INCREASING EFFICIENCY OF SOLAR POWER GRID USING PNEUMATICS

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Abstract:
In recent years we are depending on the renewable energy. Solar energy is one such source of energy. Conversion efficiency of solar energy is degraded by the deposition of dust particles on the solar panel in wide area. In this paper we are proposing novel method to increase the conversion efficiency by using pneumatics.

INTRODUCTION:

Our current consumption model relies almost entirely on the use of non-renewable energy sources such as oil, gas, coal and uranium. At the current rate of consumption, oil will be the first fossil fuel to run out. According to projections, there would be between 40 and 60 years of proven reserves of conventional oil. Natural gas could be exploited for another 70 years. For coal, there would be around two centuries of reserves.

The energy crisis is a broad and complex topic. Most people don't feel connected to its reality unless the price of gas at the pump goes up or there are lines at the gas station. The energy crisis is something that is ongoing and getting worse, despite many efforts. The reason for this is that there is not a broad understanding of the complex causes and solutions for the energy crisis that will allow for an effort to happen that will resolve it.

The energy crisis is the concern that the world's demands on the limited natural resources that are used to power industrial society are diminishing as the demand rises. These natural resources are in limited supply. While they do occur naturally, it can take hundreds of thousands of years to replenish the stores. Governments and concerned individuals are working to make the use of renewable resources a priority, and to lessen the irresponsible use of natural supplies through increased conservation.

"An energy crisis is any great bottleneck (or price rise) in the supply of energy resources to an economy. In popular literature though, it often refers to one of the energy sources used at a certain time and place, particularly those that supply national electricity grids or serve as fuel for vehicles".

Causes of the Energy Crisis:

It would be easy to point a finger at one practice or industry and lay the blame for the entire energy crisis at their door, but that would be a very naive and unrealistic interpretation of the cause of the crisis.[1]

1. Overconsumption: The energy crisis is a result of many different strains on our natural resources, not just one. There is a strain on fossil fuels such as oil, gas and coal due to overconsumption - which then in turn can put a strain on our water and oxygen resources by causing pollution.
2. Overpopulation: Another cause of the crisis has been the steady increase in the world's populationand its demands for fuel and products. No matter what type of food or products you choose to use - from fair trade and organic to those made from petroleum products in a sweatshop - not one of them is made or transported without a significant drain on our energy resources.
3. Poor Infrastructure: Aging infrastructure of power generating equipment is yet another reason for energy shortage. Most of the energy producing firms keep on using outdated equipment that restricts the production of energy. It is the responsibility of utilities to keep on upgrading the infrastructure and set a high standard of performance.
4. Unexplored Renewable Energy Options: Renewable energy remains unused is most of the countries. Most of the energy comes from non-renewable sources like coal. It remains the top choice to produce energy. Unless we give renewable energy a serious thought, the problem of energy crisis cannot be solved. Renewable energy sources can reduce our dependence on fossil fuels and also helps to reduce greenhouse gas emissions.
5. Wastage of Energy: In most parts of the world, people do not realize the importance of conserving energy. It is only limited to books, internet, newspaper ads, lip service and seminars. Unless we give it a serious thought, things are not going to change anytime sooner. Simple things like switching off fans and lights when not in use, using maximum daylight, walking instead of driving for short distances, using CFL instead of traditional bulbs, proper insulation for leakage of energy can go a long way in saving energy. Read here about 151 ways of saving energy.
6. Major Accidents and Natural Calamities: Major accidents like pipeline burst and natural calamities like eruption of volcanoes, floods, earthquakes can also cause interruptions to energy supplies. The huge gap between supply and demand of energy can raise the price of essential items which can give rise to inflation.
7. Wars and Attacks: Wars between countries can also hamper supply of energy specially if it happens in Middle East countries like Saudi Arabia, Iraq, Iran, Kuwait, UAE or Qatar. That's what happened during 1990 Gulf war when price of oil reached its peak causing global shortages and created major problem for energy consumers.

Possible Solutions of the Energy Crisis:

Many of the possible solutions are already in place today, but they have not been widely adopted.[1]

1. Move Towards Renewable Resources: The best possible solution is to reduce the world's dependence on non-renewable resources and to improve overall conservation efforts. Much of the industrial age was created using fossil fuels, but there is also known technology that uses other types of renewable energies - such as steam, solar and wind. The major concern isn't so much that we will run out of gas or oil, but that the use of coal is going to continue to pollute the atmosphere and destroy other natural

resources in the process of mining the coal that it has to be replaced as an energy source. This isn't easy as many of the leading industries use coal, not gas or oil, as their primary source of power for manufacturing.
2. Buy Energy Efficient products: Replace traditional bulbs with CFL's and LED's. They use less watts of electricity and last longer. If millions of people across the globe use LED's and CFL's for residential and commercial purposes, the demand for energy can go down and an energy crisis can be averted.
3. Easier Grid Access: People who use different options to generate power must be given permission to plug into the grid and getting credit for power you feed into it. The hassles of getting credit of supplying surplus power back into the grid should be removed. Apart from that, subsidy on solar panels should be given to encourage more people to explore renewable options.
4. Energy Simulation: Energy simulation software can be used by big corporates and corporations to redesign building unit and reduce running business energy cost. Engineers, architects and designers could use this design to come with most energy efficient building and reduce carbon footprint.
5. Perform Energy Audit: Energy audit is a process that helps you to identify the areas where your home or office is losing energy and what steps you can take to improve energy efficiency. Energy audit when done by a professional can help you to reduce your carbon footprint, save energy and money and avoid energy crisis.
6. Common Stand on Climate Change: Both developed and developing countries should adopt a common stand on climate change. They should focus on reducing greenhouse gas emissions through an effective cross border mechanism. With current population growth and over consumption of resources, the consequences of global warming and climate change cannot be ruled out. Both developed and developing countries must focus on emissions cuts to cut their emission levels to half from current levels by 2050.

Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services.
Based on REN21's 2017 report, renewables contributed 19.3% to humans' global energy consumption and 24.5% to their generation of electricity in 2015 and 2016, respectively. This energy consumption is divided as 8.9% coming from traditional biomass, 4.2% as heat energy (modern biomass, geothermal and solar heat), 3.9% from hydroelectricity and the remaining 2.2% is electricity from wind, solar, geothermal, and other forms of biomass[2]. Worldwide investments in renewable technologies amounted to more than US$286 billion in 2015. Globally, there are an estimated 7.7 million jobs associated with the renewable energy industries, with solar photovoltaics being the largest renewable employer. Renewable energy systems are rapidly becoming more efficient and cheaper and their share of total energy consumption is increasing. As of 2019 worldwide, more than two-thirds of all new electricity capacity installed was renewable. Growth in consumption of coal and oil could end by 2020 due to increased uptake of renewables and natural gas. [3], [4]
At the national level, at least 30 nations around the world already have renewable energy contributing more than 20 percent of energy supply. National renewable energy markets are projected to continue to grow strongly in the coming decade and beyond. [3]

Pneumatics has long since played an important role as a technology in the performance of mechanical work. It is also being used in the development of automation solutions. Pneumatic systems are similar to hydraulic systems but in these systems compressed air is used in place of hydraulic fluid.
A pneumatic system is a system that uses compressed air to transmit and control energy. Pneumatic systems are used extensively in various industries. Most pneumatic systems rely on a constant supply of compressed air to make them work. This is provided by an air compressor. The compressor sucks in air from the atmosphere and stores it in a high-pressure tank called a receiver. This compressed air is then supplied to the system through a series of pipes and valves.
The word 'Pneuma' means air. Pneumatics is all about using compressed air to do the work. Compressed air is the air from the atmosphere which is reduced in volume by compression thus increasing its pressure. It is used as a working medium normally at a pressure of 6 kg/sq mm to 8 kg/sq mm. For using pneumatic systems, maximum force up to 50 kN can be developed. Actuation of the controls can be manual, pneumatic or electrical actuation. Compressed air is mainly used to do work by acting on a piston or vane. This energy is used in many areas of the steel industry.

METHODOLOGY:
Solar energy is most promising energy to fulfil the energy needs of the society. The Indian government investing crores of rupees towards generation of power by using these renewable energies. Especially solar energy is most available renewable energy on the earth. The solar energy is converted in to electrical energy by the photovoltaic cells. This photovoltaic panel is placed in open ground or in roof tops. In open area wind velocity is more compared to closed area leads deposition of dust particles on surface of solar panel. Due to deposition of dust particles the conversion efficiency reduces.
The conversion efficiency depends on the factors like 1) detection of light waves 2)the transparency of surface of solar cell. In this proposed work we are suggesting novel method to increase the conversion efficiency by increasing the transparency of solar panel surface by removing dust particles deposited on the solar panel.
The proposed block diagram is as shown below.

We are using IR sensors to detect the dust particles deposited on the surface. IR transmitter and receiver are placed at two sides of solar panel within IR range. IR transmitter sends IR signals which is received at the IR receiver. If the surface is clean, then there is continuity in receiving signal. Dust particle on the surface acts as obstacles for the IR signal which makes the signal discontinue. Decision making devices like microcontroller or Arduino.The flow diagram of proposed work is as shown below.

Decision making device actuate motor. Motor will run for specified preset value. Discontinuity in receiving signal continues, which will turn on the pneumatic Machine along with motor. Pneumatic machine that uses compressed air to move cleaning arm connected to solar panel. Pneumatic machine will run for specified preset value.

CONCLUSION:

The renewable energy is the ultimate solution for the energy crisis. Renewable energy plays an important role in reducing greenhouse gas emissions. Using renewable energy can reduce the use of fossil fuels, which are major sources of carbon dioxide emissions.Solar energy is most available renewable energy on earth. We can effectively make use of this energy by using photovoltaic cells.The conversion efficiency depends on the factors like detection of light waves, the transparency of surface of solar cells. Maintaining the transparency of surface in wider area is challenging task. Manual cleaning takes lot of time and money. efficiency of cleaning manually is not good as automatic machine cleaning. Automatic machine cleaning saves a time and money.

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