TEKNOFEST

AEROSPACE AND TECHNOLOGY FESTIVAL

TECHNOLOGY FOR HUMANITY COMPETITION

PROJECT DETAIL REPORT

PROJECT NAME: Recycled Energy Generator (REG)

TEAM NAME:HES

CATEGORY: Social Innovation

TEAM ID: 351944

TEAM LEVEL: High School

TEAM MEMBERS: Bilal Anwar and Saad Amin

ADVISOR NAME: Muhammad Faisal Khan

Contents:

Bibliography:

• https://patents.google.com/patent/EP1301433A1

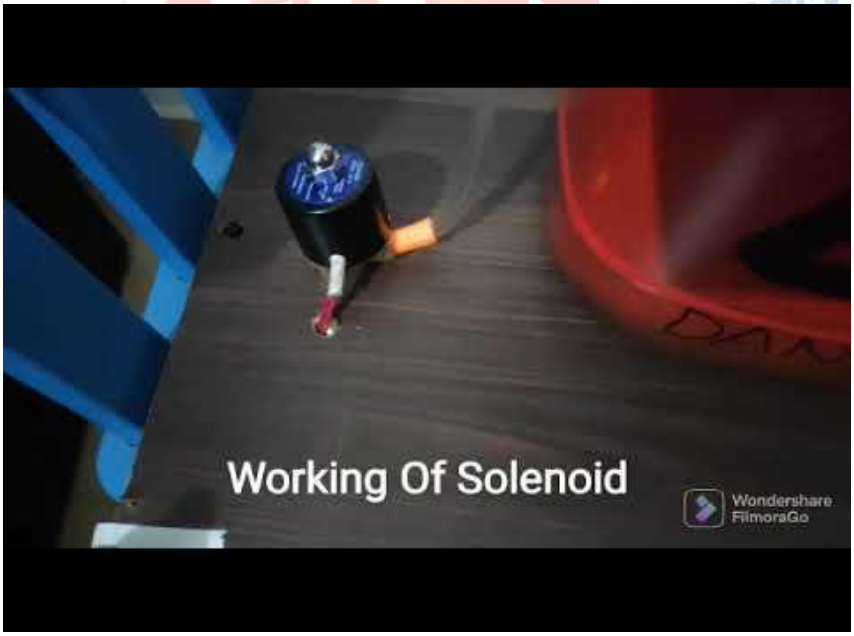
• https://www.internationaltin.org/recycling/

• https://www.bbc.co.uk/bitesize/guides/zqd8b82/revision/3

• http://mission-innovation.net/our-work/missioninnovation-breakthroughs/new-hydrogen-basedelectricity-generator-beats-alternatives/

• https://en.wikipedia.org/wiki/Carbon_filteringhttps://en.wikipedia.org/wiki/Carbon_filtering

These documents were consulted during our research and development process



This video shows the working of parts of REG

Project Detail Report

1. Project Summary:

Our project REG (Recycled Energy Generator) has been designed for the production of Hydrogen (H2) gas from Aluminum cans or other forms of Aluminum waste. This eco-friendly is advantageous to get rid of aluminum waste by the reaction NaOH (Sodium Hydroxide) with aluminum to produce Hydrogen gas. The hydrogen gas is potential fuel for the working of generator for the production of electricity. Here in the Fig. 1 related chemical reaction and related flow chart has been shown as well as the previous prototype.

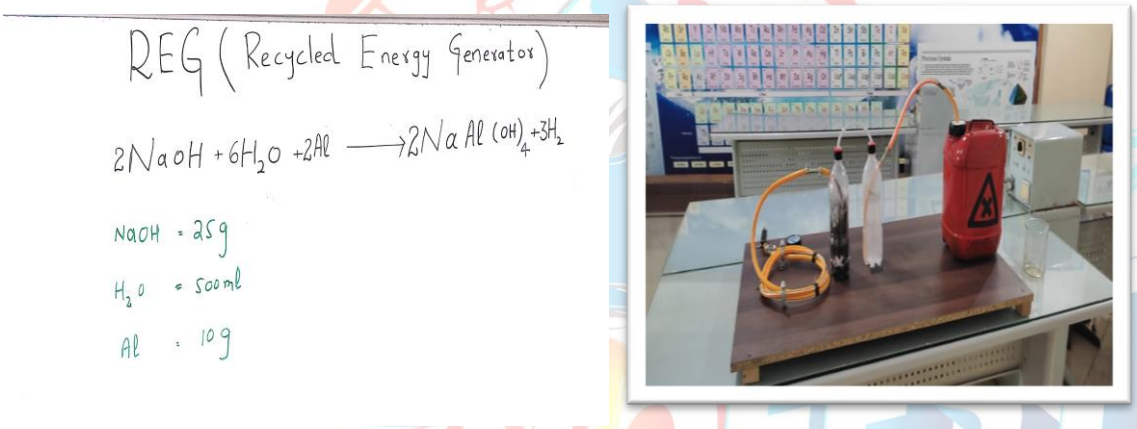


Fig 1: (Prototype and Flow chart)

2. Defining the Problem Situation:

According to Last year estimations the total weight of aluminum waste was about 2.7 million tons that was dumped into landfills out of which 47.5 percent was recycled. The rest of the waste is left untreated and takes at least 250 years to decompose and is polluting our enviroment and has long last effect on ecosystem and biodiversity. It is extremely dangerous for natural flora and fauna and is a continuousthreat. There are no existing solutions that are effective enough to deal with this problem. The improvements required in thisfield are machinesthat can effectively recycle aluminum not produce any waste. To counter the long term adverse environmental impacts of aluminum wastes that are increasing day by day, we need to develop potential techniques and methods and procedures to remove this waste.

Aluminium (Al), when present in high concentrations, has for long been recognised as a toxic agent to aquatic freshwater organisms,i.e. downstream industrial point sources of Al-rich process water. Today the environmental effects of aluminium are mainly a result of acidic precipitation; acidification of catchments leads to increased Al- concentrations in soil solution and freshwaters. Large parts of both the aquatic and terrestrial ecosystems are affected.In the aquatic environment, aluminium acts as a toxic agent on gill-breathing animals such as fish and invertebrates, by causing loss of plasma- and haemolymph ions leading to osmoregulatory failure. In fish, the inorganic species of aluminium reduce the activities of gill enzymes important in the active uptake of ions. Aluminium seems also to accumulate in freshwater invertebrates. Dietary organically complexed aluminium, maybe in synergistic effects with other contaminants, may easily be absorbed and interfere with important metabolic processes in mammals and birds.The mycorrhiza and fine root systems of terrestrial plants are adversely affected by high levels of inorganic monomeric aluminium. As in the animals, aluminium seems to have its primary effect on enzyme systems important for the uptake of nutrients. Aluminium can accumulate in plants. Aluminium contaminated invertebrates and plants might thus be a link for aluminium to enter into terrestrial food chains.

Fig : 2 (Aluminium Waste at Landfills)

3. Solution :

The effective solution to cope with this waste is to produce energy from this wastes and for this purpose grading of wastes is crucial for easy access to these wastes. Our project uses Sodium Hydroxide (NaOH) with water to produce Hydrogen gas which is an eco friendly fuel and can be used in various applications such generating clean energy or produce eco-friendly

gas to be used in houses. Hydrogen gas is future fuel to replace fossil fuels which are contniously depleting. In recent years many attemps have been made for the development of cheap methods for the production of hydrogen gas. The idea we have have presented is a unique solution to get rid of wastes as well as production of enviornment friendly fuel, normally burning of wastes or incineration generates enviornment pollluting dangerous gases.

Fig : 3 (Prototype of Our Project)

4. Method:

Our project works on the principle of generation of hydrogen gas when sodium reacts with tin or aluminium in an aqueous environment.

The produced hydrogen is then utilized to power a generator and produce electricity. In this way, the waste materials like tin cans and other metals can be recycled in order to produce electricity.

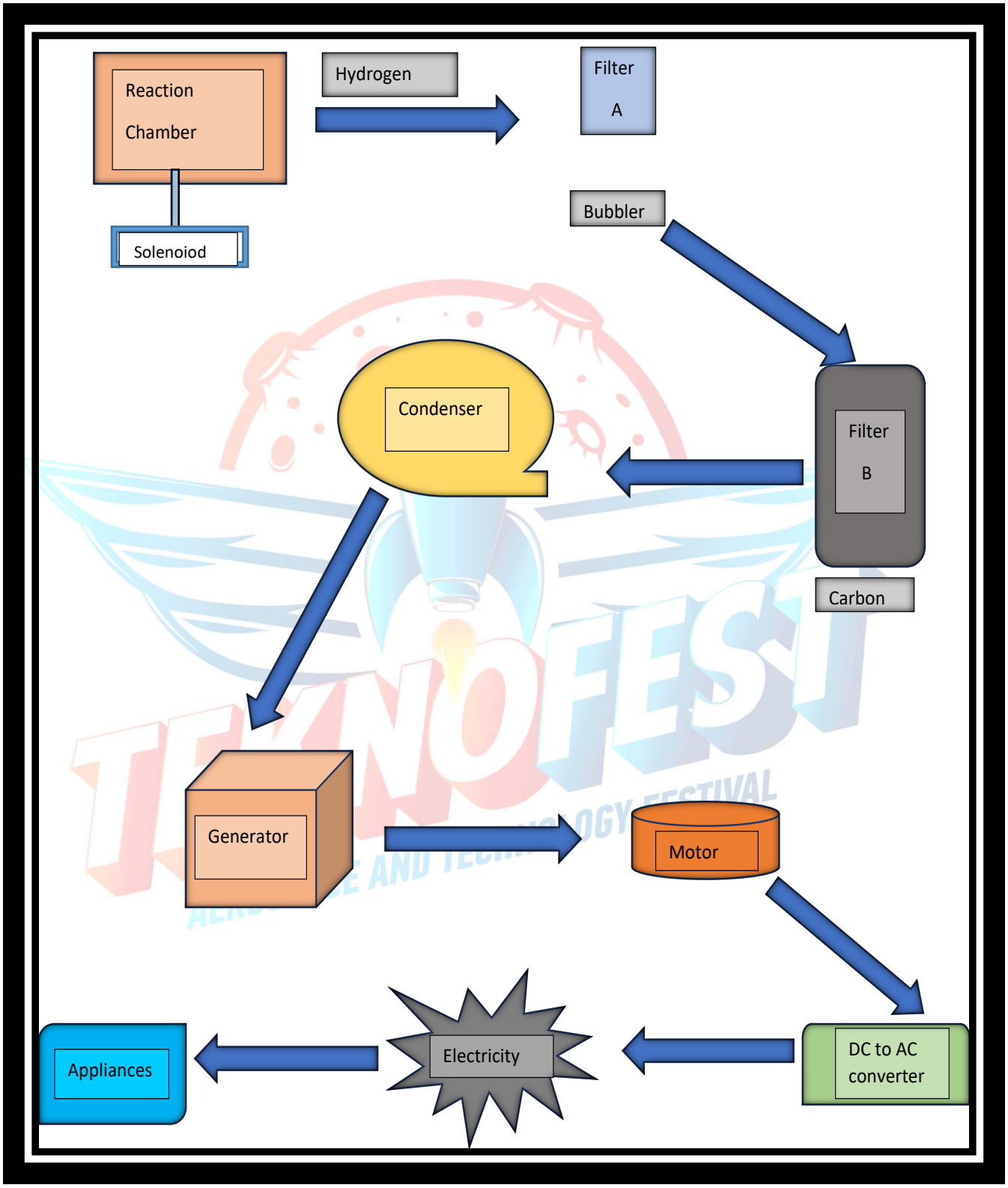
Our under development prototype is capable of producing continious Hydrogen Gas flow for 10 minutes by using only 50 G of NaOH and 10 G of Aluminium waste.

Prototype

2D Model Description:

The Reaction Chamber is used to produce hydrogen gas which is filtered by the water filter (Bubbler) and then by Activated Carbon Filter to filter out any impurities in the gas.The gas is then used to run a generator which turns a motor and produces DC current. A converter is

used to convert DC to AC current.The electricity is used to power common household appliances such as smart phones , light bulbs and TV's etc.



Schematic Diagram

5. Innovative Aspect:

This is unique and genuine concept that can be employed and excecuted at industrial scale to deal with aluminium waste. The idea is only one in nature that can produce hydrogen fuel from waste material for its uses in commercial applications such as electricity production for houseld purposes and at large scale. Even for pilot scale this project can be improved for household power supplies etc. Moreover the feul that is produced by this mechanism is very eco friendly and has no polluting effects and no toxic side products are formed . Instead the by product of reaction has various industrial applications. The design when compared with other available methhods is more efficient and can produce clean fuel. Other products that are applied in landfills also produce waste that is toxic.

Our project distinguishes itself from other similar projects because not only it provides a healthy way to discharge the excess tin and aluminium in dump sites but also uses them to generate electricity it is quite efficient and the raw materials used in this project are inexpensive, it does not require complex mechanical structures which reduces the risks of failures.

6. Applicability:

Our project can be used on a commercial scale by upsizing its components and poses no risks to be able to do so and it will become even more efficient at a commercial scale.It is applicable in small areas and can also be planted in land fills and recycling plants.For proper application we will install bins around the city which will be used to collect cans and a truck will go around to the bins and collect the Aluminium and the Aluminium will be shredded and used to produce Hydrogen Gas.

The interest in hydrogen as energy of the future is due to it being a clean energy, most abundant element in the universe, the lightest fuel, richest in energy per unit mass and unlike electricity, it can be easily stored. In future it will be used in various applications, such as generating Electricity. It is useful in cooking food,and it is also used as a fuel for automobiles It can fulfill all domestic energy requirments.

Current risks include the risk od over heating as wel as chemical handling which can be avoided by using new and improved technology.

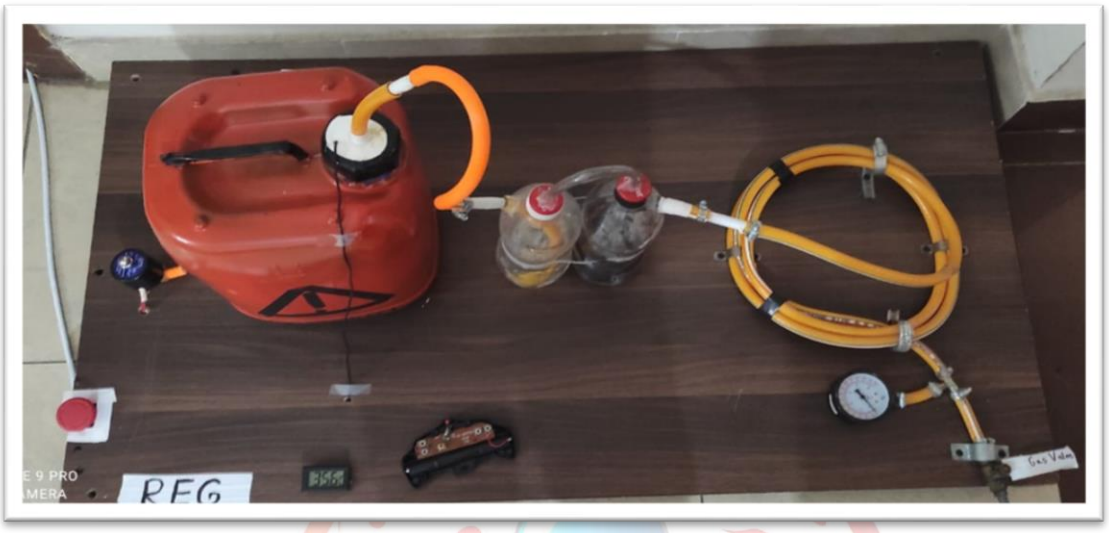


Fig : 4 (View of Prototype from above)

7. Estimated Cost and Project Scheduling:

Estimated cost of our Project REG will be around 150 US Dollars.

This cost is fairly cheap and indicates that this project is relatively low cost and budget friendly.

Table 1.1(Project Schedule)

Time Line:	Activity:	Process:	Expenditure:
March 1-3 /2022	Buying Pipes, Valves, Wood, Filters and Chemicals	Basic assembly for first stage.	US 80 Dollars
March 6-8 /2022	First tests and complete run.	Project is tested for any problems.	-
May 2-10 /2022	Purchasing Engine and Motor for power production.	Assembly of all electrical components of the project.	US 70 Dollars

May 15-17 /2022	Second test.	Testing all electrical components.	-
July 10-12 /2022	Final testing and preparing.	Project will be tested and packed for further stages.	-

Parts:

- Reaction Chamber
- Pipes
- Valves
- Brackets
- Nails
- Wooden Board
- Filters
- Solenoid Valve
- Emaergency switch
- Alarm
- Falshing Lights
- Wires
- Pressure Gauge
- Temperature Sensor

8. Target Group of the Project Idea :

The target group that will use this project are recycling plants and landfills. It can also be used by electricity producing plants and since Hydrogen is clean gas and can be used as a gas for stoves and heaters. The problem this will solve is the aluminium waste from landfills. And also solve Gas shortages in different areas.

It can be used by various Government Institutions in order to be able to recycle all aluminiuim waste and convert it into fuel for household use as well as for producing electricity.

Due to it being cost efficient it can be used by any body that owns a recycling plant or a land fill. The applicability of REG is very wide spread and not restricted to only a few stages but it is very versitable and budget friendly.

9. **Risks:**

Here are some risks that are associated with project:

- Handling of Chemicals.
- Installation of Collection Bins.
- Over Heating of Reaction.
- The Measures taken to prevent over heating will be to install coolers and condensers by water cooling the unit.
- Chemicals can be handeled by robots instead of Humans to prevent interaction with the reaction.
- This process can be entirely done by robots and Human workers are only required for supervision.

Plan B:

We ahve installed a safety mechanism in our project.

In the event of over heating of the reaction chamber which can be found out by monitoring the already installed temperature sensor we have installed an emergency switch which when pushed activates an alarm as well as warning lights.

It also opens a solenoid valve attatched directly to the reaction chamber which releases all Hydrogen Gas into a diffuser. This emergency system can also be triggered remotely by the installed remote sensor with a long range and distance remote.

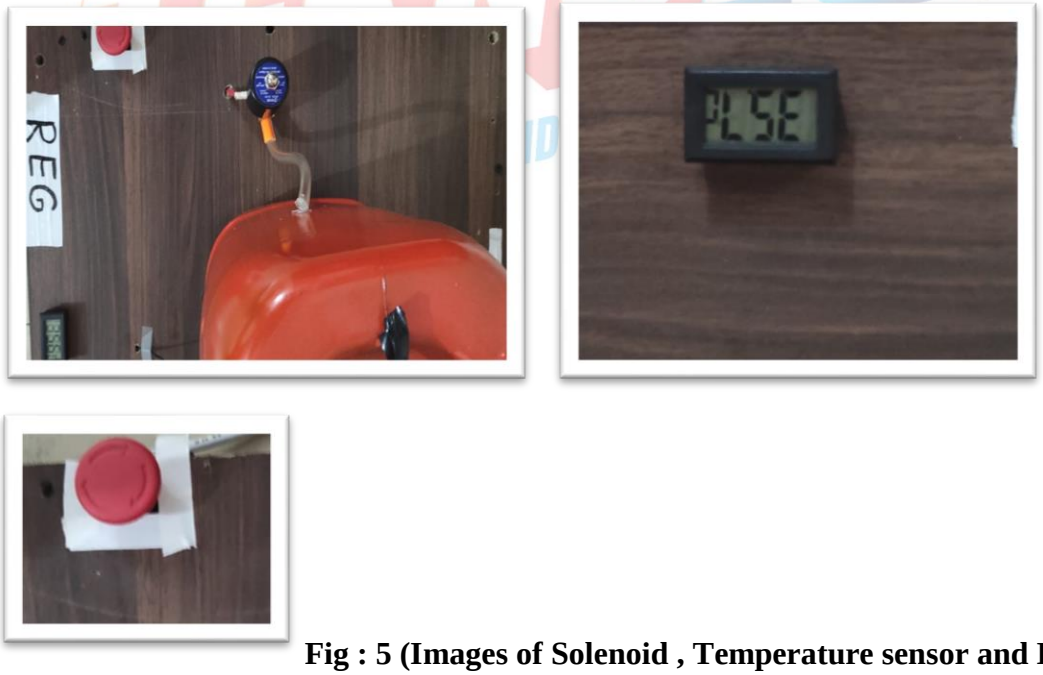


Fig : 5 (Images of Solenoid , Temperature sensor and Emergency Switch)

10. **Resources:**

Resources used were:

1. https://en.wikipedia.org/wiki/Hydrogen_internal_combustion_engine_vehicle

2. https://www.aliexpress.com/

3. https://www.daraz.pk/

4. https://www.prnewswire.com/news-releases/aquarius-engines-unveils-new-hydrogenengine-that-overcomes-fuel-cell-shortcomings-301293279.html

5. https://www.youtube.com/watch?v=79nDqxfMTvI

6. https://www.youtube.com/watch?v=WtPrIH0T3b0

1. Wikipedia(Hydrogen Engines)

2. Aliexpress For Some Parts

3. Daraz For Parts

4. Improved Hydrogen Fuel Cell Design

5. How to make Hydrogen

6. Hydrogen Combustion Experiment