GET.invest
Mobilising Renewable Energy Investments

Nigeria: Powering Electric Mobility

Model Business Case: Urban E-Mobility Business

INTRODUCTION

This Model Business Case (MBC) analyses the financial viability of a hypothetical company that offers two-wheel electric vehicle (EV) rental and operates a network of smart EV battery swapping stations in urban areas in Nigeria ("the Company"). The Company procures, owns and rents out the two-wheel EVs and additional batteries daily to certified taxi and delivery drivers. It also builds and operates the battery swapping station network for the EVs. It is assumed that the swapping stations are powered by hybrid solar PV-battery systems and the national grid.

TARGET AUDIENCE

A detailed financial analysis of the first 10 years of the Company was conducted to determine its profitability and its ability to adequately service debt while providing attractive returns to investors. The target audience of this MBC includes (but is not limited to):

- **Entrepreneurs** who may be interested in starting a new e-mobility company in Nigeria;
- **Potential investors** who may be interested in financing a new e-mobility company in Nigeria; and
- **Government officials, development partners and financiers** who may be interested in understanding the quickly-emerging EV market in Nigeria to inform the development or improvement of supporting policies and programmes.

This MBC is accompanied by a Developer Guide, which aims to inform key stakeholders about opportunities in the e-mobility sector in Nigeria and a second MBC that analyses a rural mini-grid-powered e-mobility project.

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KEY ASSUMPTIONS

This MBC is based on several assumptions, which are described below. The assumptions presented in this analysis are mainly based on publicly available information gathered through desk research as well as interviews with stakeholders in Nigeria and Uganda.[1] A detailed feasibility study would be required to determine the actual applicable costs and operational parameters for a specific business.

TABLE 1. Technical assumptions

PARAMETERS	UNIT	VALUE
Average number of EVs per swapping station	#	50[2]
Daily EV utilisation rate	%	75%[3]
Average number of EVs rented daily per station	#	38[4]
Average distance travelled per rental	km	100[5]
Average EV fleet efficiency	Wh/km	53[6]
Daily electricity consumption per rental	kWh/day	5.3[7]
Total daily swapping station load	kWh/day	201.4[8]
% of swapping station load supplied by solar	%	40%[9]
Base daily solar yield	kWh/kWp/day	4.0[10]
Annual PV module degradation	%	0.5%[11]
Average capacity of solar PV system per station	kWp	21.1[12]
EV battery size	kWh	3.6[13]
Number of batteries deployed per EV	#	2.15[14]
% of EV renters requiring battery swap	%	100%[15]
Average no. of battery swaps per station per day	#	38[16]

1) Stakeholders in Uganda were interviewed to gather relevant data from the traction gained in the country's e-mobility market.
2) Stakeholder consultations, 2023.
3) Stakeholder consultations, 2023.
4) Derived by multiplying the average number of EVs per swapping station by the daily vehicle utilisation rate.
5) Stakeholder consultations, 2023.
6) Allee, A., Sherwood, J., and Schroeder, J., "Powering Small-Format Electric Vehicles with Mini-grids: Assessing the Viability of Two- and Three-Wheeled EVs for Rural Mobility," Shell Foundation and Factor[e] Ventures, (April 2022): https://rmi.org/wp-content/uploads/dlm_uploads/2022/04/powering_small_format_electric_vehicles_with_minigrids.pdf
7) Derived by multiplying the average distance travelled per rental by the average EV fleet efficiency.
8) Derived by multiplying the number of EVs rented daily per station by the daily electricity consumption per rental.
9) Assuming that 40% of the total energy needs of each swapping station is covered by a solar-battery hybrid system while the remaining 60% is covered by grid power supply.
10) https://solargis.com/maps-and-gis-data/download/nigeria
11) "Uganda: Captive Power - Model Business Case: Solar PV for Commercial and Industrial Facilities," GET.invest Market Insights, (2020): https://www.get-invest.eu/wp-content/uploads/2020/11/GETinvest-Market-Insights_UGA_Captive_MBC-Facilities_2019.pdf
12) Computed based on the assumed swapping station load to be covered by solar power, the assumed solar yield and expected PV module degradation.
13) Allee et al., 2022.
14) Stakeholder consultations, 2023.
15) Stakeholder consultations, 2023.
16) Derived by multiplying the number of EVs rented daily per station by the percentage of renters requiring battery swaps.

Company structure assumptions

The Company is assumed to be an e-mobility business that imports two-wheel EVs and smart EV batteries from an OEM that manufactures high-quality two-wheel EVs and lithium-ion batteries with a battery management system (BMS) microchip that integrates the battery with Internet-of-Things (IoT). The BMS allows locking and unlocking of e-motorcycles, GPS tracking, and battery health monitoring. The Company pays an annual fee to its technology partner for software services that enable remote monitoring and control of the rented EVs and payment collection.

The Company is also integrated with local mobile money payment platforms to collect payments for e-motorcycle rentals and battery swaps from its customers – the EV drivers. The Company hires local staff in different cities to directly handle daily on-the-ground operations. It is assumed that the Company does not have previous experience or existing operations in Nigeria and is just starting up.

Technical assumptions

Table 1 presents the assumptions related to the technical parameters of the two-wheeled EVs, the battery-swapping station network and the customer demand characteristics.

Macroeconomic assumptions

For this analysis, the Nigerian naira (NGN) to EUR exchange rate is assumed to be 1356.75,[17] while the annual NGN to EUR depreciation is assumed to be 10%.[18] Annual inflation is assumed to be 20% based on projections for the country.[19]

Sales growth assumptions

It is assumed that within 10 years, the Company will deploy a total fleet of 50,000 two-wheel EVs and 1,000 swapping stations across Nigeria. Based on this, **Table 2** presents the Company's year-on-year growth assumptions over the analysed 10-year period.

TABLE 2. Annual growth assumptions, 2024-2033

INDICATOR	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
New EVs deployed[20]	250	1,200	2,500	4,000	5,750	7,000	7,000	7,000	7,650	7,650
Cumulative EV fleet size	250	1,450	3,950	7,950	13,700	20,700	27,700	34,700	42,350	50,000
New additional smart batteries deployed [21]	288	1,380	2,875	4,600	6,613	8,050	8,050	8,050	8,798	8,798
Cumulative additional smart batteries deployed	288	1,668	4,543	9,143	15,755	23,805	31,855	39,905	48,703	57,500
New swapping stations launched[22]	5	24	50	80	115	140	140	140	153	153

17) Based on April 7, 2024 exchange rate.
18) https://www.bodeagusto.com/post/nigeria-exchange-rate-management
19) Nigeria Inflation Rate, Trading Economics: https://tradingeconomics.com/nigeria/inflation-cpi
20) These are hypothetical values assuming the Company grows at a moderate pace from year-to-year but at a declining rate as the market becomes saturated.
21) Derived by multiplying the number of additional batteries required per EV by the fleet size.
22) Derived by dividing the number of new EVs deployed by the average number of EVs per swapping station.

Capital cost assumptions

Table 3 presents the capital cost assumptions for the Company's assets. All cost estimates provided are inclusive of procurement costs, shipping costs, import duty, and value-added tax (VAT). The equipment costs are assumed to reduce by 3% annually as global prices drop. The EVs are depreciated over a lifespan of 4 years at a rate of 25% per year, the batteries are depreciated over 5 years at a rate of 20% per year, while the other capital costs are depreciated over 10 years at a rate of 10% per year.[23]

TABLE 3. Capital cost assumptions

CAPITAL COSTS	UNIT	VALUE
Two-wheeled EVs	EUR/unit	1,200[24]
Smart batteries	EUR/kWh	152[25]
Battery swapping station construction	EUR/unit	5,358[26]
Solar PV system	EUR/W	2.26[27]

Cost of goods sold (COGS) and operating cost assumptions

Table 4 presents the cost of goods sold (COGS) and operating cost assumptions for the Company. It is assumed that the operating costs will escalate by 20% annually in line with inflation. The analysis also accounted for the costs of EV and battery replacements based on an annual price reduction of 3% compared to the initial investment.[28]

23) "Zambia: Solar PV and Hydro Mini-Grids: Model Business Case: Solar PV Mini-Grid for Rural Electrification," GET.invest Market Insights, (2020): https://www.get-invest.eu/wp-content/uploads/2020/10/GETinvest-Market-Insights_ZMB_Mini-grid_-MBC-Solar_2019-1.pdf
24) Stakeholder interviews, 2023.
25) Catsaros, O., "Lithium-Ion Battery Pack Prices Hit Record Low of $139/kWh," Bloomberg New Energy Finance, (November 26, 2023): https://about.bnef.com/blog/lithium-ion-battery-pack-prices-hit-record-low-of-139-kwh/#
26) Gairola, A., "EV Battery Swapping vs. Charging Station: Which one is Better and Why?" Bacancy, (July 24, 2023): https://bacancysystems.com/blog/ev-battery-swapping-vs-charging-station
27) https://data.bloomberglp.com/professional/sites/24/BNEF_responsAbility-report-Solar-for-Businesses-in-Sub-Saharan-Africa.pdf
28) "Zambia: Solar PV and Hydro Mini-Grids: Model Business Case: Solar PV Mini-Grid for Rural Electrification," GET.invest Market Insights, (2020): https://www.get-invest.eu/wp-content/uploads/2020/10/GETinvest-Market-Insights_ZMB_Mini-grid_-MBC-Solar_2019-1.pdf

TABLE 4. COGS and operating cost assumptions[29]

COST DESCRIPTION	UNIT	ANNUAL COST
COGS		
Mobile money costs	% of revenue	1%
IT/back-end costs	% of revenue	2%
Swapping station and solar PV system O&M cost	% of CAPEX	2%
EV O&M cost	EUR/km	0.0032
Commissions	% of revenue	3%
Grid electricity tariff for swapping stations	NGN/kWh	64.1
OPERATING COSTS		
Mobile money integration	EUR	30,000
Human resources	% of revenue	12.0%
Marketing and professional services	% of revenue	4.0%
EV insurance cost	% of CAPEX	3.0%
Other overhead costs	% of revenue	1.5%

Taxes

A corporate income tax rate of 30% is applicable to the Company if its turnover is greater than NGN 100M (EUR 73,706); 20% if its turnover is between NGN 25M (EUR 18,426) and NGN 100M (EUR 73,706); and 0% if its turnover is less than NGN 25M (EUR 18,426). The Company is also subject to a tertiary education tax of 2.5% of its profit. In addition, a standard VAT rate of 7.5% is also incorporated into the cost of the EVs and batteries.[30]

Revenue assumptions

The analysis assumes a daily EV rental fee of NGN 2,300 (EUR 1.7) and an additional fee of NGN 1,150 (EUR 0.85) for a battery swap.[31] It is also assumed that the rental fees will escalate by 20% annually in line with inflation.

29) Stakeholder interviews, 2023.

30) PwC: Nigeria: Corporate - Taxes on corporate income: https://taxsummaries.pwc.com/nigeria/corporate/taxes-on-corporate-income#:~:text=The%20CIT%20rate%20is%2030,in%20the%20year%20preceding%20assessment; and PwC: Nigeria: Corporate - Other taxes: https://taxsummaries.pwc.com/nigeria/corporate/other-taxes

31) Based on these assumptions, a driver renting an EV and additional battery will spend less than a petrol bike driver, as shown in the cost comparison presented in the Developer Guide.

TABLE 5. 10-year capital structure[32]

CAPITAL TYPE	DEBT	EQUITY	GRANTS	TOTAL
Years 1–2	0%	25%	75%	**100%**
Years 3–4	25%	25%	50%	**100%**
Years 5–8	50%	20%	30%	**100%**
Years 9–10	75%	20%	5%	**100%**
Total (% of capital)	**54.2%**	**20.7%**	**25.0%**	**100%**
Total (EUR million)	**€78.7**	**€30.1**	**€36.3**	**€145.1**

Financing structure and debt assumptions

Table 5 presents the assumed capital structure of the Company.

Two corporate debt financing options were considered: (i) EUR-denominated debt; and (ii) NGN-denominated debt. The EUR debt interest rate is assumed to be 9%, while the NGN debt interest rate is assumed to be 25%.[33] The debt tenor is assumed to be 3 years with no grace period, under both scenarios. It is also assumed that the loan terms will remain the same across all years under both scenarios. The minimum required rate of return on equity is assumed to be 20%, on average, among various staged equity investors.[34] Based on these financing assumptions, the resulting Weighted Average Cost of Capital (WACC) of the Company is 7.6% under the EUR debt scenario, and 13.6% under the NGN debt scenario.

RESULTS

Based on the assumptions described above, the financial analysis yielded the following conclusions:

— Under the EUR-denominated debt scenario, the investment opportunity is very attractive with an after-tax equity IRR of 31.6% (well above the expected equity return of 20%), Enterprise Value of EUR 51.2M, and minimum Debt Service Coverage Ratio (DSCR) of 1.4, which is above the threshold of 1.2 typically required by lenders.

— Under the NGN-denominated debt scenario, the investment opportunity is unattractive with an after-tax equity IRR of 10.6% (below the expected equity return of 20%), and Enterprise Value of EUR 16.0M due to the high cost of local debt. Also, the minimum DSCR is 1.14, which is below the required threshold, indicating the need for concessional debt terms.

— Under both scenarios, the Company will not become cashflow positive until the tenth year, due to the high capital expenditure.

The results of the financial analysis are summarised in **Table 6**.

32) These are hypothetical assumptions in line with market reality that early-stage companies are more reliant on grant financing and risk tolerant early equity, while more mature businesses seek to leverage their equity financing to secure significant debt that will finance their receivables and inventory finance needs.
33) Stakeholder interviews, 2023.
34) "Zambia: Stand-Alone Solar Businesses - Model Business Case: PAYGO Solar Home System Company in Zambia," GET.invest Market Insights, (2020): https://www.get-invest.eu/wp-content/uploads/2020/11/GETinvest-Market-Insights_ZMB_SHS_-MBC-PAYGO_2019.pdf

TABLE 6. Financial analysis results

INDICATOR	EUR-DENOMINATED DEBT	NGN-DENOMINATED DEBT
Avg. annual revenue	€26.0M	
Avg. annual expenses[35]	€13.4M	
Avg. EBITDA	€12.6M	
Avg. net income	€2.0M	€0.8M
Total free cashflow to firm (FCFF)	€5.2M	
After tax equity IRR	31.6%	10.6%
Enterprise value[36]	€51.2M	€16.0M
Year with positive cumulative FCFF	10	10
Avg. DSCR	1.74	1.48
Min. DSCR	1.40	1.14

SENSITIVITY ANALYSIS

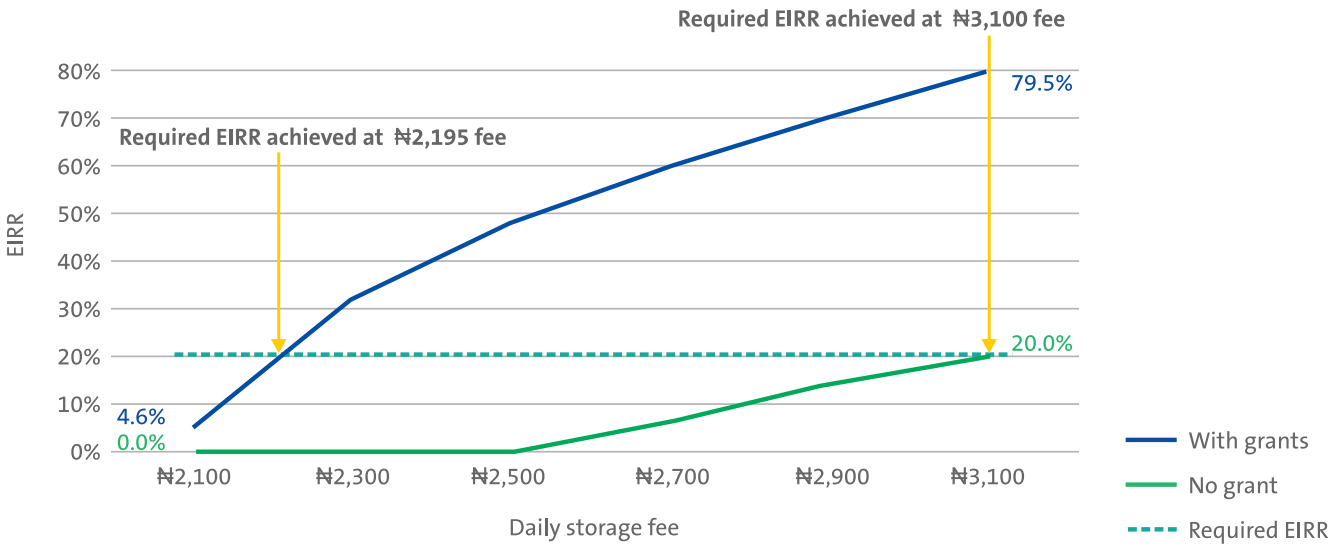
A sensitivity analysis was conducted to determine the impact of change in key assumptions on the equity IRR and DSCR as measures of the attractiveness of the business. The figures below present the results under various scenarios.

Rental fee and grant scenarios

Figure 1 illustrates the impact of changes in the daily EV rental fee and grant levels on the EIRR. The results show that the required EIRR can only be achieved without grants if the daily EV rental fee is at least NGN 3,100 (above the assumed acceptable daily EV rental fee of NGN 2,375). This will not be attractive to the drivers as the total daily rental fees will exceed the cost of operating a petrol bike. This indicates that the Company will need grant funding in order to charge rental fees that the drivers will be willing to pay.

35) Includes COGS and operating expenses.
36) Includes the Terminal Value of the Company, which was derived based on a conservative perpetual growth rate assumption of 0%. The Terminal Value represents the value of future cash flows to be generated by the Company beyond the 10-year projection period.

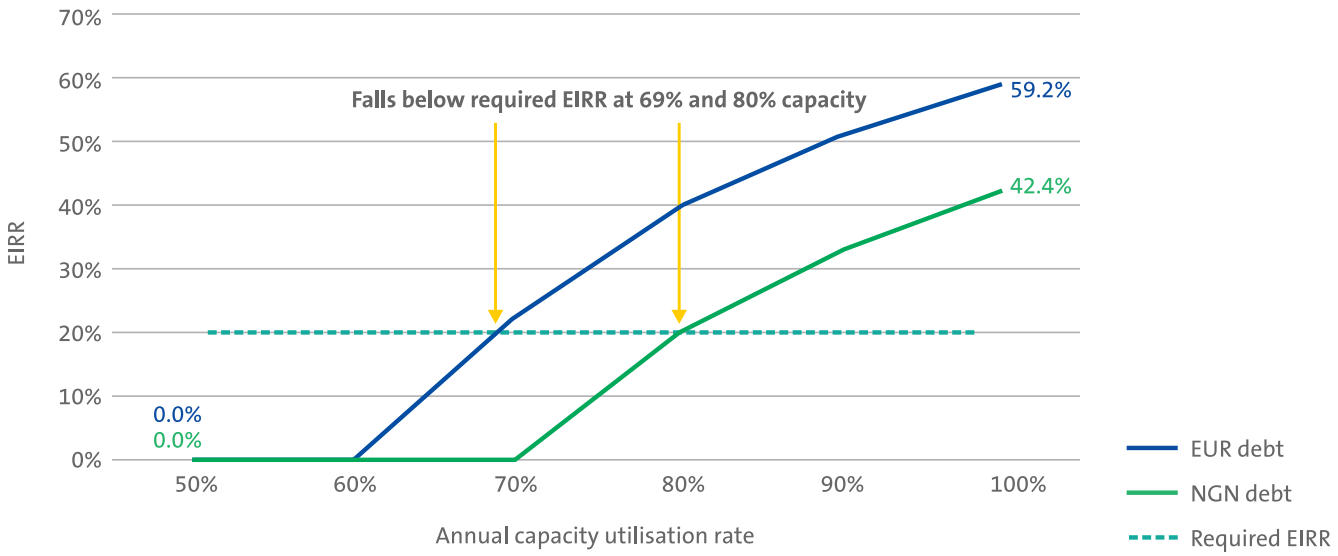
FIGURE 1. Equity IRR at various rental fee and grant levels



Daily vehicle utilisation scenarios

Figure 2 shows the impact of changes in the daily EV utilisation rate on the EIRR. The analysis found that the required EIRR can only be achieved if the annual capacity utilisation rate is at least 69% under the EUR-denominated debt scenario (lower than the assumed utilisation rate of 75%) and at least 80% under the NGN-denominated debt scenario (higher than the assumed utilisation rate of 75%). This indicates that the attractiveness of the opportunity rests heavily on the ability of the Company to achieve and sustain decent daily vehicle utilisation rates.

FIGURE 2. Equity IRR at various daily vehicle utilisation rates



Debt interest rate scenarios

Figure 3 and **Figure** 4 show the impact of increases in both the EUR-denominated and NGN-denominated debt interest rates on EIRR and DSCR, respectively. The analysis found that the required EIRR will only be achieved with EUR-denominated debt priced at a maximum of 16.2% (which is well above the assumed 9% rate) and NGN-denominated debt priced at a maximum of 18.2% (which is below the assumed 25% rate). The analysis also reveals that the minimum DSCR threshold will only be achieved with EUR-denominated debt priced at a maximum of 18.9% (which is well above the assumed 9% rate) and NGN-denominated debt priced at a maximum of 21.2% (which is below the assumed 25% rate). This indicates that the Project will require concessional debt terms if financed with NGN debt. Also, due to the assumed short debt tenor, the effect of local currency depreciation on foreign currency debt is minimal.

FIGURE 3. Equity IRR at various debt interest rates

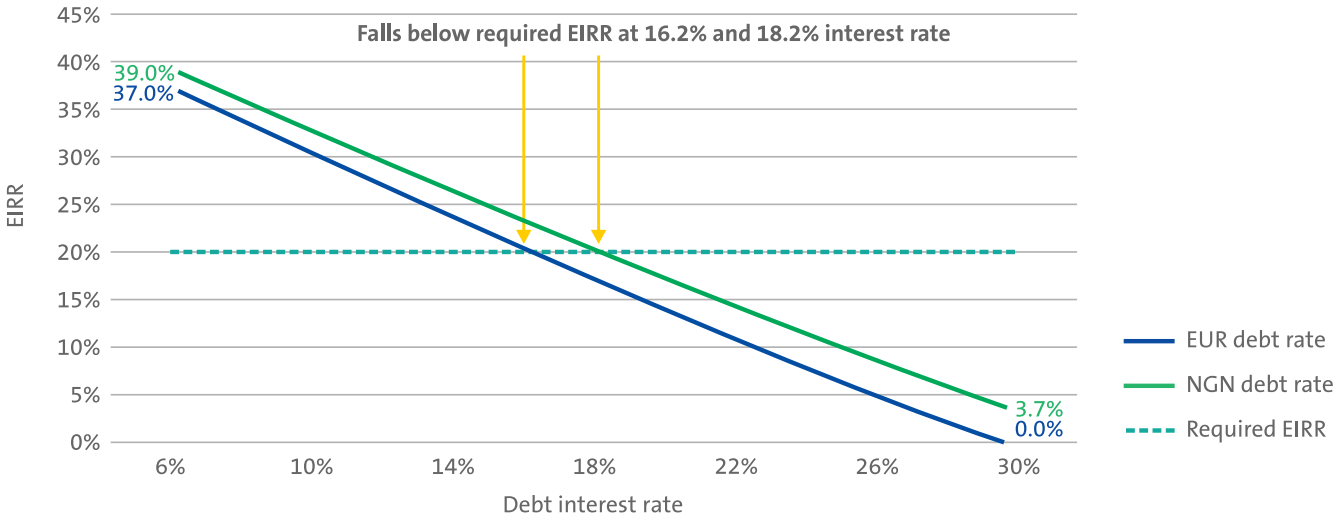
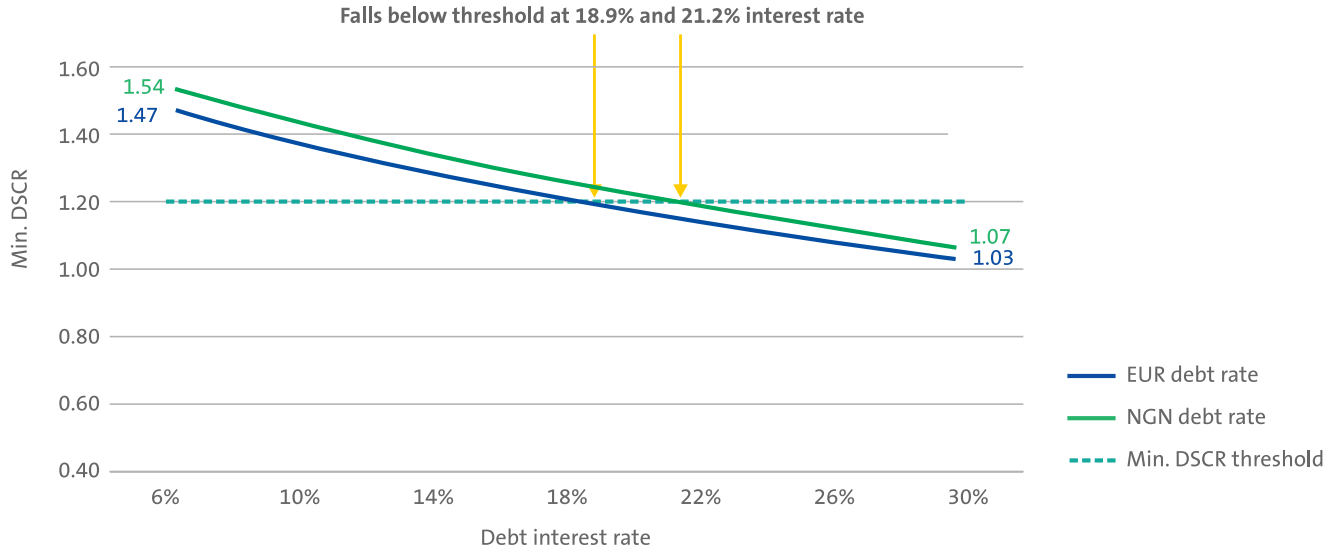


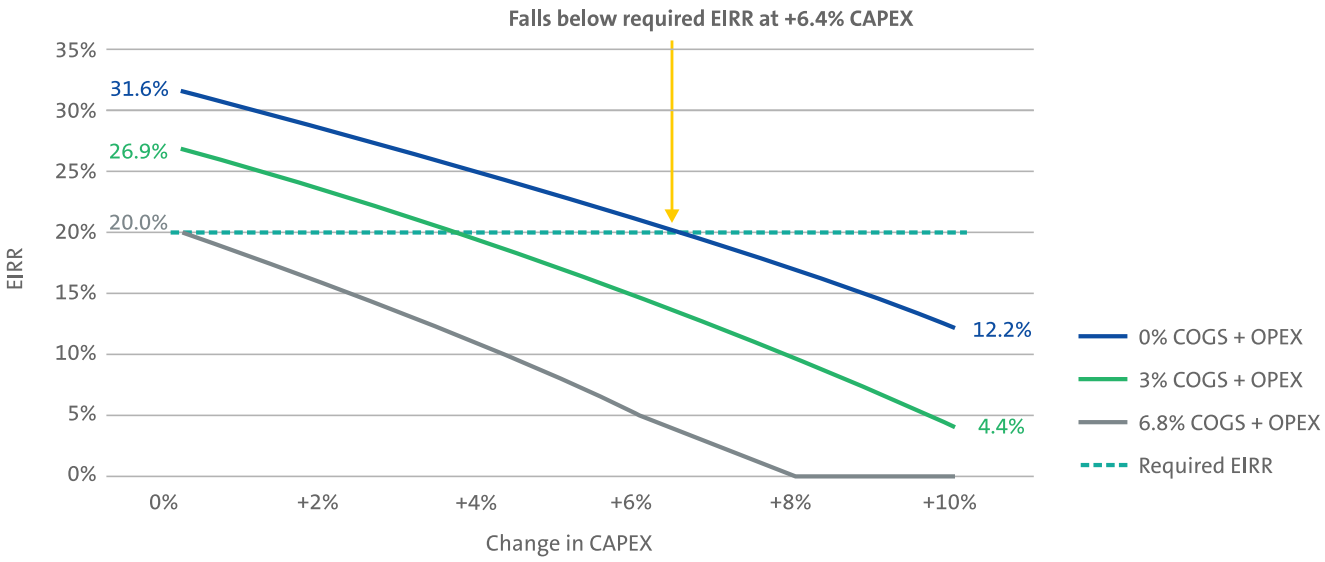
FIGURE 4. Minimum debt service coverage ratio at various debt interest rates



CAPEX, COGS and OPEX scenarios

Figure 5 illustrates the impact of changes in CAPEX, COGS and OPEX on the EIRR. The analysis found that the required EIRR will be achieved unless CAPEX increases by more than 6.4%, while COGS and OPEX remain unchanged. In addition, any increase in the COGS and OPEX above 6.8% will render the Company unviable. This reveals that the viability of the Company is very sensitive to cost increases and is more sensitive to increases in CAPEX than OPEX.

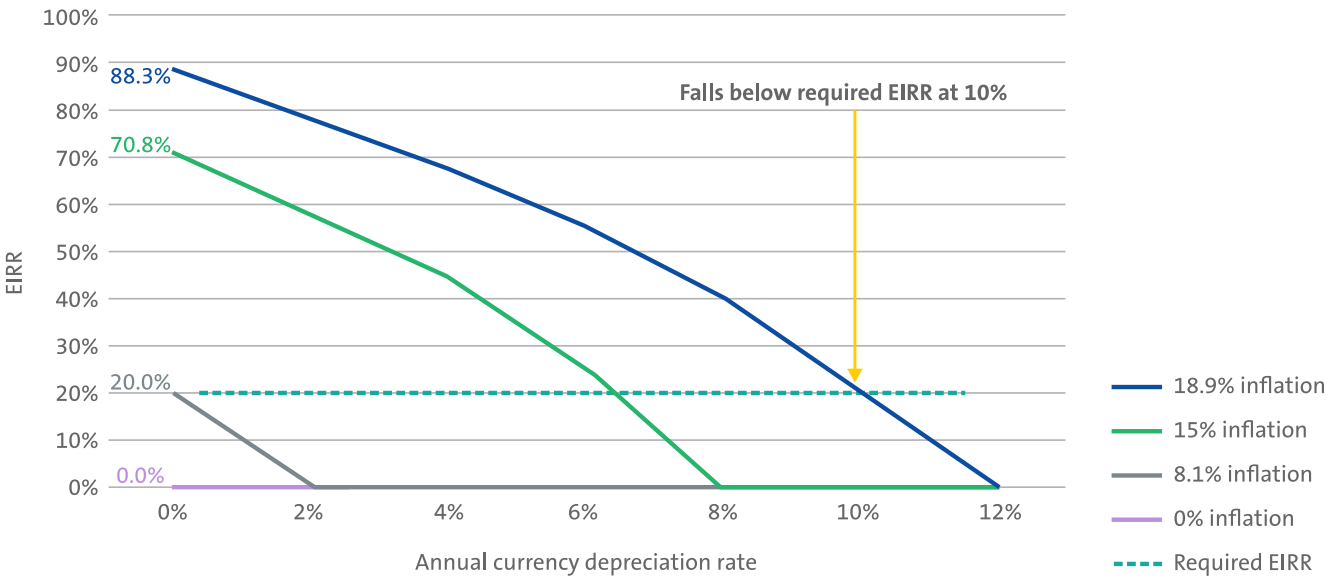
FIGURE 5. Equity IRR at various CAPEX and COGS + OPEX levels



Local currency depreciation and inflation scenarios

Figure 6 shows the impact of increases in the annual local currency depreciation rate and inflation rate on the EIRR. The analysis found that at the projected local currency annual depreciation rate of 10%, the required EIRR will only be achieved if the rental fees and costs escalate annually by at least 18.9% (below the projected rate of 20%). It also revealed that the required EIRR will only be achieved with annual price escalation of at least 8.1%, even if the local currency does not depreciate. This indicates that the viability of the Company will heavily depend on the stability of the Naira and its ability to periodically increase its fees.

FIGURE 6. Equity IRR at various inflation and currency depreciation levels



CONCLUSIONS AND KEY TAKEAWAYS

Based on the assumptions in this Model Business Case, the Company is estimated to be viable when financed with EUR-denominated debt, with an after-tax equity IRR of 31.6% and Enterprise Value of EUR 51.2M.

However, the attractiveness of the opportunity depends on the ability of the Company to (i) consistently achieve decent daily vehicle utilisation rates, (ii) periodically increase its daily rental fees and (iii) manage capital and operating costs. The required EIRR can only be achieved at a daily vehicle utilisation rate of at least 69% and a rental fee escalation rate of at least 18.9% per year.

It is also worth noting that the Company will need patient capital due to the long period required to achieve cashflow positivity. The Company will also require significant grant funding particularly in the early years of its operation in order to be viable while offering the electric motorcycles to riders at fee levels that generate sustainable cost savings. In addition, the Company will require concessional debt terms to be viable if financed with local currency debt.

KEY DEFINITIONS

Avg. annual revenue is the average annual revenue generated by the Company during its first ten years of operation.

Avg. annual expenses is the average annual COGS and operating expenses incurred by the Company during its first 10 years of operation.

Avg. EBITDA is the Company's average earnings before interest, taxes, depreciation, and amortisation during its first ten years of operation.

Avg. net income is the average net income generated by the Company during its first ten years of operation.

Total cashflow to firm refers to the total free cash flow available to all the Company's funders during the first 10 years of operation of the Company.

After tax equity IRR is the aggregate post-tax internal rate of return on the equity investments in the Company.

Cost of goods sold (COGS) refers to the direct costs of producing the goods sold by a company. This amount includes the cost of the materials and labour directly used to create the good. It excludes indirect expenses, such as distribution and sales costs.

Enterprise value is the net present value of the free cash flows to the Company during its first ten years of operation in addition to its Terminal Value.

Positive cum FCFE year is the number of years it takes for the cumulative free cash flow to equity to become positive.

Positive cum FCFF year is the number of years it takes for the cumulative free cash flow to firm to become positive.

Avg. DSCR is the average debt service coverage ratio over the first ten years of operation of the Company.

Min. DSCR is the minimum debt service coverage ratio over the first ten years of operation of the Company.

ABOUT GET.INVEST MARKET INSIGHTS

The first series of GET.invest Market Insights was published in early 2019 covering four renewable energy market segments in three countries, namely: renewable energy applications in the agricultural value-chain (Senegal), captive power (behind the meter) generation (Uganda), mini-grids (Zambia) and stand-alone solar systems (Zambia).

A **Developer Guide** aims to inform project developers, private sector technology suppliers, innovators and entrepreneurs about opportunities in Nigeria's electric mobility sector. The Guide is organised into four main sections: **1)** introduction; **2)** context for e-mobility development in different countries across sub-Saharan Africa, including an overview of the sector's policies, regulations, financing mechanisms and business models; **3)** examination of the potential for e-mobility in Nigeria, specifically looking at its enabling environment, business models, financing mechanisms and opportunities for e-mobility to support rural economic development; and **4)** exploration of the "Route to Market" – i.e., how to leverage the market research presented in the Guide to contribute to e-mobility development in Nigeria.

The two **Model Business Cases** included in this package analyse: **1)** a mini-grid powered rural e-mobility project; and **2)** an urban e-mobility business.

The GET.invest Market Insights summarise a considerable amount of data that may inform early market exploration and pre-feasibility studies. It is therefore recommended to cross-read this Developer Guide and the Model Business Cases for a comprehensive overview. The products are accessible at www.get-invest.eu.

ABOUT GET.INVEST

GET.invest is a European programme that mobilises investment in renewable energy. The programme targets private sector companies, project developers and financiers to build sustainable energy markets in sub-Saharan Africa, the Caribbean and the Pacific.

Services include tailored access-to-finance advisory, a funding database, market information, and financial sector support to increase local currency financing.

The programme is supported by the European Union, Germany, Norway, the Netherlands, Sweden and Austria. Find out more at www.get-invest.eu.

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We welcome your feedback on the Market Insights by sharing any questions or comments via email at info@get-invest.eu.

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