

The lighting efficiency
methods
environmental
sciences essay



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Energy_efficiency : Energy saving compact fluorescent light bulb glowing on green background

BACKGROUND

In the call of the Carbon Trust Applied Research and Incubator schemes for proposals on Low Carbon Technologies, APASI Energy Company LTD is pleased to submit a project proposal for your funding consideration. The Carbon Trust Applied Research and Incubator schemes has over the years through their Low Carbon Technology Assessment (LCTA) given a clear indication of their technology priorities and this have been determined on the basis of the carbon saving potential of each technology and the extent to which the Carbon Trust support is likely to have a significant impact on progress towards its commercial deployment. This they do considering the increasing amount of carbon pollution in the environment which has led to a pile up of Greenhouse Gas (GHG) and has made climate change a great concern for the entire world. According to the Pew Centre (2011) over 80% of the greenhouse gas (GHG) emissions are generated either from residential and commercial sectors which are usually associated with energy efficiency and usage from lighting and other domestic consumption like cooking, laundry e. t. c while the commercial industriesAccounts for the second major energy usage for transportation, manufacturing, packaging processes. Enhancing suitable energy and lighting methods will help to reduce the financial implications in the long run. This can be achieved according to the Pew Centre (2011) in two ways: Conservation; through minimizing the amount of time lights are in use. Lighting is a large and rapidly growing source of energy demand and greenhouse gas emissions. In 2005 grid-based

electricity consumption for lighting was 2650 TWh worldwide, which was about 19% of the total global electricity consumption. Furthermore, each year 55 billion litres of gasoline and diesel are used to operate vehicle lights. More than one-quarter of the population of the world uses liquid fuel (kerosene oil) to provide lighting (IEA 2006). Global electricity consumption for lighting is distributed approximately 28% to the residential sector, 48% to the service sector, 16% to the industrial sector, and 8% to street and other lighting. In the industrialized countries, national electricity consumption for lighting ranges from 5% to 15%, on the other hand, in developing countries the value can be as high as 86% of the total electricity use (Mills 2002). More efficient use of the energy used for lighting would limit the rate of increase of electric power consumption, reduce the economic and social costs resulting from the construction of new generating capacity, and reduce the emissions of greenhouse gases and other pollutants into the environment. At the moment fluorescent lamps dominate in office lighting. In domestic lighting the dominant light source is still the inefficient incandescent lamp, which is more than a century old. At the moment, important factors concerning lighting are energy efficiency, daylight use, individual control of light, quality of light, emissions during the life-cycle, and total costs. Efficient lighting has been found in several studies to be a cost effective way to reduce CO₂ emissions. The Intergovernmental Panel on Climate Change for non-residential buildings concluded that energy efficient lighting is one of the measures covering the largest potential and also providing the cheapest mitigation options. Among the measures that have potential for CO₂ reduction in buildings, energy efficient lighting comes first largest in developing countries, second largest in countries with their economies in

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transition, and third largest in the industrialized countries (Ürge-Vorsatz, Novikova & Levine 2008). The report by McKinsey (McKinsey 2008) shows the cost-effectiveness of lighting systems in reducing CO₂ emissions; see Figure 1. 1. The global " carbon abatement cost curve" provides a map of the world's abatement opportunities ranked from the least-cost to the highest-cost options. This cost curve shows the steps that can be taken with technologies that either are available today or look very likely to become available in the near future. The width of the bars indicates the amount of CO₂ emissions that we could abate while the height shows the cost per ton abated. The lowest-cost opportunities appear on the left of the graph.

Capture1. PNGFigure1. 1- Costs of different CO₂ abatement opportunities. (McKinsey 2008)The background above shows clearly that it is not possible to make a decision in one question without considering the others. A holistic view takes into account all energy flows in the building over time in order to reach a sustainable approach (Diemer, 2008). In order to build high performance buildings (WBDG, 2008) we have to consider all the different design processes and aspects of buildings (see figure 1. 2) and how buildings are used by owners and users. Capture3. PNGFigure 1. 2- Global objectives for High Performance Buildings. (WBDG, 2008)

INTRODUCTION

According to Pew Centre (2011) lighting accounts for about 11% of energy use in residential buildings and 18% in commercial buildings, thus the need to conserve light use and adopt more efficient technologies can yield substantial savings. In addition to that it can also reduce greenhouse gas emissions and give benefits like better reading and working conditions as

well as reduced light pollution. Carbon emission through the greenhouse gas effect remains the singular problem the whole world is facing due to the increased use of fossil fuels and use of traditional technologies in lightings at homes or in commercial buildings, as well as many buildings still remaining brown instead of going green. In order to achieve the reduction of carbon in the earth's atmosphere as well as other greenhouse gases a lot of industries have sprung up in the clean or renewable energy sector. One of those elements of the industry according to the US Department for Energy (2012) is the energy efficiency sector, which may not seem flashy or significant at first glance but is quietly spurring innovation while cutting costs and saving jobs across the country as more industry leaders are turning to innovative energy efficiency techniques to reduce energy bills and produce affordable products. Latest emerging technologies for research tends to be more reliable and efficient than the old-fashioned technologies, the former will lead to substantial gross reduction in energy usage and also reduce the emissions encountered from greenhouse gases. This project would give a description on researches on different lighting efficiency methods which can be used in Carbon emission reduction and energy conservation, as well as also help commercial firms cut costs so that they are able to produce affordable products and also help save more jobs in the present economic recession still biting most firms in top industrialised countries of the world.

COMPANY PROFILE

ABOUT US

APASI ENERGY COMPANY LIMITED is a global leader in renewable energy solution, the company was established in 1993 with its specialization in

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Lighting Efficiency Solutions and Technology. Having been in operation in Edinburgh(UK) and most countries in Europe for the past 20years, and conducts researches that span over green technologies like power engineering, lighting technology, environment pollution and management, and more recently carbon technology. The company offers the most suitable environmental strategy to meet specific environmental, comfort, energy and cost criteria. Using computational methods backed by our practical, performance-based approach we can assess various options of environmental strategies giving greater flexibility to architectural design. Areas of expertise include: Environmental façade design and optimisation - analyse performance of façade options including heat transfer, solar gains, day-lighting, and ventilation. Low energy building design - assess different designs including advice on building form and natural ventilation strategies to aid the passive low energy design. Renewable and low carbon technologies - investigate alternative technologies that best suit the project needs, including façade integrated low carbon solutions. Since the commencement of business, our shareholders have undertaken a substantial programme of investment in order to enable the company to meet the rapidly developing needs for energy utilization through lighting technology, with all emphasis in technological innovation and total efficiency, we have maximised the environmental and economic performance of our resources, which has made us excel in the energy market and meet our customers' needs.

TECHNOLOGY OVERVIEW

Lighting according represents at times up to 25% of home electrical use and it can affect the way one feels, work and interact with others. It helps accomplish everyday tasks and it is also a significant part of one's monthly utility bill. Efficient lighting would thus come in useful since it is a form of science as well as an art, despite the fact that most people still use the incandescent bulb, a technology invented some 100 years ago by Thomas Edison. Since lighting thus plays an important part in home electrical use and carbon emission from residential and commercial buildings, increasing one's lighting efficiency is thus one of the easiest and fastest ways to lower energy bills (<http://www.energy.ca.gov/efficiency/lighting/>). Lighting or Energy efficiency can thus be defined as the optimisation of energy consumption, with no sacrifice in lighting quality. It is a combination of thoughtful design and selection of appropriate lamp, luminaire and control system selection made in conjunction with informed choices of the illumination level required, integration and awareness of the environment or space which is being lit (<http://www.energyrating.gov.au/wp-content/uploads/2011/02/2009-ref-manual-lighting.pdf>).

LIGHTING EFFICIENCY METHODS

This part of the proposal would mention the popular methods to decrease the overall consumed quantity of energy through domestic and industrial systems and the following discussed options give a range of conservation options which can be implemented via the application of man-made lighting methods (source: Pew Centre, 2011):

Behavioural Change

This would mean a change in attitude of energy users whether in residential and commercial buildings. A lot of energy can be saved by simply switching lighting systems and domestic appliances which will in turn reduce the cost of electricity bills and gaseous emissions. This includes switching off lights in vacant accommodations or anywhere sufficient normal lighting can be found, also regulating man-made light production will help to enhance the energy utilization.

BEST AVAILABLE TECHNOLOGIES (BAT)

Lighting remote timer cards and sensory systems can be used to decrease amount of energy usage to the necessary level; this practice utilises techniques to simulate the behavioural change described above. Sensors are used to serve different purposes in this model of light energy efficiency and they are of different kinds: Occupancy sensors: This advantage safeguard that lights are individually on if they are constantly utilised. The Infrared boosted sensors will identify high temperature and signal, while the ultrasonic sensors will identify the effect of sound. By adequately installing to make sure that they are highly sensitive to man's activities than other interference from the surroundings. Most research proves that reliable occupancy sensors will decrease energy usage by 45%, while other estimates are as high as 90%. Photo sensors: This utilises the ambient light in regulating the output light level. For instance, photo-sensors might be utilised to switch off outdoor lights during the daylight hours (time).

OPTIMUM CULTIVATING BUILDING DESIGN

By improving the substantial amount of natural light that comes into a building, the need for artificial lighting is reduced and it may only become a supplement for use at night or when otherwise needed. Also in decreasing GHG emissions via housing designs, it is very significant to take rapid and bold steps that will consider the effects of building and shelter design on natural light. In consideration for man-made lighting, choice of energy efficient technologies will rapidly decrease energy usage and other associated GHG emissions. This choice depends on the best available technologies, it is significant to consider various methods and factors, like the quality of lighting required, the rate of usage, and the interaction with the environment both indoor or outdoor activities. These are the various types of lighting and fixtures that are commonly used in residential buildings:

INCANDESCENT BULBS

These type of bulbs radiates light whenever an electrical current that passes through tungsten filament which will cause it to glow, 90% of the energy utilized for this bulb emissions will generate more heat than light, which makes these bulbs not efficient for residential purposes upon evaluation of the lumen (quantity emitted light) output to input from the energy. Other types of incandescent bulbs are the Halogen types which are more reliable and efficient than the normal incandescent bulbs which are less efficient than the alternative options.

FLUORESCENT TUBES and COMPACT FLUORESCENT LAMPS (CFLs)

These types of lighting bulbs emits electric currents which can cause the internal gas-filled chamber to be filled with ultraviolet (UV) light source, that can be emitted as visible light via a distinct type of tubing coating. Most fluorescent bulbs needs ballast, this is a component that adjusts the level of current that goes into the lamp. This ballasts can be incorporated into the bulb, as noticed in most CFLs (enhancing them to be utilised interchangeably with all incandescent bulbs) or non-integrated, which need the ballast to be incorporated in the fixture, as it is been done in most fluorescent tubes used in academic and offices buildings. Ballasts usually has two varieties which is either magnetic (old-fashioned and less efficient) or electronic (latest and more efficient). The Fluorescent tubes and CFLs both come in different configurations, efficiencies, components and shapes (Figure 1 for a diagram of a typical CFL bulb). They usually utilize 75% energy less than the incandescent light bulbs. The CFLs will produce between ranges of 50-70 lumens per watt as compared to the 10-19 lumens per watt for incandescent bulb. These are more long-lasting and suitable products, with a lifespan of 10, 000 hours for CFLs and a lifespan of 7, 000-24, 000 hours for tubes.

http://www.energystar.gov/ia/products/lighting/cfls/images/Parts_of_CFL_large.jpg

Figure 1: Diagram of CFL Bulb (Source: U. S. EPA/ DOE Energy Star Program. " Learn about Compact Fluorescent Light Bulbs" http://www.energystar.gov/index.cfm?c=cfls.pr_cfls_about).

HIGH-INTENSITY DISCHARGE (HID) LAMPS

The HID Lamps which comes in different configurations and varieties has wide range of applications. They radiate light energy when a current passes through the ballast which is then passed in between two electrodes at the end of a gas-filled tube. Elements like mercury, sodium, or metal halide gas has various uses as each has different colours, outputs, lifespans and configurations. The High-intensity discharge lamps are not suitable for use in all places as they take longer time to come on upon switched on which make them suitable for use in areas where lighting will be maintained for long duration of hours (Used in stadiums and community street lighting).

Generally, they are over 75-90% better and efficient than incandescent bulbs due to their long lifespan.

LOW-PRESSURE SODIUM

These types of lamps are the most suitable and efficient bulbs that can be used for outdoor activities, although they have some numbers of disadvantages as they have long time start-up, and poor colour selection.

The Low-pressure sodium lamps are best used for lighting on highways, bridges and street, parking lots due to their application in niche services which makes them not a better substitute for alternative bulbs that have less efficient benefits.

LIGHT EMITTING DIODE (LED)

The light-emitting diodes which consist of electrons and electron holes (atoms that lack an electron) releases light energy. This robust technology of over 20years has many significant applications of LEDs, suitable for lighting

that have lately develop commercially since it well improved colour renditions have been advanced and has costs reduction benefits. This special LED fixtures is over 75-80% less efficient than the incandescent bulbs with lifetimes that is 25 times much longer than incandescent light bulbs.

HYBRID SOLAR LIGHTING

One of the latest and emerging technologies that are roof-mounted solar collector which radiate the visible portion of solar energy and transform it into light-conducting optical cables, which are then passed through to interior buildings. Imbedded with controllers that monitor the accessibility of solar light and replaces it with fluorescent lights that provide the best illumination intensities at every location. Recently, researches proofs that most hybrid lighting is feasible choice for lighting on the roof-top of some commercially owned buildings. This technology has tremendous advantages as the solar collector on the roof-top can be dismantled separately to expose the visible light from infrared radiation; this visible light can then be utilized for lighting while the infrared radiation is very useful for other alternative purposes like electricity production, house heating and carrying out other domestic purposes. Due to the energy split techniques, much heat is conserved which is then utilized for lighting, rather than using it alternatively in energy-consuming facilities.

SOLID-STATE LIGHTING (SSL)

This are the next generation of light energy efficiency technologies which make use of light-emitting diodes (LEDs), organic light-emitting diodes (OLEDs), or light-emitting polymers are commonly referred to as solid-state lighting (SSL). Unlike incandescent or fluorescent lamps, which create light
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with filaments and gases encased in a glass bulb, solid-state lighting consists of semi-conductors that convert electricity into light (<http://www.Irc.rpi.edu/programs/solidstate/SSLWhat.asp>). According to the United State Department of Energy (DOE) which has valuable data of other lighting technology which proffers the same level of possible to decrease energy usage in the future like the SSL. The research organization also provided an estimated data of the energy that will be save by 2030 from SSL which could likely get to 190 TWh, the yearly electrical output of about 24 massive power plants (1, 000MW) which it estimated to be 31. 4 million metric ton of CO₂ reduction and will benefits it energy saving of over \$15 billion by 2030.

RESEARCH METHODOLOGY

The purpose of this research is to know the best possible lighting technology that would guarantee energy efficiency and help reduce carbon emission from residential and commercial buildings. Investigation of the best lighting efficiency technology would be the significant part of the research and the results from it would help form the basis for the next generation of energy efficient technologies that would be used in homes, offices and industries to help save costs, keep jobs and reduce global carbon emission. The research would thus embark on finding out the most cost effective and energy efficient technology that can be used in buildings and how CO₂ and light pollution can be reduced especially using next generation technologies like the LEDs and Solid-State Lighting (SSLs).

PRODUCT INNOVATION AND APPLICATIONS

In terms of product innovation and its application, the Light emitting diodes (LED) and particularly the Solid-State Lighting (SSL) would be the innovative <https://assignbuster.com/the-lighting-efficiency-methods-environmental-sciences-essay/>

products to be developed to maintain energy efficiency and reduce carbon emissions as they are set to make valued contributions over the next 30 years. It is estimated that energy savings over the next three decades from SSL could reach 190TWh which is the estimated yearly electrical output from about 24 massive power plants which would in turn reduce 31.4 million metric ton of carbon released in the earth's atmosphere. LED lighting systems have proved useful in indicator applications such as exit signs and traffic signals due to their brightness, visibility and long-life, while new uses include small-area lighting, pathway and step marking and are set to be the lightings for entire walls and ceilings in future. The Solid-state lighting (SSL) on its part is increasingly used in a variety of lighting applications because it offers the following benefits: Long Life - LEDs can provide 50,000 hours or more of life, which can reduce maintenance costs. In comparison, an incandescent light bulb lasts approximately 1,000 hours. Energy Savings - The best commercial white LED lighting systems provide three times the luminous efficacy (lumens per watt) of incandescent lighting. Colour LEDs are especially advantageous for coloured lighting applications because filters are not needed. Better Quality Light Output - LEDs have minimum ultraviolet and infrared radiation. Intrinsically Safe - LED systems are low voltage and generally cool to the touch. Smaller, flexible light fixtures - The small size of LEDs makes them useful for lighting tight spaces and for creating unique applications. Durable - LEDs have no filament to break and can withstand vibrations.

MARKET USER GROUPS AND PROJECTIONS

There is a varying market base for products developed using the ethos of lighting energy efficiency particularly the LEDs and SSLs which are the next generation of lighting efficiency products to hit the market and are expected to great help reduce carbon emissions by reducing the amount of electrical power generated for homes and businesses. The following groups of market users are identified: Home users: Products from lighting energy efficiency can be used by home owners and individuals to reduce the amount of electrical power they consume at home through lighting. This they already do through the use of sensors in their lighting systems that detect human voice, noise or activity before turning on the lighting in places within the home. More products like the LEDs can further be developed to be used in most lighting at home to further reduce energy consumptions in residential buildings. Business leaders: There is the chance for business leaders in different industries to reduce the amount of energy they consume in their offices or industrial places. Lighting energy efficiency can help cut by as much as 30% in some cases of the energy an industrial plant consumes hence saving the company costs and also helping to keep jobs. Investor: This group of stakeholders would like to know the level of profit available in this kind of project and would be interested when they find the huge potential inherent in lighting efficiency technology and would be excited by the next generation of technology in the field such as the LEDs and SSLs.

Regulator/Government: Government of most industrialized nations like the United States are committed to making consumers and businesses go green and save money and costs by reducing the energy they consume. They

sponsor researches into the development of new LED lighting technologies
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that would help reduce power generation from government and power producers. Thus this research been done and products developed from it would help government in sensitizing people on new information or products to help them go green and be efficient in their energy consumption thereby reducing carbon emission and act as a regulatory tool for sustainable development.

PRODUCT DEVELOPMENT AND MARKETING

The research project when completed would see APASI ENERGY COMPANY LIMITED make use of its outcome to develop products in collaboration with other researchers, manufacturers, utility companies that are interested and government to devise schemes were the products would be tested to rate their efficiency and thus facilitate a broad adoption of LED technology across Scotland and indeed the UK. Also professionals in business and marketing would be brought on at a later date to help fashion out marketing strategies to help permeate home and business consumers of electrical power to take on the new products so as to reduce their energy consumptions and save them costs.

ENERGY AND CARBON SAVING PREDICTIONS

In terms of energy and carbon savings, the efficient use of lighting in residential and commercial buildings would go a long way in ensuring that happens. Energy conservation and efficient use of lightings would greatly reduce carbon emissions associated with lighting. Considering the rate at which individuals, businesses, management and efficiency measures can reduce the electricity bills, and broader use of lighting efficiency technology across the society can result in Greenhouse gas (GHG) emission reductions <https://assignbuster.com/the-lighting-efficiency-methods-environmental-sciences-essay/>

and environmental benefits derived from reduced demand for electricity. For instance, compact fluorescent (CFLs) use 75% less energy and LEDs use 75 to 80% less than the incandescent light bulbs; thereby substituting them with products for old-fashioned lighting technologies. The continued widespread use of efficient lighting technologies like the Solid-state lighting technology would be essential for GHG emission reductions with a 2008 study by the US Department of Energy revealing that replacing LEDs from their current niche uses will bring about financial profits which is equal to the output of above 27 massive coal power plants and reduce 31.4 million metric ton of carbon by 2030. Estimates by global market research company McKinsey & Co. also note that LED technology increase such as switching from incandescent and CFL bulbs to LEDs by 2030 would provide GHG emission reductions from lower energy consumptions and also cost-effective over the life-time of the bulbs. Besides from the benefits of lighting efficiency to global climate, its other benefits include lower utility bills to consumers, reduced light pollution and better reading and working conditions.

SWOT ANALYSIS

Strengths

Reduced Energy Bills: The use of timers and sensors in lightings of buildings can go a long way in reducing electricity consumption from its use and this can result in net savings for homes and businesses through lower utility bills.

Longer Life: LEDs provide a longer lasting life when used compared to incandescent bulbs. The LEDs can last for up to 50,000 hours compared to the incandescent ones that last for 1,000 hours hence there is a reduction in maintenance costs for businesses and home users. GHG Emission

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Reductions: Using efficient lighting technologies and energy conservation can result in the reduction of carbon emitted by residential and commercial buildings. The particular adoption of SSLs is estimated in the next 30 years to be a major technology in reducing the amount of electrical power generated from both non-renewable and renewable energy sources thus reducing the emission of carbon into the atmosphere. Carbon Trading: When successful developed and deployed across the UK, efficient lighting technology can help the Scotland and the whole UK save a lot of carbon which could have been emitted into the atmosphere. With new global plans to establish a global carbon market, that would give the UK lots of carbon to be traded in the carbon market.

Weaknesses

Sensors/Remote Control Lighting: These sensors are not reliable as they have the inability to detect and meet up with the occupants need since they not located close or accessible to the occupant. Upfront Costs: This pose a particularly notable barrier, though lighting technologies and practices pay for themselves over time due to their long lasting life-time - some of them particularly new edge technologies have huge up-front costs that consumers, businesses and local councils may be unwilling to pay. Also, products like the Hybrid solar lighting (HSL) has been in existence for over 20years and it is much cost beneficial and thus have made widespread acceptance not feasible. Mercury Use: Scepticism is on the increase about the authenticity of CFL bulbs which has discouraged a lot of customers though manufacturers have been able to address such concerns like its poor reflectors and noisy nature, but concerns are still high amongst consumers about the use of

mercury in it. The CFLs contains minute amount of mercury in every bulb which is less than 1/100 of the quantity found in a thermometer. Carbon Reduction: The project looks at how carbon emission can be reduced through lighting efficiency and due to the fact that carbon emission amounts to about 11% from homes and about 18% from commercial buildings totalling 29% between the two, efficient lighting technologies as presently used cannot reduce the entire global GHG emissions.

Opportunities

SSLs: The Solid-State Lighting products when fully researched and deployed have the potential to solve lots of the problems associated with light pollution and carbon emissions from residential and commercial buildings as well as saving costs. It also would greatly reduce carbon emission into the atmosphere by reducing the amount of electrical power consumed hence in turn reducing the amount of electrical power needed to be produced.

Regulatory Tool: This research project would help regulatory bodies better provide policies and regulations that would drive businesses and homes to become greener and save energy. It would also ensure that industries emit less carbon and thus reduce the amount of pollution going into the atmosphere.

Threats

Competition: There is the possible threat of competition from rival firms once this research project is made public, as they may want to produce such products. Also there is possible competition from other countries in the world who may want first mover advantage in producing technologies like the SSL

which is the future of the lighting efficiency technology industry. Utility
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Companies: Companies which sell utilities like electricity may see the development of the SSL lighting technology as a threat as it is estimated to reduce electrical energy consumption in homes and businesses amounting to up to the equivalent of 27 power plants in the next 30 years, hence they may not be cooperative in collaborating to testing the development of the new products in pilot schemes amongst their consumers to be able to generate data on the amount of electrical usage the use of SSL technology actually reduces so as to also know how much carbon emission that reduces from the power plants. Payback Periods: The estimate payback period for the usage of lighting technology may vary in different buildings, as most occupants may be indisposed to install efficient lighting technologies if they will be evacuating the buildings before they can achieve their return on investment for these technologies. Market Entry Barrier: There is a huge market barrier to new entrants in the lighting efficiency technology market hence the need for funding. To research and also make many of the new technologies in the lighting industry requires costs hence new entrants find it difficult to break into the market or even have enough funds to carry out research on next generation of technologies.

THE RESEARCH PROJECT TEAM

The research project team is a multidisciplinary one which has experts on low energy consumption technology, engineering, environment science and management, business management and administrators drawn from both Nigeria and the UK. APASI ENERGY COMPANY LIMITED would be involved in every stage of the research project from its start through its administration and coordination until its submission of full research outcomes and report to

the sponsors (Carbon Trust). The team would be led by a Head of Research and Development Prof. Ryan Harts and other members from the company and other educational bodies who would provide some level of technical support. Team Leader: Prof. Ryan Harts: Is the Head of Research and Development with APASI Energy Company Limited and a visiting Professor with Heriot-Watt University, Edinburgh and Imperial College, London in Energy respectively. He brings more than 30years experience in industrial turbo-machinery, nuclear energy systems which he expand his views and curious knowledge in development of battery-operated and remote operated vehicles in fully operation by considering its less impact in the global environment by meeting up with the CO2 emissions level in UK. With his great passion for research and development in lighting technology and energy use, developing research strengths in lighting efficiency, usage and carbon technologies. Team Members: Prof. Morrison Fischer: A graduate of Bachelor of Science in Materials Science from University of Wisconsin-Madison, Energy Engineering from University of Edinburgh, and PhD from Massachusetts Institute of Technology in Process Integration and Intensification. He joined the company in 1998 as an expert in Sustainability process and Process Intensification which has assisted APASI Energy Company Limited in achieving its corporate goals by providing best practise in sustainability development, global climate change crisis management and carbon footprint technologies. Dr. Franklin Oliver: Is the Chief Scientific Officer of APASI Energy Company Limited, He is a pioneer engineer in the development of electric propulsion systems since the 1980's with Tetra Energy Inc., Oliver brings 28years of extensive research and product development background, as well as his experience as founder and CEO of <https://assignbuster.com/the-lighting-efficiency-methods-environmental-sciences-essay/>

iCAP technologies, to APASI Energy Company Limited. Dr. Andrew Wilshire: Holds a PhD degree in Physics/ Electrical Engineering from the Robert Gordon University, Aberdeen in 1980. He is a profound academician and researcher who have published many articles on Waste Water Management, Climate Change and Environmental Pollution, and Power Engineering Improvements with his major strength in electrical power industry. Having spent over 35years in the Industrial sector he decided to bring his vast knowledge and attention into research in carbon reduction technologies and lighting efficiency use after attending a fellowship course at the Heriot-Watt University. Dr. Edward English: He is a senior lecturer of Renewable Energy Engineering (Heriot-Watt University, Edinburgh). He has brought an immeasurable wealth of experience of 20years in top managerial positions both in the manufacturing and Industrial sectors. Prior to Heriot-Watt University, he has involved in providing strategic consulting services to manufacturing, distributions, commercial and individual companies in achieving their technology and market needs. Project Administrator: Engr. Ismaila Lawal: Engr. Ismaila Lawal is responsible for strategy and coordinating project day-day activities. He has learnt and acquired uncountable experience in planning, coordinating and provide solutions to emerging companies reliable and efficient services.

WORK PLAN

PROJECT COST

This Research project will be conducted on a projectized organizational formation which will span over 12 calendar months with cost and resources allocation as follows:

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RESEARCH TEAM (AECL)**COST PER MONTH (£)****ANNUAL COST (£)**

Prof. Ryan Harts1, 50018, 000Prof. Morrison Fischer1, 00012, 000Dr. Franklin Oliver1, 00012, 000Engr. Ismaila Lawal7509, 000SUB-TOTAL

51, 000

RESEARCH TEAM (HW)**COST PER MONTH (£)****ANNUAL COST (£)**

Dr. Andrew Wilshire1, 00012, 000Dr. Edward English1, 00012, 000SUB-TOTAL

24, 000

Miscellaneous

APASI ENERGY COMPANY LIMITED Overhead Cost: Office Support, etc. £8, 000 Consumables:£4, 000Heriot-Watt University Overhead Cost: Overhead for office support £7, 000Capital Equipment: computers, etc. £15, 000Travel and subsistence costs: Meetings, etc. £14, 000Other costs: Contingency cost, etc. £5, 000

Fund Request (Total) £128, 000

SECTION B**Delphi Study**

An administrator would be selected for this part of the study which is to prepare a Delphi forecasting study for the research project in the first part of <https://assignbuster.com/the-lighting-efficiency-methods-environmental-sciences-essay/>

this work. The administrator would be me and a questionnaire would be prepared and sent out to a group of experts who would then answer them. Delphi forecasting according to Singh and Kasavana (2005) is a business research technique used to determine the likely occurrence of future events. It elicits opinions from small select group of experts and then tries to build a consensus on the topic/s handed out to the experts.

Questionnaire Design

For this study the questionnaire was designed from the background of information on lighting efficiency used in the research project and seven event statements were used in the questionnaire. This was to help determine the outcome of future technologies in the lighting efficiency industry. The questionnaire was developed along the predictive horizons of 2030 (long term) and had a five-point likelihood of occurrence with 1 indicating 'very likely to occur' and 5 indicating 'not likely to occur'. Space was also provided at the end of the questionnaire to allow respondents to submit open-ended predictions about important future events that were not identified.

Delphi Questionnaire

Q1: All lighting bulbs around the world would have been switched from incandescent ones to more efficient types? Very likelyLikelyNot sureNot likelyStrongly unlikelyQ2: Hybrid solar lighting (HSL) would have become feasible to use in many places? 1. Very likely2. Likely3. Not sure4. Not likely5. Strongly unlikelyQ3: Would the up-front cost of owning an efficient type of lighting e. g. the CFLs have become cheaper for home and commercial users? 1. Very likely2. Likely3. Not sure4. Not likely5. Strongly likely

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unlikelyQ4: LEDs lighting technology would move from being used in small areas, signs and appliances into being used as lightings in homes? 1. Very likely2. Likely3. Not sure4. Not likely5. Strongly unlikelyQ5: Can cheaper versions of Solid-State Lightings (SSLs) be produced and adopted for general use for home and commercial users? 1. Very likely2. Likely3. Not sure4. Not likely5. Strongly unlikelyQ6: What is the likelihood of use of SSL technologies in homes and offices reducing carbon emission by up to 31 million metric tons through reduced electrical generation by 2030? 1. Very likely2. Likely3. Not sure4. Not likely5. Strongly unlikelyQ7: Is there a likelihood of any other technology coming out before 2030 that would make the SSL technology obsolete, which at present is the future of lighting technology? 1. Very likely2. Likely3. Not sure4. Not likely5. Strongly unlikelyAny other comments:

Sample Size/Responses

For this Delphi study the sample size to be used to discuss the above questionnaire would be a group of experts totalling 25 drawn from the energy industry particularly those with expert knowledge on lighting energy efficiency, other would be from engineering, environmental studies and building technology industry. The panel of experts to be used in this study would comprise of 10 experts from the energy industry with many of them having vast knowledge in lighting energy efficiency technology, 7 engineering experts, four environmental studies specialists and four building technology experts especially those with previous knowledge in building green buildings. In addition each expert had to be interested in the outcome of the results from the study either through their kind of work or as

necessary information for their own field of study. Also, the panel of experts chosen had to be accessible. The Delphi questionnaire would be mailed to the panel of experts with a stamp self-addressed envelope in it, so that they can send their responses back for free. Two telephone calls would also be made to chase up responses. The first call to each of the panellists would be to verify if they have received the questionnaire, a second call would be made to encourage questionnaire completion and submission. The responses expected from the study would be issues like what opinions the experts have on current lighting efficiency technology like the CFLs, what would be the state of lighting technology in the future and the likely impact SSL would have on lighting technology and carbon emission reduction in the future. The hope of doing the Delphi study would be to help fashion out what best lighting efficiency technology to pursue in the future. It is hoped that the study would help shed light on the importance of the SSL technology for the future, whether the HSL technology can be revamped and made more feasible and cost-effective for mass adoption and how easy it would be for residential and commercial buildings to have all gone green by 2030 as it is presently expensive to do so now. Delphi Study Importance to ' Future Technologies'

The importance of Delphi studies to future technologies cannot be over-emphasized as it is the fulcrum on which important decisions are made as to which future technology to pursue and which would not be feasible to go after. Delphi as a procedure according to Singh and Kasavana (2005) is used for eliciting and refining opinions of a group of people usually experts in that field of study until a consensus is reached and the future of that field accurately forecasted, though it also allows for dissenting opinions too. It has been carried out regularly in Japan in the last 40 years to forecast

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the future of technology in that country which has seen Japan become a world leader in technological development. It is also in use in Korea where both the exploratory and normative approaches are used (Taeyoung 1998). The Delphi method is typically used in technology forecasting and it is the most suitable way to get a clear picture of what technology would be important to the society in the long-term future and also a way of using technology to solve anticipated future problems before they arrive upon us by tapping into the brains and experiences of experts in any technological field being forecasted. It is also important as it helps technological firms meet with forecasted demand in the future of any technology they have produced or are in the process of researching so that future demand do not out-strip future supply hence Delphi study is an important tool for ' futures technologies'.