Public Transportation Buses Powered By Cooking Oil

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Situation

The Greenhouse gases are in a continuous rise and are destroying the environment and public transportation buses contribute dramatically and are in an interrupted increase[1]:

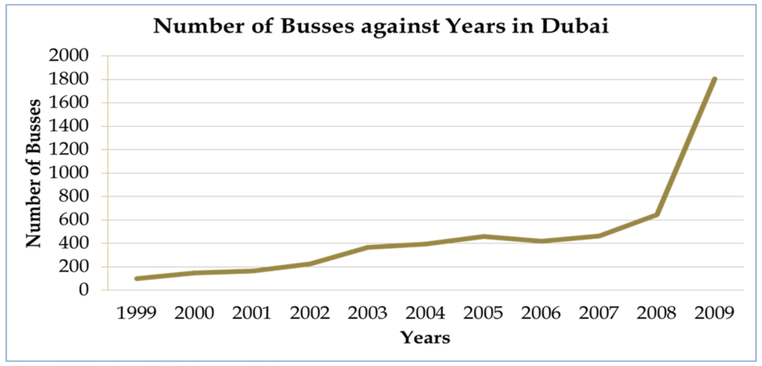

Figure 1: Number of RTA buses with time

Moreover, the world trend has been moving towards a greener environment through many solutions, and this was depicted by Bee'ah here in Sharjah who are planning to reach zero landfill waste by 2015.

Problems

- Improper cooking oil waste disposal methods, since hydrogenated cooking oil degrade in environment by oxidizing its surrounding
- Used oils acidity destroys the soil and diminishes its fertility
- On average, a building throws approximately 170 liters of cooking oil each week (According to a survey conducted in AUS by the team).
- Limited resources of crude oil with high consumption rates of fuels.
- Large amount of energy wasted by friction in the mechanical parts of a vehicle and heat loss
- The phenomenon of the global warming is clear as the temperature of the earth increases [2] :

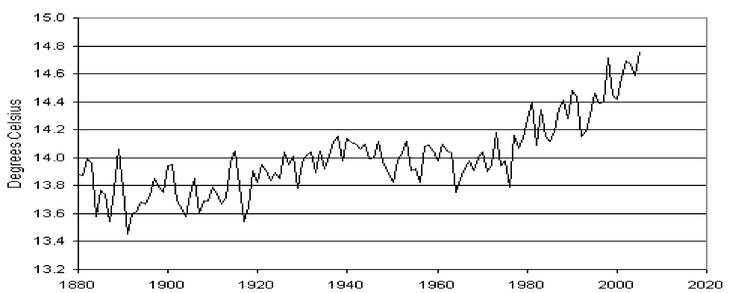

Figure 2: Average earth temperature with time [2]

Solutions

- Used cooking oil is collected from households using a new system of pipelines and meters that will be fitted into the existing and new buildings. The pipes that will be used are Ductile-Iron Pipes. Also, a meter system measurer is installed for each house measuring the amount of oil recycled and deducting an amount of money from the water and electricity bill of each house as a motivation to recycle used cooking oil
- The cooking oil will then be collected in reservoirs and will be transported to the refinery where it will be transformed to Biodiesel ready to be used in the normal diesel engines
- The hybrid bus engine will include the following components:

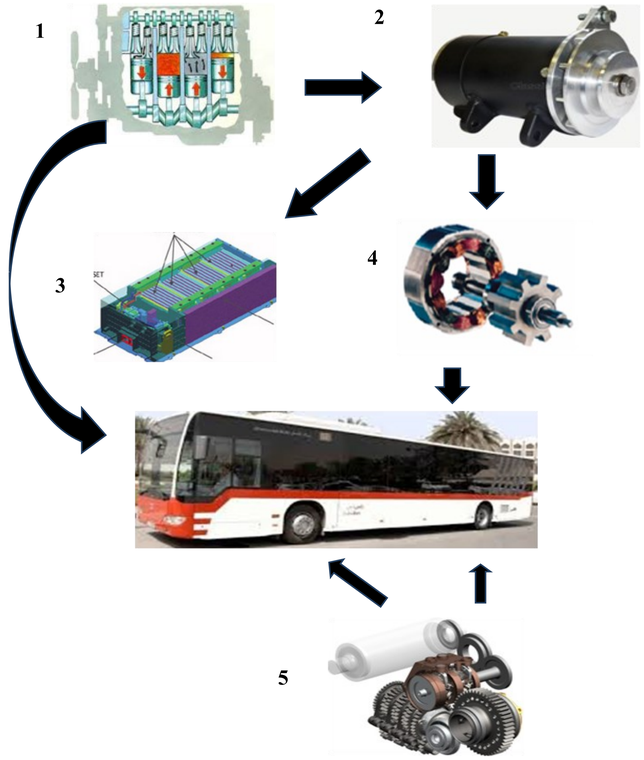

Figure 3: The Hybrid Bus mechanism

The Biodiesel combustion engine (1) generates the power needed to operate the car. This power is directed to both the wheels of the car and the electrical motor (2),which will convert the mechanical energy to electricity. Portion of the electricity will be stored in a battery (3) for later uses upon need, while the other portion will be sent to the Switch Reluctance Machine (SRM) (4). The SRM will convert back this electricity to a mechanical power which will cooperate with the Biodiesel engine in moving the car. In addition, the Kinetic Energy Recovery System (KERS) (5) will be working in parallel with system described above. As the driver breaks the KERS will harvest the energy wasted for later use

Evaluation

- Ductile-Iron pipes "has long been noted for its long term economy, performance, reliability, and proven record in serving the public's health [3]." It was also stated by [3] that these pipes have been used to convey acid and sulfur without corroding.
- Almost each building will be storing enough waste cooking oil to operate the new hybrid bus for the whole day.
- The final total cost of biodiesel is 0.4578 $/Liter which is almost double the cost of producing Petro - diesel, however, the gas emissions will differ as follows:

Table 1: Comparison between Diesel bus emission and Biodiesel bus emissions [4]-[5]

Emissions (g/km)	Diesel Bus	Bio-Diesel Bus
CO_2	1633	359.3
CO	3.5	2.07
Total Hydrocarbons	1.7	0.544
NO_x	15.2	15.96

Even though the NO_x gases emissions rise, their effects will not be substantial as they will be diluted in the atmosphere. The effect of CO_2, CO and Hydrocarbons on the atmosphere is very dangerous compared to NO_x therefore its increase is insignificant compared to the other emissions.

Conclusion

Advantages	Disadvantages
• Reduces gas pollution • Decreases petro-diesel consumption • Increases the efficiency of the system	• Biodiesel production process is expensive compared to petro-diesel • Difficulties of pipe fitting in existing buildings

Due to the expense of biodiesel, the hybrid engine will be an optimum choice to provide a cleaner environment and at the same time decrease the costs of biodiesel. Implementing it in public transportation buses shall be a prototype for further application to more automobiles.

References

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[2] L.R. Brown, Plan B2.0: Rescuing a plant under stress and civilization in trouble, *Earth policy institution,* 2006.

[3] W. Barsotti, M. G. David, K. Hardy. *Ductile - Iron pipes and fittings*. American Water Works Association, Third ed , Vol . .2009.

[4] M.Murphy, *Biodiesel: Gas from Grease*, Vol .2007.

[5] L. Pelkmans, D. De Keukeleere & G. Lenaers, "Emissions and fuel consumption of natural gas powered city buses versus diesel buses in real city trafic",

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