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ENERGY TRANSITION IN THE UNIVERSITIES

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Abstract: The aim of this study is to achieve greater output by examining the existing way of coordinating the determined attempts of energy transition in the Universities in South Africa to successfully reach the environmental sustainability by using energy source which is environmentally friendly. Furthermore, into the study we look at obstacles that prevent and those that leads to maximum utilization of energy transition measures and highlights the effects of implementing renewable energy source in the Universities in South Africa. The investigation and analysis have shown that energy transition is not well received in the Universities in South Africa and that the use of renewable energy source is minimized and not fully utilized due to budget constraints and lack of knowledge. Another detection was that lack of government structured and strategic measures of implementing and motivating the use of renewable energy source effectively. The effective and rational use of renewable energy in the Universities in South Africa is a key player in developing the environmental sustainability. The use of renewable energy source has contributed an increase in economic and improve environmentally friendly in South Africa. The slow pace adoption of energy transition is negatively impacting on the benefits of cheap available energy source in South Africa. In conclusion the study finds that the economy can be boosted by implementing renewable energy sources and improve environmental sustainability in the Universities in South Africa. Faced with the challenges of climate change, limits on fossil fuel resources and the prospects of development, it is reasonable to conclude that some other sort of energy transition must occur. These will also stabilize the negative impact of energy raising prices.
Keywords: Energy Transition; Energy Efficiency; Climate Change

INTRODUCTION

Energy is inseparable from matter. All material phenomena are associated with energy. Energy is therefore essential to life and the quality of energy consumed per capita can be used as one indicator of a country's development level. No thought was given to this in the past but today it is being included in energy efficiency management activities. Energy supply and demand must be treated with both a macro-economic and a micro-economic approach. There are different aspects in planning energy demand, whether for country, a factory or a household, but each must still be investigated individually given the characteristics involved [1]. Energy transition is changes in the patterns of energy use take many forms. Energy resources include fossil fuels such as coal, oil, and natural gas, and renewable energy flows such as wind and solar energy. These are turned into energy carriers, such as electricity or gasoline. The carriers are then supplied to energy converters, such as a compact fluorescent lightbulb or an automobile, and ultimately used to provide energy services such as lighting or transportation. An energy transition—a particularly significant set of changes to the patterns of energy use in a society—can affect any step in this chain and will often affect multiple steps [2].

BACKGROUND

The backbone of the country's economy is the extraction and processing of minerals. To date an estimation of 93% of South Africa's power is generated from coal – fired power stations, while 5% is nuclear and hydro - electric, whereas 2% is for pumped storage and gas turbines [2]. Current statistics indicate that South Africa is lagging behind in the implementation of renewable energy source.

2.1 Energy use and Market in the Universities in South Africa

Depending on the size and variables of the University; the energy cost and utilities consumes between 3% and 8% of a University's general budget. As it can be seen in figure 1, that Steam Industries consumes much of thermal electric energy. Thermal energy is used to heat water in geyser and heat pumps. The process of water-heating system is typically the largest consumer of electric energy, but the HVAC, Lighting and electric stoves can account for substantial electricity demand [3].

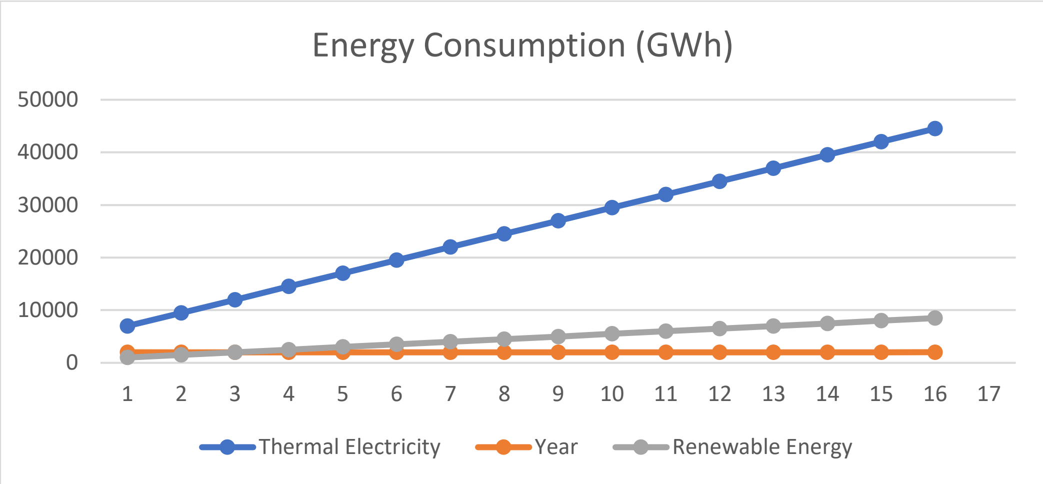

Figure 1. Trends of Energy Consumption by the Universities

2.2 Challenges facing the Universities in South Africa

Issues of energy security constantly threaten the universities; these issues stem from challenges facing the Energy Generation Sector in South Africa. With rising energy costs and prices around the world, the Universities continue to seek innovative solutions to these problems. The demand for energy in the Universities continues to rise faster, and that will require energy producers to be more efficient [4].

3. Energy Transition

3.1. Effective features of energy transition measures

Energy transition measures made based on Plan-Do-Check Act model, which serve as an organizational culture of stable advancement in energy transition. The culture of stable advancement assures that the set of objectives are obtained in a progressive manner. It also assures that those set of objectives are practical, obtainable and accommodates the available resources of the institution.

3.1.1. Plan Phase

Planning has been defined as (1) outlining a course of action to achieve an objective, (2) devising a method to attain a defined goal, and (3) developing a specific way to obtain a desired result. Each definition contains two elements: Knowing what is wanted to be a accomplished and deciding how to accomplish it. The energy planning process consists of three steps:

1. deciding what is wanted to be accomplished, or setting objectives;
2. deciding how to accomplish the objectives, or outlining procedures;
3. deciding how to apply the skills needed to meet objectives or assigning responsibilities. This step is necessary because the manager does not carry out plan singlehandedly. It is the manager's job to get other people to do this.

3.1.2 Do Phase

To gain the maximal conceivable savings capability, the investigated action plan should be prioritized and restated into a work plan. And involve the accountabilities and timeframe for different processes, the work plan must very time contain the essential resources. Highlight the energy aims and short-comings, but it will only be successful if there is enough funds and availability of resources. In addition, Energy Manager must note the achieved targets and analysis the benefits in terms of cost saving. The achieved cost saving and reduction in environment pollution should be demonstrating to motivate the employees.

3.1.3 Check Phase

Check phase aims to supervise the performance (by handling energy audits) in the expressions of energy saving and analyze the set targets. Whenever encounter any loss, it is then important that the root causes are investigated and determined to form correction to recognize set objectives. Hence, it is necessary that set objectives are significant to promote the appraisal development.

3.1.4 Act Phase

This phase mostly involves management analysis of audit, internal and external reports referring to the achievement of the energy transition program. This information plays a huge part for the organization to spot any loss and act up on it to provide continuous progress.

4. Environmental, Economic and Social Benefits of Energy

4.1 Environmental

Environmental benefits as "performance advantages," or factors in consumer decisions that are not explicitly given an economic value, have factored into energy transitions within certain applications. The volatile compound emissions associated with bituminous coal were a reason for delay in that fuel's acceptance and led to renewable energy source being the preferred for household heating. However, one simple technology allows an energy user to externalize environmental drawbacks, shifting the bulk of the burden from the user to the heat-pump for showering [5]. As a result, selection of one system over another on environmental grounds is often accomplished through policy.

4.2 Economic

The principal aim of any energy transition project is to save money using limited energy or using energy more efficiently. The economic assessment of energy projects can often be complicated since it involves the engineering techniques needed to classify the magnitude of energy savings, together with the economic principles associated in checking in case that capital investment in the project is supported [5]. The utilization of the renewable energy plant is important because if it is pushed beyond the rated flow-sheet capacity, the variable costs may rise rapidly, because of inadequate time for preventive maintenance, resulting in excessive wear or breakdowns and high labour costs for weekend and holiday maintenance work. These are called super-production costs.

5. Energy Transition Gap

One of the major problems that Universities face in relation to energy transition is an inability to balance energy demand with energy supply. The nation will not get very far with its efforts to achieve energy transition and improve energy efficiency if demand for energy continues to increase and even surpass energy supply [6]. The real problem with energy thus reaches beyond oil reserves, gasoline prices, fuel efficiency, and similar issues, it is a problem based in a way of life, one in which convenience, speed, and technologies have driven Universities attitude about energy and lifestyle.

6. Economic Barriers of Energy Transition

6.1 Hidden costs

Hidden costs are the most essential and dominant statement for the 'Energy Transition'. The engineering economic studies fail to stand for their reduction in utility connected with energy transition technologies or the additional costs connected with their use [7].

6.2 University Barriers

University barriers in this concept refers to those University factors that can withhold a range of possible energy transition investments. These factors include power, culture and awareness of the University. These factors are related to the structure, size and available infrastructure of the University.

6.3 Culture and Awareness

The standard of energy transition awareness among employees was found to be very poor. All grounds had used different awareness campaigns – like posters and information stands – but all reported that these were inefficient. Awareness rising could potentially be helping through responsibility for energy costs, using the environment impact of energy use to motivate staff, and moves towards 'team – working' and higher accountability for energy costs centre performance [8]. But all grounds lacked a high standard champion for energy transition and all reported that awareness of energy transition was low within the 'University Culture'.

6.4 Credibility and Trust

The credibility of expertise and trustworthiness are the core significant aspect of information that interfere with the energy transition improvement. Hence the successful circulation and absorption of information rely on the trustworthiness as a source. Whenever the credibility of the information source is doubtful, Universities may hesitate to invest in energy transition based on that information.

6.5 Values

In additional to the financial incentive for improving energy transition, individuals and Universities may be motivated by a desire to improve the University's environmental performance. In some case, this may have (or be expected to have) an influence on the energy consumption value.

Universities must have a robustly driven culture to environmental values, either on the part of respondents or of senior management. Senior Management must implement significant energy transition measures that exhibited a higher level of environmental concern and emphasized the importance of management commitment. The Vice-Chancellor or Deputy Vice-Chancellor must raise the profile of energy in the University, through emphatically for cost-savings reasons, and the new emphasis on the environmental agenda. However, 'energy is not seen to be as significant as the environment', apparently, so that intention turns to be directed more towards broad-based environmental improvements rather than energy transition.

6.6 Advantages of an Energy Transition

An explanation to energy transition needs systematization on energy saving methodologies. In the long run, this consequences in certain size of energy savings and cost – related improvements, as well as efficiency in process

[7-8]. At the lower standard, it widely procurer and the supplier, an energy transition. The main reasons are discussed below:

6.6.1 Cost reduction

Energy Transition's introduction can save up to 10% of energy costs in the first years of implementation by systematically identifying the weak points of your energy usage and addressing them with basic measures. Investments in lighting, refrigeration, ventilation systems, heating systems, cooling systems or technology will see a 5 – 50% reduction in power usage, and payback time of less than two years.

6.6.2 Environmental protection

Climate change is one other major catastrophe and not overlooking its effect of on the environment. The result of increasing temperature gives rise to flooding of Coastal regions and low-lying Island nations; increasing desert areas and melting glaciers. While climate change is a universal challenge stern measures must be taken to reduce the green- house effect. An efficient energy transition is therefore an important element as it can contribute considerably to reducing greenhouse gas emissions [8].

6.6.3 Improvement of public image

An ISO certification, grants your University credibility to public and that you are operating in respect to energy efficiency and hence, taking good care of the environment. Environmental requirements are progressively a significant aspect in public proportions in South Africa, inclusive of atmospheric-friendly purchasing. Both from the perspective of the procurer and the supplier, an energy transition that support the measurement of CO_2-emissions.

6.6.4 Use of financial incentives

Lack of energy saving seems to be problematic impending the development and success of Universities in South Africa. Consequently, the Power Generation Sector (Eskom) deficient the capacity to enough invest to meet the increasing demand of energy in the country; this challenge is caused by the energy pricing, since the sector is not cost effective. Again, South African Universities have a very poor financial scheme when it comes to the energy transition [8].

7. Drivers of Energy Transitions

Demand for energy services is an essential precondition for an energy transition. The existence of an energy resource, or invention of an energy converter, only alters the pattern of energy use to the extent that it can meet a demand for energy services. Changes in energy services demanded might or might not change the energy converters and resources used [9]. Changes in energy converters offer performance advantages that changes in energy resources cannot match. As a result, most of the transitions in energy services involve changes in converters. The resources used do not necessarily change.

7.1 Why an Energy Option Succeeds

Suppose that we have the conditions for an energy transition. Consumer demand for an energy service is growing, and competing resources and technologies aim to fulfill this demand. Why will certain combinations of resources and converters emerge victorious? Competition between energy options—whether between different resources to power a converter, or different converters to provide a service—can be resolved by the following factors:

- **Supply constraints** occur when a resource cannot be expanded to keep up with demand. In some cases, a finite level can be sustained at low cost, but expansion is cost prohibitive, and a relative decline in share is seen. In others, maintaining a fixed level leads to rising prices, as when a resource is being depleted, and an absolute decline is seen. Supply constraints are often exposed in a period of demand growth.
- **Cost advantages** include not only the actual cost of the fuel, but the associated labour costs, energy converter costs, and other economic impacts. An energy source may be out-competed by alternatives, even if it is not facing supply constraints. Cost advantages can occur even in a slowly growing market as an emerging alternative commercializes and gains market share.
- **Policy decisions** are important in energy consumption. Actions taken by governments affecting energy supply include tariffs, subsidies, codes, regulations, infrastructure development, and other measures. Cultural preferences often influence policy decisions [8-9].

7.2 Electrification in the Universities

Most South African Universities have established programs to expand access to electricity. Electricity improves the quality of life by providing services that no other energy option can fulfill or providing a higher-quality service than other energy options can.

For focused light, a white light-emitting diode (LED) with a solar-battery system provides the most illumination per unit cost and has the lowest greenhouse gas emissions. A compact fluorescent light (CFL) connected to the grid provides the lowest cost of area lighting. The cost of lighting from a battery powered flashlight is orders of magnitude higher than even the simplest kerosene lamps.

Experience with Universities which installed photovoltaic (PV) systems in South Africa demonstrates that demand for information and entertainment is particularly high. The Universities with installed PV systems are typically expected to be grid-connected soon. The Universities were more likely to use the PV system for lighting than for anything else. Some 90–95 percent of student residences with PV systems use the power for televisions, compared to 84 percent for water heating and 75 percent for radios. Advertisements for solar power systems emphasized the ability of the systems to power televisions.

University of Johannesburg (UJ), like some other universities in South Africa, has developed a way to meet minor demands for electricity even without a comprehensive electricity grid. "Lecture Halls" supplied either by a diesel generator or a grid connection charge battery for students, who in turn use these batteries to power appliances such as television-projectors, lights, and cell phones.

7.3 Failed Transitions, Delayed Transitions, and Revivals

Unsuccessful transitions are just as illustrative as the successful ones. History provides several examples of new energy resources being introduced and failing to claim the market share that their supporters had expected. History also provides examples of energy resources seeming to be in decline only to experience a revival later [10].

RESULTS

In general, energy transition had a very low status compared to research and teaching. However, the study results suggested a correlation between the statuses granted for implementation of energy transition and its activities. According to this ranking, University of Johannesburg (UJ) was the only university on energy transition status rated relatively high. At this university, more weight was attached to energy transition when it came to prioritizing investment decisions within the given budgets. A general lack of awareness of energy performance and energy costs was prevalent in all Universities and awareness raising activities were limited and uncoordinated. Where energy savings programmes did exist, energy efficiency management staff tended to abstain because they had 'better things to do'. Motivating staff was also difficult because they were only temporary part of the system and had little incentive to get involved.

DISCUSSION OF FINDINGS

Currently there are policy instruments opposing the implementation of energy transition in the universities in South Africa. South Africa's energy market is characterized as a regulated market; hence, government is trying to ease the heavy load on energy prices (certainly with electricity and petroleum products) by subsidizing energy. Such subsidies misrepresent the actually cost of energy supplied to the universities and inefficient send the energy prices signals to the universities.

The ignorance of policy and regulatory plays an important role in poor improvement of energy transition measures in the universities in South Africa. In a number of the universities, predominantly in South Africa, there is directly none policy or, if there is, it can be unconcerned about the energy transition.

Lack of financial injection for investment was a significant barrier to speed-up energy transition at the universities. Access to capital proved to be a problem at the university level as well as within individual universities.

CONCLUSION

The conclusions of this research cover a generic analysis of the implementation of energy transition in the universities in South Africa. South Africa 's energy system can be defined as consolidated system with universities as the dominant consumers. The review has acknowledged that, the universities over the years have made powerful efforts to speed-up energy transition; by developing policy instruments and commencing in energy transition and curriculums. Nonetheless, an extensive energy transition gap still stands in the universities and the logic behind is that, government 's efforts to implement energy transition has been aimed towards residential and commercial sectors of the economy.

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