Atmospheric Water Generator with Cfd Analysis

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Abstract- *Pure water is present in a limited amount in the earth and they are being polluted by the impurities. By a UNICEF survey every year 50 million people die due to the side effects such as mental disorder, kidney failure, skin cancer, and water borne diseases that includes cholera, dysentery, ebola, H1N1 caused by the impure water. Most of the water resources are fired. In countries like India and Africa the women and children have to walk miles to deliver water for their families. Several resources are contaminated. We are in a necessity to convert the impure or salt water into pure water by various methods which is a challenge for the people. Water cleaning systems invented by various organisations are costlier and is not affordable to people from all walks of life. Here is a generator to convert gaseous state of water in humid air into liquefied pure water. Our atmospheric water generator works on the principle of Newton's law of cooling. It uses the low temperature below the surface of the earth which is about 14°C.Our generator consists of two solid copper coils one is placed at a depth of 7 feet below the earth surface and the other one is exposed to the atmosphere. Turbine fans are used to force the air on the upper coil. By Newton's law of cooling the heats transfers from upper coil to low coil and cools to less than 16°C. This temperature is enough to condense the moisture in air since the dew point of water is 18.3°C. The cost for construction of our generator is just Rs.2000 which is at an affordable rate when compared to other water generating machines which are at an average of Rs.18000. We generated 12 litres of water per day using this generator. The power supply is not needed for the cooling system. If we install this generator it will produce energy continuously lifelong. Just consider a situation in future, our neighbours may die to get pure water but we can generate pure water sitting in our home by installing our atmospheric generator near to the house.*

Keywords- condensation, humidity, superheated temperature, wind speed, condenser, dew formation, ANSYS temperature analysis.

I. INTRODUCTION

Water is a source needed to live in the earth. But the water is being polluted by the activities of the human beings, so the need arises to purify the existing polluted water. But a recent technology called atmospheric water generator has been invented to extract the water from the humid air. Even though the process depends on the humidity of the air, it is a most effective process in water scarce areas. My innovative idea has greatly reduced the power required to generate water through this process.

II. NEED FOR ATMOSPHERIC WATER GENERATOR

In most of the places in the world the pure distilled water is obtained by the desalination process because there will be an abundant supply of water in all those places. But when there is no source of water nearer to the residence then the process becomes much tedious.

For about one billion people in the world the clean accessible drinking water is just not an option. They have to spend 40 billion hours per year to get water. Most probably in the desert areas it is hard to find the water resources. But even the air in desert has little humid content. We can convert that humid vapour into liquefied water that can be utilized by the people living in dry areas.

Atmospheric water generator:

AWG is a device that helps to extract water from moist atmosphere. In this project, we designed an atmospheric water generator that can generate water from humid air without the aid of electricity by using the chillness present in the soil. A detailed CFD analysis is performed to increase the efficiency of the atmospheric water generator.

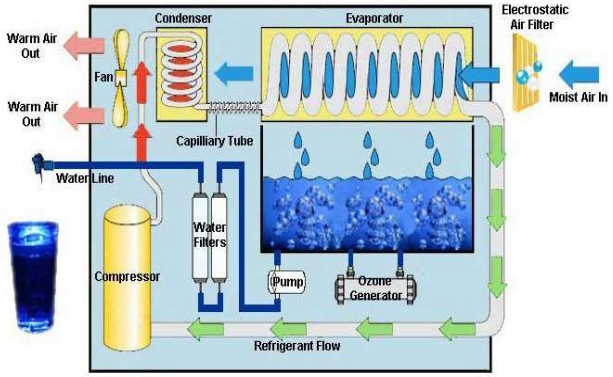

Fig 1:General refrigeration process

My innovative idea:

My innovative idea is concerned with reducing the electricity used for this process. It eliminates the use of the solar panel or any other costly power resources for the generation of the electricity required for the condensation process. The earth's coolness is used to harvest the water from air. The main parts includes a pair of coils and a turbine fan unit.

Construction:

The atmospheric water generator condenser consists of a heat exchanging copper coil deep below the earth surface at a depth of about 6 feet and a copper coil just above the earth surface. The in-between conducting part is insulated. A turbine fan is kept above the upper coils to increase the flow of air coming in contact with the upper coil. A collector is placed concentric to the upper coil.

Working:

The temperature required to condense the water from the moisture air is about 18.3°C (65°F). The temperature below 6 feet of the earth surface is 50 degree Fahrenheit, it is more than enough to condense the humid air. The only thing we have to do is to bring that temperature to the surface of earth. In this setup the lower coil acts as the heat exchanger to release the heat into the earth. So the heat from the surface of the upper coil transfers to the lower coil. As the in-between part is insulated the heat transfer takes place between the two coils only. As the upper coil becomes cool the air when comes in contact with the upper coil condenses automatically. To increase the rate of water generated a turbine fan is used that increases the amount of air in contact with the upper coil. If this plant is installed the power needed is completely reduced and we need not depend on any other water resource to get clean water but we can generate water all through our life without dependence on any source.

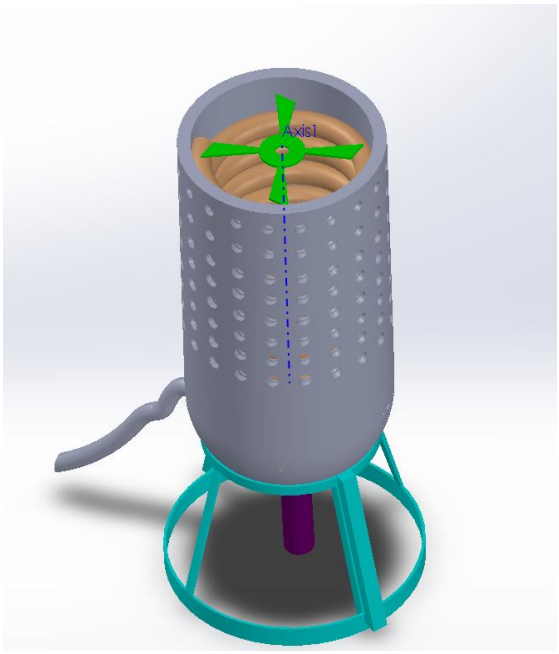

Fig 2:Schematic 3D MODEL of atmospheric water generator

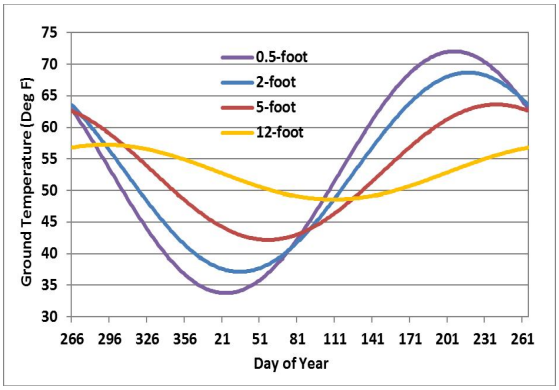

Fig 3:Variation of temperature with respect to depth under earth surface.

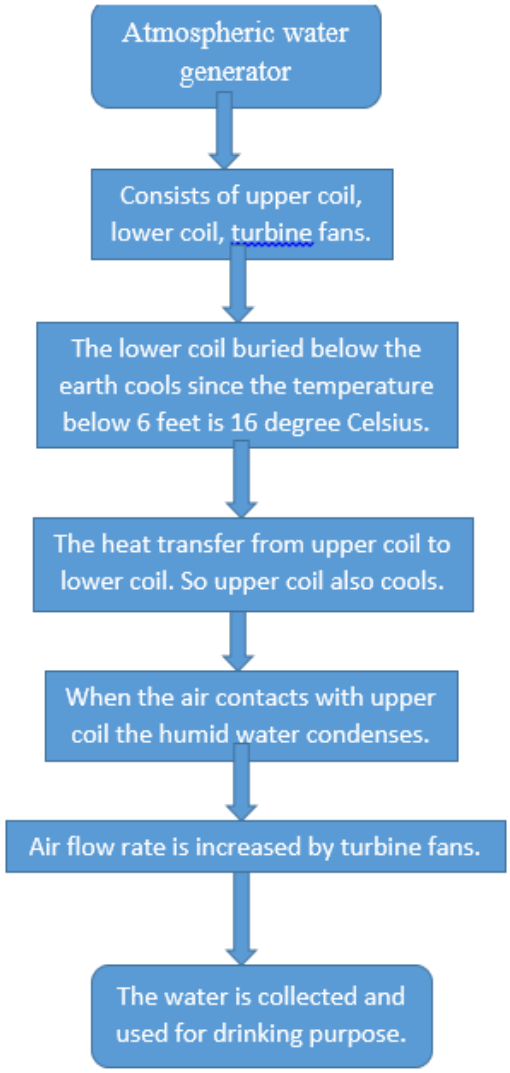

Fig 4:The flow chart of earth cooled atmospheric water generator

Fluid Analysis results of the heat exchanger coil:

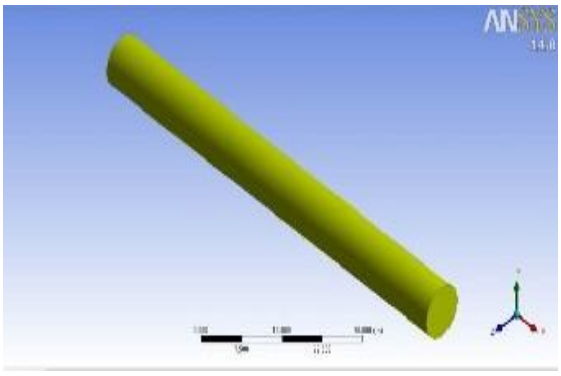

Fig 5:FE model

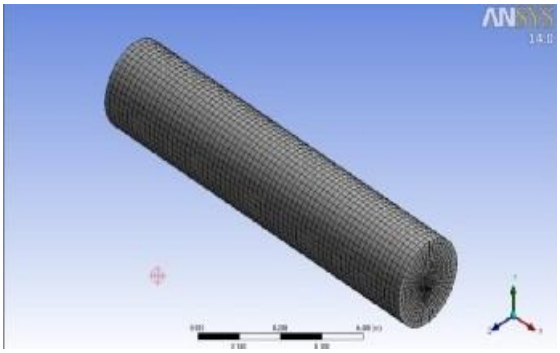

Fig 6:FE Mesh

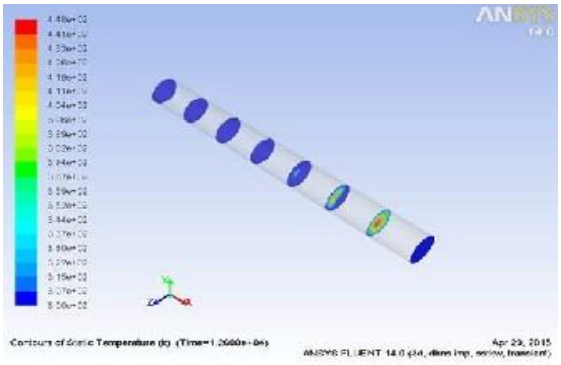

Fig 7:Temperature analysis of tube

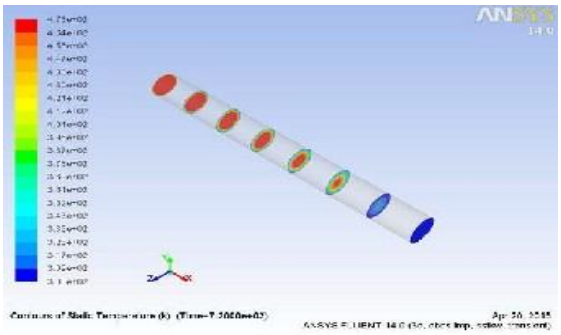

Fig 8:Temperature analysis of tube

Cost comparison and estimation:

The cost required for reverse osmosis process to generate 8 litres per day is about Rs.15000. The maintenance charge is Rs.4000 for every 6 months to change the carbon and uv filters. The average cost required to generate the same amount of water through distillation would be Rs.17000 that includes the boiling, condensing and collecting set up but due to the salt deposition the maintenance costs is also high up to Rs.9000 per annum. But when using this earth cooling process the total charge required is just Rs.1500 that includes the copper coil, insulation, collector and the fans. The maintenance charge is also negligible.

Application of AWG:

- The water obtained from this process is pure as rain water and there is no need to purify this water.
- AWG can be used in areas where water supply is negligible such as deserts and arid areas.
- Major reason to implement an atmospheric water generator is for emergency and medical purposes. Having one of these units handy during recovery efforts can help source drinkable water for families, store supplies, medicine and blood, alongside other necessities.
- The device is cost efficient. The maintenance cost is negligible.
- Another benefit of this method of water retrieval is no additional operating expenses.
- There is no need for any condenser circuit so the cost is greatly reduced.
- It can be also used in the green house plant due to high relative humidity inside the green house farm.
- If this generator is installed near the sea, plenty of pure water can be generated since the humidity of water is much high.

Challenges to overcome:

- If solar cell is used, the initial investment of the project will high. This could be eliminated by using earth coolness.
- Large amount of energy is used in the AWG process to operate the condenser and purifier. But in our AWG the power required is very low.
- On cloudy days the solar power generation will be low to operate the AWG if the solar power is used.

III. CONCLUSION

Implementation of this project in arid areas will be a better source of drinking water. So many people will be benefited by the installation of this project. This could be a better water source for the poor people since the cost required to install and maintain this plant is very low. This will change the life of many people who lag for pure water and the water crisis will be solved. According to emerald steins, a great poet the next world war may be caused by the demand for water. This can be avoided by generating water on our own.

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