International Journal of Advances in Electrical Engineering

**E-ISSN:** 2708-4582
**P-ISSN:** 2708-4574
IJAEE 2023; 4(1): 01-02

www.electricaltechjournal.com
Received: 01-10-2022
Accepted: 05-11-2022

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# The effect of hydrogen energy and environment

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**Abstract**
A society's growth may be gauged by looking at the amount of energy consumed per capita. Fossil fuels like coal, oil, and natural gas make up the majority of today's energy sources, and they may seriously harm the environment by contributing to acid rain, global warming, and climate change. The sources of fossil fuels are not only associated with serious environmental issues, but finite. Research is being compelled to look for renewable energy sources due to the rising need for energy, including wave, tidal, hydro, biomass, wind, solar, etc.
The prospect of hydrogen (H2) as a clean energy source appears to be greater. In reality, it serves as a clean energy transporter and aids in environmental preservation. Due to its high energy density, H2 is often regarded as a clean energy transporter. By utilizing it as fuel in combustion engines or fuel cells, it also reduces the production of greenhouse gases. H2 must be compressed or liquefied in order to be used as fuel. Both procedures are challenging and expensive.
Metallic and nonmetallic hydrides have gained substantial study interest in recent years. NaBH4, which retains 10.8 w% hydrogen, is one of the most promising H2 storage compounds. NaBH4 is hydrolyzed in the presence of a sufficient catalyst, producing H2. The ability to go around the second law of thermodynamics using fuel cells is another crucial feature.
In this paper, we will mostly discuss the detrimental consequences of fossil fuels and the beneficial effects of fuel cells on the environment.

**Keywords:** Carnot cycle, environmental pollution, fuel cells

## Introduction
A society's evolution may be roughly predicted by looking at its energy use per person. Fossil fuels like coal, oil, and natural gas dominate the energy sector today. These fuels have the potential to seriously harm the environment by contributing to acid rain, global warming, and climate change. Fossil fuels' resources are limited, and they also cause serious environmental issues. Researchers are compelled to look for renewable energy sources including hydro, biomass, wind, solar, geothermal, wave, tidal, and others due to the world's growing energy needs.
For a clean energy source, hydrogen (H2) appears to be a good contender. In actuality, it is a transporter of clean energy with a function in environmental preservation. Because of its high energy density, H2 is commonly recognized as a clean energy transporter. By utilizing it as fuel in combustion engines or fuel cells, it also reduces the production of greenhouse gases.
Hydrogen energy is clean energy with no negative effects on the environment. However, fossil fuels release greenhouse gases and air pollution. Consequently, it is necessary to reduce the use of fossil fuels.

### The primary negative effects of fossil fuels come in several forms
1. They are scarce worldwide, and they will probably run out within the next 50 years.
2. They also have S- and N-hetero-compounds, which, when burned, turn into $SO_2$ and NOx acid gases. The environment then transforms these gases into $SO_3$ and $NO_2$. These gases change into H2SO4 and HNO3, respectively, when they interact with atmospheric water vapor. These acids eventually precipitate as "acid showers." Acid showers are a tragedy for the environment as well as for people, animals, and plants.
3. $CO_2$ production as a result of burning fossil fuels. The primary greenhouse gas responsible for climate change and global warming is $CO_2$.

As was discussed above, burning fossil fuels produces $SO_2$, NOx, and $CO_2$ gas, which makes them unfriendly to the environment.

Acid rain is a significant problem on its own. The influence of $CO_2$ on global warming and climate change, as well as methods for reducing atmospheric $CO_2$ emissions through chemical and physical processes, will be the main topics of this section.
When dealing with energy, greenhouse gases, global warming, climate change, and what steps need to be made to comply with the Kyoto Protocol should all be taken into consideration at the very beginning.

**Remedy**
Since all fossil fuels eventually release $CO_2$, their use needs to be reduced, if not completely stopped. This necessitates the search for other energy sources.
The industrial revolution has been powered by fossil fuels. However, these fossil fuels have negative side effects, such as global warming and pollution. The amount of environmental pollution has gotten so bad that it now poses a major risk to the health of people, animals, and plants. For instance, air pollution contributes to the development of major illnesses like cancer and asthma.
To raise the share of renewable energy in overall energy consumption, renewable energy technologies must be developed. Biomass as well as solar, wind, and geothermal energy are all showing great promise. More attention than ever before is currently being paid to H2 energy in particular.

**Hydrogen (H2) Energy**
Because of its high energy density, hydrogen is commonly recognized as a clean energy source. It also helps to minimize greenhouse gas emissions when used as a fuel for engines or fuel cells.
Technically, in order to use hydrogen as fuel, the gas must either be compressed to a tiny volume or liquefied. Due to hydrogen's unique physical and chemical characteristics, both procedures are challenging and expensive. In addition to these conventional hydrogen storage methods, metallic and nonmetallic hydrides have attracted a lot of scientific attention recently. NaBH4, which stores 10.8% hydrogen, is one of the most promising hydrogen storage materials. In addition to having a large capacity for storing hydrogen, it is nonflammable, nontoxic, and stable in alkaline solutions.
Hydrogen is generated by the following hydrolysis reaction of NaBH4 in the presence of a suitable catalyst:

$$NaBH4 + 2H2O \rightarrow NaBO2 + 4H2$$

As can be observed, the fact that water contributes to half of the hydrogen produced makes it an efficient on-board hydrogen generation technique for portable PEM fuel cell applications. Borate, the reaction's end product, is ecologically friendly and can be recycled to create more NaBH4.
The Sadi Carnot Cycle, which limits efficiency under the second law of thermodynamics, is not an issue if we employ H2 in a fuel cell. With that, we will not only live in a clean environment, but the efficiency is also considerably higher than in the usual way. That is using traditional manner.

Chemical Energy → Heat energy → Mechanical Energy → Electrical Energy

As can be observed, there are a few intermediary processes, which results in reduced efficiency.
However, it is feasible to transform chemical energy directly into electrical energy by employing a fuel cell.

Chemical Energy → Electrical Energy

In this case, Carnot Cycle Limitations are by-passed. For this reason, the future of fuel cells is very bright and H2-economy will probably dominate in near future.

**Conclusion**
- It is inevitable that more efficient fossil fuel cycles and cogeneration systems will be used to produce energy.
- We need to realize that climate change is a global issue rather than a local one.
- Current research on hydrogen energy has been extensive. If some hydrogen technology issues can be resolved, a lot of things in our lives will change. Petroleum will be replaced by hydrogen. Electricity may be generated in fuel cells with a high efficiency of up to 60% (and up to 80% with cogeneration).

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