

SECD2523 – DATABASE
SEMESTER 1 2023/2024

PHASE 3 - DATABASE CONCEPTUAL DESIGN (ERD)
<Carbon Reduction and Sustainability Engagement System>

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1.0 Introduction // ni yg lama

This project explores the sustainability efforts that Malaysia has made, mainly concentrating on the Low Carbon Blueprint for Iskandar Malaysia 2025 and the Low Carbon Cities Framework (LCCF). By 2025, the target is to reduce carbon intensity by 58 percent from the baseline of 2005 levels. To raise awareness and promote the adoption of low carbon emission practices, the Malaysian government, more specifically in the Johor state has launched a number of initiatives. These include the Iskandar Malaysia Eco Life Challenge (IMELC) programme, the Johor Education Department's (JPNJ) e-Lestari system, and the Iskandar Puteri City Council's (MBIP) Iskandar Puteri Low Carbon (IPRK) initiative.

One of the main initiatives supporting the Low Carbon Society (LCS) in the Iskandar region is MBIP's IPRK initiative, which gathers information about community energy-saving activities. Among the projects included in this programme is the Iskandar Puteri Low Carbon Calendar Competition. However, there are issues with the existing data gathering approach, including a laborious entry process, a need for comprehensive participant information, and manual carbon reduction calculations.

The development of an automated data gathering and analysis system akin to the successful e-Lestari system executed by the Johor Education Department (JPNJ) is the most optimal solution that emerges to meet the current quandaries. This method is meant to cover a variety of community groupings, such as individuals who reside in multistory homes or landed property, institutions, MBIP divisions, and MBIP employees. This suggested data gathering and analysis system's main feature is a trustworthy computation process that determines carbon reductions for the usage of water, electricity, garbage, and repurposed frying oil. The ability to detect regions with significant carbon dioxide emissions—which includes a dashboard that allows users to self-monitor their carbon emissions—is another crucial component of the suggested system. Implementing the system in Bahasa Melayu, the national language, will ensure that all local users understand it.

The document highlights the potential for these solutions to enhance the Iskandar Puteri Low Carbon Calendar Competition in addition to providing a thorough outline of them. A self-monitoring dashboard for users is among the new dashboards that offer real-time insights into participants' carbon contributions. The Iskandar Puteri City Council (MBIP) is the client in this instance. They anticipate accurate cost estimates, technical viability, and clarity on suggested solutions. In addition, customers want a clearly defined schedule with quantifiable benchmarks and results, including improved data quality and higher engagement. This document functions as a thorough and complete plan to meet these goals and improve the Iskandar Puteri Low Carbon Calendar Competition's efficacy.

2.0 Overview of Project

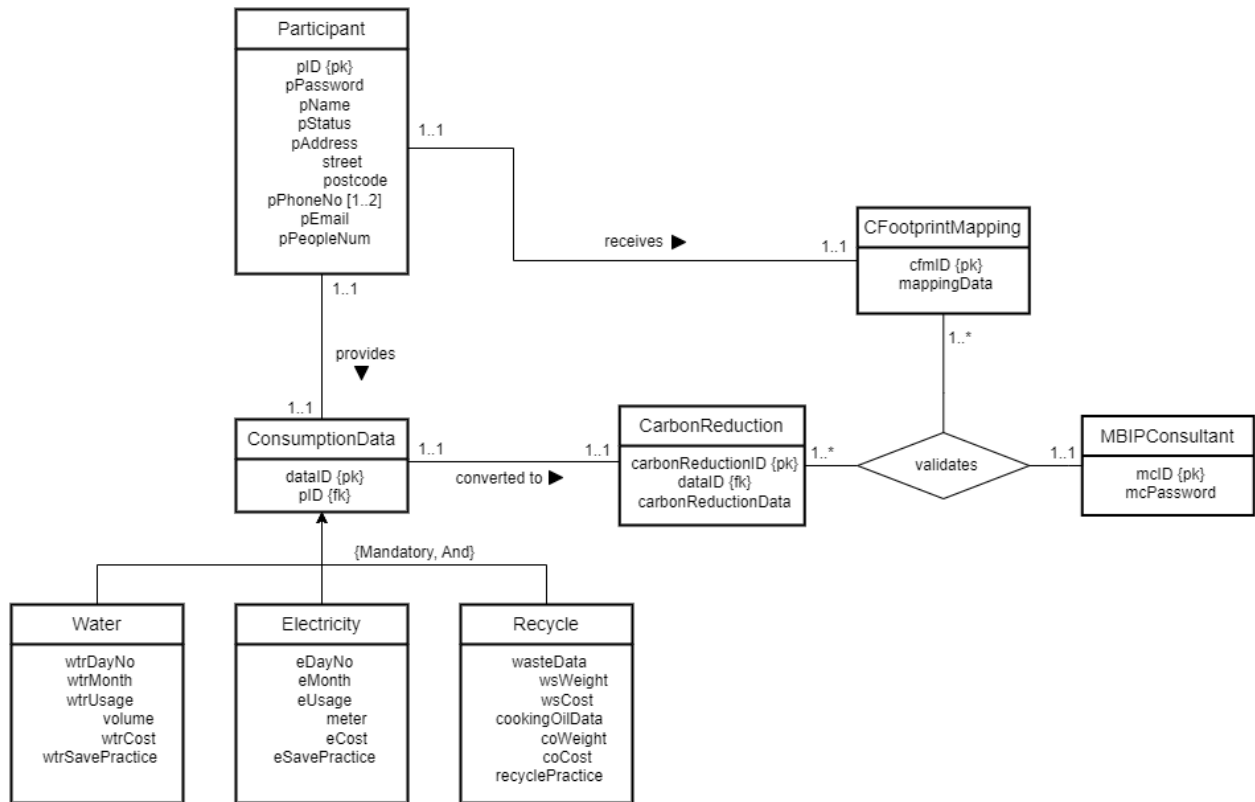
3.0 Database Conceptual Design

3.1 Updated Business Rule

The business rule for the Carbon Reduction and Sustainability Engagement System :

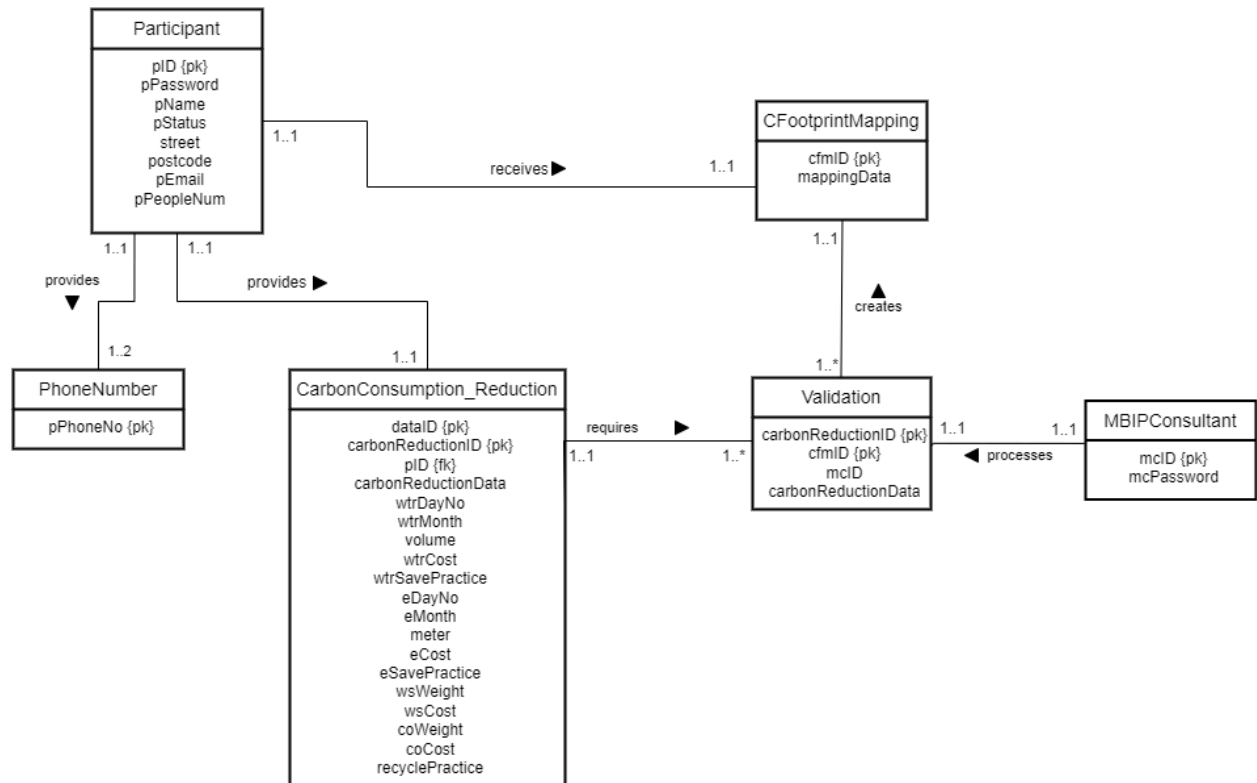
1. One participant provides at least one consumption data
2. At least one consumption data are provided at least one participant
3. Each participant receive result of carbon footprint data at least one
4. Each carbon footprint data are receive result of by at least one participant
5. Each consumption data can be converted to one carbon footprint data
6. Each carbon footprint data converted to one consumption data
7. One MBIP town dept manage one CFM mapping
8. Each CFM mapping can be manage by more than one MBIP town dept
9. One MBIP town dept manage one carbon footprint data
10. Each carbon footprint data can be manage more than one by MBIP town dept
11. Each MBIPConsultant can validates one carbon reduction to be used in
CFootprintMapping
12. Each CarbonReduction can be validate at least one MBIPConsultant that can be used in
CFootprintMapping
13. Each CFootprint that has been validated by at least one MBIPConsultant has at least one
CarbonReduction data.

3.2 Conceptual ERD



4.0 Database Logical Design

4.1 Logical ERD



4.2 Updated Data Dictionary

Entity Relationship

Entity	Description	Aliases	Occurrence
Participant	Holds participant information	Consumer	Participants receive carbon reduction data. Participants provides consumption data
CarbonConsumption_Reduction	Hold consumption reduction data	Data Carbon Consumption Reduction	Every consumption data are converted to one carbon reduction data
Water	Hold participant water consumption	Water	Every water consumption data from each participants must store at consumption data
Electricity	Holds participant electricity consumption	Electricity	Every electricity consumption data from each participants must store at consumption data
Recycle	Holds participant recycle consumption	Recycled waste and cooking oil	Every recycled waste and cooking oil data from each participants must store at consumption data
PhoneNumber	Holds participant phone number	Phone number	Each participant has phone number
CFootprintMapping	CFootprintMapping validates by MBIPConsultant	Carbon Footprint Map	CFootprint Mapping are been validates by carbon reduction data

			and MBIP consultant
Validation	Holds carbon footprint mapping and carbon reduction data for validation	Validation	A report show the carbon footprint mapping and carbon reduction
MBIPConsultant	Process on validate the information	MBIP Consultant	MBIP consultant validates Carbon reduction and CFootprint Mapping

Entity Relationship

Entity	Multiplicity	Relationship	Entity 2	Multiplicity
Participant	1..1	provides	PhoneNumber	1..2
	1..1	provides	CarbonConsumption_Reduction	1..1
	1..1	receives	CFootprintMapping	1..1
CarbonConsumption_Reduction	1..1	requires	Validation	1..1
MBIPConsultant	1..1	processes	Validation	1..1
Validation	1..*	creates	CFootprintMapping	1..1

Entity Attributes

Entity	Attribute	Description	Data type & Length	Constraints
Participant	pID	Participant identification number attribute	VARCHAR2(20)	Primary Key, Not NULL, Unique
	pPassword	Participant's password during login	VARCHAR2(20)	Not NULL

	pName	Participant's name	VARCHAR2(30)	Not NULL
	pStatus	Participant's status (employed, unemployed, student)	VARCHAR2(15)	Not NULL
	street	The street's name where participant lives	VARCHAR2(15)	Not NULL
	postcode	The postcode number of where participant lives	VARCHAR2(15)	Not NULL
	pEmail	Participant's email	VARCHAR2(15)	Not NULL, Unique
	pPeopleNum	Total number of people in the household	NUMBER(2)	Not NULL
PhoneN umber	pPhoneNo	Participant phone number	VARCHAR2(15)	Primary Key, Not NULL,
Carbon Consum ption_R eductio n	dataID	Carbon consumption data identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	carbonRedu ctionID	Carbon reduction data identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	carbonRedu ctionData	Carbon reduction data	VARCHAR2(25)	Not NULL
	wtrDayNo	Number of days the data covered for water usage	NUMBER(4)	Foreign Key, Not NULL,
	wtrMonth	Number of months the data	NUMBER(3)	Foreign Key, Not NULL,

		covered for water usage		
	volume	Data regarding water usage (m ³)	NUMBER(5, 2)	Foreign Key, Not NULL,
	wtrCost	Data regarding water bill (RM)	NUMBER(5, 2)	Foreign Key, Not NULL,
	wtrSavePractice	Participant's practice to save water usage	VARCHAR2(30)	Foreign Key, Not NULL,
	eDayNo	Number of days the data covered for electricity usage	NUMBER(4)	Foreign Key, Not NULL,
	eMonth	Number of months the data covered for electricity usage	NUMBER(3)	Foreign Key, Not NULL,
	meter	Data regarding electricity usage (kWh)	NUMBER(4)	Foreign Key, Not NULL,
	eCost	Data regarding electricity bill (RM)	NUMBER(5, 2)	Foreign Key, Not NULL,
	eSavePractice	Participant's practice to save electricity usage	VARCHAR2(30)	Foreign Key, Not NULL,
	wsWeight	Data regarding wastes weight (kg)	NUMBER(4)	Foreign Key, Not NULL,
	wsCost	Data regarding wastes cost (RM)	NUMBER(5, 2)	Foreign Key, Not NULL,
	coWeight	Data regarding cooking oil weight (kg)	NUMBER(4)	Foreign Key, Not NULL,
	coCost	Data regarding	NUMBER(5, 2)	Foreign Key, Not

		cooking oil cost		NULL,
	recyclePractice	Participant's practice to recycle	VARCHAR2(30)	Foreign Key, Not NULL,
MBIP Consultant	mcID	MBIP Consultant identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	mcPassword	MBIP consultant password for login	VARCHAR2(20)	Not NULL
CFootprintMapping	cfmID	Carbon footprint mapping identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	mappingData	Carbon footprint mapping data	VARCHAR2(20)	Not NULL
Validation	carbonReductionID	Carbon reduction data identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	cfmID	Carbon footprint mapping identification number	VARCHAR2(20)	Primary Key, Not NULL, Unique
	mcID	MBIP Consultant identification	VARCHAR2(20)	Foreign Key, Not NULL,
	carbonReductionData	Carbon reduction data		Not NULL

4.3 Normalization

First Normal Form (1NF)

Relational Schema
Participant (<u>pID</u> ,pPassword,pName,pStatus,street,postcode,pEmail,pPeopleNum) Primary Key : pID
PhoneNumber (pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference Participant(pID)
CFootprintMapping (<u>cfmID</u> , mappingData) Primary key : cfmID
CarbonConsumption_Reduction (<u>dataID</u> , <u>carbonReductionID</u> , pID, carbonReductionData,wtrDayNo,wtrMonth, volume, cost, wtrSavePractice,eDayNo,eMonth,meter,cost,eSavePractice,wsWeight,wsCost,coWeight,coCost,recyclePractice) Primary Key : dataID, carbonReductionID Foreign Key : pID reference Participant(pID)
Validation (<u>carbonReductionID</u> , <u>cfmID</u> ,mcID,carbonReductionData) Primary Key : carbonReductionID, cfmID Foreign Key 1 : mcID reference MBIPConsultant(mcID) Foreign Key 2 : carbonReductionID reference CarbonConsumption_Reduction(carbonReduction) Foreign Key 3 : carbonReductionData reference CarbonConsumption_Reduction(carbonReductionData)
MBIP (mcID,mcPassword) Primary Key : mcID

Second Normal Form (2NF)

Relational Schema
ParticipantAccount (<u>pID</u> , pPassword, pEmail) Primary Key : pID
ParticipantInfo (<u>pID</u> , pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference ParticipantAccount(pID)
ParticipantAddress (<u>pID</u> , street, postcode) Primary Key : pID Foreign Key : pID reference ParticipantAccount(pID)
PhoneNumber (pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference ParticipantAccount(pID)
CFootprintMapping (<u>cfmID</u> , mappingData) Primary key : cfmID
CarbonReduction (<u>carbonReductionID</u> , carbonReductionData) Primary Key : carbonReductionID
CarbonConsumption_Reduction (<u>dataID</u> , <u>carbonReductionID</u> , pID) Primary Key : dataID, carbonReductionID Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)
Water (<u>dataID</u> , wtrDayNo, wtrMonth, volume, wtrcost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Electricity (<u>dataID</u> , eDayNo, eMonth, meter, cost, eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)

Recycle (<u>dataID</u> ,wsWeight,wsCost,coWeight,coCost,recyclePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Validation (<u>carbonReductionID</u> , <u>cfmID</u>) Primary Key : carbonReductionID, cfmID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
ValidationMC (<u>carbonReductionID</u> , <u>cfmID</u> ,mcID) Primary Key : carbonReductionID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
MBIPConsultant (<u>mcID</u> , mcPasssword) Primary Key : mcID

Third Normal Form (3NF)

Relational Schema
ParticipantAccount (<u>pID</u> ,pPassword, pEmail) Primary Key : pID
ParticipantInfo (<u>pID</u> , pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference ParticipantAccount(pID)
ParticipantAddress (<u>pID</u> ,street,postcode) Primary Key : pID Foreign Key : pID reference ParticipantAccount(pID)//xde TD
PhoneNumber (pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo//xde TD Foreign Key : pID reference ParticipantAccount(pID)

CFootprintMapping (<u>cfmID</u> , mappingData) Primary key : cfmID//xde TD
CarbonReduction (<u>carbonReductionID</u> , carbonReductionData) Primary Key : carbonReductionID/xde TD
CarbonConsumption_Reduction (<u>dataID</u> , <u>carbonReductionID</u> , pID) Primary Key : dataID, carbonReductionID/xde TD Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)
Water (<u>dataID</u> , wtrDayNo, wtrMonth, volume, cost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Electricity (<u>dataID</u> , eDayNo, eMonth, meter, cost, eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Recycle (<u>dataID</u> , wsWeight, wsCost, coWeight, coCost, recyclePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Validation (<u>carbonReductionID</u> , <u>cfmID</u>) Primary Key : carbonReductionID, cfmID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
ValidationMC (<u>carbonReductionID</u> , <u>cfmID</u> , mcID) Primary Key : carbonReductionID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
MBIPConsultant (<u>mcID</u> , mcPasssword) Primary Key : mcID// xde TD

Boyce-Codd Normal Form (BCNF)

Relational Schema
ParticipantAccount (<u>pID</u> ,pPassword, pEmail) Primary Key : pID
ParticipantInfo (<u>pID</u> , pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference ParticipantAccount(pID)
ParticipantAddress (<u>pID</u> ,street,postcode) Primary Key : pID Foreign Key : pID reference ParticipantAccount(pID)
PhoneNumber (pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference ParticipantAccount(pID)
CFootprintMapping (<u>cfmID</u> , mappingData) Primary key : cfmID
CarbonReduction (<u>carbonReductionID</u> , carbonReductionData) Primary Key : carbonReductionID
CarbonConsumption_Reduction (<u>dataID</u> , <u>carbonReductionID</u> , pID) Primary Key : dataID, carbonReductionID Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)
Water (<u>dataID</u> , wtrDayNo,wtrMonth, volume, wtrcost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Electricity (<u>dataID</u> ,eDayNo,eMonth,meter,ecost,eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)
Recycle (<u>dataID</u> ,wsWeight,wsCost,coWeight,coCost,recyclePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)

Validation (<u>carbonReductionID</u> , <u>cfmID</u>) Primary Key : carbonReductionID, cfmID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
ValidationMC (<u>carbonReductionID</u> , <u>cfmID</u> ,mcID) Primary Key : carbonReductionID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID)
MBIPConsultant (<u>mcID</u> , mcPasssword) Primary Key : mcID

5.0 Relational Database Schemas (after normalization)

Relational Schema
ParticipantAccount (<u>pID</u> ,pPassword, pEmail) Primary Key : pID
ParticipantInfo (<u>pID</u> , pName, pStatus, pPeopleNum) Primary Key: pID Foreign Key : pID reference Participant(pID)
ParticipantAddress (<u>pID</u> ,street,postcode) Primary Key : pID Foreign Key : pID reference Participant(pID)
PhoneNumber (pID, <u>pPhoneNo</u>) Primary Key : pPhoneNo Foreign Key : pID reference Participant(pID)
CFootprintMapping (<u>cfmID</u> , mappingData) Primary key : cfmID
CarbonReduction (<u>carbonReductionID</u> , carbonReductionData)

<p>Primary Key : carbonReductionID</p>
<p>CarbonConsumption_Reduction(<u>dataID</u>, <u>carbonReductionID</u>, pID) Primary Key : dataID, carbonReductionID Foreign Key 1 : pID reference ParticipantAccount(pID) Foreign Key 2 : carbonReductionID reference CarbonReduction(carbonReductionID)</p>
<p>Water(<u>dataID</u>, wtrDayNo,wtrMonth, volume, cost, wtrSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)</p>
<p>Electricity(<u>dataID</u>,eDayNo,eMonth,meter,cost,eSavePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)</p>
<p>Recycle(<u>dataID</u>,wsWeight,wsCost,coWeight,coCost,recyclePractice) Primary Key : dataID Foreign Key : dataID reference CarbonConsumption_Reduction(dataID)</p>
<p>Validation(<u>carbonReductionID</u>,<u>cfmID</u>) Primary Key : carbonReductionID, cfmID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID) Foreign Key : cfmID reference CFootprintMapping (cfmID)</p>
<p>ValidationMC(<u>carbonReductionID</u>,<u>cfmID</u>,mcID) Primary Key : carbonReductionID Foreign Key : carbonReductionID reference CarbonConsumption_Reduction(carbonReductionID) Foreign Key : cfmID reference CFootprintMapping (cfmID) Foreign Key : mcID reference MBIPConsultant(mcID)</p>
<p>MBIPConsultant(<u>mcID</u>, mcPasssword) Primary Key : mcID</p>

ParticipantInfo

pID	pName	pStatus	pEmail	pPeopleNum
A001	Ally	EMPLOYED	alliy248@gmail.com	6
A002	Khai	EMPLOYED	mokmok@gmail.com	3
A003	Atirah	UNEMPLOYED	email312@gmail.com	2

ParticipantAccount

pID	pPassword
A001	Alias_32JJK248
A002	MessixRonaldo7@0
A003	pass2to3t0@

ParticipantAddress

pID	street	postcode
-----	--------	----------

A001	Jalan Jeje	81200
A002	Jalan Borara	95600
A003	Jalan Hafiz	62000

PhoneNumber

pID	pPhoneNo
A001	016-597 2862
A002	014-848 7293
A003	013-280 6822

CFootprintMapping

cfmID	mappingData
CFMA01	564.23
CFMA02	465.23
CFMA03	789.65

CarbonReduction

carbonReductionID	mappingID
CRID001	506.56
CRID002	1589.35

CRID003	354.29
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CarbonConsumption_Reduction

dataID	carbonReductionID	pID
DID001	CRID001	A001
DID002	CRID002	A002
DID003	CRID003	A003

Water

dataID	wtrDay	wtrMonth	volume	wtrCost	wtrSavePractice
DID001	15	3	456.94	46.97	Water reservoir
DID002	31	5	357.52	89	Less time showering
DID003	28	12	512.34	62.01	Wash cloth full loaded

Electricity

dataID	eDay	eMonth	meter	eCost	eSavePractice
DID001	15	3	780.46	110.32	Switch off lights

DID002	31	5	556.23	78.45	Use warmlight light
DID003	28	12	895.24	150.69	Turn off water pump

Recycle

dataID	wsWeight	wsCost	coWeight	coCost	recyclePractice
DID001	10	7.87	5	50	Keep used oil
DID002	5	1.20	3	15	Keep tin can
DID003	5	2.46	6	5	Recycle

Validation

carbonReductionID	cfmID
CRID001	CFMA01
CRID002	CFMA02
CRID003	CFMA03

ValidationMC

carbonReductionID	cfmID	mcID
CRID001	CFMA01	MC001
CRID002	CFMA02	MC002
CRID003	CFMA03	MC003

MBIPConsultant

mcID	mcPassword
MC001	ja@12
MC002	zaz@12
MC003	don@12

6.0 SQL Statements (DDL & DML)

Create table PARTICIPANTACCOUNT

Unset

```
CREATE TABLE PARTICIPANTACCOUNT  
  
(  
  
  pID VARCHAR2(20) NOT NULL,  
  
  pPassword VARCHAR(20) NOT NULL,  
  
  pEmail VARCHAR2(20) NOT NULL,  
  
  CONSTRAINT pID_pk PRIMARY KEY (pID)  
  
);
```

Create Table PARTICIPANTINFO

Unset

```
CREATE TABLE PARTICIPANTINFO (  
  
  pID VARCHAR2(20),  
  
  pName VARCHAR2(30) NOT NULL,  
  
  pStatus VARCHAR2(15) NOT NULL,  
  
  pPeopleNum NUMBER(2) NOT NULL,  
  
  CONSTRAINT pi_pID_pk PRIMARY KEY (pID),  
  
  CONSTRAINT pi_pID_fk FOREIGN KEY (pID) REFERENCES  
  PARTICIPANTACCOUNT (pID)  
  
);
```


Create Table PARTICIPANTADDRESS

Unset

```
CREATE TABLE PARTICIPANTADDRESS (  
    pID VARCHAR2(20),  
    street VARCHAR2(15) NOT NULL,  
    postcode VARCHAR2(15) NOT NULL,  
    CONSTRAINT pa_pID_pk PRIMARY KEY (pID),  
    CONSTRAINT pa_pID_fk FOREIGN KEY (pID) REFERENCES PARTICIPANTACCOUNT  
    (pID)  
);
```

Create Table PHONENUMBER

Unset

```
CREATE TABLE PHONENUMBER (  
    pPhoneNo VARCHAR(15),  
    CONSTRAINT pPhoneNo_pk PRIMARY KEY (pPhoneNo)  
);
```

Create Table CFOOTPRINTMAPPING

Unset

```
CREATE TABLE CFOOTPRINTMAPPING  
(  
    cfmID VARCHAR2(20) NOT NULL,  
    mappingData VARCHAR2(20) NOT NULL,  
    CONSTRAINTS cfm_cfmID_pk PRIMARY KEY (cfmID)  
);
```

Create Table CARBONREDUCTION

Unset

```
CREATE TABLE CARBONREDUCTION (  
  carbonReductionID VARCHAR2(20),  
  carbonReductionData VARCHAR2(25) NOT NULL,  
  CONSTRAINT cr_crID_pk PRIMARY KEY (carbonReductionID)  
);
```

Create Table CARBONCONSUMPTION_REDUCTION

Unset

```
CREATE TABLE CARBONCONSUMPTION_REDUCTION (  
  dataID VARCHAR2(20) UNIQUE,  
  carbonReductionID VARCHAR2(20),  
  pID VARCHAR2(20) NOT NULL,  
  CONSTRAINT cr_pk PRIMARY KEY (dataID, carbonReductionID),  
  CONSTRAINT cr_pID_fk FOREIGN KEY (pID) REFERENCES PARTICIPANTACCOUNT (pID),  
  CONSTRAINT cr_crID_fk FOREIGN KEY (carbonReductionID) REFERENCES  
  CARBONREDUCTION (carbonReductionID)  
);
```

Create Table WATER

Unset

```
CREATE TABLE WATER  
(  
  dataID VARCHAR2(20),  
  wtrDayNo NUMBER(4,0) NOT NULL,  
  wtrMonth NUMBER(3,0) NOT NULL,  
  volume NUMBER(5,2) NOT NULL,  
  wtrcost NUMBER(5,2) NOT NULL,  
  wtrSavePractice VARCHAR2(30) NOT NULL,  
  CONSTRAINT wtr_dataID_pk PRIMARY KEY(dataID),  
  CONSTRAINT wtr_dataID_fk FOREIGN KEY (dataID) REFERENCES  
  CARBONCONSUMPTION_REDUCTION (dataID)  
);
```

Create Table ELECTRICITY

Unset

```
CREATE TABLE ELECTRICITY
(
  dataID VARCHAR2(20),
  eDayNo NUMBER(4,0) NOT NULL,
  eMonth NUMBER(3,0) NOT NULL,
  meter NUMBER(4) NOT NULL,
  cost NUMBER(5,2) NOT NULL,
  eSavePractice VARCHAR2(30) NOT NULL,
  CONSTRAINT e_dataID_pk PRIMARY KEY(dataID),
  CONSTRAINT e_dataID_fk FOREIGN KEY (dataID) REFERENCES
  CARBONCONSUMPTION_REDUCTION (dataID)
);
```

Create Table RECYCLE

Unset

```
CREATE TABLE RECYCLE
(
  dataID VARCHAR2(20),
  wsWeight NUMBER(4,0) NOT NULL,
  wsCost NUMBER(3,0) NOT NULL,
  coWeight NUMBER(4) NOT NULL,
  coCost NUMBER(5,2) NOT NULL,
  recyclePractice VARCHAR2(30) NOT NULL,
  CONSTRAINT ws_dataID_pk PRIMARY KEY(dataID),
  CONSTRAINT ws_dataID_fk FOREIGN KEY (dataID) REFERENCES
  CARBONCONSUMPTION_REDUCTION (dataID)
);
```

Create Table VALIDATION

Unset

```
CREATE TABLE VALIDATION
(
  carbonReductionID VARCHAR2(20) UNIQUE NOT NULL,
  cfmID VARCHAR2(20) UNIQUE NOT NULL,
  CONSTRAINTS val_crID_pk PRIMARY KEY (carbonReductionID,cfmID),
  CONSTRAINTS val_crID_fk FOREIGN KEY (carbonReductionID)
  REFERENCES CARBONCONSUMPTION_REDUCTION(carbonReductionID),
  CONSTRAINTS val_cfmID_fk FOREIGN KEY (cfmID) REFERENCES
  CFOOTPRINTMAPPING (cfmID)
);
```

CREATE TABLE VALIDATIONMC

Unset

```
CREATE TABLE VALIDATIONMC
(
  carbonReductionID VARCHAR2(20) UNIQUE NOT NULL,
  cfmID VARCHAR2(20) UNIQUE NOT NULL,
  mcID VARCHAR2(20) NOT NULL,
  CONSTRAINTS valmc_crID_pk PRIMARY KEY (carbonReductionID,cfmID),
  CONSTRAINTS valmc_crID_fk FOREIGN KEY (carbonReductionID)
  REFERENCES CARBONCONSUMPTION_REDUCTION(carbonReductionID),
  CONSTRAINTS valmc_cfmID_fk FOREIGN KEY (cfmID) REFERENCES
  CFOOTPRINTMAPPING (cfmID),
  CONSTRAINTS valmc_mcID_fk FOREIGN KEY (mcID) REFERENCES
  MBIPCONSULTANT (mcID)
);
```

CREATE TABLE MBIPCONSULTANT

Unset

```
CREATE TABLE MBIPCONSULTANT (  
    mcID VARCHAR2(20),  
    mcPassword VARCHAR2(20) NOT NULL,  
    CONSTRAINT mc_mcID_pk PRIMARY KEY (mcID)  
);
```

INSERT INTO PARTICIPANTACCOUNT

Unset

```
INSERT INTO PARTICIPANTACCOUNT(pID,pPassword,pEmail)  
    VALUES ('A001','Alias_32JJK248','alliy248@gmail.com');  
  
INSERT INTO PARTICIPANTACCOUNT(pID,pPassword,pEmail)  
    VALUES('A002','MessixRonaldo7@0','mokmok@gmail.com');  
  
INSERT INTO PARTICIPANTACCOUNT(pID,pPassword,pEmail)  
    VALUES('A003','pass2to3t0@','email312@gmail.com');
```

INSERT INTO PARTICIPANTINFO

Unset

```
INSERT INTO PARTICIPANTINFO(pID,pName,pStatus,pPeopleNum)  
    VALUES('A001','Ally','EMPLOYED','6');  
  
INSERT INTO PARTICIPANTINFO(pID,pName,pStatus,pPeopleNume)  
    VALUES('A002','Khai','EMPLOYED','3');  
  
INSERT INTO PARTICIPANTINFO(pID,pName,pStatus,pPeopleNume)  
    VALUES('A003','Atirah','UNEMPLOYED','2');
```

INSERT INTO PARTICIPANTADDRESS

Unset

```
INSERT INTO PARTICIPANTADDRESS(pID,street,postcode)
VALUES('A001','Jalan Jeje','81200');
```

```
INSERT INTO PARTICIPANTADDRESS(pID,street,postcode)
VALUES('A002','Jalan Borara','95600');
```

```
INSERT INTO PARTICIPANTADDRESS(pID,street,postcode)
VALUES('A003','Jalan Hafiz','62000');
```

INSERT INTO PHONENUMBER

Unset

```
INSERT INTO PHONENUMBER(pPhoneNo)
VALUES('016-597 2862');
```

```
INSERT INTO PHONENUMBER(pPhoneNo)
VALUES('014-848 7293');
```

```
INSERT INTO PHONENUMBER(pPhoneNo)
VALUES('013-280 6822');
```

INSERT INTO CFOOTPRINTMAPPING

Unset

```
INSERT INTO CFOOTPRINTMAPPING(cfmid,mappingData)
VALUES('CFMA01','564.23');
```

```
INSERT INTO CFOOTPRINTMAPPING(cfmid,mappingData)
VALUES('CFMA02','465.23');
```

```
INSERT INTO CFOOTPRINTMAPPING(cfmid,mappingData)
VALUES('CFMA03','789.65');
```

INSERT INTO CARBONREDUCTION

Unset

```
INSERT INTO CARBONREDUCTION(carbonReductionID,carbonReductionData)
VALUES('CRID001','506.56');
```

```
INSERT INTO CARBONREDUCTION(carbonReductionID,carbonReductionData)
VALUES('CRID002','1589.35');
```

```
INSERT INTO CARBONREDUCTION(carbonReductionID,carbonReductionData)
VALUES('CRID003','354.29');
```

INSERT INTO CARBONCONSUMPTION

Unset

```
INSERT INTO CARBONCONSUMPTION_REDUCTION(dataID,carbonReductionID,pID)
VALUES('DID001','CRID001','A001');
```

```
INSERT INTO CARBONCONSUMPTION_REDUCTION(dataID,carbonReductionID,pID)
VALUES('DID002','CRID002','A002');
```

```
INSERT INTO CARBONCONSUMPTION_REDUCTION(dataID,carbonReductionID,pID)
VALUES('DID003','CRID003','A003');
```

INSERT INTO WATER

Unset

```
INSERT INTO WATER(dataID,wtrDayNo,wtrMonth,volume,wtrcost,wtrSavePractice)
VALUES('DID001',15,3,456.94,46.97,'Water reservoir');
```

```
INSERT INTO WATER(dataID,wtrDayNo,wtrMonth,volume,wtrcost,wtrSavePractice)
VALUES('DID002',31,5,357.52,30.89,'Less time showering');
```

```
INSERT INTO WATER(dataID,wtrDayNo,wtrMonth,volume,wtrcost,wtrSavePractice)
VALUES('DID003',28,12,512.34,62.01,'Wash cloth full loaded');
```

INSERT INTO ELECTRICITY

Unset

```
INSERT INTO ELECTRICITY(dataID,eDayNo,eMonth,meter,cost,eSavePractice)
VALUES('DID001',15,3,780.46,110.32,'Switch off lights');
```

```
INSERT INTO ELECTRICITY(dataID,eDayNo,eMonth,meter,cost,eSavePractice)
VALUES('DID002',31,5,556.23,78.45,'Use warmlight light');
```

```
INSERT INTO ELECTRICITY(dataID,eDayNo,eMonth,meter,cost,eSavePractice)
VALUES('DID003',28,12,895.24,150.69,'Turn off water pump');
```

INSERT INTO RECYCLE

Unset

```
INSERT INTO RECYCLE(dataID,wsWeight,wsCost,coWeight,coCost,recyclePractice)
VALUES('DID001',10,7.87,5,50,'Keep used oil');
```

```
INSERT INTO RECYCLE(dataID,wsDayNo,wsMonth,coWeight,coCost,recyclePractice)
VALUES('DID002',5,1.20,3,15,'Keep tin can');
```

```
INSERT INTO RECYCLE(dataID,wsDayNo,wsMonth,coWeight,coCost,recyclePractice)
VALUES('DID003',5,2.46,6,5,'Recycle');
```

INSERT INTO VALIDATION

Unset

```
INSERT INTO VALIDATION(carbonReductionID,cfmID)
VALUES('CRID001','CFM001A01');
```

```
INSERT INTO VALIDATION(carbonReductionID,cfmID)
VALUES('CRID002','CRID02CB9');
```

```
INSERT INTO VALIDATION(carbonReductionID,cfmID)
VALUES('CRID003','CFM001A55');
```


INSERT INTO MBIPCONSULTANT

Unset

```
INSERT INTO MCCONSULTANT(mcID,mcPassword)
VALUES('MC001','Ja@12');
```

```
INSERT INTO MCCONSULTANT(mcID,mcPassword)
VALUES('MC002','zaz@12');
```

```
INSERT INTO MCCONSULTANT(mcID,mcPassword)
VALUES('MC003','don@12');
```

INSERT INTO VALIDATIONMC

Unset

```
INSERT INTO VALIDATIONMC(carbonreductionID,cfmID,mcID)
VALUES('CRID001','CFM001A01','MC001');
```

```
INSERT INTO VALIDATIONMC(carbonreductionID,cfmID,mcID)
VALUES('CRID002','CRID02CB9','MC002');
```

```
INSERT INTO VALIDATIONMC(carbonreductionID,cfmID,mcID)
VALUES('CRID003','CFM001A55','MC003');
```

7.0 SUMMARY

For this particular phase, the MBIP's Carbon Reduction and Sustainability Engagement System is created based on the logical ERD. The logical ERD is derived from the conceptual ERD (EERD) from the previous phase.

From the logical ERD, the entities go through the normalization process from the 1st Normal Form (1NF) up until Boyce-Codd Normal Form (BCNF). The normalization process serves the purpose of supporting the database design while also identifying any data redundancy and update anomalies. This also will make the system able to handle the data more efficiently, all while the data integrity is not compromised.

Apart from that, the data dictionary is updated according to the normalized relations. This is a crucial step in the phase as it records the information of all the entities, attributes and relationships. Then, SQL code statements for the system are defined using Oracle Developer, and thorough documentation is done to further clarify the purpose of the code. A prototype is also created to clearly demonstrate the flow of the system and how the database works.

To conclude, at the end of the phase and the project, we hope the system will achieve the objectives of the system based on the requirements of MBIP. We also hope that the system will prove to be not only functional, but also user-friendly, so that users and stakeholders alike are satisfied with the product.

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