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## ABSTRACT

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This study focuses on the overall sustainability analysis of smart energy meters (SM) in comparison to conventional static energy meters (CM) in Pakistan. The study aims at the characterization of the environmental impacts, economic viability and consumer acceptability of SMs in the context of a developing country. Life Cycle Assessment (LCA) method has been deployed for the eco-sustainability of selected energy meters. For this, 8 midpoint categories including Climate Change Potential (CCP), Ozone Depletion Potential (ODP), Terrestrial Ecotoxicity Potential (TETP), Fossil Resource Scarcity (FFP), WaterConsumption Potential (WCP), Freshwater Eutrophication Potential (FEP), Fine Particulate Matter Formation (FPMF) and 1 endpoint category has been selected i.e., Damage to Human Health based on the selected functional unit. Highest impact scores have been observed in CCP, FFP, WCP i.e.,  $9.61\text{E}+00$  and  $7.60\text{E}+00$  kg CO<sub>2</sub> eq.,  $9.59\text{E}+00$  and  $7.77\text{E}+00$  kg oil eq.,  $6.98\text{E}+00$  and  $6.69\text{E}+00$  m<sup>3</sup> water for CM and SM respectively. Among the three life cycle phases under study, the highest impact contribution has been observed for the production phase for both the energy meters. For the economic assessment, Life Cycle Costing (LCC) method has been deployed. The initial cost of SM and CM has been calculated as 8,028 PK and 7,231 PKR respectively while the overall life cycle cost of SM is 61% less than that of CM. Economic indicators have also been calculated for comparative profitability analysis. For all the selected economic indicators, SM presented improved performance as compared to CM with 15% higher Benefit to Cost Ratio, 1.5 years less payback period, 5% higher Net Present Value and 2% higher Internal Rate of Return. According to the results of the social analysis, the factors influencing consumer acceptability include prior awareness regarding SM benefits, environmentally responsible behavior, preferences regarding SM installation, willingness to spend on energy efficient appliances and social influence. In a nutshell, the study reported significant environmental and economic benefits of SM deployment based on the complete life cycle perspective. However, there is still a long way to go for disseminating these benefits among the consumers and utility suppliers. Policy interventions and roll-out programs should be designed to present SM not merely as an electricity metering device instead as a portal through which consumers and utilities can communicate.