IFC International Finance Corporation World Bank Group

Diversifying Energy Access in Emerging Markets

A Portfolio Approach to Distributed Generation Opportunity (PADGO)

Background

Lack of access to reliable energy is a significant obstacle to economic development in emerging markets, particularly for people and businesses living and operating outside of the large urban centers. Traditional power sector models are based on large-scale, central generation facilities accompanied by developed transmission and distribution (T&D) networks. They therefore face restrictions in how they meet the energy needs of diverse segments of the market. Utility economics is further aggravated by low operating efficiencies, inadequate regulatory frameworks, and limitations in institutional capacity.

Distributed Generation (DG) - the small-scale production of electricity at or near the load - has emerged as an attractive alternative in addressing the issues above. In addition to addressing access needs, DG has the potential to improve reliability and efficiency of energy supply, reduce pollution and environmental degradation, and increase supply security by diversifying the supply source. It also allows investors to approach energy sector investments in a modular fashion, instead of the large, bulk capital investment required under traditional models. This lowers the hurdle for new entrants to the electricity market, fostering increased competitiveness and service quality.

A Portfolio Approach to Distributed Generation Opportunity (PADGO) is a new initiative led by the International Finance Corporation (IFC) that addresses the impediments to wider proliferation of DG technologies and provides support and innovative financing models to promote the growth of this new market.

The Concept - Matching a Portfolio of Technologies with Customer Needs

PADGO makes use of a range of DG technologies with varying capacities, costs, fuels, performance parameters, and operating and maintenance requirements. This allows the flexibility needed to cater to the diverse geographical and operational needs of different customer segments. Examples include locally available renewable fuels such as biomass, solar energy, and wind-power with low operating and maintenance costs, or fossil based generation but at higher efficiency levels.[1]

The starting point for the initiative is DG technologies that are close to becoming commercially viable in developing countries. As other technologies emerge and become increasingly competitive in cost and delivery, they will be added — thereby gradually moving towards a greener portfolio of energy options that are able to serve customers with smaller needs at competitive prices. The aim is to create a market that will ultimately serve the needs of underserved customers. The technology will be selected based on 1) energy requirements, 2) operating constraints, and 3) operating and maintenance costs to the consumer base that it would serve.

For underserved populations or local industrial consumers who may not have the institutional capacity and knowledge needed to manage power purchase agreements (PPA), operation and maintenance contracts, and long-term servicing contracts, PADGO will provide a replicable model for transactions in order to lower transaction costs for all stakeholders.

The initiative will also structure replicable methods for financing these technologies in order to reduce the disproportionate transaction costs often applied to smaller projects. Smaller unit sizes may be financed through local or regional capital markets. IFC will provide support in the form of financial products to local financial institutions. The initiative also aims to improve understanding among financial institutions about the risks associated with financing DG.

The Structure

There are four basic components of PADGO, which work as a framework to support proliferation of DG:

Market Entry Support - Using donor funds, IFC will undertake research to identify and, where possible, mitigate impediments to DG's market penetration. For instance, connection fees for DG (if the plant is connected to the grid) often do not reflect the costs and benefits of the services provided. The environmental and safety regulations may also not reflect the reality of the operation of DG, especially if the plant is not connected to the grid. The research will cover three dimensions:

- consumer segmentation and affordability
- regulatory framework and tariff methodology
- technical specification to grid connection and dispatchability

[1] DG technologies operating in combined heat and power (CHP) mode recover waste heat thus increasing efficiency.

Ensuring quality and access - To ensure that the types of technology used under this framework promote clean energy, efficiency, as well as off-grid access, performance benchmarks will be established for each applicable technology. The benchmarks will go beyond IFC's environmental performance standards, and also address energy efficiency, reliability, and servicing.

Standard Contract and Agreement - The power purchasing agreement, concession (TOR or management) contracts, and other agreements will be standardized to provide comfort to operators and business developers, as well as to ensure quality of service to consumers. The standardization will lower transaction costs and also allow easy replication in other markets/regions.

Risk-Sharing Product - IFC will structure a risk-sharing product, under which the IFC/GEF will share in the potential loss from non-payment, thus supplementing the risk taking capacity of local financiers. While the risk sharing product will facilitate initial lending to the new sector, other components will provide further comfort and sector knowledge to make the lending sustainable over time.

What technologies are currently available?

The PADGO model allows for new technologies to be added to the portfolio as they come close to being commercially viable. Each technology will be selected based on energy requirements, operating constraints, and maintenance and operating costs of the consumer base that it would serve. The following are some of the technologies currently available:

1. **Solar Energy Systems:** Suited for home or large-scale electrification requirements in a grid parallel or isolated fashion. A battery back-up system will increase reliability.

2. **Mini-hydro:** Capacity is usually less than 10 MW, using run-of-river designs.

3. **Stirling Engines:** Classified as "external combustion engines", commercially viable products are available in units with 55kW capacity range. Smaller capacity models are due to reach commercial viability in a few years. It provides a wide range of fuel flexibility and applications.

4. **Wind based generation:** Ranges from the large MW size turbines to kW sizes. Recent advancements in lower capacity systems have lead to increased flexibility and reliability. However, the technology is still dependent on the geographical condition of sufficient annual wind velocity.

Pilot Project - Sri Lanka

The PADGO concept has received US$3.6 million funding approval from the Global Environment Facility (GEF) Council for its first pilot in Sri Lanka. Sri Lanka was chosen for the pilot as the country has been developing renewable energy through World Bank projects and its electricity grid coverage ratio of 60% represented significant need. The project will continue the market development activities initiated by the Renewable Energy for Rural Economic Development (RERED) initiative, and build on the good understanding and working relationship developed with the government in the Renewable Energy sector.

IFC is also exploring ways to replicate PADGO in other markets which have the similar enabling regulatory environment and resources, such as Southeast Asia.

5. **Micro-Turbines:** Relatively new technology that is physically compact and offers fuel flexibility, within the capacity range of 250kW range. Commercially available for operation in both isolated and grid-parallel fashion.

6. **Thermo-electric Generators:** Only available in small scale generation in 15-550W range. Semiconductor material and its properties are utilized to produce electricity.

7. **Reciprocating Internal Combustion Engines (RICEs):** Systems available from 5kW to 7MW capacity range. Allows wide variety of biomass fuel flexibility (bagasse, rice husks, farm wastes), it is considered to be one reaching mature among the emerging DG technologies.

8. **Biogas Energy Plant:** Generation capacity available in few kW to 1 MW. Utilizes anaerobic digestion of organic waste matter from communities, animals and farms.

9. **Bagasse Energy Plants:** Utilizes sugar cane stalks, which are produced as a by-product of sugar production. The systems can generate energy either through direct combustion or through steam production.

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