Green Power for Mobile

Green Power Evaluation Tool
Country Financial Viability Assessments

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Green Power Evaluation Tool Summary

What is the Green Power Evaluation Tool (GPET)?

- GPET is a model that conducts an assessment of the financial & technical feasibility for using wind, solar or hybrid wind/solar solutions across a specific country. It performs a financial comparison against a base case of a diesel generator running continuously. It uses NASA weather data as the basis for assessment of available renewable resource. The tool uses Monte Carlo analysis to simulate all latitude/longitude locations in country, and to vary specific input parameters: base station site load & delivered diesel price. It then exports metrics for assessing financial viability of using green power solutions within the selected country, for example, payback period in comparison to the diesel generator base case.

When should GPET be used?

- GPET is suitable to perform high level assessments of whether there is an economic case for using green power solutions within a country. It allows operators to identify whether there is a case for further investigation into using green power. GPET is not suitable for specifying single site locations. This is due to the following reasons:
- The model uses NASA weather data which has coarse resolution. Data confidence for wind is lower than solar as it doesn't incorporate topographic affects.
- The process for selecting between technologies and sizing the required solution is complex. GPET uses high-level rules of thumb for specifying and sizing a system based on the NASA data - as such sites are normally specified conservatively. The HOMER tool is an advanced and comprehensive tool for specifying single site locations and should be used to specify single sites accurately.

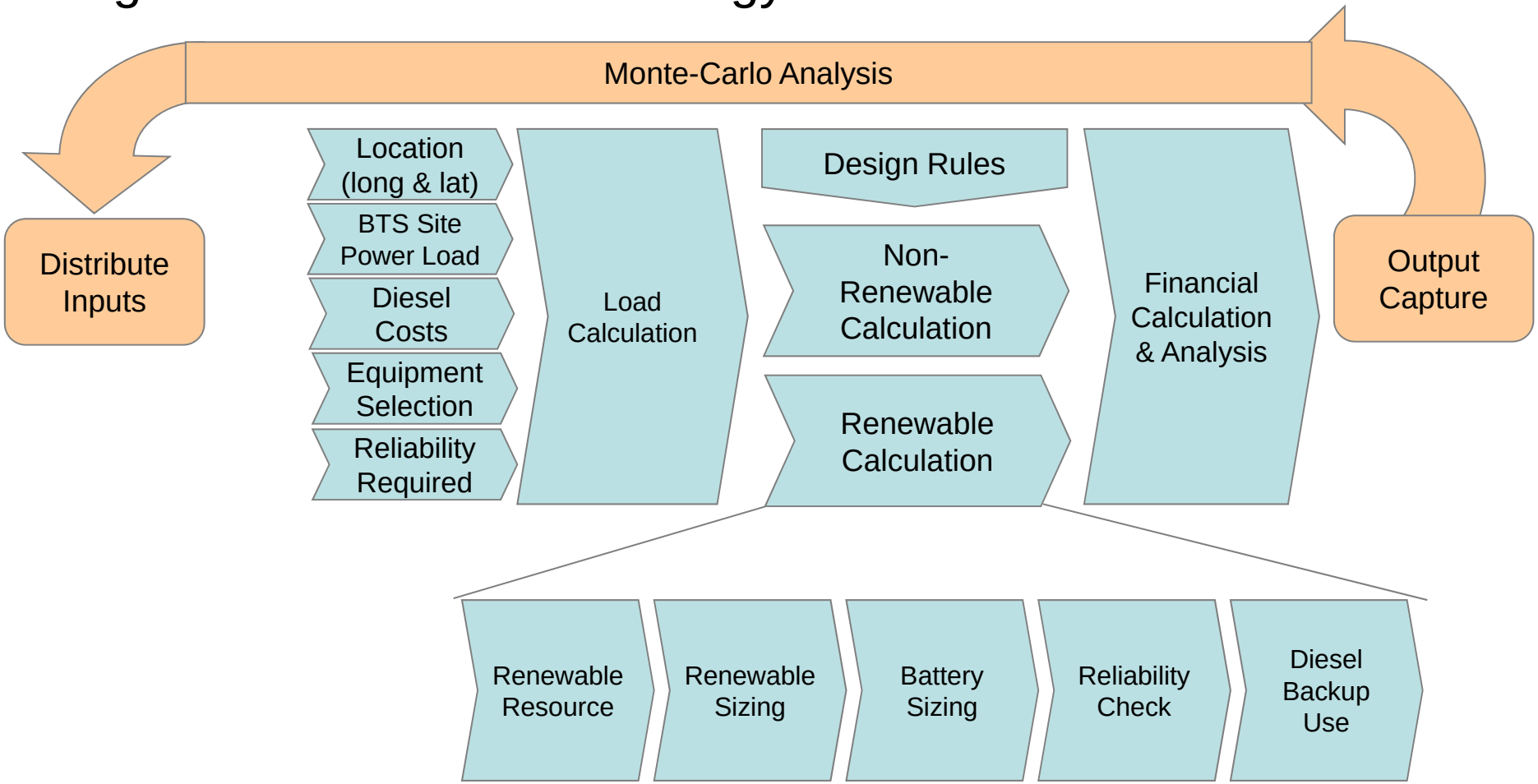
How do I use GPET?

- The financial analysis results from GPET are available for a selection of countries as found in this document.

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High Level Model Methodology



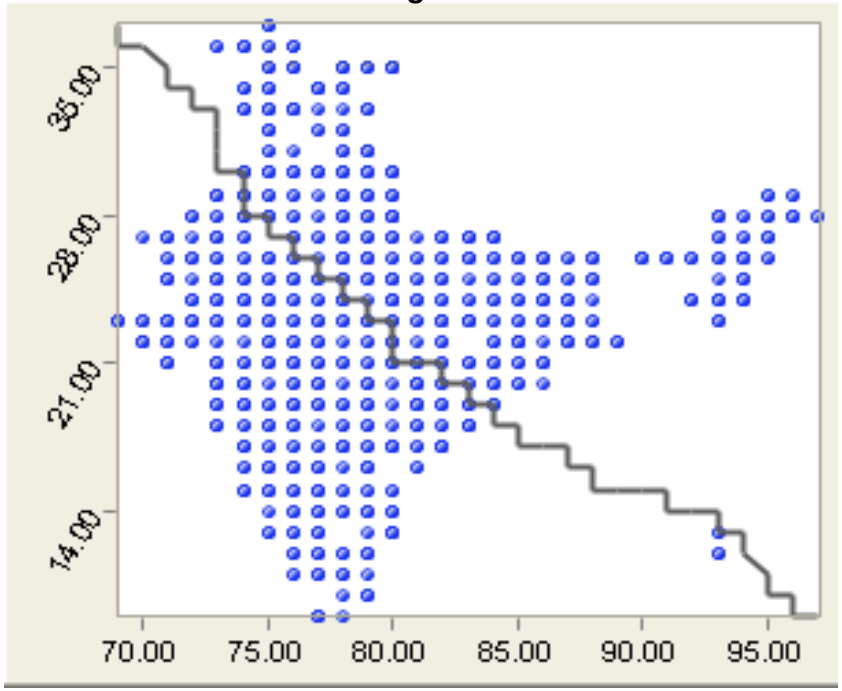
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Monte Carlo Inputs – Location

- Site Location:
  - Country is specified
  - Model uses Monte Carlo analysis to simulate all latitude & longitude locations in that country
  - Model uses NASA weather data to calculate renewable resource

Examples Site Locations in India based on Latitude/ Longitude Intersections



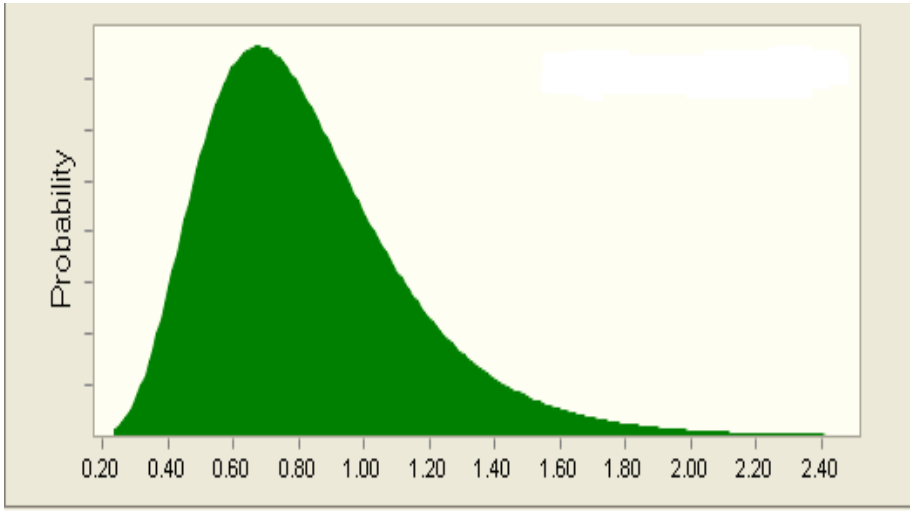
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Monte Carlo Inputs – Diesel Price

- Retail Diesel Price:
  - User specifies country
  - Model simulates retail diesel price according to probability curve on right
  - Mean retail diesel price is set depending on country
  - Standard deviation of retail diesel price is constant for all countries
- Diesel delivery price:
  - This is calculated as an additional 1/3 of retail diesel price

Example Diesel Price Distribution Curve



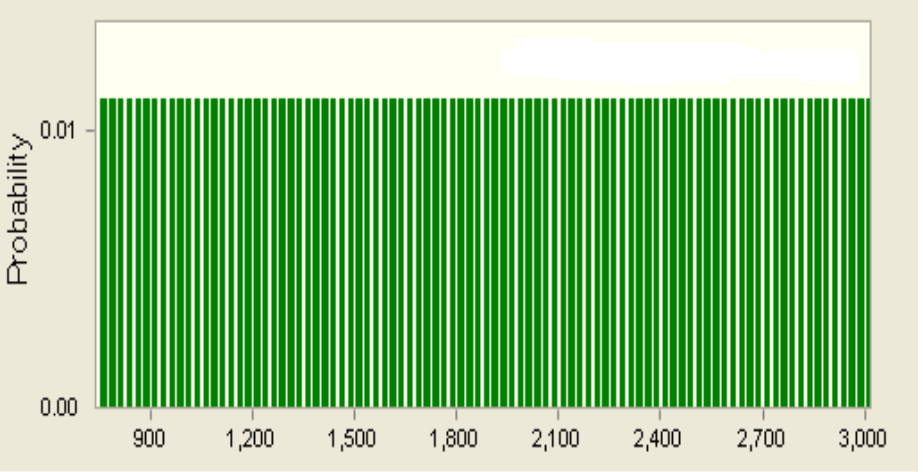
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Monte Carlo Inputs – Base Station Site Load

- Base Station Site Load:
  - Model simulates base station site load by randomly selecting between 750W-3000W
  - Model simulates base station site load according to probability curve on right, so that all options have equal probability
  - The model can be adapted to specific probabilities of site loads to simulate specific networks

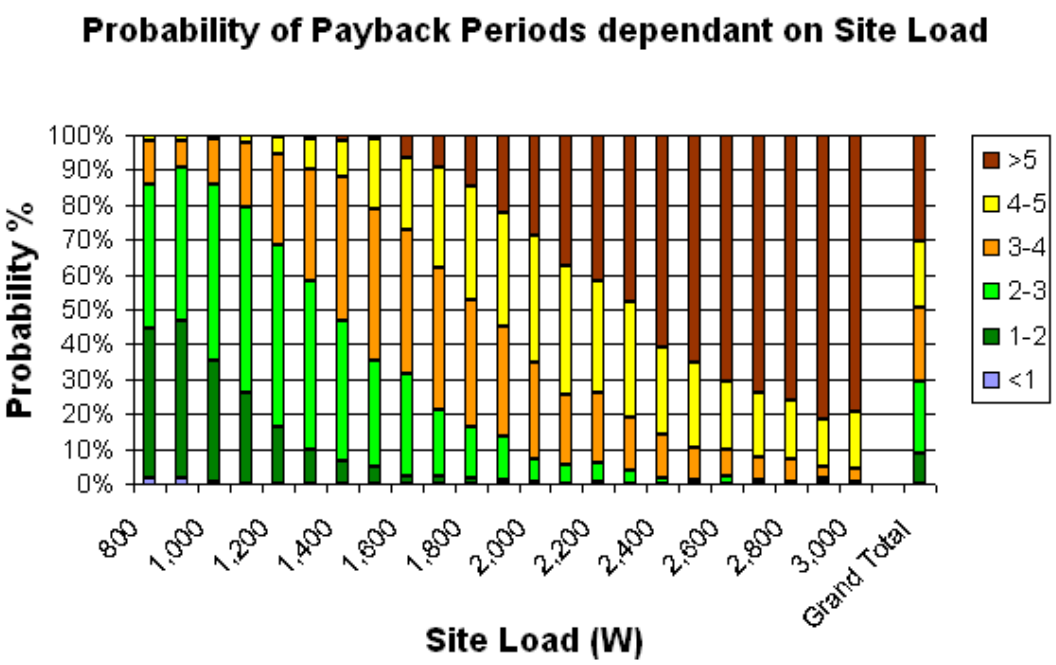
Base Station Site Load Distribution Curve



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Kenya Financial Viability - Payback Period – Large Battery Reserve



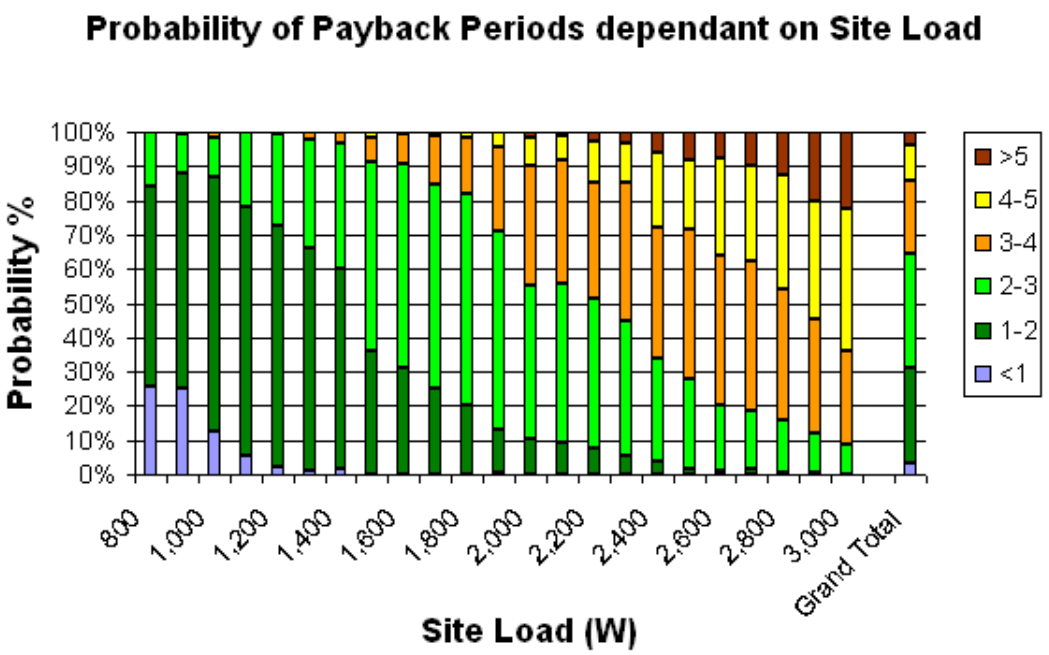
Retail price of diesel (US$) *	1.7
Battery Reserve (days)	3
Probability of GP BTS payback within 3 years (%)	29.2
Probability of GP BTS payback within 5 years (%)	69.6

* Source: GSMA Member Operators

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Kenya Financial Viability - Payback Period – Small Battery Reserve



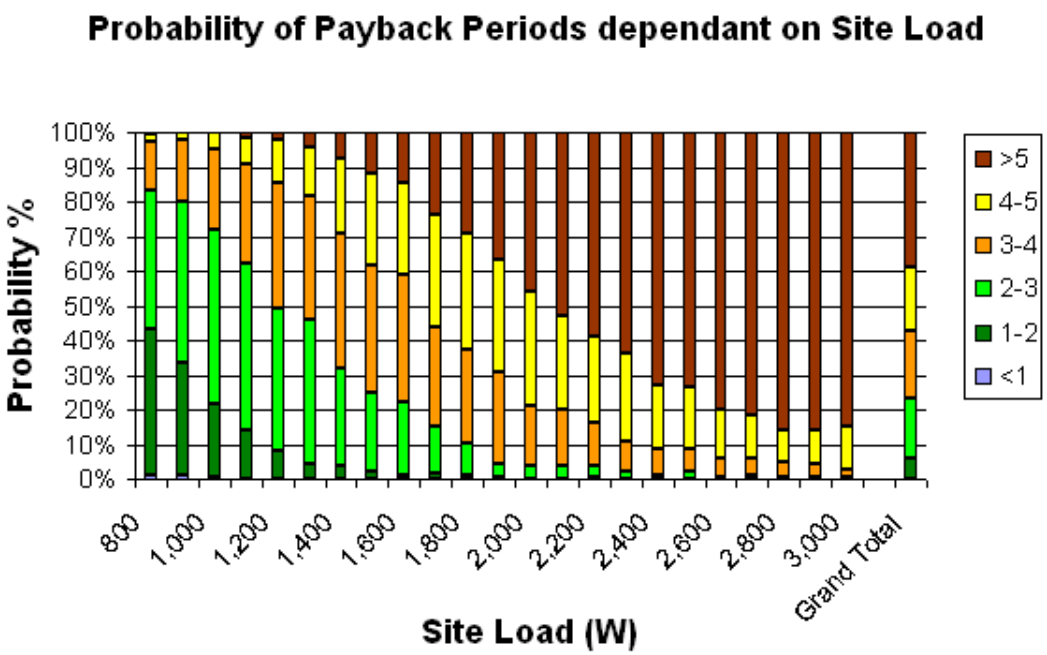
Retail price of diesel (US$) *	1.7
Battery Reserve (days)	1
Probability of GP BTS payback within 3 years (%)	64.3
Probability of GP BTS payback within 5 years (%)	96.2

* Source: GSMA Member Operators

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Uganda Financial Viability - Payback Period – Large Battery Reserve



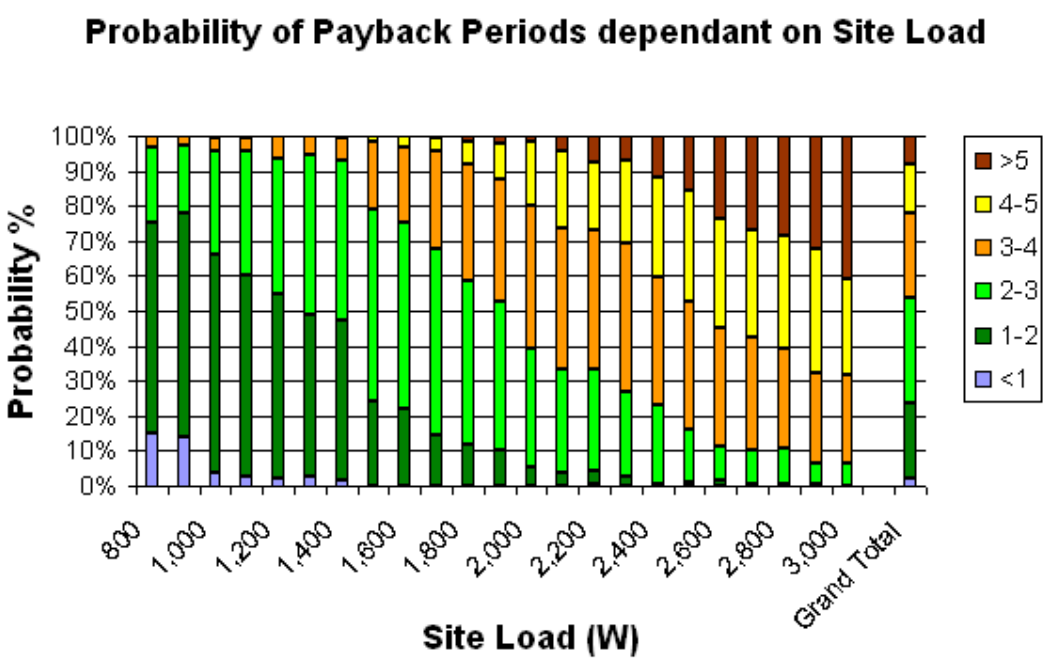
Retail price of diesel (US$) *	1.56
Battery Reserve (days)	3
Probability of GP BTS payback within 3 years (%)	23.2
Probability of GP BTS payback within 5 years (%)	61.1

* Source: GSMA Member Operators

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Uganda Financial Viability - Payback Period – Small Battery Reserve



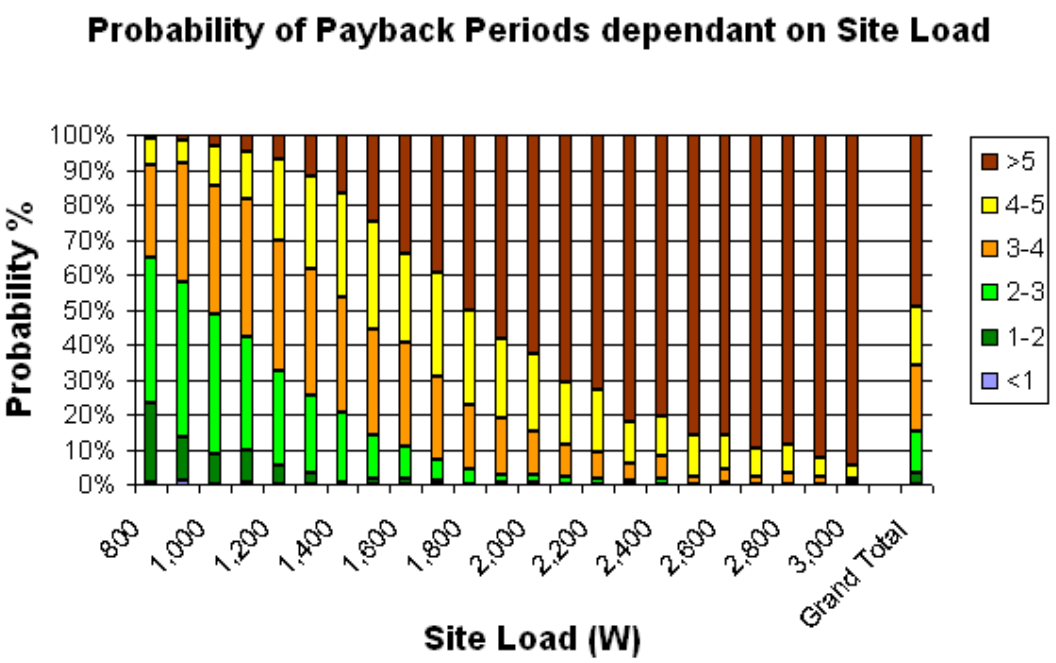
Retail price of diesel (US$) *	1.56
Battery Reserve (days)	1
Probability of GP BTS payback within 3 years (%)	53.8
Probability of GP BTS payback within 5 years (%)	91.2

* Source: GSMA Member Operators

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South Africa Financial Viability - Payback Period – Large Battery Reserve



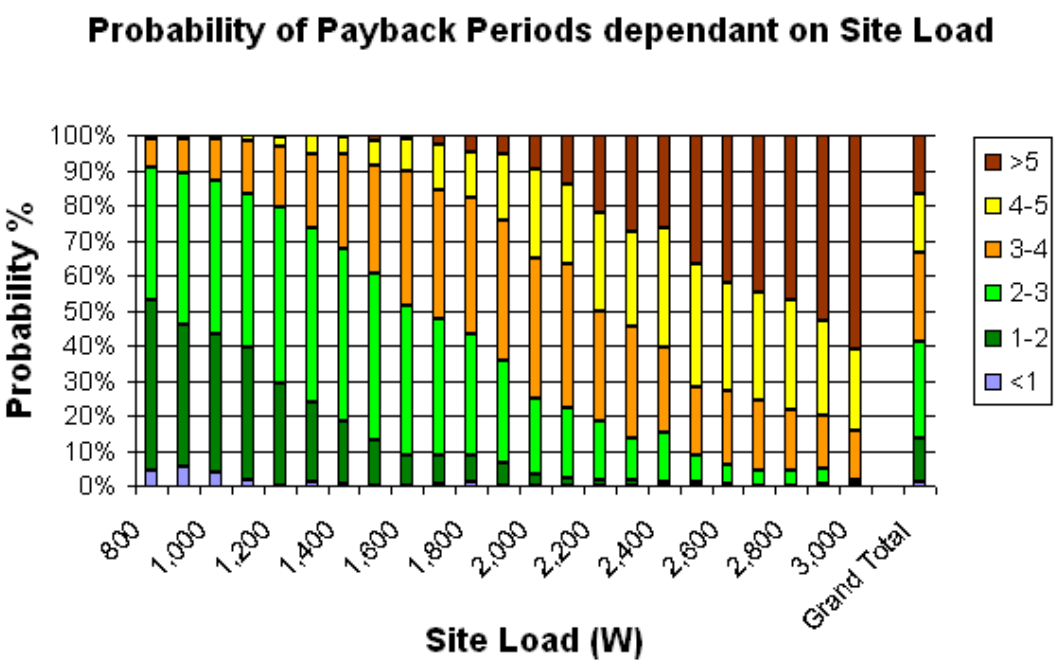
Retail price of diesel (US$) *	1.47
Battery Reserve (days)	3
Probability of GP BTS payback within 3 years (%)	15.3
Probability of GP BTS payback within 5 years (%)	50.8

* Source: GSMA Member Operators

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South Africa Financial Viability - Payback Period – Small Battery Reserve



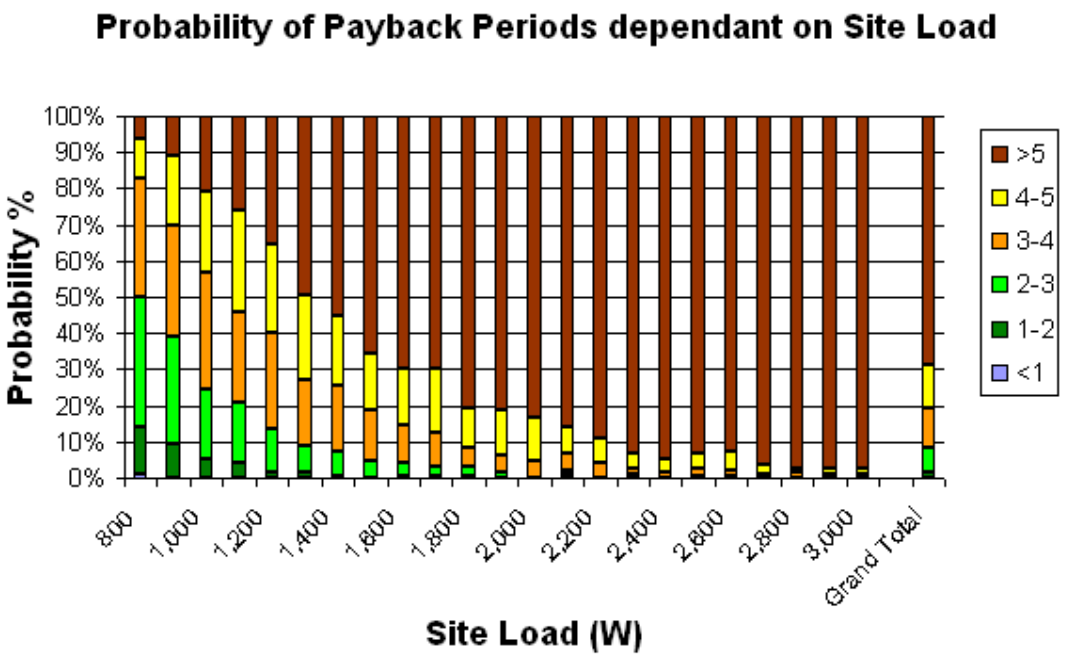
Retail price of diesel (US$) *	1.47
Battery Reserve (days)	1
Probability of GP BTS payback within 3 years (%)	41.25
Probability of GP BTS payback within 5 years (%)	83.5

* Source: GSMA Member Operators

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India Financial Viability - Payback Period – Large Battery Reserve



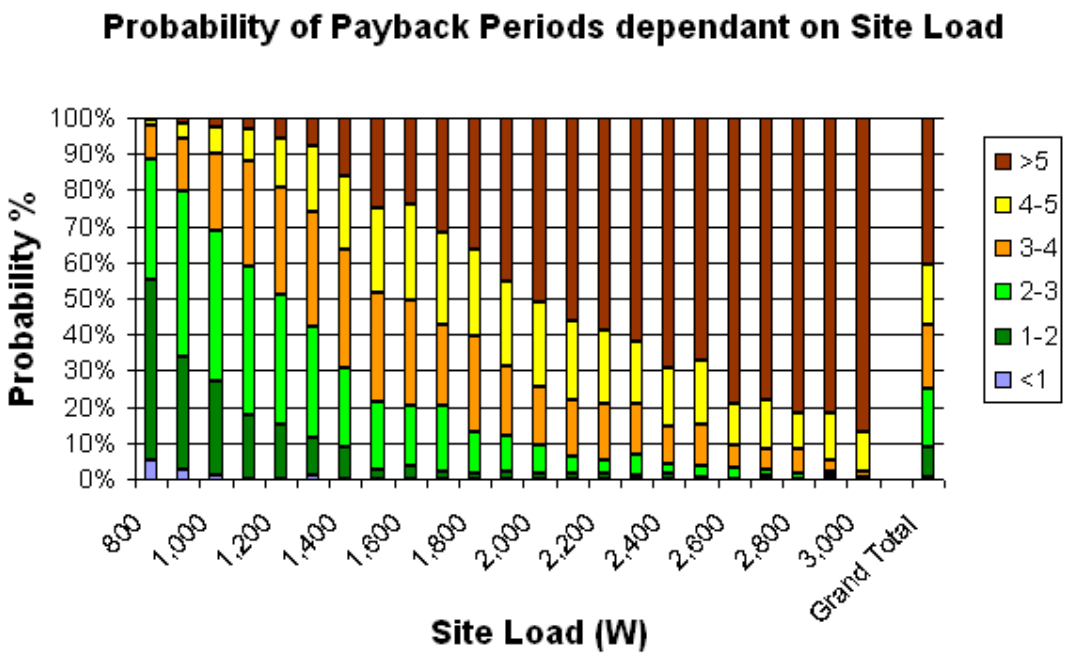
Retail price of diesel (US$) *	1.13
Battery Reserve (days)	3
Probability of GP BTS payback within 3 years (%)	8.2
Probability of GP BTS payback within 5 years (%)	31.3

* Source: GTZ extrapolated to 2008

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India Financial Viability - Payback Period – Small Battery Reserve



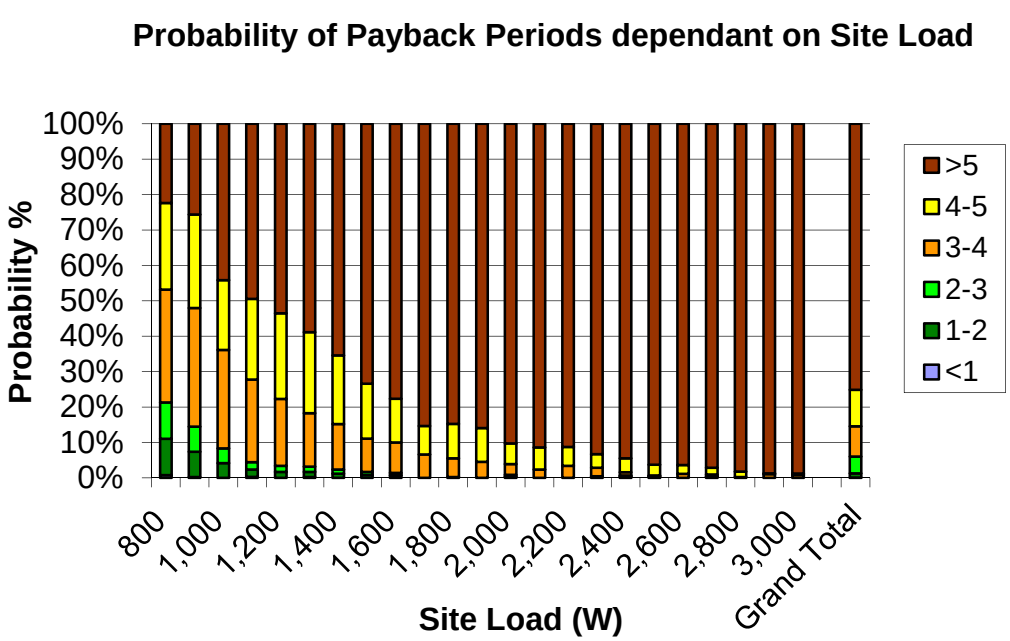
Retail price of diesel (US$) *	1.13
Battery Reserve (days)	1
Probability of GP BTS payback within 3 years (%)	24.9
Probability of GP BTS payback within 5 years (%)	59.2

* Source: GTZ extrapolated to 2008

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Philippines Financial Viability - Payback Period – Large Battery Reserve



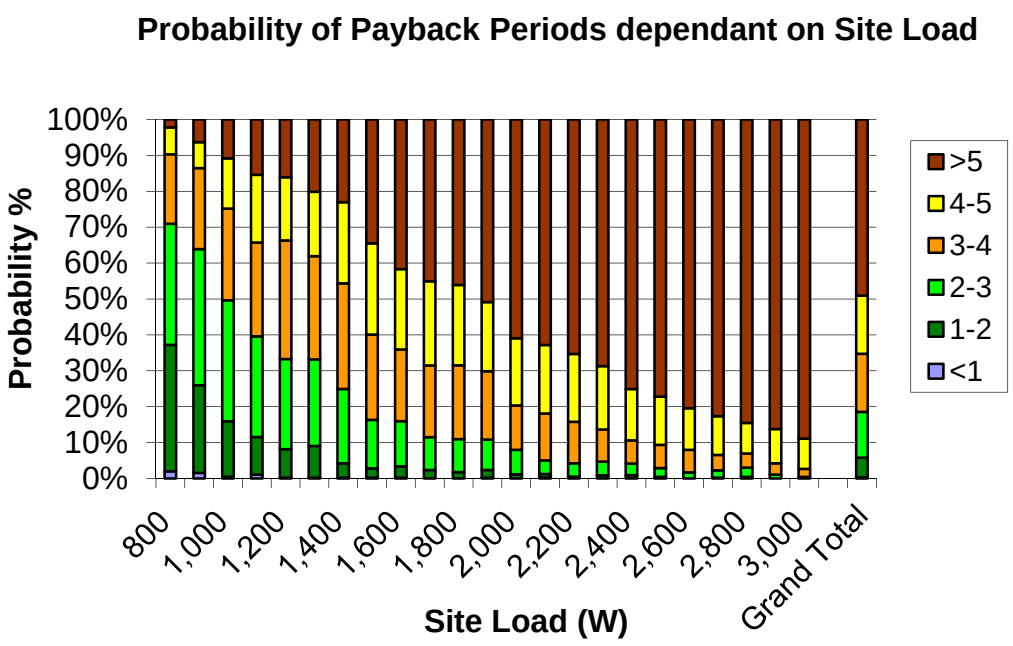
Retail price of diesel (US$) *	1.01
Battery Reserve (days)	3
Probability of GP BTS payback within 3 years (%)	6
Probability of GP BTS payback within 5 years (%)	24.9

* Source: GTZ extrapolated to 2008

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Philippines Financial Viability - Payback Period – Small Battery Reserve



Retail price of diesel (US$) *	1.01
Battery Reserve (days)	1
Probability of GP BTS payback within 3 years (%)	18.6
Probability of GP BTS payback within 5 years (%)	50.9

* Source: GTZ extrapolated to 2008

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Key Points

- High site load lengthens payback period
- High diesel price shortens payback period
- Reducing the battery reserve requirement shortens payback period. Example situations of this include:
  - Uptime reliability can be lowered, for example, the BTS site is not part of a backbone ‘daisy chain’ link
  - The renewable resource is very consistent
  - The diesel generator is used more frequently to provide backup power

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Next Steps

- Expand the number of countries analysed
- Obtain more specific values for diesel price and BTS site load distribution from operators
- Use the model to investigate:
  - Carbon credit opportunity
  - Unreliable grid situations
  - Impact on economics of increasing diesel generator use
  - Business case for upgrading BTS site to modern, efficient equipment before installing green power

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