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Report on Analytic Solution

Building Power BI Report Using Oil & Gas Drilling Dataset

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Introduction

In the fast-paced and complex world of oil and gas drilling, optimizing operations while maintaining cost efficiency and safety is crucial. To achieve this, data-driven insights play an essential role in understanding and improving performance. Using Power BI, I analyzed a dataset containing detailed information on daily drilling activities, including rate of penetration (ROP), downtime, incidents, and costs. This analysis is designed to track operational efficiency, identify bottlenecks, and provide actionable insights to enhance decision-making in real-time.

Through visualizing this data, my goal is to highlight key performance metrics that allow stakeholders to assess the effectiveness of their drilling strategies, minimize non-productive time (NPT), and reduce overall operational costs. The use of Power BI enables a dynamic and interactive exploration of the data, providing a comprehensive understanding of drilling performance across various wells, rigs, and formations.

Mission Statement

To leverage data analytics and interactive visualizations using Power BI to monitor, optimize, and improve the operational efficiency, cost-effectiveness, and safety of oil and gas drilling activities. By providing stakeholders with real-time insights into key performance indicators, this analysis aims to support data-driven decision-making that enhances drilling outcomes and minimizes operational risks.

Purpose and Goals

The purpose of analyzing this dataset is threefold:

- Track the Daily Operational Performance of the drilling process to ensure that it meets or exceeds benchmarks for efficiency and safety.
- Identify Inefficiencies or Issues that could negatively impact the drilling operation. This includes downtime and non-productive time (NPT), which need to be minimized to reduce costs and maximize productivity.
- Enable Real-Time Decision-Making by leveraging Power BI's interactive visualizations to provide stakeholders with actionable insights.

Goals

- Optimize Drilling Efficiency: This involves using key metrics like ROP, mud type, formation, and bit type to ensure optimal drilling performance.
- Track Drilling Costs: Monitoring the cost of operations over time and comparing them across different wells, rigs, or formations to identify cost-saving opportunities.

- Minimize Non-Productive Time (NPT): By identifying bottlenecks such as downtime and incidents, the analysis will help in improving operational efficiency.

Key Performance Indicators (KPIs)

The following KPIs were identified as critical for tracking the drilling operations:

- Average Rate of Penetration (ROP): This KPI helps measure how fast the drilling is progressing, which is crucial for optimizing time and costs.
- Total Downtime: This measures the total hours lost due to non-productive time (NPT), providing insights into operational inefficiencies.
- Total Incidents: Tracking incidents helps improve safety and operational performance.
- Total Cost by Quarter: Monitoring quarterly costs helps in budgeting and identifying any unexpected expenses or cost overruns.

Dataset Selection

I selected the drilling operations dataset to gain insights into the efficiency, cost, and performance of oil and gas drilling activities. The dataset contains crucial operational information, including daily drilling depth, rate of penetration (ROP), mud types used, downtime hours, incidents, and total costs. This dataset was appealing because it provides a rich variety of data points that allow for comprehensive analysis of drilling performance, which can be directly linked to decision-making processes in the oil and gas industry.

My primary goal was to extract actionable insights that could be used to optimize the drilling process, reduce downtime, and minimize costs.

Key Questions on the Data

In order to make the data actionable, I focused on three key questions:

1. What are the total Minor and Major Incidents?
2. What Are the trends in drilling cost, monthly and annually?
3. What are the trends in total downtime per month.

Connecting to the Data Using Power BI

To connect to the dataset, I used Power BI's built-in data connector to import the drilling data, which was initially stored in a CSV format. The process involved the following steps:

- Importing the Data: I selected the "Get Data" option in Power BI and chose the appropriate format (CSV in this case) to import the dataset into the Power BI workspace.
- Data Preparation: After importing the data, I used Power BI's Power Query Editor to clean the dataset. This involved handling missing values, renaming columns, and ensuring that the data types (such as date and numerical fields) were correctly defined.
- Data Modeling: I then modeled the data by creating relationships between different attributes, such as well ID and rig ID, ensuring that my visualizations could reflect accurate comparisons across different dimensions.

Strategy for Presenting Data Effectively

For effective data presentation in Power BI, I used the following strategy:

- Interactive Dashboards: Power BI allows for creating interactive dashboards where users can drill down into specific wells, rigs, or time periods to investigate performance in more detail.
- Visualizations: I used several types of visualizations:
- Line Charts: To track daily drilling depth and ROP trends over time.
- Bar Charts: To compare downtime across different wells and rigs.
- Pie Charts: To show cost distribution across different drilling operations.
- Filters and Slicers: I implemented slicers in Power BI to enable users to filter data by well ID, rig ID, or time period. This allows decision-makers to focus on specific areas of interest.
- KPI Cards: I added KPI (Key Performance Indicator) cards for quick insights into essential metrics like average ROP, total downtime, total incidents, and total costs. These KPIs provide an immediate overview of operational performance.

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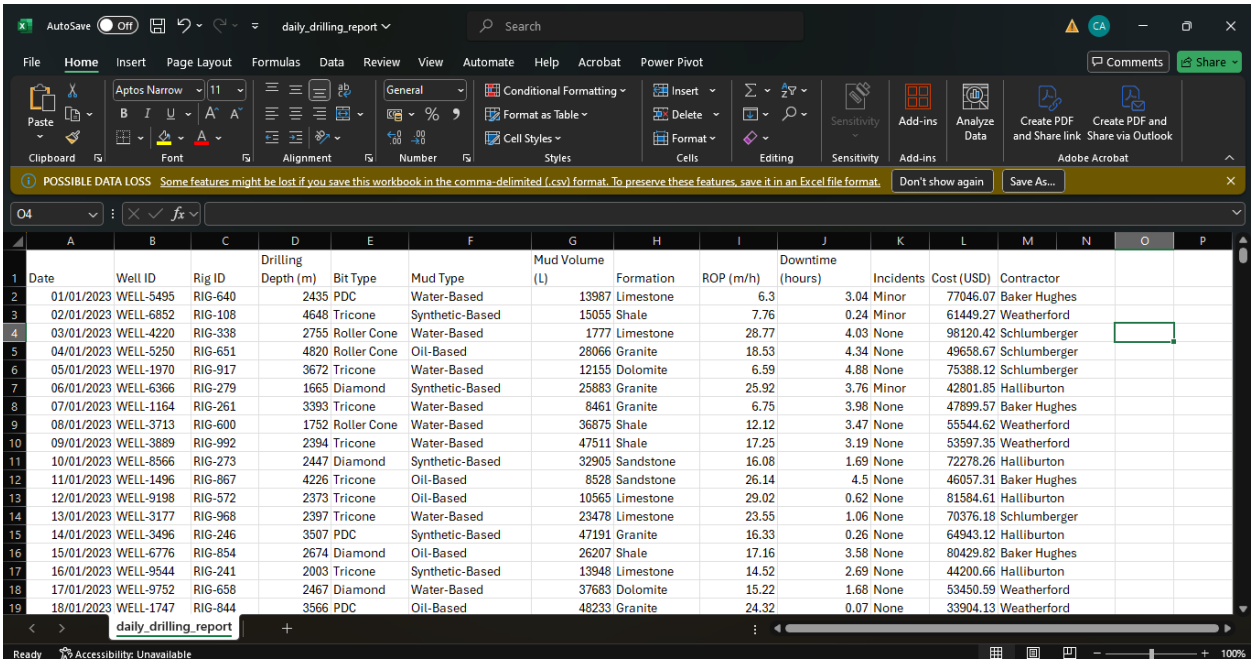
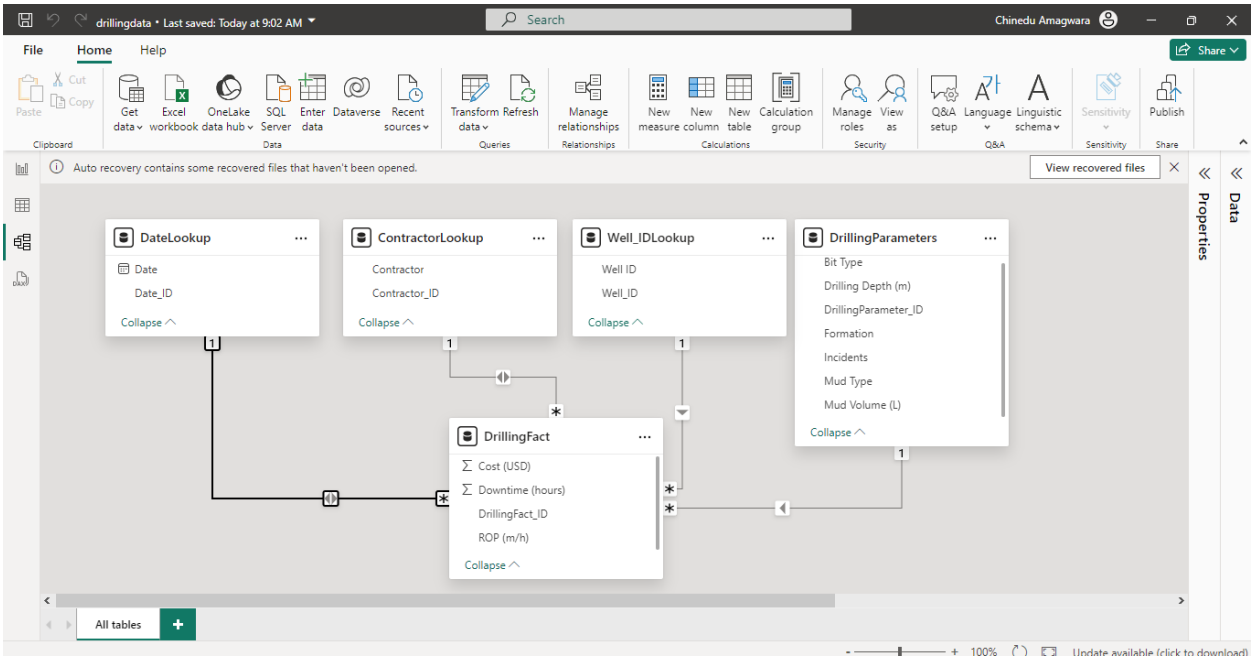
Drilling Data Flat Table



Date	Well ID	Rig ID	Drilling Depth (m)	Bit Type	Mud Type	Mud Volume (L)	Formation	ROP (m/h)	Downtime (hours)	Incidents	Cost (USD)	Contractor
01/01/2023	WELL-5495	RIG-640	2435	PDC	Water-Based	13987	Limestone	6.3	3.04	Minor	77046.07	Baker Hughes
02/01/2023	WELL-6852	RIG-108	4648	Tricone	Synthetic-Based	15055	Shale	7.76	0.24	Minor	61449.27	Weatherford
03/01/2023	WELL-4220	RIG-338	2755	Roller Cone	Water-Based	1777	Limestone	28.77	4.03	None	98120.42	Schlumberger
04/01/2023	WELL-5250	RIG-651	4820	Roller Cone	Oil-Based	28066	Granite	18.53	4.34	None	49658.67	Schlumberger
05/01/2023	WELL-1970	RIG-917	3672	Tricone	Water-Based	12155	Dolomite	6.59	4.88	None	75388.12	Schlumberger
06/01/2023	WELL-6366	RIG-279	1665	Diamond	Synthetic-Based	25883	Granite	25.92	3.76	Minor	42801.85	Halliburton
07/01/2023	WELL-1164	RIG-261	3393	Tricone	Water-Based	8461	Granite	6.75	3.98	None	47899.57	Baker Hughes
08/01/2023	WELL-3713	RIG-600	1752	Roller Cone	Water-Based	36875	Shale	12.12	3.47	None	55544.62	Weatherford
09/01/2023	WELL-3889	RIG-992	2394	Tricone	Water-Based	47511	Shale	17.25	3.19	None	53597.35	Weatherford
10/01/2023	WELL-8566	RIG-273	2447	Diamond	Synthetic-Based	32905	Sandstone	16.08	1.69	None	72278.26	Halliburton
11/01/2023	WELL-1496	RIG-867	4226	Tricone	Oil-Based	8528	Sandstone	26.14	4.5	None	46057.31	Baker Hughes
12/01/2023	WELL-9198	RIG-572	2373	Tricone	Oil-Based	10565	Limestone	29.02	0.62	None	81584.61	Halliburton
13/01/2023	WELL-3177	RIG-968	2397	Tricone	Water-Based	23478	Limestone	23.55	1.06	None	70376.18	Schlumberger
14/01/2023	WELL-3496	RIG-246	3507	PDC	Synthetic-Based	47191	Granite	16.33	0.26	None	64943.12	Halliburton
15/01/2023	WELL-6776	RIG-854	2674	Diamond	Oil-Based	26207	Shale	17.16	3.58	None	80429.82	Baker Hughes
16/01/2023	WELL-9544	RIG-241	2003	Tricone	Synthetic-Based	13948	Limestone	14.52	2.69	None	44200.66	Halliburton
17/01/2023	WELL-9752	RIG-658	2467	Diamond	Water-Based	37683	Dolomite	15.22	1.68	None	53450.59	Weatherford
18/01/2023	WELL-1747	RIG-844	3566	PDC	Oil-Based	48233	Granite	24.32	0.07	None	33904.13	Weatherford

Data Model



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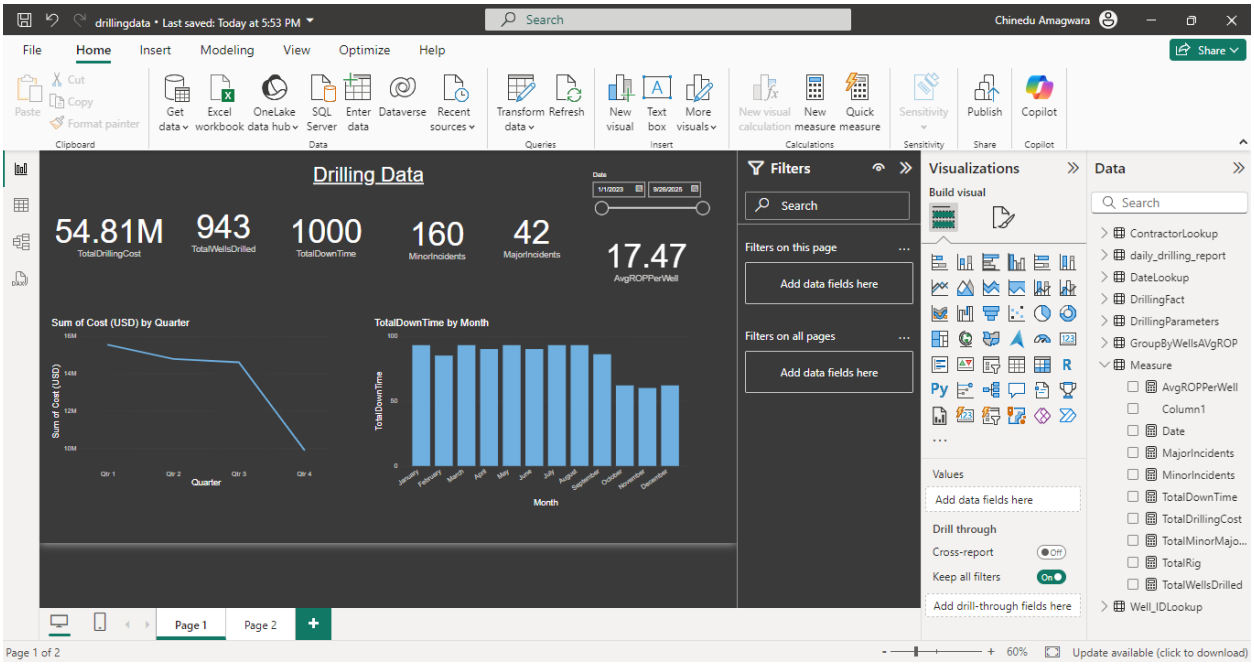
Power BI dashboard Result



In the dashboard above we can see the following reports.

1. Total Drilling Cost – $54.881M
2. Total Wells Drilled – 943
3. Total Downtime – 1000 hours
4. Total Minor Incidents – 160
5. Total Major Incidents – 40
6. Average ROP per Well – 17.47 meters/hour
7. Sum of Drilling cost by Quarter
8. Total Downtime by Month.

Conclusion

Using Power BI to visualize and interpret the drilling data has allowed me to uncover key insights that could significantly impact operational performance. By focusing on KPIs like ROP, downtime, incidents, and costs, I have been able to highlight areas for improvement and opportunities to optimize the drilling process. The ability to filter data by well, rig, and time period has also given stakeholders a powerful tool for real-time decision-making.

Ultimately, by addressing the key questions in the data, the analysis provides a foundation for improving drilling efficiency, reducing costs, and minimizing risks in future operations.