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**Introduction**

The **Fuel pricing in Western Australia** (WA) has been the subject for economic, consumer and political discussions for a long time. The pricing is not just a cost profit component for consumers but also as a strategic tool for retail businesses and government authorities. In this leading fuel business, Western Australia having a vast geographical landscape, the accessibility, fuel demand and supply makes the fuel price component a key factor to understand.

The objective of this report is to **analyse the patterns in the Fuel pricing behaviour** across fuel types, locations and the selling brands using the data gathered under FuelWatch. It is an initiative by the WA government to promote pricing transparency and boost the power of consumer decision-making. This study emphasizes on Diesel fuel, given its commercial and logistical importance and comparing the two prominent brands that represents distinct pricing theories – Puma and Vibe.

**Background**

The fluctuating fuel prices in the Western Australia is increasing the issues faced by businesses, governments and retail consumers. The decentralised fuel distribution networks in WA are contributing to the price fluctuations thereby increasing competencies between different brands and fuel type. The logistics expenditure, inconsistent customer demand, and poor visibility of the price trends can lead to misaligned stock reserve management, and ineffective promotions (Romero-Jordan et al., 2013).

The FuelWatch platform by the WA government, provides daily fuel prices looking forward in improving the market responsiveness. However, analysis is a key factor here to transform this raw gata generated into useful information, later contributing to valuable inferences. The inferences help fuel retailers identify the price behaviour patterns by the brand and highlight on the pricing imbalance that exists, meriting targeted action plan.

Diesel is the fuel type chosen for the in-depth analysis due to its central freight and rural transportation. Puma and Vibe brands were chosen to uncover the contrasting brand strategies – one often associated with the stability and the other with the price competitiveness.

**Objective:**

The report aims to understand the key metrics of the fuel prices by analysing in the following aspects.

* Calculating the monthly average price for each fuel type across WA.
* Identifying the dates with the highest and lowest prices for each fuel category.
* Examining regional patterns by performing a breakdown of price behaviour by region for a selected fuel type.
* Creating visual comparisons of fuel price trends for two selected brands, highlighting weekly patterns.
* Deriving actionable business insights by interpreting price behaviour across brands, fuel types, and timeframes.

Together, these objectives contribute to a more effective understanding of the WA fuel market and serve as a basis for data-driven strategy development. (Burke & Teame, 2018)

**Dataset Overview**

The dataset explored in this report is the **FuelWatch WA** dated between **June and October 2024**. The dataset contains around 697,528 records and 12 columns. The dataset covers 126 different dates, 7 fuel types, 29 brands and 775 petrol stations located in 10 regions and 55 areas within WA. This daily fuel price data includes the publish\_date, brand\_description, region\_description, product\_description, and product\_price.

The different key attributes in the dataset include:

|  |  |
| --- | --- |
| **Variable names** | **Explanation** |
| publish\_date | the date for which the fuel price is applicable |
| brand\_description | brand name of the fuel provider |
| region\_description, area\_description | geographic markets across WA |
| product\_description | type of fuel (e.g., ULP, PULP 95, Diesel) |
| product\_price | the price (in cents per litre) |

***Table 1.1: Dataset Dictionary***

The **Data Dictionary** (Table 1.1) explains each variable present in the dataset well. These details help us in understanding the required variables for our analysis.

Preprocessing steps were row elimination if there exists a Missing value, convert publish\_date to the datetime format, and create the derived field for year-month to time-based grouping. Text standardisation was also performed to ensure a consistent casing in brand and product descriptors.

**Methodology and Tools**

This project utilized the Python programming language for detailed fuel price trends analysis in Western Australia with the FuelWatch dataset. The analysis started with implementations towards the goals using a **Pseudocode**. This gives a base structure to practically implement the same in Python program. Important libraries involved pandas, for data manipulation, numpy for numerical computations and matplotlib for data visualization. Overall, the coding part met the Input-Process-Output models.

The below steps provide the overall analytical processes taken place.

1. **Installing Required Packages**

All the required packages were installed using the pip package manager. Packages such as **pandas** – for data wrangling, **matplotlib.pyplot** – for data visualisation, **math** – for arithmetic calculations in the price tick calculation, **datetime** – for time-based groupings and **os** – for setting up the base file, were installed in prior to the other steps.

1. **Data Cleansing and Formatting**

The data was checked for any missing values and the corresponding rows were removed using the **.isna()** and **.dropna()** functions within pandas library. The publish\_date column is converted from general to the date format executed using **pd.to\_datetime()** from datetime module. Standard string functions like **.upper()** and **.capitalise()** were used to improve columns ensuring consistency.

1. **Column Feature Creation**

To interpret based on the weekly and the monthly data from the publish\_date column **.dt.strftime(‘%Y-%m’)** and **.dt.strftime(‘%Y-%U’)**. This allows a temporal grouping of their fuel price trends.

1. **Grouping and Aggregation**

The **.groupby()** method for performing grouping was used with **.mean()** to find the average price value for every other fuel type. The **.reset\_index()** method is used to flatten grouped outputs providing better visual representations.

1. **Filtering and Selection**

For the purpose of analysing some questions specifically (e.g., highest/lowest price by fuel type), the Boolean functions and specific filtering has been performed together with **max()**, **min()**, and **sd()**. This process allowed us to pick out significant records alongside their respective dates. The **.iloc[0]** method was used to retrieve the first matching row from each filter.

1. **Data Visualisation Strategies**

The **matplotlib.pyplot** was used to create line plots for summarising the weekly trends and brand comparisons. A function was defined to plot the weekly brand trends for the selected brands – Puma and Vibe. Tick intervals were calculated using the **range()** and **math.ceil()** for consistent y-axis scaling. Both labels and titles were placed on the charts to improve the understanding, and legends were added to make fuel types or brands easily distinguishable.

**Analysis and Insights**

After performing all the initial steps such as installation of the required packages and modules for data cleaning, filtering, grouping and visualisation, putting these to use to analyse the dataset aligning with the key objectives. These analyses will be helpful in deriving actionable insights for the business model later.

**Monthly Price Variations per Fuel Type – Q1**

The Average price of the fuels for each month portrays distinct behavioural patterns. **Diesel** remains **fairly** **stable**, with very low variation in the given time frame. This consistent behaviour explains its usage fields, thereby reinforcing the importance of it in operations and logistics. Unlike any luxury branding, these are less prone to the business required price variability. On the other hand, fuels such as **98 RON and PULP** demonstrated **high volatility** between each month as the major consumers are in households and not much in business industries (Leung et al., 2019).

From a business perspective, the difference in volatility between the Diesel and other premium fuels presents varieties of opportunities for segmentation within. The business models and retailers can use Diesel for their operations with efficiency and the premium fuel brands for high margin promotional activities. This monthly average analysis also helps in forecasting procurement volumes for each fuel type while also assisting in the price model decision designing.

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***Figure 1.1: Monthly Price Variations per Fuel Type***

The line chart (Figure 1.1) shows the monthly price trends for each fuel type and clearly portrays that Diesel remains stable while PULP and 98 RON shows higher monthly variance. On a broad spectrum, the analysis concludes that all the fuel products have unique characteristics and hence should be treated in different revenue models.

**Highest and Lowest Price for each Fuel Type – Q2**

By evaluating the maximum and the minimum recorded prices for each fuel type, shows the presence of high differences and hence volatility in the fuel costs. Diesel’s price range, i.e. the maximum and the minimum values were pretty low, which indicates the absence of any promotional spikes. This narrow range makes this product easier to use across different industries, where the end customers prioritise fuel access and uptime over the minor variations.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fuel Type** | **Max Fuel Price** | **Max Fuel Date** | **Min Fuel Price** | **Min Fuel Date** |
| ULP | 252.9 | 2024-06-01 | 145.7 | 2024-09-06 |
| DIESEL | 250.0 | 2024-06-01 | 152.7 | 2024-09-04 |
| 98 RON | 298.9 | 2024-08-06 | 164.9 | 2024-10-04 |
| BRAND DIESEL | 249.9 | 2024-07-11 | 151.7 | 2024-09-06 |
| PULP | 263.9 | 2024-07-09 | 159.3 | 2024-09-17 |
| LPG | 239.9 | 2024-07-01 | 119.9 | 2024-06-06 |
| E85 | 279.9 | 2024-06-01 | 253.9 | 2024-06-01 |

***Table 1.2: Extreme Prices per Fuel Type***

Conversely, 98 RON has the widest price range, indicating the market is highly volatile, unreliable but potentially responsive to the holiday pricing strategies taken or by the moves of competitors marketing (Dahl, 2012). In a fuel business standpoint, this allows the businesses to have flexibility in choosing their operating price ranges, being able to prioritise more profits or attracting more consumers based on their situations, marketings and strategies. The table (Table 1.2) above with the values portrays the same numerically.

The maximum and minimum values, and their differences, helps in assessing the prices for areas with inconsistent consumer traffic patterns. In areas near airports, tourist spots, remote coastal view routes, or in closer proximity to city commercial buildings, the retailers could push the prices to the upper range and still expect customers. But for business models requiring transport, having a stable pricing for fuels, eases out their cost analysis and decision making in this regard.

**Price Analysis for a Diesel for each Region throughout WA (Monthly) – Q3**

A **monthly trend analysis** was performed to understand the **Diesel price fluctuations** across WA, and the pricing revealed a clear and conclusive trend. The monthly trend reveals the isolated highs and lows in the pricing and on the change of fuel price for different regions over time.

Looking for more information when considering Diesel into account for each region, when comparing the rural and the metropolitan regions (Table 1.3), the rural ones like Pilbara or Gascoyne are paying higher cost per litre of Diesel than the cities. This difference might be because of **low competitive rates** in the locality and to compensate for the transportation costs as the population will be less and the demand is lower. This is a concern on the affordability check in rural areas especially where fuel access is critical, although this is a rational business focussed decision taken by the production and logistics companies.

The difference in prices between the rural and the city areas for Diesel, a fuel that is largely used in business and is critical on a day-to-day basis trading works taken by rural communities, might face backslash and the loyalty of the customers might be on stake with this difference. The table below clearly shows the maximum and minimum values of Diesel prices in all the given regions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Region** | **Max Price** | **Max Date** | **Min Price** | **Min Date** |
| Peel | 203.9 | 2024-07-05 | 159.7 | 2024-09-13 |
| Great Southern | 212.0 | 2024-06-01 | 158.9 | 2024-09-23 |
| Metro | 200.9 | 2024-07-01 | 152.7 | 2024-09-04 |
| South-West | 212.0 | 2024-06-01 | 153.3 | 2024-10-04 |
| Kimberley | 249.9 | 2024-08-02 | 180.9 | 2024-10-04 |
| Gascoyne | 230.8 | 2024-07-12 | 177.8 | 2024-10-01 |
| Goldfields-Esperance | 250.0 | 2024-06-01 | 181.9 | 2024-09-27 |
| Wheatbelt | 209.8 | 2024-06-01 | 158.5 | 2024-09-17 |
| Mid-West | 221.9 | 2024-06-01 | 161.5 | 2024-09-20 |
| Pilbara | 225.9 | 2024-07-01 | 179.9 | 2024-09-26 |

***Table 1.3: Extreme Prices per Region for Diesel***

Hence having **regionalised pricing strategies**, **unified fuel sourcing** and transportation of fuel and adopting bundled services for regular customers might bring the effect down to an extent that is profitable from both the ends. Also, this supports the fair pricing policies and helps in preventing the reputational risks associated with the perceived overcharging in the sub-urban, rural and other vulnerable markets (Zingbagba, Nunes, & Fadairo, 2020).

**Price Analysis for all Fuel Types in Puma and Vibe Brands (Weekly) – Q4 & Q5**

Drilling down further, a **weekly price analysis** for two brand’s fuels – **Puma and Vibe** are carried out. Both the brands showed a steady decline in their prices over a selected time. This indicated the minimal price fluctuations in a daily basis. These insights suggest that both brands react to wholesale market prices. Unlike the common assumptions, where a smaller brand tends to be more reactive and volatile, **Vibe’s pricing** was **stable** like that of Puma’s and lower.

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***Figure 1.2: Weekly Puma Fuels Price Variations***

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***Figure 1.3: Weekly Vibe Fuels Price Variations***

The brand positioning and the **premium level** of **Puma**, functioning focussing the **regular loyal and long-haul fleet customers** who prioritize reliability and brand legacy, holds its price in a higher end. Whereas **Vibe** is capturing the **customer base looking for affordability**, by having lower profit margins consistently rather than tactical discounts.

The weekly trend graphs (Figure 1.1 and Figure 1.2) validate the discussed observations thereby showing parallel but consistently separated lines across time, supporting the structured pricing without implying brand and opportunistic approach (Meng et al., 2025). By a conscious choice and preference, understanding the target customers, if this is considered for marketing and operations, this will ensure alignment between brand name and pricing point.

**Interpretation of Fuel Price Trends – Overall & Q5**

The analysis of the fuel prices across different regions in WA from different brands shows insightful and distinct patterns. The trends observed over the weekly pricing interpretations between two brands, shows the **downwards trend of the fuel price over time**, while the nature and extent of the decline varied significantly (Van Eyden et al., 2019).

With all the other fuel types, **Diesel** prices remained the most stable with minor changes on a weekly basis. This in turn reflects the utility-driven demands, particularly in rural areas, where the short-term customer behaviour and long-term logistics planning evidently influencing the fuel prices. This makes the **budgeting** and **procurement fairly simple** thereby sliding the businesses to depend on Diesel.

In contrast, the sharper fluctuations in the premium fuel ranges like **98 RON** and **PULP** denotes the seasonal usage patterns, travel reasons and advertising and tactical discount strategies used by the brands. These fluctuations showing **customer-oriented markets**, face more **retail consumer driven actions**.

The brand comparison between **Puma and Vibe**, where Puma’s pricing and brand image is inclined to the premium level having loyal customer base and Vibe having an affordable yet stable market; this shows that the **discount-oriented approach** by the big brands like Puma is good in marketing end but adds a volatile nature to the brand image. The Vibe brand is less volatile and inclining more towards **volume-driven markets**.

Overall, the fuel price trends in WA are shaped by brand image, volatility and market conditions. The absence of volatility across brands and fuel types reflects a relatively structured pricing level which outweighs the reactive pricing behaviour.

**Challenges – Q6**

The difficulties faced and how they were resolved while interpreting the fuel price changes in WA are the following.

* **Conceptual** **knowledge**: The dataset regarding fuel types and different locations, there was a difficulty in understanding the practical usage of each fuel types, what different brands mean to people here in Australia and the demographics of the locations used. This understanding was the base for interpreting the graphs in a more realistic and approachable way.
* **Interpretation of Array outputs**: There was a difficulty in interpreting the table of Question 1 to get a conclusion point. After using a line chart for visualisation, it became more clear and insightful.
* **Formatting inconsistencies causing errors in few cases**: Transforming the time based columns to proper format, and handling the formatting inconsistencies in strings using .upper() and .capitalise() helped in resolving this problem.
* **Visualising multiple variables in a single graph**: The basic setups gave an unclear, cluttered and a graph that is difficult to read and understand. The use of tick marks and labels, handling grid spacing, and usage of legends to ensure consistency in the dependent variable axis; thereby making the graph more clear, insightful and interpretable.

**Business Decision-Making – Q6**

Based on the observations and the interpretations made from the fuel price dataset, across fuel types, regions and brands, the following are one of the solid business recommendations.

* **Segmented Brand Placements**: The Business that has the feasibility of including dual-brand strategy, can place premium outlets that depends on loyalty and brand image in high traffic metro zones as the people are also less price sensitive. On the other hand, brands that has consistency yet focussing on affordability can place their locations in the competitive regional markets.
* **Predictive Planning and Logistics**: The stable prices in the Diesels can be useful in developing a predictive stock management model. This will help in locking the procurements during low cost timings, hence being able to get more profits or provide in lower costs to the consumers gaining trust and improving the brand image.
* **Shared Logistics in Remote Areas**: Regionally operating brands have high costs because of the logistics and transportation. Hence having a collaborative transportation partnership with the other brands functioning in the locality, will be a win-win in almost every aspect as this also reduces the consumer selling cost and more readily available goods (Pang, 2014).

**Conclusion**

This report analysed the changes and the factors that are influencing the changes in fuel prices in different locations across Western Australia in the last few years. The findings revealed the consistent pricing for Diesel in different brands and timings, and hence the usage lies in cost sensitive and business sectors. On the other hand, the premium fuel brands with a brand strategy and image, showed more fluctuations, driven by promotions for target audience. Altogether, rather than having the same approach for all cases, modifying based on the problem and an efficient solution is the best possible way to make ends meet. These patterns provide a clear path for data-informed pricing and planning across the WA’s fuel industry.

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**Appendix 1 – Pseudo-Code**

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**Appendix 2 – Python Code**

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