RENEWABLE ENERGY AND THE AVAILABILITY OF WATER IN A FUTURE SOUTH AFRICA

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Abstract

The world is increasingly being misused by its inhabitants by the wasteful manner that its resources are utilized and the amount of pollution that is generated in the environment. This practice is unsustainable and it is incumbent on the present generation of decision-makers to rectify this phenomenon if our descendants are to have an opportunity to live life in the same manner as we do.

Special emphasis should be placed on a reduction in the amount of air pollution that is created by electrical power generating plants, as well as the manner in which potable water is utilized and wasted.

In this article the local situation with respect to the generation and use of electrical energy and water is discussed. It is encouraging to see that the National Government is taking strong steps to address these problems. Yet, it might not have the required ability to finance these efforts fully.

Keywords: Renewable Energy, energy-economy, concentrating solar power plant, wind farms.

1. INTRODUCTION

South Africa is trailing most of the developed world in the utilization of renewable energy and other measures taken to ensure a sustainable environment and responsible economy – especially with regard to the use of water in our relatively arid country. This should not be a surprise to anybody who is relatively informed about the typical developmental trends of developing countries, as well as the extreme costs involved in the development and roll-out of renewable energy technologies and sustainable environmental practices.

2 ALTERNATIVE ENERGY

Power generation plants contribute approximately half of South Africa's current greenhouse gas emissions. (National Planning Commission, 2011), necessitating drastic measures to curb this phenomenon. An important, alternative indicator of the need for international use of alternative energy is the fact that freight transport is estimated to contribute 8% of energy-related carbon-dioxide emissions worldwide (CSIR, 2011). This contributes significantly to global warming which presents a much greater and more immediate threat than previously thought (CSIR, 2011).

However, there are significant promising indications that this is about to change in the near future in South Africa. Eskom is on record as supporting the local use of renewable energy, whilst technical support from overseas is also becoming the order of the day.

The South African cabinet approved a White Paper on Renewable Energy in 2003. In this White Paper Government's vision for an energy-economy with an increase in the use of renewable energy is detailed. An important consideration is how much renewable energy will be required to get the pollution dilemma sufficiently under control. Many believe it will be in the neighbourhood of 15-20% (Education, 2012). A concerted effort is about to be launched in line with the above mentioned White Paper, partially aimed at the increasing utilization of other than coal-powered power generating stations. Such efforts can only be supported.

A target of 20 000 MWh of renewable energy produced by South Africa by 2030 has been set – the largest envisaged in any African country to date (National Planning Commission, 2011). However, at the moment only about 1% of South Africa's electricity is generated from renewable sources. The planned spending of no less than R47bn on renewable energy generation in the foreseeable future (Derby, 2012) indicates the seriousness with which the South African National Government regards this programme - even though some commentators remarked that, due to a shortage in the local industrial base for renewable energy, countries such as China will be the main financial beneficiaries of the programme.

Eskom has already indicated that it is focusing on four specific types of renewable energy, viz. biomass, solar, wind and ocean power (utilizing waves and current) and it is investigating the possible integration of the outputs of such systems into the national power grid. Eskom-managed, off-grid, stand-alone units are not considered at present. The South Africa's Energy Minister, Ms Dipuo Peters, stated recently that the Department will contract private firms to produce 3,725MW of renewable energy by 2016 (Business Day, 2012). The implementation of such units will be executed by independent providers, but ESKOM will still solely be responsible for the creation and maintenance of the national grid for electrical energy (Business Day, 2012).

Internationally efforts are being made to tap into alternative energy sources to provide the required amount of electrical energy. The Solana Solar Power Plant, which is to be built in Arizona, USA with a capacity of 250 MW, is an example of efforts that are underway to utilize solar power for this purpose. It will produce sufficient energy to cover consumption needs of 70,000 houses while avoiding emission of 475 000 tons of carbon-dioxide per year compared with a natural gas plant.

It will be able to store 6 hours of thermal energy utilizing molten salts, enabling the generation of energy during cloudy periods and at night whilst creating between 1600 and 1700 jobs during construction, with 85% of these eventually converted into permanent jobs. (Ortiz, 2011).

Figure 1: Solana Solar Power Plant - an experimental concentrated solar power electricity generator in the USA

In South Africa, a 100MW concentrating solar power plant which is to be constructed in the Northern Cape, will hopefully be functional by 2013. Obviously the Northern Cape has a very high percentage of sunny days which is indicative of the suitability thereof for the generation of solar energy. The experimental solar-thermal power generating plant will have thermal storage capacity enabling 24 hour per day possible utilization. It will cost South African electricity users approximately R7 billion to develop and commission. However the need for renewable energy in South Africa has made this investigation an imperative, rather than an expensive technical game played by Eskom staff. The good news is that, even though the initial cost for this system might be high, it should have an operational lifespan of approximately 35 years at relatively low cost.

Figure 2: Eskom Heliostat experimental system for concentrated solar power generation

Aligned with these alternative energy sentiments of Eskom is the current development and assessment of wind farms – primarily in the Western and Eastern Cape regions. Unfortunately South Africa has relatively low annual wind speeds – less than one-third of that of Northern Europe where wind farms are already a very common sight – some of which are even installed in the ocean, such as the Gunfleet Sands Wind Park which is located off the South Eastern coast of England (Kleinschmidt, p. 17) - producing more than 40% of its renewable energy. Unfortunately this phenomenon limits the local potential use of wind energy.

Internationally ocean power is not yet utilized extensively and the expectation is that it will not soon be in common use in South Africa either.

Minister N Pandor, the South African minister of Science and Technology, recently said that a fledgling South African company, Clean Energy, had already sold 18 platinum-using fuel cells as back-up power systems to the South Africa's mobile phone supplier sector. Clean Energy is still in its market development stage (Martin Creamer, 2012).

It has been modeled that biomass is one of the most promising renewable energy sources in the world. Hence, the choice by Eskom of this potential solution to our energy problems can be understood and progress made with the implementation of experimental power generating sites of this nature should be followed closely. It is also an interesting fact that biomass is already one of the largest contributors to renewable energy in Germany.

It should be noted that, even though biomass is a primary source of renewable energy, it is not necessarily a primary source of electrical power – although recent technological developments enable it. Rather, in Europe energy produced in this manner is used primarily for heating purposes. In 2008 approximately 7,4% of the total heat consumed in Germany was derived from biomass. The dissimilarity between the South African and European weather may, however, limit the direct, local applicability of these technologies even though the cost of energy generation in this manner is relatively low.

As in the case with biomass as a source of renewable energy, technologies developed in Europe and elsewhere in the world, as well as accompanying employment trends, are often not directly transferable to the South African conditions. However, it might be interesting to compare the local efforts with international trends. For this purpose the German employment scenario is considered. During the recent past there has been a steady increase in the number of employment opportunities in the renewable energy sector. Hence, in 2008 approximately 278,000 people were employed in the German renewable energy sector alone. This should certainly be another contributor to an inevitable decision to an increased use of renewable energy in South Africa.

Even though the running and maintenance of renewable energy installations can be relatively inexpensive, the acquisition and installation of such are not cheap, but the question is whether South Africa has any choice in the future use of renewable energy. Obviously the construction of alternative energy sources, whether solar, wind, hydro-electric or biofuel will need to take into consideration the durability and longevity of the products used to construct them (Education, 2012) – especially since it is planned that such sources will have a typical lifespan of 25 to 35 years.

3. WATER

The estimated demand for water in South Africa will reach 17,7 billion cubic meters in 2030. In comparison, supply, if the current trend persists, will total only 15 billion cubic meters (Barradas and Zhuwakinyu, 2012).

A structured planning process has already identified the actions necessary to reconcile the water demands of urban and industrial centres with potential supplies up to 2030 (National Planning Commission, 2011, p. 156). Reducing per capita demand rather than just increasing supply, is important. Current planning assumes that it will be possible to achieve an average reduction in water demand of 15% below business-as-usual levels in urban areas over the period leading to 2030. This will also require active programmes to reduce water leakage in distribution networks, and to increase the efficiency of water use by domestic and commercial users.

The production and use of bottled water is increasing at a very high rate. Fortunately the preparation of bottled water is very efficient. The industry benchmark for the amount of water used to manufacture a product is 1.8:1 whilst there are South African plants that achieve ratios of as low as 1.3-1.4:1 by recycling their bottle-rinse water (Water 360, 2012).

4. SUMMARY

The cost of proactively building a just, low-carbon and resilient economy and society will likely be far lower than the costs of an unplanned response (National Planning Commission, 2011, p. 186). However, the planning and roll-out of such a situation will not be cheap, neither simple. Fortunately financial institutions have also begun to realize that there is money to be made by supporting energy entrepreneurs. For example ABSA is currently offering loan finance to a total value of 40 million euros to companies with commercially viable clean energy or energy-efficient products (ABSA). The complexity of the development, manufacture and installation of alternative energy installations was demonstrated by recent numerical simulations to model the optimal physical configuration of solar cells. These particular simulations required the utilization of the high-performance Lima Computer Cluster in Erlangen, Germany, using 1536 processors (Pflaum and Jandl, p.28).

However, there simply is no choice but to strive to the optimal utilization of alternative energy, as well as potable water, in South Africa.

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