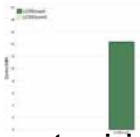
3.003 Principles of Engineering Practice

Solar Options in a nutshell

background

Solar energy option avoids issues with traditional technology—greenhouse gases, dependance on foreign oil, etc



Necessary to minimize the levelized cost of energy, the cost per kWh over the energy system's lifetime.

issues

Lowering Costs- According to the DOE, by 2015 retail electricity range: $0.06 to $0.15/kWh/ wholesale electricity range: $0.04 to $0.08/kWh—solar much reach this to compete

Materials Optimization- Choosing the right materials for solar cell efficiency maximization requires analysis detailed in previous slides

Peak Load- Highest photovoltaic production does not match the peak load use, requiring a backup of oil/natural gas use at night

Governmental Policy- Cooperation from the governmetn in enacting policy is necessary

Analysis:

Availability Though peak load does not match peak production, solar energy is readily available

Security 1) Reduces dependance on foreign oil
2) Silicon (main material) does not pose a threat to humans

Reduced transmission losses Ease of localized production lowers transmission losses

Grid independent Local photovoltaics runs independent of grid energy losses and efficiency losses

Grid load leveling Can ease the surges in the grid and stabilize overall production by making up for losses

Greenhouse reduction Solar cell implementation would drastically reduce carbon dioxide emissions and other greenhouse gas emissions from traditional energy sources

New jobs The creation of a new industry would bring new jobs

Rectification of Issues:

Cost minimization is achieved through choice of materials and correct optimization of grid vs. local production

1) Materials: Choice of silicon *thin film* cells due to dependable and constant efficiency of 10% and cadmium telluride cells due to lower costs from lower material usage

2) Grid vs. Local: If the solar power produced from panels installed on the roof of a building cannot cover its total usage, it will be automatically classified as grid powered, and if it can be covered, it will be powered locally

3) DC vs. AC: Many home appliances are capable of running on DC power so no inefficiencies resulting from installation of AC to DC converters will be necessary for homes, reducing costs

ASSUMPTIONS AND LIMITATIONS:

- New energy technologies have no guarantee of success in terms of reducing costs
- For a market to be successful and self-sustaining, it must be ~200 billion dollars, which is difficult to reach—**but** taking into account solar power's current 20%-30% exponential growth rate, it is projected to match increased electricity demand before 2020

recommendations

Total Annual Impact =
(Baseline-Improved Costs)(Serviceable Addressable Market)

Increase Δcosts by decreasing improved costs

- Cheaper materials (thin film silicon)
- Government subsidy for photovoltaic R&D

Garner essential support

- Lobby for political support
- Community task forces to determine power needs and logistical issues

consequences

Photovoltaics is necessary for avoiding the negative effects of the oil/gas industry on the environment, economy, and foreign policy

It is essential to follow a strict balance of local vs. grid power to allow for minimization of costs— local power: thin film silicon/ grid power: CdTe

Without solar matching increased power demand by 2020, its exponential growth will experimentally not match predicted estimates

There must be political and corporate support for the photovoltaic industry to reach at least 200 billion dollars (with an infrastructure industry at 20 billion dollars)

Local and national cooperation and communication through the use of committees and effective legislation is fundamental to the implementation of a solar energy plan

In fifty years, if the photovoltaic industry maintains an exponential growth rate of 30%, large solar fields coupled with local and residential solar plating can replace most of the need for unappealing and environmentally, socially, and politically unfavorable gas/oil sources (perhaps all with the possibility of energy storage)

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