

From least-cost plans to implementable electrification: A regulatory–financial framework to achieve universal access

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Abstract-

Achieving universal electricity access requires more than a least-cost electrification plan. In many low- and middle-income power sectors, affordability constraints, distressed distribution utilities, and high perceived risk prevent least-cost pathways from being implemented by raising the cost of capital. This paper develops an integrated regulatory–financial framework that completes least-cost planning by linking: (i) techno-economic analysis across grid and off-grid options; (ii) implementable business models under cost-of-service regulation; and (iii) a financing architecture that coordinates public resources, concessional instruments, and commercial capital through a centralized platform that pools and ring-fences flows and disbursement rules. The results separate two implementation constraints. The first is the “viability gap”, the shortfall between realized cash revenues and the regulated cost of service when affordability and weak retail performance prevent full annual recovery. The second is “financing needs”, which arise because electrification requires large upfront investment, while cost recovery occurs gradually, even when the plan is viable in the long run. The framework clarifies the policy levers: viability gaps require explicit and predictable compensation mechanisms, while financing needs require capital structures, tenors, and liquidity facilities aligned with the regulatory recovery schedule and allowed returns sufficient to cover financing costs and preserve equity value. The approach provides a transferable methodology for regulators and policymakers to move from least-cost targets to implementable electrification programs with revenue adequacy and financeable cash-flow trajectories. It is illustrated with applications in Rwanda and Uganda, showing how the same logic can be parameterized across institutional forms to support universal access.

Index Terms- Universal electricity access; Infrastructure investment; Public-private partnerships; Cross-subsidization; Cost-of-service regulation

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