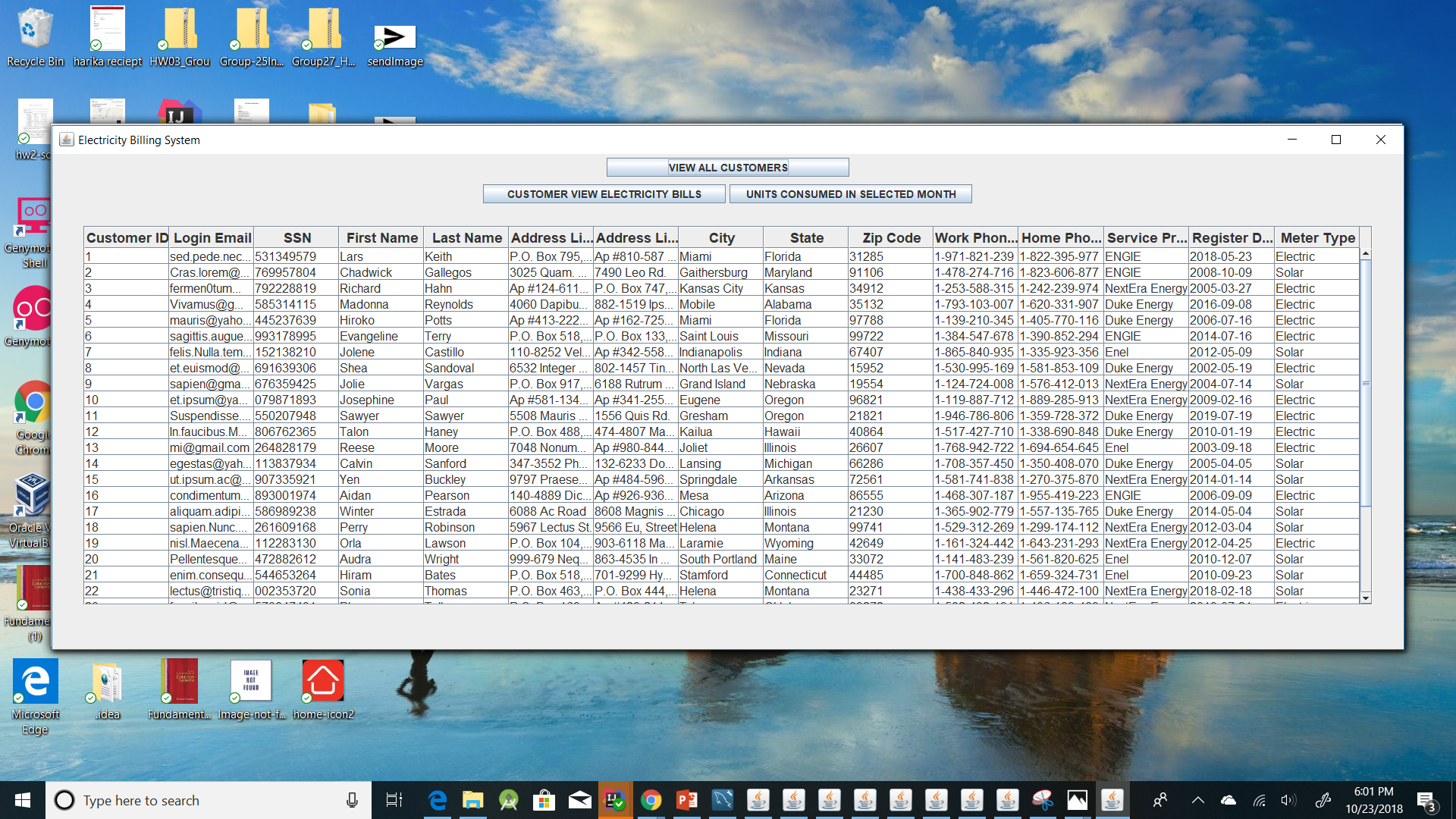
zipcode

phone\_no\_primary

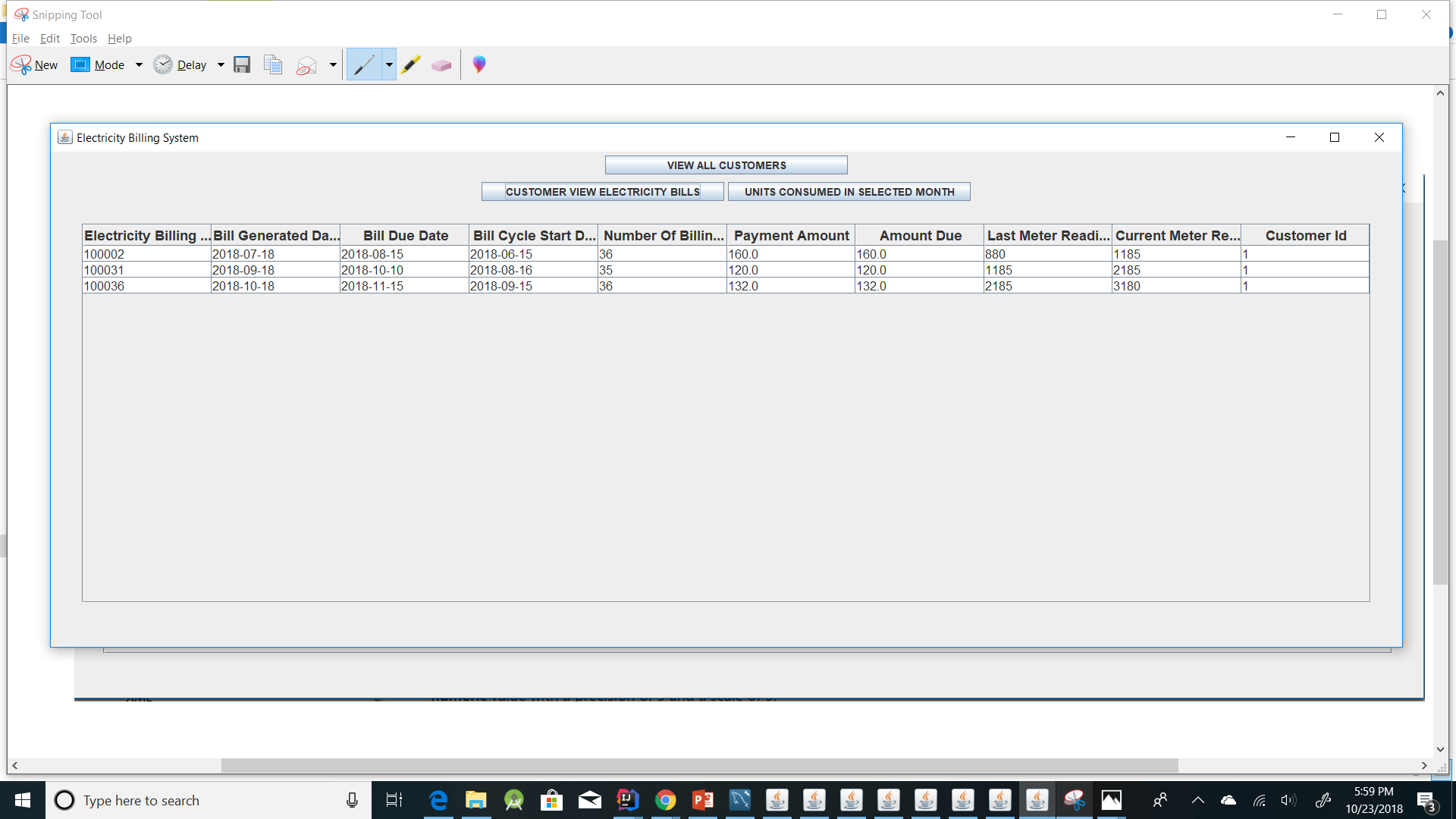
phone\_no\_secondary

**Queries:**

1. SELECT \* FROM Customer;

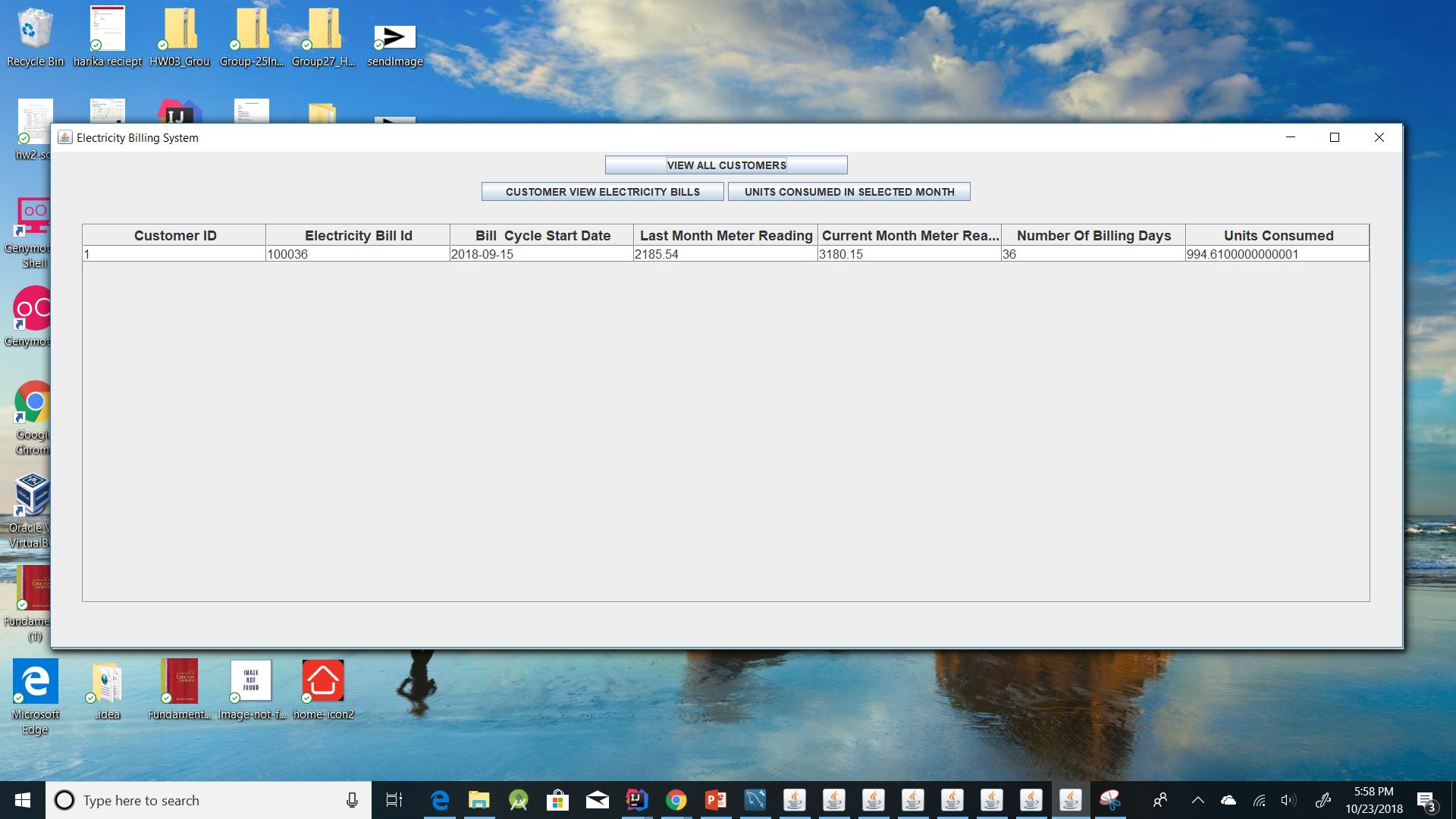


2. SELECT \* FROM Electricity\_Billing\_Details where customer\_id=1;



3.

SELECT Electricity\_Billing\_Details.customer\_id, Electricity\_Billing\_Details.electricity\_bill\_id, Electricity\_Billing\_Details.billing\_cycle\_start\_date, last\_meter\_reading, Electricity\_Billing\_Details.present\_meter\_reading, Electricity\_Billing\_Details.number\_of\_billing\_days, (Electricity\_Billing\_Details.present\_meter\_reading-Electricity\_Billing\_Details.last\_meter\_reading) as Units\_Consumed FROM Electricity\_Billing\_Details where customer\_id=1 AND MONTH(billing\_cycle\_start\_date)=9 AND YEAR(billing\_cycle\_start\_date)=2018;



**Sprint 2**

### **Part 1: Refine requirements:**

|  |  |
| --- | --- |
| **Story ID** | **Story Description** |
| US1 | As a customer I want to register under a service provider. |
| US2 | As a customer I want to login into the system. |
| US3 | As a registered customer I want to view all electricity bills. |
| US4 | As an admin I want to view all registered customers. |
| US5 | As a customer I want to view number of units consumed. |
| US6 | As a registered customer I want to view bill of any selected month. |
| US7 | As a customer I want to view the tariff rates of any area offered by various service providers already listed. |
| US8 | As a customer I want to change a service provider. |
| US9 | As a customer I want to deregister. |
| US10 | As an admin I want to change the tariff rates of service provider. |
| US11 | As an admin I want to add a customer in the electricity billing system. |
| US12 | As an admin I want to remove a customer from the electricity billing system. |
| US13 | As an admin I want to add a service provider. |
| US14 | As a registered customer I want to pay the bills. |

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### **Part 2: Conceptual design**

Entity: **Customer**

Attributes:

customer\_id

login\_email\_id

login\_password

ssn

name[composite]

first\_name

last\_name

address[composite]

address\_line\_1

address\_line\_2

zipcode

state

city

phone\_number[multivalued]

service\_provider\_name

register\_date

meter\_type

Entity: **Electricity\_Billing\_Details**

Attributes:

electricity\_bill\_id

bill\_generated\_date

bill\_due\_date

billing\_cycle\_start\_date

number\_of\_billing\_days

payment\_amount

amount\_due

Entity: **Admin**

Attributes:

login\_id[Email id of Admin]

login\_password

employee\_number

name[composite]

first\_name

last\_name

address[composite]

address\_line\_1

address\_line\_2

zipcode

state

city

phone\_no[multivalued]

Entity: **Service\_Provider**

Attributes:

service\_provider\_name

license\_number

license\_expiry

address[composite]

address\_line\_1

address\_line\_2

zipcode

state

city

head\_office\_number

helpline\_number

Entity: **Tariff\_Details**

Attributes:

zip\_code

provider\_name

state

city

peak\_time\_charge

off\_peak\_charge

peak\_time

off\_peak\_time

Entity: **Meter\_Reading**

Attribute:

meter\_number

peak\_hour\_reading

off\_peak\_hour\_reading

meter\_reading\_date

total\_current\_reading

total\_previous\_reading

Relationship: **Customer** has **Meter\_Reading**

Cardinality: One to Many

Participation:

Customer has partial participation

Meter\_Readinghave total participation

Relationship: **Meter\_Reading** generates **Electricity\_Billing\_Details**

Cardinality: One to One

Participation:

Customer has partial participation

Meter\_Readinghave total participation

Relationship: **Service\_Provider** has **Tariff\_Details**

Cardinality: One to many

Participation:

Service\_Provider has partial Participation

Tariff\_Details have partial Participation

Relationship: **Customer** views **Tariff\_Details**

Cardinality: Many to Many

Participation:

Customer has partial participation

Tariff\_Details have partial\_participation

Relationship: **Admin** adds **Customer**

Cardinality: One to Many

Participation:

Admin has partial Participation

Customer has total participation

### **Part 3: Logical design**

Table: **Customer**

Columns:

customer\_id

login\_email\_id

login\_password

ssn

first\_name

last\_name

address\_line\_1

address\_line\_2

zip\_code [foreign key; references zip\_code of ZipCode\_Details Table]

phone\_number\_primary

phone\_number\_secondary

service\_provider\_name

register\_date

meter\_type

**Primary Key Justification**: customer\_id of each customer will be unique, and it will be assign during registration of customer in system.

**Normal form:**

Highest normalization level:4NF

Table: **Admin**

Columns:

employee\_id

login\_id[Email id of Admin]

login\_password

first\_name

last\_name

address\_line\_1

address\_line\_2

zip\_code [foreign key; references zip\_code of ZipCode\_Details Table]

phone\_no\_primary

phone\_no\_secondary

**Primary Key Justification**: employee\_id of the system admin will be unique.

**Normal form:**

Highest normalization level:4NF

Table: **Service\_Provider**

Column:

provider\_name

license\_number

office\_Address\_line\_1

office\_address\_line\_2

zip\_code[foreign key; references zip\_code of ZipCode\_Details Table]

head\_Office\_Number

helpline\_Number

**Primary Key Justification**: Name of Service provider is unique

**Normal form:**

Highest normalization level:4NF

Table: **Tariff\_Details**

Columns:

provider\_name[foreign key; references provider\_name in Service\_Provider]

zip\_code

peak\_time\_charge

off\_peak\_charge

peak\_time

off\_peak\_time

**Foreign key mapping:**

We have decided to map the primary key of Service\_Provider as the foreign key in Tariff\_Details as there is a one to many relationship in the conceptual design.

**Primary Key Justification**:

The zip\_code and service\_provider\_name uniquely determines the tariff details of each for any area of specific service provider.

**Normal Form:**

Highest normalization level:4NF

Table: **Meter\_Reading**

Columns:

meter\_reading\_id

meter\_number

peak\_hour\_reading

off\_peak\_hour\_reading

meter\_reading\_date

total\_current\_reading

total\_previous\_reading

customer\_id[foreign key: references customer\_id of Customer Table]

**Primary Key:**

We have a meter\_reading\_id as our Primary key as each meter reading will uniquely determines the meter readings taken each month and this will uniquely determine each electricity bill generated using this meter reading.

**Normal Form:**

Highest normalization level: 4NF

**Justification**: We need composite key here as this is used to record meter readings of each customer for each billing-cycle.

Table: **Electricity\_Billing\_Details**

Columns:

electricity\_bill\_id

meter\_number [foreign key;references meter\_number of Meter\_Reading table]

bill\_generated\_date

bill\_due\_date

billing\_cycle\_start\_date

number\_of\_billing\_days

payment\_amount

amount\_due

**Primary Key Justification:** electricity\_bill\_id will be unique, as this will be assign whenever new bill is being added into the system.

**Normal Form:**

Highest normalization level:4NF

Table: **Zipcode\_Details**

Columns:

zip\_code

city

state

**Primary Key Justification:** zip\_code will be unique for every region and that uniquely determines the state and city and here as or system is for United States so we have not included country column.

**Normal Form:**

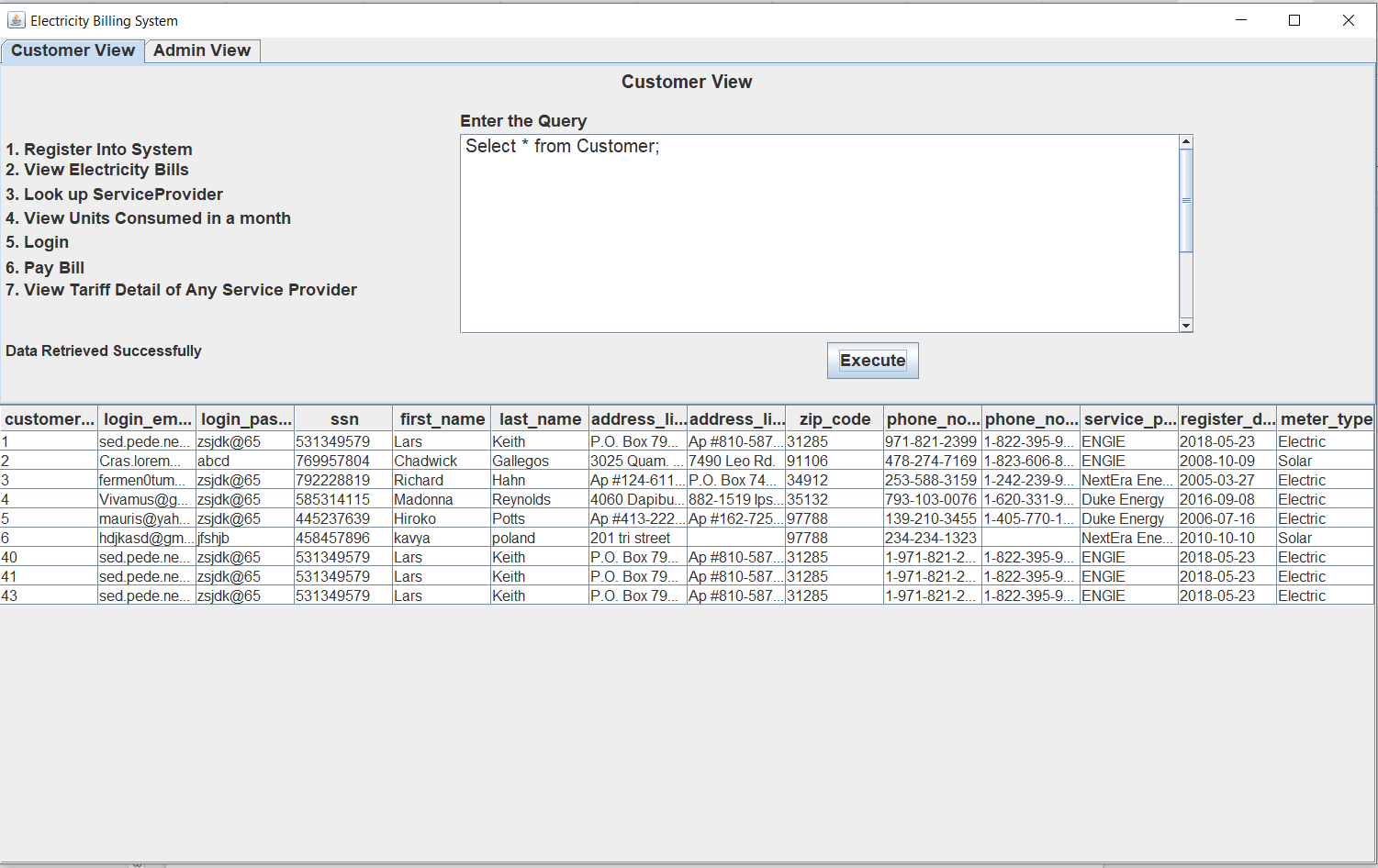
Highest normalization level:4NF

**Queries:**

1. **Register a Customer**

**Before**

Select \* from Customer;

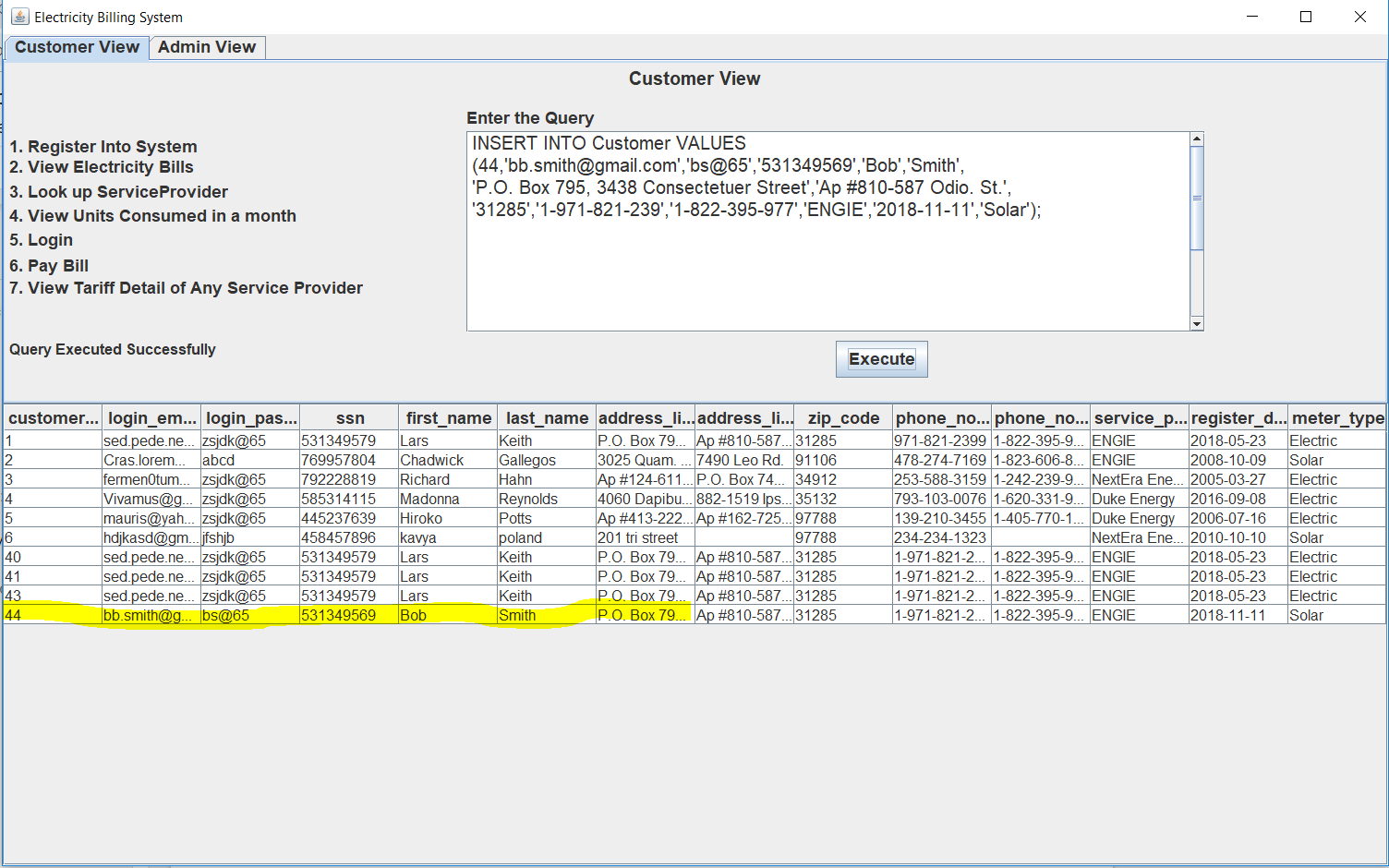
****

**After insertion:**

INSERT INTO Customer VALUES (44,'bb.smith@gmail.com','bs@65','531349569','Bob','Smith',

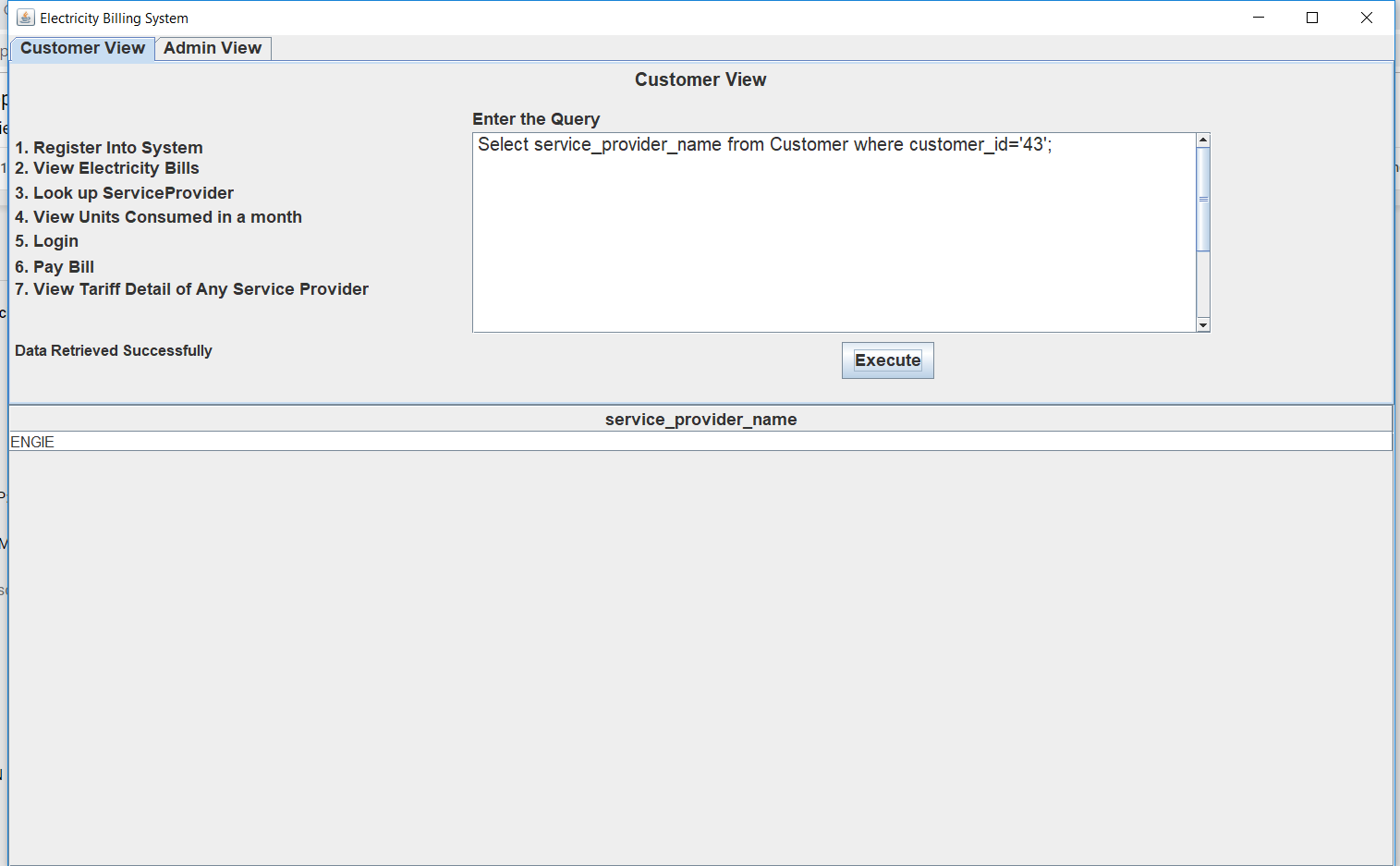
'P.O. Box 795, 3438 Consectetuer Street','Ap #810-587 Odio. St.',

'31285','1-971-821-239','1-822-395-977','ENGIE','2018-11-11','Solar');

****

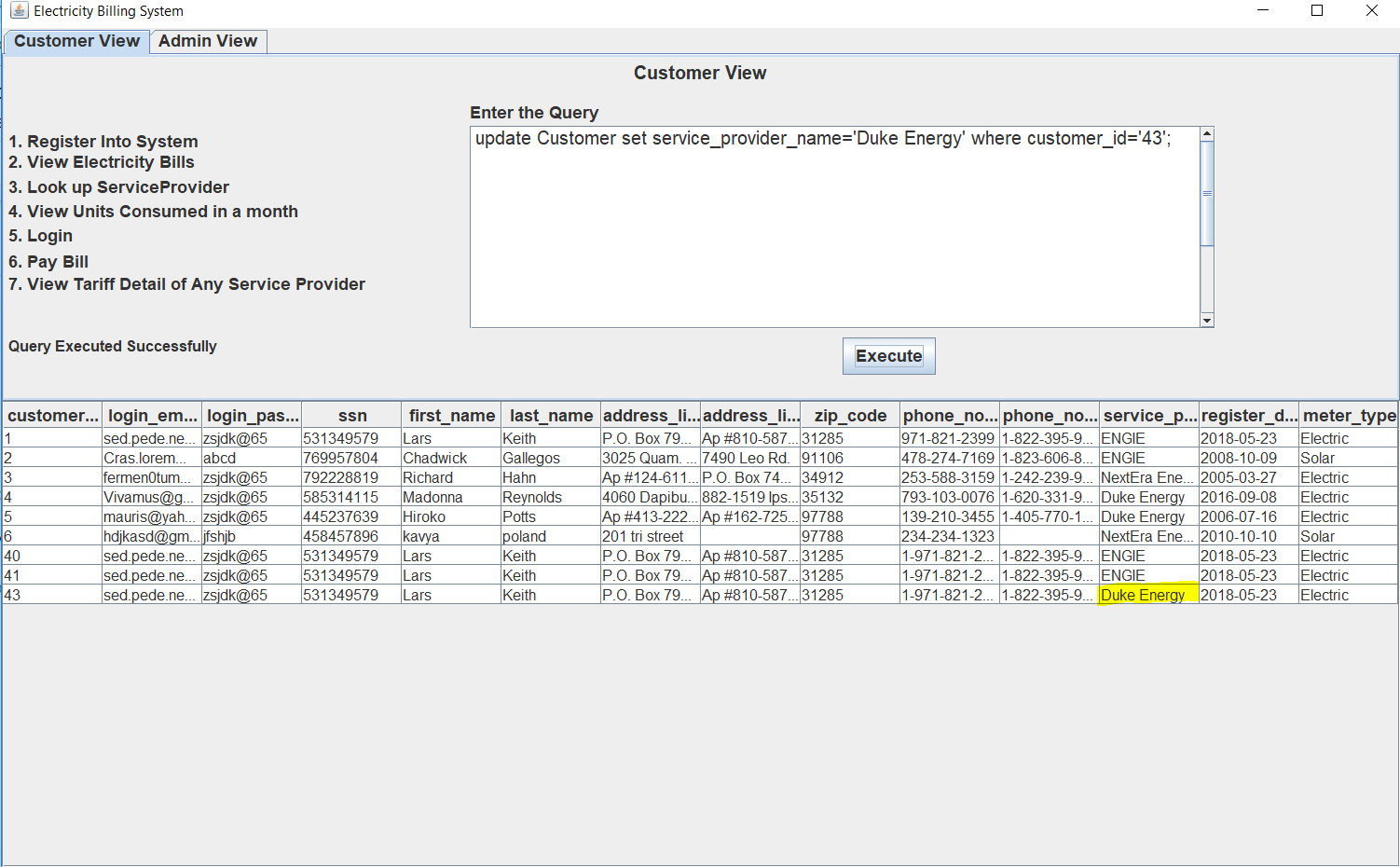
**2. Customer changes Service Provider.**

**Before:** Here customer\_id we are taking is 43**.**

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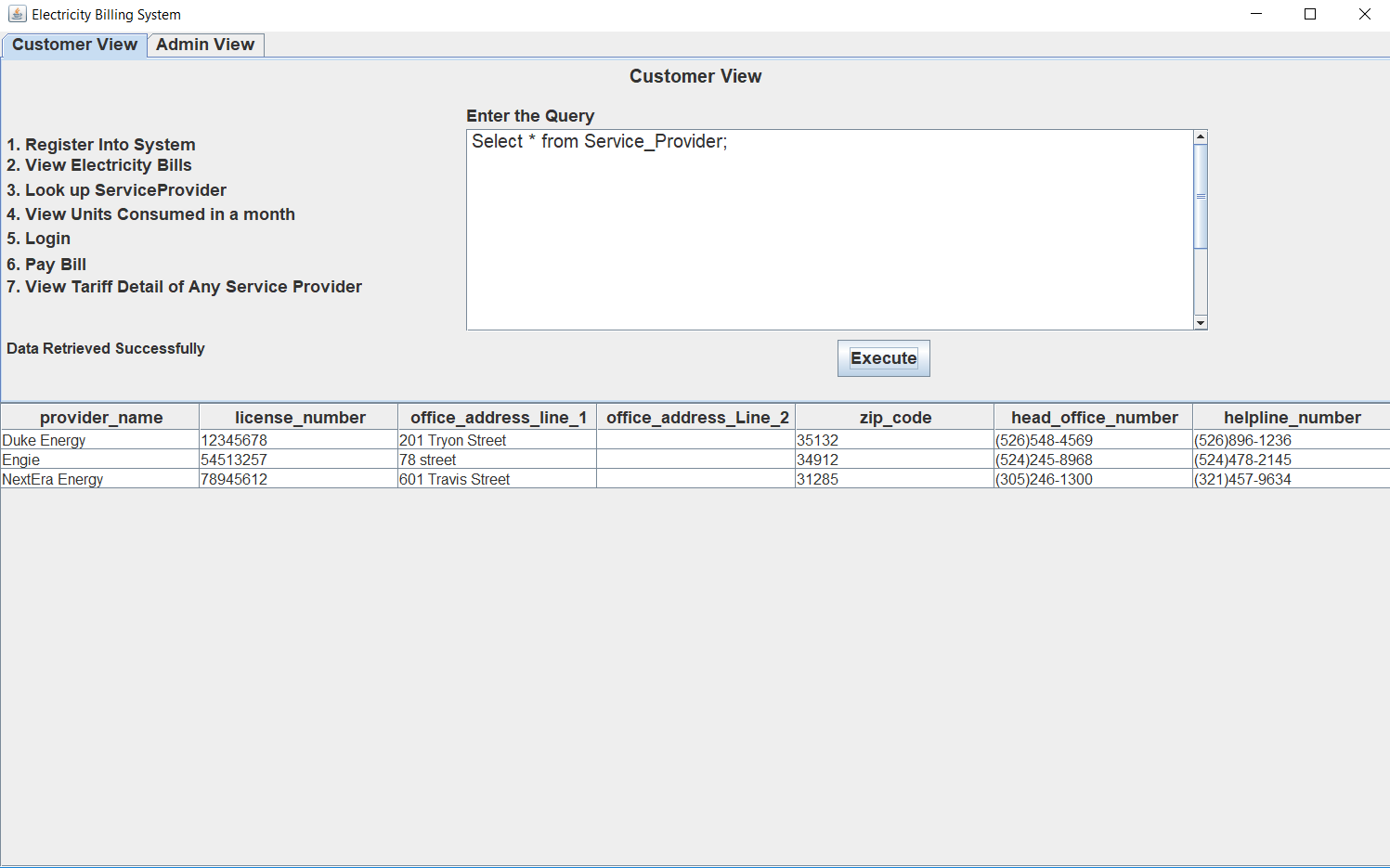
**After updating:**

update Customer set service\_provider\_name='Duke Energy' where customer\_id='43'**;**

****

**3. Look up Service Providers available;**

Select \* from Service\_Provider;

****

4. **Customer can view Tariff\_Details of any Service Provider of any specific area.**

Select \* from Tariff\_Details where provider\_name='Duke Energy' and zip\_code='97788';

