Economic Analysis of Fuel Trucks Transportation for The Gas Station in Riyadh City

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Abstract

This report shows an economic analysis of fuel track transportation options for gas stations. The study of transportation options and defining the fixed, operation, and variable costs which will affect the transportation. The result shows breakeven point of when the Outsourcing, Own, or Rent to won method is the most valuable with its equations.

Keywords

Cost Analysis, Annual Worth (AW), Minimum Attractive Rate of Return (MARR), Net Present Worth (NPW).

1. Introduction

This report shows a study of fuel truck options of filling the gas stations tanks in Riyadh city. The fuel could be supplied to the stations by the fuel logistics vendors (Outsourcing), or the stations have their truck to fill the stations' tanks (Own a Truck option). The second option "Own a Truck" has two options. First, once you are buying a truck, the second option is to own a truck by "Rent to Own "method. For the study period of 36 months (about 3 years), the most preferable options will lie on the respective Net Present Value (NPV). There are several types of costs are noticed which are fixed, operation, and variable costs that are the effect factors in the transport. The fixed cost includes Truck Head Unit and Truck Unit costs which will be paid once at the present time while diver cost and truck insurance will be reiterated at the beginning of each year. Second, the operation cost which contains the reparative monthly bases cost such driver salary including the allowances and maintenance cost. Third, the variable cost of tires life and truck diesel consumption are calculated depending on cost per Kilometer and by finding the average monthly distance of the truck trips. Finally, the economic analysis is applied using the basic principles to obtain and discuss the best option feasibility.

1.1 Objectives

This study aims to deploy basic economical tools to provide the best option of fuel transportation in Riyadh City by determining all fuel transportation options. Define cost types with effect factors on transportation. And analysis of the defined options possibilities.

2. Literature Review

Annual Worth (AW) is easy to understand for any individual acquainted with annual amounts, for example, dollars per year. The AW value, which has the same interpretation as A used thus far, is the economic equivalent of the PW and FW values at the MARR for n years. All three can be easily determined from each other by the relation. Sullivan, (W. G., Wicks, E. M., & Koelling, C. P., 2015).

MARR is used in project selection. According to Merrett & Sykes, "The selection and financing of capital projects are indisputably two of the most important and critical business decisions" (p.xi). Specifically, the MARR is used to discount project cash flows. This means that the MARR used has a direct effect on the outcome of project evaluation and comparison. As a result, the rate chosen as the MARR is extremely important (Prescott, Lisa, 1999). However, despite its significance, engineering economy does not have a clear consensus on how this rate should be determined (Prescott, Lisa, 1999)

The internal rate of return (IRR), mathematically defined as the interest rate that equates the present worth of a series of cash flows to zero, is and has been a popular measure of worth for purposes of project evaluation. When unique, it defines the return achieved by an investment (or actual cost of a loan) and can often be viewed as a measure of efficiency in determining whether an investment will prove to be a promising investment in the future, it is normal that the investor pays heed to how that investment has performed previously. And, whilst past performance is no guarantee of future performance, it is an important influence on the measurement of the financial attractiveness of an investment. Measures of Performance are yields /returns that the investor has received over the preceding period. (PATRICK, Michael; FRENCH, Nick, 2016)

The NPW technique is applicable regarding the current present worth of cash flows that represent a difference between the present worth of benefits versus costs (Timmons, Weiss, Callister, Loucks, & Timmons, 2014). Graber and Rothwell (2006) consider net present value and option analysis with respect to the feasibility of nuclear plant projects. Whitman and Terry (2012) and Blank and Tarquin (2011) indicate that the NPW technique is appropriate for examining potential engineering investments. (DOSS, Daniel A., et al, 2015)

Break-even analysis is a useful tool to study the relationship between fixed costs, variable costs and returns. A break-even point defines when an investment will generate a positive return and can be determined graphically or with simple mathematics. (Kampf, Rudolf, Peter Majerčák, and Pavel Švagr, 2016) Break-even analysis computes the volume of production at a given price necessary to cover all costs. Break-even price analysis computes the price necessary at a given level of production to cover all costs. (W. G., Wicks, E. M., & Koelling, C. P., 2015). To explain how break-even analysis works, it is necessary to define the cost items.

3. Methods

In this study, the economical concepts are applied to compare the economic feasibility between the options. Therefore, data of options for fuel trucks are gathered to apply this study using the concepts:

1. Cost Analysis
2. AW
3. MARR
4. NPW
5. Average Cost

Additionally, the Cash Flow Diagrams (CFD) represent the incomes and expenses of the study.

4. Data Collection

This section provides detailed description of the collected data of fuel transportation for the gas stations and used the economical techniques to select the best option. The summary table of collected data are shown in Table 1.

Table 1. Summary of primary data for fuel transportation study

Category	Item(s)	Cost (SAR)	Iteration
Fixed Cost	Truck Head Unit	312,000	Per Unit
	Truck Unit (36,000 L)	110,000	Per Unit
	Driver Cost	11,000	Annually
	Truck Insurance	8,500	Annually
Operation Cost	Total Driver Salary	3,300	Monthly
	Maintenance	1,000	Monthly
Variable Cost	Diesel Cost	0.19	Per KM
	Tyre Cost	0.17	Per KM

Other data used in this study is listed below:

- Total interest of "Rent to Own" truck for the period = 21,840 SAR.
- Diesel Price (SAR/ Liter) = 0.63
- Average Monthly Distance of Fuel Trucks (KM)= 15,000.
- Tyre Cost = 1,500 SAR
- Tyre Life = 120,000 KM (Each 8 months).
- The number of truck Tyres = 14.
- Average Daily trips = 3.

5. Results and Discussion

Cost Formulas

- Total Truck Cost (SAR) = Truck Head Unit + Truck Unit (36000 L)
- Annual Fixed Cost (SAR) = Truck Insurance + Driver Cost
- Operation Monthly Cost (SAR) = Total Driver Salary + Maintenance
- Variable Cost (SAR/KM) = (Diesel Cost + Tyer Cost * Total Number of Tyers) * Actual Distance in KM.
- Average Monthly Tyre Cost (SAR)= (Tyre Cost * Total Number of Tyers) * Average Monthly Distance of Fuel Trucks.
- Average monthly fuel consumption (SAR) = Deiseal Cost *Average Monthly Distance of Fuel Trucks (KM)
- Average Monthly Variable Cost (SAR)= Average Monthly Tyres Cost + Average monthly fuel consumption

Present Worth given future value formula

$$P = F(1+i)^{-N} \qquad \text{Equation 1}$$

$$(1+i)^{-N} = (P/F,i\%,N)$$

Present Worth given constant payment about formula

$$P = A(P/A,i\%,N) \qquad \text{Equation 2}$$

Where P is present worth, F is future worth, i is interest rate percentage, A is an annual worth, and N is period length (years, months, …, etc).

5.1 Own option

- Total Truck Cost = 312,000 + 110,000 = 422,000 SAR
- Annual Fixed Cost = 8,500 +11,000 = 19,500 SAR
- Salvage Value (according to market value) = 150,000 SAR
- Operation Monthly Cost = 3300 + 1000 = 4300 SAR
- Average Monthly Tyre Cost = (0.17) * 15,000 = 2,250 SAR
- Average Monthly fuel consumption (SAR) = 0.19 * 15,000 = 2,850 SAR
- Average Monthly Variable Cost =2,250 + 2,850 = 5400 SAR

Table 2. Cash flow summary for "Own" option (1)

Year	Annual Balance (EOY)	Monthly Balance (36 months (about 3 years))	Net Cash Flow (EOY)
Present	(441,500)	-	(441,500)
1	(19,500)	(9,700)	(29,200)
2	(19,500)	(9,700)	(29,200)
3	130,500	(9,700)	120,800

Note: From Table 2, NPV = -441500 + -9700 (P/A, 0.208%, 36) -19500 (P/A, 2.5%, 3) +150000(P/F,2.5,3) = (693991.86) SAR

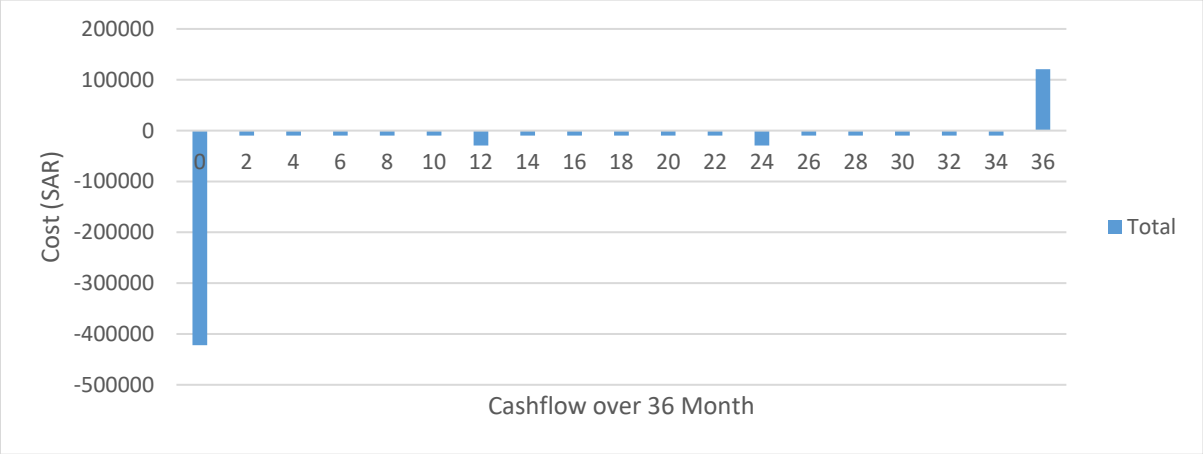

Figure 1. Cashflow of fuel transportation using Own option

The cash flow of fuel transportation using "Own" Option is shown in Figure 1.

5.2 Rent to Own

- Monthly payment of "Rent to Own" is 9,273.33 SAR.
- Annual Fixed Cost = 8,500 + 11,000 = 19,500 SAR
- Salvage Value = 150,000
- Operation Monthly Cost = 3300 + 1000 = 4300 SAR
- Average Monthly Tyre Cost = (0.17) * 15,000 = 2,250 SAR
- Average Monthly fuel consumption (SAR) = 0.19 * 15,000 = 2,850 SAR
- Average Monthly Variable Cost =2,250 + 2,850 = 5400 SAR

Table 3. Cash flow summary for "Rent to Own" option (2)

Year	Annual Balance (EOY)	Monthly Balance (36 months (about 3 years))	Net Cash Flow (EOY)
Present	(19,500)	-	(19,500)
1	(19,500)	(18,973)	(38,473)
2	(19,500)	(18,973)	(38,473)
3	130,500	(18,973)	111,527

Note: From Table 3 and Figure 2, for the total loan value 333,840 SAR while the operation, variable cost and salvage value are the same of "Own" option, the PV = -333,840 -110,000-336089.32-55692.46+139,289.91 = (696331.55) SAR

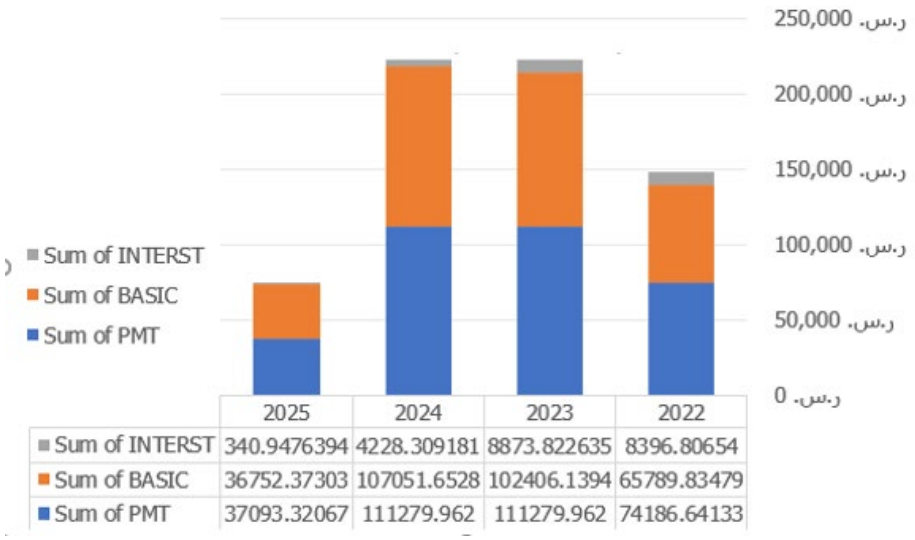

Figure 2. Rent to Own Option Summary

5.3 Outsource

The Average outsource cost according to the market study is **400** SAR per Trip. By having the average value of tips/day 3, the monthly estimated cost is 36,000 SAR.

Table 4. Cash flow summary for "Outsoaring" option (3)

Year	Annual Balance (EOY)	Monthly Balance (36 months (about 3 years))	Net Cash Flow (EOY)
Present	0	0	0
1	0	(36,000)	(36,000)
2	0	(36,000)	(36,000)
3	0	(36,000)	(36,000)

Note: Form Table 4, NPV = A (P/A, i, n) = 36000 (P/A, 0.208%, 36) = (1,247,341.79) SAR

6. Conclusion

From this project, we conclude that for the Own option, the fixed cost for baying the truck head unit and the tank is the most capital cost at the present time which cost 422,000 SAR, the driver cost, and truck insurance are costing an 19500 SAR of annual fixed cost payment while 9700 SAR of average monthly operation cost expenses. The salvage value of 150,000 at the end of month 36 was obtained according to the market value analysis. For the Rent to Own option, its total the same operation and variable costs the interest amount around 21,840 SAR for the loan Rent to Own have a monthly cash flow value of 9273 for the loan expenses (4.44 % APR). The outsourcing the fuel transportation has only a net cash flow of 36000 as monthly average expenses over 36 months.

The own option is the best since it has the highest present value followed by rent to own and outsourcing with the net present value. (693991.86), (696331.55), and (1,247,341.79). We could define the cost equation of outsourcing and own or rent to own options as shown the figure 3. From the graph the average outsourcing cost expressed as (-0.0141 x^2 + 2.016 x + 300.91) while the operation cost as 0.36 x + 358. The x variable represents the distance in KM. From the yellow line, the average operation cost if invested for 1 year with MARR of 9.2% or higher interest, the outsourcing will have the opportunity of lower operation cost.

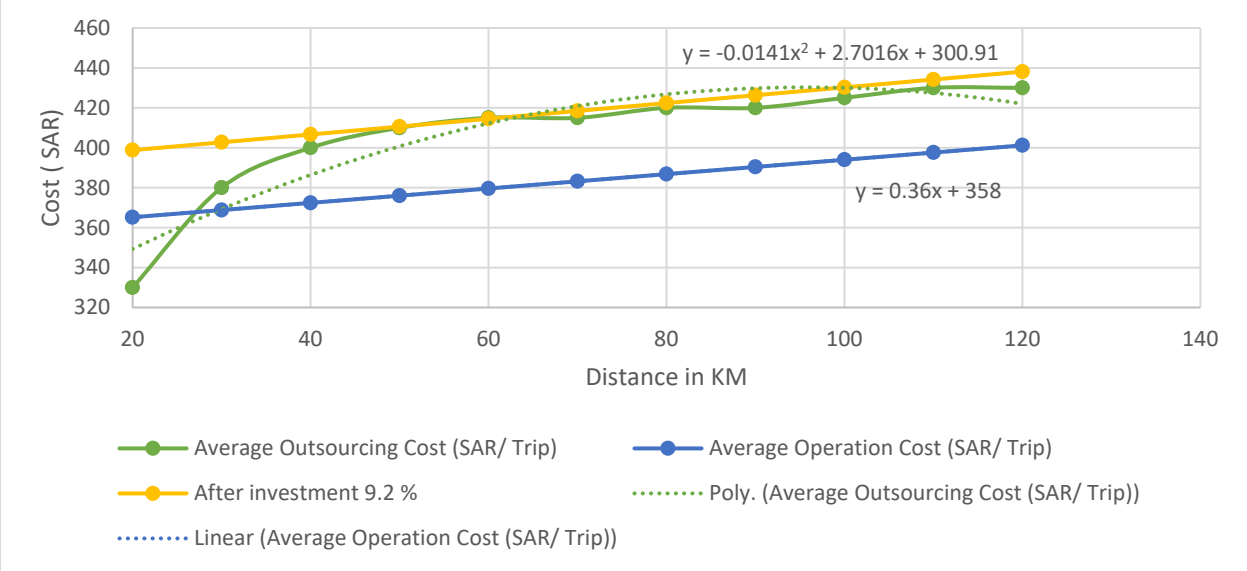

Figure 3. outsourcing and operation cost of fuel transportation in Riyadh City

Additionally, as illustrated in Figure 3, the breakeven point extracted from the graph that the gas stations distances less than 30 Km from refinery it is better to use outsourcing while over 30 Km involving of the operation “own” is valuable.

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Biographies

Dr Sobhi Mejjaouli possess several years of progressive experience in the Industrial and Systems Engineering fields and their applications. He is serving now as an Industrial Engineering Assistant Professor at Alfaisal University. Sobhi earned a Bachelor and Master Degree in Industrial Engineering from Ecole Nationale d'Ingenieurs de Tunis before joining the Systems Engineering Department at University of Arkansas at Little Rock, USA where he got his Phd. Sobhi qualifications and research are related to the fields of Engineering Economics, Operations Research and Optimization (Linear and non-linear programming, network and Dynamic Programming, heuristics..etc), C/C++ Programming, supply chain Management, and software like CPLEX, LINGO, ARENA and MATLAB.

Abdulrahman Alosaimi is first year graduate student at Alfaisal University (FU) of Systems and Engineering Management Program (MEM). He has B.S. in Electrical Engineering major in Electronics and Control Systems with honor degree from Al Imam Mohammad ibn Saud Islamic University, 2019. His experience obtained after his graduation from working at NCMS as electronics systems engineer for technology transformation and products developments divisions. He has a great experience of technical data packages modification and reviewing; system processes and operations and transferring the products form research centers to manufacturers. Additionally, He possess an experience of using software such Altium Designer, MATLAB, and C/C++ programming languages. C/C++ programming languages.

Amel Aljahdari has earned her bachelor’s degree in Computer Information System from Prince Sultan University; she is working in semi government sector as a Data Engineer. She is in the process of completing her graduate studies in Systems and Engineering Management from Alfaisal University with an expected graduation date in May 2023.

Abdullah Alshahrani. Has Bachelor's degree in Engineering Electromechanical 2009, Worked in, Saudi Royal Air Force, And Has Major Rank. His Department Projects Affairs, At Engineering and Works Directorate, was an officer for a lot of projects, attended meetings in The United States of America and the United Kingdom discussed the

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