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Mathematical Modelling of Energy Mix and Optimization of Renewable Energy

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With energy as direct and indirect fundamental life supporting resource, the domestic and industrial demands for energy has been rising due to technological advancement, population increase, and economic growth. Various sources of energy including use of fuels, hydro-electric energy, geothermal energy, wind energy, solar energy and nuclear energy are all available alternative sources of energy in different proportions. Production and distribution of energy in an attempt to satisfy the inhomogeneous individual needs, in tandem with the desire to conserve the environment, has been a complex problem, with pertinent constraints including demand, supply, production, distribution and environmental impact dynamics. Mathematical Modelling of Energy Mix and stability in the interchange is considered in this research as a feasible solution to the losses through leakage and wastage, caused by distribution of unused power loading. Through the analysis of individualized demands and associated production and distribution cost. The objectives of this study is to formulate a mathematical model to analyse and determine the desired parameter thresholds that guarantee stability and robustness of energy variation. This is done using Neural Networks feedback control algorithms, with adaptation so as to automatically control and maintain the optimal stability of energy levels during changeover. Using three types of users: Household, School and Small Commercial Entreprise, simulated results show that energy shifts is stable, with a peak time t_p=0.4s and power overshoot of 18.5%. This is stabilized to acceptable tolerance of 2% in a settling time of t_s=4.35s. Energy cost analysis showed that the Energy Mix of Hydro Electicity (E), Solar Power (S) and use of LPG Gas (G) is optimal when used in the ratio E:S:G=6:129:1. Using a Smart Grid system, all sources of energy can be intelligently mixed for the achievement of optimal individualized energy consumption and distribution mix.

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