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An optimized hybrid energy system with emphasis on renewable energy

Renewable energy sources are becoming of increasing importance, because of their renewability and environmental friendliness. One major draw back they face however is due to their high loss of load probabilities (LOLP). One way round this problem of unreliable supply is to combine several energy sources to form a cluster for energy delivery. Such a Hybrid system, with storage when excess energy is available, will result in a low LOLP and hence a high reliability of power delivery.

In this study we have designed an optimizing algorithm for minimizing the resource costs for a given energy demand. By resource costs we mean, the total cost from capital, operational, environmental and non renewability considerations. The resource constraints for this optimization problem, come from a GIS based renewable energy map of Wind, Solar and Hydro. The optimization problem at any given moment is solved by a search algorithm, while the time dependence (future resource availability) is taken into account, by a quadratic term (K-factor) we have introduced to the Energy Cost function. The cost of present energy use is made proportional to the inverse square of estimated future availability. The costs of non-renewability have been introduced, by accounting for the opportunity loss resulting from the unavailability of the used quantum of energy at any future date.

The Algorithm with linkage to a renewable energy source GIS map has been computerized and several times simulations performed. This work is not only of significance to Sri Lanka, which has a mixed abundance of renewable energy sources; but also to the optimum utilization of these sources worldwide.