LOCAL SOLAR ELECTRICITY: PROBLEMS, CONSTRAINTS AND SOLUTIONS

There exists a significant problem with the transmission of power from generation locations to the consumption points. The main problem is the loss of power.
The longest cost-effective transmission of power achieved has been over 7000 Km. Power loss in resistors (a transmission line is a resistor) is given by $P_{loss} = I^2R$, where I is the current and R is the resistance. As the current increases, the loss of power will increase as a power of 2 proportional to the current. Transformers are used to increase the Voltage, thus decrease current. This is because voltage and current are inversely related as V = IR.

Power loss can be shown through a calculation, as follows:

300 W are being transmitted at 120V to a house in a wire of certain length. The cable has a resistance of 0.25Ω/length. The current is traveling at 25 Amps/length.

Power loss = I^2R
= 25^2 x 0.25 Ω
= 156 W (Compare this to the 300W initially pumped in)

This means that more than 50% of the power was lost during the transmission as heat. Local solar production relies on countering this loss of power – saving over 50% of the power lost during transmission.

Another problem is the infrastructure for the transmission of power from one point to another. With local power generation and use, the infrastructure will be altered and consume a lot less material and labour compared to what it currently does.

The solar cell production is currently increasing at a rate of 35%, whereas, the American energy demand is increasing at a rate of 2% a year. Although, both start off at different values, if the current increase sustains, it will be possible to have solar completely overtake energy production by 2014 – that's in four years! The following graph agrees with the above statement.

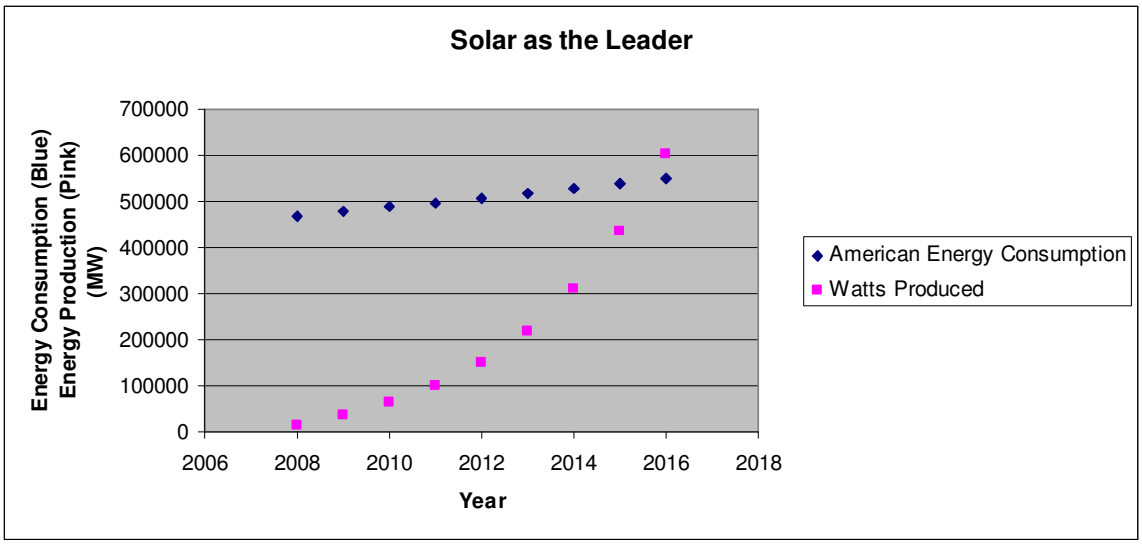

Figure III.1 - Increase in Solar Cell production vs. the increase in Energy Consumption in the United States. If the trends continue, Solar can become a prevalent source of energy in 6 years (by 2016).

As the following graph indicates, the price per watt of solar energy has been constantly decreasing over the past 10 years and is expected to decrease as time progresses.

Graph of SolarBuzz Retail Module Index removed due to copyright restrictions.

Solar does not have a fuel cost. Its fuel is the sun, which is free. The biggest local market for solar technology includes rooftop installations – industrial, commercial and residential. Rooftop areas differ from city to city and region to region, however, there is an ample amount to produce enough energy. In New York City, the available rooftop area is approximately 20 km^2, with 1.366 kilowatts/m^2. The rooftop area in New York City can produce 27,000,000 kilowatts or 27,000 megawatts. Other possible markets for solar include irrigation and increased use in farming to drive heavy machinery.

The possible constraints that exist against local solar technology are infrastructure, materials supply, labour and government. The grid system already exists and it might be easy to connect the solar farms to the grid, however, the local power generation and use would require a new infrastructure. For local power generation, silicon is the 2nd most abundant element in the Earth's crust. Inclusive is the battery power – this seems to be the greatest hindrance to the success of the Local power generation. This is probably the most important research area in the industry so far. Currently, a lack of skilled labour haunts the solar industry, however, an increase in local solar production would stimulate the specialization of a new skilled set of labour. This will further stimulate the economy and create monetary prosperity. Government Subsidies have been responsible for

building multiple industries to their current level. Possible subsidies can lead to the acceptance of the solar industry as a new industry and the economic stimulation.

Solar Energy has the potential to be the future of energy generation. It can be the leader in 4 years; however, a conservative estimate would be 10-15 years. Due to the depleting amount of other resources, it is necessary to have solar as a green alternative. The following graph serves two purposes:-

i) From 1900-1940 is the development of the oil industry, which allows us to make a conservative estimate for the Solar industry.

ii) It shows the depletion of our most used resources at the moment, thus, pointing to the fact that it is necessary to find a viable solution to the energy crisis.

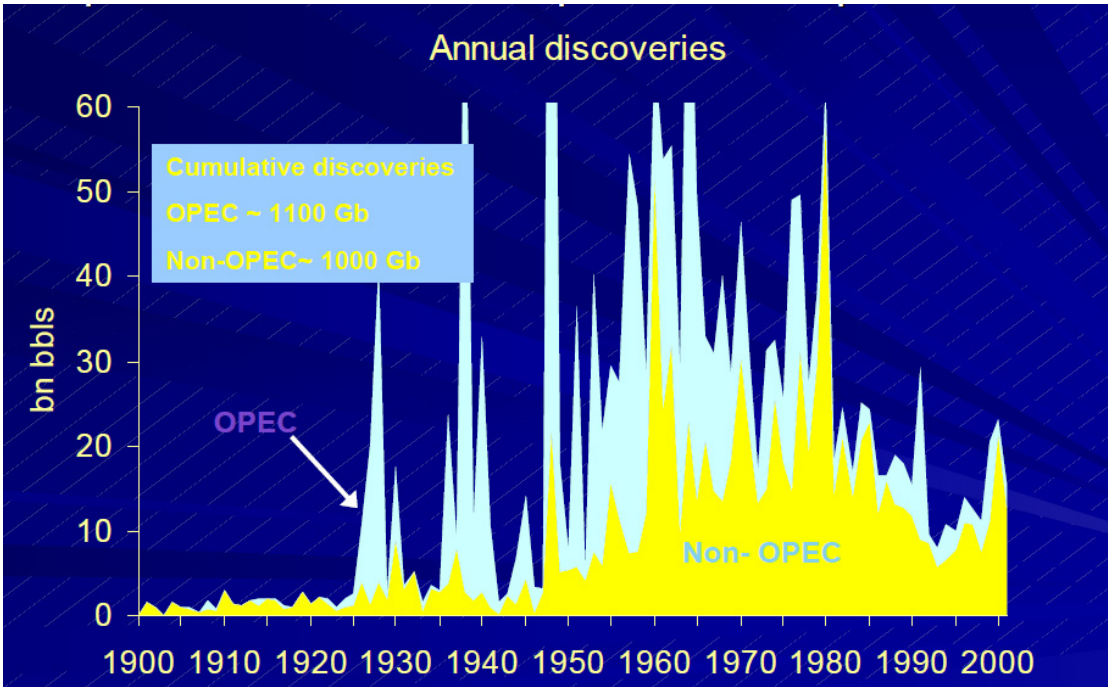

Figure III.2 – Graph depicting the peak discovery of oil, indicating the inevitable decline in the oil industry. Also, the period from 1900 – 1940 indicated the development of the oil industry took 40 years.

Works Cited:

Paris, L. "PRESENT LIMITS OF VERY LONG DISTANCE TRANSMISSION SYSTEMS." *Global Energy Network Institute*. Print.

"Solarbuzz Retail Module Price Index." *Solar Module Retail Price Environment*. Web. 25 April 2010. <http://www.solarbuzz.com/Moduleprices.htm>.

3.003 Principles of Engineering Practice

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