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POLICY BRIEF

OVERCOMING THE OBSTACLES TO DECENTRALIZED ELECTRICITY GENERATION FOR SUSTAINABLE DEVELOPMENT IN LEAST DEVELOPED COUNTRIES

Decentralized electricity systems based on renewable generation technologies and mini-grids — small, self-contained generation and distribution systems serving local populations — have enormous potential to accelerate progress towards universal access to electricity in least developed countries (LDCs), by helping to overcome the historical obstacles of limited urbanization and low population density in rural areas. They could also transform rural economies in LDCs, which would make a considerable contribution towards eradicating poverty (Policy Brief 54). However, realizing this potential means overcoming a number of serious financial, technical, economic and institutional obstacles.

Key points

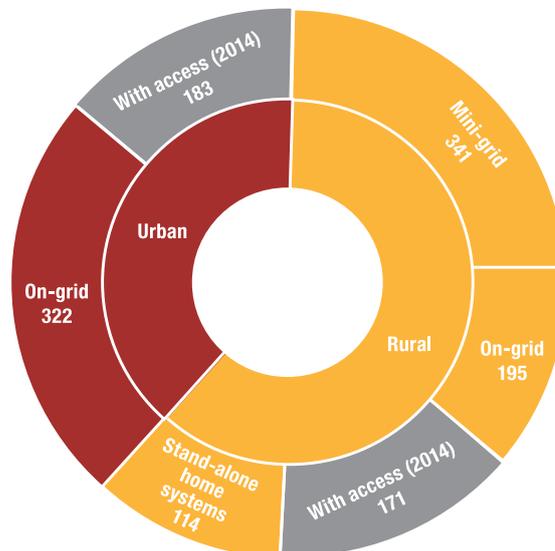
- Decentralized electricity systems can make a major contribution towards increasing access to electricity, transforming rural economies and eradicating poverty.
- There are, however, major economic, financial, technical and institutional obstacles to realizing this potential.
- Measures to address these obstacles are therefore a high priority, for both energy policies and development strategies.

The role of mini-grids

Decentralized electricity systems are critical for achieving universal access to electricity in LDCs by 2030, as envisaged in the 2030 Agenda for Sustainable Development. While around half of the 1 billion people

to whom electricity access would need to be extended to achieve this goal by 2030 might be reached by grid extension, some 450 million people would be dependent on mini-grids or stand-alone systems (see figure).

Indicative targets for LDC population gaining electricity access by 2030 (millions of people)



The scalable nature of renewable energy sources, such as solar photovoltaic and wind, makes them particularly well suited to situations in which demand is initially relatively low, but the potential for growth over time, although uncertain, is potentially very rapid. The use of such renewable energy sources can also make an important contribution to the diversification of the generation mix, which in most LDCs is dominated by fossil fuel generation and hydroelectricity.

By bringing generation closer to users and limiting the distances over which electricity needs to be transmitted, decentralized systems can also help to reduce transmission and distribution losses. This is a particularly important consideration in an LDC context, where such losses are typically very high and rural settlements are generally relatively small and widely dispersed. In most island LDCs, the dispersion of populations across a large number of small islands, many with very small populations, makes a substantial degree of decentralized generation inevitable. It may also provide a means of overcoming logistical obstacles to long-distance transmission of electricity, e.g. in the mountainous terrains of LDCs such as Nepal and Afghanistan.

The challenges

Mini-grids thus play a particularly important role in providing the transformational energy access that is central to reaping the full development benefits of electrification in LDCs (Policy Brief 55). However, the circumstances of LDCs also give rise to particular obstacles to decentralized generation that are often overlooked. While many of these issues also apply, to some degree, to centralized systems, they are accentuated in the case of decentralized systems. If the immense developmental potential of electrification through decentralized systems in LDCs is to be unleashed, measures to address these challenges will be a high priority.

A central concern is financing the considerable investments required for the deployment of mini-grids on this scale. Official development assistance to the energy sector in LDCs currently represents only a small fraction of the investment needed. Domestic public resources are limited, and private investors have shown little appetite for investment, particularly in distribution systems, focusing instead primarily on stand-alone systems.

Limited commercial interest partly reflects the tension between affordability of electricity supplies and the financial viability of investments (Policy Brief 58), which is particularly acute in the case of rural mini-grids. Costs are higher, due to the lack of economies of scale, coupled in some cases with logistical issues, so that cost-reflective tariffs are typically higher than for grid-supplied electricity. Purchasing power, and hence demand, is constrained by the particularly high incidence and severity of poverty, particularly in remote rural communities.

Commercial investment is further deterred by the particularly high levels of risk and uncertainty surrounding mini-grids, due to wide local variations in the cost-effectiveness of alternative generating technologies and uncertainty about long-term demand prospects. Mini-grids also need to be individually designed according to the specific conditions of the particular locality, further increasing both the costs and the need for technical skills.

Mini-grids present challenges to regulators as well as to investors. Effective regulation is essential, not only to address issues such as supply standards, safety and fee collection, but also to ensure consistent technical specifications to allow future interoperability of mini-grids with the grid. Given the considerable number and dispersion of mini-grids that would be required to achieve universal access in

most LDCs, these regulatory needs give rise to issues of institutional arrangements, the availability of the necessary technical skills and financial costs.

Additional issues arise in locations such as peri-urban and unserved urban areas, where mini-grids represent a stepping stone towards later grid connection, rather than an optimal long-term means of transformational energy access. The possibility of future grid extension leading to competition with lower-cost grid supplies can represent a major threat to the long-term profitability of investments in mini-grids, especially where revenues are limited in the early stages of operation due to low demand.

Policy implications

Challenging as they undoubtedly are, these obstacles will need to be overcome if LDCs are to achieve universal access to electricity, or — given the essential role of access to modern energy — structural transformation of their economies and poverty eradication. A number of policy approaches can contribute to this, including:

- Making soft loans or grants available for investment in mini-grids, e.g. through development banks (though likely financed from external sources);
- Embedding rural electrification plans in overall rural development strategies, to promote productive use of electricity, coordinate increases in electricity supply and demand, and thus harness the energy–transformation nexus (Policy Brief 54);
- Establishing public (e.g. health or educational) facilities, or promoting the development of productive activities to provide an anchor load;
- Establishing a clear and transparent long-term plan for widening grid access and favourable arrangements and terms for mini-grid providers in the event of grid connection, to reduce investor uncertainties;

- Collecting relevant information on local renewable energy resources, settlement patterns and demand prospects, and disseminating such information as a public good (including for other purposes, such as water provision and rural development);
- Providing training to ensure the availability of the skills required, both for the design, installation, operation and maintenance of mini-grids, and for effective management, regulation and policy-making;
- Establishing decentralized regulatory structures suited to the regulation of a multiplicity of mini-grids dispersed across the entire national territory, both in development (to ensure system compatibility and interoperability) and during operation;
- Promoting the establishment of community cooperatives to operate mini-grids (e.g. in the allocation of public resources for electrification) and establishing protocols for their operation, as a means of making provision more responsive to local needs and reducing (though by no means eliminating) the need for regulation; and
- Promoting mutual learning and experience-sharing within and between LDCs (and with other developing countries, including through South–South cooperation) in relation to business models and technical aspects of mini-grid design, installation and operation.

Additional reading

UNCTAD (2017). *The Least Developed Countries Report 2017: Transformational Energy Access*. United Nations publication. Sales No. E.17.II.D.6. New York and Geneva.

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