



Renewable Mini-Grids for Last Mile Electrification: Enabling Environment



Energy Access in Pakistan



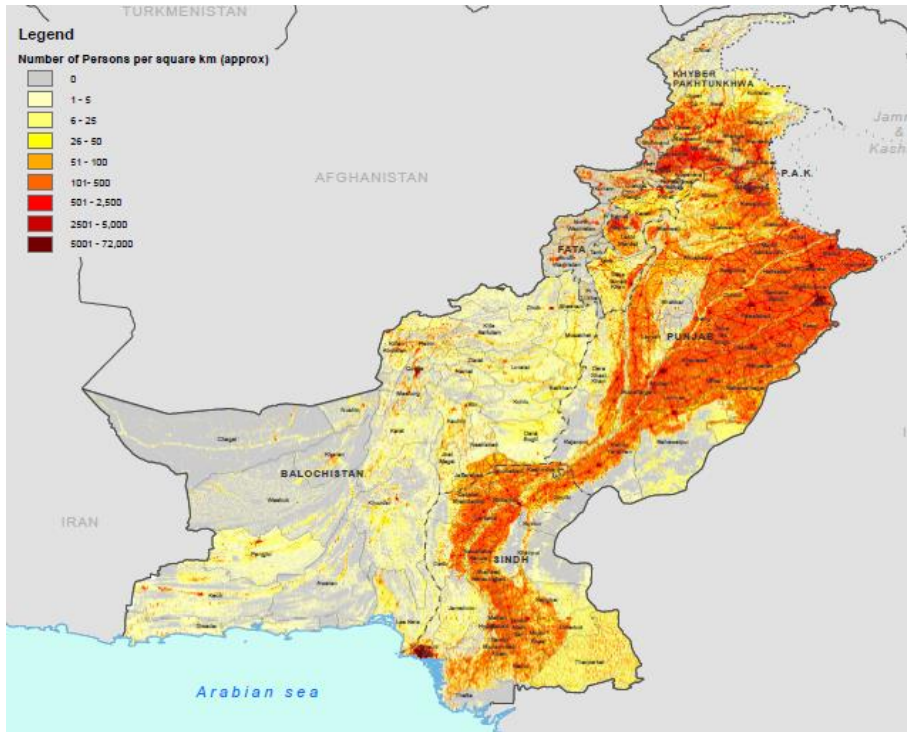
Socio-Economic Development of the communities is highly dependent on the Energy Access

- For areas with the population density of 26-50 persons/sq. km located at the distance of 20 kilometers outside the grid, the DISCOs find economically unviable to provide energy access through their wirelines network
- Resultantly, these areas, with no electricity access, are deprived with basic necessities as education, health, sustainable development, etc.
- About 50 million of population is estimated to reside in the off-grid areas in scattered localities across the four provinces
- Enhancing grid infrastructure to the off-grid areas remained a strangled issue for the decades
- Mini and Micro-grids provide a favorable option of electrification keeping in view the must needed necessity

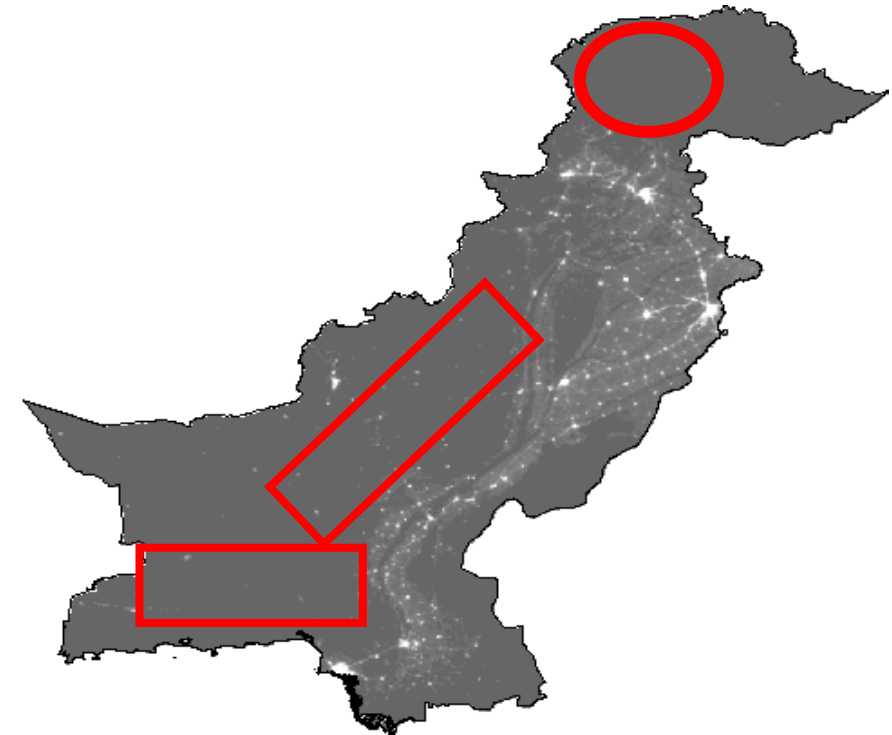
Electricity access in Pakistan in the year 2020 has been 75.4%

Energy Accessibility in Pakistan

Comparison of Off-Grid Electrification provided by satellite imagery identifies the areas in the provinces of *Baluchistan* and *Khyber Pakhtunkhwa* lack the access to energy due to out-of-coverage locality from grids



Population Density



Potential regions with weak or no grids

Mini Grids!

A Midway of Standalone and Grid Systems

Independent, decentralized electricity networks that can function separately from a national grid

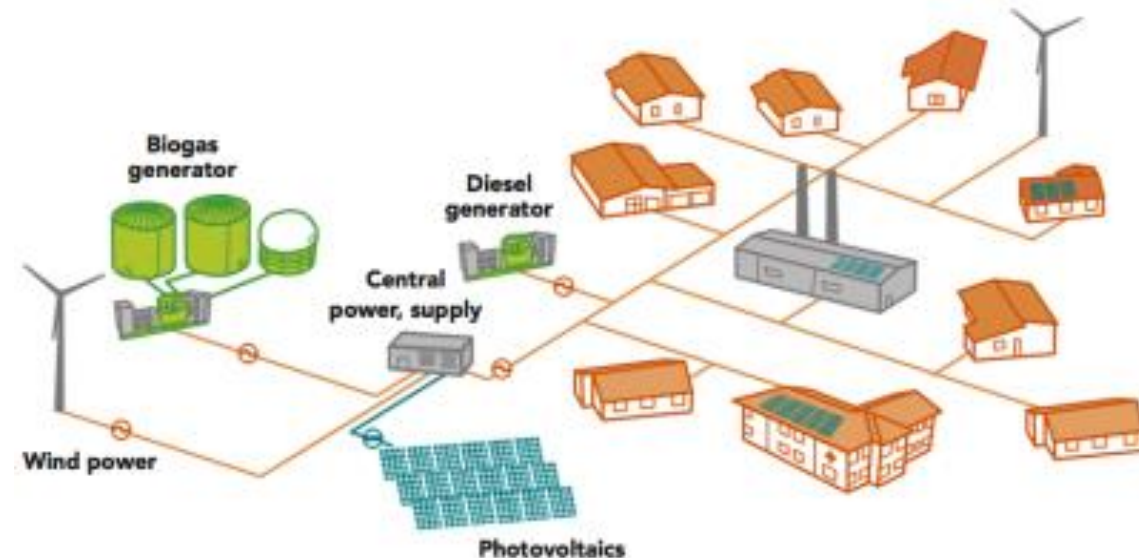
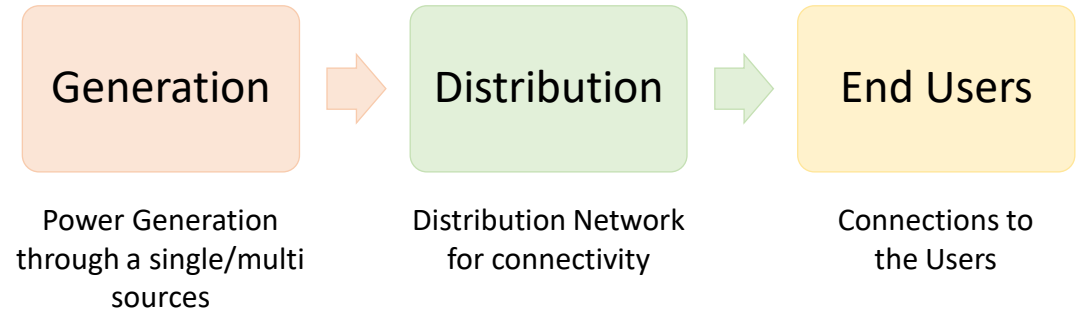
- Enabling the developers to better track and understand a community's energy needs
- Ensures higher reliability of supply and better power quality in the remote and rural areas, thus lessening the T&D Losses

Improvement in rural livelihood

Enhances economic activities

Value Creation to local products and services

Growth of local businesses



Landscape of Micro-grids in Pakistan

Salient Features of NEPRA Micro-grids Regulations, 2022

- Mandated to electrify the “unserved areas”
- Micro-grids capacity size up to 5 MW
- Insurance of reasonable tariffs for consumers
- Existence of strong technical regulations
- Allows Localized Energy Systems, Business to Business (B2B) and Social Welfare Organizations

Drivers for Adoption of Micro-grids

- ❑ Cost-Effectiveness of Micro-grids for rural electrification compared to Grid System
- ❑ Improvement in ARE deployment capabilities
- ❑ Inclusion of private investments in the power sector

Barriers/Challenges

- ✓ Policy formulation at the national level has remained largely focused on IPP-type procurement
- ✓ Difficulties with accessing finance by mini-grid developers
- ✓ Lack of experience in mini-grid development by business entities
- ✓ Consideration of mini-grid businesses as risky ventures
- ✓ Lack of financial capacity by local developers to meet the equity requirements

Renewable Energy based Mini-grids: Economic Attractiveness

RE dominated MGs presents much more financial feasibility as compared to conventional fossil-fuel based generation

- ✓ Potential applicability of RE sources demonstrates a compelling case for adoption
- ✓ Localized RE Solutions based on Micro-grid saves costs
- ✓ Fuel Diversification based on distributed generation ensures more cost-effectiveness and increased energy supply
- ✓ Intermittency issues arising in Variable Renewable Energy sources can be mitigated effectively

Potential Business Models

- ✓ Utility Owned
- ✓ Investors' Owned through competitive tariff
- ✓ Investors' Owned and Operated with partial funding from international donor and philanthropist organizations

Challenges

Lack of upfront finances for the development

Lack of awareness and technical expertise

Non-Applied business models for development of micro-grids

Investments risks due to uncertain market of electric supplier through mini- and micro-grids

Tariff Settlement for Micro-grids: Perceived Challenge!

NEPRA allows tariff for micro-grids to be settled bilaterally by the Micro-grid developer and the consumers

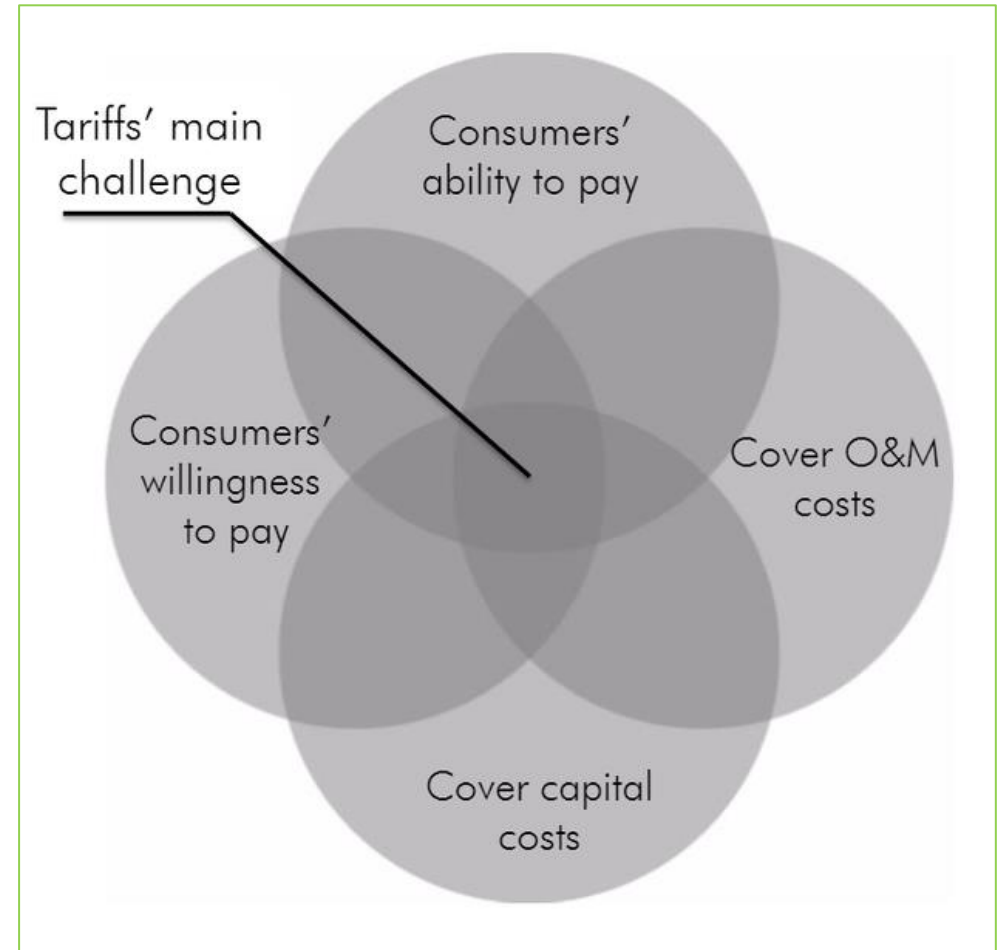
Aims to consider during Tariff Settlement

Attracting commercial entities to invest in Micro-grids

Ensuring financial viability and sustainability

Supporting Economic development and Improvisation of living standards

Balancing Sustainability and Affordability



Financial Sustainability of Micro-grids

Consumers' Tariffs are relatively low to maintain the energy affordability of users

Donors' Support is instrumental for the financial sustainability of Micro-grids

Support from government, financing institutes and international bodies for funding needs to cover the operation and maintenance costs of the mini-grids

Public-Private Partnerships

Development framework for Micro-grids requires close working cooperation between government agencies, commercial entities, research institutions, international organizations and financing instruments

Cooperate Social Responsibilities

Commercial giants can be driven to contribute in RE-based Micro-grids development

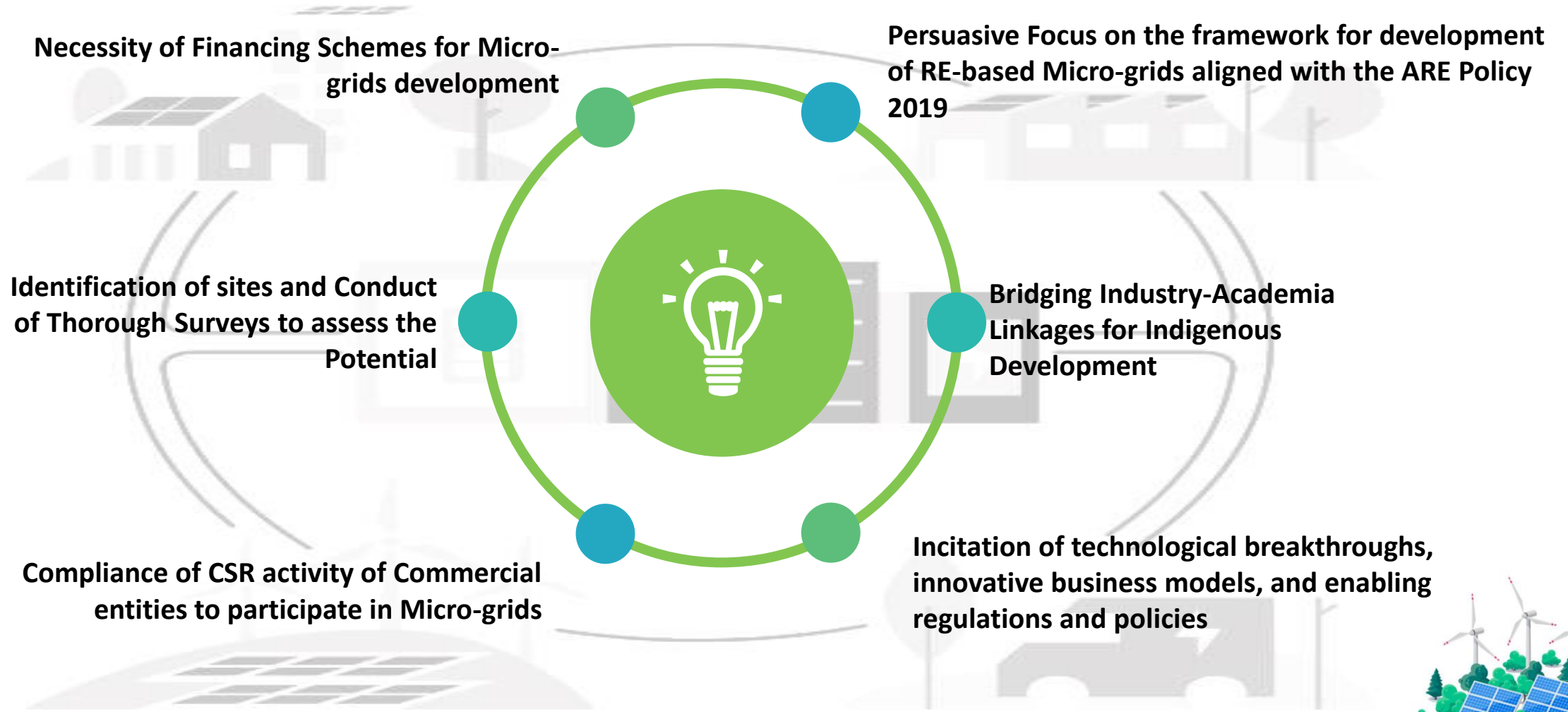
Regulations of Subsidized Tariff for Off-grid electrification

Government is required to enforce tariff remains equitable with the energy affordability of the consumers

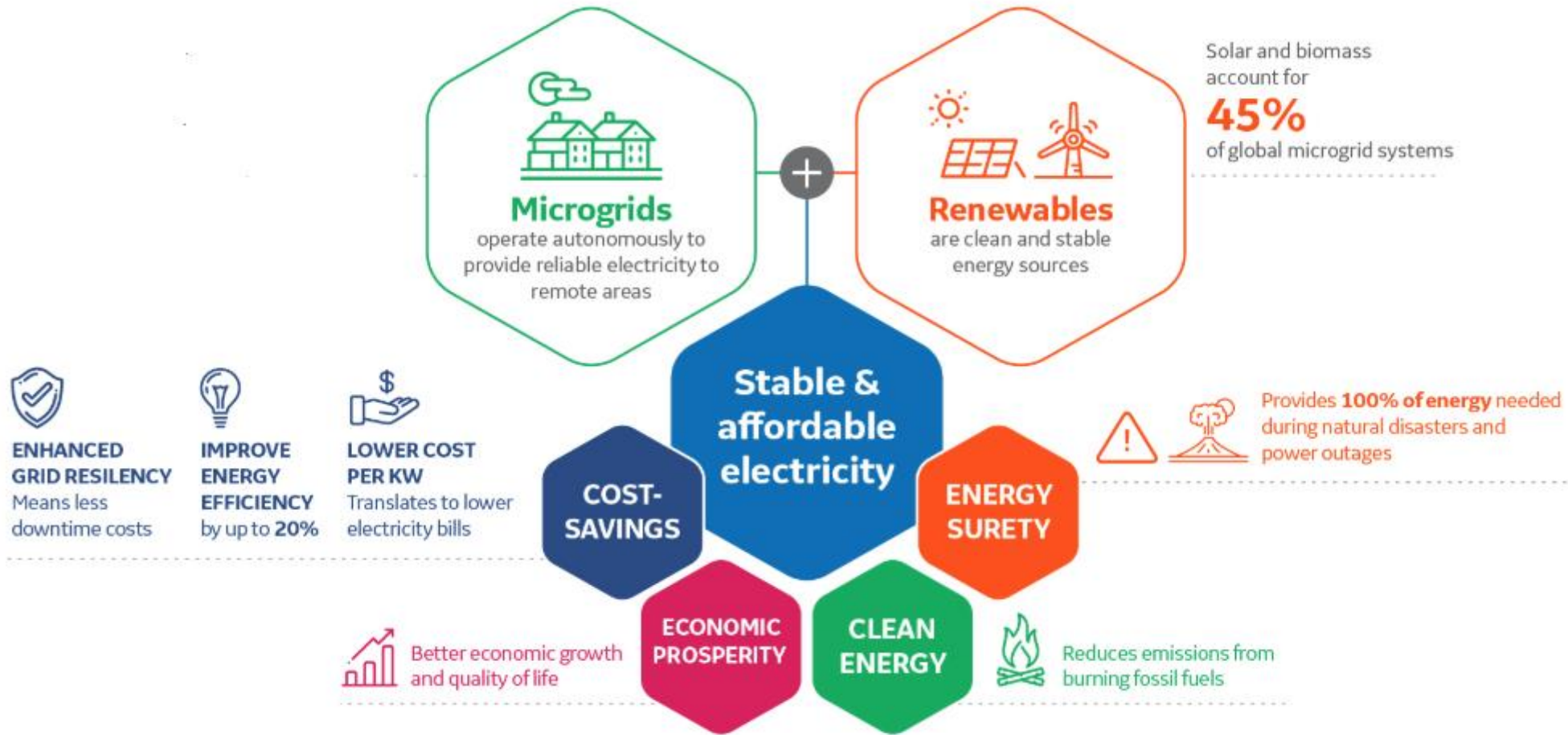
Streamlining Financing Schemes

For steady development, concessional financing schemes are necessary

Developing RE-based Micro-grids in Pakistan: Recommendations and Suggestions



A Complete Solution for Rural Electrification



THANK YOU!