

# Zambia: Stand-Alone Solar Businesses

## *Model Business Case: PAYGO Solar Home System Company in Zambia*

### INTRODUCTION

This Model Business Case illustrates the viability of a Pay-As-You-Go (PAYGO) Solar Home System (SHS) enterprise in Zambia, considering a hypothetical but realistic launch of a company retailing a basic, pico-scale SHS (<11 W) on a PAYGO basis. The use of PAYGO payment models to retail such solar kits increases affordability and accessibility for households that have limited ability to pay, low and irregular incomes and limited access to finance.

### TECHNICAL, ORGANISATIONAL, AND MARKET CONSIDERATIONS FOR PAYGO SOLAR

**Annex A** provides more details.

### TARGET AUDIENCE

This document is for **early stage entrepreneurs and investors** considering a new PAYGO SHS business in Zambia.

### ASSUMPTIONS AND MAIN PARAMETERS

Projecting the performance of high-growth ventures with large market and operational variability requires certain substantial simplifications and assumptions. The case is intended to be illustrative, and does not substitute for on-the-ground research, analysis and modelling.

The assumed company is a semi-vertically integrated PAYGO solar company. The company imports products from an international PAYGO SHS technology and services provider. The following additional assumptions have been made:

- The focal company retails only one SHS product solution — an 11 W kit including a basic set of LED lamps, a mobile phone charger, a radio and a torch;
- The company pays a back-end fee to its supplier, for software services, that enable monitoring and control of products, payment collection and inventory management;



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- The company handles on-the-ground operations and does not have external or 3rd party product distribution partners;
- The company is integrated with mobile money payment platforms and offers both cash and mobile money payment options;
- The company does not have previous PAYGO SHS experience and is starting up.

The domestic off-grid market size was projected forward on the basis of historical grid access rates and population growth. Growth to serve less than 15% of the total addressable market over the 10-year period was considered a moderate assumption; both to build a reasonably sized business while also considering that many off-grid households may not actually be serviceable, for reasons of commercial viability and affordability. Growth in unit sales was benchmarked against industry precedents.

The model is based on an investment in EUR. Sales revenue is converted from Zambian Kwacha (ZMW) to EUR equivalent and a EUR inflation rate is applied (see [Table 4](#)). The potential impact of currency exchange rate fluctuations due to the effects of Zambian inflation was also assessed.

## MODEL PARAMETERS

The key parameters of the business are provided in [Tables 1–4](#). The first 10-years of the enterprise timeframe was considered in this model.

**TABLE 1. Key sales and market inputs<sup>1</sup>**

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Off-grid households in Zambia	2,435,708	2,470,779	2,504,149	2,535,552	2,564,687	2,591,325	2,615,232	2,615,233	2,615,234	2,615,235
New sales in period	500	10,500	21,000	31,500	37,800	45,360	49,896	51,393	52,421	52,945
New sales churned	15	315	630	945	1,134	1,361	1,497	1,542	1,573	1,588
Systems paid off	—	—	485	10,185	20,370	30,555	36,666	43,999	48,399	49,851
Systems paying	485	10,670	30,555	50,925	67,221	80,665	92,398	98,250	100,699	102,205
Cumulative systems sold	500	11,000	32,000	63,500	101,300	146,660	196,556	247,949	300,370	353,315
Market served	0%	0%	1%	3%	4%	6%	8%	9%	11%	14%

1) Notes:

- Sales projections were based on a benchmarking exercise of historical unit sales by M-Kopa, Mobisol, Fenix and BBOX, using publicly available data and author assumptions
- The churn rate was set at 3% of new sales
- Systems paid off assumes a 24-month customer payment period (see [Table 2](#))

**TABLE 2.** Key product cost and pricing inputs

PARAMETER	UNIT	VALUE
Freight on Board (FOB) cost	EUR	75
Back-end per system sold	EUR	5
PAYGO price (all-in)	EUR-eq <sup>2</sup>	176
Down payment	EUR-eq	8
Payment period	months	24
Monthly ARPU (Average Revenue per User)	EUR-eq	7

A basic PAYGO SHS unit was modelled with a 24-month payback period. The major cost items of the model are shown in **Table 3**. VAT and import duties were each modelled at 0% in the “Base Case” scenario.<sup>3</sup> Capital expenditures are included in “Corporate” costs, and generally refer to the development of an office and call centre, warehouse, and retail locations. Costs and revenues were adjusted for inflation throughout the model.

**Table 4** lists additional inputs informing the development of the model. Average return on equity was assumed at 20%, although this will likely vary greatly among various staged equity investors. To keep the model simple, only one type of loan was modelled — an inventory loan — with 24-month term and 12-month grace period. A generic capital structure was assumed for the “Base Case” by covering the investment requirements of years 1 and 2 with 50% grant and 50% equity, equity covering all but system procurement costs during years 3 and 4, and inventory finance loans covering system procurement from year 3 onwards. Debt was modelled to maintain a minimum Debt Service Coverage Ratio (DSCR) of 1.4 and maximum Debt-to-Equity ratio of 300%. Systems were considered “on the books” of the company through the end of the PAYGO period, and thus were depreciated over 2 years. Office and other CAPEX were conservatively depreciated over 5 years.

2) Note: EUR-eq = EUR equivalent

3) SHS kits are generally zero-rated for import VAT and import duty (depending on their components) when the importer has obtained a solar import license from the Energy Regulation Board (ERB) – see the accompanying Developer Guide (accessible at [www.get-invest.eu](http://www.get-invest.eu)) for more details. However, companies have reported experiencing difficulties in the application of zero-rated VAT and import duty. The sensitivity of this is therefore tested later in the Model Business Case

**TABLE 4.** Financing and additional inputs

PARAMETER	UNIT	VALUE
Average return on equity	%	20
Loan term	months	24
Loan grace period	months	12
Loan interest	%	8 to 14
Min. DSCR <sup>4</sup>	—	1.4
Max. debt to equity	—	3
Corporate tax	%	35
VAT	%	0
Import duty	%	0
ZMW:EUR 2018	ZMW	11.5
Inflation ZMW	%	8.20
Inflation EUR	%	1.70
System depreciation	years	2
Office and other CAPEX depreciation	years	5

To summarise, the basis of the analysis comprises investment and financing inputs as described previously. The “Base Case” scenario considers 50% equity / 50% grant financing for years 1 and 2 and partial equity funding for years 3 and 4; and uses a 10% interest rate on all extended debt. This yields a capital structure as shown in **Table 5**.

**TABLE 5.** Assumed capital structure of the base case scenario (EUR)

	CAPTIAL	SHARE OF TOTAL
Grants	1,174,480	4.6%
Equity	8,661,652	33.6%
Debt	15,911,972	61.8%
<b>Total Financing</b>	<b>25,748,104</b>	<b>—</b>

4) DSCR = Debt Service Coverage Ratio

**TABLE 3.** Summary of operational and capital expenditures (EUR)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
System procurement	37,500	800,888	1,629,005	2,485,047	3,032,752	3,701,170	4,140,499	4,337,214	4,499,166	4,621,408
System shipping	16,500	48,053	81,450	109,342	133,441	155,449	168,104	175,223	180,866	92,428
VAT	—	—	—	—	—	—	—	—	—	—
Import duty	—	—	—	—	—	—	—	—	—	—
Commissions	2,250	48,053	97,740	149,103	181,965	222,070	248,430	260,233	269,950	277,284
Repairs/replacements	188	4,004	8,145	12,425	15,164	18,506	20,702	21,686	22,496	23,107
MoMo integration <sup>5</sup>	30,000	—	—	—	—	—	—	—	—	—
MoMo costs	815	17,698	36,609	56,796	70,492	87,491	99,540	106,042	111,871	116,865
Back-end costs	2,500	53,393	108,600	165,670	202,183	246,745	276,033	289,148	299,944	308,094
Human resources	128,800	561,384	856,391	929,013	944,806	960,868	977,203	993,815	1,010,710	1,027,892
Corporate	85,375	511,560	425,393	336,442	241,045	198,018	173,052	178,207	183,090	187,625
Total Cost of Goods Sold (COGS) <sup>6</sup>	20,002	123,148	234,804	344,233	421,280	508,191	564,380	592,099	615,178	540,494
Total OPEX <sup>7</sup>	221,425	714,197	1,069,238	1,204,183	1,260,841	1,326,559	1,376,556	1,409,751	1,440,863	1,469,526
Total CAPEX <sup>7</sup>	62,500	1,207,688	1,939,292	2,695,422	3,139,727	3,755,567	4,162,628	4,359,719	4,522,053	4,644,685
Inflator (%)	1.00	1.02	1.03	1.05	1.07	1.09	1.11	1.13	1.14	1.16

5) MoMo = Mobile Money

6) COGS covers system shipping, repairs/replacements, mobile money costs and back-end costs

7) Total OPEX and CAPEX are not the sum totals of the preceding rows, because "corporate" costs include both OPEX and CAPEX items:

a) OPEX covers VAT and import duty, agent commissions, mobile integration, human resources and the marketing, professional services, office operations and insurance cost components of "corporate" costs and

b) CAPEX covers SHS procurement and the real property development cost components (office, warehouse, call centre, retail locations) of "corporate" costs

## FINANCING CONSIDERATIONS

The way in which PAYGO companies are fundraising is quickly evolving as the market opportunity is becoming better known to an expanding community of entrepreneurs and investors:

- a) PV and battery costs are evolving, while expanded unit sales volumes are additionally driving down system costs.
- b) A greater number of transactions is increasing investor confidence in the opportunity, making early stage capital comparatively more available for “Generation 2”<sup>8</sup> PAYGO companies.
- c) Debt instruments (e.g. securitization) that are considered standard in other industries are beginning to be piloted in the sector. Investors, development financiers, transaction advisors, and companies are each on a learning curve as to how to apply these instruments in a comparatively data-scarce and lesser-known industrial context.
- d) The industry has been led by start-ups to date, yet several multinationals are now entering. This development is likely to change the competitive landscape in specific country-markets considerably.

Because of these changes, it is unknown — from a fund-raising perspective — how and how fast new entrants will acquire capital and grow. Based on industry experience, there are a few early lessons for companies that intend to newly launch:

- a) Companies finance primarily through grants and equity for the first 2–3 years;
- b) Once a commercial track record is established, inventory finance can be accessed; however sufficient equity investment is required to propel expansion and ensure that overleveraging is avoided;
- c) Companies with sizeable loan portfolios and asset bases may secure finance for the financing of consumer receivables, and/or consider longer-term corporate debt.

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8) Second generation (Generation 2) PAYGO businesses are those that have been established more recently and have learned from the experiences of the pioneer (Generation 1) PAYGO companies that were the first movers

While the PAYGO SHS opportunity is considered attractive, grants or viability gap finance remain an important source of seed investment, complementing angel or founder rounds, providing access to finance, and enabling access into nascent markets with no or limited sector experience, which would otherwise remain un-explored. In this model, it is assumed that grants would be available to support the business during the first two years of operation.

Imported equipment requires inventory financing, which is often availed on relatively short-term 12- to 24-month basis. These loans are modelled as a 24-month term with 12-month grace periods.

PAYGO companies are debt-intensive businesses; as one expands from the earliest stages, it begins to look like a hybrid energy and financial services organisation.<sup>9</sup> As mature PAYGO SHS companies manage a large portfolio of loans, the value of a company is determined by its cost of capital. Market leading PAYGO SHS companies have begun to implement off-balance sheet structures to finance consumer receivables, enabling increased risk management and access to more competitive debt pricing. For simplicity, this model assumes an integrated company view (i.e. not a disaggregated AssetCo/OpCo structure<sup>10</sup>). Early stage entrepreneurs and investors may wish to consider modelling an AssetCo/OpCo scenario from (for example) year 5 of operations onwards, to better understand how their investment may improve with re-structuring.

## ANALYSIS RESULTS

The model was analysed for profitability, the impacts of debt pricing and grant financing, currency risk, and the impact of VAT and import duties.

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9) See CGAP (2018). Link: <https://www.cgap.org/research/publication/strange-beasts-making-sense-paygo-solar-business-models> – accessed April 2019

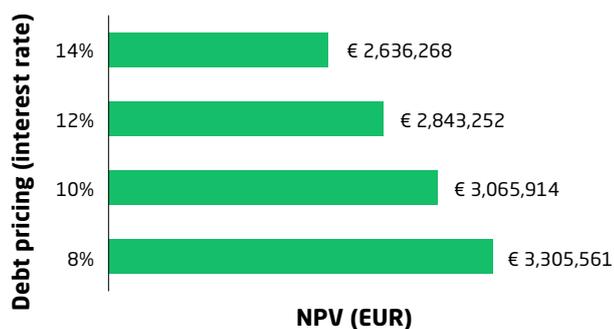
10) Under a segregated AssetCo/OpCo (or FinCo/OpCo) structure, a PAYGO SHS business would be broken into two separate but related companies – one for marketing, distribution, sales, customer service, etc., for the energy products (OpCo) and one (which could own the inventory and/or pool the PAYGO contracts for securitisation) for customer risk assessment, credit control, portfolio management, payment collection, etc. (AssetCo).

**Enterprise profitability:** Using an expected equity return of 20% and interest rate of 10% (Weighted Average Cost of Capital = 11%), the company’s IRR was calculated on Unlevered Free Cash Flows (free cash flow to firm) as 43%. The company provides an Equity IRR of approximately 18%, calculated on Levered Cash Flows (free cash flow to equity). The former represents the amount of cash flow from operations available for distribution after depreciation expenses, taxes, working capital and investments are paid.

The latter is an aggregate equity return calculation, and does not consider changes in share pricing nor equity investor expectations between successive priced rounds.

**Impact of varying debt pricing:** Varying debt pricing extended to the company from 8 to 14% did not produce material impacts on profitability, however a clear impact on company NPV (e.g. due to changes in cash flow) is observed. It is important to keep in mind that relatively short-tenor loans were modelled in this business case; debt pricing would impact cash flows and profitability to a greater extent when considering longer tenor corporate loans.

**FIGURE 1. Company NPV as a function of debt pricing**



**Impact of grant funding:** Because of the massive financing required by PAYGO, grants serve an access-to-finance purpose rather than one related to mainly establishing commercial viability which is more commonly seen in other types of renewable energy access investments. Table 6 compares the 10-year equity and firm IRR values for grants received in Years 1 and 2.

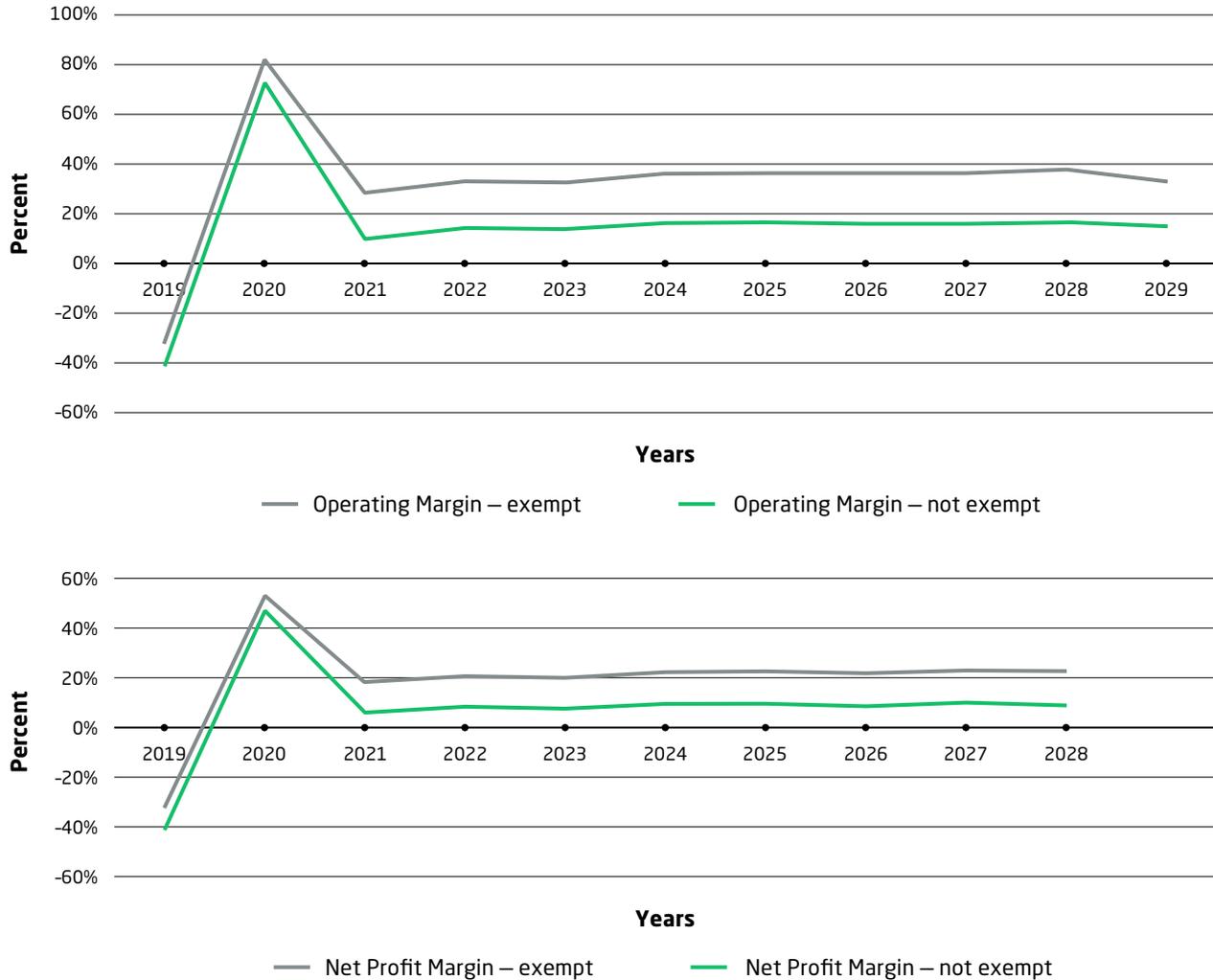
**TABLE 6. 10-year impact of securing early stage grant finance**

GRANT % OF TOTAL CAPITAL	AMOUNT OF GRANT (EUR)	EQUITY IRR	FIRM IRR
0%	0	14%	29%
5%	1,174,480	18%	43%
7%	1,837,702	21%	59%

**Currency risk:** Currency risk was modelled using the base case of the 10% debt pricing, capital structure shown in Table 5 and zero-rating on VAT and import duties. Applying the relative inflation rates shown in Table 4, a total of EUR 679,000 of foreign exchange exposure was calculated on EUR 15.9 million of debt extended. Currency risk is relatively limited given the short tenors modelled.

**VAT and import duties:** Entrepreneurs in Zambia report that VAT and import duty exemptions are inconsistently applied, leading to uncertainty in cash flows and, often, unanticipated costs. The extent of the negative impact on business performance can be clearly seen by modelling a scenario in which imports are subject to 16% VAT and 25% import duty. As shown in Figure 2, the addition of VAT and import duty can substantially alter the economics of the business. Operating margins drop from a 10-year average of 33% to 15%, while the 10-year average net profit margin of 19% drops to less than 10%.

**FIGURE 2.** Impact of 16% VAT and 25% import duty



**KEY TAKEAWAYS**

- PAYGO SHS companies are complex organisations requiring capabilities in technology, operations and financial domains. There are many different market considerations and variables that can affect the performance of the business. The potential of the development of or investment in a PAYGO SHS company is highly specific to the market opportunity and team and should only be made after a detailed assessment.
- While the modelled return on investment at the firm level is attractive at 43%, the equity IRR (18%) does not quite reach the required threshold of 20% in the Base Case. The application of additional viability gap funding of a total of about EUR 660,000 in year 1 and year 2 (leading to 7% instead of 5% viability gap financing) would, however allow investors to realise the required return. On the other hand, if 16% VAT and 25% import duty were to be assessed on the importation of inventory by the firm, the 10-year operating margin and net profit margin of the business would be cut in half.
- Significant risks for PAYGO SHS companies in Zambia include: **a)** market competition, **b)** currency exchange rates, **c)** cost of customer acquisition due to low population densities, and **d)** enforcement issues around VAT and import duty.

## ANNEX A. TECHNICAL, ORGANISATIONAL, AND MARKET CONSIDERATIONS FOR PAYGO SOLAR

PAYGO SHS kits range from pico- to large-scale. GOGLA (2018) categorises **pico-SHS** as kits having PV modules under 11 Wp, **entry-level** SHS kits with modules between 11 and 20 Wp, **basic** SHS kits with modules between 21 and 49 Wp, **medium** SHS kits between 50 and 100 Wp, and **large** kits as >100 Wp.

PAYGO SHS kits typically consist of four main components:

- Photovoltaic modules which convert solar irradiation to Direct Current (DC) electricity;
- Batteries which store energy for later use;
- Communication modules which enable remote monitoring and control as well as the use of mobile money platforms;
- Appliances that provide users access to energy services such as lighting and phone charging.

There are broadly two types of PAYGO solution configurations; those retailed with basic energy appliances only, and those retailed with more than basic appliances. Nearly all kits include a basic appliance configuration including a lighting kit and USB mobile phone charger. Lighting kits often include a combination of hanging LED and LED tube lamps. SHS kits sold as packages with a wider range of appliances typically have larger power and energy storage capacities and may include appliances that serve both household and micro-enterprise customers. Appliances packaged within smaller-scale SHS kits, or retailed separately, include torches, TVs of varying sizes, radios, fans, electric shavers and USB phone charging stations.

Given the discrete ranges of energy services that may be provided by SHS kits and given that electricity usage is defined for specific end-uses and appliances, there are limited technical considerations for system sizing and installation. Some kits require installation by technicians certified by the PAYGO retailer, while others are self-installed. Panels must be securely installed with adequate solar exposure. If a kit is GSM (Global System for Mobile communications) or GPRS (General Packet Radio Service) enabled, network connectivity is required. All Lighting Global Quality Standards<sup>11</sup> require that SHS kits have in-built battery management to protect against deep discharge and overcharge.

### Organisational design considerations

While SHS kits can be considered non-complex from an energy technology perspective, PAYGO SHS companies are complex organisations requiring capabilities in technology, operations, and financial domains.

- **Technology:** PAYGO SHS businesses require a complex set of data integrations to run daily operations. Systems, customers, and various components of corporate operations (e.g. points of sales, agents, call centres, logistics centres, headquarters) are connected via transactions spanning mobile money service providers, mobile network operators and the company's software back-end. This "back-end" encompasses several platforms, not limited to: customer registration, agent management, payments, mobile network integrations, Customer Relationship Management (CRM), call centres, supply chain, accounting and product monitoring;
- **Operations:** PAYGO SHS companies must ensure efficient service delivery without compromising customer service, portfolio quality, brand value, nor operating margins. Companies manage high volume supply chain operations, manage large sales agent networks, and maintain high touch customer relationships, usually through call centres;
- **Finance:** The leading PAYGO SHS companies have developed sophisticated financial capabilities, particularly related to credit risk management. Companies must develop internal credit policies, including methodologies for credit assessment, managing payment default and system repossession and processes for system redeployment. Mature PAYGO companies are strengthening credit and data teams to ensure readiness for asset securitization.

11) View Lighting Global quality standards for Pico-PV and SHS Kit solutions at <https://www.lightingglobal.org/quality-assurance-program/our-standards/>

### Market considerations

As retail enterprises, PAYGO companies react to a set of several, dynamic market conditions:

- **Market opportunity:** The size of the addressable and serviceable markets, and the dynamics of a country's electricity sector, determine whether, to what extent and when a market is worth investing in;
- **Product-market fit:** Consumer aspirations and ability to pay for varying levels of energy services allow companies to consider the match between their offering and consumer demand, as well as positioning against competitive solutions;
- **Business model and pricing:** Pricing is competitive in under saturated but increasingly crowded marketplaces, with competitors testing a variety of product design, payment, appliance, credit and up-selling strategies;
- **Mobile network operator and mobile money network partnerships:** Geographical network coverage, user coverage, agent networks and the contractual terms available for partnerships determine the business model design of a PAYGO entrant;
- **Investment climate and regulatory environment:** Infrastructure, licencing, taxation, import procedures, investor incentives, the local financial sector and human capital are important aspects of the investment climate affecting initial market operations.

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Each Market Insight package includes **a)** a 'how to' Developer Guide, **b)** Model Business Cases and **c)** Case Studies. The Developer Guide enables the reader to navigate the market and its actors, to understand the current regulatory framework and lays down the step-by-step process of starting a new project/business. The Model Business Case analyses project economics and presents hypothetical, yet realistic, investment scenarios. It hence indicates the criteria for a viable project/business to enable the reader to identify the most cost-effective project/business opportunities. The Case Study analyses the viability of operational or high-potential projects/businesses to highlight lessons learnt and industry trends.

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