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MODIFIED TECHNIQUES FOR WATER HARVESTING

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Abstract: In this paper the study is done for modified techniques for water harvesting. Now a day's water harvesting is most important due to decreasing the ground water table. So, for increasing the ground water level – water harvesting plays an important role. Day by day water level decreases which is critical problem for everyone. Rainwater harvesting is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off. Rainwater can be collected from rivers or roofs, and in many places, the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for gardens, livestock, irrigation, domestic use with proper treatment, indoor heating for houses, etc. The harvested water can also be used as drinking water, longer-term storage, and for other purposes such as groundwater recharge. Therefore, in this paper all details are given with modified techniques.

Keywords: Water, Rain water harvesting

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INTRODUCTION

Water is essential for the healthy functioning of the human body. Without food, human beings can live for 14 days or more, but the human body can only survive a few days without water. Having access to safe and sufficient water and sanitation are now recognized as a basic human right. Freshwater scarcity and stress are increasing in tropical regions as a result of expanding populations, tourism, climate change and pollution, states the United Nations Environment Program. According to, one billion people worldwide live without clean, safe drinking water, and two billion live without basic sanitation. In most cases, the problem is not a lack of available water but rather the inability to obtain it in a cost-effective, reliable manner. Population growth and rising standards of living in many developing countries are increasing demand for clean, safe drinking water. Access to water can also be the critical difference in business continuity and adverse situations. An island or remote location where water infrastructure is not available will do well with a mobile machine that delivers water on site according to the capacity required, without fail, rain or shine. Drawing water from air (a so called atmospheric water generation, AWG) is a generic technology that produces potable water from water vapour in the air by a process that is a kind of dehumidification: difference is only in the product fluid, dehumidified air or the condensed humidity. The basic approach is to cool the atmospheric air below its dew point temperature, i.e. extract the specific heat of humid air and then the latent heat in the water content, and water begins to condense. In fact, this approach, if utilizing the day/night temperature difference, is known from ancient times as dew wells or dew ponds. There are two opportunities for electrostatics to improve this process: (a) to decrease the energy consumption by the minimizing the parasitic cooling of air; and (b) to increase the Proc. ESA Annual Meeting on Electrostatics 2015 2 condensation rate by the enhancing of water delivery to the cooling surface by the external field. There is an electrostatic enhancement of condensation which is based on the combination of three phenomena: 1) the dielectrophoretic (DEP) nucleation of the vapor on electrically charged centers; 2) the electrohydrodynamic (EHD) flow of the vapor due to the drag by electrically charged droplets; and 3) the temporal (until droplets are discharged) storage of heat energy in electrically charged droplets. This paper presents atmospheric water harvesters as viable alternatives to existing water supply systems. Atmospheric water harvesters producing varying water capacity can also be considered as supplementary resources and logistical assets for consumers and industries that have limited access to water.

1. Need of Water Harvesting:

As there is need of water in the desert region and the region where rainfall is low collection of water is important. The collection of water is done from the atmosphere i.e atmospheric water generator (AWG). The increase in the demand of water because of the rapid increase in the industrialization and population it is necessary to harvest water. The need of water is increasing day by day, due to low rainfall which leads to scarcity of water to fulfil the need of the humans water vapour harvesting is needed.

2. Methodology:

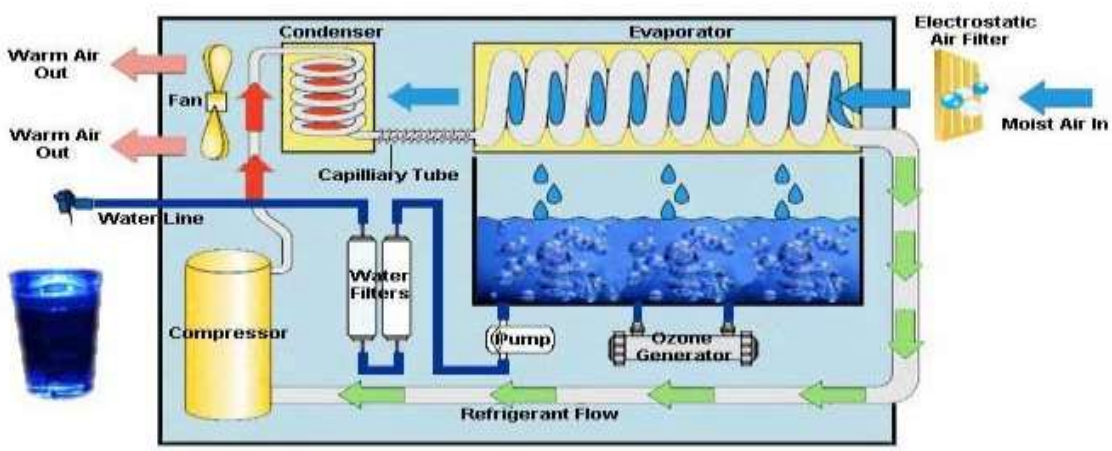
Fog Harvesting - Age-old Practices That Still Work

Water treatment systems are rapidly seeing changes, from days of conventional filtration systems to top of the range desalination plants with sophisticated membrane systems.The various sources of water are being tapped – rivers, lakes, springs, mountain streams and where these aren't readily accessible, seawater and even humidity in the air are being harvested.But collecting water from the air is not new. It has been in use for at least 2,000 years with air wells in the Middle Eastern deserts and in Europe. Dewponds in the 1400s collected water, and later fog fences.Fog fences use a technique called fog harvesting or fog collection or even cloud stripping, to collect water from the humidity in the fog. It can be used in coastal areas where inland wind bring in the fog, and high altitude areas (if water is present in stratocumulus clouds), from 400m to 1,200 m (UNEP, 1997).How does it work? It uses a mesh material strung tightly on poles, supported by gutter to collect droplets, fed into pipes, and then stored in tanks. The size of the mesh can be as small as a metre in length or nearly 100m long, depending on the lay of the land, space available, and the quantity of water needed.According to non-profit organisation , fog collectors can harvest a range of water quantities, from 200 to 1,000 litres per day, factoring in daily and seasonal variables. Efficiency of harvesting is increased with larger fog droplets, higher wind speeds, and narrower collection fibres/mesh width.A fog collection system in eastern Nepal produces on average 500 liters of water daily and about half the quantity in the dry season (see video).**[i]** A study has shown that in Eritrea (East Africa), 1,600 square metres of mesh produced an average of 12,000 litres of water a day.**[ii]**Remote places in Peru, Ecuador and Chile rely on this technique to draw much needed water for consumption and irrigation. Other areas that can potentially benefit from this technique, according to the International Development Research Centre (1995), include the Atlantic coast of southern Africa (Angola, Namibia), South Africa, Cape Verde, China, Eastern Yemen, Oman, Mexico, Kenya, and Sri Lanka.**[iii]**

Scientists are still testing and innovating better quality meshes and configurations that will maximize water production under different conditions.

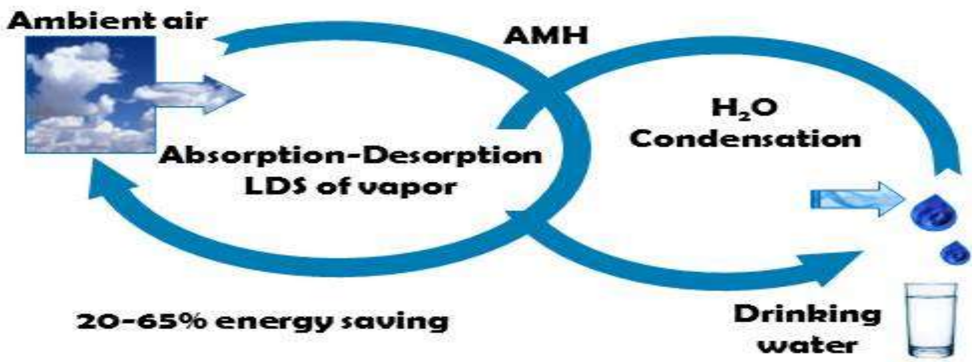
Modern Atmospheric Water Harvesting

The artisanal method of fog harvesting, however, is not always suitable or practical, especially in dry and arid areas. This is where more modern techniques can be considered. An atmospheric water harvester or atmospheric water generator (AWG) is a electricity-powered device that uses the dehumidification principle to make drinking water out of the moisture in the air. With the amount of renewable water in the earth's atmosphere estimated to be around 12,504 cubic kilometres**[iv]**, there is certainly an unlimited source of water to harvest from.While AWG can be used virtually anywhere where potable water is needed, it is most applicable in places with higher humidity. The ideal place for this is the band around the equator (40° North Latitude to 40° South Latitude). That also happens to be where most of the people are in the world. Interestingly, this band is also where most of the water shortage problems have been identified.AWG devices are specified to generate water at relatively moderate temperatures but high relative humidity. They tend to produce more water in places with higher temperatures and humid climates, and less water in colder or drier regions. Absolutely no conventional or secondary water source is needed in an AWG. The only resource needed for AWG to work is the air with its trapped moisture, as the process mimics how rain is formed. Electricity powers the device, which can be obtained from the main power grid or from clean energy sources such as solar panels, wind turbine, wave converter and more.The technology is a decentralized system of harvesting of atmospheric water that has not been previously considered as a potable water supply for the masses. It is sustainable, reliable, and produces potable water without massive, complicated installation.



How Does AWG Work?

Water vapour in the air is condensed by cooling the air below its dew point, exposing the air to desiccants, or pressurizing the air. The two primary techniques in use are cooling and desiccants.The AWG operates by way of distillation. It captures water vapor from the air and channels it towards an evaporation system in a sanitary environment before it liquefies and is exposed to pollution. Its technology extracts the distilled water vapor and converts it into crystal clear drinking water. Air is drawn through a double-layered anti bacteria air filter and ionised before being 'captured' into pure water. Collected water is then scientifically purified through pre-and-post charcoal filtration, chemical-free nano-membrane filtration and ultraviolet light sterilization to remove harmful organic substances.A significant quantity of clean water is produced before it has been exposed to earthly contaminants. This sets AWGs apart from other water systems (municipalities, filtering and bottled water suppliers) that provide drinkable variations of polluted water by removing or neutralizing the hundreds of chemicals, micro-organisms and particulate in ground water.The AirQua Sano model can produce up to 48 litres of pristine drink water per day, depending on the humidity, the volume of air passing through the coils, and the size of the machine. These units can operate 24 hours/day as water generators and also serve as water purifiers, air purifiers, hot and cold-water dispensers and dehumidifiers.



Advantages and Benefits of AWG

Water-from-air is an environmentally, sustainable and responsible water supply solution in tropical regions that have high moisture content in the ambient air.AWG machines can be placed virtually anywhere, opening the door to otherwise impossible land development. Places that would benefit greatly from such machines are under developed sites where the water infrastructure is yet to be stabilized. Schools, hospitals, places of worship, police and fire stations stand to gain the most from the deployment of such machines.Applications can also include larger housing developments – at a cost – as well as greenhouse irrigation and light industrial use. Some models are scalable while others are not. The volume of pure water generated can even go up to a few thousand litres of water a day.

There are distinct benefits associated with a typical AWG system:

- Highly portable, economical and easy to maintain
- No expensive piping infrastructure investment is needed
- Quick flexible deployment
- No conventional water source required
- Needs only to plug into electrical socket to generate fresh, pure water
- Convenient, dependable, and safe
- Gives you total control over your water need

Comparing AWG with Desalination

The water produced from AWG is purer than some other water treatment systems. Due to the rigorous filtration methods employed, a few AWG models generate water with virtually no inorganic minerals (e.g. sodium and chloride), impurities and contaminants. The "dew" water is clean, natural and free from chemicals. Figure 2 lists the comparisons of AWG with the reverse osmosis (RO) process as documented by AridTec. Desalination is used widely around the world, in particular with the RO process, especially in dry countries, on maritime vessels and small islands. The Middle East is still the largest user of desalination and seawater desalination plants of capacity over 300 ML/d are being constructed there(e.g. Ashkelon plant in There is increasing use in Europe in countries such as Spain and in North America with plants of over 100 Ml/d of water per day capacity in the Caribbean.[v]The process of desalination is conventionally expensive and energy intensive, with high maintenance and operations. In typical water production and distribution cycles of any water treatment plant for that matter, copious amounts of energy are needed to extract, pump, transport, treat and distribute water to all users. It is estimated that 2-3% of the world energy consumption is used to pump and treat water for urban residents and industry.[vi]Desalination also produces concentrated waste streams of brine, which have to be disposed of responsibly. For these reasons, it is generally a source of last resource, implemented when all others have failed. The most practical and attractive desalination options are for water that does not have much salt in it to start with, i.e. brackish water or recycled water. Still the quality of water can be less than what was hoped forThe environmental impacts are significant. With high energy consumption comes high greenhouse gas production. A study by the Sydney Coastal Councils Group in 2005 suggested that the proposed Sydney Water desalination plant producing up to 500 Ml/d through reverse osmosis would require 906 GWh of energy per year. It would also produce 950,000 tonnes (using the existing energy grid) of greenhouse gasses per year.[vii] There are threats to marine life with the high volume of brine discharge that may also contain pollutants that are toxic, primarily due to contact with metallic materials used in the construction of the plant facilities. According to the study, the environmental impacts may include increased turbidity, reduced oxygen levels and increased density of discharged wastewater.Concerns cited by the Sydney Coastal Councils Group included significant environmental impact on delicate local ecosystems containing heritage listed sand dunes, sensitive wetlands and protected marine and intertidal areas. Other research has suggested that the greatest single ecological problem associated with desalination plants that use seawater is that organisms living with in the vicinity of the desalination plant are sucked into its equipment.

AWG Strengths and Weaknesses

Atmospheric water harvesting technology in comparison requires little infrastructure building as AWG equipment are portable and scalable. The equipment can serve large requirements by integrating them together to produce greater outputs. An advantage is to be able to take them apart depending on situational changes. As there is no need to tap in to any existing of potential water infrastructure, the AWG can be considered as a stop-gap measure in the building of huge and large scale water treatment plants. Environmental impacts of AWG are negligible as by-products are warm air and machine consumables – much smaller carbon footprint compared to desalination plants and bottled water factories. The energy consumption of AWG machines in general is said to be lower than any other water generation methods, however this remains unsubstantiated. Clean energy sources should be considered for the reduction of costs of electrical power in the long run, like solar or wind power. Where cost is concerned, the product price of an AWG is relatively higher compared to municipal water supplies, as the latter tends to enjoy government subsidies. Climate plays an important factor for AWG machines to run efficiently. The best conditions would be places with relative humidity and cool. AWGs face a challenge with sandy areas such as deserts – the air filters are susceptible to blockage by sand particles. This can be resolved by changing blocked air filters often while the machine continues to produce untainted drinking water. In arid areas such as Middle East winters, according to AridTec, water production by AWGs can be less efficient by 15% -20%.

3. Conclusion:

Despite widespread water pollution and shortages of drinking water, there is an abundance of water around us – from the air that we breathe to the water in the sea. Several water treatment methods exist to tap these sources, from artisanal, traditional methods of atmospheric water generation to unconventional, modern techniques of desalination.Water harvesting and treatment technologies that are solar or wind powered is the most environmentally friendly way to extract pure quality water from the air or sea at a low cost. These technologies are now commercially available and mostly scalable depending on need and location.

4. References:

1. Robert S. Schemenauer, The complementary aspects of projects to collect rain, fog and dew. Pilar Cereceda and Pablo Osses Instituto de Geografía, Pontificia Universidad Católica de Chile, Santiago, Chile. XI IRCSA CONFERENCE.

2. Roland Wahlgren, Atmospheric water vapour processing WATERLINES VOL. 12 NO.2 OCTOBER 1993

3. Axel Ritter, Carlos M. Regalado, and Juan Carlos Guerra, Quantification of Fog Water Collection in Three Locations of Tenerife (Canary Islands) Received: 10 April 2015 / Accepted: 15 June 2015 / Published: 26 June 2015, ISSN 2073-4441

4. Ayman F. Batisha Fog collection as a complementary water resource in Egypt, Researcher, Environment and Climate Research Institute, National Water Research Center, Cairo, Egypt, 1-3 April 2003 page no. 591.

5. Sean Graham Furey, Fogwater Harvesting for Community Water Supply. Supervisor Tim Hess September 1, 1998,Cranfield University

6. Shashank Swarndeep, Design Optimisation of Fog Collector . Supervised by Mr. R.S. Kashyap Department of mechanical engineering, Dr. C.V. Raman Univerisity, Kargi road, Kota, Bilaspur, C.G. , Vol. 3 Issue 6, June 2016 ISSN (Online) 2348 – 7968 | Impact Factor (2015) - 4.332

7. www.google.com