Alterntive energy in buildings research paper examples

Technology

As the price of oil and its derivatives fluctuate and reserves of easily accessible sweet crude decline, the cost of energy consumption has increased. Conversely, world energy consumption increased over 49% between 1984 and 2004 [1]. Based on calculations of extraction costs and energy needs, it is clear that fossil fuels are an unsustainable source of energy and as a result, there has been increasing interest in finding alternative methods of energy generation and reducing current use. This interest has been exacerbated due to the negative environmental impact of burning fossil fuels. Buildings are an enormous part of overall energy consumption. During 2004, overall building energy consumption was 37% of total energy consumption in the region, far greater than industry (27%) or transport (32%). The high use of power predominantly comes from the heating and cooling energy inputs that are used to maintain ambient conditions. This high demand for power has led to focused efforts to find alternatives for this need. For individual residential and commercial buildings, geothermal drilling and solar panels offer onsite energy generation while thermoelectric and green technologies boost energy efficiency while reducing emissions. Self-sufficiency is also of interest as its builds power generation grid resilience. The main purpose of the paper is to explore and analyze the recent technological developments and improvements in exploiting modern buildings as avenues for alternate forms of energy. Novel methods of power generation can be applied to building heating and cooling within the buildings themselves. Geothermal technologies rely on heat stored within the ground to produce power. This heat is generated primarily through the decay of organic materials although a much smaller

percentage comes from the breakdown of radioactive materials. Pockets in the earth’s crust also have access to earth’s internal heat, which comes to the surface as hot springs and geysers. By drilling to access the heat, it is possible to power turbines that are then used in electricity generation . This technology is still improving but with improved means of access and lower cost, it is becoming more attractive as a power generation source for buildings. Through combining a heat pump with a ground heat exchanger, ground source heat pumps transfer heat into the ground during the summer and extracts heat during the winter employing the geothermal phenomenon. They are one of the fastest growing applications of any kind of renewable energy and it is expected that their use will only continue to grow . Technological advances are making it easier for large commercial buildings to drill geothermal wells themselves, leading to energy self-sufficiency. Solar power uses special photovoltaic cells to capture energy from the sun and convert it into electricity. Currently, efficiency is relatively low although it is expected to improve in the future. Solar panels can be placed on rooftops, on the sides of buildings and in places, wherever the solar load reaches acceptable levels. The technology can be used in combination with solar power concentrators that increase the efficiency and therefore the appeal of solar panels. In terms of cost, solar panels are still prohibitively expensive for mainstream residential use, with an entire system costing tens of thousands of dollars. However, the price per watt is rapidly falling and it is expected to fall below $2. 00 per watt in the near future [4]. Government programs and subsidies can make their use more appealing. The potential for solar power even at the residential level is enormous. As a point of use

system, residential buildings offer the ability to convert the sun’s energy into electrical power not only for heating, cooling and internal use, but also for future vehicles that can be charged using the homes electrical grid . In essence, buildings of the future may all become “ solar gas stations”.

Some technologies work by increasing the efficiencies of the systems that are already in place. Waste heat is generated during electricity production and it contains large amounts of energy. Research efforts have examined the potential to recycle or access the energy stored within it with the goal of increasing the efficiency of the electricity production process and avoiding emissions . Thermo electric technologies rely on the Peltier effect to generate electricity. Peltier effect relates to temperature difference created by voltage between two electrodes connected to a sample of semiconductor material and can be used to transfer heat from one medium to another. Their properties allow them to convert waste heat directly into electrical power, which can then be used for heating and cooling. This type of technology is particularly useful where heat is drawn out of the building such as for air-conditioning. Rather than treating the heat as waste, we can use it as a valuable source of energy that feeds the actual energy use of the air-conditioning process . These systems offer the opportunity to increase the intrinsic energy conversion efficiency of existing system architecture. To go even further, it is possible to treat building energy use as a system in which heating and cooling energies supplement each other.

These energy efficient systems can be boosted even further using natural techniques. Shade trees for example have been shown to have a tangible effect on the energy consumption of a building. The trees shade the building

in the summer and act as a barrier for heat loss in the winter, it is estimated that shade trees will provide a return of about $35 for every hundred square meters covered . In addition to the direct financial benefit of using this approach, trees also have a negative impact on the rate of emissions as they act as a carbon sinks for pollution. Green roofs operate in a similar way, the green roof blocks the sun from directly reaching the roof, which cools it and prevents the heat from transferring into the building. It also acts as a degree of insulation in the summer. The exact amount of energy savings will vary based on the structure of the building and the type of green roof that is installed. For example, Wong et al., (2003) found that a roof top garden on a five-story building would result in energy savings of between 0. 6 and 14. 5%

Power generation in buildings utilises many of the same technologies that are being developed for widespread commercial use. Solar power systems and geothermal drilling are attractive to energy distributors. The advantage of these technologies is that they can be developed and used on location, allowing the building to become self-sufficient in terms of power generation. To this end, it is likely that building designers will continue to look for ways to boost the overall energy efficiency of the buildings that they design. Thermoelectric technologies offer ways to utilize the waste heat that is developed as part of the electricity production, offering ways to boost energy efficiency and reduce emissions while natural mechanisms like shade trees and green roofs cut down on the energy needed for heating and cooling.

References