

# **DATABASE TECHNOLOGY AOL PRESENTATION**

**Nicholas Sinclair Alfianto 2702208581**

**Nicholas Hardianto Johari 2702208594**

**Nicholas Salim 2702209363**

**Chico Alberto Gilardino 2702217296**

**Sharron Aurellia 2540122634**

# Abstrak

Sistem basis data ini dirancang untuk mengelola transaksi energi dalam pembangkit listrik, termasuk data pelanggan, rencana energi, penggunaan energi, pembayaran, dan kontrak. Proses normalisasi hingga bentuk normal ketiga (3NF) memastikan pengurangan redundansi dan integritas data.

Desain ERD memvisualisasikan hubungan antarentitas seperti pelanggan, pembangkit listrik, dan transaksi energi, mendukung operasional yang efisien dan analisis data yang akurat. Sistem ini relevan bagi industri energi untuk memantau emisi karbon, mengelola tagihan dan kontrak, serta menawarkan rencana energi yang sesuai kebutuhan pelanggan.

Hasilnya, sistem ini mendukung keberlanjutan dan efisiensi manajemen energi secara keseluruhan.

# Implementasi Pada Aplikasi

- Identifikasi Masalah

Mengatasi redundansi dan inkonsistensi data konsumsi energi pelanggan.

- Normalisasi Data

Melakukan proses normalisasi hingga 3NF untuk memastikan integritas data dan efisiensi penyimpanan.

- ERD

Merancang diagram ER untuk hubungan antara entitas.

- Pengembangan Database

Implementasi menggunakan DBMS dalam menghasilkan struktur tabel yang optimal.

- Hasil

Sistem mendukung pengelolaan data energi secara terstruktur, analisis konsumsi energi, dan pelaporan efisiensi.

**UNF**

TransactionID	CustomerID	CustomerName	CustomerAddress	AccountNumber	GroupCustomer	GroupCustomerID
TRX01	CU001	John Doe	123 Main St, Jakarta	1001	Residential	GC01
TRX02	CU002	Jane Smith	456 Oak St, Surabaya	1002	Residential	GC01
TRX03	CU003	Alice Brown	789 Pine St, Bandung	1003	Business	GC02
TRX04	CU004	Bob White	123 cedar St, Yogyakarta	1004	Industrial	GC03
TRX05	CU005	Chris Green	987 Elm St, Bali	1005	Residential	GC01
TRX06	CU006	Nicholas Blue	345 Sunset Place, Bandung	1006	Residential	GC01

Energy Plan	Energy PlanID	EnergyPlanDescription	PowerPlantID	PowerPlant LocationID	PowerPlantLocation	PowerPlantCapacity [MW]	PowerPlantCapacityCategory	PowerPlantStatusID	PowerPlantStatus
Plan A	EP01	A basic residential solar or wind energy plan offering medium capacity (200 MW) and zero emissions.	PP01	PL01	Jakarta	200	Medium	PPS01	Operational
Plan B	EP02	A residential coal-based plan offering large capacity (500 MW) with higher emissions for reliability.	PP02	PL02	Surabaya	500	Large	PPS02	Under Construction
Plan C	EP03	A business plan using solar and hydro sources, with medium capacity (300MW) and zero emissions.	PP03	PL03	Bandung	300	Medium	PPS01	Operational
Plan D	EP04	An industrial plan with biomass and wind energy, offering large capacity (400 MW) with moderate emissions.	PP04	PL04	Yogyakarta	400	Large	PPS01	Operational
Plan E	EP05	A residential plan with solar and wind, large capacity (600MW) and zero emissions, designed for high usage.	PP05	PL05	Bali	600	Large	PPS03	Under Maintenance
Plan E	EP05	A residential plan with solar and wind, large capacity (600 MW) and zero emissions, designed for high usage.	PP05	PL03	Bandung	600	Large	PPS01	Operational

EnergySource	EnergySourceID	FuelType	FuelTypeID	Emissions (kgCO2)	TransactionDate
Solar, Wind	ES01, ES02	Solar, Wind	FU01, FU02	0, 0	1/1/2024
Coal	ES03	Coal	FU03	10	1/2/2024
Solar, Hydro	ES01, ES04	Solar, Hydro	FU01, FU04	0, 0	1/15/2024
Biomass, Wind	ES05, ES02	Biomass, Wind	FU05, FU02	500, 600	2/1/2024
Solar	ES01	Solar	FU01	0	2/10/2024
Wind	ES02	Wind	FU02	0	2/10/2024

EnergyType	EnergyTypeID	EnergyUsageID	EnergyProduced (kWh)	EnergyConsumed (kWh)	PeakUsage (kWh)	Off-PeakUsage (kWh)	BillingAmount
Electricity, Electricity	ET001, ET001	EU001, EU002	160, 160	3000, 3200	1800, 1900	1200, 1300	\$50
Gas	ET002	EU003	450	5000	3500	1500	\$75
Electricity, Electricity	ET001, ET001	EU004, EU005	200, 220	6000, 6200	3500, 3700	2500, 2700	\$80
Electricity, Electricity	ET001, ET001	EU006, EU007	250, 260	7000, 7200	4000, 4200	3000, 3200	\$90
Electricity	ET001	EU008	300	8000	4500	3500	\$100
Electricity	ET001	EU009	310	8200	4700	3700	\$100

PaymentStatus	PaymentStatusID	ContractStartDate	ContractEndDate	ContractStatus	ContractStatusID	ContractID	TransactionPriority
Paid	PA01	1/1/2024	1/1/2025	Active	CS01	CT001	Urgent
Pending	PA02	1/2/2024	1/2/2025	Active	CS01	CT002	High Priority
Paid	PA03	1/15/2024	1/15/2025	Active	CS01	CT003	Low Priority
Paid	PA04	2/1/2024	2/1/2025	Active	CS01	CT004	Urgent
Pending	PA05	2/10/2024	2/10/2025	Pending	CS02	CT005	Not Urgent
Waiting for Approval	PA06	2/8/2024	2/12/2026	Renewed	CS03	CT006	Not Urgent

# ANOMALI

## Insert Anomaly

1. **Energy Plan Description** : Tidak bisa memasukkan deskripsi EnergyPlan tanpa data lengkap kapasitas.
2. **Customer Data**: Tidak bisa menambah pelanggan baru tanpa PowerPlantLocation atau EnergyPlan.
3. **Zero Emissions** : Data bahan bakar sulit dimasukkan karena emisi tidak realistik.

## Delete Anomaly

1. **Duplikasi Data Pelanggan** : Menghapus pelanggan "CU006" menghilangkan informasi terkait PowerPlantLocation (PL03/PL05).
2. **Contract and Payment**: Menghapus transaksi juga menghapus data pembayaran atau kontrak pelanggan.

## Update Anomaly

1. **Mismatch PaymentStatus** : Perubahan PaymentStatusID tanpa sinkronisasi status teks menyebabkan inkonsistensi.
2. **Overlapping Contract Dates** : Pembaruan ContractStatus tanpa memperbarui tanggal menyebabkan data salah.
3. **Energy Plan Description**: Mengubah kapasitas tanpa memperbarui deskripsi menyebabkan inkonsistensi.

## Solusi Normalisasi:

Normalisasi dilakukan hingga Bentuk Normal Ketiga (3NF) untuk memastikan data bebas dari redundansi dan anomali.

**INF**

Transaction ID	Customer ID	Customer Name	CustomerAddress	Account Number	GroupCustomer	GroupCustomerID	Energy Plan	Energy PlanID	EnergyPlanDescription
TRX01	CU001	John Doe	123 Main St, Jakarta	1001	Residential	GC01	Plan A	EP01	A basic residential solar or wind energy plan offering medium capacity (200 MW) and zero emissions.
TRX01	CU001	John Doe	123 Main St, Jakarta	1001	Residential	GC01	Plan A	EP01	A basic residential solar or wind energy plan offering medium capacity (200 MW) and zero emissions.
TRX02	CU002	Jane Smith	456 Oak St, Surabaya	1002	Residential	GC01	Plan B	EP02	A residential coal-based plan offering large capacity (500 MW) with higher emissions for reliability
TRX03	CU003	Alice Brown	789 Pine St, Bandung	1003	Business	GC02	Plan C	EP03	A business plan using solar and hydro sources, with medium capacity (300MW) and zero emissions.
TRX03	CU003	Alice Brown	789 Pine St, Bandung	1003	Business	GC02	Plan C	EP03	A business plan using solar and hydro sources, with medium capacity (300MW) and zero emissions.
TRX04	CU004	Bob White	123 Cedar St, Yogyakarta	1004	Industrial	GC03	Plan D	EP04	An industrial plan with biomass and wind energy, offering large capacity (400 MW) with moderate emissions.
TRX04	CU004	Bob White	123 Cedar St, Yogyakarta	1004	Industrial	GC03	Plan D	EP04	An industrial plan with biomass and wind energy, offering large capacity (400 MW) with moderate emissions.
TRX05	CU005	Chris Green	987 Elm St, Bali	1005	Residential	GC01	Plan E	EP05	A residential plan with solar and wind, large capacity (600 MW) and zero emissions, designed for high usage.
TRX06	CU006	Nicholas Blue	345 Sunset Place, Bandung	1006	Residential	GC01	Plan E	EP06	A residential plan with solar and wind, large capacity (600 MW) and zero emissions, designed for high usage.

PowerPlantID	PowerPlantLocationID	PowerPlantLocation	PowerPlantCapacity (MW)	PowerPlantCapacityCategory	PowerPlantStatusID	PowerPlantStatus	EnergySource	EnergySourceID	FuelType
PP01	PL01	Jakarta	200	Medium	PPS01	Operational	Solar	ES01	Solar
PP01	PL01	Jakarta	200	Medium	PPS01	Operational	Wind	ES02	Wind
PP02	PL02	Surabaya	500	Large	PPS02	Under Construction	Coal	ES03	Coal
PP03	PL03	Bandung	300	Medium	PPS01	Operational	Solar	ES01	Solar
PP03	PL03	Bandung	300	Medium	PPS01	Operational	Hydro	ES04	Hydro
PP04	PL04	Yogyakarta	400	Large	PPS01	Operational	Biomass	ES05	Biomass
PP04	PL04	Yogyakarta	400	Large	PPS01	Operational	Wind	ES02	Wind
PP05	PL05	Bali	600	Large	PPS03	Under Maintenance	Solar	ES01	Solar
PP05	PL03	Bandung	600	Large	PPS01	Operational	Wind	ES02	Wind

FuelTypeID	Emissions (kg CO2)	TransactionDate	EnergyType	EnergyTypeID	EnergyUsageID	EnergyProduced (kWh)	EnergyConsumed (kWh)	PeakUsage (kWh)
FU01	0	1/1/2024	Electricity	ET001	EU001	150	3000	1800
FU02	0	1/1/2024	Electricity	ET001	EU002	160	3200	1900
FU03	10	1/2/2024	Gas	ET002	EU003	450	5000	3500
FU01	0	1/15/2024	Electricity	ET001	EU004	200	6000	3500
FU04	0	1/15/2024	Electricity	ET001	EU005	220	6200	3700
FU05	500	2/1/2024	Electricity	ET001	EU006	250	7000	4000
FU02	600	2/1/2024	Electricity	ET001	EU007	260	7200	4200
FU01	0	2/10/2024	Electricity	ET001	EU008	300	8000	4500
FU02	0	2/10/2024	Electricity	ET001	EU009	310	8200	4700

Off-PeakUsage (kWh)	Billing Amount	Payment Status	PaymentStatusID	ContractStartDate	ContractEndDate	ContractStatus	ContractStatusID	ContractID	TransactionPriority
1200	\$50	Paid	PA01	1/1/2024	1/1/2025	Active	CS01	CT001	Urgent
1300	\$50	Paid	PA01	1/1/2024	1/1/2025	Active	CS01	CT001	Urgent
1500	\$75	Pending	PA02	1/2/2024	1/2/2025	Active	CS01	CT002	High Priority
2500	\$80	Paid	PA03	1/15/2024	1/15/2025	Active	CS01	CT003	Low Priority
2700	\$80	Paid	PA03	1/15/2024	1/15/2025	Active	CS01	CT003	Low Priority
3000	\$90	Paid	PA04	2/1/2024	2/1/2025	Active	CS01	CT004	Urgent
3200	\$90	Paid	PA04	2/1/2024	2/1/2025	Active	CS01	CT004	Urgent
3500	\$100	Pending	PA05	2/10/2024	2/10/2025	Pending	CS02	CT005	Not Urgent
3700	\$100	Waiting for Approval	PA06	2/10/2024	2/10/2025	Renewed	CS03	CT006	Not Urgent

# **Fungsional Dependensi**

Primary Key di 1NF :

TransactionID, CustomerID, EnergyPlanID, PowerPlantID, EnergySourceID, EnergyTypeID, EnergyUsageID, PaymentStatusID, ContractID

FD FULL

{TransactionID, CustomerID, EnergyPlanID, PowerPlantID, EnergySourceID, EnergyTypeID, EnergyUsageID, PaymentStatusID, ContractID} → EnergyProduced(kWH)

FD PARTIAL

TransactionID → TransactionDate, TransactionPriority

CustomerID → {CustomerName, CustomerAddress, AccountNumber, GroupCustomerID, GroupCustomer}

EnergyPlanID → {EnergyPlan, EnergyPlanDescription}

PowerPlantID → {PowerPlantLocationID, PowerPlantLocation, PowerPlantCapacity, PowerPlantCapacityCategory, PowerPlantStatusID, PowerPlantStatus}

**EnergyUsageID** → {**EnergyProduced (kWh)**, **EnergyConsumed (kWh)**, **PeakUsage (kWh)**, **Off-PeakUsage (kWh)**, **Emissions (KG CO2)**}

**EnergySourceID** → {**EnergySource**, **FuelTypeID**, **FuelType**}

**PaymentStatusID** → {**BillingAmount**, **PaymentStatus**}

**EnergyTypeID** → **EnergyType**

**ContractID** → {**ContractStartDate**, **ContractEndDate**, **ContractStatusID**,  
**ContractStatus**}

#### FD TRANSITIVE

**PowerPlantID** → **PowerPlantLocationID** → **PowerPlantLocation**

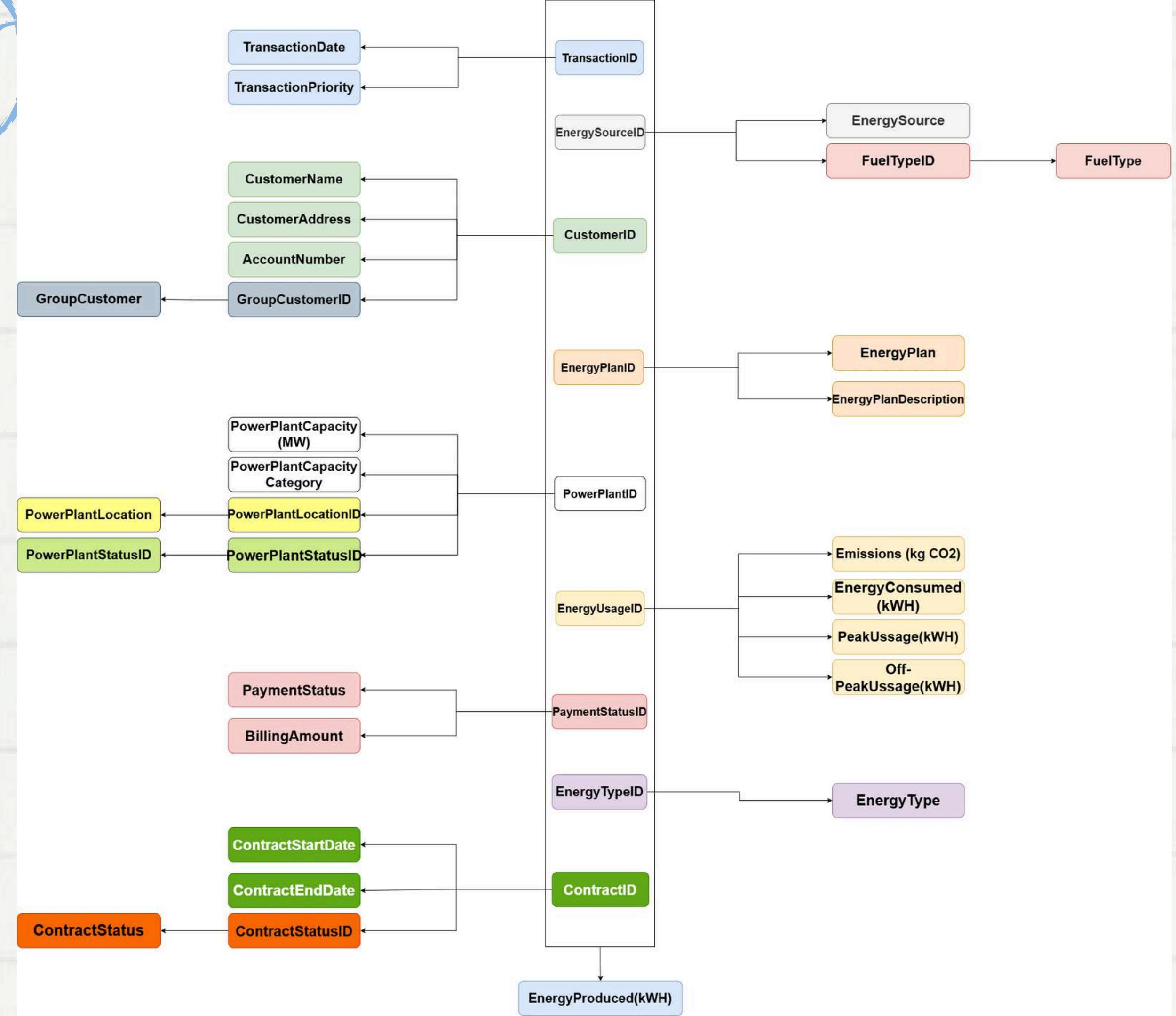
**EnergySourceID** → **FuelTypeID** → **FuelType**

**ContractID** → **ContractStatusID** → **ContractStatus**

**PowerPlantID** → **PowerPlantStatusID** → **PowerPlantStatus**

**CustomerID** → **GroupCustomerID** → **GroupCustomer**

# Diagram Dependensi



**2NF**

PRIMARY  
KEY

FOREIGN KEY

PRIMARY +  
FOREIGN KEY

## Composite Key (2 PK) = TransactionID, EnergySourceID

TransactionID	CustomerID	EnergyPlanID	PowerPlantID	EnergySourceID	EnergyTypeID	EnergyUsageID	PaymentStatusID	ContractID	EnergyProduced(kWH)
TRX01	CU001	EP01	PP01	ES01	ET001	EU001	PA01	CT001	150
TRX01	CU001	EP01	PP01	ES02	ET001	EU002	PA01	CT001	160
TRX02	CU002	EP02	PP02	ES03	ET002	EU003	PA02	CT002	450
TRX03	CU003	EP03	PP03	ES01	ET001	EU004	PA03	CT003	200
TRX03	CU003	EP03	PP03	ES04	ET001	EU005	PA03	CT003	220
TRX04	CU004	EP04	PP04	ES05	ET001	EU006	PA04	CT004	250
TRX04	CU004	EP04	PP04	ES02	ET001	EU007	PA04	CT004	260
TRX05	CU005	EP05	PP05	ES01	ET001	EU008	PA05	CT005	300
TRX06	CU005	EP05	PP05	ES02	ET001	EU009	PA06	CT006	310

PRIMARY  
KEY

FOREIGN KEY

PRIMARY +  
FOREIGN KEY

CustomerID	CustomerName	CustomerAddress	AccountNumber	GroupCustomer	GroupCustomerID
CU001	John Doe	123 Main St, Jakarta	1001	Residential	GC01
CU002	Jane Smith	456 Oak St, Surabaya	1002	Residential	GC01
CU003	Alice Brown	789 Pine St, Bandung	1003	Business	GC02
CU004	Bob White	123 Cedar St, Yogyakarta	1004	Industrial	GC03
CU005	Chris Green	987 Elm St, Bali	1005	Residential	GC01
CU006	Nicholas Blue	345 Sunset Place, Bandung	1006	Residential	GC01

Energy PlanID	EnergyPlan	EnergyPlanDescription	Power PlantID	PowerPlant LocationID	PowerPlant Location	PowerPlant Capacity	PowerPlant CapacityCategory	PowerPlant StatusID	PowerPlant Status
EP01	Plan A	A basic residential solar or wind energy plan offering medium capacity (200 MW) and zero emissions.	PP01	PL01	Jakarta	200	Medium	PPS01	Operational
EP02	Plan B	A residential coal-based plan offering large capacity (500 MW) with higher emissions for reliability.	PP02	PL02	Surabaya	500	Large	PPS02	Under Construction
EP03	Plan C	A business plan using solar and hydro sources, with medium capacity (300 MW) and zero emissions.	PP03	PL03	Bandung	300	Medium	PPS01	Operational
EP04	Plan D	An industrial plan with biomass and wind energy, offering large capacity (400 MW) with moderate emissions.	PP04	PL04	Yogyakarta	400	Large	PPS01	Operational
EP05	Plan E	A residential plan with solar and wind, large capacity (600MW) and zero emissions, designed for high usage.	PP05	PL05	Bali	600	Large	PPS03	Under Maintenance
PRIMARY KEY		FOREIGN KEY		PRIMARY + FOREIGN KEY					

**PRIMARY  
KEY**

**FOREIGN KEY**

**PRIMARY +  
FOREIGN KEY**

EnergySourceID	EnergySource	FuelType	FuelTypeID
ES01	Solar	Solar	FU01
ES02	Wind	Wind	FU02
ES03	Coal	Coal	FU03
ES04	Plan D	Hydro	FU04
ES05	Biomass	Biomass	FU05

TransactionID	TransactionDate	TransactionPriority
TRX01	01/01/2024	Urgent
TRX02	02/01/2024	High Priority
TRX03	15/01/2024	Low Priority
TRX04	01/02/2024	Urgent
TRX05	10/02/2024	Not Urgent
TRX06	10/02/2024	Not Urgent

EnergyType	EnergyTypeID
Electricity	ET001
Gas	ET002

EnergyUsage ID	Emissions (kg CO2)	EnergyProduced (kWh)	EnergyConsumed (kWh)	PeakUsage (kWh)	Off-PeakUsage (kWh)
EU001	0	150	3000	1800	1200
EU002	0	160	3200	1900	1300
EU003	10	450	5000	3500	1500
EU004	0	200	6000	3500	2500
EU005	0	220	6200	3700	2700
EU006	500	250	7000	4000	3000
EU007	600	260	7200	4200	3200
EU008	0	300	8000	4500	3500
EU009	0	310	8200	4700	3700

BillingAmount	PaymentStatus	PaymentStatus ID
\$50	Paid	PA01
\$75	Pending	PA02
\$80	Paid	PA03
\$90	Paid	PA04
\$100	Pending	PA05
\$100	Waiting for Approval	PA06

PRIMARY KEY

FOREIGN KEY

PRIMARY + FOREIGN KEY

**PRIMARY  
KEY**

**FOREIGN KEY**

**PRIMARY +  
FOREIGN KEY**

ContractID	ContractStartDate	ContractEndDate	ContractStatus	ContractStatusID
CT001	1/1/2024	1/1/2025	Active	CS01
CT002	1/2/2024	1/2/2025	Active	CS01
CT003	1/15/2024	1/15/2025	Active	CS01
CT004	2/1/2024	2/1/2025	Active	CS01
CT005	2/10/2024	2/10/2025	Pending	CS02
CT006	2/10/2024	2/10/2025	Renewed	CS03

# 3NF

PRIMARY  
KEY

FOREIGN KEY

PRIMARY +  
FOREIGN KEY

## Composite Key (2 PK) = TransactionID, EnergySourceID

TransactionID	CustomerID	EnergyPlanID	PowerPlantID	EnergySourceID	EnergyTypeID	EnergyUsageID	PaymentStatusID	ContractID	EnergyProduced(kWH)
TRX01	CU001	EP01	PP01	ES01	ET001	EU001	PA01	CT001	150
TRX01	CU001	EP01	PP01	ES02	ET001	EU002	PA01	CT001	160
TRX02	CU002	EP02	PP02	ES03	ET002	EU003	PA02	CT002	450
TRX03	CU003	EP03	PP03	ES01	ET001	EU004	PA03	CT003	200
TRX03	CU003	EP03	PP03	ES04	ET001	EU005	PA03	CT003	220
TRX04	CU004	EP04	PP04	ES05	ET001	EU006	PA04	CT004	250
TRX04	CU004	EP04	PP04	ES02	ET001	EU007	PA04	CT004	260
TRX05	CU005	EP05	PP05	ES01	ET001	EU008	PA05	CT005	300
TRX06	CU005	EP05	PP05	ES02	ET001	EU009	PA06	CT006	310

Customer ID	GroupCustomer ID	Customer Name	Customer Address	Account Number					
CU001	GC01	John Doe	123 Main St, Jakarta	1001					
CU002	GC01	Jane Smith	456 Oak St, Surabaya	1002					
CU003	GC02	Alice Brown	789 Pine St, Bandung	1003					
CU004	GC03	Bob White	123 Cedar St, Yogyakarta	1004					
CU005	GC01	Chris Green	987 Elm St, Bali	1005					
CU006	GC01	Nicholas Blue	345 Sunset Place, Bandung	1006					
PowerPlant ID	PowerPlant LocationID	PowerPlant StatusID	PowerPlant Capacity (MW)	PowerPlant Capacity Category					
PP01	PL01	PPS01	200	Medium					
PP02	PL02	PPS02	500	Large					
PP03	PL03	PPS01	300	Medium					
PP04	PL04	PPS01	400	Large					
PP05	PL05	PPS03	600	Large					

GroupCustomerID	GroupCustomer
GC01	Residential
GC02	Business
GC03	Industrial

PowerPlantLocationID	PowerPlantLocation
PL01	Jakarta
PL02	Surabaya
PL03	Bandung
PL04	Yogyakarta
PL05	Bali

EnergyPlanID	EnergyPlan	EnergyPlanDescription
EP01	Plan A	A basic residential solar or wind energy plan offering medium capacity (200 MW) and zero emissions.
EP02	Plan B	A residential coal-based plan offering large capacity (500 MW) with higher emissions for reliability.
EP03	Plan C	A business plan using solar and hydro sources, with medium capacity (300 MW) and zero emissions.
EP04	Plan D	An industrial plan with biomass and wind energy, offering large capacity (400 MW) with moderate emissions.
EP05	Plan E	A residential plan with solar and wind, large capacity (600 MW) and zero emissions, designed for high usage.

EnergyType	EnergyTypeID
Electricity	ET001
Gas	ET002

PowerPlantStatusID	PowerPlantStatus
PPS01	Operational
PPS02	Under Construction
PPS03	Under Maintenance

PRIMARY  
KEY

FOREIGN KEY

PRIMARY +  
FOREIGN KEY

EnergySourceID	FuelTypeID	EnergySource
ES01	FU01	Solar
ES02	FU02	Wind
ES03	FU03	Coal
ES04	FU04	Hydro
ES05	FU05	Biomass

FuelTypeID	FuelType
FU01	Solar
FU02	Wind
FU03	Coal
FU04	Hydro
FU05	Biomass

PaymentStatusID	BillingAmount	PaymentStatus
PA01	\$50	Paid
PA02	\$75	Pending
PA03	\$80	Paid
PA04	\$90	Paid
PA05	\$100	Pending
PA06	\$100	Waiting for Approval

ContractStatusID	ContractStatus
CS01	Active
CS02	Pending
CS03	Renewed

ContractID	ContractStatusID	ContractStartDate	ContractEndDate
CT001	CS01	1/1/2024	1/1/2025
CT002	CS01	1/2/2024	1/2/2025
CT003	CS01	1/15/2024	1/15/2025
CT004	CS01	2/1/2024	2/1/2025
CT005	CS02	2/10/2024	2/10/2025
CT006	CS03	2/10/2024	2/10/2025

PRIMARY  
KEY

FOREIGN KEY

PRIMARY +  
FOREIGN KEY

PRIMARY  
KEY

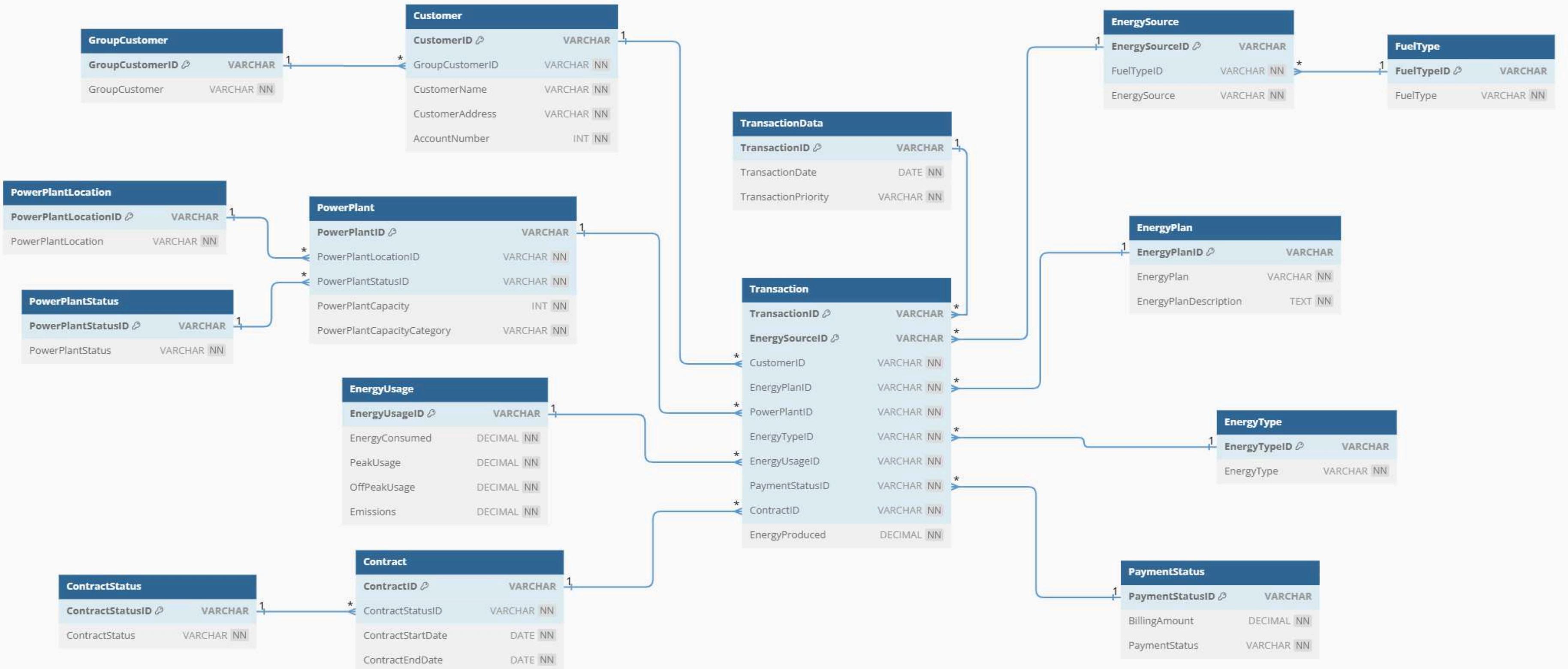
FOREIGN KEY

PRIMARY +  
FOREIGN KEY

EnergyUsageID	Emissions (kg CO2)	EnergyProduced (kWh)	EnergyConsumed (kWh)	PeakUsage (kWh)	Off-PeakUsage (kWh)
EU001	0	150	3000	1800	1200
EU002	0	160	3200	1900	1300
EU003	10	450	5000	3500	1500
EU004	0	200	6000	3500	2500
EU005	0	220	6200	3700	2700
EU006	500	250	7000	4000	3000
EU007	600	260	7200	4200	3200
EU008	0	300	8000	4500	3500
EU009	0	310	8200	4700	3700

TransactionID	TransactionDate	TransactionPriority
TRX01	01/01/2024	Urgent
TRX02	02/01/2024	High Priority
TRX03	15/01/2024	Low Priority
TRX04	01/02/2024	Urgent
TRX05	10/02/2024	Not Urgent
TRX06	10/02/2024	Not Urgent

**Tabell  
ERD**



**SQL DDL**

```
-- Table: TransactionData
CREATE TABLE TransactionData (
    TransactionID VARCHAR(10) PRIMARY KEY,
    TransactionDate DATE NOT NULL,
    TransactionPriority VARCHAR(50) NOT NULL
);
```

```
-- Table: EnergyPlan
CREATE TABLE EnergyPlan (
    EnergyPlanID VARCHAR(10) PRIMARY KEY,
    EnergyPlan VARCHAR(50) NOT NULL,
    EnergyPlanDescription TEXT
);
```

```
-- Table: GroupCustomer
CREATE TABLE GroupCustomer (
    GroupCustomerID VARCHAR(10) PRIMARY KEY,
    GroupCustomer VARCHAR(50) NOT NULL
);
```

```
-- Table: EnergyType
CREATE TABLE EnergyType (
    EnergyTypeID VARCHAR(10) PRIMARY KEY,
    EnergyType VARCHAR(50) NOT NULL
);
```

```
-- Table: EnergyUsage
CREATE TABLE EnergyUsage (
    EnergyUsageID VARCHAR(10) PRIMARY KEY,
    EnergyConsumed DECIMAL(10, 2) NOT NULL,
    PeakUsage DECIMAL(10, 2) NOT NULL,
    OffPeakUsage DECIMAL(10, 2) NOT NULL,
    Emissions DECIMAL(10, 2) NOT NULL
);
```

```
-- Table: FuelType
CREATE TABLE FuelType (
    FuelTypeID VARCHAR(10) PRIMARY KEY,
    FuelType VARCHAR(50) NOT NULL
);
```

```
-- Table: PowerPlantLocation
CREATE TABLE PowerPlantLocation (
    PowerPlantLocationID VARCHAR(10) PRIMARY KEY,
    PowerPlantLocation VARCHAR(50) NOT NULL
);
```

```
-- Table: PowerPlantStatus
CREATE TABLE PowerPlantStatus (
    PowerPlantStatusID VARCHAR(10) PRIMARY KEY,
    PowerPlantStatus VARCHAR(50) NOT NULL
);
```

```
-- Table: PaymentStatus
CREATE TABLE PaymentStatus (
    PaymentStatusID VARCHAR(10) PRIMARY KEY,
    BillingAmount DECIMAL(10, 2) NOT NULL,
    PaymentStatus VARCHAR(50) NOT NULL
);
```

```
-- Table: ContractStatus
CREATE TABLE ContractStatus (
    ContractStatusID VARCHAR(10) PRIMARY KEY,
    ContractStatus VARCHAR(50) NOT NULL
);
```

-- Table: Customer

```
CREATE TABLE Customer (
    CustomerID VARCHAR(10) PRIMARY KEY,
    GroupCustomerID VARCHAR(10),
    CustomerName VARCHAR(100) NOT NULL,
    CustomerAddress VARCHAR(200),
    AccountNumber INT NOT NULL,
    FOREIGN KEY (GroupCustomerID) REFERENCES
    GroupCustomer(GroupCustomerID)
);
```

-- Table: EnergySource

```
CREATE TABLE EnergySource (
    EnergySourceID VARCHAR(10) PRIMARY KEY,
    FuelTypeID VARCHAR(10),
    EnergySource VARCHAR(50) NOT NULL,
    FOREIGN KEY (FuelTypeID) REFERENCES
    FuelType(FuelTypeID)
);
```

-- Table: PowerPlant

```
CREATE TABLE PowerPlant (
    PowerPlantID VARCHAR(10) PRIMARY KEY,
    PowerPlantLocationID VARCHAR(10),
    PowerPlantStatusID VARCHAR(10),
    PowerPlantCapacity INT NOT NULL,
    PowerPlantCapacityCategory VARCHAR(50),
    FOREIGN KEY (PowerPlantLocationID) REFERENCES
    PowerPlantLocation(PowerPlantLocationID),
    FOREIGN KEY (PowerPlantStatusID) REFERENCES
    PowerPlantStatus(PowerPlantStatusID)
);
```

-- Table: Contract

```
CREATE TABLE Contract (
    ContractID VARCHAR(10) PRIMARY KEY,
    ContractStatusID VARCHAR(10),
    ContractStartDate DATE NOT NULL,
    ContractEndDate DATE NOT NULL,
    FOREIGN KEY (ContractStatusID) REFERENCES
    ContractStatus(ContractStatusID)
);
```

```
-- Table: Transaction
CREATE TABLE [Transaction] (
    TransactionID VARCHAR(10),
    EnergySourceID VARCHAR(10),
    CustomerID VARCHAR(10),
    EnergyPlanID VARCHAR(10),
    PowerPlantID VARCHAR(10),
    EnergyTypeID VARCHAR(10),
    EnergyUsageID VARCHAR(10),
    PaymentStatusID VARCHAR(10),
    ContractID VARCHAR(10),
    EnergyProduced DECIMAL(10, 2) NOT NULL,
    PRIMARY KEY (TransactionID, EnergySourceID),
    FOREIGN KEY (TransactionID) REFERENCES TransactionData(TransactionID),
    FOREIGN KEY (CustomerID) REFERENCES Customer(CustomerID),
    FOREIGN KEY (EnergyPlanID) REFERENCES EnergyPlan(EnergyPlanID),
    FOREIGN KEY (PowerPlantID) REFERENCES PowerPlant(PowerPlantID),
    FOREIGN KEY (EnergySourceID) REFERENCES EnergySource(EnergySourceID),
    FOREIGN KEY (EnergyTypeID) REFERENCES EnergyType(EnergyTypeID),
    FOREIGN KEY (EnergyUsageID) REFERENCES EnergyUsage(EnergyUsageID),
    FOREIGN KEY (PaymentStatusID) REFERENCES
        PaymentStatus(PaymentStatusID),
    FOREIGN KEY (ContractID) REFERENCES Contract(ContractID)
);
```

**SQL DML**

```
INSERT INTO TransactionData (TransactionID,  
TransactionDate, TransactionPriority)  
VALUES  
('TRX01', '2024-01-01', 'Urgent'),  
('TRX02', '2024-02-01', 'High Priority'),  
('TRX03', '2024-01-15', 'Low Priority'),  
('TRX04', '2024-02-01', 'Urgent'),  
('TRX05', '2024-02-10', 'Not Urgent'),  
('TRX06', '2024-02-10', 'Not Urgent');
```

```
INSERT INTO GroupCustomer (GroupCustomerID,  
GroupCustomer)  
VALUES  
('GC01', 'Residential'),  
('GC02', 'Business'),  
('GC03', 'Industrial');
```

```
INSERT INTO FuelType (FuelTypeID, FuelType)  
VALUES  
('FU01', 'Solar'),  
('FU02', 'Wind'),  
('FU03', 'Coal'),  
('FU04', 'Hydro'),  
('FU05', 'Biomass');
```

```
INSERT INTO PowerPlantLocation (PowerPlantLocationID,  
PowerPlantLocation) VALUES  
('PLO1', 'Jakarta'),  
('PLO2', 'Surabaya'),  
('PLO3', 'Bandung'),  
('PLO4', 'Yogyakarta'),  
('PLO5', 'Bali');
```

```
INSERT INTO PowerPlantStatus (PowerPlantStatusID,  
PowerPlantStatus) VALUES  
('PPS01', 'Operational'),  
('PPS02', 'Under Construction'),  
('PPS03', 'Under Maintenance');
```

```
INSERT INTO ContractStatus (ContractStatusID,  
ContractStatus) VALUES  
('CS01', 'Active'),  
('CS02', 'Pending'),  
('CS03', 'Renewed');
```

```
INSERT INTO EnergyType (EnergyTypeID, EnergyType)  
VALUES  
('ETO01', 'Electricity'),  
('ETO02', 'Gas');
```

```
INSERT INTO EnergyPlan (EnergyPlanID, EnergyPlan, EnergyPlanDescription)
VALUES
('EPO1', 'Plan A', 'A basic residential solar or wind energy plan offering medium capacity (200 MW) and zero emissions.'),
('EPO2', 'Plan B', 'A residential coal-based plan offering large capacity (500 MW) with higher emissions for reliability.'),
('EPO3', 'Plan C', 'A business plan using solar and hydro sources, with medium capacity (300 MW) and zero emissions.'),
('EPO4', 'Plan D', 'An industrial plan with biomass and wind energy, offering large capacity (400 MW) with moderate emissions.'),
('EPO5', 'Plan E', 'A residential plan with solar and wind, large capacity (600 MW) and zero emissions, designed for high usage.');
```

```
INSERT INTO EnergyUsage (EnergyUsageId, EnergyConsumed, PeakUsage, OffPeakUsage, Emissions)
VALUES
('EU001', 3000, 1800, 1200, 0),
('EU002', 3200, 1900, 1300, 0),
('EU003', 5000, 3500, 1500, 10),
('EU004', 6000, 3500, 2500, 0),
('EU005', 6200, 3700, 2700, 0),
('EU006', 7000, 4000, 3000, 500),
('EU007', 7200, 4200, 3200, 600),
('EU008', 8000, 4500, 3500, 0),
('EU009', 8200, 4700, 3700, 0);
```

```
INSERT INTO PaymentStatus (PaymentStatusID, BillingAmount, PaymentStatus)
VALUES
('PA01', 50, 'Paid'),
('PA02', 75, 'Pending'),
('PA03', 80, 'Paid'),
('PA04', 90, 'Paid'),
('PA05', 100, 'Pending'),
('PA06', 100, 'Waiting for Approval');
```

```
INSERT INTO EnergySource (EnergySourceID, FuelTypeID, EnergySource)
VALUES
('ES01', 'FU01', 'Solar'),
('ES02', 'FU02', 'Wind'),
('ES03', 'FU03', 'Coal'),
('ES04', 'FU04', 'Hydro'),
('ES05', 'FU05', 'Biomass');
```

```
INSERT INTO Customer (CustomerID, GroupCustomerID, CustomerName, CustomerAddress, AccountNumber)
VALUES
('CU001', 'GC01', 'John Doe', '123 Main St, Jakarta', 1001),
('CU002', 'GC01', 'Jane Smith', '456 Oak St, Surabaya', 1002),
('CU003', 'GC02', 'Alice Brown', '789 Pine St, Bandung', 1003),
('CU004', 'GC03', 'Bob White', '123 Cedar St, Yogyakarta', 1004),
('CU005', 'GC01', 'Chris Green', '987 Elm St, Bali', 1005),
('CU006', 'GC01', 'Nicholas Blue', '345 Sunset Place, Bandung', 1006);
```

```
INSERT INTO PowerPlant (PowerPlantID, PowerPlantLocationID, PowerPlantStatusID, PowerPlantCapacity,
PowerPlantCapacityCategory)
VALUES
('PPO1', 'PL01', 'PPS01', 200, 'Medium'),
('PPO2', 'PL02', 'PPS02', 500, 'Large'),
('PPO3', 'PL03', 'PPS01', 300, 'Medium'),
('PPO4', 'PL04', 'PPS01', 400, 'Large'),
('PPO5', 'PL05', 'PPS03', 600, 'Large');
```

```
INSERT INTO [Contract] (ContractID, ContractStatusID, ContractStartDate, ContractEndDate)
VALUES
('CT001', 'CS01', '2024-01-01', '2025-01-01'),
('CT002', 'CS01', '2024-02-01', '2025-02-01'),
('CT003', 'CS01', '2024-01-15', '2025-01-15'),
('CT004', 'CS01', '2024-02-01', '2025-02-01'),
('CT005', 'CS02', '2024-02-10', '2025-02-10'),
('CT006', 'CS03', '2024-02-10', '2025-02-10');
```

```
INSERT INTO [Transaction] (TransactionID, EnergySourceID, CustomerID, EnergyPlanID, PowerPlantID,
EnergyTypeID, EnergyUsageId, PaymentStatusID, ContractID, EnergyProduced)
VALUES
('TRX01', 'ES01', 'CU001', 'EPO1', 'PPO1', 'ETO01', 'EU001', 'PA01', 'CT001', 150),
('TRX01', 'ES02', 'CU001', 'EPO1', 'PPO1', 'ETO01', 'EU002', 'PA01', 'CT001', 160),
('TRX02', 'ES03', 'CU002', 'EPO2', 'PPO2', 'ETO02', 'EU003', 'PA02', 'CT002', 450),
('TRX03', 'ES01', 'CU003', 'EPO3', 'PPO3', 'ETO01', 'EU004', 'PA03', 'CT003', 200),
('TRX03', 'ES04', 'CU003', 'EPO3', 'PPO3', 'ETO01', 'EU005', 'PA03', 'CT003', 220),
('TRX04', 'ES05', 'CU004', 'EPO4', 'PPO4', 'ETO01', 'EU006', 'PA04', 'CT004', 250),
('TRX04', 'ES02', 'CU004', 'EPO4', 'PPO4', 'ETO01', 'EU007', 'PA04', 'CT004', 260),
('TRX05', 'ES01', 'CU005', 'EPO5', 'PPO5', 'ETO01', 'EU008', 'PA05', 'CT005', 300),
('TRX06', 'ES02', 'CU006', 'EPO5', 'PPO5', 'ETO01', 'EU009', 'PA06', 'CT006', 310);
```

```
SELECT t.TransactionID, c.CustomerID, c.CustomerName, c.CustomerAddress, c.AccountNumber, gc.GroupCustomer,
c.GroupCustomerID, ep.EnergyPlan, ep.EnergyPlanID, ep.EnergyPlanDescription, pp.PowerPlantID, pp.PowerPlantLocationID,
ppl.PowerPlantLocation, pp.PowerPlantCapacity, pp.PowerPlantCapacityCategory, pp.PowerPlantStatusID,
pps.PowerPlantStatus, es.EnergySource, es.EnergySourceID, f.FuelType, f.FuelTypeID, eu.Emissions, td.TransactionDate,
et.EnergyType, et.EnergyTypeID, t.EnergyUsageID, t.EnergyProduced, eu.EnergyConsumed, eu.PeakUsage, eu.OffPeakUsage,
ps.BillingAmount, ps.PaymentStatus, ps.PaymentStatusID, ct.ContractStartDate, ct.ContractEndDate, cs.ContractStatus,
ct.ContractStatusID, t.ContractID, td.TransactionPriority
FROM
[Transaction] t
INNER JOIN TransactionData td ON t.TransactionID = td.TransactionID
INNER JOIN Customer c ON t.CustomerID = c.CustomerID
LEFT JOIN GroupCustomer gc ON c.GroupCustomerID = gc.GroupCustomerID
INNER JOIN EnergyPlan ep ON t.EnergyPlanID = ep.EnergyPlanID
INNER JOIN PowerPlant pp ON t.PowerPlantID = pp.PowerPlantID
LEFT JOIN PowerPlantLocation ppl ON pp.PowerPlantLocationID = ppl.PowerPlantLocationID
LEFT JOIN PowerPlantStatus pps ON pp.PowerPlantStatusID = pps.PowerPlantStatusID
INNER JOIN EnergySource es ON t.EnergySourceID = es.EnergySourceID
LEFT JOIN FuelType f ON es.FuelTypeID = f.FuelTypeID
INNER JOIN EnergyUsage eu ON t.EnergyUsageID = eu.EnergyUsageID
INNER JOIN EnergyType et ON t.EnergyTypeID = et.EnergyTypeID
INNER JOIN PaymentStatus ps ON t.PaymentStatusID = ps.PaymentStatusID
INNER JOIN Contract ct ON t.ContractID = ct.ContractID
LEFT JOIN ContractStatus cs ON ct.ContractStatusID = cs.ContractStatusID;
```

**Thank you  
very much!**