Role of PVs in Sustainable Development Towards ICT-2020

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Abstract
A low carbon economy is one which is characterised by activities which emit low levels of carbon dioxide into the atmosphere. Demand for low carbon activities is already substantial and is widely expected to increase. There is a pressing need to accelerate the development of advanced clean energy technologies in order to address the global challenges of energy security, climate change and sustainable development. This paper gives an overview of the concept of Low carbon economy, Energy Management and role of photovoltaics.

Keywords
Energy Management, Low Carbon Economy, Sustainable Development, Smart Meters

I. Introduction

The shift towards low carbon ways of working is increasingly associated with the creation of a broad range of new employment opportunities. Our desire to cut carbon dioxide emissions has been associated with the creation of activities focused directly on using fossil fuels more efficiently (such as hybrid vehicle technology), activities which prevent the release of emissions into the atmosphere, or remove carbon dioxide from the environment (such as carbon capture and storage facilities) and which support the transition to less carbon intensive operations (such as carbon finance and carbon trading activities). However, precisely defining and identifying the current scale of activities which derive their demand from this desire remains a challenge. The concept is often confused with wider notions of green jobs, the green economy, green collar jobs, the environmental economy and eco-industries. Also, their cross-sectoral nature results in a poor match with standard industrial and occupational classifications.

II. Our Hunger for Energy

In reality, energy use has always had a noticeable impact on the environment. Looking back today, it is obvious that burning wood was less than ideal and that the harmful noxious fumes created by such fires considerably reduced the life expectancy of our ancestors. A fast - growing world population, increasing prosperity and the hunger for fuel that has developed as a consequence have led to a rapid rise in the need for energy. Although the resulting environmental problems may only have affected certain regions, the effects of our hunger for energy can now be felt around the world. Overconsumption of energy is the main trigger for the global warming that is now threatening to cause devastation in many areas of the world [1, 10]. Global warming that is now threatening to cause devastation in many areas of the world.

III. Energy Management

Energy is one of the most important resources to sustain our lives. At present we still depend a lot on fossil fuels and other kinds of non-renewable energy. The extensive use of renewable energy including solar energy needs more time for technology development. In this situation Energy Management is the critical needs in any countries in the world. Energy is one of the management resources of an organization, and shall be managed and controlled by a systematic method in harmony with the management of other resources. Energy Management is managing all kinds of energy used in the company by making out an optimum program of purchasing, generating and consuming various types of energy based on the company's overall short-term and long-term management program, with due consideration of costs, availability, economic factors, and so on [8].

The government of UK has set a target of ensuring every home and business has smart meters installed by 2020, capable of providing real-time, accurate electricity and gas use and cost data. Smart meters are a significant step forward in managing energy and carbon usage. They provide a real-time, accurate, record of the gas and electricity you are using, day and night, and how much it costs. Estimated readings will be a thing of the past. They include a display device that will tell you how much energy you are using at any given time, and how much it is costing you - and even how much carbon that equates to. This display will put you in total control of your energy use - which is vital when more and more of us are becoming more energy efficient on financial and environmental grounds. You can view energy consumption as a timeline, showing how your consumption changes in real time. Smart meters will also make it easier for people who generate their own energy to measure how much they are exporting back to the national grid.

Financially, the benefits of smart meters are considerable. Based on the government's impact assessment, the rollout of smart meters will deliver net benefits of £2.5bn-£3.6bn over the next two decades [9]. Fig. 1, show Total Industrial output compared to selected industries.

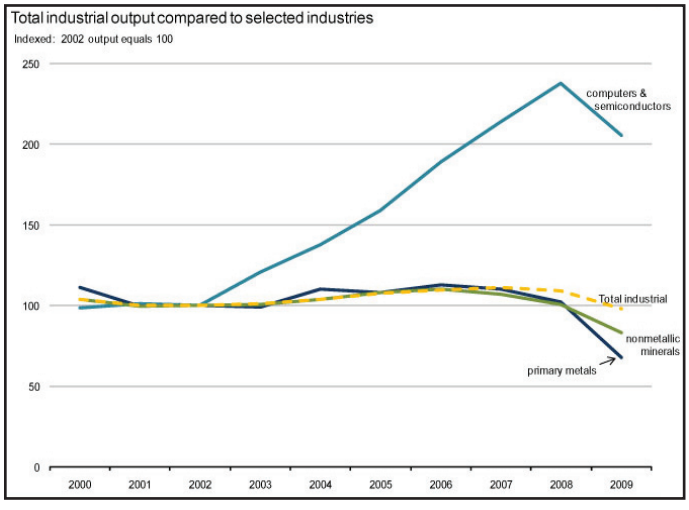

Fig. 1: Total Industrial Output Compared to Selected Industries

IV. ICT 2020

While the sector plans to significantly step up the energy efficiency of its products and services, ICT's largest influence will be by enabling energy efficiencies in other sectors, an opportunity that could deliver carbon savings five times larger than the total emissions from the entire ICT sector in 2020. These are not easy wins. There are policy, market and behavioral hurdles that need to

be overcome to deliver the savings possible. For example, Chinese factory managers find it difficult to stop producing long enough to implement more efficient industrial processes because they risk losing revenue and competitiveness [2, 5]. The scale of emissions reductions that could be enabled by the smart integration of ICT into new ways of operating, living, working, learning and travelling makes the sector a key player in the fight against climate change, despite its own growing carbon footprint. The ICT sector can't act in isolation if it is to seize its opportunity to tackle climate change. It will need the help of governments and other industries. Smart implementation of ICTs will require policy support including standards implementation, secure communication of information within and between sectors and financing for research and pilot projects. As stated in the Intergovernmental Panel on Climate Change's (IPCC) 2007 Synthesis Report: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level."

V. Renewable Energy Sources

Solar energy is the most abundant energy resource on earth. The solar energy that hits the earth's surface in one hour is about the same as the amount consumed by all human activities in a year [3-4]. There is a pressing need to accelerate the development of advanced clean energy technologies in order to address the global challenges of energy security, climate change and sustainable development. Each year the sun radiates 1.5 quintillion kilowatt hours of energy towards the earth. The atmosphere swallows up around 30% of this energy but over one quintillion kilowatt hours are still able to reach the earth's surface. Our current primary energy needs are around 125 trillion kilowatt hours worldwide. By the way, a quintillion is a 1 with 18 zeros, and a trillion has 12 zeros. Therefore, the amount of energy that reaches the earth ' s surface from the sun each year is 8000 times more than the total primary energy requirement of the world. So we only need to use about one hour ' s worth of the solar energy that reaches the earth ' s surface in order to cover the energy needs of the whole of mankind for a whole year [1, 11]. Fig. 2, shows Comparison of annual renewable energy available and global primary energy requirement with the total existing conventional energy sources on earth.

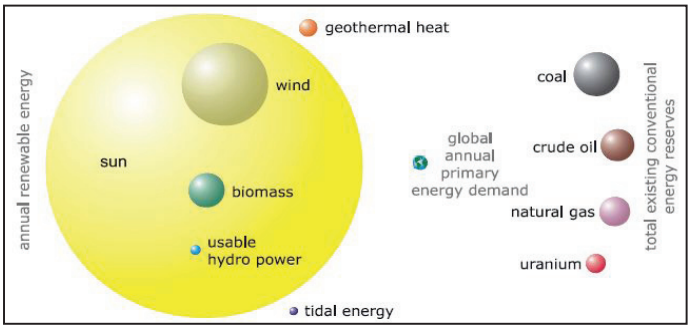

Fig. 2: Comparison of Annual Renewable Energy Available and Global Primary Energy Requirement with the Total Existing Conventional Energy Sources on Earth

A. Photovoltaic- Energy from Sand

The combination of rising energy costs and our insatiable appetite for technology advancements will lead to significant environmental impact unless aggressively addressed by a unified strategy. Due to recent innovations and research endeavours, the cost of Renewable Energy Sources (RES), particularly Photovoltaic (PV), is constantly decreasing. Moreover, solar power uses a free renewable energy source i.e. Sun, which means there is no re-occurring cost from consuming power and it does not produce any negative environmental effects by way of pollution to the air, land or water [6]. PV probably offers the best deal for the environment among non-conventional sources of energy which directly convert solar energy into electricity with reasonable efficiency. Fig. 3 shows Cumulative Cost of Energy System for Off-Grid Cell Site (Solar v/s Diesel).

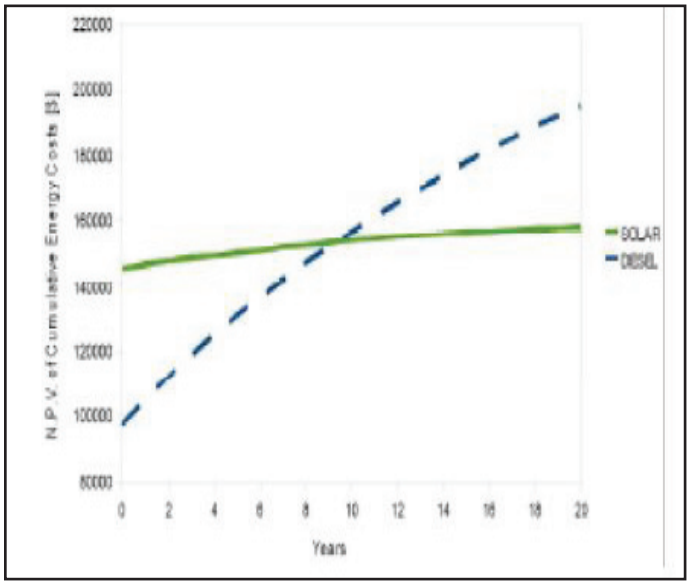

Fig. 3: Cumulative Cost of Energy System for Off-Grid Cell Site (Solar v/s Diesel [6]

B. HCPV (Highly Concentrated Photovoltaic)

The Sunflower highly concentrated photovoltaic system integrates photovoltaic modules, advanced tracking, unique power optimization, an embedded controller and wireless communication, into one elegant solution to produce cost-competitive solar power while reducing installation and maintenance costs. The Sunflower system uses proprietary Micro-Converter technology to improve energy delivery by conditioning modules' power output and optimizing maximum power point. A Micro-Converter optimizes Maximum Power Point Tracking (MPPT) over only 5 modules versus up to several thousand modules in traditional single inverter MPPT architecture. This provides more precise and effective MPPT and therefore more usable energy. In addition, this architecture reduces electrical losses within the array and increases the energy produced. This occurs when both shaded modules and un-shaded modules are present, and under low light conditions such as sunrise and sunset when traditional inverters would shut down due to under voltage conditions.

C. Cost Comparison of Conventional and Renewable Energy Sources

The Menanteau and Finon examined the efficiency of the different incentive schemes for the development of renewable energy sources, both from a theoretical point of view by comparing price-based approaches with quantity-based approaches, and from a practical point of view by looking at concrete examples of how these different instruments have been implemented [7]. Fig. 4 shows the Cost comparison graph of Conventional and Renewable Energy Sources.

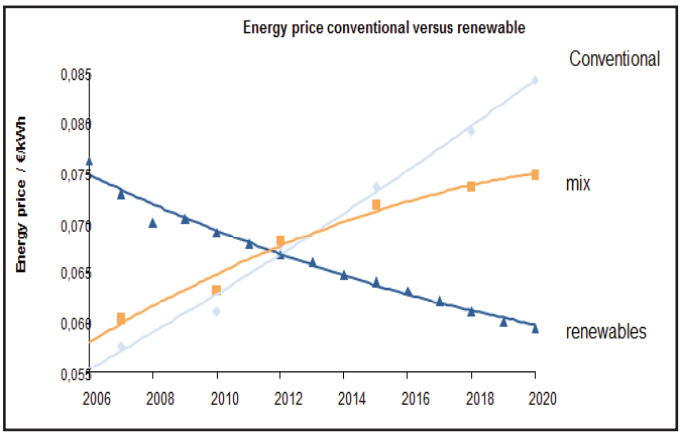

Fig. 4: Cost comparison of Conventional and Renewable Energy Sources [3]

At Bochum University, Solar car reached average speed of 73km/h during 3000km Race shown in fig. 5.

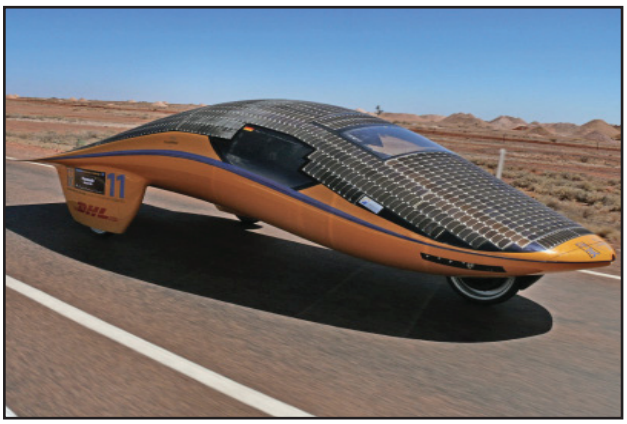

Fig.5: Powerful Solar Cells with Efficiencies of Well Over 20% Provide the Necessary Drive Energy

This Technology is not without Pros and Cons. We can sum-up the Pros and Cons associated with PV technology as follows:

1. Pros

- Distributed energy source
- No moving parts hence reliable
- Green power
- Low maintenance
- Unlimited energy source

2. Cons

- Capital intensive
- Low capacity utilization (<20%)
- Low efficiency and large area is required
- Security of panels in some locations

VI. Conclusion

According to World Commission on Environment and Development, 1987; Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. When it comes to sustainability issues, development means advancement in every domain viz. Economy, Social equity and Environment. Ultimately, a low carbon economy is one which is characterised by activities which emit low levels of carbon dioxide into the atmosphere. With estimated emissions of 15.4 million tonnes of carbon dioxide equivalents per person each year, the tenth highest globally6, the UK is some way from this standard. The 2008 Climate Change Act has committed the UK to reduce its emissions by 18 per cent from 2008 levels by 2020 and 80 per cent by 2050. Through the EU has committed to cut our emissions by 20 per cent of 1990 levels by 2020 and to renewably source 15 per cent of their energy by 2020. Meeting these targets will require a switch away from the use of fossil fuels, or a dramatic expansion in forms of carbon offset. A fast growing world population, increasing prosperity and the hunger for fuel, has led to a rapid rise in the need for energy. Overconsumption of energy is the main trigger for the global warming that is now threatening to cause devastation in many areas of the world. Use of renewable energy sources is the only way to end our dependence on energy sources like oil and uranium, which are so costly both in financial terms and in the havoc they wreak on our environment, and satisfy our hunger for energy in a way, that is sustainable and compatible with the climate. Among the renewable energies that currently exist, Photovoltaic (PV) offers the most possibilities for different uses.

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