

Eco-Friendly Green Factory

Hessa Ali (ELE), Maitha Ahmad (ELE), Nadeem Yousuf (MCE)
American University of Sharjah
Eng 207- Dr. Khawlah Kaid Ahmed

Situation

- Eco-friendly green factories have become crucial in the UAE as the country has been ranked as one of the top emitters of CO₂. The emissions have increased from 2000-2012 by 40% [1].
- Waste from the factories that produce carbon dioxide and nitrogen dioxide depletes the ozone layer.
- Cement factories have caused 40mg/m³ emissions causing air pollution [2].

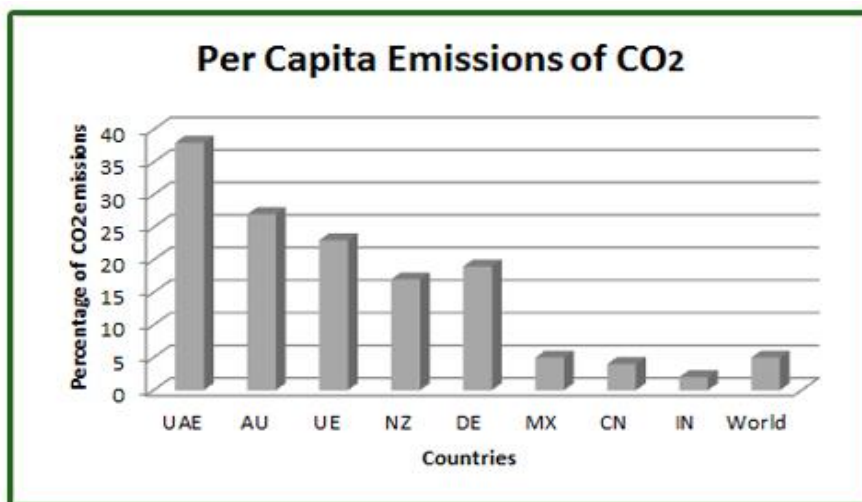


Figure 1: Comparison of UAE with the world [1]

Problems

- The efficiency of the machines in factories is less than 100% when mechanical energy is converted to electrical energy because of vibrations and noises.
- Factories dump and burn waste produces CO₂ which causes a negative impact on the environment
- Electricity generating factories contribute slightly more than 50 percent of greenhouse gases which cause global warming [3].

Solutions

- Piezoelectric technique uses losses such as vibrations and noises from machines to produce electrical energy.
 - Piezoelectric materials have a crystalline structure that provides a unique ability to convert an applied strain or pressure into an electrical current and vice versa.
 - The most common two types of piezoelectric materials are Quartz and PZT. PZT is a combination of silicone and nano ribbons of lead zirconates.
 - PZT converts up to 80% of mechanical energy into electrical energy [4].

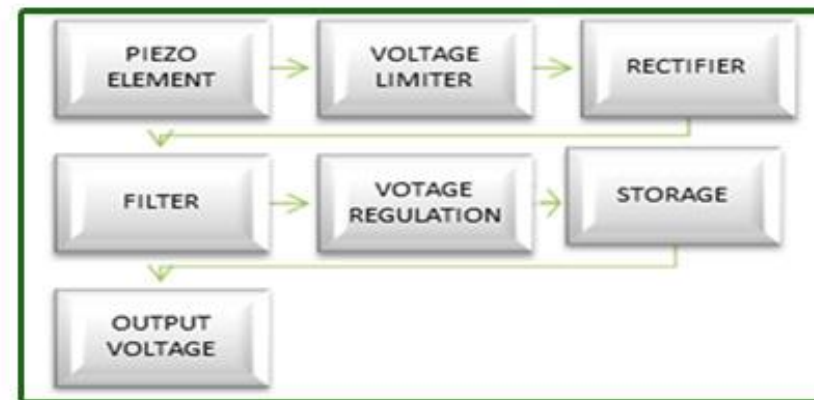


Figure 2: Process of converting mechanical to electrical energy

- Different methods to get rid of factories waste
 - Plasma gasification is a method to convert waste to mechanical energy.
 - Thermo electric devices convert heated syngas into electrical energy.

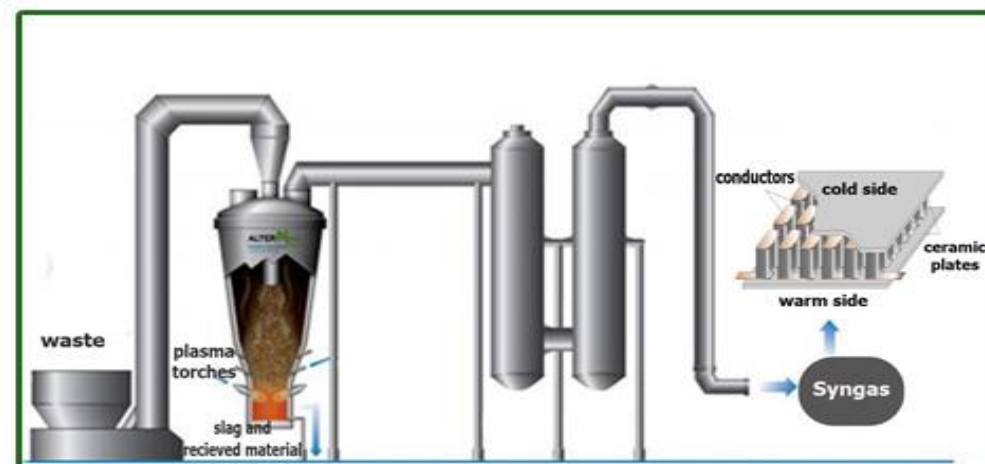


Figure 3: Process of converting waste to energy [5]

- Net power combustion cycle conserves CO₂

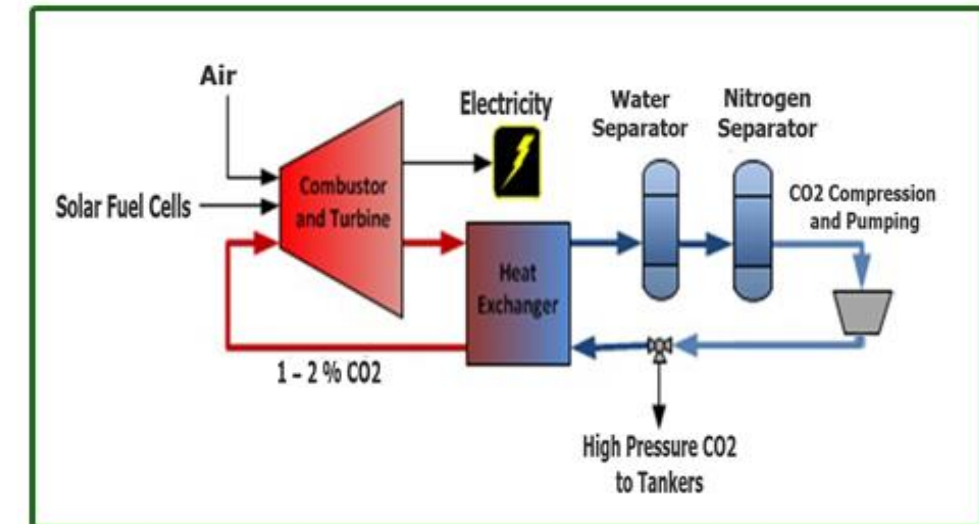


Figure 4: Improved version of Alam's cycle [6]

- Combustion takes place in the combustor and turbine producing electricity.
- CO₂ collected through tankers can be used in refrigerators and air conditioners as refrigerants.

Evaluation

- Thermoelectric devices' are compact, simple and inexpensive, but the efficiencies are around 5–8% only [7].
- Solar fuel cells which are used in the net power combustion cycle are expensive.
- The power generated using piezoelectric technique is not consistent because it relies on the amount of vibration per second so it needs a backup to provide sufficient continuous power.

References

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