

## Challenges of Accessing Electricity for Ict Use In Kenyan Secondary Schools: A Case Of Nandi County

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**Abstract:** - The use of ICT in the teaching and learning in local secondary schools in Nandi County has not been realized because of challenges arising from accessing electricity. This study focused on the electric power accessibility challenges facing the use of ICT equipment in secondary schools in Nandi County. The specific objectives of the study included; the determination of the use of alternative sources of energy in schools, the investigation of factors affecting the use of the alternative sources of energy in the powering of ICT equipment in schools, and the assessment of the schools principals' attitudes towards the use of alternative sources of energy in local secondary schools. The study was conducted through a survey research design. Purposive sampling techniques were used to select the sample for the study. The data was analyzed by the use of the Statistical Package for Social Sciences (SPSS) computer program. The findings of the study revealed that there was lack of electricity supply to many secondary schools; there were frequent power outages in the schools supplied with electricity; the cost of electric power use was high; the use of generators to generate electricity was expensive, and renewable sources of energy were not used to power ICT equipment in many secondary schools. The conclusions arrived at were that it was difficult to use ICT equipment in secondary schools in Nandi County because many secondary schools lacked access to electricity; there were frequent power outages in the schools supplied with electricity; cost of electricity was high; the cost of running generators were also high and there was lack of use of cost-effective alternative sources of energy. This study recommends that the government should supply electricity to all secondary schools, initiate renewable sources of energy projects to cater for the electricity deficit and the power distribution companies to use modern distribution methods to help reduce the power outages.

**Keywords:** - ICT, Alternative Sources of Energy, Insolation, Outages, Renewable energy

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### I. INTRODUCTION

The use of ICT in the teaching and learning in local secondary schools in Nandi County has not been realized because of challenges arising from accessing electricity. This study focused on the electric power accessibility challenges facing the use of ICT equipment in secondary schools in Nandi County. The specific objectives of the study included; the determination of the use of alternative sources of energy in schools, the investigation of factors affecting the use of the alternative sources of energy in the powering of ICT equipment in schools, and the assessment of the schools principals' attitudes towards the use of alternative sources of energy in local secondary schools. The study was conducted through a survey research design. Purposive sampling techniques were used to select the sample for the study. The data was analyzed by the use of the Statistical Package for Social Sciences (SPSS) computer program. The findings of the study revealed that there was lack of electricity supply to many secondary schools; there were frequent power outages in the schools supplied with electricity; the cost of electric power use was high; the use of generators to generate electricity was expensive, and renewable sources of energy were not used to power ICT equipment in many secondary schools. The conclusions arrived at were that it was difficult to use ICT equipment in secondary schools in Nandi County because many secondary schools lacked access to electricity; there were frequent power outages in the schools supplied with electricity; cost of electricity was high; the cost of running generators were also high and there was lack of use of cost-effective alternative sources of energy. This study recommends that the government should supply electricity to all secondary schools, initiate renewable sources of energy projects to cater for the electricity deficit and the power distribution companies to use modern distribution methods to help reduce the power outages.

## II. MATERIALS AND METHODS

This study adopted a survey research design. According to Onen and Oso (2005), survey research studies are those that are concerned with providing qualitative and numeric descriptions of some part of the population. This study was concerned with determining challenges of accessing electricity for ICT use in Kenyan secondary schools. It was specifically intended to investigate the availability and barriers of using the Kenya Power Company electricity, standby generators, solar power and wind power to power ICT equipment in Nandi County secondary schools. The survey research design enabled the researcher to consider issues such as economy of the design, rapid data collection and ability to understand populations from a part of it (Igo, 2007). It helped the researcher to carry out an extensive research. Survey research eased the researcher's accessible information and provides unbiased representation of population under the study (Owens, 2002). Both quantitative and qualitative research methods were used in the study. Since the objectives of the study were varied, it was appropriate to use both methods for complementarities in the case of Nandi County. A questionnaire, an interview schedule and observation method were used to collect data for the study. The study employed purposive sampling technique. The instruments used in the study were first examined and validated. A pilot study was conducted in ten schools in Uasin Gishu County giving a minimum Cronbach Alpha Coefficient of 0.95 and that was considered appropriate. The Statistical Package for Social Sciences (SPSS) computer software was used to analyze the data collected.

## III. RESULTS AND DISCUSSIONS

**Table 1** The Availability of the Alternative Source of Energy in the Schools:

| Item   | Response | Frequency | Percentage |
|--|----------|-----------|------------|
| Our school has installed solar power generated electricity         | No       | 110       | 100        |
| Our school has installed wind power generators                     | No       | 110       | 100        |
| Our school has a standalone generator power to power ICT equipment | No       | 110       | 100        |

The problem of using ICT equipment in Nandi County is mainly as a result of inadequate supply of electricity by Kenya Power from the national grid and lack of the use of alternative sources of energy. In this study, it comes out clearly that most of the schools were not supplied with electricity from the national grid. Table 1 shows that majority of the schools, i.e. 74 schools out of 110 representing 67%, were not supplied with electricity from the Kenya Power Company. This was due to the shortage of electricity in the county. This is underscored by Chapari (2009) who laments that there is a serious shortage of electricity in Kenya. This problem is compounded because most of these schools are located in remote areas where grid extension is expensive. In most of the remote areas, there is no access to the grid because the grid extension is unaffordable (Winrock International, 2004). Kenya has inadequate electricity generation capacity because it relies on hydro generated power which is hampered by lack of many big rivers. This is in line with ICS (2011) assertion that most of African countries have inadequate electricity generation capacity. The schools in Nandi country lacked electricity because there was a general scarcity of electricity and the little electricity available could not reach remote areas due to high cost in electric power grid extension.

It is also revealed by this study that the schools did not use solar power generated electricity. Table 1 also indicates that all 110 sampled secondary schools (representing 100%) did not use solar power. All the sampled secondary schools were not using solar power to power ICT infrastructure because of lack of awareness. Chandak (2011) attributes lack of the use of solar power to higher level of ignorance and awareness of the benefits accrued from the use of solar energy. Also the solar power fittings were perceived by many schools administrators as being expensive. In his study of the factors affecting the use of solar power to generate electricity, Madson (2011) reported that to produce sufficient amounts of electricity, a large number of panels may be needed resulting to a significant financial investment. Modi (2010) supports Madson by indicating that the PV technology and some associated fitting costs have a high initial cost. Lack of government initiative and encouragement to use solar power has made people to lose confidence on the use of solar power. Chandak (2011), in his study of the use of solar power to power ICT equipment in India reported that people's loss of confidence in the use of solar power is the reasons for failure of solar energy to power ICT equipment in the schools. The schools in Nandi County did not use solar power electricity because they lacked awareness of its benefits, there were no government incentives and the administration felt that the cost of solar power fittings was expensive.

The study also shows that there was no use of wind generated power in Nandi County schools. Table 1 reveals that all respondents in 110 schools (100%) indicated that all the sampled secondary schools had no installed wind power generator. This was because many people in the county were ignorant of the use of wind

power generated electricity. Poor level of awareness is a factor that has led to many local secondary schools lack of utilization wind power generated electricity (Chandak, 2011). Another reason that leads to lack of the wind power generated electricity is that small scale wind turbines sometimes generate intermittent electricity which is not quality for the use of ICT equipment. This is underscored by Pyakuryal (2002) who says that among the decentralized electricity systems, small-scale wind system is intermittent and weather dependent. Big wind power generator requires a substantial investment making many school administrations blush aside its installation. High capital cost and lack of sufficient wind regime data are some of the barriers affecting the exploitation of wind energy resource (SREP, 2011). This indicates that the local secondary schools had no wind power generated electricity installed in the institution because of poor levels of awareness, high initial capital cost and lack of sufficient wind regime.

The sampled secondary schools did not also use standalone generators to power ICT equipment. Table 1 also shows that all 110 (100%) sampled secondary schools did not have standalone generators to generate power. This is because of high prices of generator fuel. High prices for gasoline prevent many local schools from making use of standby generators (Zweibei, 2008). The use of a standalone generator can be faced with difficulties of investment, financing and operating-cost (Modi, 2010). All sampled secondary schools had no standalone generator generated power to be used to power ICT infrastructures because the cost of running a standalone generator was considered high.

**Table 2**Challenges Facing the Use of Alternative Sources of Energy to Power ICT Equipment in Local Secondary Schools:

| Item   | Response          | Frequency | Percentage |
|--|-------------------|-----------|------------|
| There is a scarcity of electricity in our school         | Strongly disagree | 19        | 17         |
|  | Agree             | 74        | 67         |
|  | Strongly agree    | 19        | 17         |
| Kenya Power electricity is expensive                     | Strongly disagree | 19        | 17         |
|  | Agree             | 74        | 67         |
|  | Strongly agree    | 19        | 17         |
| The school experiences electric power outages            | Strongly disagree | 19        | 17         |
|  | Agree             | 55        | 50         |
|  | Strongly agree    | 36        | 33         |
| There is lack of standalone generators in the our school | Strongly disagree | 19        | 17         |
|  | Agree             | 55        | 50         |
|  | Strongly agree    | 36        | 33         |
| Solar power panels are expensive                         | Strongly disagree | 19        | 17         |
|  | Disagree          | 19        | 17         |
|  | Agree             | 55        | 50         |
| There are no solar power fitting technicians             | Strongly agree    | 19        | 17         |
|  | Strongly disagree | 19        | 17         |
|  | Agree             | 74        | 67         |
| There are no standby generator mechanics                 | Strongly agree    | 19        | 17         |
|  | Strongly disagree | 19        | 17         |
|  | Agree             | 74        | 67         |
|  | Strongly agree    | 19        | 17         |

The secondary schools in Nandi County faced a number of challenges in the use of alternative sources of energy. This study revealed that all sampled secondary schools lacked solar power generated electricity. Table 2 shows that half of the respondents representing 55 schools out of 110 or 50% agreed and 33% of the respondents representing 36 schools out of 110 strongly agreed that schools lacked solar power to power ICT equipment. This is because lack of awareness of the merits of using solar power and administrators perceptions that, solar power system fittings are expensive. Low awareness of the potential opportunities and economic benefits offered by solar technologies are some of the barriers affecting the exploitation of solar energy resource (SREP, 2011). The variation of weather conditions is a challenge to the use of solar power. The off-site opportunities for solar power energy are limited in most areas and cannot be significantly developed (Nicholson, 2010). According to Njeri (2011), the weather has been quite unpredictable in some regions in Kenya making it difficult to utilize solar power. The local schools lacked solar power to power ICT equipment because of high initial capital costs and low awareness of the potential opportunities and economic benefits offered by solar technologies. For the case of Nandi County, weather conditions are not a drawback as such since the area enjoys a substantial amount of sunshine.

The lack of the use of standalone generators was another drawback to the use of ICT in the secondary schools. Table 2 again indicates that half of the respondents representing 55 schools out of 110 or 50 % of the respondents agreed and 33% of the respondents representing 36 schools out of 110 strongly agreed that the schools lacked the use of standalone generators to power ICT equipment. This is because the imported fuel that is used to run the generators is expensive. Standalone generators rely on expensive oil to generate electricity making the average cost of power production extremely high (ICS, 2011). Menjo and Boit (2005) agree with ICS by stating that the use of standalone generators is challenging because diesel is expensive. The high price of fuels is a drawback to the use of standby generators to power ICT equipment in the Nandi County secondary schools.

There was no solar power systems installed in the schools because the administrators felt that solar power system fittings were expensive. Table 2 shows that half of the respondents representing 55 schools out of 110 or 50% agreed while 17% of the respondents representing 19 schools out of 110 strongly agreed that solar power system were expensive to install. This shows that installing solar power systems in schools is expensive. Nicholson (2010) reports that solar power system fittings are expensive making the installation of solar power systems a big challenge. The initial cost of solar power is high but its use has long term benefits that outweigh the incurred initial costs. While often more expensive than other renewable technologies, the modularity of PV systems and the broad availability of the solar resource, sunlight, often make PV the most technically and economically feasible power generation option for small installations in remote areas(USAID, 2004). The installation of solar power systems in schools is expensive because photovoltaic are high in cost and are highly taxed once imported.

The installation of solar power systems require qualified technicians who are not available in Nandi County. Table 2 indicates that majority of the respondents representing 74 schools out of 110 or 67% agreed while 17% of the respondents representing 19 schools out of 110 strongly agreed that getting a qualified solar power electrician to install and service a solar power system was a problem. This indicates that there was a problem to find a qualified solar power electrician to install and repair schools solar power systems. Where electrical energy sources are present, there often is insufficient operations, maintenance and repair capability on the part of the local people (Vaccaro, et al, 2010). The schools may be willing to install solar power systems but they need qualified technicians to service them when they fail. PV systems are more likely to fail in areas that lack the commercial and technical equipment needed to ensure long-term sustainability (Winrock International, 2004). In a study conducted by Venezky (2001), most schools technical difficulties were reported as a major barrier to usage and a source of frustration for students and teachers. There is a problem to find a qualified solar power electrician to install and repair the local schools solar power systems. This has led to solar power systems insufficient operations, maintenance and repair capability on the part of the local people.

The running of a standby generator involves rotation of parts that wear out due to friction and therefore require a qualified mechanic to occasionally service them. In Nandi county schools, there were no qualified mechanics to service standby generators. Table 2 reveals that majority of the respondents representing 74 schools out of 110 or 67% agreed that getting a qualified mechanic to service a standby generator is a problem. This indicates that is was a problem to find a qualified mechanic to repair a standby generator in most schools. The use of standby generators is faced with technical problems such as lack of qualified technicians in case it breaks down (Modi, 2010). Ragaller and Dandliker (2010) lament that, attracting young students into careers as engineers, technologists or technicians is difficult in most countries (Ragaller and Dandliker, 2010). Lack of local knowledge, including illiteracy in some cases, contribute to once-functioning systems languishing in a state of disrepair (Vaccaro, et al, 2010). There was a problem to find a qualified mechanic to repair the standby generators in most local schools in Nandi County. This could be because of lack of many young people interested in engineering, technologist or technician carriers.

**Table 3**The Use of Solar Power to Power ICT Equipment in Nandi County:

| <b>Item</b>  | <b>Response</b> | <b>Frequency</b> | <b>Percentage</b> |
|--|-----------------|------------------|-------------------|
| Our school use of solar power to power overhead projectors used teaching and learning. | No              | 110              | 100               |
| Our school use of solar power to power computers used in teaching and learning.        | No              | 110              | 100               |

There was no use of solar power to power ICT equipment in Nandi County secondary schools. In this study, it comes out clearly that all the schools did not use solar energy to power ICT equipment. Table 3 shows that all the respondents 110 (or 100%) indicated that all the schools did not use solar power to power overhead projector in teaching and learning. All the respondents 110 (or 100%) indicated that all the schools did not use solar power to power computers for teaching and learning. In general, this indicates that the secondary schools did not use solar power to power ICT equipment. This is in harmony with Muwanga (2007), who revealed that

many local schools did not use solar power generated electricity to power ICT equipment because of lack of awareness of the solar power potential. Low awareness of the potential benefits offered by solar power is one of the barriers affecting the use of solar energy resource (SREP, 2011). Another possible reason that affects the use of solar power to power ICT equipment in Nandi County secondary schools is the high prices of solar power fittings. This is in line with Modi (2011) who reported that people are afraid of using solar power because the PVs and associated fittings have high initial costs.

#### **IV. CONCLUSION AND RECOMMENDATIONS**

**Conclusion:** The purpose of this study was to assess the challenges of accessing electricity for ICT use in Kenyan secondary schools. It was clear that majority of the local secondary schools were not supplied with electricity by the utility company and the few schools that were supplied with electricity experienced power outages and thus solar power and wind power generated electricity can assist to power ICT equipment in Nandi County secondary schools. In general, ICT integration in teaching and learning is important and must be embraced by all schools; this majorly relies on the availability of electricity and therefore it is imperative to use alternative sources of energy to power ICT equipment besides the mains supply to ensure reliability.

**Recommendation:** The Kenyan government should initiate renewable sources of energy projects to cater for the electricity deficit. This will reduce the cost of electricity because generating electricity from renewable sources of energy is cheaper than electricity generated by diesel generators which relied on imported and expensive fuel. Again, the power distribution companies should use modern power distribution strategies and technologies that are less prone to breakages due to the natural phenomena. This will reduce to power outages and greatly protect the ICT equipment from power surges and destruction.

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