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Modern photovoltaic systems provide competitive energy returns

Most modern societies depend on fossil fuels (oil, gas and coal) as sources of energy for development and growth. Switching to renewable energy sources, such as photovoltaic (PV) systems, is necessary for sustainable development in the future. A new study suggests that it is currently much more efficient to use fossil fuels to develop PV power plants than to combust the same amount of fossil fuels in conventional thermal power plants: thus the sooner PV systems are developed, the sooner society will reduce its reliance on fossil fuels.

When comparing different energy options, a common indicator used to assess the feasibility or pay-back of energy systems is the Energy Return on Energy Investment ratio (EROI). The higher this ratio, the greater the energy return on energy investment. Since the beginning of the last century, depletion of reserves means the EROI of oil and gas has declined from over 100 to around 10 to 30 at present. For coal, the EROI is around 40 to 80, although coal is more polluting than gas and oil.

Until now, the EROI of PV systems has been considered to be too low for the technology to become a viable alternative to conventional power plants. In this study, however, the researchers suggest that this view of PV is incorrect and has been caused by using outdated lifecycle energy data and a lack of consistency in calculations and assumptions. This study found that, when calculated in terms of equivalent primary energy, the EROI of modern PV technologies is in the range 19-38, similar to that of oil (10-30) and approaching that of coal (40-80).

In addition, the EROI of modern PV is achieved by exploiting a virtually inexhaustible renewable energy source (sunlight), rather than by depleting limited stocks of non-renewable fossil fuels. Currently only about 1% of the electricity generated in the world comes from PV systems. However, advances in technology means that the economic and environmental efficiency of PV continues to improve and in the future there will be a greater share of electricity produced by PV.

Although PV systems are a promising alternative source of energy, there are some disadvantages to the technology. A complete long-term analysis of the EROI of PV, compared to the generation of conventional energy cannot be achieved by examining individual systems separately. This kind of analysis would need research into different combinations of renewable energy systems, their relationships and storage. Electricity produced by PV plants is intermittent: no electricity is produced at night, for example. So long as the share of electricity supplied to the electricity grid by PV plants is small (less than 20%), this does not cause operational problems. But in the future, as more PV systems are installed and fed into the grid, the excess electricity produced during the day would have to be stored for use at night or during bad weather. Storage of electricity is expensive. Currently, the most suitable and cheapest storage option is “Compressed Air Energy Storage”, but it requires underground storage facilities, such as abandoned mines, to contain the compressed air. In addition, energy is used during the conversion and recovery processes, which reduces the efficiency of the PV and storage systems. Research is on-going into other storage options that are economically attractive.

Despite the issues with energy storage, the researchers suggest that the earlier investments are made in large-scale installation of PV, the better society will be protected against future energy shocks from depleted reserves of conventional fossil fuels, and the sooner society will be able to reduce its reliance on non-renewable energy supplies.

Source: Raugei, M., Fullana-i-Palmer, P., Fthenakis, V. (2012) The energy return on energy investment (EROI) of photovoltaics: Methodology and comparisons with fossil fuel life cycles. *Energy Policy* 45: 576–582. DOI:10.1016/j.enpol.2012.03.008
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