

A solution for south african energy crisis environmental sciences essay

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This study investigates assorted sustainable energy beginnings in order to set up which beginning would be most dependable to run into the electricity demand of South Africa. Hydro-energy, air current energy, ocean current energy and solar energy were studied. Although a substructure already exist, for air current energy the study concludes that solar energy would be the most dependable renewable energy beginning.

Modern societies across the Earth are dependent on the handiness of dependable electricity supply for the care of human and economical activities. Worldwide people are hence progressively concerned about the handiness and the sustainability of energy beginnings for the coevals of electricity.

Presently in South Africa the topic "sustainable energy" is besides high on the docket. This study will look into the place of electricity supply in South Africa and the possible solution that sustainable energy beginnings might keep for South Africa.

This study will foremost give a historical overview of the origin and the development of the electricity supply industry in South Africa. Then it will look briefly at the complex inquiries that electricity providers have to face. Finally the assorted types of sustainable energy applicable to South Africa, viz. hydroenergy, air current energy, ocean current energy and solar energy will be discussed.

2 Historic overview

The history of the origin and development of the Southern African electricity supply industry is an absorbing topic. The proficient challenges, the <https://assignbuster.com/a-solution-for-south-african-energy-crisis-environmental-sciences-essay/>

interaction with Industry every bit good as political leaders is non new, but has been portion of electricity from the exchanging on of the first street visible radiations on the African continent in Kimberley on 1 September 1882, three yearss before the launching of the first commercial power station in New York.

The history of sustainable energy in South Africa is in fact longer than most people would conceive of. Already in 1895 there were attempts to tap the hydro-energy potency of the Victoria Waterfalls. In 1895, forty old ages after Livingstone had discovered the Victoria Falls, Professor George Forbes arrived in Southern Africa. He was the interior decorator of the Niagara Falls Hydroelectric Power Station, which was at that clip the largest power strategy in the universe. With the Victoria Falls, non merely every bit broad as Niagara, but with dual the tallness, he could non neglect to be impressed by its possible as a hydroelectric strategy to provide the Witwatersrand with an abundant and inexpensive supply of electricity.

Although the chief obstruction came in the signifier of the 1 000 kilometer distance over which the power had to be transmitted, a subordinate called the African Concession Syndicate was created in 1901. This mob was granted the exclusive right to tackle the Zambezi River for present and future hydroelectric power strategies. In malice of these readyings, the usage of H₂O in the coevals of electricity would merely come much later (Conradie & A ; Messerschmidt, 2000) .

3 The complexness of electricity systems

During the argument in the media around the current crisis a few affairs became clear. First, it is non widely understood that electricity can non be stored and in the instance of renewable energy beginnings, that becomes a major challenge.

The 2nd complexness that was (and still is) non widely understood, is the complex workings of the electricity supply. The coevals of electricity from power Stationss which are largely situated in the northern inside of the sub-continent and conveyed to the client by manner of 28 000 kilometer of high electromotive force and 250 000 kilometer of lower electromotive force lines, is besides hard to understand. The reconciliation of changing supply and demand requires the changeless attending of the National Control Centre and if the demand outstrips the supply, it is possible to see entire electromotive force prostration, similar to the state of affairs in the north eastern American continent on 14 August 2003 when the consecutive tripping of power lines by trees under power lines in three different countries lead to a electromotive force prostration of the transmittal system. This plunged big metropoliss like New York and Washington in partial darkness and metropoliss like Toronto in entire darkness. The full Restoration of the power system took about a hebdomad to finish. The term `` burden casting '' (besides non understood by most) is used to denote the sloughing of burden or electricity demand in order to forestall the 50 Hz frequency from dropping excessively low, ensuing in under-frequency tripping of power Stationss and entire electromotive force prostration.

4 Sustainable energy

For many old ages South Africa has been, and still is, bring forth some of the cheapest electricity in the universe. This was mostly due to the handiness of really inexpensive low class coal. With the lifting demand in the remainder of the universe for that coal, South Africans will decidedly experience the pinch. Because of this state of affairs the natural response is to look at pulling off the demand for electricity every bit good as investigate renewable energy beginnings.

As can be seen in Figure 1, a figure of sustainable energy beginnings have been identified in the universe. These beginnings can be classified harmonizing to the type of energy they produce. The challenge for South Africa is to use those beginnings most fitting for the fortunes here.

Figure 1: Sustainable energy beginnings identified worldwide

(Beginning: Renewable energy. The possible and the restrictions. 2008. [Online] . Available: [hypertext transfer protocol: //www. fraw. org. uk](http://www.fraw.org.uk). [2009, December 15] .)

Two chief issues need to be considered when looking at the viability of alternate energy beginnings. The first is of class the proficient feasibility of the undertaking. The 2nd is the cost at which electricity can be produced by the alternate beginning.

5 Hydroenergy

One of the most obvious renewable beginnings is hydroenergy. In many states, particularly in the Northern hemisphere, many electrical public-

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service corporations produce power in this manner. In the instance of South Africa, the state does not hold big rivers that can be used to bring forth electricity with.

6 Current usage of hydroenergy in South Africa

At this phase Eskom operates a figure of pump storage strategies that pump H₂O into keeping dikes during off-peak periods and usage that to bring forth power during extremum periods. As such this is not a renewable beginning as it uses electricity from fossil fuelled power Stations for pumping H₂O.

7 The Congo river as the energy provider for Southern Africa

One instead ambitious undertaking that Eskom is presently involved in is to use the hydroenergy from the Congo River. Harmonizing to its inaugural one-year study, the Western Power Corridor (PTY) Ltd (Westcor) (2008) proposes to tap the rich, big graduated table renewable hydroresources of the Western, Central and Eastern Corridor of Southern Africa finally. When to the full tapped, the magnitudes will transcend 100GW. This joint venture between the take parting national state-owned electricity companies of Angola, Botswana, Democratic Republic of Congo, Namibia and South Africa was signed on 7 September 2005 in Gaborone, Botswana.

Harmonizing to Mr E Nelumba, Chairman of the Shareholders Steering Committee, Westcor was formed to develop the Western Power Corridor which includes the development of the 3 500 MW tally of river hydroelectric power works at Inga 3 in the Democratic Republic of Congo (DRC). It will

besides build power transmittal systems to incorporate with the national grids of the participating every bit good as the remainder of southern Africa.

The concluding aspiration is to bring forth 10 000 MW at Inga 3. The Congo River has an estimated 100 000 MW capacity with 40 000 M³s per second and all possible sites are under examination to finally make the end of 50 000 MW of Grand Inga. This is larger than the sum installed capacity of the full Eskom system. Angola has besides indicated that their exploitable hydroelectric potency is about 18 000 MW of which merely 810 MW is presently used.

One of the great challenges of this undertaking remains the transmittal of the power to the chief clients in the South. In order to reassign the power faithfully and economically it would be necessary to run the 4 000 kilometer power lines at electromotive force between 600 kilovolts and 1000 kilovolt. The engineering to be able to make this is still in its babyhood and is the topic of current research. To add to the quandary the environment that the proposed lines will track includes countries with some of the highest happening of veld fires and these have the ability to do breaks to the flow of power.

8 Wind energy

The usage of air current as an energy beginning is likely one of the best known signifiers of renewable energy and successful commercial operations have been around for a long piece. Harmonizing to

the IngenierbAA? ro fAA? r neue Energien air current coevals in Germany sums to 39 500 GWh (Power in Europe, 2008) . This accounts for more than half of the renewable energy in that state. The universe 's entire installed capacity of air current generators was 94 GW at the terminal of 2007 (Smit et Al, 2008) .

9 Wind turbines in usage presently

Eskom commissioned three wind turbines between August 2002 and February 2003 at its Klipheuwel site North of Cape Town. Two Danish turbines and one French turbine, with a combined capacity of 3. 16 MW, were installed to enable Eskom to compare the different design and operational features. To day of the month the installation has generated more than 15 GWh, which was fed into the grid at the Klipheuwel 11 kV/66kV substation (Smit et Al, 2008) .

The single power, responsibilityrhythm and cost features of each of the turbines are being collected in a engineering matrix that will finally incorporate a suite of Renewable Energy engineering options, with air current being the first. The tower dynamic features and quiver status supervising baseline measurings every bit good as the interaction between the grid and the generators have already been done. The production analysis will be used in the future selling of green energy (Smit et Al, 2008) .

10 Variability in available energy

As with other signifiers of renewable energy, the variableness in the available energy is an issue that concerns the developers of these systems.

Wind is no exclusion and in this instance an accurate finding of air current

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climatologies is required, based on several old ages of air current informations. A well-known survey carried out by Geernaert et Al (1988) used information of a 109 old ages (between 1873 and 1982) and showed that fluctuations of up to 30 % from the average value can be expected from one decennary to the following. This information is important if it is considered that the installation may hold a lifetime of 20 old ages and longer. The available air current energy is of class besides influenced by topographical factors every bit good as variableness in air current speed due to height fluctuations. This makes the pick of the appropriate site a really of import issue.

11 The hereafter of air current energy

With the valuable research done at Klipheuvel the hereafter for air current coevals seems bright. Eskom announced the building of a 100 MW installation on the West Coast close to Koekenaap in 2007. The EIA and commercial activities are good underway and building is planned to get down tardily in 2008. The installation will dwell of approximately 50 units runing between 1. 5 to 2. 5 MW and will be integrated into the 132 kilovolt system at Eskom 's Juno or Koekenaap substations. Based on the variableness discussed above and an energy use factor of 26 % , the installation is expected to bring forth 2 28G Wh per annum (Smit et Al, 2008) . Based on old experience the building of the installation will take about one twelvemonth to finish.

12 Ocean current energy

The energy fluxes of the oceans have attracted the attention of applied scientists for a long time and include the assorted signifiers.

13 Continual moving ridge gesture

The continual moving ridge gesture that can power coastal devices. One illustration is the US \$ 29.5m experimental installation of Scots Power at the Orkney Islands (Power in Europe, 2008). The Pelamis system consists of four elephantine metal "sausages", each 450 m long, bobbing on the moving ridges and each bringing forth 750 KW by turning the gesture into electricity via the pumping of hydraulic fluid through the articulations. By some estimations Scotland should be able to bring forth every bit much as 1 300 MW by 2020.

14 Tidal energy

The gravitative forces of the Sun and Moon consequence in the surface of the sea changing by about 2 m. This consequence can be amplified by up to 11 m due to the effects of bays and channels. It is this energy that is used by systems such as the tidal energy works at La Range in France with a capacity of 240 MW.

15 Salinity differences

Although the salt differences between the ocean H₂O and fresh overflow represent differences in chemical potency which may be harnessed through a suited membrane, this has merely been demonstrated on a little graduated table.

16 Thermal differences

The thermic differences between surface and deep H₂O can be every bit much as 15 grades and a heat engine can be used to bring forth power. This construct, referred to as Ocean Thermal Energy Conversion (OTEC) has, nevertheless, a thermodynamic efficiency of merely 8 % and Eskom is presently measuring the usage of cold deep H₂O as a coolant for coastal power Stations, where its efficiency will be higher.

17 Fast fluxing ocean currents

The fast flowing western boundary ocean currents can hold speeds of up to 2.5 m/s which could supply a beginning of comparatively high power denseness for power coevals although there are no commercial undertakings presently under development. Eskom is actively involved in research on this topic.

18 Energy denseness of H₂O

Because the energy denseness of a medium is straight relative to its denseness and is a map of the speed cubed, the energy denseness for H₂O is far higher compared to weave at comparable speeds. The denseness of H₂O is about two orders of magnitude higher than that of air. This means that an ocean current is far more fecund as a resource compared to onshore air current. Due to the rough environment demands on an ocean current generator, it is assumed that for a commercially feasible undertaking, the energy denseness should be dual of that required of air current. This implies that currents with speeds of at least 1,5 m/s need to be found.

19 Solar energy

Southern Africa has over many old ages used the copiousness of sunlight to market the state as "Sunny South Africa". It is hence non surprising that this signifier of energy is regarded by some as the chief beginning that can significantly act upon Eskom 's supply side.

20 Solar panels

The work about solar panels both photovoltaic and solar H₂O warmers are good known and late Prof Vivian Alberts of the University of Johannesburg announced a discovery in the production of a new photovoltaic panel that will be up to 50 % cheaper than anything else on the market (Venter, 2007)

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21 Concentrated Solar Power (CSP)

Another exciting and advanced usage of solar power is presently being investigated by Eskom. The engineering referred to as concentrated Solar Power (CSP) uses sun energy to heat a mixture of 60 % Sodium Nitrate (NaNO₃) and 40 % Potassium Nitrate (KNO₃) to a temperature of 565A°C. CSP is besides regarded as the lone large-scale renewable engineering with proved energy storage. The heat energy can be stored for up to 14 hours and is used to bring forth steam for the 100 MW reheat steam turbine at a unrecorded steam force per unit area of 125 saloon. This means that the works will be able to bring forth power for a full 24 hours during the summer solstice. An mean expected burden factor of 70 % is expected.

22 Decision

As the demand for electricity rises, a more sustainable energy beginning to replace the dodo fuel energy beginning was investigated. In South Africa research has been done in both the engineering and tackling electricity from renewable energy beginnings.

The study showed that hydro energy, weave energy, ocean current energy and solar energy were investigated. Due to the changeless sunlight in South Africa, it appeared like solar energy would be the most dependable energy beginning.