# CENOVUS ENERGY LTD.


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## Introduction

A good database helps a company store, manage, and use information easily. It makes work faster, reduces mistakes, and helps in making better decisions. In this project, we will design a simple database for **Cenovus Energy Ltd.**, an oil and gas company. This database will keep track of workers, drilling sites, machines, production, repairs, and supplies to help the company run smoothly.

## About the Company

**Cenovus Energy Ltd.** is a Canadian company that produces oil and gas. The company works responsibly, cares for the environment, and supports the local communities where it operates.

## MISSION

The mission is to produce oil and gas while prioritizing environmental protection and supporting local communities safely and responsibly. This involves maintaining high standards of safety, environmental care, and social responsibility. The goal is to meet energy needs while respecting the natural world and surrounding communities.

## OBJECTIVE

The objective is to develop a comprehensive database that tracks workers, drilling sites, machinery, oil and gas production, repairs, and supplies. This system will help ensure smooth operations, improve decision-making, enhance safety, and support environmental and community responsibilities.

# List of Tables

1. **Workers :** Keeps records of all employees, including their names, positions, certifications, and the sites or machines they're assigned to. This helps manage workforce safety and productivity.

2. **Drilling Sites :** Stores information about each drilling location, its operational status, and environmental details. It ensures proper site management and regulatory compliance.

3. **Machines :** Tracks all machinery, including their types, current location, operational status, and maintenance history. This helps prevent breakdowns and supports efficient operations.

4. **Oil and Gas Production :** Records the daily, weekly, or monthly production volumes of oil and gas at each site, along with quality and timing details. It provides vital data for reporting and decision-making.

5. **Repairs :** Logs all maintenance and repair activities, including dates, parts replaced, and the workers involved. This ensures equipment stays safe, functional, and reliable.

6. **Supplies :** Manages inventory of materials needed for drilling and maintenance, including quantities, storage locations, and reorder levels. It helps maintain smooth operations by avoiding shortages.

## List of attributes:

### ➢ Workers Table

- **WorkerID (Primary Key):** A unique number assigned to each worker to identify them within the database and link them to other records.
- **FirstName:** The first name of the worker, used for identification and internal communication purposes.
- **LastName:** The last name of the worker, providing complete identification alongside the first name.
- **Position:** The job title or role held by the worker (e.g., Drilling Engineer, Technician), used to define their responsibilities.

- **Department:** The department or team the worker is assigned to (e.g., Operations, Maintenance), used for organizing staff and workflow.
- **HireDate:** The official date the worker joined the company, used for service records and employment management.
- **ContactNumber:** The personal or work phone number of the worker, used for direct communication when needed.
- **Email:** The official email address of the worker, used for formal communication and company updates.

## ➢ Drilling Sites Table

- **SiteID:** A unique identifier for each drilling site, used to distinguish one site from another within the database.
- **SiteName:** The name assigned to the drilling site, used for identification and reporting purposes.
- **Location:** The physical address or geographic coordinates of the drilling site, important for operational planning and logistical management.
- **ManagerID:** A foreign key that links to the WorkerID in the Workers table, indicating which employee is responsible for managing the site.
- **OperationalStatus:** Describes the current state of the drilling site, such as Active*,* Maintenance*, or* Closed*,* for operational monitoring and decision-making.
- **Capacity:** The maximum production or operational limit of the site, typically measured in barrels per day or cubic meters of gas.

## ➢ Machines Table

- **MachineID (Primary Key) :** A unique identifier assigned to each machine, used to distinguish and track individual machines within the database.
- **MachineName :** The name or label given to the machine for identification and reporting purposes.
- **Type:** The category or kind of machine (e.g., Drill Rig, Pump, Compressor), indicating its function in operations.
- **PurchaseDate :** The date when the machine was purchased, used for asset management and maintenance scheduling.
- **SiteID (Foreign Key to Drilling Sites Table) :** Links to the SiteID in the Drilling Sites table, indicating which site the machine is currently assigned to.
- **Status :** Describes the current operational condition of the machine (e.g., Operational, Under Repair, Out of Service), helping in maintenance and usage planning.

## ➢ Production Table

- **ProductionID (Primary Key) :** A unique identifier assigned to each production record, used to track and manage individual production entries within the database.

- **SiteID (Foreign Key to Drilling Sites Table) :** Links to the SiteID in the Drilling Sites table, indicating where the oil and gas production took place.
- **ProductionDate :** The specific date on which the production was recorded, used for operational tracking and reporting.
- **OilQuantity :** The amount of oil produced on the recorded date, typically measured in barrels or liters.
- **GasQuantity :** The amount of natural gas produced on the recorded date, typically measured in cubic meters or cubic feet.
- **WorkerID (Foreign Key to Workers Table) :** Links to the WorkerID in the Workers table, indicating the employee responsible for supervising or recording the production activity.

## ➢ Repairs Table

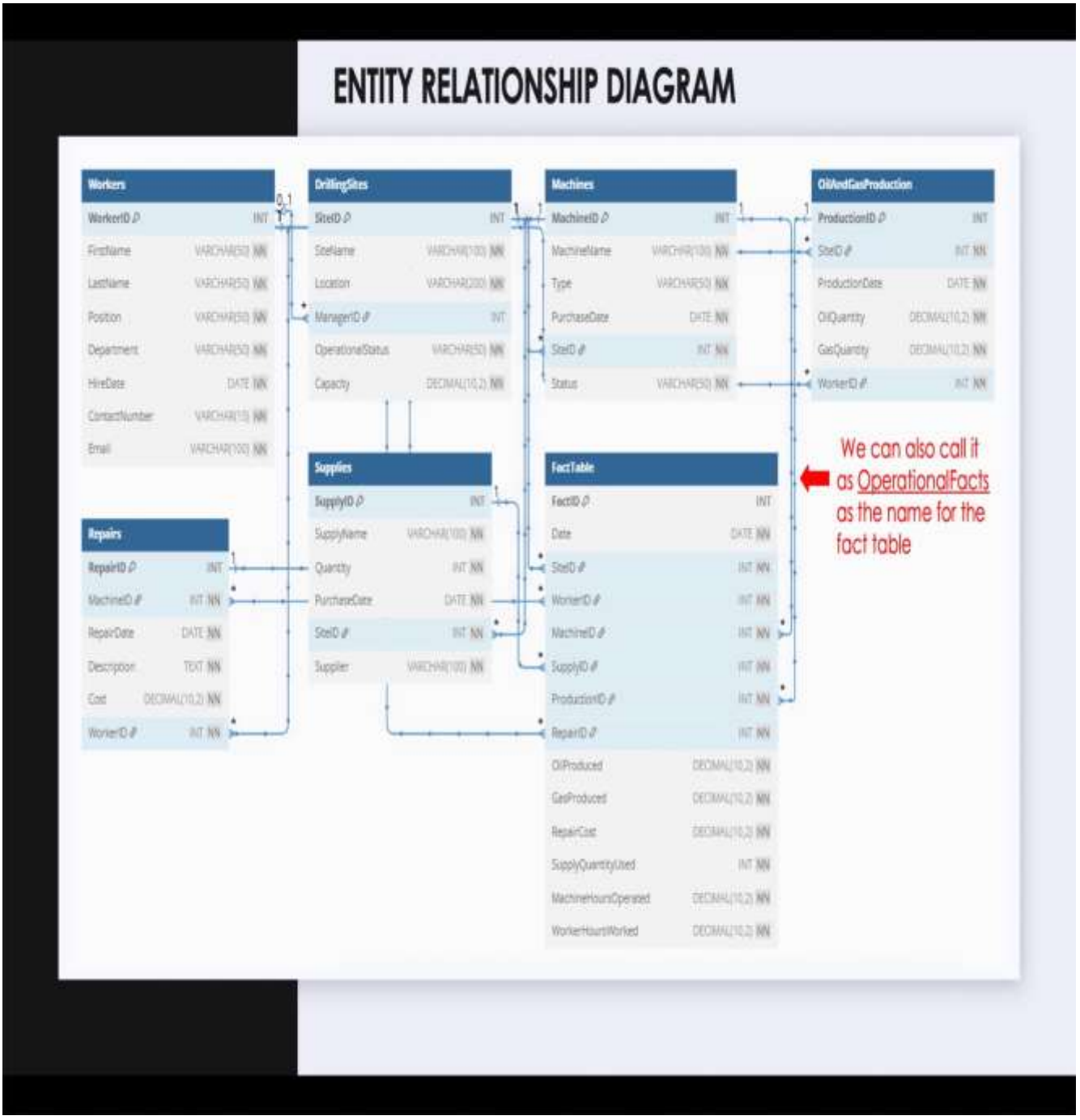
- **RepairID (Primary Key) :** A unique identifier assigned to each repair record, used to track individual maintenance activities within the database.
- **MachineID (Foreign Key to Machines Table) :** Links to the MachineID in the Machines table, identifying which machine the repair was performed on.
- **RepairDate :** The specific date when the repair or maintenance work was carried out, useful for scheduling and maintenance history tracking.
- **Description :** A brief explanation of the problem or repair work performed on the machine, providing details for future reference.
- **Cost :** The total expense incurred for the repair, including parts and labor, important for financial and operational records.

- **WorkerID (Foreign Key to Workers Table) :** Links to the WorkerID in the Workers table, identifying the employee responsible for carrying out the repair work.

## ➢ Supplies Table

- **SupplyID (Primary Key) :** A unique identifier assigned to each supply record, used to track individual supply entries in the database.
- **SupplyName :** The name of the supply item (e.g., Drill Bits, Hydraulic Fluid), used for identification and inventory purposes.
- **Quantity :** The amount or number of supply items available or delivered, used for inventory management.
- **PurchaseDate :** The date when the supplies were purchased or received, important for stock tracking and financial records.
- **SiteID (Foreign Key to Drilling Sites Table) :** Links to the SiteID in the Drilling Sites table, indicating which drilling site the supplies are allocated to.
- **Supplier :** The name or company that provided the supplies, used for vendor management and procurement records.

# ENTITY RELATIONSHIP DIAGRAM



# Relationships

- **Workers to Drilling Sites: One-to-Many**
  → One worker (specifically a manager) can be responsible for managing multiple drilling sites, but each drilling site has only one assigned manager.

- **Workers to Repairs: Many-to-Many**
  → Multiple workers can be involved in multiple repair activities. This usually requires a junction table (like WorkerRepairs) to properly represent the relationship in a relational database.

- **Workers to Oil and Gas Production: Many-to-Many**
  → Multiple workers can participate in or record multiple oil and gas production events. This too typically involves a junction table (like WorkerProductionRecords) to manage the many-to-many association.

- **Drilling Sites to Machines: One-to-Many**
  → One drilling site can have multiple machines assigned to it, but each machine is assigned to one drilling site at a time.

❖ **Drilling Sites to Supplies: One-to-Many**

→ One drilling site can receive multiple supplies, but each supply record is associated with only one drilling site.

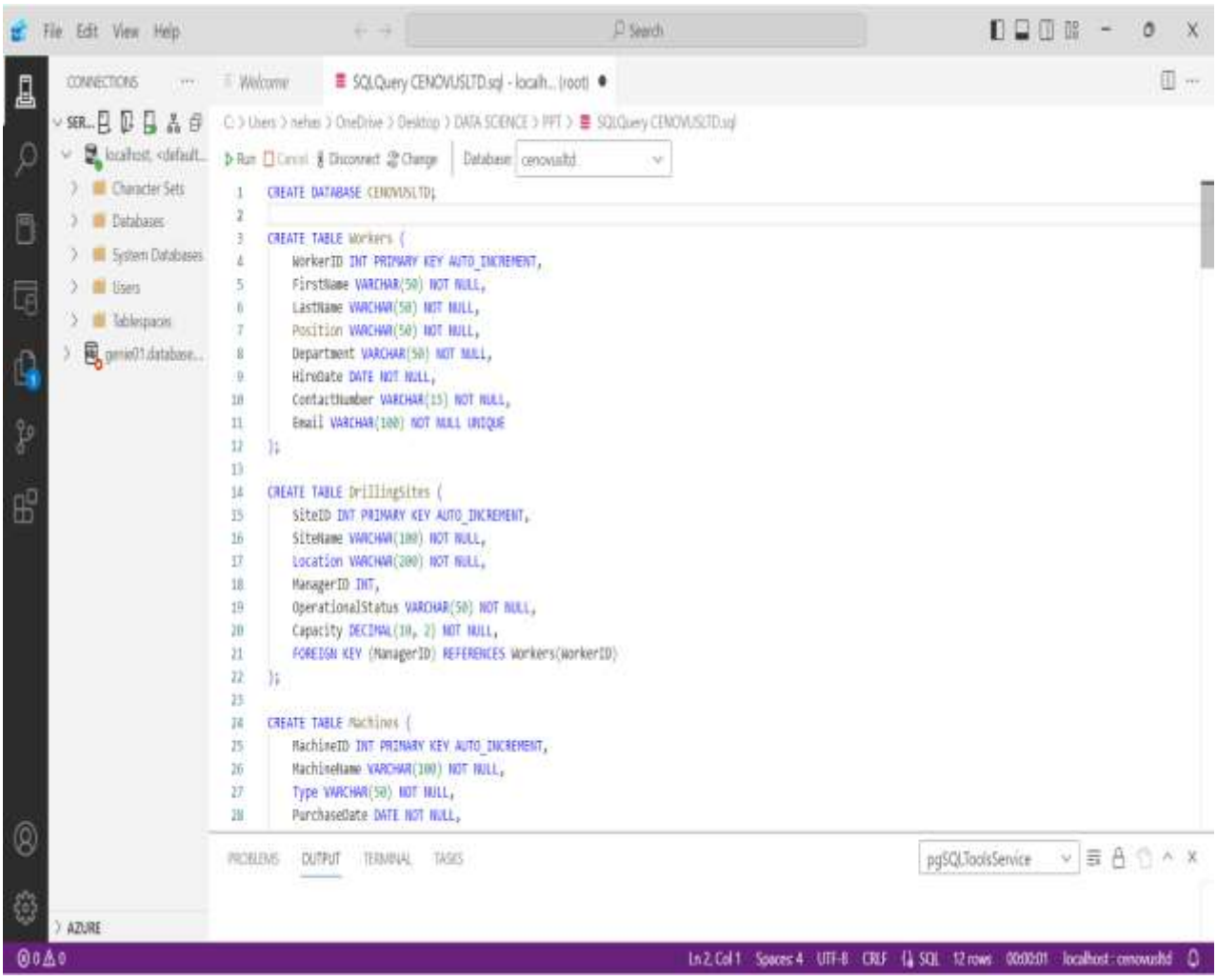
❖ **Machines to Repairs: One-to-Many**

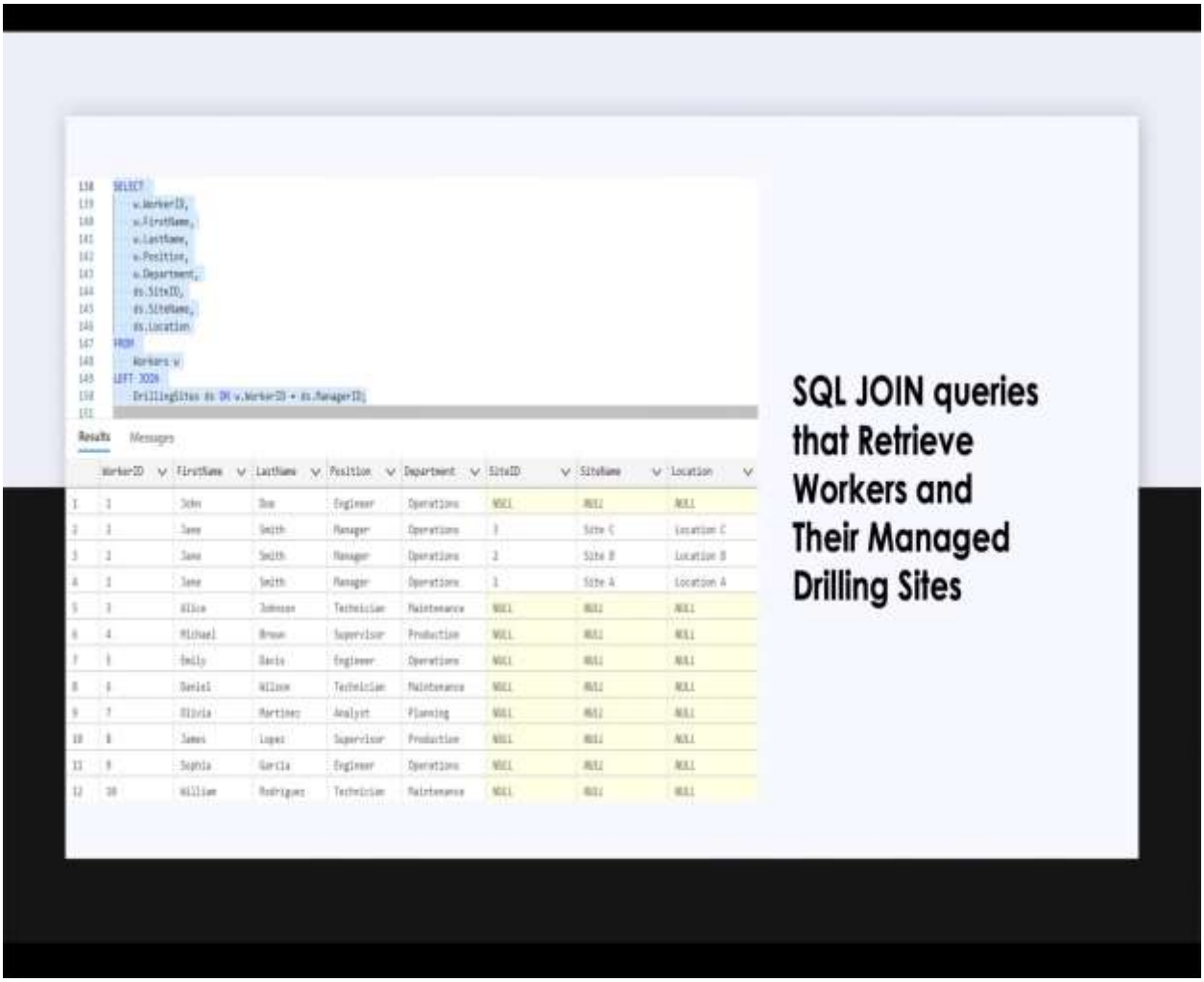
→ One machine can have multiple repair records over time, but each repair record is associated with one specific machine.

❖ **Supplies to Drilling Sites: Many-to-One**

→ Many supply records can be linked to a single drilling site, indicating that a site can receive multiple types of supplies or multiple deliveries, but each individual supply record belongs to one site.

# CREATING DATABASE ON MYSQL FOR CENOVUS LTD.






- This query demonstrates how SQL JOINs can be leveraged to associate employees with the assets or operations they are responsible for. In this example, using a LEFT JOIN between Workers and DrillingSites helps us not only identify who manages which sites but also recognize employees without site responsibilities. This type of query is essential for operational dashboards and HR reporting in industries like oil and gas where project assignments are dynamic and decentralized.


- These SQL queries showcase how to use relational data to extract meaningful insights for decision-making in the oil and gas industry. The first query merges production, worker, and site information to get a comprehensive view of daily output. The second query aggregates this data to compare total production across all drilling sites, helping identify top-performing locations. Sorting by oil and gas quantity gives leadership a quick view of which sites are most productive, which is essential for resource planning and operational efficiency.

# OUTCOMES

1. **Comprehensive Data Management** :

- The system is designed with well-structured relational tables (e.g., Workers, DrillingSites, Machines, OilAndGasProduction) that manage all core data related to employees, operations, equipment, and production. By organizing data across multiple interconnected entities, the database ensures:

- Easy storage, retrieval, and updates
- Support for multiple departments (operations, maintenance, production)
- Centralized access to critical business information

**2. Data Integrity :**

The use of primary keys and foreign key constraints ensures accuracy and consistency in the data:

- Prevents duplication (e.g., unique WorkerID and SiteID)
- Ensures valid references (e.g., DrillingSites must reference valid ManagerID from Workers)

This maintains the reliability of the data over time, especially as it grows.

### 3. Operational Insights :

With JOIN queries and aggregation functions like SUM(), the database supports powerful analysis and reporting, giving stakeholders real-time insights:

- Track daily or total oil and gas production
- Monitor employee assignments and site activity
- Evaluate site performance and output trends

### 4. Scalability :

The database is built to handle increasing amounts of data without affecting performance. As more drilling sites, workers, machines, and production records are added:

- The relational structure remains efficient
- Queries remain optimized
- The system can integrate new tables (like environmental data, safety logs, etc.) easily

# Conclusion:

- In this project, we designed and implemented a comprehensive relational database system for Cenovus Energy Ltd to manage its core operations more efficiently. The database includes well-structured tables for workers, drilling sites, machines, oil and gas production, repairs, and supplies, along with a central fact table that integrates all these entities.

- This design ensures comprehensive data management, enforces data integrity through primary and foreign key relationships, and enables the extraction of operational insights using SQL queries and aggregations. Furthermore, the system is built to support scalability, allowing for future expansion as business operations grow.