GEOSPATIAL PORTFOLIO PLANNING

MINI GRIDS FOR HALF A BILLION PEOPLE

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10 building blocks to deploy mini grids at scale

Where We Are Today

47 million people connected to **19,000 mini grids,** mostly hydro and diesel-powered, at an investment cost of **$28 billion**. *Plus: 7,500 mini grids planned, mostly in Africa, mostly solar-hybrid, connecting more than 27 million people at an investment cost of $12 billion.*

Where We Want to Be to Reach Universal Access by 2030

490 million people served at least cost by **210,000 mini grids,** mostly solar-hybrids, requiring an investment of **$220 billion.**

10 Building Blocks need to be addressed in countries to deploy mini grids at scale: (i) solar-hybrid technology and costing, (ii) geospatial portfolio planning, (iii) income-generating uses of electricity, (iv) community engagement, (v) local and international industry, (vi) access to finance, (vii) training and skills-building, (viii) institutional framework, (ix) workable regulations, and (x) enabling business environments.

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Why geospatial planning, why now?

- Technological advances and cost reductions in satellite imaging and machine learning
- Increased sophistication of algorithms and analytical software
- Proliferation of global positioning system (GPS) devices and Web-based and mobile technologies
- Availability of high-quality open-source software
- Accessibility of big data and cloud-based computing

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National Least-Cost Electrification Planning

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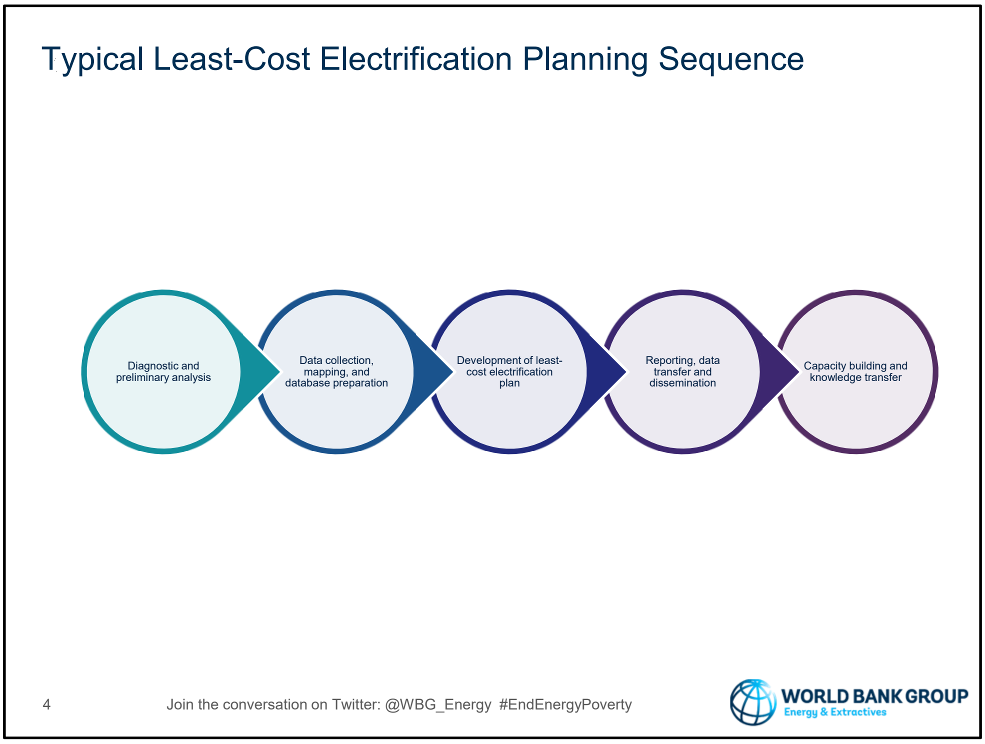
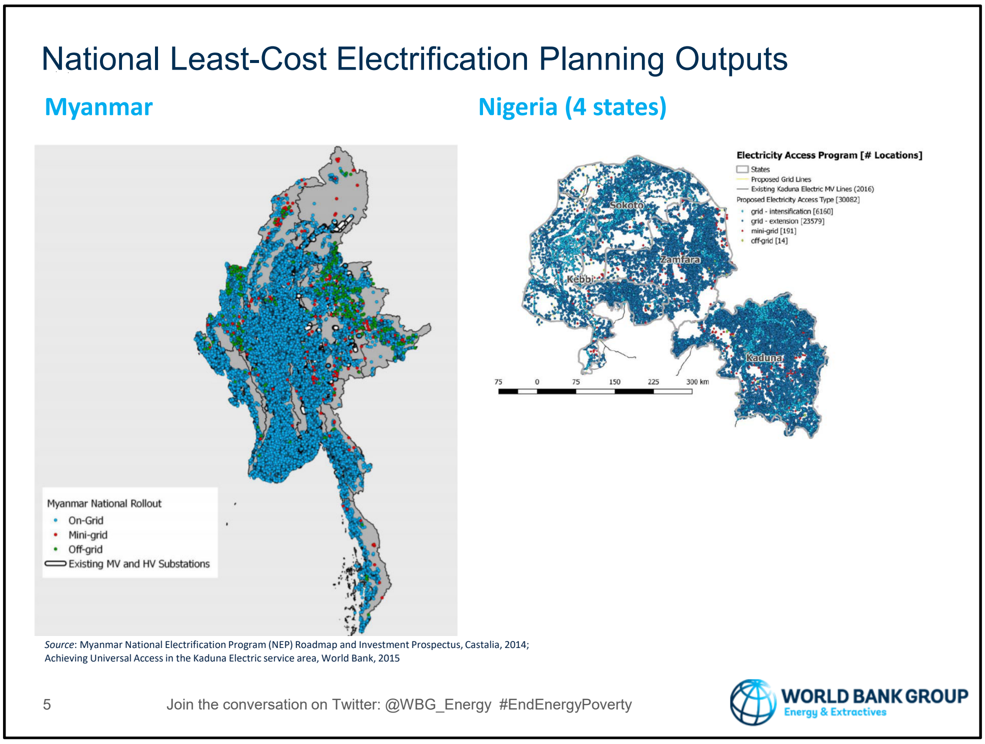


Even though these national plans for the first time in history include all options for electrification—grid extension, mini grids, and off-grid—they still rely to some extent on chosen input assumptions that can result in a more advantaged position of one solution over the other. It is important that, during the preparation of these plans, the different stakeholders are carefully consulted so that the ultimate outcome is carried out by as many stakeholders as possible. Countries using advanced geospatial analysis to develop national electrification plans include Ethiopia, Kenya, Myanmar, Nigeria, and Rwanda.

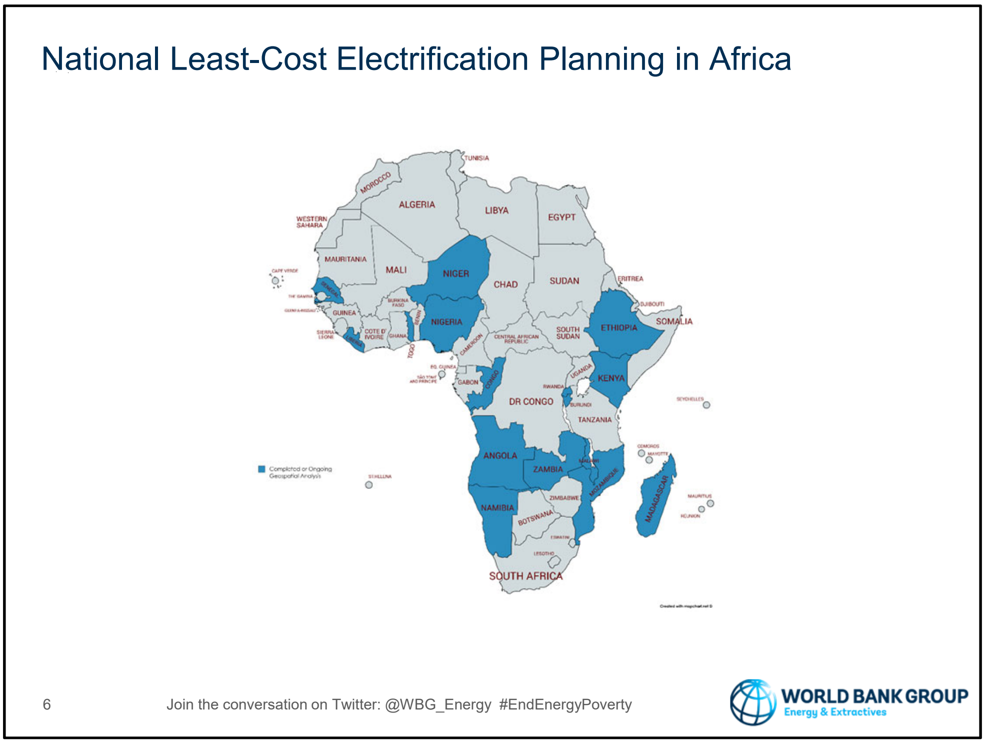


Countries are using geospatial analysis to develop national electrification plans that clearly delineate areas for mini grids (figure ES.5). Through a geospatial approach to national electrification planning, the

existing grid network is mapped and its attributes are digitalized. The supply of and demand for electricity are geo-located and overlaid with supporting data, including demographic (population density and growth

patterns); social infrastructure (schools, health centers, churches, administrative offices); and economic (household income, poverty, commercial activities, willingness to pay) data. Spatial modeling then delivers a

least-cost plan that identifies the optimal grid or off-grid technology—technology that is tailored to local circumstances, technically feasible, and economically viable.



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Mini Grid Portfolio Planning

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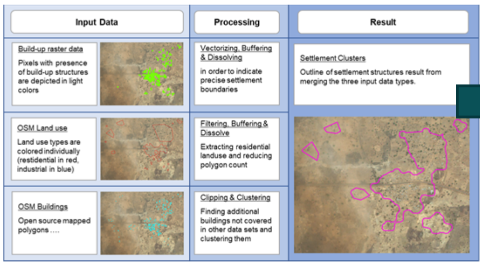
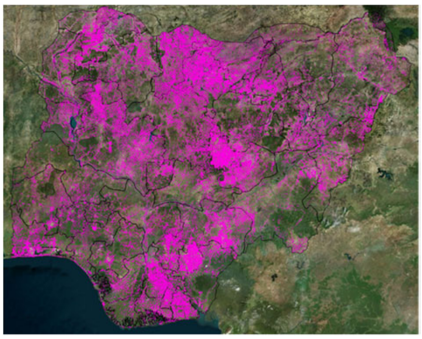
Site Identification and Prioritization



Source: RLI and Integration



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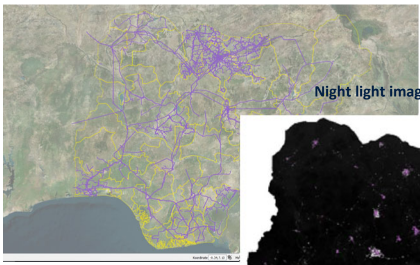
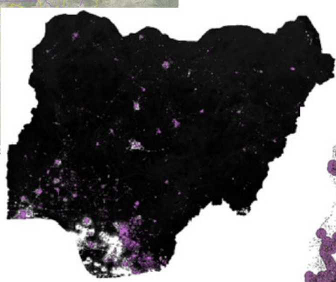
Site Identification and Prioritization

Map of available geospatial grid data coverage in Nigeria

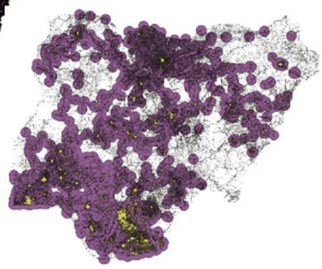


Source: https://energydata.info

Night light imagery of Nigeria



20-kilometer buffer zones



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Site Identification and Prioritization

Additional socio-economic data available for entire Nigeria are number of schools, health facilities and telecom towers currently relying on diesel generators.

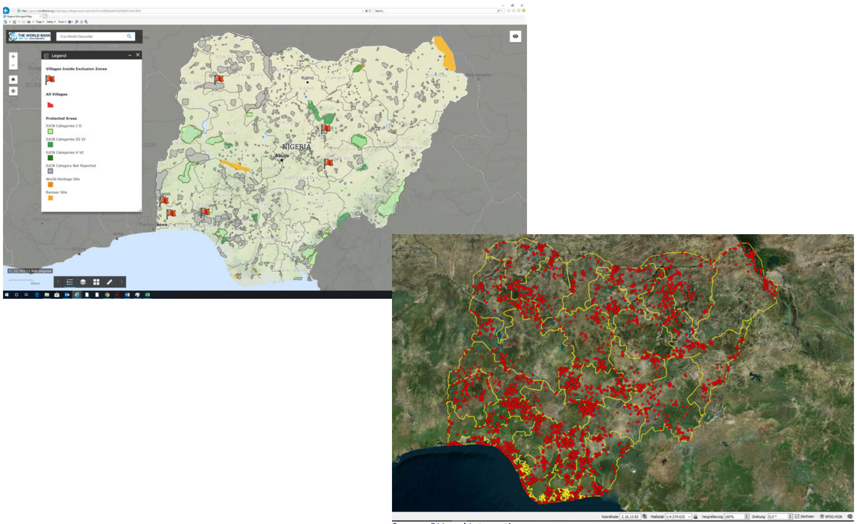
Exclusion Criteria:

- Exclusion of sites with distance to grid <5km
- Exclusion of sites with population < 1,000
- Exclusion of sites that fall within protected areas, national parks and other ecologically sensitive zones

Prioritization Criteria:

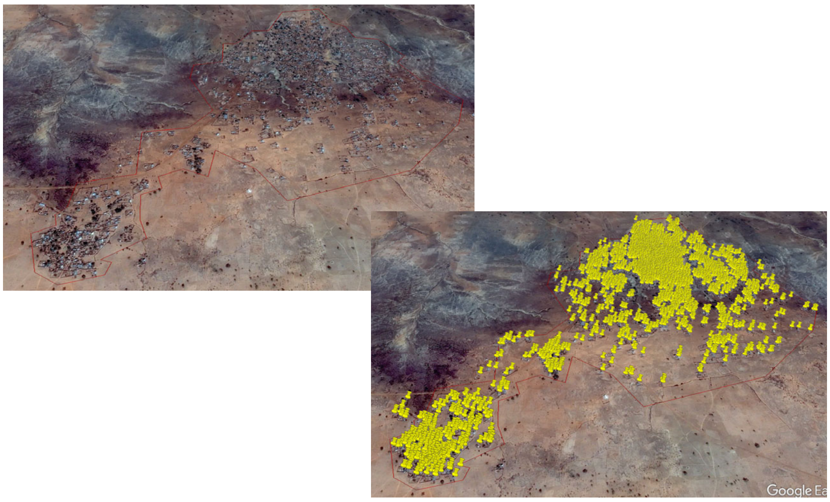
- Ranking of sites based on population, density, schools, health facilities, distance to grid, anchor customers.

Site Identification and Prioritization

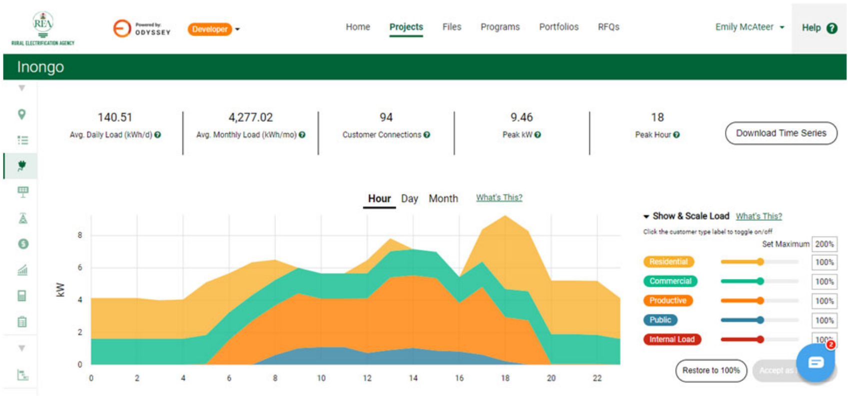


Source: RLI and Integration

Customer Mapping



Survey Data Collection and Load Modeling



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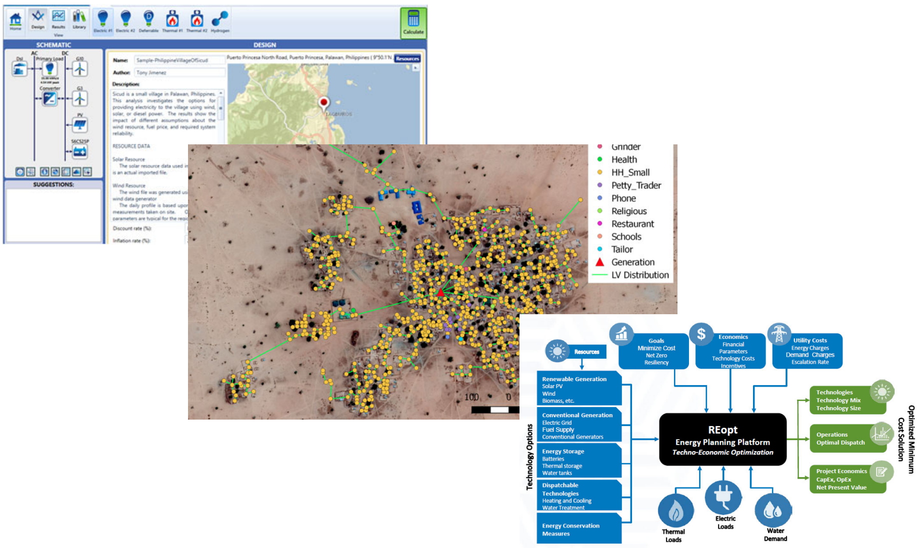
System Optimization



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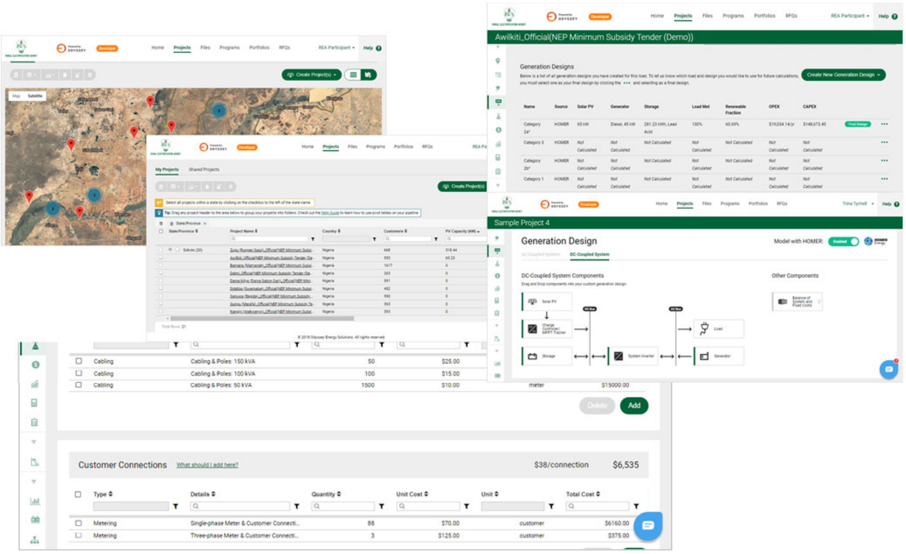
Online Platform



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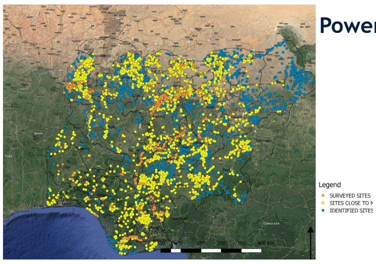
Private Developer Initiatives

Powerhive



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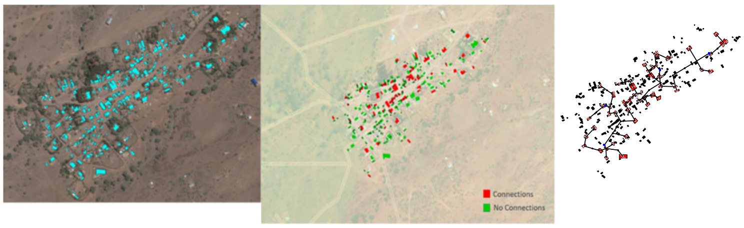

Conclusions

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Impact of Geospatial and Digital Tools

- Significant **reduction in pre-investment costs** associated with mini grid development
- **Unprecedented scale** possible because of the low costs involved
- **Swifter speed** compared to traditional approaches that require the deployment of multi-disciplinary teams at considerable expense
- Experience from Nigeria suggests mini grid portfolio planning already feasible at a cost of approximately $2300 per site, with scope for further cost reduction

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Thank You

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