

# DESIGN AND MODIFICATION OF FUEL-GUN NOZZLE TO ELIMINATE THE FUEL LOSSES

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**Abstract-** We all know about the scarcity of Fuel faced by everyone all over the world. With the view of reducing the usage, we must also focus on reducing the minor losses that can be controlled and can result in an Ideal conservation and Usage of Fuel. In the present situation we observed that at a fuel station while refueling any vehicle, some of the fuel droplets fall down and get totally wasted. By considering this aspect we are presenting one specific remedy to lower the losses rate to some extent. The aim of our model is using the power of air flow to push the fuel droplets that remain at the tip of fuel-gun nozzle into the vehicle tank and by doing so we intend to save the wastage of fuel.

**Keywords:** - Fuel loss, Fuel droplet, Fuel consumption, Fuel-Gun, Teflon coating.

## I INTRODUCTION



*Figure 1 Need of fuel supply*

We know that fuel is a high Energy source that is being used for most of work producing devices. It is combusted in a chamber and the power generated is used to achieve several outputs. All over the World, most of the machines use Fuel as an energy Source. This all starts with the removal of crude oil from the resources and then refining it to obtain its sub-constituents which are then supplied to the 60,799 fuel stations as of 2017 in India. [1] The medium used for this are the underground piping and various

road transports that are assured with safety regulations. This has also given rise to the new technologies where fuel consumption is not a prior aspect, still some of the major machineries that require high power input for their respective operations need to be supplied with the fuel as it is a prime source of heat energy.

According to a survey around 4,489,000 barrels of petrol is consumed every day in India itself. [2]. This represents the abundant usage that is been carried out every day without any control over it and with the rise in needs this figure will go on increasing to an unreachable height. It is also being said that in next 47.3 years we will definitely face the extinction of fuels too. [3]. Hence, it is essential to preserve it. As we know that the reasons for continual increasing cost of fuel is due to the shortage of resources that is being experienced by the refineries. Hence, the one important aspect that has to be taken into account is of reducing the losses that take place. As a result, various methods for improving the efficiency of respective machineries is successfully carried before, as it is said "Several Drops make the Ocean", we need to identify the minor losses too that lead to large overall changes in a system. In this paper we present design and analysis of a model that will help in saving the losses of fuel.

## II PROBLEM STATEMENT



*Figure 2 Fuel droplets getting wasted*

Fuel refilling done by any person on an average is once or twice a week. It has a basic system of the fuel pipe inserted in the fuel filler hole of the vehicle. Usually after the refueling the person takes out the fuel nozzle out of the filler, but during this some fuel droplets remain around the tip of nozzle and flow out. In the span of removing the nozzle from filler and keeping it back to the holder, those fuel droplets tend to spill out and are totally wasted. We made an observation at a fuel station that in the above stated span usually three drops are wasted in each refueling. According to our survey at various Fuel stations and other calculations, approximately 12600 liters of fuel is getting wasted every day in India itself. This is a huge loss that cannot be neglected and hence is needed to be focused on.

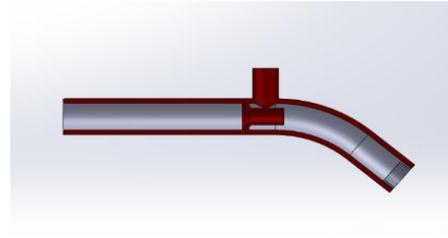
### III ESTIMATION OF FUEL LOSS

As per our observation, after every refueling of vehicle 3 fuel droplets fall down. Fuel like petrol or diesel has low viscosity, hence their total density too is small. After testing a petrol sample at a laboratory, we came to know that one drop of fuel has a density of 0.07ml. As 3 fuel droplets fall each time, the total fuel loss per vehicle is 0.21ml. As per the data, every day approximately 1000 vehicles come for refueling. [4]. Hence, the fuel loss at a fuel station in a day will be 210ml. This value still seems small but when we calculate for the losses of fuel taking place in whole India, as for the 60799 fuel stations the total loss of fuel in a day in India is approximately 12600 liters that counts for a total investment of Rs.9,65,790 considering the current price of petrol i.e. Rs.76.65 in Maharashtra. [5].

### IV METHADODOLOGY

The model that we have prepared consists of a battery, small air blower, a push button operating the air blower and we have modified the internal design of the fuel-gun nozzle. Once the operator refuels the vehicle, he will push the push button for few seconds and this will operate the air blower which will start the air flow and hence this flow will push the fuel droplets that are remaining at the tip of the fuel-gun nozzle inside the vehicle fuel tank itself. We prepared the model using SOLIDWORKS software and we had to conduct the analysis so as to check whether we get the expected

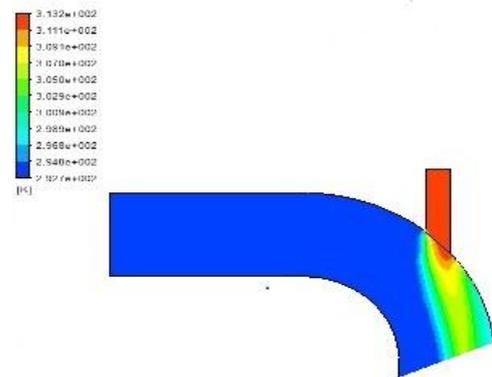
results with the modified internal design of the fuel-gun nozzle.



*Figure 3 CAD Model*

### V RESULT

We carried out the analysis by doing the CFD (Computational Fluid Dynamics) of the model. CFD is used to analyze and solve problems that involve fluid flows. By CFD we got the actual motion of air flow that will take place in case of our mathematical model. We did get the expected results. The air flow was enough to push the total remaining fuel droplets i.e. 0.21ml. Thus, the proposed mathematical model was successful at some extent. We did achieve the expected results from our proposed mathematical model but later on considering the evaporation factor of fuel we noticed some drawbacks in it.



*Figure 4 CFD Analysis*

### VI DISCUSSION

Fuel usually tends to evaporate faster than other fluids because of its weak intermolecular adhesion. Some of the molecules in the fuel hold some kinetic energy in them and this kinetic energy tends to escape the fuel surface and enter gaseous phase. Hence, in the case of our mathematical model the air flow will result in energizing the kinetic

modules of fuel and result in the evaporation of the same. Because of this drawback we had to come up with other alternative for this and thus we came up with the idea of coating the internal part of fuel-gun nozzle with an anti-adhesive material so that the fuel droplets will slip out over it and hence no evaporation or no residual fuel droplets will occur. Providing an anti-adhesive material will lower the coefficient of friction between the fuel and internal part of fuel-gun nozzle. The coating of Teflon (polytetrafluoroethylene) serves the need of anti-adhesive material. [6]. Teflon has found to have a good corrosion resistant property and also have the lowest coefficient of friction. The Teflon sheets are available as thin as 1mm and hence the internal part of the fuel-gun nozzle can be coated with it and the fuel droplets will no more remain at the tip of nozzle and get waste.

## **VII CONCLUSION**

The fuel losses taking place daily is a huge problem and looking at the consequences such as shortage of fuel supply, it has to be solved. Daily in India approximately 12600 liters of fuel is being wasted and is still not being taken care until now. The Mathematical model we proposed had some drawbacks such as the evaporation of the fuel and finally we came to an alternative way. Coating the internal part of the fuel-gun nozzle with Teflon material will provide a lower coefficient of friction and hence the fuel droplets will not remain at the tip of nozzle and the loss of fuel will be prevented.

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