**PROJECT ESSENCE**

- This project aims to design and develop a comprehensive condition monitoring test bed on an existing solar micro grid. The extension of this project in the subsequent year will employ this test bed to design a new smart, self-sustaining and optimized solar micro grid for a marginalized community in the rural area of Pakistan.
- To develop the model for test micro grid that can give the energy demand estimate in correlation with the weather conditions and the trend in the social life style
- To formulate the most accurate technique for online determination of PV system’s actual performance
- To minimize the number of data acquisitioning units required for condition monitoring through optimization

**METHODOLOGY**

- MODULE I: Post operational data analysis and modelling of a micro grid in rural area of Pakistan for better load forecasting under changing weather conditions. The aim of this module is to come up with a multivariable statistical or numerical or machine-learning algorithmic model of the existing micro grid which can correlate the electrical parameters with the weather measurements.
- MODULE II: Online estimation of aging and degradation rate of the in-field solar power system. The performance evaluation of solar panels determines the degradation rate happening due to aging and environmental effects. This evaluation is of paramount importance for estimating the cost effect of the performance degradation and also to make efficient scheduling for preventive maintenance.
- MODULE III: Optimizing the Placement of Sensors to Minimize the Cost of Data Acquisitioning using Complex Network Theory Power system stability, quality and reliability can be improved through monitoring the grid variables such as voltages, currents, frequency and phase. The real time power measurement unit (PMU) however incurs a substantial installation cost Therefore the main objective of this module is to develop the optimization technique through complex network theory which will identify the minimum number of strategic nodes in a micro grid which can give full observability of the system.

**POTENTIAL STAKEHOLDERS**

- Planning commission
- Energy regulators
- Ministries relating to energy such as W&P, MP&NR, etc.
- Ministry of finance
- Pakistan Poverty Alleviation Fund (PPAF)
- Arizona State University (ASU)
- Industry related to co-generation
- National Energy Efficiency and Conservation Authority
- International development partners e.g. USAID, ADB, etc.

**RESEARCH IMPACT**

1. On Quality of Life: Providing reliable and affordable electricity to a marginalized community is in fact providing the basic human right. This can have direct and drastic positive impact on the quality of life.
2. On Socio-Economics: There are several deprived areas in Pakistan where the people are living below poverty level. Improving the quality of their lives by providing access to energy can uplift them to contribute to the economy of the country. Moreover, independence from the conventional power grid, which is already under huge stress in Pakistan, will improve the energy issue of Pakistan.
3. On Research & Development: The best part of this project is not only the development of a micro grid, but the design of tools, model and algorithms for the research and development leading to an optimized micro grid. Such a micro grid will be the first of its kind in Pakistan which will be equipped with a condition monitoring system for data analysis.