

## LIQUID NITROGEN VEHICLE

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### ABSTRACT:

*A liquid nitrogen vehicle is powered by liquid nitrogen, which is stored in a tank. Traditional nitrogen engine design work by heating the liquid nitrogen in a heat exchanger, extracting heat from the ambient air and using the resulting pressurized gas to operate a piston or rotary motor.*

### INTRODUCTION:

Soul of each and every engine is fuel. We are using fuels since olden days from fossils which are about to extinct. Majority of pollution in the world is contributed by automobiles. Also the price of fuels is increasing day to day and availability is decreasing so we have to go for alternative choice. Liquid nitrogen is generated by cryogenic or reversed Sterling engine coolers that liquefy the main component of air, nitrogen ( $N_2$ ). The cooler can be powered by electricity or through direct mechanical work from hydro or wind turbines. Liquid nitrogen is distributed and stored in insulated containers. The insulation reduces heat flow into the stored nitrogen; this is necessary because heat from the surrounding environment boils the liquid, which then transitions to a gaseous state. Reducing inflowing heat reduces the loss of liquid nitrogen in storage. The requirements

of storage prevent the use of pipelines as a means of transport. Since long-distance pipelines would be costly due to the insulation requirements, it would be costly to use distant energy sources for production of liquid nitrogen. Petroleum reserves are typically a vast distance from consumption but can be transferred at ambient temperatures.



### LIQUID NITROGEN

### PRINCIPLE OF OPERATION:

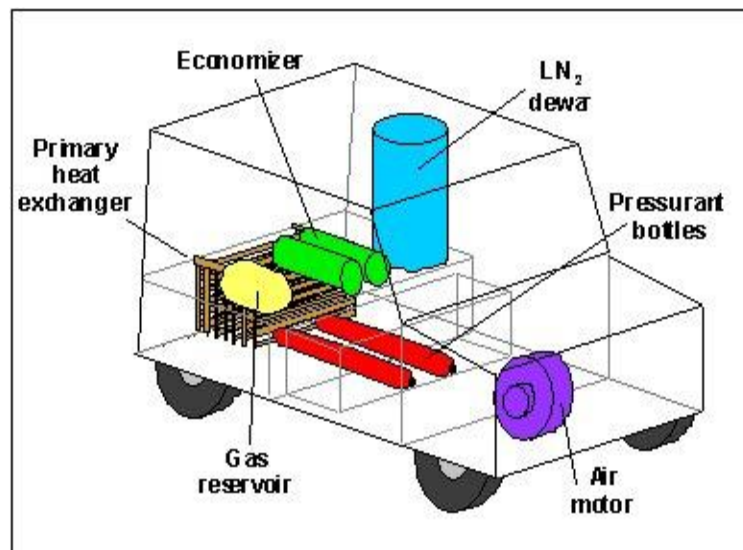
- Liquid nitrogen at 77.4k is pressurized and then vaporized in a heat exchanger by ambient temperature of surrounding air.

- This heat exchanger is like the radiator of a car but instead of using air to cool, it uses air to heat and boil liquid nitrogen.
- Liquid nitrogen passing through the primary heat exchanger quickly reaches its boiling point.
- The vaporized liquid nitrogen expands to a gas with a pressure of 150 kpa.
- The pressurized nitrogen gas drives the motor.
- The only exhaust is nitrogen which is major constituents of our atmosphere.
- $\text{ENERGY} + \text{N}_2(\text{L}) \rightarrow \text{N}_2(\text{G})$
- Hence there is no pollution produced by running the car.

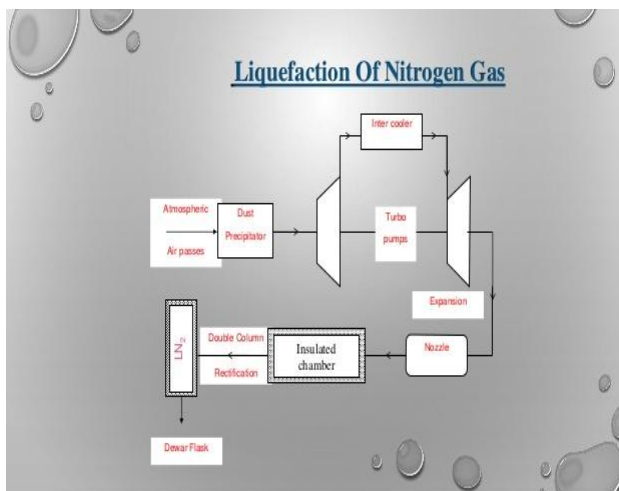
- Exhaust produced by the car is environment free.

### DISADVANTAGES:

- Liquid nitrogen is not available in public refueling stations.
- To convert nitrogen gas into liquid nitrogen requires lot of energy.



SCHEMATIC DIAGRAM OF LIQUID NITROGEN CAR



### LIQUEFICATION OF NITROGEN GAS

#### ADVANTAGES:

- Liquid nitrogen is not combustible, or toxic.
- Have significant performance
- Much lighter and refilling it takes about 10-15min.