

The Global LPG Partnership

KfW

The European Union



Clean Cooking for Africa Program

LPG for Clean Cooking in Cameroon: Investment and Implementation

Prepared by the Global LPG Partnership

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Clean household cooking in Cameroon,
with microfinanced LPG equipment



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Editorial Note: About the time frames used in this report

The analyses, findings and recommendations in this report address the timeframe 2019-2030. From the vantage point of October 2019, given that there is the probability that all the steps set forth in this Feasibility Study to be taken in 2019 and the immediate following years will not be accomplished on such a timely basis, and that this might jeopardize the achievement of the projected LPG penetration rate and usage volumes for household cooking by 2030, it would be worthwhile for the reader to consider the 2019-2030 target years of activity to be Years 1-12.

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Glossary and Abbreviations

BC	Black Carbon
BCRM	Branded Cylinder Recirculation Model Best-practice model for the structuring and regulation of LPG markets for growth, safety and bankability ¹
BP	LPG Bottling Plant
CCA	Clean Cooking Alliance (formerly, the Global Alliance for Clean Cookstoves)
CCCM	Consumer-Controlled Cylinder Model
CDM	Clean Development Mechanism
CFA	Central African Franc (also XAF)
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DALYs	Disability-Adjusted Life Years
DHS	Demographic and Health Survey
DFI	Development Finance Institution
EU-ITF	European Union Infrastructure Trust Fund Primary source of financial cooperation funds supporting the Clean Cooking for Africa Program
FEICOM	Special Council Support Fund for Mutual Assistance (also SCSFMA)
FNGOs	Financial Non-Governmental Organizations
fNRB	Fraction of Non-renewable Biomass
GACC	See CCA
GBD	Global Burden of Disease
GHG	Greenhouse Gases
GLPGP	The Global LPG Partnership The Project Execution Agency for the Clean Cooking for Africa Program
GS	Gold Standard
GWP	Global Warming Potential
HAP	Household Air Pollution
HH	Households
IAQG	Indoor Air Quality Guidelines (defined by the World Health Organization)
IFI	International Financial Institution
Institutional capital	Pension funds, sovereign wealth funds, foundations, large family offices, DFIs, IFIs, MDBs, banks and proprietary capital

¹ See www.wlpga.org/wp-content/uploads/2015/09/wlpga-guidelines-for-the-development-of-sustainable-lp-gas-markets.pdf

ISLE	Indicators of Sustainable LPG Expansion
KfW	KfW Development Bank Administrator of the EU-ITF financial cooperation funds supporting the Clean Cooking for Africa Program
kge or kgeq	Kilogram-equivalent A measure used in expressing weighted-average cylinder sizes
KT	Kilotonnes
LACE	LPG Adoption in Cameroon Evaluation Study Carried out by the University of Liverpool in coordination with the Clean Cooking for Africa Program
LMICs	Low and Middle Income Countries
LMC	LPG Marketing Company (also LPGMC)
LPG	Liquefied Petroleum Gas LPG is comprised of propane (C ₃ H ₈), butane (C ₄ H ₁₀), or a blend of both. LPG combusts to give heat with near-zero emissions. LPG is a gas when unpressurized and becomes a liquid under modest pressure across a wide range of temperatures. LPG is created as a by-product of oil and gas production and oil refining
LPGMC	See LMC
M&E	Monitoring and Evaluation
MDB	Multilateral Development Bank
MICS	Multiple Indicator Cluster Surveys
MFI	Microfinance Institution
MJd	Megajoules delivered to a cooking pot
MINATD	Ministry of Territorial Administration and Decentralization
MINEE	Ministry of Energy and Water Resources
MoH	Ministry of Health
MT	Metric tonnes
NAMA	Nationally Appropriate Mitigation Action Climate change mitigation measures proposed by developing country governments to reduce emissions below 2020 business-as-usual levels and to contribute to domestic sustainable development, as called for in the Bali Action Plan of the UN Climate Change Conference of the Parties
NG	Natural Gas Natural gas is comprised primarily of methane (CH ₄) and may contain fractional quantities of other gases such as LPG
NGLs	Natural Gas Liquids Components of natural gas other than methane, which may be separated and handled distinctly from natural gas. LPG is a type of NGL
NIHR	National Institute of Health Research
N ₂ O	Nitrous Oxide
NIS	Institute National de la Statistique du Cameroun

OC	Organic Carbon
PDC	Private and Development Capital
PM _{2.5}	Particular Matter of a diameter of up to 2.5 micrometres
PRG	Partial Risk Guarantee
Quasi-equity	Convertible debt, convertible securities, revenue shares, warrants
SCDP	Société Camerounaise des Depots Petroliers Petroleum Depot Company of Cameroon
SCSFMA	Special Council Support Fund for Mutual Assistance (also FEICOM)
SDG	United Nations Sustainable Development Goals See www.un.org/sustainabledevelopment/sustainable-development-goals
SEforAll	Sustainable Energy for All UN-affiliated organization responsible to assist countries in achieving Sustainable Development Goal 7 (universal access to clean, modern energy)
SSA	Sub-Saharan Africa
TA	Technical assistance
TNMOC	Total Non-Methane Organic Compounds
UN	United Nations
Unit margin	The profit to a seller from the sale price of (revenue from) one unit of a product less the variable costs associated with that product
USD	United States Dollars
WHO	World Health Organization
WLPGA	The World LPG Association The international trade association for the LPG industry
XAF	See CFA



Cooking with biomass fuel in Cameroon

I. Introduction

LPG and the vast, deadly, environmentally destructive “clean cooking problem”

2.8 billion people across the developing world have no access to clean, modern energy for their main energy-consuming task: cooking. They rely instead on solid fuels like wood and charcoal, or on kerosene. Their reliance on solid fuels causes millions of premature deaths each year, causes large-scale loss of health, significantly harms forests, retards economic development and contributes to climate change. In this report, this reliance, together with its severe, negative consequences, are called the Clean Cooking Problem.

Addressing this 2.8-billion-person challenge became one of the pillars of United Nations Sustainable Development Goal 7 (SDG7). It is also a stated policy priority of the governments of over 20 low- and middle-income countries (LMICs), together representing one quarter of the world’s population.

The International Energy Agency, in its World Energy Outlook 2017, reported that if universal energy access for cooking is to be achieved by 2030, it will be achieved for 1.4 billion of these 2.8 billion persons through access to, and use of, LPG. That is, LPG would become the solution to the Clean Cooking Problem for, potentially, half the world, over at least the next 12 years.

What is LPG?

Briefly, LPG is a gas with very high energy content, similar to natural gas, that can be transported very efficiently in small, sturdy bottles, called cylinders, for combustion by consumers to create heat. LPG is often called “cooking gas” in developing countries, where cooking is its primary use. Chemically, LPG is comprised of the gases propane or butane, or a mix of the two. Approximately 2 billion people worldwide are LPG users today, according to the World LPG Association, an international trade body.

The Clean Cooking for Africa Program

Supported by a grant from the European Union Infrastructure Trust Fund and administered by German development bank KfW, the Global LPG Partnership undertook to address in detail the question of how feasible and scalable LPG could be as a clean cooking energy solution in three partnering African countries, and how such scale-up could be effectively carried out and financed across the full LPG value-chain.

These three countries are Cameroon, Ghana and Kenya.

Collectively, this multi-country effort is called the Clean Cooking for Africa Program. The program further contemplates, where properly justified, to direct appropriate resources for implementing national-scale LPG solutions.

The purpose of this report

This report, part of a series of five, discusses the main LPG investment projects for scaling up LPG as a major clean cooking energy solution for Cameroon through 2030 from a finance provider and implementer perspective.

Companion report

A companion report, the *National Feasibility Study: LPG for Clean Cooking in Cameroon*² (Feasibility Study) examines the overall ecosystem in which the essential investment projects required for scale-up of LPG consumption, supply, infrastructure and distribution will occur. This report presumes the reader is familiar at a high level with the Feasibility Study report.

Beyond 2030

The Clean Cooking for Africa Program limits its time horizon to 2030, on the twin premise that the LPG clean cooking solution is likely to be transitional and that funders of the major LPG projects are likely to require monetization or repayment of their investments or loans (if across multiple tranches) by that time.

To the extent LPG delivers on its potential for scaling and for socio-economic, environmental and climate benefit through 2030 as presented in the Feasibility Study, then LPG will be at a minimum an effective transitional solution until a fully renewable, clean, modern and effective cooking-energy solution emerges over the next decade and beyond. With the entry into commercial markets of meaningful, competitively priced quantities of bio-LPG during 2018, the lifespan of investments in LPG-based solutions for clean cooking may extend well past 2030.

² GLPGP (2018)

II. Executive Summary

Cameroon has an LPG ecosystem which, in general, is conducive to large scale, sustainable expansion of the LPG value chain. As discussed in the Feasibility Study, the ecosystem could be enhanced, but it is adequate to support investment and other programmatic measures to achieve the overall objectives of the Clean Cooking for Africa Program, as well as the objectives of the Government of Cameroon.

The financing ecosystem with respect to LPG is not adequate, but could become so. The critical inadequacy, identified both in the Feasibility Study and by the Government's ad hoc multistakeholder LPG Investment Committee, is in the bankability of a major scale-up investment in LPG cylinders and in the lack of availability of capital (on reasonable terms) both domestically and internationally. This lack of access to capital is a function of limitations within the domestic financial sector generally, and a lack of willingness by capital providers to evaluate, price, and accept LPG sector investment risk (among other risks) given the relative bankability of the required cylinder investment.

The Government of Cameroon has set a policy goal of 58% of the population using LPG as their main cooking fuel, and for other uses, by 2030. The main reasons are to reduce pressure on Cameroon's forests from use of unsustainably harvested wood fuels and production of charcoal for cooking; to make substantial progress toward Sustainable Development Goal 7 (universal access to clean, modern energy); and to improve the lives of Cameroon's people and accelerate Cameroon's development.

Today, approximately 31% of Cameroon's population uses LPG as a primary cooking fuel.

The Government's 58% usage target is deemed attainable, if appropriate investments are actually made, projects well executed, supportive measures taken, and ecosystem enhancements enacted, as described in the Feasibility Study.

The recommended investments have been structured into three tranches which take into account potential growth in consumption, corresponding expansion of assets and business operations to serve that consumption, projected financial performance of the modalities, and expectations of a representative mix of prospective financing sources, based on conversations and interviews held. The tranches and key derisking actions and gating conditions are as follows:

Tranche	Time period	Major required derisking actions / gating conditions to proceed
1	2019-2022	<ul style="list-style-type: none"> • None
2	2023-2026	<ul style="list-style-type: none"> • Acceptable results from Tranche 1 • Reform initiated of Governmental LPG subsidy, so that subsidy availability does not limit sector growth • Implementation of LPG Master Plan regulatory and pricing reforms, (i) to improve bankability and performance of the sector and (ii) to improve LPG equipment affordability for consumers • Completion of import terminal expansion (by 2024), to handle expected growth in LPG imports • If demand does not develop at the rate expected during Tranche 1, implementation of demand-incentivizing measures

Tranche	Time period	Major required derisking actions / gating conditions to proceed
3	2027-2030	<ul style="list-style-type: none"> Continuation of derisking actions and gating conditions from Tranche 2 If demand growth slows materially toward the end of Tranche 2, a reduction in the scale of Tranche 3 investments, or an increase in demand-incentivizing measures, would be required

Each tranche could be considered a standalone portfolio of linked projects. Tranche one represents the least risk, because it involves a measured expansion of the current LPG value chain, tapping into significant unmet demand (quantified in Chapter 12) without assuming any growth in per-user consumption, which is the main, material differentiator between the lower and upper bounds of the demand projection.

During tranches two and three, certain risks may become more important, and the level of these risks should be reassessed at the time. These include (i) the capacity of Government to continue to support fully the LPG subsidy as it grows, or the willingness of Government to reform the subsidy so that it no longer grows linearly with consumption but still provides appropriate support to the poor; (ii) the completion, ideally by 2024, of the terminal expansion project, and (iii) the level of consumption growth per LPG user vs. historical levels. With results known from the tranche one projects and activities, financing sources can make wiser funding decisions about the second, and then third, tranche, each of which might be resized or shifted in time to accommodate the evolving LPG environment and increased operational and financial knowledge about it.

In case consumption growth turns out to be closer to the lower bound of the demand projections than the upper bound, programs to stimulate additional demand and consumption may be implemented, instead of shrinking or delaying the supply-side investments. Certain such programs are described later in this report.

To expand the supply chain to serve the projected addressable demand effectively and efficiently, an estimated capital investment by the LPG sector of € 274 million will be required over twelve years. Because the Cameroon financial sector has constraints that are expected to limit its ability to fund all these investments indigenously, international commercial funding sources must participate as well. Prospective international funders have expressed interest in co-financing if LPG-specific and country-specific risks can be mitigated. However, they express reluctance to act as lead funders, especially with respect to the largest, most important, and most risky investment category: LPG cylinders.

To crowd in funding from these two groups in greater quanta and, potentially, with less onerous terms, development capital will have an important role to play. This would be both in the form of technical assistance grants that strengthen and facilitate the projects and help mitigate risks, and in the form of investment capital (equity/quasi equity, loans) that helps attract commercial capital providers to the projects and gives them a greater level of confidence that they can achieve the financial returns they require on the time horizons they require.

In turn, addressing the overlapping but distinct requirements of these different classes of funders determines the options for how the financing for different classes of project may be structured.

Sector strategy

Cameroon has 12 LPG marketing companies and a state-owned quasi-utility, Société Camerounaise des Depots Petroliers (SCDP), that performs the majority of the bottling, storage, and bulk logistics function for LPG in the country. This represents a relatively well-concentrated set of counterparties for directing capital investment and relevant forms of technical assistance.

The marketing companies face a challenge in common: LPG cylinders can be acquired and deployed at a rate limited by their operational cash flows, and the terms associated with capital (when they can access capital at all) for major cylinder investments are onerous. The companies have indeed grown the residential LPG market organically, incrementally. However, these limitations on their potential growth rate mean that a significant portion of the LPG demand in the country remains unserved, and will remain unserved to 2030 without accelerating the deployment of cylinders and expanding the supply of LPG and LPG infrastructure in proportion. Moreover, the presence of significant unmet demands also means that there has been no motivation for the LPG sector to attempt to innovate in marketing, selling, distribution, geographic targeting, and so on, in ways that would expand demand even more (particularly among lower-income and rural populations).

Strategically, marketers also face the choice of insourcing or outsourcing incremental bottling and bulk storage capacity as they grow. The sole practical option for outsourcing is SCDP. SCDP requires demonstrated demand to justify expansion investment, and access to capital for such investment.

Investment in SCDP is less risky than in marketers' cylinder inventory expansion projects, because the assets are fixed. Cylinders are, intentionally, mobile assets; physical control over them moves among multiple value chain nodes over time. From a transactional standpoint, SCDP, as a single utility-like counterparty, presents a number of advantages to the investor. Chief among these is that all bottling and bulk-storage related investment needed in the country could, in principle, be aggregated into a single transaction with SCDP.

It is expected that the existing LPG marketing companies, once able to acquire and deploy accelerated volumes of cylinders through one or more of the structuring options discussed in this report, will continue to operate largely as they have, albeit at increasing scale, seeking to preserve market share and benefit from certain scale economies as the LPG market grows more quickly than in a business-as-usual case. That is, there is not a (major) role to be played by industry consolidation or integration in the Cameroon LPG sector.

A final consideration is the willingness of the Government to sustain (or improve) its pricing formula, including subsidy support, as the LPG market grows. The Government has accepted a national LPG Master Plan which specifies a level of market growth and corresponding subsidy growth to 2030 which exceed the consumption projections of the Feasibility Study, understanding that the subsidy cost would grow in proportion, absent reforms. However, Government acceptance of a projected future fiscal burden of the subsidy for planning purposes, and Government's actual future ability to bear the subsidy burden, are not the same. Therefore, there is a risk of the Government facing possible fiscal difficulty in continuing its subsidy on LPG in future, unmodified and unabated.

Ecosystem strategy

The Feasibility Study as well as the Government-led multistakeholder national LPG Investment Committee recommend the Government modify its LPG pricing formula to generate a new revenue (cashflow) stream that would fund a discounting fund for aggregated procurement of cylinders by the LPG marketers, causing their net cylinder cost – and the cylinder deposit amount paid by consumers – to fall by a notional 40%. The recommended fund mechanism is also intended to provide risk mitigation for investors who would otherwise be reluctant to finance an individual marketer based solely on the marketer’s operating cashflow capability.

The Feasibility Study also recommends reducing the role of “wholesalers”, a type of distributor which is not linked to the brand of any particular Marketer. However, in the view of the experienced industry experts of the Clean Cooking for Africa Program, as well as in the view of the senior managements of the country’s leading LPG marketing companies, reducing wholesalers’ share of the distribution function in the supply chain, while desirable, is not a critical prerequisite for successful investment, growth, and sector sustainability.

The Feasibility Study also recommends that the Government eventually transition from a blanket subsidy on LPG fuel to a needs-based subsidy targeted at poorer households, such as India has done, in order to reduce the rate of growth of the subsidy obligation as the LPG market grows large.

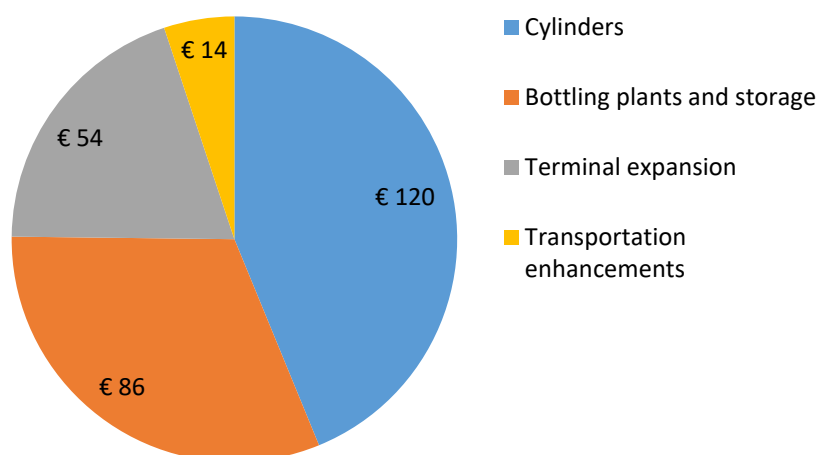
LPG investments and key assumptions

The total investment required to expand the LPG supply chain to serve the projected demand potential in the country is estimated at € 274 million, excluding importation and production, allocated as follows:

Table 1. Capital investment requirements to 2030 for LPG sector scale-up

Category	Capital Requirement (mm Euro)	Supply Chain Node
Cylinders	€ 120	Marketers / Consumers
Bottling plants and storage	€ 86	SCDP ³ / Marketers
Terminal expansion	€ 54	SCDP or competitor
Transportation enhancements	€ 14	Distribution (trucking)
Total	€ 274	

³ SCDP is the national utility company for LPG (and other hydrocarbon) storage and LPG filling, utilized by most LPG marketing companies.



Tranches for these investments are as follows:

Table 2. Investment financing tranches

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Cylinders	53,709 €	46,563 €	19,780 €
SCDP Bottling Plants/Storage	24,847 €	15,448 €	231 €
Non-SCDP Bottling Plants/Storage	28,019 €	17,420 €	261 €
Terminal Expansion ⁴	20,000 €	34,000 €	0 €
Transportation Enhancements	3,818 €	5,091 €	5,091 €
Total Capital Investment	130,393 €	118,523 €	25,362 €

As is the case in all LPG markets worldwide, the key asset for LPG market expansion is the inventory of cylinders, without which there can be no growth in residential LPG users.

Such investment would be staged in annual increments over 12 years. When the key leading indicator of market saturation used by the LPG industry, the cylinder rotation rate, begins to trend downward, further investments made on a commercial basis would be slowed or stopped in order to meet the financial return requirements of investors. Any further expansion of the value chain would then depend on additive incentivizing measures put in place for industry and/or for consumers.

Additionally,

- An LPG **microfinance expansion project** is recommended and proposed, with the aim of stimulating LPG adoption and use among households able to afford LPG in place of charcoal and purchased firewood on an ongoing basis but unable to afford the up-front lump sum cost to obtain the necessary consumer equipment to use LPG. This would occur initially on a small and controlled scale during tranche one, in order to develop local capabilities and learnings while stimulation of

⁴ The terminal expansion could be pushed fully into tranche two, as long as interim floating storage is utilized to address the import storage gap that the terminal expansion would fill permanently. The recommended year for the new terminal facilities to be put into service is no later than 2024.

additional demand is not of concern, and then would ramp up to full scale in concert with tranche two. The target objective for the project is up to 500,000 additional LPG-using households, with a project cost of up to € 25.7 million. This is detailed in the Project Annexes, Chapter 25, beginning on page 202. And,

- **Technical assistance measures** of up to € 22.9 million could be employed to improve the success characteristics of both the investments and the LPG ecosystem in which the investments would be made, as well as to encourage additional demand. These are detailed in Chapter 21 beginning on page 144.

These programs would be matched and scaled with the investment tranches, as follows:

Table 3. Technical assistance and microfinance tranches

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Microfinance	8,600 €	17,100 €	- €
Technical assistance measures	14,300 €	8,085 €	550 €
Total	22,900 €	25,185 €	550 €

Requirement for holistic investment within each tranche

It is important to recognize that no single LPG project is viable in isolation, and no single LPG project will deliver a specific and precisely quantifiable set of benefits and impacts. Just as building a power plant is pointless without also building power transmission facilities, and building transmission facilities is pointless without also building power plants, investment in one part of the LPG supply chain is pointless without making corresponding, proportional investment in the rest.

It is the combination of investment all along the chain which creates the possibility of large-scale LPG transition for clean cooking, and delivers the corresponding benefits, stage by stage.

Key assumptions

Table 4. Key investment program characteristics and assumptions

Total new user population to be served by 2030	12 million, or an additional 28% of the population (low case) 12.5 million, or an additional 29% of the population (high case)
Total capital investment requirement to 2030	€ 274 million
Target leverage	75% notionally comprising 40% concessional, 35% non-concessional debt
New and expanded Bottling Plants	10 including important incremental investment in safety

New cylinders in circulation	4.3 million
Potential technical assistance requirement ⁵	€ 22.9 million across all identified value-added activities
Potential microfinance project	€ 25.7 million to stimulate demand among 500,000 additional households
Major impacts to 2030	35-54 million trees saved 5.0-5.6 million MT of CO ₂ eq averted 19,000 lives saved Significant cost savings for households switching to LPG from charcoal
Key assumptions	End-user LPG pricing and supply chain margins remain regulated and increase by no more than approximately 12.5% to fund the expansion of the supply chain; the Government does not reduce or eliminate its per-tonne LPG price subsidy Relative stability of long-term LPG commodity input price ⁶ LPG can be made available over time, on a commercial basis, in underserved geographic areas (defined as those where LPG is already accessible within 20 minutes of home by the user), but will not necessarily become commercially available where LPG has no presence today ⁷ Historical demographic and economic trends affecting household fuel purchasing behavior will continue in force LPG asset costs will remain stable across the investment time horizon The Cameroon inflation rate and foreign exchange rates will not dramatically change Adequate foreign currency supply will remain available to import LPG SCDP and the private sector LPG companies will, on average, accept investment capital and deploy assets substantially as described

Gross vs. net investment requirement

There are two main ways in which the total financing requirement would be less than the total capital expenditure requirement.

The first way is for Marketers to borrow internally against the cylinder deposits obtained from their end-customers. Under law and by practice, the cylinder deposit amount in Cameroon is set to 80% of the cost of the cylinder to its Marketer. The funds provided by the customers are, in principle, a liability of the Marketer, to be returned to the consumer when s/he cancels service and returns the cylinder to the Marketer. In practice, Marketers redeploy most or all of the consumer deposit funds internally. This makes

⁵ Includes both critical and optional elements. See Chapter 21 for details of program activities and structure.

⁶ Through the subsidy mechanism, the price of domestically produced LPG is and imported LPG is the same

⁷ This assumption is incorporated in the Feasibility Study demand scenario models and reflects that geographic areas with effectively zero LPG penetration today are the areas which lack the necessary road networks for LPG distribution to occur, and/or lack an adequate cash economy to make LPG retailing viable there.

the consumer, in effect, a major financing source for Marketers. As modelled and discussed in Chapter 4 (beginning on page 60), this causes the net amount needed for cylinder financing to be closer to 20% of the capital cost of the cylinders than 100%. The aforesaid levy mechanism, if implemented, would effectively shrink this floor value to 12%, while reducing the deposit amount for the consumer from 80% of the cylinder cost to 48%.

In practice, the financing requirement for cylinders will fall somewhere between the hypothetical net (a floor value⁸) of € 24 million and the gross of € 120 million.

Impacts

A key motivation of the Cameroon Government to promote national LPG adoption and use; of the Global LPG Partnership, the EU ITF and KfW to study, to assist, and potentially to direct resources to, Cameroon's LPG scale-up efforts; and of the global development community generally, is to translate wisely spent funds into demonstrated, significant social, environmental and economic impacts for the host country.

As described in detail in the Feasibility Study, the low case and high case of expected impacts from the LPG investment projects against a business-as-usual scenario are as follows, covering the period 2020-2030:

Environmental:

- **Averted deforestation:** 35 to 54 million trees saved annually relative to base case projections in 2030 and over 300 million trees saved between 2020 and 2030.
- **Carbon dioxide equivalent (CO₂eq) emissions⁹ averted:** 5.0 to 5.6 million MT of CO₂eq emissions reduced annually in 2030 and over 40 million MT of CO₂eq emissions averted cumulatively between 2020 and 2030.
- **Black Carbon equivalent (BCeq) emissions¹⁰ averted:** 5.5 to 8.0 million MT of BCeq emissions averted annually in 2030 and over 46 million MT of BCeq emissions averted cumulatively between 2020 and 2030.
- **The economic value of averted CO₂eq emissions in terms of carbon financing:** € 45 – € 147 million cumulatively between 2020 and 2030, using the 2018 prevailing price of carbon.

Health:

- **Averted premature deaths:** 18,985 deaths could be averted cumulatively between 2020 and 2030 due to increased LPG usage.
- **Avoided Disability Adjusted Life Years (DALYs):** 926,484 DALYs.

⁸ The amount to be financed can never be as small in practice as the hypothetical net value, because of timing differences in the outgoing and incoming cashflows related to acquisition and deployment of cylinders and collection of deposits, and because of churn in the customer base and the need to maintain a deposit reserve against the churn. Additionally, an uneven rate of growth (such as an exponential rate of growth), as some individual Marketers have projected regarding themselves, would amplify these timing effects.

⁹ CO₂eq emissions include carbon dioxide equivalent emissions from carbon dioxide, methane, and nitrous oxide. These were calculated using IPCC conform standards.

¹⁰ BCeq emissions includes black carbon equivalent emissions from black carbon, organic carbon, carbon monoxide, and total non-methane organic compounds.

- **Economic value of averted deaths and avoided DALYS:** € 207 million between 2020 and 2030.

Consumer economics:

- **Average annual savings per household from switching to LPG:** € 22 switching from charcoal, € 26 from kerosene, € 310 from purchased firewood in urban/peri-urban areas, € 184 from purchased firewood in rural areas.
- **Average annual spending increase per household from switching to LPG from gathered firewood:** Up to € 156, if LPG were to be used exclusively.
- **Total annual savings among all switching consumers:** € 780 million to € 1.2 billion as of 2030.
- **Economic value of labor time gained:** 470 million hours gained, worth € 52 million per year, as of 2030.

National economics:

- **Cumulative tax revenue (assuming no rate or law changes):** Decrease of € 150 to € 220 million in 2030.
- **LPG subsidy (assuming no subsidy reforms):** Increase by CFA 36 to 48 billion (€ 54 to € 72 million) per year in 2030.
- **Trade balance (assuming no rate or law changes and constant local LPG production):** Expansion of trade deficit by CFA 87 billion (€ 56 million) to CFA 117 billion (€ 175 million) as of 2030.
- **Job creation:** 17,976 – 24,097 net new jobs in the LPG sector, but an unquantifiable reduction in the charcoal and woodfuel sectors.

Major risks

Among the most important risks are:

- **Picking the winners.** Choosing the right operational modality targets (individual firms) for investment, whether or not they are aggregated via intermediary financing vehicles. Additionally, there can be lack of alignment between winners chosen (directly or indirectly) by (i) the government, (ii) the market, and (iii) investors. The current limited number of LPG Marketers does not minimize this importance. Bringing relevant LPG industry and investment expertise and experience to bear in selecting capital recipients is thus essential.
- **Government policy change.** This can be government failing to follow through on enabling BCRM enforcement over time, or switching its support to a different solution for clean cooking in place of LPG (for example, attempting electric cooking for all) soon after major LPG investments are made. This is highly unlikely, but were it to occur, it would derail the investment program and could harm the LPG sector, its consumer beneficiaries, and its investors.
- **Subsidy change.** While the Feasibility Study recommends that the Government eventually convert its general LPG subsidy into a needs-targeted subsidy in order to increase LPG adoption and use without exposing the Government to a significantly increased fiscal burden as the LPG market grows, the Government has not prioritized study of such a conversion for the present, anticipating the state's ability to fund the subsidy, at whatever level is required, for the near and medium term.

A severe miscalculation by Government about its ability to fund increased future subsidy amounts could result, in practice, in a destructive shift of the subsidy cost to industry, or a consumption-depressing increase in the end user price.

A comprehensive list of risks and mitigation options is presented in Chapter 17 beginning on page 120.

Conclusion

LPG demand that is projected to be unmet or to be possible to stimulate could comprise 59-60% of the population by 2030, consistent with Cameroon's policy goal of achieving LPG use as a primary cooking fuel for 58% of its population by 2030. Serving that demand will deliver meaningful social, environmental and development benefits to the country and its people.

This can be can only be achieved if (i) key reforms to the LPG market structure and regulation are well concluded and effectively implemented and enforced, (ii) essential investments are adequately defined with capable and bankable counterparties and financing structures, (iii) the LPG subsidy can be maintained (or refocused on those in actual need as it gets larger), and (iv) other incentivizing measures, which can include consumer financial empowerment such as microfinance, education, and other steps, are taken to stimulate LPG consumption over the medium and long term beyond the level of unmet demand. Well-considered use of development system capital to help mitigate risks, crowd in risk-averse non-concessional capital, and provide technical assistance will be important to Cameroon's overall success.

Absent demand-side measures, LPG is nonetheless projected to become either a primary or a secondary cooking fuel for about 58% of the population by 2030, but such measures would be important for ensuring that LPG becomes the primary cooking fuel for that 58%.

It was beyond the scope of this report to define in detail a full program of demand-side measures or estimate the sensitivity the primary/secondary mix through 2030 to such measures.

III. LPG and the Clean Cooking Problem

The global community has recognized the central role of access to clean, modern energy for development with the adoption of the 2030 Agenda for Sustainable Development by the United Nations in 2015.

With the second decade of the 21st Century nearly over, more than 3 billion people still suffer the harmful and often fatal effects of cooking with solid fuels and kerosene. Household air pollution (HAP) caused by burning these fuels far exceeds the safe levels defined in the World Health Organization (WHO) Indoor Air Quality Guidelines (IAQG). According to WHO¹¹, nearly 4 million people die prematurely each year from these effects of HAP, and many more suffer from chronically worsened health. Recent evidence on the relationships between HAP exposure and health risk indicates that levels of household particulate matter must be reduced nearly to WHO guidelines levels if a large portion of this health burden is to be averted.

A major portion of the woodfuels and charcoal consumed for cooking purposes come from unsustainably harvested biomass. This adds to already significant pressure on forest cover, in the form of increased deforestation and forest degradation. Loss and degradation of forest cover may, in turn, weaken agricultural productivity in adjacent land areas.

The pollutants from cooking with solid fuels also contribute to shorter-term climate warming through black carbon and methane.

Obtaining and cooking with solid fuels is also more time consuming than obtaining and cooking with fuels such as LPG, which are commercially obtainable (or are delivered to the home), provide “instant-on, instant-off” heat energy for cooking, and require de minimis maintenance and cleaning of cooking appliances and cooking areas.

In Sub-Saharan Africa (SSA), four of five people use wood fuel or charcoal as their main source of cooking energy. In view of the rapid population growth in Africa (projected to more than double to 2.5 billion by 2050)¹², the total number of solid fuel users will increase, together with all the associated negative health, environmental and development consequences, unless urgent and effective action is taken.

In this context, a growing number of governments of countries in Sub-Saharan Africa and other regions have set ambitious policy goals and plans for scaling up the use of liquefied petroleum gas (LPG) as a cooking fuel. Their reasons include meeting the Sustainable Energy For All (SEforAll) goals and Sustainable Development Goal (SDG) 7 of universal access to modern energy; improvements in public health from reduction of the health burden from HAP caused by cooking with biomass and kerosene; improvements in quality of life for their people; economic development; and forest protection.

All of these goals are applicable to Cameroon. Indeed, Cameroon was the first country in the world to create and governmentally approve an LPG Master Plan, created to guide the rapid, safe and sustainable development of the Cameroon LPG sector.

¹¹ WHO (2016). Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children Report. Geneva: World Health Organization.

¹² United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.

IV. LPG Demand Potential to 2030

LPG consumption in Cameroon has been rising steadily over many decades, growing from 21 KT per annum in 1995 to 103,000 KT in 2017, driven mainly by urban and peri-urban households switching from firewood for cooking. Residential LPG consumption in 2017 amounted to 95,000 of the 103,000 total KT. Household penetration of LPG as the primary cooking fuel has reached 47% of urban/peri-urban households and 6% of rural households, with total penetration of approximately 41%. Table 5 summarizes key data points related to baseline LPG demand in Cameroon in 2017 as discussed in the preceding sections.

Table 5. Summary of baseline LPG consumption in Cameroon in 2017

Components of baseline LPG consumption	2017
Total residential LPG consumption for household cooking	95,000 MT
National per capita LPG consumption per year	4 kg
Estimated share of households consuming LPG as primary or secondary fuel	41%
As primary fuel	30%
As secondary fuel	11%
Annual LPG consumption per capita per LPG user	14.2 kg
Urban	15.5 kg
Rural	12.9 kg

The demand forecast scenarios to 2030, presented at greater length in the Feasibility Study, are:

- Scenario 1: Base case, where forecasted consumption was derived by extrapolating historical growth trends for residential LPG consumption without market reforms and associated acceleration and scale-up of investment. Total annual LPG consumption for household cooking is projected to grow to 171,339 MT by 2030, with a national per capita consumption of 5.5 kg per year and 2.9 million households (46% of all households) using LPG.
- Scenario 2: Market reform and expansion scenario, reflecting policy and investment interventions as described in this report. This scenario comprises two sub-scenarios, leading to a range of projected impacts:
 - Scenario 2A: Lower-bound expanded LPG availability, incorporating demand growth from demographic changes, as well as the impact of expanded LPG availability to serve latent demand without shortages. Total annual LPG consumption for household cooking is projected to grow to 269,699 MT by 2030. This represents a national per capita LPG consumption of 8.1 kg per year and 3.8 million households (59% of all households) using LPG by 2030.
 - Scenario 2B: Upper-bound expanded LPG availability, incorporating the same demand drivers as Scenario 2A (demographic changes and expanded LPG availability) and modelling the effect of shifts in cooking preferences that cause more average LPG consumption per user. Total annual LPG consumption for household cooking is projected to grow to 303,194 MT by 2030. This represents a national per capita LPG consumption of 9.1 kg per year and 3.X million households (60% of all households) using LPG by 2030. Additionally, 1.6 million

households (24% of all households) presently using LPG as a secondary cooking fuel are projected to transition to using LPG as their primary fuel by 2030¹³.

The Feasibility Study recommended a 300 CFA price increase on the 12.5kg cylinder or cylinder-equivalent (12.5kge), equal to a 4.6% increase in current end-user LPG price, to generate a new source of funding to be applied to reduce the capital cost to industry, consumers and investors of new LPG cylinders. This price increase is projected in the Feasibility Study to result in residential consumption of 254,812 MT in 2030 in the lower bound case, a 5.5% decrease. In the upper bound case, a proportional reduction would result in usage of 286,458 MT. Figure 1 shows the forecasted residential LPG demand by 2030. This suggests a roughly proportional ratio between price increase and consumption decrease under present and foreseeable demographic conditions. (It has been the Government's longstanding policy to maintain a stable, subsidized LPG price for purposes of affordability.)

Figure 1. Scenarios of forecasted residential LPG demand in Cameroon (2017-2030)



Selection of demand scenario

As discussed in the Feasibility Study (Chapter 19), local industry projections of consumption, as incorporated into the national LPG Master Plan, exceed the upper bound of the modelled projections shown in Figure 1 by approximately 25%. This is caused primarily by a difference in the forecasting methodology used within the sector (a widely-used global LPG industry methodology), their assumption that the recommended reforms to the LPG ecosystem would be promptly instituted by the Government, and their assumption about the level of per-user consumption in 2030 (in the industry case, this value was about 20% higher, based on a more aggressive view about the extent to which users will use LPG as the primary cooking fuel rather than only as a secondary cooking fuel). All projections agree that the

¹³ See the Feasibility Study for the details of each scenario.

penetration of LPG in the population would reach around 58%-60% by 2030, without necessarily requiring additive demand-stimulating measures—that is, measures that go beyond the usual marketing and selling activities of the sector. To ensure adequate supply-chain capacity is planned for, this report uses the 59% penetration scenario and the upper bound of the modelled consumption volumes (Figure 1), which falls approximately mid-way between the lower bound projections and the industry/Master Plan projections.

It should also be noted that, as indicated in the GLPGP-Dalberg household survey (Feasibility Study, Annex Chapter 27), there is considerable consumer “willingness to pay” at prices significantly above present market prices, even in remote rural areas, and even where the actual ability of poorer consumers to pay over time for LPG refills is suspect. This suggests that LPG is often seen as an aspirational purchase by poorer households. (The view of local industry salespersons is generally the same.) LPG adoption driven by aspiration implies that, initially, a portion of new users will use LPG only in limited ways. But some of these new users will transition over time to using LPG as their primary cooking fuel, based on increased familiarity with LPG, increased preference for the benefits of LPG, improved understanding of its cost savings (where they exist), improvement in the household’s economics, and other factors. The lower bound demand case includes secondary users but excludes this transition; the upper bound case includes the transition.

V. Critical Path LPG Infrastructure Investment Projects to 2030

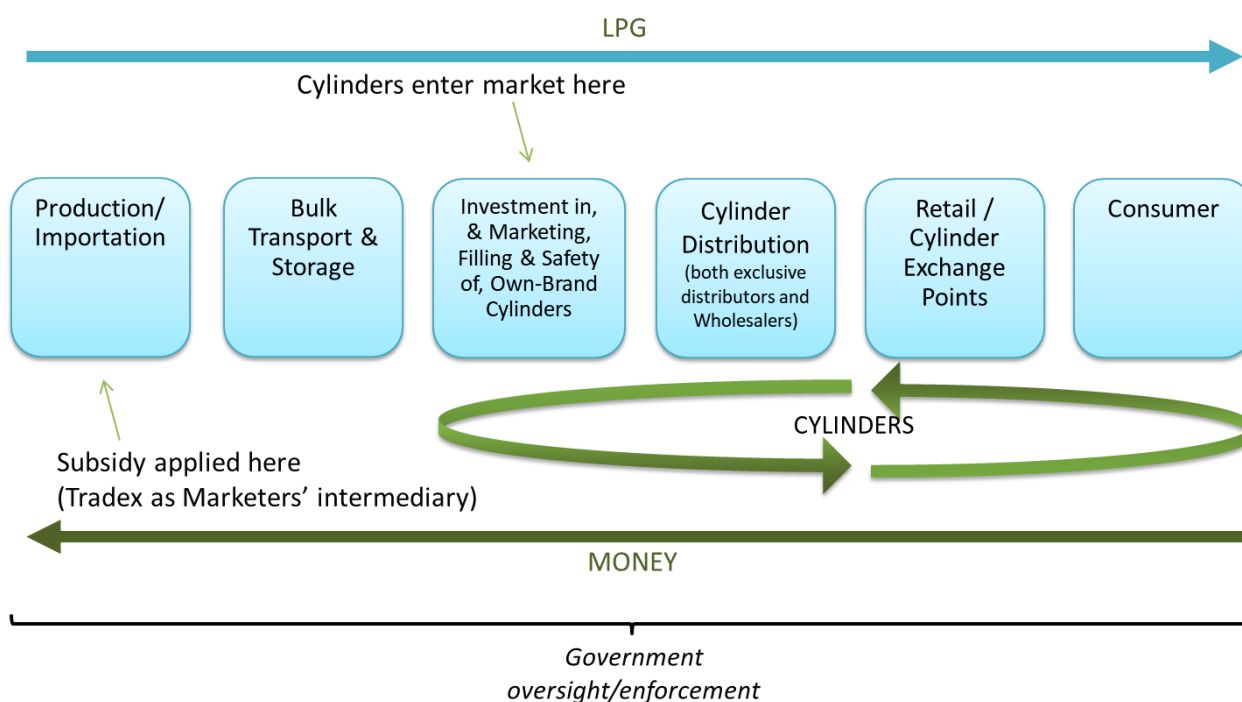
This Part describes the key infrastructure projects to be undertaken to serve the projected LPG demand that can be unlocked and created by 2030, as described in detail in the Feasibility Study. The LPG consumption projection for 2030 in the Government's Master Plan is more ambitious than the demand projections of the Feasibility Study and would require additional measures, beyond these projects alone, in order to be achieved. An outline of a program of such additional measures—and of the role which could be played by an expanded Clean Cooking for Africa Program in support thereof—is described in Part VIII beginning on page 142.

1. LPG Supply Chain

Existing Cameroon LPG value chain

The Cameroon LPG value operates under a moderately strong form of the Branded Cylinder Recirculation Model (BCRM). A key added element is the introduction of a governmental subsidy on the LPG commodity as it enters the supply chain, via a reimbursement mechanism to Tradex, the national LPG importing company (among its other business functions). This is shown in the following figure:

Figure 2. Cameroon LPG value chain



The nodes of the value chain are:

1. *Production/Importation*. LPG is sourced from importation and/or as a by-product from the production of natural gas or from petroleum refining. As noted above, a governmental subsidy is applied to

imported LPG as it enters the supply chain¹⁴. This shields the remainder of the supply chain from margin risk and governmental reimbursement risk as LPG input costs fluctuate while regulated end-user prices remain fixed.

2. *Bulk Transport and Storage Companies.* These companies obtain LPG from sources of importation and/or production and transport it downstream, in bulk, by rail or by tanker truck.
3. *Marketers.* These companies are either licensed sellers of petroleum products generally, which can include LPG, and licensed sellers of LPG only. While they may refill consumers' LPG cylinders themselves through their own facilities, Cameroonian Marketers largely, but not exclusively, outsource the cylinder filling function to SCDP, which operates as a national cylinder filling quasi-utility company. Marketers may, and often do, self-distribute cylinders to the consumer through their own facilities, or through dedicated (brand-exclusive) distributors serving networks of retail points, or through multibrand Wholesalers.
4. *Wholesalers ("Grossiste"), Distributors, and Depot operators ("Dépot Gaz").*
 - i. *Wholesalers.* Wholesalers are significant participants in this distribution node in the supply chain in Cameroon, unlike in most other LMIC markets, with approximately one-third share of cylinder distribution, measured by fuel volume. Wholesalers operate without contracts, using a standard price list. They have no obligation to return an empty cylinder to its brand-owning Marketers, and no responsibility for the safety of cylinders. Wholesalers are not required to report to Marketers on their sales outlets or their trucks. When a Wholesaler received a Marketer's cylinder, the Marketer loses operational control over brand marketing actions associated with cylinders, the cylinders' safety, and the sales network. Wholesalers are permitted to, and do, freely collect and keep cylinders from any Marketer and return them to any other Marketer (the branding on the cylinder itself notwithstanding).
 - ii. *Distributors.* Distributors in Cameroon are uncommon, unlike in most other LMIC markets. The distributor has a contractual, exclusive right to market a given Marketer's cylinders in its territory. The distributor pays a deposit to the Marketer for cylinder inventory; the Marketer undertakes to pay back the deposit upon return of the (empty) cylinder. The Distributor has its own network of retail outlets, or sells directly to homes. The Distributor represents the Marketer's brand under exclusive conditions prescribed in a distribution agreement. The cylinders are owned by the Marketer, despite being under the Distributor's operational control when away from the Marketer's facilities. The Distributor is prohibited to have cylinders filled by any unauthorized third party (e.g., a competing Marketer, or a pirate marketer), and to collect or keep cylinders belonging to other Marketers. The Distributor has one or more cylinder storage facilities to which the Marketer delivers filled cylinders. Finally, the Distributor owns a fleet of trucks that deliver to retail points under contract with it.
 - iii. *Depot operators and Resellers.* In Cameroon, a Dépot Gaz (or Gas Storage Facility) is defined by law and requires a business license. This facility plays a dual role: first, as a

¹⁴ Domestically produced LPG is priced equal to the subsidized import price.

Wholesaler that stores LPG in cylinders, and second as a retail outlet. This category is under public pressure to be scaled down by Government due to an accumulation of accidents (explosions) in recent years at such facilities. Resellers, conversely, are intermediaries between some Wholesalers and some of their retailers, operating as a shadowy “half node” in the supply chain between the two. Resellers have no legal obligations regarding safety, reporting of activity, licenses, etc.

5. *Retail outlets.* The retail outlet is where consumers exchange their empty cylinders for filled ones. Cameroon has retail outlets that are part of petrol stations, and standalone retail outlets. Retail outlets are served by Marketers (if owned by the Marketer).
6. *Consumer.* The Cameroonian consumer is the largest single investor, in aggregate, in the assets of the value chain, because the consumer, through a deposit, funds 80% of the cost of the market’s inventory of cylinders. (The 80%-of-cost deposit factor is defined by law¹⁵.) The consumer puts down a deposit on a cylinder of his/her preferred brand at a nearby retail outlet which carries that brand. (Due to the brand-blurring of some of the retailing by the Wholesalers, some retail outlets offer multiple brands.) When the consumer has used up the LPG, he/she returns to the retail point to exchange the empty cylinder for a full one, paying only for the new LPG on a per-kg basis. In many retail outlets, exchange of same-brand empty cylinder for same-brand filled cylinder is not enforced. The consumer takes the filled cylinder home.

The following table lays out the distribution mix.

Table 6. LPG national retail footprint by channel type (2017)

	Total	Direct channels (single branded)	Indirect channels (multibranded)
Main distribution players in channel	320	35 Distributors	285 Wholesalers
Average annual tonnage per Distributor / Wholesaler		283 MT ¹⁶	111 MT
Estimated number of retail outlets	4,766	806	3,960
Population per retail outlet	10,309	Low: Douala 3,252	High: Garoua 84,898
% volume handled	100%	67%	33%
Average annual tonnage / retail outlet	23 MT	75 MT	8 MT

The average throughput of the different channel modes shows that the direct, single-brand channels are far more effective for (i) achieving a critical mass of sales volume for their business entities and (ii) providing much denser coverage of the population.

More than half of residential LPG consumption is served directly by the retail footprints of major Marketers, such as via petrol station networks, without (reported) use of independent distributors.

¹⁵ Governmental Order 011/MINDIC/CSPH of 30 April 2003. The price of a cylinder imported to Douala, plus defined transport cost from Douala to the Marketer facility, is the defined cost basis for the deposit.

¹⁶ Excludes volumes sold directly by Marketers via captive retail outlets.

Overall, these data confirm the need to increase the distribution system footprint significantly in order to serve both current and projected unmet demand. Industry expert stakeholder consultation suggests, and the National LPG Master Plan recommends, a target of 3,000 population per retail outlet, vs. 10,309 today.

Special roles for specific entities

- SCDP (Société Camerounaise des Dépôts Pétroliers) is a 51% state-owned company, responsible for bulk storage of LPG nationwide and for cylinder filling on a public-utility basis, although Marketers are free to perform in-house filling as well.
- Tradex is a 44% state-owned company and a subsidiary of SNH. Tradex is the main petroleum-product importer, exporter and distributor, and is also a leading LPG Marketer. (Tradex is one of the local LPG operating partners in the Cameroon GLPGP/Clean Cooking for Africa LPG microfinance program.) Tradex is a subsidiary of SNH (Société Nationale des Hydrocarbures du Cameroun), the Cameroon state oil company.
- CSPH (Caisse de Stabilisation des Prix des Hydrocarbures) is the Hydrocarbon Price Stabilization Fund, which compensates for volatility in the input price of petroleum products into the sector, including LPG. Because pricing is set by regulation below international parity, CSPH effectively implements the national subsidy mechanism. It also implements LPG cross-subsidies such as the transportation equalization tax. CSPH also regulates the distribution subsector, including pricing compliance, and, in cooperation with Tradex, manages tenders for LPG (and other hydrocarbons) for the input quantity not assigned to Sonara.
- SONARA (Société Nationale de Raffinage SA) is the state oil refinery company. Sonara is allocated a 20% share of the national market for LPG supply, the remainder sourced from abroad through CSPH/Tradex tenders.
- CAMSHIP (Cameroon Shipping Lines) and CAMRAIL (Cameroon Railway Corporation) are the providers of primary domestic maritime and rail transport of LPG. CAMSHIP handles transport of LPG from Sonara in Limbe to SCDP primary storage facilities in Douala. CAMRAIL transports LPG in bulk from SCDP Douala storage facilities to SCDP satellite facilities in Yaounde, Bélabo and Ngaoundéré.

Low fragmentation

The relatively low fragmentation of the supply chain at the Marketer level creates improved bankability, when taken as a whole. In principle, it also reduces burdens on the regulator, who would otherwise oversee a very large number of companies and proprietorships compared to the level of revenue to the regulator generated by the system. However, because the Wholesaler distribution channel is opaque, with little to no reporting of activity, the regulatory burden is actually larger. This is evidenced by the limited efforts of regulators to police the sector downstream of the Marketers, except with respect to Depot operators.

Risk associated with the activities of Wholesalers

The presence of unbranded Wholesalers handling a portion of the Marketers' cylinder business creates a fracture in the link connecting cylinder investment, profits and safety, which makes it more risky for Marketers relying on Wholesalers to invest, and for financing sources to provide investment capital to

them. Presently, the level of such wholesale activity is not dominant, and therefore is not a fundamental barrier to investment, but the risk profile of the investments would be improved by reducing the share of the distribution channel that multibrand Wholesalers occupy, or by eliminating the category outright through law or regulation. Companies that do not work extensively with unbranded Wholesalers are advantaged, from a risk standpoint, compared to companies that do.

This situation is avoided by oil companies who sell own-brand LPG through their own petrol stations. However, the national petrol station network is not, and never will be, adequately dense, nor located where the bulk of future LPG demand is: it is, and will remain, located and sized according to the need of vehicle drivers to fuel up.

Cameroon supply chain nodes and participants

Production and importation

LPG production comes from Sonara, the national oil refinery, for about 20% of the present national total. Additional LPG is imported via tenders run by CSPH/Tradex. LPG importation is pooled among the Marketers and delegated to Tradex, which conducts the calls for tenders and contracts suppliers. Each Marketer must pay its share up front, via letter of credit.

Importation is primarily from Equatorial Guinea and secondarily from the Americas. It is landed at the Bonaberi SCDP terminal. This terminal has a storage capacity of 2,500 tonnes of LPG and a shallow draught for accepting LPG vessels, which limits the maximum vessel size and thus creates a practical floor for the cost of ocean shipping of imported LPG. A floating storage platform paired with a shuttling coastal vessel mitigate this in part. Eventual implementation of a new terminal facility at Kribi, able to store 20,000 tonnes of LPG and receive correspondingly larger LPG vessels, would expand importation capacity, increase the choice of import sources, reduce importation costs, ensure more buffer storage to prevent LPG fuel shortages, and store future LPG produced along with methane (natural gas) from new domestic natural gas field production.

Under the future growth scenarios described in this report, importation is expected to increase significantly its share as a source of supply, because (i) domestic oil refinery output of LPG would not change as a function of LPG consumption, but only to the extent domestic oil refinery output overall is chosen (and funded) to be expanded to serve additional petroleum product demand that may arise, and (ii) the forecasted LPG consumption growth will exceed the anticipated co-production of LPG from natural gas fields.

Adequate LPG is expected to be available for importation far beyond 2030 at relatively stable prices. (See Annex Chapter 32 on page 223 for details.) It is also expected that the prices of Cameroon's domestically produced LPG will continue to be linked to the region's international LPG reference price. This is both a good business practice and good policy practice for avoiding unintended arbitrages and resulting market distortions.

Bulk transport and storage

Primary bulk transport of LPG is handled by CAMSHIP and CAMRAIL.. The national storage network is managed by SCDP, with bulk road transport handled by company-owned bobtail trucks or through contract with independent petroleum-products trucking firms.

The bulk storage capacity in Cameroon is connected with its filling capacity, as described in the next section.

Filling

The following figure and table set out the national filling and storage capacity as catalogued in the Master Plan:

Figure 3. Filling plants and their capacities (2015)

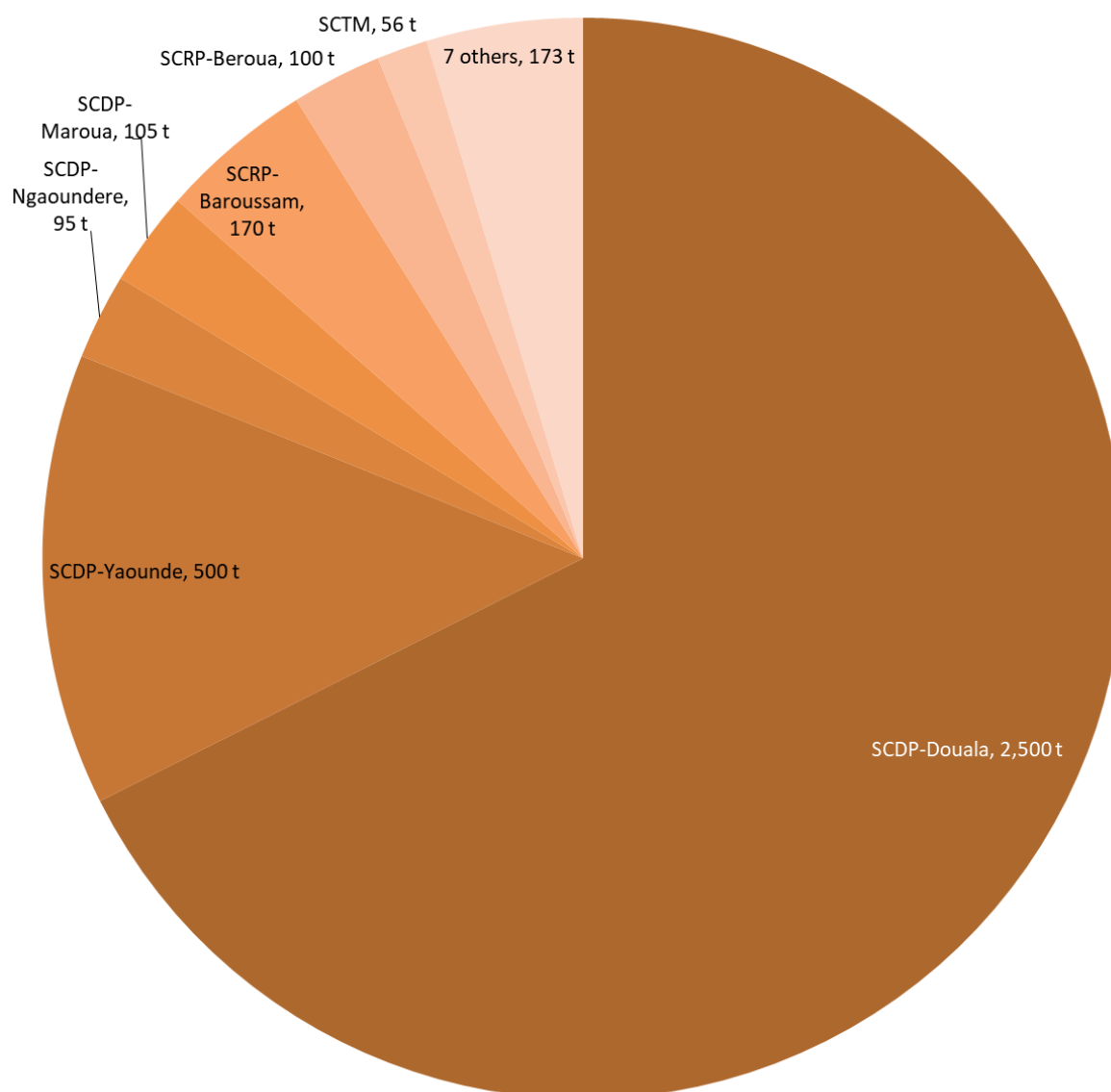


Table 7. Filling plant capacities and capacity shares (2015)

Filling facility	Storage Capacity (MT)	Capacity Share
SCDP-Douala	2,500	67.6%
SCDP-Yaounde	500	13.5%
SCDP-Ngaoundere	95	2.6%
SCDP-Maroua	105	2.8%
SCRP-Baroussam	170	4.6%
SCRP-Beroua	100	2.7%

Filling facility	Storage Capacity (MT)	Capacity Share
SCTM	56	1.5%
Others:		
AZA (4 sites)		
GlocalGaz	173	4.7 %
Stargas		
Green Oil		
Total	3,699	100.0%

LPG Marketing Companies

Twelve companies were licensed as LPG Marketers as of the end of 2018. Of those, six are multiproduct companies: typically larger, multifuel petroleum distribution companies that pursue a national marketing and retailing strategy with LPG distribution centered on their respective petrol stations. The LPG market leader, however, is a non-petroleum company: Société Camerounaise de Transformation Métallique¹⁷ (SCTM), a private sector firm with approximately 27% LPG market share.

All twelve had LPG activity in 2018. The most recent entrant, Stargas, moved into LPG in 2015, growing quickly from a small base.

The following figure and table show their market shares for 2017:

¹⁷ SCTM was originally established as a national metalworking and LPG cylinder manufacturing company.

Figure 4. LPG Marketers market shares (2018)

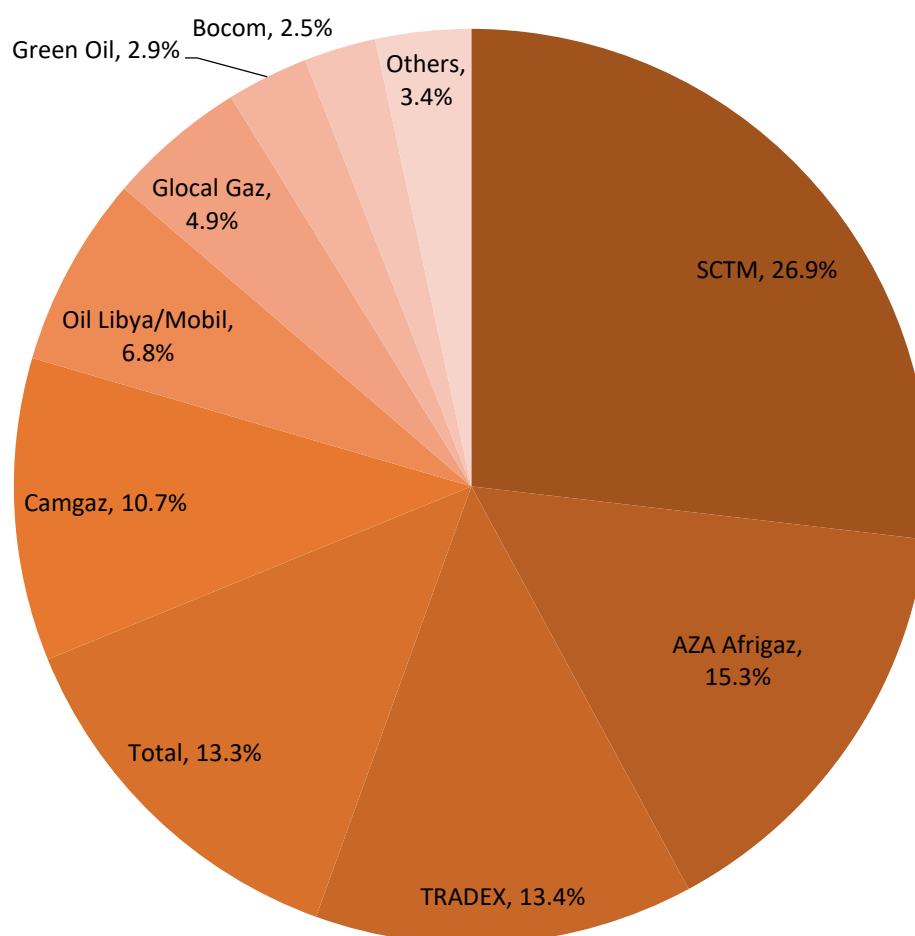


Table 8. LPG Marketers, volumes and market shares (2018)

Company	LPG Sales (MT)	LPG Market Share	Type
SCTM	30,567	26.9%	LPG
AZA Afrigaz	17,383	15.3%	LPG
Tradex	15,245	13.4%	Multifuel
Total	15,159	13.3%	Multifuel
Camgaz	12,179	10.7%	LPG
Oil Libya/Mobil	7,693	6.8%	Multifuel
Glocal Gaz	5,589	4.9%	LPG
Green Oil	3,291	2.9%	Multifuel
Bocom	2,890	2.5%	Multifuel
Infotech	1,744	1.5%	LPG
Stargas	1,209	1.1%	LPG
Corlay	890	0.8%	Multifuel
Total	113,839	100%	Multifuel: 6 LPG: 6

The main difference between the multifuel and LPG-only types of firm is that the multifuel company operates service (petrol) stations that may include LPG among the products offered, and may also have LPG Distributors and Wholesalers, whereas the LPG-only company sells only LPG, which may be direct to the public through its own facilities or through Distributors or Wholesalers, and does not have automotive service stations.

Transportation services

Transportation of LPG in cylinders is carried out by Distributor or Wholesaler vehicles, or under contract by them to third party trucking firms. Their costs and margins are subsumed into the costs of the Marketers in the national LPG pricing formula. (See Chapter 10 (Pricing) of the Feasibility Study for a detailed discussion.)

Distributors and Wholesalers

As shown in Table 6 on page 32, Cameroon had 35 Distributors managing 806 retail outlets and 285 Wholesalers managing 3,960 retail outlets in 2017, handling in aggregate 283 MT and 111 MT, respectively, of average annual LPG volumes. On average, a single Distributor handles approximately nine times the volume of a given Wholesaler.

The total volume in cylinders handled by the Distributors and Wholesalers in 2017 represented only about 40% of the market, with the remainder being sales by Marketers directly to consumers through their own retail outlets (primarily, petrol stations). The number of petrol stations in Cameroon was estimated at 550 in 2015, of which 100 were owned by 17 oil-and-gas companies not operating in the LPG sector.

Future importation and bulk storage capacity

In addition to the import terminal development planned for Kribi, as mentioned above, there is an eventual requirement to add capacity to the national storage footprint. With a storage capacity of 3,699 MT, including the Bonaberl SCDP terminal and excluding Sonara storage for discharge of its LPG production, the national storage capacity is turned over approximately 30 times per year. At a minimum, the national storage network should have the capacity to store one week of supply, or about 50 turns per year. Thus, by the time the residential market has increased by approximately two-thirds, additional storage capacity will be required. The associated investment requirements are described in the next Chapter of this report.

2. Investment Summary

This Chapter describes GLPGP’s recommended scenario of expansion and development of the critical LPG infrastructure needed to serve the latent and unmet residential demand as projected to 2030. The estimates of costs have been built on the basis of international technical standards.

Although the national LPG Master Plan calls for a reduction of the share of distribution handled by Wholesalers, such a shift in the distribution modality has not been assumed to occur, nor required to occur, as a precondition for successful investment into, and implementation of, infrastructure expansion projects. Nevertheless, improvements to the risk profile of investments involving LPG companies with a significant distribution role for unbranded Wholesalers, and to the safety profile of the sector via reducing the involvement of Wholesalers, would serve to increase the rate of LPG adoption and extent of LPG use. Therefore, to the extent that the Government and/or industry are effective at reducing the role of Wholesalers, the overall ecosystem—investments and their financial returns, public safety, consumer adoption and use of LPG—is likely to be better for all stakeholders than what has been analyzed and modelled in the Feasibility Study and in this report.

Upon completion of these investment projects, Cameroon would have an expanded network of infrastructure and distribution assets with the capacity and capability to address the safety, productivity, and quality needs of refilling of cylinders to serve the projected demand through 2030 and beyond.

An important consideration is the capability of Marketers to acquire and deploy cylinders at the required pace, given their available cash flow and their ability to obtain and absorb investment capital. This is discussed in detail in the next Chapter.

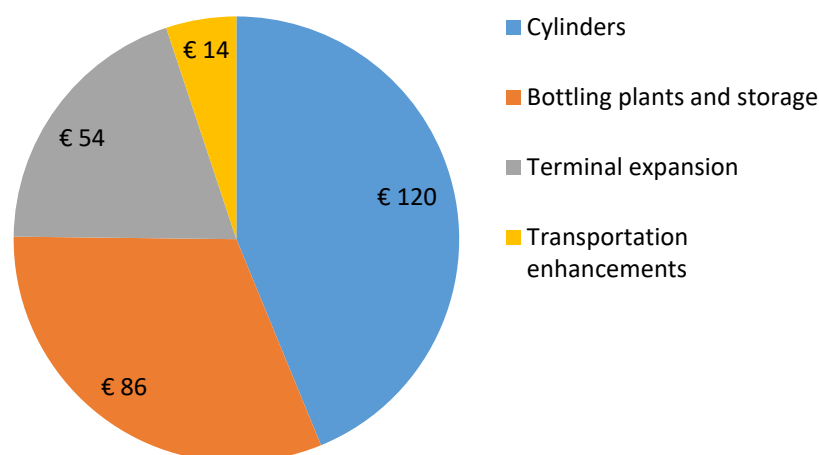
The Marketers must, in turn, plan and carry out business expansion driven by expanded cylinder inventories, wherein they develop deeper and broader retailing footprints.

The acquisition of the cylinders themselves, being a procurement task, is addressed in detail in the Project Annexes, Chapter 24. The quantity of cylinders in circulation and their velocity (rotation rate, in industry terms) along the value chain is related to the required capacities of the filling plants.

The total investment requirement is summarized in the following table:

Table 9. Capital investment requirements to 2030 for LPG sector scale-up

Category	Capital Requirement (mm Euro)	Supply Chain Node
Cylinders	€ 120	Marketers / consumers
Bottling plants and storage	€ 86	SCDP / Marketers
Terminal expansion	€ 54	SCDP or competitor
Transportation enhancements	€ 14	Distribution (trucking)
Total	€ 274	



Cylinders clearly represent the largest single asset type by far, at about 45% of the total, and Marketers—as cylinder owners—the largest single category of entity for deployment of capital.

Tranches for these investments are as follows:

Table 10. Investment financing tranches

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Cylinders	53,709 €	46,563 €	19,780 €
SCDP Bottling Plants/Storage	24,847 €	15,448 €	231 €
Non-SCDP Bottling Plants/Storage	28,019 €	17,420 €	261 €
Terminal Expansion ¹⁸	20,000 €	34,000 €	0 €
Transportation Enhancements	3,818 €	5,091 €	5,091 €
Total Capital Investment	130,393 €	118,523 €	25,362 €

The projected gross amount of required investment – € 274 million -- can be reduced over the 12-year period in three ways:

1. Marketers benefit by consumers paying a deposit for use of the cylinder. The percentage varies by country (in Cameroon it is 80% by law, and in Kenya can exceed 100%, set by the market). This deposit usually would be received by the Marketer within three months from the original purchase of the cylinders by the Marketer. In Cameroon, these funds are required to be treated as a liability to the customer, who may recover the deposit upon cancelling service and returning the cylinder. Given an 80% deposit to be taken by the Marketers, their net cost of the cylinders is reduced from € 120 million to € 24 million, with a somewhat proportional reduction in the amount of financing required. The quantum of financing would not fall in exact proportion due to factors including the rate of cylinder inventory growth year over year, deposit liability reserve levels, cylinder losses and

¹⁸ The terminal expansion could be pushed fully into tranche two, as long as interim floating storage is utilized to address the import storage gap that the terminal expansion would fill permanently. The recommended year for the new terminal facilities to be put into service is no later than 2024. For further discussion, please see the *Cameroon LPG Investment and Implementation* report.

scrap rates, and other factors, all of which affect the amount needed to grow and maintain the cylinder park year over year.

2. Based on detailed conversations, the Clean Cooking for Africa/GLPGP expert team anticipates that some Funders would offer terms for the financing of the cylinders which would help to minimize the working capital component of any borrowing by Marketers. It is likely that the Funders would seek a minimum principal repayment schedule with increased amounts depending on the level of deposits collected and the speed with which they are paid. Nevertheless, any such financing terms would help to reduce the actual amount of borrowings by the Marketer.
3. The debt portion of the funding to purchase cylinders and to purchase or build other assets in this report is structured in three tranches. Were repayments to be made completely timely, the funds could in effect be rolled over to supply the actual funds for the second and, possibly even, the third tranche. The result is that, if the same Funders invest across the full investment time horizon, the Funders would not have to put up new funds in the latter portions of the 12-year period. Instead, they would, in effect, recycle the initial funds up to twice more. From a Funder's perspective, this would mean considerably less capital at risk, even if the total amount on offer over the three tranches would be the larger amount.

It is not possible in this report to completely estimate the terms of any particular financing transaction, as that depends on the reality of the financial marketplace at the time of the transaction and the prior steps taken by the Government to de-risk the environment. Nevertheless, it is clear that reuse of cylinder deposits and structured financing by Funders should allow Marketers to reduce significantly the actual amount of funding sought. The result, in this case, would be somewhere between the € 274 million gross amount and a € 178 million net amount.

Additionally,

- The Cameroon LPG microfinance program, being carried out in its second pilot phase as of this writing, could be scaled up at a projected cost of up to € 25.7 million across tranches one and two, to unlock demand for a target of up to 500,000 households that can afford to switch to LPG in place of charcoal or purchased firewood for cooking, but cannot afford the up-front lump sum costs of the required LPG consumer equipment. The program is described in the Project Annexes, Chapter 25, beginning on page 202. And,
- Technical assistance (TA) measures of up to € 22.9 million could help to improve the bankability and outcomes of these investments and contribute to development of demand as well. The TA measures are described in Chapter 20 beginning on page 142.

These programs would be matched and scaled with the investment tranches, as follows:

Table 11. Microfinance and technical assistance (TA) tranches

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Microfinance	8,600 €	17,100 €	0- €
Technical Assistance (TA) Measures	14,300 €	8,085 €	550 €
Total	22,900 €	25,185 €	550 €

Combining the amounts shown in the prior two tables, the overall program costs by tranche are:

Table 12. Combined tranches: investments, microfinance, and TA measures

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Cylinders (Gross Amount)	53,709 €	46,563 €	19,780 €
SCDP Bottling Plants/Storage	24,847 €	15,448 €	231 €
Non-SCDP Bottling Plants/Storage	28,019 €	17,420 €	261 €
Terminal Expansion ¹⁹	20,000 €	34,000 €	0 €
Transportation Enhancements	3,818 €	5,091 €	5,091 €
<i>Subtotal: Capital Investment</i>	130,393 €	118,523 €	25,362 €
Microfinance	8,600 €	17,100 €	0 €
Technical Assistance (TA)	14,300 €	8,085 €	550 €
<i>Subtotal: Microfinance and TA</i>	22,900 €	25,185 €	550 €
Gross Financing Total	153,293 €	143,708 €	25,912 €
Less: Cylinder Deposits (Potentially)	(42,967 €)	(37,250 €)	(15,824 €)
Net Financing Requirement (Potentially)	110,326 €	106,458 €	10,088 €
Gross Financing Total to 2030			322,913 €
Net Financing Total (Potentially) to 2030			226,872 €

Concessional capital in a tranche-one critical mass of projects

As described in detail Part VIII beginning on page 142, it is recommended that concessional capital sources, such as DFIs, IFIs, and MDBs, consider participating at a level of 40% of the financing for the above hard assets and business projects as part of a blended capital stack, as well as to fund proposed technical assistance measures and microfinance programs, with tranche one serving as a self-contained, first financial cooperation project-of-projects. Capital repaid from tranche one could then be considered for reinvestment into the later tranches.

¹⁹ The terminal expansion could be pushed fully into tranche two, as long as interim floating storage is utilized to address the import storage gap that the terminal expansion would fill permanently. The recommended year for the new terminal facilities to be put into service is no later than 2024. For further discussion, please see the *Cameroon LPG Investment and Implementation* report.

3. Investments at the Sector Level

This Chapter describes the investments necessary over time to serve the demand potential identified in the Feasibility Study. This investment stream has been calibrated in four main ways, and may be recalibrated in future as needed:

1. *Demand.* The hypothetical sector-level investments identified in the Cameroon national LPG Master Plan, developed using confidential growth forecasts provided by the LPG Marketers, assumed more users, and higher usage per LPG user, than the upper bound demand assessment of the Feasibility Study. (Some Marketers were highly aggressive in their growth forecasts, while others were more conservative.) The investments outlined in this report utilize the upper bound demand assessment of the Feasibility Study as a constraint on the scale and pace of investing, for sake of conservatism.
2. *Financial returns available to investors and lenders.* The financial returns of the investments are consistent with identified requirements of anticipated participants in the capital stack, as described in Annex Chapters 26 and 27;
3. *Normative LPG industry operational and cost-structure ratios.* The operational performance of the supply chain nodes is consistent with LPG industry operating and costing norms for Sub-Saharan Africa LPG markets where BCRM is practiced;
4. *Future growth dynamics.* To the extent the demand estimates prove to be greater than actual demand, the rate of investment can be slowed or halted in any year to rebalance supply, capacity, capacity utilization, and supply-chain growth with actual demand and the actual rate of demand growth. If demand estimates prove to be lower than actual demand, the rate of investment can be accelerated up to the sustainable growth rate limit of the businesses in the supply chain, or can be continued beyond 2030, to catch up to actual demand and, potentially, to the rate of demand growth.

Chapter 4 examines the investment economics and returns at the firm level.

The key metric which ties together all aspects of the financial and operational modelling of the investments, and of the firms, is the number of cylinders required to be in national circulation (i) for the expected usage to be served reliably by the supply chain, and (ii) for the LPG supply chain to generate adequate cashflows to pay for required operations, growth, and the anticipated financial returns required by investors and debt payments required by lenders.

The number of cylinders required is a function of

1. The number of users;
2. The frequency of refilling of their cylinders;
3. The size of the cylinder; and
4. How and how quickly the cylinders recirculate within the supply chain.

The investments are staged in a series of annual and multi-year steps (based on the asset type) over twelve years, in order to optimize returns, minimize execution risk, and match expansion of supply and distribution to the anticipated growth of demand.

The number of users is projected in Part IV. As elsewhere in this document, a “user” is a member of a household that uses LPG for cooking. Aggregated Cameroon industry data, obtained via survey and interviews, are used to define standard operational parameters for modelling. These are detailed hereafter. Future refill frequency is solved for through analysis of other operational, inventory and usage statistics, and is evolved over time from the industry data, consistent with norms for BCRM in equivalent- and larger-sized LPG markets (measured in usage per capita) in Sub-Saharan Africa. The industry term for this parameter is the cylinder rotation rate, which is a function of multiple drivers that include gross and average consumption level by households, the mix of cylinder sizes, the efficiency of the supply chain including its logistics, the level of diversion (loss, whether temporary or permanent) of cylinders to competitive interventions (legal or illegal) and to mishandling in distribution, the extent of ongoing cylinder maintenance and scrapping required, and other factors. The rotation rate is a key metric for an LPG business to assess and predict the earnings generated by the cylinder inventory it owns or manages. A declining rotation rate in a given geography is a leading indicator of saturation of that geography’s LPG market, all other things being equal, and is a reason to slow or pause further investment.

The main cylinder sizes in Cameroon for households are 6kg and 12.5kg, with 12.5kg overwhelmingly dominant. The current mix has been assumed to continue in this analysis. For purposes of the analysis, cylinders are defined using a measure of kge (kg-equivalent). That is, a 6kg LPG cylinder (for example) is treated as equivalent to 0.48 12.5kge cylinders, or 12/25ths of a 12.5kg cylinder. Where “kg” is used regarding cylinders, it indicates a specific cylinder size; where “kge” (or “kgeq”) is used, it indicates a weighted average of sizes.

The combination of expected (and desired) LPG adoption and consumption rates by households, cylinder rotation rates, associated cylinder inventory requirements, and other factors drives the sizing and costing of the LPG infrastructure that will be required to serve future demand. The sector-level modelling of the needed infrastructure and investments was performed regionally, because (i) the necessary regional data exist, and (ii) regional variations in the key parameters are large enough to be material.

Calculation of operating projections per region

Households vs. persons

While projections could be made based on either households or persons (users) of LPG, for purposes of calculating capacities and investment requirements, persons (population) has been used. That is because consumption of LPG for cooking is linked to the number of meals cooked, which varies not with households (each region having its own average household size), but with the number of persons across the using households. Cylinders themselves, conversely, are linked to the count of households (or, more properly, to the number of “kitchens”, in that the concept of a household, from a cooking standpoint, might involve more than one family group at a time, with shared cooking duties).

Projection of LPG consumption to 2030

It has been assumed that the LPG consumption progression rate varies between the southern regions and the northern regions and that LPG consumption will progress more quickly going north, starting from a proportionately smaller base, compared to the south, where LPG in has already achieved high penetration in the regions around Douala and Yaounde.

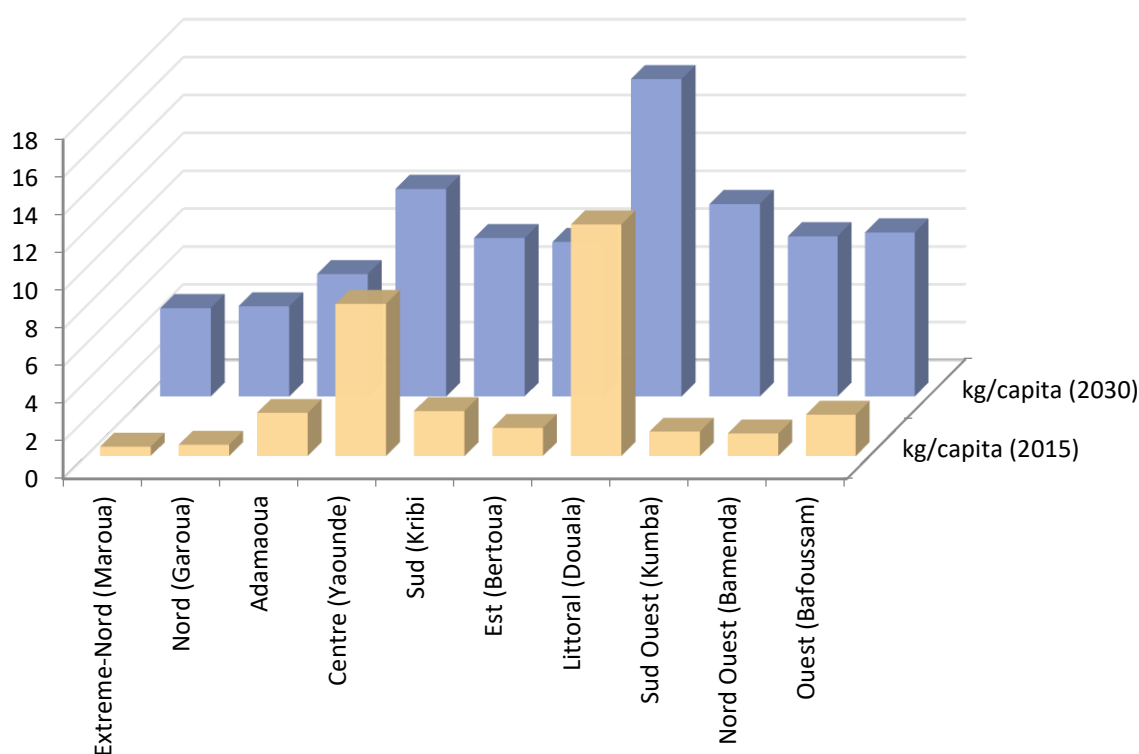
LPG annual volume growth was annualized in three stages, the first from 2019-2020 (as the first new infrastructure is deployed), then 2021-2025 to the inflection point in the demand projections, as market saturation starts to take effect, and finally 2026-2030. A linear interpolation was used for purpose of ramping up the investments.

The penetration rate and consumption level per region were determined by applying the region-by-region growth projections for each from the Master Plan to the 2018 starting values. The consumption rate ramps, as in the upper bound demand scenario, to 20.3 kg per capita per user, to give the projected LPG volume per region over time.

The projected usage and volume data are summarized in Table 14 on page 47.

The following figure shows the consumption per capita per region that the investments in supply chain capacity will track, as a proxy for penetration of each region (and a rough proxy for regional volume):

Figure 5. Projection of consumption by region to 2030 for investment sizing



Note: Linearity of the projected consumption, done for investment purposes, (i) anticipates projected demand growth per the demand studies, ensuring adequate supply is in place adequately in advance of demand to be served, and (ii) serves to minimize the potential for volatility in the requirement to absorb and deploy capital by the supply chain for expansion

Summary of projected LPG volumes and cylinder requirements

As discussed in detail in the Feasibility Study, LPG end-user pricing may be increased slightly by the Government, if it implements fully the recommendations of the Master Plan and of the national LPG Investment Committee, in order to spread out the up-front cost of new cylinders over time. The notional maximum extent of such a price increase is proposed to be € 0.037 per kg, which, if passed on fully to the end-consumer, is modelled to result in reduction in consumption volume of approximately 5.5% but negligible effect on the percentage of new households adopting LPG (and requiring new cylinders).

A reduction in consumption without a corresponding reduction in the number of users implies a reduction in the refill rate. However, the cylinder inventory requirement does not decline materially, because the refill rate is only one of many factors affecting the national cylinder requirement.

The cylinder requirement is calculated for each region using a 2017 baseline of its residential LPG consumption and cylinders, the population served per existing cylinder, its rate of population growth, the implied cylinder rotation rate, working stock requirements, and cylinder replacement inventory requirements related to the trade-in of existing unbranded cylinders and their replacement with branded cylinders, including governmental and industry expert analysis of the number of existing cylinders which can be refurbished and the number which can be scrapped, and the expected level of average consumption per LPG user in 2030 (20.3kg) from the demand projections.

These elements are shown in the following set of tables:

Table 13. LPG consumption by region (2015)

Region	Population ²⁰ (millions)	LPG residential usage/capita	Population per cylinder	LPG residential consumption	
				Volume (MT)	As %
Extreme-Nord (Maroua)	3.9	0.5	54	2,078 t	2.3%
Nord (Garoua)	2.3	0.6	52	1,432 t	1.6%
Adamaoua	1,1	2.3	13	2,624 t	2.9%
Centre (Yaounde)	4.0	8.1	5	32,490 t	35.8%
Sud (Kribi)	0.8	2.4	18	1,899 t	2.1%
Est (Bertoua)	0.9	1.5	29	1,312 t	1.4%
Littoral (Douala)	3.2	12.3	3	39,945 t	44.1%
Sud Ouest (Kumba)	1.6	1.3	30	2,063 t	2.3%
Nord Ouest (Bamenda)	2.0	1.2	33	2,394 t	2.6%
Ouest (Bafoussam)	2.0	2.2	18	4,405 t	4.9%
Total	21.9	4.1	10	90,641 t	100.0%

Applying the region by region penetration projections from the Feasibility Study, and solving for an average penetration target of 58% nationally in 2030 for achievement of the governmental policy goal, the following regional breakdown of future regional consumption results for residential cylinders:

²⁰ GLPGP industry survey (2016)

Table 14. Estimated cylinder filling volumes and penetration by region in 2015 and 2030

Region	LPG volume in cylinders (KT, 2015)	LPG volume in cylinders (KT, 2030)	Population (mm, 2030)	LPG residential usage/capita (kg, 2030)
Extreme-Nord (Maroua)	2.1	28.0	5.9	4.7
Nord (Garoua)	1.4	16.8	3.5	4.8
Adamaoua	2.6	11.1	1.7	6.5
Centre (Yaounde)	32.5	66.5	6.0	11.0
Sud (Kribi)	1.9	10.0	1.2	8.4
Est (Bertoua)	1.3	11.2	1.4	8.2
Littoral (Douala)	39.9	82.5	4.9	16.8
Sud Ouest (Kumba)	2.1	24.1	2.4	10.2
Nord Ouest (Bamenda)	2.4	26.2	3.1	8.5
Ouest (Bafoussam)	4.4	26.6	3.0	8.7
Total	91 KT	303 KT	33.1	9.1 kg

This projection reflects an average level of LPG use by an LPG user through 2030 of 20.3kg per year, as discussed in detail in the Feasibility Study. The standard industry metric of 9.1kg/capita of annual nationwide consumption projected for 2030 begins to approach the levels of already better-developed LPG markets in Sub-Saharan Africa, such as Senegal and Cote d'Ivoire, which were well above 10kg/capita in 2018.

It is possible that more than 59% of the population will cook with LPG, or that users will expand their LPG use to more than 20.3 kg per year, on average. New users may ramp up their LPG use as they gain familiarity with the use of LPG to cook an increasing portion of their meals. Others may immediately cook exclusively with LPG, far exceeding the average consumption level. The theorized maximum usage level of an average Cameroon household that uses LPG for cooking, as discussed in the Feasibility Study, is 33 kg per year, if LPG is used exclusively for cooking all meals every day. A "user" means a member of a household that cooks with LPG.

For purposes of this Part, incremental investment in LPG infrastructure through 2030 will result in the capacity for approximately 60% of the population to have LPG access, via a cylinder in the home, and to use LPG at or above the present average level among existing users in the country.

The GLPGP industry survey of the Cameroon LPG marketing companies calculated a weighted average cylinder rotation rate of 3.19, projected by the companies to grow moderately to a weighted average of 3.36 in 2030.

The foregoing data, in combination, predict cylinder inventory requirements:

Table 15. Cylinder requirements to 2030, nationally and by region
(000s of total new 12.5kg units²¹ in circulation, shown in alternate years)

Region	2019	2020	2022	2024	2026	2028	2030
Extreme-Nord (Maroua)	96	131	217	321	422	511	608
Nord (Garoua)	59	80	131	194	254	307	365

²¹ Cameroon industry forecasts for new residential cylinders included solely the 12.5kg cylinder size, due to the negligible level of consumer adoption of the other sizes permitted by regulation.

Region	2019	2020	2022	2024	2026	2028	2030
Adamaoua	102	121	159	195	218	229	241
Centre (Yaounde)	880	1,015	1,259	1,452	1,522	1,486	1,439
Sud (Kribi)	67	81	114	148	176	195	216
Est (Bertoua)	42	56	90	131	170	204	242
Littoral (Douala)	1,113	1,282	1,588	1,825	1,906	1,854	1,787
Sud Ouest (Kumba)	88	118	192	281	367	441	522
Nord Ouest (Bamenda)	82	114	193	291	388	474	568
Ouest (Bafoussam)	132	168	252	347	433	501	576
Total 12.5kge	2,660	3,165	4,194	5,185	5,857	6,203	6,564

These required cylinder inventories, rotation rates, and total LPG refill volume in each region over time are the key determinants of the required capacities of the filling plants over time.

The number of circulating cylinders (also called the “cylinder park”)

The official number of existing cylinders in circulation in Cameroon is not available, but was obtained for 2015 (deemed old enough to be of low competitive risk) through a MINEE-mandated survey carried out by GLPGP, and extrapolated for 2018 based on overall LPG market growth from 2015-2018. A cylinder in circulation is any cylinder, in use or idle at home, in the plant, shop, or warehouse, or on a truck.

Cylinder park technical and physical condition

It was assumed, absent information to the contrary, that the cylinder inventory is in adequate safety condition, with a normal 20-year or longer life, indicating an approximately 5% annual need to scrap cylinders that are no longer safe, maintainable and recertifiable.

Number of cylinders

The projected number of cylinders required year by year is presented in Table 15 on page 47, starting from the number of existing cylinders (net of cylinders to be scrapped) in 2017.

The usual methodology used in the LPG industry is based on the average cylinder rotation rate (the average annual number of refills per cylinder), which include all the cylinders in the country. It directly affects the financial return on the cylinder investment. The rotation rate is applied to one size-equivalent: for Cameroon, this is 12.5kg (the dominant size). It is necessary to convert all the other sizes to 12.5kg equivalent for purposes of the calculation.

To be conservative in the modelling, very modest growth in the rotation rate was permitted year over year in each region, even though the rotation rate usually increases significantly with major additions of cylinders into a market. It is likely that the rotation rate will improve significantly in Cameroon due to the proposed, massive investment in new cylinders, by making the distribution process more productive and allowing the distributors’ truck drivers to be more efficient in collecting empty cylinders. If the rotation rate were to improve from 2.9 to 3.6, the number of cylinders required for investment would be reduced by about 3 million.

Calculation of the annual quantities of cylinders to be acquired

The total number of additional cylinders (about 4.3 million of 12.5kge) to be invested includes all cylinders in use, in stock, sitting idle, located with consumers, at distribution points, at the filling plants, in transition (recirculation) in trucks, and in transition for maintenance. They should be seen as a flow of annual investments rather than a one-time investment. In the present case, the annual flow of investment is about 500,000 cylinders per year during the peak of the first investment phase (2020-2022), then declining to under 200,000 per year in the final phase (2026-2030).

Table 16. Projected new 12.5kge cylinder quantities required to 2030 (000; in two-year increments)

	2019-20	2021-22	2023-24	2025-26	2027-28	2029-30
New 12.5 kge cylinders	890	1,029	991	672	346	361

The investment calculation has been made on the basis of the following assumptions for the procurement of new cylinders:

- Import parity (CIF), import taxes and import audit service are not included;
- The specifications of the cylinder are basic-level ones, and could be improved;
- The valve (e.g., clip-on) is included and mounted;
- A preliminary procurement process by GLPGP obtained a best commercial cylinder quote price at the required specification of € 28 per cylinder, when aggregating the total quantities for the entire market by year.

Depending on the final procurement process chosen to be used for these cylinders, the estimate of the required investment in cylinders through 2030 is therefore €120 million.

Investment in cylinders is an annual process, adjusted according to market trends. This investment plan can self-adjust the pace of the investment, based on actual consumption and the actual level of increase of the rotation rate, either for proper balancing of assets with consumption, or to improve the return on investment through improved asset utilization with scale. The pace of investment may be accelerated if consumption is greater than forecast, up to the sustainable growth rate of the firm, and decelerated if the market starts to saturate (that is, the demand for new cylinders stabilizes with respect to demographic trends).

As the cylinder rotation rate eventually stabilizes or declines in a given geographic area, absent any other major factors, it indicates saturation of the market area at its then-current level of consumption.

Assumptions regarding the number of cylinders in the working stock

The cylinder counts include working stock. To insure a fluid and efficient cylinder filling process and good availability of cylinders in the distribution network for the end-user, the theoretical cylinder working stock in terms of maximum daily consumption, taking seasonality into account, is as follows:

- Pallets:
 - In the filling plant: 1.5
 - On the trucks (cylinder primary transport): 1
 - In the warehouse or cylinder regional depot: 2
 - On the trucks (secondary transport): 1
- Cages:
 - In the distribution network: 4

Overall, the working stock represents 9.5 days of consumption.

These figures assume that the equipment (filling plant and trucks) are optimally used. If not, a minimum stock is required (for example, an 800-cylinder truck will need a stock minimum of 800 cylinders).

Import terminal capacities

The Kribi deepwater port, originally constructed by China Harbour Engineering Corporation, already handles petroleum product importing and exporting for Cameroon. Its petroleum-handling capability is planned to be expanded, in part in connection with the development of natural gas production in the country. The LPG Master Plan calls for constructing a new oil, gas and LPG terminal facility at Kribi. This LPG capacity has been costed on a preliminary basis at € 54 million. SCDP awarded a contract for the project to Blaze Energy of Canada in 2015, subject to financing to be obtained by Blaze Energy. As of this writing, the project has not yet moved forward. (Meanwhile, natural gas is being handled at Kribi through a floating storage system deployed and operated by Perenco and SNH.)LPG production capacity

It is assumed that Sonara cannot arbitrarily increase domestic LPG production, because that production is a by-product of its oil refining chemistry. Therefore, all growth in production is assumed to occur through importation, and Sonara's share of the LPG supply will fall from 20% today to around 7% by 2030.

The filling and storage capacity described in this Part have regional annual turns of between 14 (Far North) and 35 (Douala), with a capacity-weighted average of 25, which is consistent with having two weeks' LPG surplus in the system at any given time. The turn ratios necessarily fluctuate moderately year by year, as a given facility serves consumption that grows steadily in-between capacity upgrades. With the exception of Douala, the turns are substantially lower in 2030 than they were in 2015, at which time shortages were frequent. Douala is projected to have a 1.5 week buffer capacity on average (noting that its expansion is sized to have a further 20% buffer to deal with peak demand periods). However, as seen in the figure above, Douala's LPG service growth will be modest on a percentage basis compared to the growth in rest of the country. Douala is the least shortage-prone facility, being the hub of the SCDP storage network.

If the overall storage ratio were to be optimized to 36 from 25, the storage capacity could accommodate a total supply volume of more than 500,000 MT/year.

Filling plant and storage capacities

Filling plants may be grouped into SCDP facilities and the in-house facilities of other LPG Marketers. These may be subdivided into expansion of existing facilities and construction of new facilities. Where existing

facilities are in place, the investment plan presented builds up from the 2017 volume and capacity, ramping up capacity in stages to achieve the storage and throughput requirements for the facility's anticipated share of the total national LPG cylinder refilling volume, region by region and entity by entity. (SCDP provided its own forecast of the aggregate future volumes it would serve from Cameroon's LPG Marketers, taken together.)

In regions without existing facilities, it was assumed that operations from a new facility would commence during 2020, after which it would be expanded, as necessary, in steps as its throughput requirements increase to serve the demand associated with that facility.

A Cameroon filling plant audit was conducted by the GLPGP/Clean Cooking for Africa engineering and construction experts in 2018 to review operations, potential improvements, and estimate near-term, medium-term, and long-term investments costs consistent with the Master Plan (as recalibrated to the demand projections described in this report).

Total required bottling capacity was projected to be approximately 380 KT per year in 2030 nationwide, with one shift of operations (labor) depending on the region to serve the projected consumption (upper-bound scenario). This nameplate capacity allows for 20% of flexibility to cover all peak needs throughout the year.

Projected filling capacity and number of bottling plants

The filling capacity requirement is defined by the peak consumption in a year, increased by a safety factor. The peak of consumption is related to the seasonality.

The filling capacity has been calculated conservatively at 120% of the annual consumption target.

The following table shows the theoretical need of bottling in the different regions.

Table 17. Theoretical maximum bottling capacity required to 2030 (MT)

Region	2018a	2020e	2022e	2024e	2026e	2028e	2030e
Extreme-Nord (Maroua)	2.6	8.5	11.7	15.4	19.3	23.5	28.0
Nord (Garoua)	1.8	5.2	7.1	9.3	11.6	14.1	16.8
Adamaoua	3.3	7.9	8.6	9.3	10.0	10.6	11.1
Centre (Yaounde)	40.5	66.0	68.2	69.6	69.6	68.4	66.5
Sud (Kribi)	2.4	5.3	6.2	7.1	8.0	9.0	10.0
Est (Bertoua)	1.6	3.6	4.9	6.3	7.8	9.4	11.2
Littoral (Douala)	49.8	83.5	86.0	87.4	87.2	85.3	82.5
Sud Ouest (Kumba)	2.6	7.7	10.4	13.4	16.8	20.3	24.1
Nord Ouest (Bamenda)	3.0	7.4	10.5	14.0	17.8	21.8	26.2
Ouest (Bafoussam)	5.5	10.9	13.6	16.6	19.8	23.1	26.6
Total	113	206	227	248	268	285	303

Overall filling and storage investments

The following two tables show the filling and storage capacity requirements by region:

Table 18. Filling plant capacity growth requirements by region to 2030 (KT)

Region	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Extreme-Nord (Maroua)	10		4		5				3	
Nord (Garoua)	7	2		3			3		2	
Adamaoua (Ngaoundere)	4	2			1					
Centre (Yaounde)	39									
Sud (Kribi)	7				2				2	2
Est (Bertoua)		3			1		2		3	
Littoral (Douala)	43									
Sud Ouest (Kumba)	10		3		4			4		
Nord Ouest (Bamenda)	11		4		4			4		6
Ouest (Bafoussam)	10			5				4		
Total	139	7	11	8	17	0	5	12	10	8

Table 19. Filling plant storage growth requirements by region to 2030 (MT)

Region	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Extreme-Nord (Maroua)		90		60		75				15	
Nord (Garoua)		105	30		45			45			
Adamaoua (Ngaoundere)		25	30			15					
Centre (Yaounde)	570	474									
Sud (Kribi)			7,500			6,000					
Est (Bertoua)								30		45	
Littoral (Douala)											
Sud Ouest (Kumba)		140		45		60			60		
Nord Ouest (Bamenda)		168		60		60			60		90
Ouest (Bafoussam)		70			75				60		
Total	570	1,072	7,560	165	120	6,210	0	75	180	60	90

The total incremental filling facility investment requirement for these capacities is estimated as follows:

Table 20. Filling facility investment requirements to 2030

(€ millions)

Category	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Storage capacity	2.6	4.9	34.8	0.8	0.6	28.6		0.3	0.8	0.3	0.4
Filling capacity		6.6	0.3	0.5	0.4	0.8		0.2	0.6	0.5	0.4
Cylinder maintenance units		0.5	0.5	0.5		0.3				0.3	

The investment cost through 2029 (with no further investment required in 2030) is € 74 million for expanded storage, € 10 million for added filling equipment (carousels, etc.), and € 2 million for added cylinder maintenance equipment, totaling € 86 million.

SCDP investments

Even though SCDP is projected to own and operate 79% of the total capacity of the sector, due to economies of scale and other factors, the SCDP share of the incremental investment requirement was

costed at just € 40 million, or 47% of the total of € 86 million. (Additional investments to improve safety and infrastructural flexibility were identified at € 10.7 million.) This includes the following specific elements:

- Increased LPG storage and pipeline capacity at the Bonaberi facility, comprising three new spherical units of 1,300 tonnes each and a new 8" pipeline for unloading LPG vessels. This could also delay the time by which a new terminal at Kribi would be required to come on line.
- Expansion of the Yaounde facility to the level of 40 KT per year, which will entail a separate assessment of its integration with the Yaounde hydrocarbon depot.
- Consistent utilization of filling carousels, palletizers, on-line scales and cylinder running stock.

The SCDP investments are grouped into five main phases, as shown in the following table:

Table 21. SCDP filling investment requirements summary
(€ millions)

Category	Investment Amount
Security and safety enhancements*	0.7
"Quick win" improvements (very rapid financial payback)*	10.0
Near-term scale-up (through 2021)	23.2
Medium-term scale-up (2022-2025)	14.1
Long-term scale-up (after 2025)	3.5
Total	51.5

* These items increase safety and improve operations but do not increase capacity per se

Capacity would increase in the following steps:

Table 22. SCDP filling capacity and storage build-out steps (KT)

Year	Capacity	Storage
2019	60	3.0
2020	170	9.5
2024	255	13.0
2028	315	14.0

National technical committee under SCDP

A new national technical committee, led by SCDP, is expected to be created in 2019 to perform the detailed engineering studies (including detailed descriptions of equipment, calculations, and all necessary drawings) and the estimation of the final investment cost of filling and storage expansion capacities to 2030. The technical committee would also specify or define the relevant safety and construction standards. The 2018 GLPGP audit of SCDP facilities is to provide a starting point for the technical committee's work.

Projection of storage capacity of filling plants

The LPG storage capacity of a filling plant is calculated to address the risks of supply disruptions during the primary bulk transportation of LPG to the plant. The primary transportation can be by bulk road tankers (BRT), pipeline or train. The time necessary for a truck, for example, to transport LPG to the filling plant

without difficulties corresponds with the distance of the plant from the depot where the truck loads the LPG, taking into account the queueing of the truck, the change of driver, any labor working hours constraints, the break time for the driver, traffic speed, the quality of the road, etc.

If the plant is located within 50km distance, one or two daily round trips can easily be managed, and the storage capacity can be reduced accordingly, because the risk of trucks being delayed is very low. The proximity of the plant with a terminal does not require excess storage capacity (which is expensive). The factor used to summarize this is the “tank rotation rate per year”; that is, how many times the storage facility is refilled in a year.

The following tank rotation rates are recommended to calculate the size of the storage capacity:

- “24” (i.e. 24 fillings in a year, or a filling every two weeks) for a very distant plant in order to have more storage capacity, reduce any risk of supply disruption and avoid any scarcity situation due to the long transportation time;
- “36” for plants less than one day’s transport from the source of the product, and
- “52” for any plant located near the import terminals and/or refineries where the product is located.

The following tank rotation rates were calculated with respect to the final storage capacity of each region’s filling plants in 2030:

Table 23. Estimated tank rotation rates for each region in 2030

Region	Rotation Rate
Extreme-Nord (Maroua)	14
Nord (Garoua)	15
Adamaoua	16
Centre (Yaounde)	17
Sud (Kribi)	Special*
Est (Bertoua)	19
Littoral (Douala)	35
Sud Ouest (Kumba)	16
Nord Ouest (Bamenda)	19
Ouest (Bafoussam)	16

* Note: Kribi import terminal storage would also serve the Kribi regional filling plant. Because the terminal would have national-scale storage, the rotation rate on that storage relative to the regional filling volume of the associate plant is not a useful calculation, being dominated by the national-scale storage.

The foregoing schedule of rotation rates takes the following into account:

- It will not be possible to change the storage capacity every year or two;
- The size of tanks—especially spherical tanks—are more or less standardized, the typical sizes being 250 MT, 500 MT, 1000 MT, and 2000 MT.
- For bullet tanks, there is no standard size, but the overall diameter is more or less standardized: 2.5m, 3m, and 3.5m. These diameters are imposed by transport convenience. The ratio length of a

bullet/diameter is more or less observed; around 10. For economic reasons, it is useful to multiply the number of bullets. Four bullets of 50 T are far cheaper than one of 200 T.

- Financially, a spherical tank is cheaper than a multiple bullet of the same size. A 250 MT spherical tank is less costly than 300 MT of bullets. For operational reasons, the 10-year inspection of a sphere requires a stoppage for more than one month; thus, it is wise not to have only one sphere or bullet.

Figure 6. Examples of spherical and bullet LPG storage



The following table summarizes the recommended rules for tank sizing and type:

Table 24. Mapping of storage capacity to tank type and size

Desired storage	Bullet type	Spherical type
300 T	6x50 T	
400 T	8x50 T	
500 T	10x50 T	1x 500 T
1000 T		1x 1 000 MT
1500 T		1x 1000 MT+ 1x500 MT
2000 T		2x 1000 MT

Strategic reserve storage capacity

The projected consumption of LPG for cooking in 2030 will be up to 303 KT per year, or 25 KT per month. Existing LPG storage capacity (3.7 KT MT) plus new storage at filling plants of about 16 KT, for a total of about 19.7 KT, will store approximately 24 days' consumption of LPG at the 2030 volume.

Any storage capacity above 30 days will result in an unneeded increase in the asset intensity of the supply chain, and would therefore result in an increase of the cost for the supply chain and/or an increase in the price to the end-user. In the event additional temporary storage capacity is needed, such as for transitions, a floating storage can easily be added on a temporary basis.

Primary transport capacity

There are about 20 Bulk Road Tankers (BRTs) in Cameroon owned or under contract to SCDP. A further 54 are projected to be needed through 2030 to serve the expanded network of filling facilities, based on one BRT of 24 MT average capacity transporting 4,100 MT per year, with 3-4 trips per week.

Bulk transportation

In the LPG supply chain, the *mass primary transport*, filling, and cylinder primary transport must satisfy an economic transportation optimization.

The positioning of the filling plant must be as close as possible to the sales area, as large as possible to minimize bottling costs, yet cannot be in an urban area due to safety concerns.

The mass primary transport must be favored over the cylinder primary transport, because the former transports only the product while the latter transports the product and the weight of the cylinder steel (the weight of the steel of the cylinder is approximately equal to the weight of the LPG it contains when full).

As a general rule, it is more economical and professional to have filling capacity above 20 KT/year, to minimize the per-unit bottling cost and ensure a higher safety level and refilling quality.

When the consumption of a region is less than 20K T/year, it was assumed to have a cylinder depot supplied by the filling plant of a neighboring region, as shown in the table above. This rule must be weighed against the cost of cylinder secondary transport. For example, in the East and South regions could be served from Yaounde (Central region) during the first several years, and it may be optimal for those two regions to share a common filling and storage facility for the long term.

It is recommended that the rollout of filling plants (new and expanded), as much as possible, be based on economic criteria, rather than on administrative sequencing. This will ensure that the highest probability new LPG users, in the most numbers, with the strongest underlying business fundamentals for industry, are served first.

Definition of terms used in the adjacent paragraphs:

- **Mass primary transport:** semi-trailer transport of the liquid product
- **Cylinder primary transport:** transport of large quantities of bottles (8-900 bottles) from the filling center to the warehouse.

Ship and rail transportation

The capacities of CAMRAIL AND CAMSHIP for bulk transport of LPG are deemed adequate and expandable for the forecast period, and therefore have not been addressed in this report.

Road transportation

To serve the expanded network of filling plants and storage, additional road tanker capacity will be required. Approximately 20 tankers were active in 2015 to serve filling plants, per SCDP data.

The number required to support the added infrastructure will be 15 additional in 2019, 10 additional in 2020, and from 1-5 more in each additional year to keep pace with increasing refilling volumes, for a total

of 39 additional vehicles as of 2030. Preliminary procurement data indicate an estimated acquisition cost of € 13.5 million, in aggregate.

Cost of cylinder distribution vehicles

The cost of additional cylinder delivery trucks is deemed recovered by delivery SMEs through the marketing margin of the existing national price build-up formula, and the recommended distribution-specific margin of the recommended formula described in Chapter 10 of the Feasibility Study.

Total investment

Set forth in the following table are the components of the total investment for filling, storage, cylinders, transport, and import terminal of € 274 million, or about € 8.3 per capita in 2030, adequate to serve approximately 60% of the population.

Table 25. Summary of capital investment to 2030, by asset type

Asset type	Amount (€ mm)	Per capita (2030)
Filling plant and storage: expansion and new facilities	86 €	2.6 €/capita
Additional cylinders	120 €	3.6 €/capita
Terminal expansion	54 €	1.6 €/capita
Transportation	14 €	0.4 €/capita
Total²²	274 €	8.3 €/capita

One may extrapolate this figure to about € 20/capita for a 100% penetration rate, taking into account the diseconomies of scale from serving the most remote areas of the country.

Measured on a per-household basis, the € 8.3/capita value is approximately € 70 per LPG-using household in 2030 and € 40 per household for all households. Adding the cost of a typical basic Cameroon LPG stove and associated accessories (€ 37), the cost per household comes to approximately € 77 (€ 107 for only LPG-using households). This value is consistent with infrastructure and equipment costs experienced by other LMICs executing major LPG scale-up programs.

Investment in LPG infrastructure (cylinders and bottling plants and bulk depots) can last up to 50 years, if the BCRM continued to be well enforced and its safety rules and maintenance requirements continue to be fully observed.

Overview of investment project assumptions and methodology

The assumptions and methodology are based on what the Government of Cameroon and its state sector and private sector LPG companies have indicated to GLPGP, as described in detail in the Feasibility Study and as set forth in the Cameroon LPG Master Plan.

²² Amount does not add exactly due to rounding.

The LPG companies provided information under the direction of MINEE on a confidential basis, for use in aggregate without attribution or reference to any specific company. The exception was SCDP, which permitted evaluation and auditing of its national filling and storage infrastructure and operations.

The LPG companies indicated an interest in financing solutions for increasing their cylinder investment, but were not willing, on a preliminary basis, to make commitments to specific cylinder investment volumes (as called for in the Master Plan and as indicated that they could achieve with appropriate financing). They were also not willing to have detailed discussions about procurements or financing of procurements without a demonstrated and specific financing package on offer from a credible source.

A technical assumption is that the current, nearly exclusive use of butane for Cameroon's LPG would continue. Butane-rated equipment (storage, cylinders, etc.) can generally withstand a certain level of propane content, but too much propane creates safety risks due to its significantly higher vapor pressure. Propane-rated infrastructure would be more costly, due to its need to handle higher-pressure gas, but the ability to handle a higher level of propane in the LPG mix could reduce the average cost of the gas. It was beyond the scope of this report to evaluate the potential for changing the fuel specification in regulation and standards, and in the infrastructure costing, to account for such a change.

The methodological approach used was to estimate the projected filling volume per filling region from 2017 to 2030, described earlier in this Chapter, and introduce appropriately sized plants or plant-expansions in multiple phases.

The steps were:

1. Utilize the demand data and projections described in the Feasibility Study, allocated among the regions based on historical usage patterns and cross-checked with the 2017 and 2018 sales of every LPG marketer for residential use and combined with relevant parameters regarding the cylinders' operating cycle (supply-chain velocity and bufferage), to project the cylinder inventory requirements and the refill volumes for each region over time;
2. Scale these as necessary for alignment with the demand forecast upper bound case, in order to ensure adequate capacity to serve the projected demand without creating shortages;
3. Project the step-wise capacity required of the sector through 2030 in adequate anticipation of consumption year by year, while maintaining reasonable stability in the year-over-year pace of investment in order to help the sector to absorb and deploy capital and to grow with minimum risk of operational and financial disruption or discontinuity;
4. Calculate the filling and storage capacity required in each region to serve the consumption in its region over time, concluding with overall 50% adoption and use by 2030 in accordance with the demand forecast²³;
5. Separate out the SCDP facilities for separate assessment and costing, because SCDP, due to its unique position as a quasi-utility in LPG storage and filling, has a different infrastructure starting position and different economies of scale from the remainder of the LPG sector.

²³ As discussed previously, the pace and scale of investment would, in practice, be adjusted in each year or each multiyear phase (based on the type of asset), based on whether demand rises faster or slower than projected.

By calculating the annual filling volumes, the required capacity of the plants' main elements (scales, storage, etc.) can be defined according to industry norms, taking into account good operational practices and adequate capacity buffer to absorb peaks of consumption.

Then, the equipment and facilities of each facility are specified and the cost of construction estimated (land cost not included).

Note: This report does not consider the future of the non-residential LPG segments, such as LPG as a vehicle fuel.

4. Investments at the Firm Level

This Chapter examines the economics of the sector-level investments at the firm level.

SCDP, a state-controlled enterprise, would lead on carrying out necessary filling, storage and terminal investments (potentially with foreign partners) as detailed in the preceding Chapter. Importantly, SCDP would not be in position to make the most critical investment of all: in new, branded cylinders that the Marketers would deploy to consumers.

Therefore, the relevant supply chain node for this Chapter's analysis is the LPG Marketer.

Methodology

In the ideal case, multiple firms would volunteer financial information and business plans showing how they would grow their businesses, and this body of information would then drive a bottom-up investment scenario. In Cameroon, while firms disclosed volume projections to 2030 on a confidential basis, obtaining detailed financial projections firm by firm was not possible, because (i) businesses were, in general, unwilling to share proprietary internal business information, except to a recognized financing source interested to discuss a transaction; (ii) businesses were also, in general, concerned about violating applicable competition law by disclosing internal financial or operating data that could eventually be viewed by the public; (iii) for entrepreneurial firms in marketing, retailing and distribution, standardized financial statements often did not exist; and (iv) for oil and gas companies, LPG financial data typically were aggregated with data about non-LPG operations, and not practical to extract.

In the absence of volunteered financial and business planning information from a critical mass of individual firms, the alternative was chosen to construct a pro-forma model of firms and investments at the key supply chain node.

This choice involved making certain assumptions about unit margins, potential costs of capital (i.e., financial return requirements), and key operating parameters affecting the cash flow generation potential and growth rate capacity of a typical firm. Details behind the key assumptions are described in Chapter 10 of the Feasibility Study and Chapter 5 (Investment Plan Overview) of this report beginning on page 71.

Where possible, the pro forma case has been benchmarked against information provided under conditions of confidentiality, or through public non-binding disclosures and announcements, by representative firms. The pro forma cases are in line with such benchmarks.

These additional firm categories were not modelled, for the following reasons:

- *SCDP facilities.* SCDP did not disclose financial details of its operations or balance sheet. As a utility company, it is expected to cover its costs (including its costs of capital) through its fees, which are defined in the national LPG price structure. SCDP investment requirements have been included in the tranches specified in this report on the basis that SCDP may require, or may seek, some level of non-sovereign financing for those investments; being critical investments for the development of the sector, it would be imprudent not to include them in the Investment Plan. While SCDP has stated that it is expected to carry out necessary expansion of facilities utilizing funding sources accessible to the state, if SCDP determines to seek assistance in obtaining outside financing, an

appropriate analysis and modelling of the transaction and an arranging of funding sources for the SCDP projects and assets may be performed at that time, with SCDP's internal financial data disclosed for that purpose. The Kribi LPG investment requirements have been included in the tranches specified in this report on the basis that the project may nonetheless seek independent financing for the LPG component if seen as advantageous to the overall project, and on that basis that it is a critical investment for the development of the sector beyond the first investing tranche.

- *Bulk Road Vehicles and cylinder trucks.* Vehicles are easily obtainable, together with financing, by the oil and gas companies for their multiproduct fleets, or by specialty trucking firms, using their existing balance sheets and cashflow capacity. Truck service to carry cylinders is not growth-constrained, and access to vehicle financing is not a barrier to capacity growth.
- *Production and importation.* No expansion of domestic production from Sonara is assumed. The new LPG import terminal capacity at Kribi is currently part of a separate, government-initiated project for overall petroleum product importation facilities. Floating facilities for LPG storage are adequate in the near term to handle expansion of LPG imports during the period the new LPG terminal project is completed.
- *Retail (cylinder exchange) points.* The anticipated main source of new retailing facilities is existing shops already offering non-LPG products to the public. To the extent outside financing of cylinder inventory is required at this level, it would be accomplished through small-scale entrepreneurial lending from domestic lending sources, with creditworthiness determined by those lenders, and/or through credit that Oil Marketing Companies (OMCs) and LPG Marketing Companies (LPGMCs) choose to extend. The lack of standardized financial and accounting reports at this level of the supply chain, together with the challenge of diligencing thousands of individual retail-point owners, does not make large-scale financing feasible.

The following examination of prospective firm-level economics is based on a representative model of a marketer with a 10% market share, investing in cylinders at the rate necessary to match the growth of the LPG sector as presented earlier in this Part of this report.

Despite the restrictions and limitations affecting the gathering and evaluation of firm-level data, partial information was obtained on a confidential, voluntary basis and was used for benchmarking the pro-forma model. These data were in line with the models.

The model excludes the use of an LPG volume-based capital recovery levy fund to support the cylinder investment. If implemented in Cameroon, this levy would shift a notional 40% of the capital cost of all new cylinders to this fund. The fund would pay for the shifted 40% through an increase of € 0.037 per kg of LPG in the national pricing formula over twelve years, expiring in 2030. Use of an LPG capital recovery levy is currently being studied by relevant ministries of the Government. This approach is discussed in detail in Chapter 5 (Investment Plan Overview) beginning on page 71.

The model includes a sensitivity analysis to revenue per tonne and to the percentage of equity vs. debt utilized for the required investment in new assets.

Finally, the pro-forma capital structure and costs of capital (debt and equity) used for modelling capitalization and financial returns are based on the outcomes of detailed discussions with the major Cameroon banks and other financial sector institutions, and with DFIs that are active in other sectors in

Cameroon, regarding relevant transaction benchmarks and applicable lending and investment policies and limitations.

LPG Marketer financial model

This pro-forma LPG Marketer is modelled on the basis of a 10% market share by volume, including investment in 10% of the national cylinder requirement in each year. It is thus a composite (at 1/10th scale) of the LPG marketers active in Cameroon (considering only their LPG lines of businesses), whose 2018 market shares range from 1% to 27%, with an average share of 8.3%.

For purposes of this analysis, the existing price build-up formula Revenue is made from the permitted unit margin under the national price formula for filling of cylinders. In this case, the unit margin under both the existing and recommended new price build-up formulas is € 210.5 per tonne²⁴.

The baseline modelling is performed for a Marketer which opts to outsource its filling function to SCDP. This is financially desirable for a Marketer to do wherever practical, because SCDP provides a low filling cost per tonne, as well as a lower capital expenditure per tonne of capacity, due to its economies of scale. Nonetheless, some Marketers choose to bottle in-house, or to split their bottling between their own facilities and SCDP, in order to maintain higher control over their cylinder assets and the filling and safety operations, or to enter a geographic service area that is outside of the practical SCDP footprint²⁵.

Assumptions

The following are the main financial and operating assumptions:

Item	Value
Market share of the firm	10%
Cost of cylinder (12.5kge)	28 €
Cylinder deposit (as % of cost)	80%
Net cylinder cost to marketer	20%
Margin per tonne (includes cylinder-related margin)	210.5 €/t
Annual rate of margin increase	0%
Cost of outsourced filling to SCDP	€ 24.6/t
Share of filling handled by SCDP	100%
Company income tax rate	20%
Tranches of capital increase (loans and equity)	3
Blended cost of debt	8.93%
Loan tenors	3-7 years
Minimum required rate of return to equity	20%

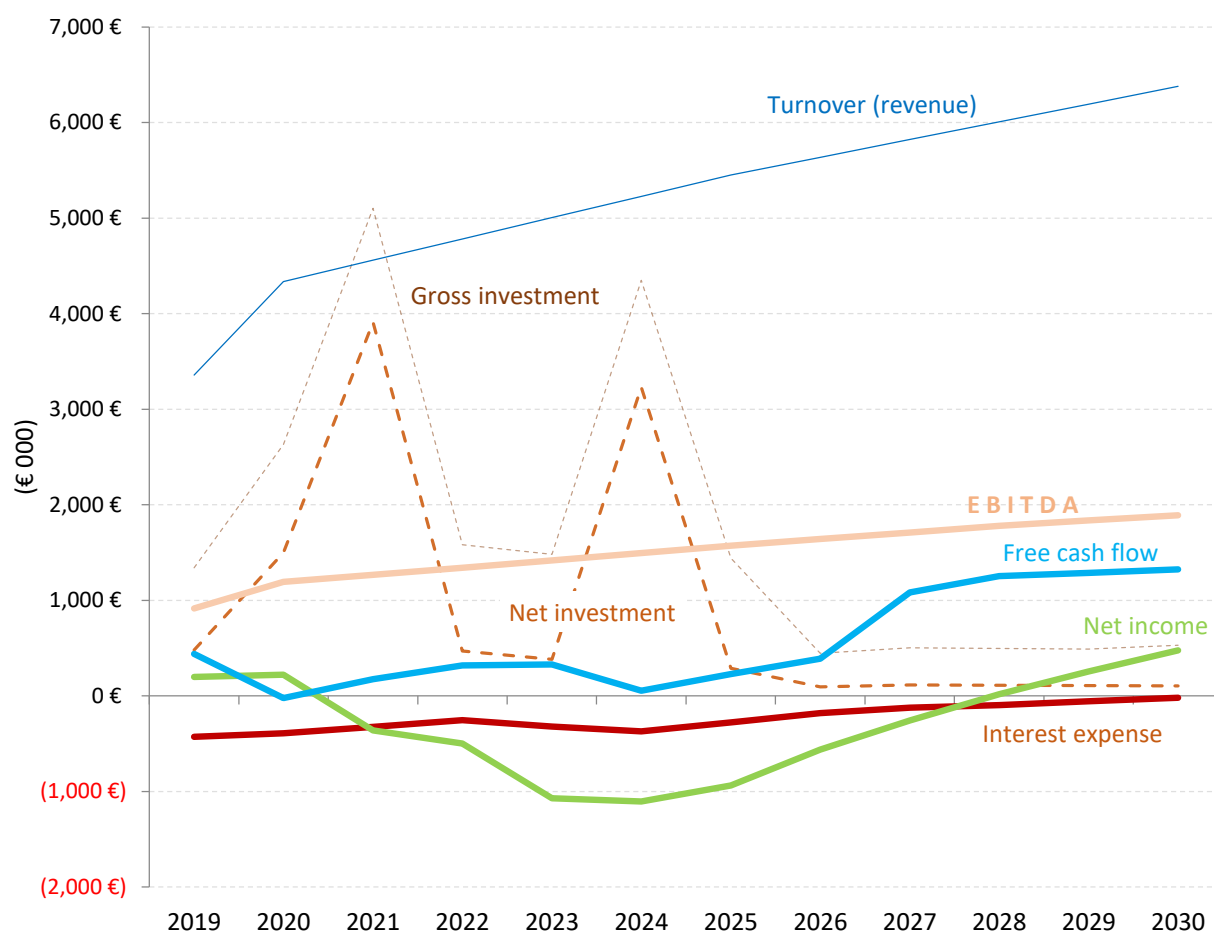
²⁴ Under the existing formula, this is an exact amount. Under the new formula, it is broken out into the following components: stock-loss recovery (€ 5.2), cylinder depreciation (€19.8), cylinder maintenance (€35.4), marketer margin (€ 110.1), and an increase to the distributor/ retailer margin to cover formally the distribution cost (a net increase of approximately €40).

²⁵ An industry rule of thumb is that a given filling plant can serve an area within a roughly 100 km radius with workable economics. This radius can be significantly larger or smaller based on the efficiency of the cylinder transportation, which is largely a function of the quality and capacity of the road networks radiating outward from the plant.

Capitalization:	
Non-concessional debt (at 10%)	35%
Concessional debt (at 8%)	40%
Equity	25%

These parameters result in the following financial characteristics and performance of the firm over time:

Figure 7. LPG Marketer with cylinder investment and SCDP outsourcing: financial performance



The selected metrics are as follows:

Gross investment	Value at purchase/construction of invested assets
Net investment²⁶	Gross investment less cylinder deposits received via the distribution network
Turnover (revenue)	Tonnage x margin/tonne
EBITDA	Turnover less operating costs
Net income	EBITDA less depreciation ²⁷ , interest expense and taxes
Free cash flow	Net income adjusted for non-cash charges

²⁶ The effect of the proposed capital recovery levy to offset the cylinder acquisition costs borne by the firm would reduce the net investment amount by an additional 40%. The effect of the proposed levy has not been included in this analysis.

²⁷ Note: The model assumes that the gross investment amount is usable for purposes of determining depreciation. Such treatment would be subject to the approval of the actual firm's accounting and tax advisors and the relevant tax authorities.

As evidenced in the above chart, the free cashflows available for self-financing of needed investments do not support a consistently rapid growth rate. External financing is needed, on terms which are economically sustainable over the financing period.

The following table sets forth the financial performance data of the firm over the projection period.

Table 26. LPG Marketer with cylinder investment and SCDP outsourcing: pro-forma financial data
(values in 000s except as noted)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTALS
Cylinders Acquired and Deployed	38	50	53	50	49	50	51	16	17	17	17	19	429
Price of Cylinder	28	28	28	28	28	28	28	28	28	28	28	28	
Gross Capital Cost of Cylinders	1,077 €	1,413 €	1,490 €	1,391 €	1,374 €	1,401 €	1,441 €	440 €	485 €	482 €	479 €	531 €	12,005 €
Cylinder Deposits Received	861 €	1,130 €	1,192 €	1,113 €	1,099 €	1,121 €	1,153 €	352 €	388 €	386 €	384 €	425 €	9,604 €
Net Cylinder Cost	215 €	283 €	298 €	278 €	275 €	280 €	288 €	88 €	97 €	96 €	96 €	106 €	2,401 €
Tonnage	16 t	21 t	22 t	23 t	24 t	25 t	26 t	27 t	28 t	29 t	29 t	30 t	298 t
Marketer Margin/Tonne	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	210.5 €	2,526 €
Total Marketer Margin	3,357 €	4,336 €	4,559 €	4,783 €	5,006 €	5,229 €	5,452 €	5,637 €	5,822 €	6,008 €	6,193 €	6,378 €	62,761 €
TUNROVER (REVENUES)	3,357 €	4,336 €	4,559 €	4,783 €	5,006 €	5,229 €	5,452 €	5,637 €	5,822 €	6,008 €	6,193 €	6,378 €	62,761 €
% Filling by SCDP	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
SCDP Filling Fee	392 €	507 €	533 €	559 €	585 €	611 €	637 €	659 €	680 €	702 €	724 €	745 €	
Bulk Transport Costs	526 €	680 €	715 €	750 €	785 €	820 €	855 €	884 €	913 €	942 €	971 €	1,000 €	
Distribution Costs	640 €	826 €	869 €	911 €	954 €	996 €	1,039 €	1,074 €	1,109 €	1,144 €	1,180 €	1,215 €	
General OPEX	718 €	916 €	951 €	985 €	1,017 €	1,049 €	1,079 €	1,101 €	1,122 €	1,142 €	1,177 €	1,212 €	
Total OPEX	2,554 €	3,293 €	3,456 €	3,618 €	3,780 €	3,769 €	3,922 €	4,046 €	4,171 €	4,294 €	4,427 €	4,559 €	52,151 €
EBITDA	517 €	679 €	726 €	774 €	823 €	874 €	925 €	972 €	1,019 €	1,067 €	1,100 €	1,133 €	10,610 €
Less Depreciation	(215 €)	(498 €)	(796 €)	(1,074 €)	(1,349 €)	(1,409 €)	(1,414 €)	(1,204 €)	(1,023 €)	(845 €)	(666 €)	(484 €)	(10,976 €)
OPERATING INCOME (EBIT)	301 €	181 €	(70 €)	(300 €)	(526 €)	(535 €)	(489 €)	(232 €)	(4 €)	223 €	435 €	650 €	(366 €)
Interest Expense	72 €	63 €	45 €	27 €	40 €	55 €	39 €	23 €	21 €	22 €	13 €	4 €	425 €
OPERATING PROFIT BEFORE TAXES	229 €	118 €	(115 €)	(327 €)	(566 €)	(589 €)	(528 €)	(256 €)	(25 €)	201 €	421 €	645 €	(791 €)
Income Tax	(46 €)	(24 €)	0 €	0 €	0 €	0 €	0 €	0 €	0 €	(40 €)	(84 €)	(129 €)	(323 €)
Tax Holiday	no	no	no	no	no	no	no	no	no	no	no	no	
NET INCOME (NI)	184 €	94 €	(115 €)	(327 €)	(566 €)	(589 €)	(528 €)	(256 €)	(25 €)	161 €	337 €	516 €	(1,114 €)

Capital infusions are structured into three tranches, as follows:

<i>(in 000s)</i>	Tranche 1	Tranche 2	Tranche 3
Cylinders	2019	2023	2027
Debt	376 €	326 €	138 €
Concessional Debt	430 €	373 €	158 €
<i>Debt amortization in years</i>	<i>2-5</i>	<i>6-9</i>	<i>10-12</i>
Equity	269 €	233 €	99 €
Total	1,074 €	931 €	396 €

Note: Because it is possible that all the steps set forth in this report (dated December 2018) to be taken in 2019 and the immediate following years may not be accomplished on such a timely basis, and that this might jeopardize the achievement of the projected LPG penetration rate and usage volumes for household cooking by 2030, it would be worthwhile for the reader to consider the 2019-2030 target years of activity to be Years 1-12.

The following table shows debt service, EBITDA coverage of debt service, and free cash flows, and calculations of notional terminal value in 2030 and the corresponding IRR for equity:

Table 27. LPG Marketer with cylinder investment: debt coverage, FCF, and equity IRR

Total Debt Service

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTALS
Total Principal	806 €	0 €	0 €	0 €	698 €	0 €	0 €	0 €	297 €	0 €	0 €	0 €	1,801 €
Total Interest	72 €	63 €	45 €	27 €	40 €	55 €	39 €	23 €	21 €	22 €	13 €	4 €	425 €
Total Debt Service	878 €	63 €	45 €	27 €	739 €	55 €	39 €	23 €	318 €	22 €	13 €	4 €	2,226 €
EBITDA	517 €	679 €	726 €	774 €	823 €	874 €	925 €	972 €	1,019 €	1,067 €	1,100 €	1,133 €	10,610 €
EBITDA Coverage of Debt Service	0.59x	10.78x	16.1x	28.7x	1.1x	16.0x	23.7x	41.5x	3.2x	48.0x	82.5x	255.4x	
EBITDA After Debt Service	(361 €)	616 €	681 €	747 €	85 €	819 €	886 €	948 €	701 €	1,045 €	1,087 €	1,129 €	8,384 €
Taxes	(46 €)	(24 €)	0 €	0 €	0 €	0 €	0 €	0 €	0 €	(40 €)	(84 €)	(129 €)	(323 €)
Cashflow After Debt Service & Taxes	(407 €)	592 €	681 €	747 €	85 €	819 €	886 €	948 €	701 €	1,005 €	1,003 €	1,000 €	8,061 €
Exit Multiple	5.0x												
Terminal Value FCF												5,666 €	5,666 €
Total Cash Flow	(402 €)	592 €	681 €	747 €	85 €	819 €	886 €	948 €	701 €	1,005 €	1,003 €	6,666 €	13,732 €

Calculation of Operating Cash Flow

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTALS
Net Income	184 €	94 €	(115 €)	(327 €)	(566 €)	(589 €)	(528 €)	(256 €)	(25 €)	161 €	337 €	516 €	(1,114 €)
+ Depreciation & Amort	215 €	498 €	796 €	1,074 €	1,349 €	1,409 €	1,414 €	1,204 €	1,023 €	845 €	666 €	484 €	10,976 €
+ Non Cash Charges	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Free Cash Flow From Operations	399 €	592 €	681 €	747 €	783 €	819 €	886 €	948 €	998 €	1,005 €	1,003 €	1,000 €	9,862 €
- Principal Debt Repayments		201 €	201 €	201 €	201 €	175 €	175 €	175 €	175 €	99 €	99 €	99 €	1,801 €
Cash Flow After Debt Payments (FCF)	399 €	391 €	479 €	546 €	582 €	645 €	712 €	774 €	823 €	906 €	904 €	901 €	8,061 €
										Tax Adjusted EBITDA		907 €	
										Terminal Multiple		5.0x	
										Terminal Value		4,533 €	
- Equity Fundings	269 €				233 €					99 €			600 €
Net FCF to Equity (Net of Investment)	130 €	391 €	479 €	546 €	349 €	645 €	712 €	774 €	823 €	807 €	904 €	5,434 €	11,994 €
Total Equity Fundings	(600 €)												(1,736 €)
IRR to all Equity Classes	60%												

The equity IRR, based on the notional capital stack, is a very healthy 60%, including a terminal value of approximately € 4.5 million in 2030.

If there is adequate capacity to withstand future changes to the unit margins, as shown in in Table 28:

Table 28. LPG Marketer with cylinder and filling plant investment: IRR sensitivity

IRR to all Equity Capital	
	60%
Revenue/t	190.00 €/t
	17%
	200.00 €/t
	38%
	210.50 €/t
	60%
	220.00 €/t
	79%
	230.00 €/t
	100%

IRR to all Equity Capital				
Equity as % of Capitalization				
Revenue/t	60%	20%	25%	50%
190.00 €/t	19%	17%	11%	
200.00 €/t	42%	38%	26%	
210.50 €/t	66%	60%	40%	
220.00 €/t	89%	79%	53%	
230.00 €/t	19%	17%	11%	

Impact of cylinder-discounting levy on LPG Marketer IRR

Further sensitivity analysis indicates that, if the capital structure is kept the same, and the margin to the Marketer is reduced by € 37/tonne as a mechanism for entirely funding a cylinder discounting scheme that further reduces the up-front capital cost of cylinders by 40%, the IRR to equity becomes negative and EBITDA is not adequate to cover debt service. Therefore, the cylinder-discounting levy, if implemented, would need to be funded through an increase in the national pricing structure, as outlined in the Feasibility Study (Chapter 10).

LPG Marketer with investment in in-house bottling capability

As an alternative to utilizing the bottling capability of SCDP on an outsourced basis, a Marketer may opt to perform bottling in-house, by investing in its own filling plant facilities. The foregoing models, adjusted for this, reflect the following assumptions:

Item	Value
Market share of the firm	10%
Cost of cylinder (12.5kge)	28 €
Cylinder deposit (as % of cost)	80%
Net cylinder cost to marketer	20%
Margin per tonne (includes cylinder-related margin)	210.5 €/t
Annual rate of margin increase	0%

Share of filling handled by SCDP	0%
Cost of bottling operations per tonne	35 €
Company income tax rate	20%
Tranches of capital increase (loans and equity)	3
Blended cost of debt	8.93%
Loan tenors	3-7 years
Minimum required rate of return to equity	20%
Capitalization:	
Non-concessional debt (at 10%)	35%
Concessional debt (at 8%)	40%
Equity	25%

Capital infusions are structured into three tranches, as before. The first two tranches are concurrent for cylinders and plant expansion. The third tranche is for cylinders only:

<i>(in 000s)</i>	Tranche 1	Tranche 2	Tranche 3
Cylinders	2019	2023	2027
Debt	376 €	326 €	138 €
Concessional Debt	430 €	373 €	158 €
<i>Debt amortization in years</i>	2-5	6-9	10-12
Equity	269 €	233 €	99 €
Total	1,074 €	931 €	396 €
Plant	2019	2023	
Debt	1,850 €	1,072 €	
Concessional Debt	2,115 €	1,225 €	
<i>Debt amortization in years</i>	2-8	6-12	
Equity	1,322 €	766 €	
Total	5,278 €	3,064 €	

While EBITDA is adequate to cover debt service, the resulting returns to equity are no longer adequate to incentivize non-concessional sources of equity or quasi-equity capital, with the IRR to equity at just 12%. This is shown, adjusted for various margin levels and degrees of financial leverage, in Table 29:

Table 29. LPG Marketer with cylinder investment and in-house bottling: IRR sensitivity

IRR to all Equity Capital	
	12%
Revenue/t	1%
190.00 €/t	7%
210.50 €/t	12%
220.00 €/t	16%
230.00 €/t	20%

		IRR to all Equity Capital			
		Equity as % of Capitalization			
		12%	20%	25%	50%
Revenue/t	190.00 €/t	2%	1%	-3%	
	200.00 €/t	8%	7%	2%	
	210.50 €/t	14%	12%	6%	
	220.00 €/t	18%	16%	9%	
	230.00 €/t	23%	20%	12%	

Nonetheless, some marketers do perform in-house filling, in whole or in part. That choice is made for strategic reasons: to maximize control over cylinder assets, to support a geographic strategy that extends outside the effective SCDP geographic coverage area, or to prepare for significant expansion which can deliver economies of scale in bottling, which are reflected in the SCDP bottling costs charged to Marketers (on a utility basis) but are not possible for a Marketer to match until its volumes become much larger²⁸. GlocalGaz, for example, performs its filling entirely in-house in Limbe, from which it serves the Southwest region on a local basis rather than using SCDP's Douala facility approximately 80 km distant. GlocalGaz also claims a marketing advantage from refilling cylinders more accurately: according to the company, its consumers report that its more rigorous and fair-to-the-consumer refilling standard means that their LPG cylinders last up to a week longer than rival brands, with the same level of cooking.

LPG Marketers with hybrid filling strategies

For comparison, a Marketer was modelled with 50% of its bottling done in-house, and 50% outsourced to SCDP. The Marketer thus invests only half as much in new bottling capacity to 2030 as the foregoing case. The resulting IRR to equity is 33%, with sensitivities as shown below:

Table 30. LPG Marketer with cylinder investment and hybrid bottling: IRR sensitivity

		IRR to all Equity Capital	
			33%
Revenue/t	190.00 €/t	18%	
	200.00 €/t	26%	
	210.50 €/t	33%	
	220.00 €/t	39%	
	230.00 €/t	45%	

		IRR to all Equity Capital			
		Equity % of Capitalization			
		33%	20%	25%	50%
Revenue/t	190.00 €/t	21%	18%	11%	
	200.00 €/t	29%	26%	16%	
	210.50 €/t	37%	33%	21%	
	220.00 €/t	44%	39%	25%	
	230.00 €/t	52%	45%	29%	

²⁸ A Marketer can also reduce average filling costs by cutting corners, and some in Cameroon do, as per a recent national filling plant audit. This is a further motivation for bottling to remain primarily the responsibility of a (well-run) national utility.

5. Investment Plan Overview

Key financing topics

This Part of the report will discuss:

1. The investment funding needs;
2. Preferred structuring options using Blended Capital;
3. Factors to consider for structuring in order to access prospective Funders' capital on optimal terms;
4. Prospective Funders (Cameroonian and foreign); and
5. Risk mitigation options for the Funders.

This is an evolving process, because regulatory and other related frameworks for the Cameroonian paradigm covered in the LPG National Master Plan are still being refined locally, and specifications of the investment projects remain subject to change by the Cameroonian authorities.

Summary of assets and projects requiring financing

The GLPGP Clean Cooking for Africa expert team, working with Cameroon governmental ministries and agencies, LPG industry participants, and financial sector entities, identified the following € 274 million of capital expenditures over the 2019-30 period to serve projected unserved and underserved LPG demand.

Table 31. Capital investment requirements to 2030 for LPG sector scale-up

Category	Capital Requirement (mm Euro)	Supply Chain Node
Cylinders	€ 120	Marketers / consumers
Bottling plants and storage	€ 86	SCDP / Marketers
Terminal expansion	€ 54	SCDP or competitor
Transportation enhancements	€ 12	Distribution (trucking)
Total	€ 274	

The overall financing would cover 4.3 million additional LPG cylinders of 12.5kg equivalence, expansion of existing filling plants and construction of new plants with appropriate storage capacity, and development of the planned new LPG import facility at Kribi.

The cylinders would be funded in three four-year tranches spaced over the 2019-30 period, with interest only the first year and equal principal repayments in the remaining years. Repayment periods would range from 3-7 years, based on the tranche. The filling plants involve short-term, medium-term and long-term cost components, and the main investments would be clustered in 2020-2021 and in 2024.

Because state-owned SCDP and/or SNH are main owners of certain portions of these assets (in particular, the Kribi terminal project and the major portion of the filling plants and national storage network), they

may have access to sovereign or sovereign-backed funding apart from the approaches described in this report. If that turns out to be a workable modality for that portion of the financing, it can be split from, or partially co-funded with, the remaining cylinder, filling, storage and transport investments. However, because access to adequate funding from the governmental balance sheet has not been predetermined and is not assured, this report makes the assumption that the state-owned LPG assets will require—or at least may benefit from—external financing and therefore should be included in the asset mix that to be financed, in order to ensure that critical investments in state-owned assets will keep pace with the investment program for the sector as a whole.

Gross vs. net investment requirement

There are two main ways in which the total financing requirement would be less than the total capital expenditure requirement.

The first way is for Marketers to borrow internally against the cylinder deposits obtained from their end-customers. Under law and by practice, the cylinder deposit amount in Cameroon is set to 80% of the cost of the cylinder to its Marketer. The funds provided by the customers are, in principle, a liability of the Marketer, to be returned to the consumer when s/he cancels service and returns the cylinder to the Marketer. In practice, Marketers redeploy most or all of the consumer deposit funds internally. This makes the consumer, in effect, a major financing source for Marketers. As modelled and discussed in Chapter 4 (beginning on page 60), this causes the net amount needed for cylinder financing to be closer to 20% of the capital cost of the cylinders than 100%. The aforesaid levy mechanism, if implemented, would effectively shrink this floor value to 12%, while reducing the deposit amount for the consumer from 80% of the cylinder cost to 48%.

In practice, the financing requirement for cylinders will fall somewhere between the hypothetical net (a floor value²⁹) of € 24 million and the gross of € 120 million.

The second way is for funding sources to re-invest their returned capital into later investment tranches after recovering it from earlier tranches. This is mainly relevant for debt providers. It is not possible to estimate in advance the extent to which the funders participating in the first tranche will participate equally in the second tranche, nor in the third. However, to the extent that capital can be recycled across tranches, the total capital committed will be a smaller quantum than if fresh capital were invested in each later tranche. From a funder's perspective, this would mean considerably less capital at risk, even if the total amount on offer over the three tranches would be the larger amount.

Investment and financing tranches

The investments are grouped into three financing tranches, corresponding to years 1-4, 5-8, and 9-12.

Each tranche could be considered a standalone portfolio of linked projects. Tranche one represents the least risk, because it involves a measured expansion of the current LPG value chain, tapping into significant

²⁹ The amount to be financed can never be as small in practice as the hypothetical net value, because of timing differences in the outgoing and incoming cashflows related to acquisition and deployment of cylinders and collection of deposits, and because of churn in the customer base and the need to maintain a deposit reserve against the churn. Additionally, an uneven rate of growth (such as an exponential rate of growth), as some individual Marketers have projected regarding themselves, would amplify these timing effects.

unmet demand (quantified in Chapter 12) without assuming any growth in per-user consumption, which is the main, material differentiator between the lower and upper bounds of the demand projection.

The tranche amounts are as follows:

Table 32. Investment financing tranches

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Cylinders	53,709 €	46,563 €	19,780 €
SCDP Bottling Plants/Storage	24,847 €	15,448 €	231 €
Non-SCDP Bottling Plants/Storage	28,019 €	17,420 €	261 €
Terminal Expansion ³⁰	20,000 €	34,000 €	0 €
Transportation Enhancements	3,818 €	5,091 €	5,091 €
Total Capital Investment	130,393 €	118,523 €	25,362 €

During tranches two and three, certain risks may become more important, and the level of these risks should be reassessed at the time. These include (i) the capacity of Government to continue to support fully the LPG subsidy as it grows, or the willingness of Government to reform the subsidy so that it no longer grows linearly with consumption but still provides appropriate support to the poor; (ii) the completion, ideally by 2024, of the terminal expansion project, and (iii) the level of consumption growth per LPG user vs. historical levels. With results known from the tranche one projects and activities, financing sources can make wiser funding decisions about the second, and then third, tranche, each of which might be resized or shifted in time to accommodate the evolving LPG environment and increased operational and financial knowledge about it.

In case consumption growth turns out to be closer to the lower bound of the demand projections than the upper bound, programs to stimulate additional demand and consumption may be implemented, instead of shrinking or delaying the supply-side investments. Certain such programs are described later in this report.

Potential capital recovery and cylinder affordability mechanism

An important element in the proposed Investment Plan is the establishment of a notionally 12-year LPG levy in the national LPG price structure, such that the price structure can reduce significantly the cost of new cylinders to the supply chain and to the consumer. This reduction, if employed, is in effect a subsidy that covers a portion of the capital cost of the key, high-risk asset—cylinders—thereby improving the risk profile of the cylinder investment for the Marketers and their investors and lenders, and increasing substantially the rate at which cylinders can be acquired and deployed without generating negative cashflow. As a corollary benefit, it would also decrease significantly the size of the deposit required of consumers to acquire a new LPG cylinder.

This mechanism, which (if paid by the consumer) would increase LPG pricing by approximately 4.6% on average over 12 years, might increase consumer demand on balance, but quantification of that effect was not feasible to calculate with the data available. The countervailing reduction in LPG consumption (but not

³⁰ The terminal expansion could be pushed fully into tranche two, as long as interim floating storage is utilized to address the import storage gap that the terminal expansion would fill permanently. The recommended year for the new terminal facilities to be put into service is no later than 2024.

in the rate of adoption) from such a price increase would be approximately of 5.5%, based on the price sensitivity analysis performed in the Feasibility Study.

As an alternative to charging the consumer, this amount could be deducted from the margins provided to the Marketers. As shown in Chapter 4 (Investments at the Firm Level), which begins on page 60, the Marketers have enough spare cashflow capability on average to be able to absorb this effect entirely, while still generating an acceptable 22% IRR to equity.

The LPG levy, if adopted as proposed and as discussed to date with the Government, would result in a reduction in the capital cost paid by the LPG Marketers for cylinders of approximately 40%. This 40% savings would have a ripple effect throughout the supply chain, potentially reducing in proportion the working capital need of the distribution and retailing network and the one-time deposit amount to be paid by consumers for access to their LPG cylinder service under BCRM.

The levy, when combined with an SPV or other similar financing vehicle for pooling of national cylinder acquisition and management, has several purposes:

1. To partially shift the risk associated with cylinder investment from the Marketers to the LPG market as a whole (that is, recovery of capital is partially shifted to the levy, a state-administered mechanism associated with the total volume of LPG consumed in the country, and not to any one private counterparty);
2. To increase (by approximately the same 40%) the rate at which the entire supply chain, starting with the Marketers³¹, can acquire and deploy cylinders without reducing their free cashflows to unsustainably low levels, or to zero or below;
3. To provide a layer of improved diligence, transparency, and accountability for cylinder assets to the Funders, in view of many private-sector LPG businesses having non-standard or incomplete accounting (of their LPG operations, where multiproduct), insufficiently strong balance sheets, inadequate credit capacity (such as for obtaining letters of credit affordably), and so on;
4. To increase the focus of the LPG sector on customer acquisition and customer service by reducing the need to focus on cylinder acquisition and financing.

Importantly, the structures proposed in this report to back these expenditures benefit from transparency, liquidity, and potential pricing and returns requirements of Funders as well as regulatory bodies that control local institutions such as banks, pensions, and insurance companies. This set of benefits should make successful funding more likely.

As of this writing, the Government had not made a determination to proceed with such a levy. Ultimately, the modalities and Funders will have to make business decisions about whether (and when) to proceed with recommended investments, based on a view of whether (and when) the Government might implement the recommended levy.

³¹ Each node of the supply chain downstream of the Marketers, as cylinder investors, obtains its cylinder inventory from the node above on deposit, which consumes working capital. The deposit amounts would decrease by 40% in a cascade down the chain, ultimately reducing the deposit paid by the consumer for an individual new cylinder.

Asset ownership

The cylinders, filling plants, storage, terminal and transportation are recommended to be built and procured through a public tender process and under a “build, own, transfer” (BOT) framework. Ownership should remain with the relevant aggregating entity (SPV, as discussed below), and not transfer to an ultimate end-owner until the cost of that part of the financing has been fully repaid. This ensures that the SPV can reallocate money and cylinders over time as Marketers perform, or do not perform. A secondary effect is a level of *de facto* consolidation, pooling risk across the sector while enforcing operational discipline and mandating adequate reporting and accountability from all participants to a standard level of completeness and quality.

Operational responsibility for the asset will flow from such entities by contract to the responsible local parties, such as the Marketers for the cylinders. Once the Funders are fully repaid, the relevant SPV can sell the individual assets for the residual value remaining in the assets’ expected operational life, and, for the cylinders, less what was originally paid up-front by the Marketers and customers’ deposits.

Currency

An advantage for financing Cameroonian projects is that the purchase contracts of assets sold by non-Cameroonian firms into Cameroon could be denominated in Euros, because is a fixed currency link between the Euro and the CFA.

Addressing Funder requirements for LPG financing

1. In building the specific capitalization mix from blended finance sources, one must be aware of the particular characteristics of the targeted Funders, and take these into consideration. These include but are not limited to:
 - a) Funders’ Own Liability and Fiduciary Requirements: Requirements for repaying or meeting their funds sources’ repayment requirements. Pensions and insurance companies need to match the weekly, monthly or other payment requirements of their clientele.
 - b) Other Competing Investment Opportunities: The range of structures and the risk-adjusted returns being offered is considerable.

The opportunity cost of taking on an LPG-related investment versus other investments available must be addressed. LPG-related investments are competing for domestic funds against government securities and also other high-quality fixed income instruments.

2. For the proposed and recommended LPG structures to be attractive, the funding vehicles must at a minimum be able to attract investors with the correct blend of risk-adjusted prices, equity comparable returns (meaning high and predictable cash flow), credit comfort (if debt or debt-like), and maturities at least as attractive as those of comparable opportunities.
3. For the portion of the Cameroon LPG sector development funded by such entities, the four options are appropriately suited to take advantage of the structural expectations and realities in Cameroon’s capital markets.
4. GLPGP determined from its face-to-face discussions and market research with leading Cameroonian investment groups and banks that:

- There is a preference for debt or fixed income-linked investment securities over equities (for reasons of predictability of returns, transparency, and current income);
- The local institutional investors seek high levels of asset coverage. For example, Afriland First Bank stated a requirement of 1.5X coverage of assets for any letter of credit provided. Thus, for example, € 120 million of cylinder investment would require € 180 million of acceptable assets as collateral, if purchased *en masse*.
- Therefore, sourcing of equity and quasi-equity, and of debt on terms supportable by the Cameroon LPG modalities on average, will require significant participation from international Funders able to tolerate and/or mitigate the risks represented by the equity component of the investments and the higher risk asset types, such as cylinders.

Potential Funders

Below is a discussion of internal and external sources of possible blended finance for the Master Plan implementation. The conclusion is that there is a range of potential options to mobilize funding and risk mitigation sources for that build-out.

Internal Funders: Analysis of Cameroonian sources of funding

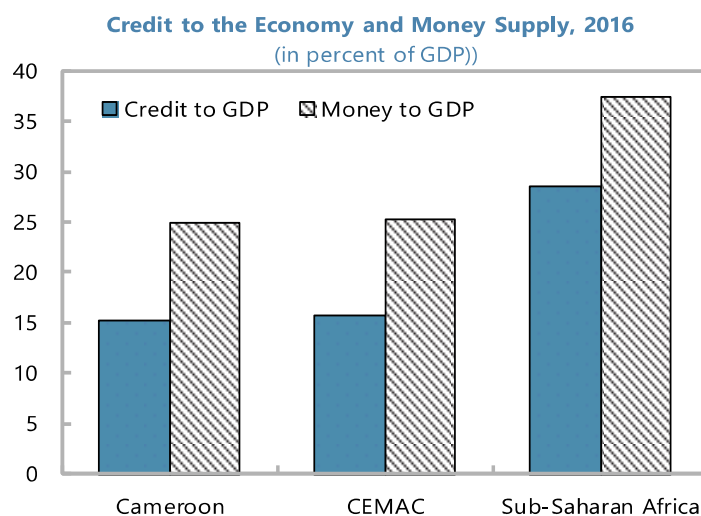
Cameroon has the shallowest level of relative banking activity of the Clean Cooking for Africa Program countries studied to date. According to the respective Central Bank reports and IMF data, banks in Ghana and Kenya account for 42% and 33% of GDP, respectively, in 2017. By contrast, banking assets in Cameroon accounted for 27% of Cameroonian GDP as of the end of 2017. The IMF Country Report indicates that the four largest banks (Afriland First Bank, Société Générale, BICEC and Ecobank), accounted for 59% of banking market share of lending and other activities in Cameroon. According to the IMF, "...the private sector credit to GDP was 15.3% (in Cameroon) compared to 28.5% for SSA average at the end of 2016."

Table 33. Cameroon bank assets (end-2017)

	Number	CFAF billion	% of GDP	Market share
Assets				
Banks	14	5,308	26.9	100.0
4 largest banks	4	3,143	15.9	59.2
Foreign-owned banks	9	3,422	17.3	64.5
Domestic private banks	3	1,376	7.0	25.9
Domestic public banks	2	271	1.4	5.1
Banks in difficulties	4	688	3.5	13.0
Microfinance Institutions (2016)	412	768	3.9	100.0

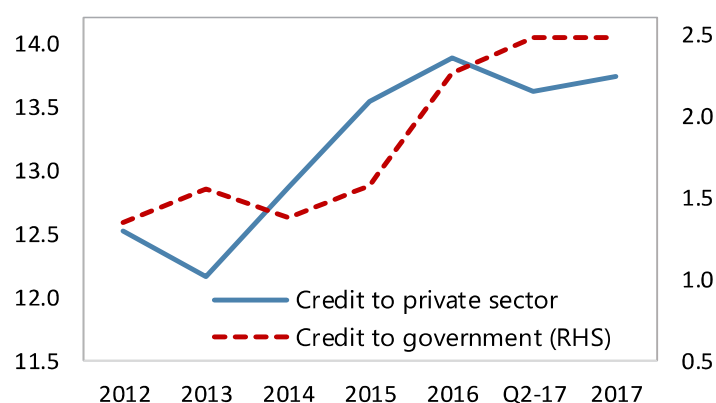
Sources: BEAC; and IMF staff calculations.

Figure 8. Credit to the economy and money supply (2016)



The Government has internal funding demands and budgetary constraints that limit its ability to support the LPG Master Plan without raising outside capital from bonds or other sources. Major SOEs like Sonora are placing budgetary strain on local banks and the Government budget, according to the IMF. The IMF reports that “...about two-thirds of arrears are tax arrears, which generate revenue gaps for the government”. Banks control close to US \$9.2 billion in assets³², indicating availability of capital, but large exposures to non-performing loans (NPLs) from SOEs like CAMTEL, CAMWATER, and CDE limit internal funding capacity to lend to a wider range of private or PPP projects, such as the LPG initiatives described in this report.

The following figure shows how private credit, primarily from local banks and bond markets, is the largest source of funding in Cameroon, and that such sources are tied up in Government financing activities. This leads to a “crowding-out effect”, which then requires foreign funds to be drawn into the mix.

Figure 9. Credit to the Government and private sector in Cameroon, 2012-2017³³

³² IMF Country Report No. 18/256 (August 2018)

³³ Sources: BEAC, COBAC, IMF calculations

The following two figures indicate, under a positive interpretation, a role for the Government in mobilizing or attracting foreign capital for investment and GDP growth, including for the LPG sector.

Figure 10. Economic growth and public investment (2000-07, 2008-15, 2016-17)³⁴

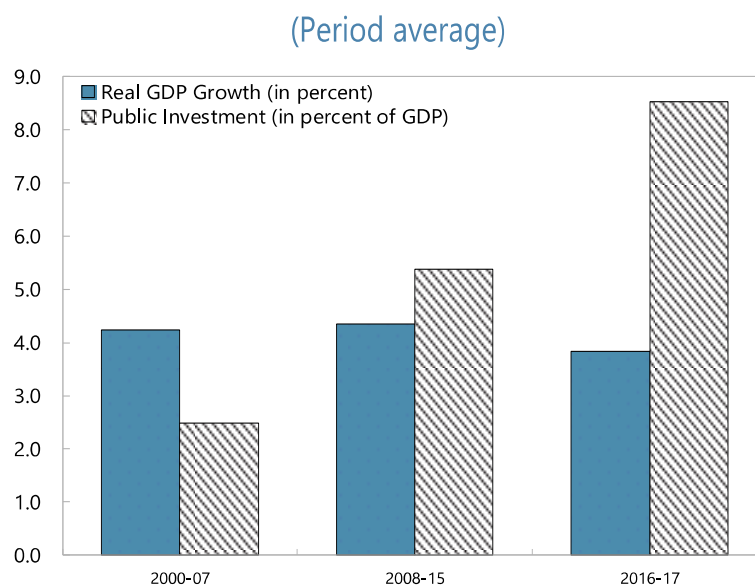
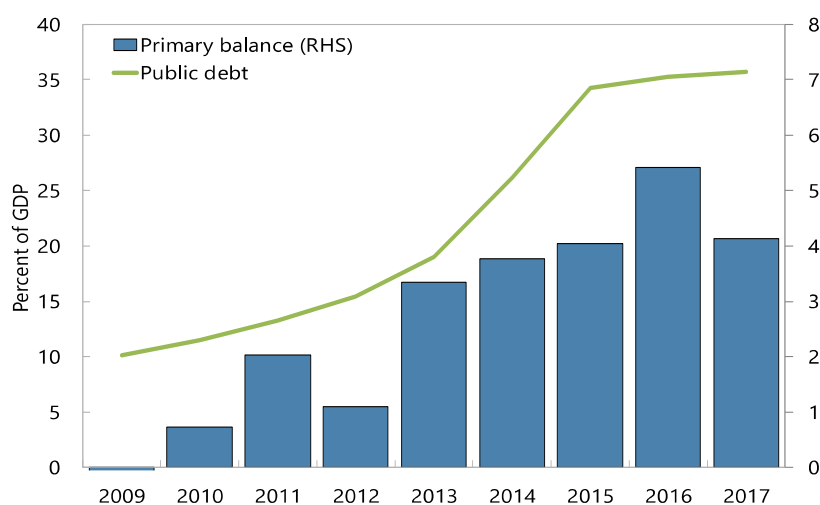


Figure 11. Public debt and primary balance, 2009-2017³⁵



Under a negative interpretation, public investments outpace GDP growth, with the government accumulating public deficits. If the source of such borrowing is local financial institutions, and if these are meaningful tax arrears, it suggests the possibility of a misuse of resources.

Outside of local banks, which have US \$9.2 billion in assets, the internal sources of institutional investment capital in Cameroon are not as deep as in other sub-Saharan African countries. Thus, the full funding of the recommended investment plan for Cameroon will also depend heavily on mobilizing non-Cameroon based capital sources. According to the August 2018 IMF Country Report No. 18/256. *Cameroon Selected Issues*,

³⁴ Sources: Government of Cameroon, IMF calculations (2018)

³⁵ Ibid.

the relevant institutional funding and investment landscape in Cameroon is comprised mainly of 14 commercial banks, one pension fund, 26 insurance companies, one postal savings institutions, and an extremely small stock exchange (three listed companies as of the 2018 IMF study). Together, their assets were approximately US \$12 billion.

Table 34. Cameroon financial sector assets breakdown (2018)³⁶

Financial Sector Category	XAF (billion)	US \$ (million)	% of GDP	No. institutions
Commercial banks	5,308	9,215	26.9%	14
Insurers	553	959	2.8%	26
Pension funds	455	788	2.3%	1
Mortgage institutions	316	548	1.6%	1
Postal savings institutions	158	274	0.8%	1
Total	6,790	11,784	34.4%	

Sources: Government of Cameroon, BEAC, IMF, GLPGP analysis

Typically, pensions, insurance companies, and mutual funds are long-term fixed income seeking investors. Their demand feeds countries' bond markets and other fixed income investments that back infrastructure and other national spending initiatives. Cameroon only has one domestic pension fund, according to the IMF. For perspective, this compares to 33 pension funds in Ghana, excluding the state owned SSNIT (the largest in Ghana). According to the World Bank, pensions in 2016 accounted for 12.75% and 4.06% of GDP in Kenya and Ghana, respectively. This compares to 2.3% in Cameroon. Cameroon's pension fund, the National Social Security Fund (CNPS), has approximately \$800 million in assets. Insurance companies have another approximate US \$1 billion in assets – these (pension and insurance companies) are all being regulated in what they can invest in particularly with regards to the private sector. This limits the scope of local investable funds generated within Cameroon. In short, banks would therefore become the most likely local source of funding for GLPGP related initiatives, given their US \$9.2 billion in assets. However, given the hindrances discussed, foreign blended capital sources are critical to achieve the funding needs and structural risk mitigation.

The Douala Stock Exchange has only three listed companies. By comparison, Kenya and Ghana have much more active publicly-listed equity and debt exchanges; while not extremely liquid, numerous private companies have listed on the Kenyan and Ghanaian exchanges, and they have attracted both domestic institutional pensions, mutual funds, and insurance companies as investors. Cameroon's much shallower public listing market implies taking creative approaches to structures that can attract CEMAC regional and international investors to fund a Cameroonian SPV. This would most likely occur through either a private placement or a regional listing (eventually) of an SPV in the CEMAC regional public markets (debt or equity).

Although the bulk of the capital for the Investment Plan is expected to come from foreign capital, it is desirable also to attract some Cameroonian banks, pensions, mutual funds, insurance companies and specialized investment funds, as supplemental domestic investor targets, even though the locally active commercial banks have expressed a strong preference for fixed-income investments and for very high asset coverage. Politically, it may be advantageous (noting the risk of misuse of resources mentioned above) for local financial sector participation as well. International investment banks and specialized institutions (such

³⁶ Sources: Government of Cameroon, BEAC, IMF, GLPGP analysis

as development banks)—thus represent a first prospective lead source of funding. Second are private/public/parastatal specialized infrastructure and sector funds, institutions like pensions, mutual funds, insurance companies, and private debt and equity firms.

Hurdle rates of return among local banks

To understand the hurdle rates of returns expected by local banks, key operational performance points are worth noting in designing the necessary structures:

- i. The banks' overall Return on Assets (ROA) was 0.7% in 2017. Although this is slightly better than the 0.6% for CEMAC region banks, it is low for banks globally (Ghanaian banks produced an average 2.8% ROA in 2017, for example).
- ii. In Cameroon, Return on Equity (ROE) for the banks on average is 14%. By comparison, ROE was 19.7% for the 34 Ghanaian banks surveyed by PwC in its *PwC 2018 Ghana Banking Survey*.
- iii. Specific to the pricing of bank loans in the capital structure presented in this report, the targeted 8.93% interest payment and 20% IRR equity returns should satisfy these ROA and ROE benchmarks, since the hard currency interest rate and equity return targets are higher than what banks are realizing.

Identification and qualification of Funders

To ascertain the capacity of banks to meet the LPG Investment Plan needs, GLPGP established dialogues with leaders such as Afriland First Bank, Ecobank, and Stanbic. With these Funders, assets and collateral are, in some cases, as important as cash flows, requiring business and transaction structuring to satisfy those interests. This could benefit from guarantees from DFIs or other groups working with DFIs like GuarantCo. In Cameroon, private sector banks and DFIs have worked together funding entities in partnerships including the utilization of guarantees.

Local institutional capital from banks, pensions, insurance, mutual funds and specialized funds, using SPVs to ring-fence the borrowers' assets and cash flows for honoring repayment and returns to Funders, are all prospective financing participants. These identified Cameroonian institutions are active in debt and debt-linked investments such as Government and CEMAC sovereign securities. Importantly, LPG the funding needs in Cameroon are over a 12-year period, allowing the Funders to phase in their funding over time. This means that local Funders may be able to roll over their exposures once a prior lending tranche is repaid. Additionally, some Cameroonian-sourced Funders may then be in a position to put more money into follow-on tranches, if satisfied with the performance of their initial exposures. A pension fund or insurance company might buy a tranche of 4-year exposure, and have it repaid over that period. A DFI or IFI with a much longer time horizon (5 to 12 years) could take straight private debt and hold for a longer period. With this kind of capital stacking and layering over time, it is anticipated to be feasible to mobilize the required € 274 million internationally and locally into properly-structured SPVs in Cameroon.

As previously noted, outside of local banks the internal sources of institutional investment capital in Cameroon are not adequately deep, based on their assets, limitations on the investments they may make, and their risk-return objectives. As such, the full funding of the recommended LPG investments for Cameroon will also depend heavily on mobilizing non-Cameroon based capital sources.

External Funding Sources: Non-Cameroonian Sources of Funding

With regard to external sources of funding, DFIs, IFIs, MDBs, private debt/equity, and regional and international bond markets have all been active recently in funding Cameroon. As previously described, the IFC and EIB syndicated and led the Nachtigal Financing, which is a current reference around options for Cameroonian-focused funding for LPG may be developed, by targeting similar blended finance syndicate Funding sources.

To do this effectively, the LPG projects must demonstrate the capacities to meet these Funders' requirements. A number of prospective Funders have expressed interest in exposure to the LPG sector in Central Africa, under suitable conditions. DFIs and IFIs will typically price their debt at spreads to their cost of funds such as Libor, Euribor, or US Treasuries. Hybrid institutions such as MDBs (AfDB for example) may have members who provide funding at a range of costs to support certain international impact and development initiatives. For DFIs and IFIs, their pricing spreads may range from 200 basis points (bps) to 600 bps. This varies based on capital markets conditions as well, and can be lower for some DFIs. These same groups have an acceptable range for loan maturities, repayment approaches (amortizing or bullet maturity), moratoriums on the commencement of repayment of interest and principal, etc. In terms of maturities and timing of funding and exposures for LPG in Cameroon, there is alignment with the maturity tolerances of DFIs and IFIs in the range of 5 to 15 years. These are highlighted in the next figure:

Table 35. Capitalization stacking and maturities of DFIs and IFIs

CAPITALIZATION STACKING	Grants	Typically Up to		Terms			Grace Prd.
		Debt	Equity	Benchmark Pricing/Int	Spread	Applicable Term (yrs)	
DFIs/IFIs							
AfDB	yes	\$50 - \$100	yes			15 to 20 years	yes
BOAD			yes				
DFID:CDC (Infra, health and ed, financial inst some priorities)	yes	\$20 - \$100	yes	Cap Mkts		5 to 10 yrs	yes
DEG		\$50 - \$100	yes				
EIB	yes	\$50 - \$100	yes	Cap Mkts		5 to 10 yrs	yes
ECOWAS Bank		\$50 - \$100					
FinnFund		\$10 to \$50	yes				
US EXIM (Guarantees and trade facilitation)							
IDA (Credit/grants & guarantees to Govt directly for Infra Projs)	yes					5 to 10 yrs	yes
IDA (Private Sector Window: debt/eq/grants/gtees: to Govt or Projs)	yes			Libor/Euribor		5 to 10 yrs	yes
IDA (Scale up Facility & Transitional Support Rates: Fixed Rate)	yes	\$50 - \$100		Libor/Euribor	+120/+125	15 -18 (terms)	yes
IDA 17 (Scale up Facility: Fixed Spread)	yes	\$50 - \$100		Libor/Euribor	+120/+125	24 (terms)	yes
IDA 18 (Scale up Facility SUF: Fixed Spread)	yes	\$50 - \$100		Libor/Euribor	+120/+125	to 35 (ARM 20)	yes
IBRD (Inv Proj Fin "IFP") or IBRD Loans (Fixed Spread)	yes	\$50 - \$100		Libor/Euribor	+120/105	15 -18 (terms)	tbd
IBRD (Inv Proj Fin "IFP") or IBRD Loans (Variable Spread)	yes	\$50 - \$100		Libor/Euribor	+86/+86bps	15 -18 (terms)	tbd
IBRD (Development Policy Financing "DPF")	yes	\$50 - \$100		6 Mo Lib	min 200bps	5 to 10 yrs	3-5 yrs
IBRD (Trust Funds FIFs: GEF, Climate Inv Funds) (to Govt or Proj)	yes	\$50 - \$100		Cap Mkts		5 to 10 yrs	tbd
IBRD (Proj Prep Facility) (to Govt or Proj)	yes	\$50 - \$100		Cap Mkts		5 to 10 yrs	tbd
IFC (Debt, equity, convertible loans etc, guarantees)		\$50 - \$100	yes	Cap Mkts		7 to 12 yrs	
Dutch Govt Fund: Infrastructure Dev Fund	yes		yes	Cap Mkts			
FMO		up to \$50 /tranche	yes	tbd			
FMO; CFM; USAID Climate Investor One		\$5 dev; \$75					
Nordic Development Fund Grants financing for climate related)	yes						
Norfund		up to \$50 /per deal	yes				
OeEB (sponsors should be 30%)(own Global Climate Fund)	yes	\$10 to \$50	30% expected			up to 15 yrs	yes
OPEC Dev Fund		\$50 - \$100					
OPIC		up to \$100 / tranche	through inv funds	UST+200	200 - 600bp:	5 to 20 yrs can be 30yr	yes
Proparco		\$10 to \$50/ per deal	yes				
Swedfund		\$10 to \$50/ per deal	yes				
USAID	yes/DCA	\$10 to \$50/ per deal					

Succinctly put, there is a considerable amount of capital for LPG-related entities (SPVs or otherwise) to engage with outside of Cameroon, provided projects and structures are prepared and positioned properly.

The following information shows the depth of activities and the capacity of some leading prospective Funders:

1. MDB commitments in 2014 (includes exposures through: grants, loans, guarantees, technical assistance etc.)
IBRD (US \$22.2 billion)
IDA (US \$18.6 billion)
AfDB (US \$7.1 billion)
Asian DB (US \$13.5 billion)
European BRD (US \$8.9 billion)
Inter-American DB (\$13.5 billion)
2. IFC commitments in 2015
US \$18 billion for a total portfolio of \$84 billion

The information in the following table indicates how DFIs are active in areas that overlap with the targeted initiatives. This makes them candidates to be lead Funders and risk mitigation providers for selected initiatives. Related sectors and aspects, such as SMEs, Financial Institutions/Innovations, and Infrastructure could be part of the appeal to DFIs. In addition to the areas described in the table, additional options may exist and should be explored with respect to Energy and Forestry, the latter in view of the importance of the Cameroon LPG initiative to reduce pressure on forests from extensive cooking with non-renewable woodfuels. For example, if an SPVs, an NBFi, or a pair of Investment Funds were created to fund the build-out of the LPG sector and related SMEs/MSMEs, participation may appeal to DFIs because those are areas they target. AfDB, CDC, DEG, FMO, IFC, Norfund, OPIC, and Swedfund are already active in Cameroon, with prospective alignments among their funding windows.

Table 36. Focus areas of selected prospective DFI Funders³⁷

DFI	Sector	Region	Instrument	Staff Size	Ownership Structure	Tied to National Interests
OPIC	I, F, A, SME	G	L, G, I	230	Owned by U.S. government	U.S. interest required
BIO	F, SME, I	A, A-P, LA, MENA	E, Q-E, L	44	Owned by Belgian government	Untied
CDC	F, I, S	A, SA	E, Q-E, L, G	158	Owned by UK government	Untied
COFIDES	I, A, M, SME, S	G, LA	E, Q-E, L	72	Owned by Spanish government (54%), Spanish banks (45%), and CAF (1%)	Spanish interest required
DEG	A, F, I, M, SME	G	E, Q-E, L	491	Owned by KfW, the German development bank	United
FINNFUND	F, I, A	G	E, Q-E, L	54	Owned by Finnish government (93%), Finnvera, and Confederation of Finnish Industries	Finnish interest required
FMO	F, I, A	G	E, Q-E, L, G	372	Owned by Dutch government (51%) and commercial banks, trade unions, and others (49%)	Untied
IFU	I, F, A	G	E, Q-E, L, G	56	Owned by Danish government	Danish interest required
Norfund	I, F, A	A, LA, A-P	E, Q-E, L, G	45	Owned by Norwegian government	Untied
OeEB	F, I, A	G	E, Q-E, L, G	40	Owned by Oesterreichische Kontrollbank AG, the Austrian export credit agency	Untied
PROPARCO	F, I, A, S	G	E, Q-E, L	168	Majority owned by AFD (64%), the French development agency	Untied
SBI	S, A, I	A-P, LA, LA, A	E, Q-E, L	6	Owned by Belgian government (63%) and private financial institutions	Belgian interest required
Sifem	F	G	E, Q-E, L	17	Owned by Swiss government	Untied
SIMEST	S, I, A	G	E-, Q-E, L	163	Owned by CDP, the Italian national promotional bank	Italian interest required
SOFID	I, S, A	A, LA, MENA	L, G	12	Owned by Portuguese government (60%) and four Portuguese banks	Portuguese interest required
SWEDFUND	F, I, A	G	E, Q-E, L, G	33	Owned by Swedish government	Untied

Relevant sector codes:

- **SM: Small and Medium Enterprise**
- **F: Financial Institutions/Innovations**
- **I: Infrastructure**

One further prospective funding avenue is through the IFC and its active syndication process, with respect to the private sector elements of the Investment Plan. The IFC can provide direct project-related funding, debt, convertible securities, equity, and investment fund capital, typically originated directly by the funded entity and funded accordingly (which could be the SPV-C, if correspondingly structured). The IFC also provides risk mitigation products.

Operationally, the IFC active syndication process brings in additional qualified funding partners. Its syndicate is a capital and resource-intensive club of IFIs and DFIs. A Master Cooperation Agreement (MCA)

³⁷ Source: GLPGP interviews

among IFC and several, or even dozens, of DFI and IFI partners brings together the members' respective capital markets teams. This process was more deeply institutionalized in October 2009, when the IFC created, along with DEG, FMO, and PROPARCO, an MCA syndication format for syndicated and parallel loans, with 30 participating members. The MCA details how the IFIs and DFIs will work, in a pre-arranged, standardized manner, to co-finance projects where the IFC is the mandated lead arranger.

This is accomplished through the IFC Parallel Loans Program. The IFC acts the lead arranger for loans, and can also act as administrative agent. In such a situation, MCA participants (DFIs, IFIs, et al.) benefit from the IFC using its syndication platform, deal-structuring team, origination expertise, due diligence, loan documentation and closing for its own exposures and those of its fellow Parallel Loan syndication members. (IFC, for LPG purposes, could partner with an expert group in LPG, such as the Clean Cooking for Africa/GLPGP group, to supplement IFC in-house expertise, which is not LPG-specific.) This approach could create blended funding-related efficiencies in terms of scale of funding (larger pools raised), time (close more investors/Funders faster), and costs of funding. In the case of the MCA, many of the target institutions for potential participation in LPG financing in Cameroon are already signatories.

The core issue for unlocking Cameroon LPG sector scale-up

Given that there is substantial unmet and underserved demand for LPG, the fundamental issue in Cameroon that had caused LPG sector scale-up to be slower than it could be, and is desired to be, by all relevant stakeholders including the Government—despite a reasonably good LPG ecosystem—is that self-financing by Cameroonian LPG businesses for major expansion of the national cylinder inventory is generally unfeasible. This is due to LPG Marketers' cashflows being limited by the margins allowed by law and regulation, and by external financing being prohibitively difficult to obtain or to justify, considering both the cost of capital and the terms available for acquiring the capital. In short, the first major issue for unlocking significant growth in LPG use in Cameroon is a bankability and financing.

Serving this demand is the “low hanging fruit” for investment projects. Beyond this, a combination of additional investments in the supply chain and demand-stimulating measures for accelerating adoption and consumption of LPG, represent the “middle hanging fruit”. (The “high fruit” is among the largely wood-gathering rural population living mostly outside the cash economy, who are likely to switch to LPG use only as economic and demographic trends shift them into the “middle” group.) Once the LPG sector does grow significantly, the cost to the Government of the LPG price subsidy as presently configured may become an equal or more important issue affecting the continuation of rapid growth.

Approaches to work through or around the bankability and financing challenge are discussed in detail throughout this Part of the report.

Summary of financial structuring and arranging approach

To fund these investment projects, it is recommended to create up to four types of financing vehicles: two special purpose vehicles (SPVs), Non-Bank Financial Institutions (NBFIs), or Investment Funds (Funds). The determination of which vehicle or vehicles to utilize would be based on the requirements of the critical mass of Funders for the investments. The preferences and requirements of Funders actually willing to deploy capital for the LPG investments would drive which one vehicle, or vehicles, would be utilized.

A potential financing role for the Clean Cooking for Africa Program/GLPGP could be to provide the expert resources to act as technical advisor to the SPV managerial companies, the NBFi and/or the Funds, to help establish objective outside management and oversight of comfort to both large foreign and some domestic institutional (debt and equity) providers (Funders), as well as risk mitigation sources.

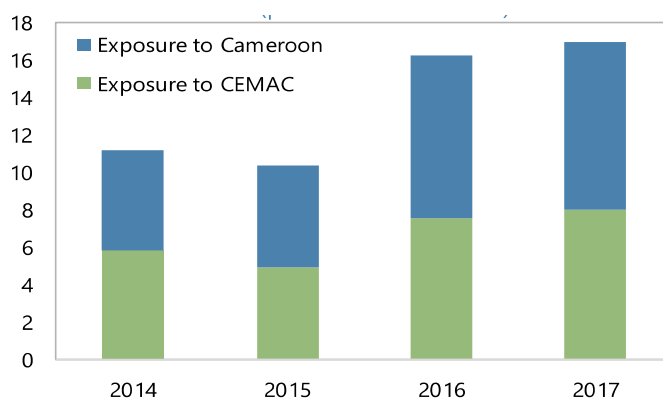
The recommended approach for mobilizing funding, guarantees, and risk mitigation options is initially to focus on sizable sources, as “leaders,” in building the capital and risk mitigation layers and “crowd in” other Funders. This entails engaging both Cameroonian and non-Cameroonian sources. Ideally the approach will enable GLPGP-related entities in the target markets to mobilize funding to build out the LPG supply chains, and use commercial and concessional capital (Blended Capital) to yield, in hard currency, an overall target debt interest rate of around 8% and a target equity internal rate of return (IRR) of around 20%. These rates are consistent with what capital providers to top-ranked investments are currently realizing in target Sub-Saharan African markets.

Identification of prospective funding sources

To focus efforts efficiently on targeting the largest and most accommodative mix of blended capital from pivotal funding groups (Development Finance Institutions (DFIs), International Financial Institutions (IFIs), and Multilateral Development Banks (MDBs)) as leads, coupled with risk mitigation, the Clean Cooking for Africa/GLPGP team conducted face-to-face discussions and phone calls, and researched comparable activities of the targeted organizations.

In Cameroon, there is a relatively limited depth of capital and investment/funding flexibility by the existing financial sector capital sources (banks, investment funds, pensions, insurance companies and others). Banks are also strained by debt exposure to state-owned enterprises (SOEs) and typically limit their funding to larger, more established businesses that can maintain high cash balances at the banks: trade-related accounts that can serve as collateral, or hard assets. The chart below from the latest IMF report on Cameroon (IMF 2018) demonstrates that Cameroon’s banks are investing heavily in the Central African countries beyond Cameroon. This results in limited capital available and deployed to local businesses.

Figure 12. Cameroon banks' sovereign exposure, 2014-2017



Because of the limitations of the domestic Cameroon business funding markets, it is anticipated that the majority of the funding for the investments described in the preceding Chapters will be led by foreign capital sources of debt and equity and then supplemented by local banks and potentially other local

institutional investors (e.g., from the sole pension fund in Cameroon). Efficient funding efforts should therefore focus on targeting the largest and most accommodative larger-scale mix of blended capital from funding groups such as development finance institutions (DFIs), international financial institutions (IFIs) and multilateral development banks (MDBs) as leads, coupled with risk mitigation.

The Clean Cooking for Africa/GLPGP financing experts conducted face-to-face discussions and calls with, and researched comparable activities of, an array of prospective financing sources inside and outside Cameroon. Funding must be customized to meet the requirements of these sources, and may come from privately placed arrangements. An example is the € 1.2 billion Nachtigal hydropower plant financing announced 22 November 2018 with funding from a syndicate led by the EIB and the IFC. This transaction demonstrates the potential to blend large international Funders with some local banks/institutions. The equity and debt markets for public capital-raising are thin on the Douala Stock Exchange, as mentioned above, so utilizing larger regional listed capital approaches may be preferable, or listing an SPV on selected Central or West African stock exchanges using the services of pan-African banks such as Ecobank, UBA, Standard Charter or Stanbic. These banks have expressed interest in assisting in this capacity.

It is noteworthy that international MDBs, such as the IBRD, IDA, AfDB, AsDB, EBRD and IADB, committed almost \$84 billion in 2014. European DFIs, such as BIO, CDC, COFIDES, DEG, FINNFUND, FMO, IFU, Norfund, OeEB, PROPARCO, SBI, Siferf, SIMEST, SOFID, and SWEDFUND committed \$6.8 billion in 2015, and OPIC a further \$4.4 billion. IFIs contributed additional funds. This indicates that funding and Funders are available if the targeted recipient and project are right.

Critical path of financing steps

Based on the research and analysis of the Clean Cooking for Africa/GLPGP financial expert team, the following steps are recommended to be taken by the Government and its advisors³⁸:

1. Confirm the Government's support for the proposed, or some amended version of the, national LPG investment plan (Investment Plan), including confirmation by MINEE and the Ministry of Finance (MINFI);
2. Select the appropriate funding structure(s) to optimize access to Funders at the most attractive overall terms for the Government, and for designated private sector champions;
3. Identify the leading Funders which can "crowd in" others;
4. Ensure the domestic execution parties have the cash flow absorption, deployment and generation capacities to support the proposed financing structures and to perform their roles;
5. Strengthen the "bankability" of the financing with sufficiently strong backstops, such as levies, guarantees and risk mitigation tools; and
6. Secure operational approval from relevant ministers and agencies as to the structuring and financing path chosen.

³⁸ Which may continue to include GLPGP

No set of Funders can ultimately be chosen until an LPG Investment Plan has been approved by the Government, and the specific recipients of the associated funding (that is, public sector or private sector companies or consortia for each major project or expansion of an existing business) identified and qualified.

Main structuring options

1. The four options discussed below are the likeliest alternatives on an initial basis and would be refined based upon further local LPG constituent and Funder discussions to occur beyond the date of this writing. While they are not the only options, they represent the most attractive identified to-date based on extensive consultations.
2. The four options all entail prioritizing the blending of local capital with international capital. They differ in that the Investment Funds approach (Option 4) will most likely not attract considerable local funding, because institutional investors' stated preferences regarding liquidity would be difficult or impossible to meet via a longer-horizon fund.

Four Options

1. The four options are prioritized as follows. They match funding structures with appropriate Funders and risk mitigation sources:
 - a) **"SPV-C (Cameroon)" Listed.** For example, a cylinder-focused SPV for Cameroon. For cylinder investment, a dedicated LPG fuel levy could be created and used to cover the portion (notionally 40%) of the capital costs of cylinders borne by the SPV. The SPV would be funded by investors, would acquire cylinders, would resell them at a 40% discount to Marketers, and would recover that 40% from the levy over time. This involves active outside oversight, such as through an escrow agent and specialist³⁹, and transparent involvement of capital expenditures entities. DFI and other guarantors, such as the Africa Guarantee Fund, could be brought in to support the Investment Plan through, or alongside, the SPV-C. The SPV-C approach allows for aggregated investment in, oversight of, and monetization from, cylinder assets, while allowing for direct investment or co-investment into more conventional (non-mobile) assets and modalities, such as storage facilities and cylinder filling plants.
 - b) **LPG (Vertical) SPVs-listed or Non-listed.** For example, an LPG sector SPV for Cameroon. The SPV would fund the underlying modalities' growth. As with all the structures, this option would depend on the creation/enhancement of the "bankability" of the underlying entities to be funded and de-risked. This also involves active outside oversight, such as through an escrow agent and specialist, and transparent involvement of capital expenditures entities. A sector SPV would provide the greatest flexibility with respect to structures, types of capital to be invested, and monetization options. The level of official market based oversight, such as through the Cameroon Securities and Exchange Commission (SEC) if this

³⁹ Such as Clean Cooking for Africa/GLPGP

SPV were listed, will also impact the level of appeal such a structure will have to Funders. A sector SPV could subsume the role and function of the cylinder-focused SPV-C.

- c) **LPG Non-Bank Financial Institution (NBFI).** Create a new NBFI entity which could finance specific LPG developments (and also could be listed). This option would be appropriate as a backup to the above two SPV approaches, if a critical mass of Funders cannot be assembled to capitalize an SPV structure. The NBFI would be limited to lending activities (no equity investment) and would be subject to specific regulations and requirements that GLPGP has researched and discussed for potential partnering with existing local financial institution leaders such as Afriland First Bank, which is an existing banker to nine of the 12 Cameroon LPG marketing companies. AfDB, CDC, DBSA, DEG, FMO, IFC, Norfund, OPIC, Proparco (which has expressed its interest for such time as the right funding candidates are put forward) and Swedfund are prospective NBFI Funders. These institutions are active in financial institutions/innovations and also infrastructure plays. In addition, along with EIB, many of these institutions were recently part of the announced € 1.2 billion Nachtigal Hydro Power Company financing (Nachtigal Financing).
- d) **Investment Funds (LPG infrastructure Development Fund (LID) and LPG First Costs Fund (FCF)).** Clean Cooking for Africa/GLPGP could create two multicountry LPG-specific Investment Funds with an appropriate and qualified fund operating partner (a DFI or a regional investment or merchant bank with relevant experience) for LPG sector investment in Clean Cooking for Africa countries, such as Cameroon, where large-scale LPG investment is deemed feasible. These Funds would act as aggregators and managers of DFI and other institutional capital from major Funders. The LID Fund would be for the capital expenditures and growth capital along the LPG supply chain. The concessional-rate FCF Fund would be for the related SME working capital and consumer and small business microfinance needs. Because of the FCF Fund's mandate to facilitate accessible and affordable finance for SMEs and consumers, it may be an earlier candidate to design and partner with a local financial institution, such as Afriland First Bank or BICEC (Banque International du Cameroun pour l'Epargne et le Crédit), which have asset management activities.

The case of the DFI/local bank Nachtigal Financing is instructive because it demonstrates that, despite being capital-constrained, larger locally-operating banks such as Societe Generale Cameroun and Standard Chartered Bank Cameroon can step into the financing equation alongside major international Funders (concessional and commercial) to create a blended finance mix of significant scale. The major foreign and domestic Funders and providers of other structural supports like guarantee mechanisms include African Development Bank, Africa Finance Corporation, Agence Francaise de Developpement, Attijariwafa SCB Cameroon, BICEC, CDC Group, DEG, EIB, PIDG company - the Emerging Africa Infrastructure, FMO, International Finance Corporation, OFID, Proparco, Société Générale Cameroun, and Standard Chartered Bank Cameroon.

Primary Advantages

- a) They are potentially appealing to the Government because MINFI, as well as the Central Bank of Central African States (BEAC, Banque des États de l'Afrique Centrale), desire to encourage more domestic and foreign institutional investment into Cameroon's infrastructure and critical social and business sector development.
- b) They will also appeal to DFIs and IFIs who are trying to promote capital flows into Cameroon and emerging markets through innovative financial instruments. AfDB, CDC, FMO, OPIC, and the IFC are active examples of groups to be approached to back these instruments in some capacity. This can be through investment in the SPVs, on-lending or funding the NBFIs or parent company, investing as limited partners in an Investment Fund (debt or equity funds), or providing guarantees. These groups have indicated their potential interest once the specifics are established behind how such vehicles might be structured and operated.
- c) They can attract a wide range of local and CEMAC institutional investors such as pension funds, mutual funds, insurance companies, private investment houses and foreign investors.
- d) The precedents for documentation and structuring have been established and accepted for SPV and corporate related securities issuance and shelf registrations of debt and equity, bonds, etc. This means that the primary targets among local market institutional investors and foreign investors are familiar with the concepts involved.
- e) On the listing side, some Central African public listings have taken place, on a limited basis. If structured correctly, this could make an LPG-listed instrument (SPV, debt or equity vehicle) another avenue for a potential funding. This also creates some investor liquidity.

Primary Risks/Issues and Mitigants

- a) SPV or NBFIs, while intending to create simplification and improved accountability for investors, potentially add complexity for the sector. The complexity can be addressed by referral to established precedents known to investors in Cameroon. Cameroon has numerous SPVs that have attracted Funders' institutional capital into sector enterprises such as cocoa and the energy sector bond restructurings. LPG companies would have to be educated, based on these precedents, how an SPV or NBFIs for LPG would improve access to capital and, possibly, lower the cost of capital.
- b) The LPG industry must accept and contract with the proposed structures, and it is not certain that all industry players will wish to do so. As intermediaries for capital and as temporary owners of assets, the SPV/NBFIs change the dynamics of the sector during their investment and asset-ownership period, in exchange for providing aggregation and pooling benefits to the sector participants. The risk of industry acceptance and participation can be addressed in two ways: first, initial, willing participants would gain the benefits (and competitive advantages) of

participating; as non-participants observe the benefits to their competitors, they will be increasingly motivated to join. Second, the detailed design of the SPV/NBFI and its sharing of benefits and obligations must be acceptable to both the investors and the modalities; involving both groups therein can mitigate the risk of non-acceptance and non-participation.

- c) Where a listing is desirable, there is a risk of failure to list, or underperformance once listed. Utilizing precedents and benchmarks from other sectors can mitigate this risk. Some Central African public listings have taken place, on a limited basis. If structured correctly, adapting well the learnings from these precedents, it could make an LPG-listed instrument (SPV, debt or equity vehicle) another avenue for a potential funding.
- d) A risk to investors (as with any investment) is liquidity and monetization, in particular with respect to equity or quasi-equity components. Listing of one of these vehicles would create some investor liquidity. If a listing is not done, then mutually acceptable monetization mechanisms should be built into the contracts for financing and asset ownership and transfer between the SPV/MNFI and the industry participants.

Important drivers in choosing among alternatives for financing the investments

Important requisites for choosing financing approaches and sources include:

1. Cameroon's targeted LPG-related funding needs all along the value chain (from importation to consumer) should be well defined.
2. The entities or modalities in the LPG value chain which are willing and able to take on the ultimate repayment responsibilities should be able to demonstrate "bankability". (This implies that not all market participants will initially participate in the funding solution; of those that do not, some will work toward participating later, some will stay out and presumably be at a competitive disadvantage, and some may contemplate mergers or being acquired.)
3. The debt and equity (or other instruments) should reflect the blended capital that is most efficient, to achieve the costs and structural terms most suited for the Investment Plan.
4. The risk and return needs (financial, liability management, etc.) of the Funders have to be factored into the instruments for best success potential to be able to close with the Funders.
5. Attracting the participation of meaningful internal sources is a means to "crowd in" external funding sources by providing a vote of confidence).
6. Operational cashflow predictability and managerial, operational and financial transparency should be well-established to encourage faster responses from Funders.
7. There should be built-in risk mitigation: Escrow accounts, liquidity, governance by outside parties (trustee agents such as banks and industry auditors) to monitor economic flows.
8. Respected, professional, and sector-experienced management for the funding vehicles is necessary.

9. If possible, an “official request” by the Government will facilitate responses from DFI, IFI, and MDB Funders when sound, detailed business plans for the projects and business expansions are in place. The Government is currently active with international Funders, so fund arrangers (which may involve the Clean Cooking for Africa Program/GLPGP) should approach MINFI and the national agencies designated to attract national investments, to align interests and strategize on approaching the larger foreign sources of capital and guarantees.

Funder issues to be addressed in financing the investment plan

1. In building the specific capitalization mix from blended finance sources, one must be aware of the particular characteristics of the targeted Funders, and take these into consideration. These include but are not limited to:
 - c) Funders’ Own Liability and Fiduciary Requirements: Requirements for repaying or meeting their funds sources’ repayment requirements. Pensions and insurance companies need to match the weekly, monthly or other payment requirements of their clientele.
 - d) Other Competing Investment Opportunities: The range of structures and the risk-adjusted returns being offered is considerable.

The opportunity cost of taking on an LPG-related investment versus other investments available must be addressed. LPG-related investments are competing for domestic funds against government securities and also other high-quality fixed income instruments.

2. For the proposed and recommended LPG structures to be attractive, the funding vehicles must at a minimum be able to attract investors with the correct blend of risk-adjusted prices, equity comparable returns (meaning high and predictable cash flow), credit comfort (if debt or debt-like), and maturities at least as attractive as those of comparable opportunities.
3. For the portion of the Cameroon LPG sector development funded by such entities, the four options are appropriately suited to take advantage of the structural expectations and realities in Cameroon’s capital markets.
4. GLPGP determined from its face-to-face discussions and market research with leading Cameroon investment groups and banks, that:
 - There is a preference for debt or fixed income-linked investment securities over equities (for reasons of predictability of returns, transparency, and current income);
 - The local institutional investors have both more regulatory and investment preference for listed or Government-supported instruments.

Recommended cylinder acquisition process under a cylinder aggregation SPV

A SPV-Cylinders (SPV-C) would purchase the new cylinders by pooling all the procurements under a BOT framework, using different contracts signed among the SPV-C, the Marketers, and the Funders. It would be necessary to secure from each Marketer its commitment to the SPV-C to put up its share of the funding based on its existing share, or expected share of the increase, in cylinders.

SPV-C would conduct a global procurement based on agreed-upon specifications (see below). The cylinder purchases are expected to be in three tranches of approximately four years each, with the subsequent one activated based on the successful completion of the sales of the prior one. In the contract, each Marketer would address its participation in the program, including the necessary details of commitments and obligations (the maintenance and replacement of the cylinders, the conditions of the BOT, and the safety and distribution of cylinders).

In advance of the order, each Marketer would be expected to provide two financial amounts:

- i. A rolling indicative purchase order for that tranche, setting out the number of cylinders it expects to order over that period; and
- ii. A commitment letter to buy a specified number of cylinders for that year if a manufacturer's offered price in the public auction is at or below the Marketer's specified price.

If the specified price is met, the Marketer must then prepay the order with the Funders' financing. If the price to the Marketer includes a levy-backed discount, the Marketer is prepaying its 60% of the cylinder cost, and final asset transfer would occur after the levy mechanism pays the SPV-C the remaining 40%. If there is no material discount (other than from pooling of purchases), the Marketer bypasses the BOT approach to take immediate title to the cylinders. This helps avoid a requirement of asking the Marketer or Bottler to post a standby letter of credit to ensure payment performance. Manufacturers could then start to build the cylinders against that confirmed, and paid for, order.

"Rolling" means that at the end of each 12-month period, each Marketer needs to present a new indicative order. Given the size of the orders, it is expected that at least two manufacturers will be contracted to provide cylinders, to avoid the risk that a single provider has production problems which could hamper the growth and development of the Cameroonian cylinder market.

For cylinders subject to BOT, ownership of the cylinders would remain with the SPV-C until the Funders were repaid and the cylinders transferred. However, the cylinders remain the responsibility of each Marketer through the BOT contract between the SPV-C and these parties, which includes undertakings: (i) that the responsibility and the obligation of the Marketers is to ensure the cylinder remains under the control of its distribution network, (ii) to not resell or transfer the ownership rights of the cylinders, (iii) to transfer the use of the cylinders through the refundable deposit scheme, (iv) to refill the cylinders complying with the applicable norms, and (v) to maintain and repair the cylinders (including the valves) as per the applicable norms to guarantee the safety of the cylinder over its useful life.

Harmonized Specifications

While respecting each Marketer's registered color and brand, it is recommended to establish a harmonized set of specifications for the cylinders, based on the Cameroon norm, and to allow each Marketer to choose its preferred size(s) of cylinder (12.5kg, 6kg, etc.) Any order not 12.5kg in size and different from the harmonized specifications may result in different pricing for those cylinders.

Environmental/carbon finance

The potential carbon-market value from implementing what is described in this report is potentially €3-4 million per year, as discussed in Part VII beginning on page 137. However, monetizing that value as an

additional financing source faces a significant practical challenge, for which no solution can presently be envisioned. The challenge is that the ownership of the carbon-credit value is attached to the consumers' use of LPG for cooking, through displacement of higher carbon-emitting fuels and technologies. This implies monetizing the carbon value from millions of individual points of use, through an acceptable, practical, and cost-efficient means of measuring and auditing the net carbon benefit from each. The monetized carbon value would also have to be transferrable not to the end-user, but to the service providers along the LPG supply chain which make the investments to be co-funded through that carbon value.

The CDM does not allow carbon credits for fossil fuels (since these are defined as non-renewable), and therefore LPG is not eligible for carbon credits under CDM, despite the fact that overall the impact on climate forcing is similar to or less than even the best biomass stoves when all emissions are considered. Recent evaluation studies of CDM-approved, more efficient biomass stoves also demonstrate that there is a substantial risk that these interventions fail to realize the expected fuelwood and associated-carbon reductions under real-life conditions because of technology performance, fuel stacking (the ICS is used together with the traditional stove instead of replacing it) and/or because of extra cooking tasks performed due to previously suppressed demand. In addition, some improved stoves (including rocket and natural draft stoves) have been shown to emit more BC and PM_{2.5} emissions than traditional biomass stoves and open fires.

Gold Standard offers a possible path forward if the issue of end-user scale can be solved, as Gold Standard includes the Kyoto Protocol gases and Black Carbon (BC), although it still does not include CO, SO₂, OC and NMHC.

A number of small-sized LPG projects have been funded through the Gold Standard carbon credit mechanism. One example is the 9,000-stove Darfur Low Smoke Stoves Project implemented by Practical Action and CarbonClear Ltd., which began stove dissemination in 2010. Each LPG stove in that project avoids about 4.6 tons of CO₂ equivalent a year compared to traditional and improved mud wood stoves (15-20% efficiencies) and to traditional and improved metal charcoal stoves (20-25% efficiencies).⁴⁰

Should a practical mechanism arise for monetizing the carbon-credit value created by millions of added users of LPG, and for deploying that value toward the financing of the supply chain expansion that makes the carbon-credit value possible, it could lower both the cost of capital for the expansion and potentially the cost that consumers incur to become new LPG users.

⁴⁰ Carbon Clear (2016): *The Gold Standard: Project Design Document for Gold Standard Voluntary Offset projects - Darfur Efficient Cook-Stove Project*. See mer.markit.com/br-reg/public/project.jsp?project_id=103000000002416.

VI. The Investment Opportunity for Funders

The Cameroon LPG sector represents an opportunity for impact-oriented institutional Funders and donors to deploy resources efficiently to meet the need of € 274 million of new assets, based on in-depth country level analysis through the Clean Cooking for Africa/GLPGP expert team, demand assessment and impact assessments integrated with discussions with governmental agencies and financial entities. They can do this at scale and make an impact in the areas of cleaner cooking fuel sources, related health impacts, reduction of carbon output from charcoal or wood-based fuels, prevention of deforestation, and also create new areas of domestic SME development along the LPG value chain. Their investment, risk mitigation and technical assistance (TA) resources can serve as a catalyst to mobilize complimentary commercially-oriented capital into blended funding for the LPG sector. This could be both foreign and domestic sources. If structured correctly and provided the right business and regulatory environments, the blended sources of growth capital, risk mitigation and TA may realize their return objectives – financial and impact. The analyses in this document suggest that this can be the case.

6. Evolution to a More Bankable LPG Industry

Increasing LPG penetration to approximately 60% of the population by 2030 will be facilitated by the adoption of the comprehensive Government-mandated regulatory and operational frameworks as discussed and recommended in the Feasibility Study. Adopting the frameworks, in particular the recommended strong form of BCRM, will create a more robust and more sustainable economic model for operators such as the LPG Marketers and Bottling Plant entities in the supply chain. With such frameworks in place, companies will be more inclined to make investments in critical operational assets, because loss of revenues due to events such as cylinder cross-filling will be substantially reduced or eliminated, and only legally established filling relationships, as regulated by the Government's agencies, will prevail.

The investment needs are not the only consideration, but must be balanced against the needs and expectations of capital providers. The Government's regulatory frameworks to protect the economic flows of assets like cylinders will make these operational modalities more justifiably "bankable" to institutional Funders such as DFIs, IFIs, MDBs, and private and other funding and risk mitigation sources that are a critical link in the evolution of the sector.

Modeling of the potential returns to Funders indicates that, through 2030, investments in the two key areas of Marketers (mainly cylinders) and bottling plants can generate hard currency-equivalent returns of approximately 8% to 10% on debt and more than 30% on equity. For investors and Funders looking at debt, debt-linked instruments, and instruments with equity-like characteristics, there is a way to take exposure to the LPG sector. This is framed as a strawman financial scenario in Chapter 4: LPG Marketers investing in new cylinders for € 120 million in aggregate through 2030, with a forecasted IRR of 74%;

These returns are attractive from a P/E vantage point, as the return threshold usually identified by emerging markets institutional investors is 20% minimum. However, foreign capital sources are needed, since a €274 million LPG investment program would likely be too large a quantum for in-country financial institutions to support single-handedly. Foreign investment funding, risk mitigation resources and technical assistance (TA) funding will bring more scalable capital and more risk mitigation to the investment equation. This will enhance longer-term scalability potential and attractiveness to both domestic and foreign investors/Funders. In order to protect the returns associated with such exposures, guarantee

structures from groups such as those noted below are available. DFIs such as KfW or its DEG unit, for example, might lead such a process for funding and risk mitigation. The approach regarding mobilizing non-Cameroonian sources of funding and risks protection is to use concessional funding through groups such as KfW/DEG, DFIs, MDBs, and IFIs, and use these entities to crowd in both additional non-concessional sources of capital and Cameroonian sources of capital – mainly pension funds and banks in particular that are used to lower risk investments. The blending of domestic and foreign concessional and non-concessional resources is an important catalyst for realizing the recommended LPG investments and their benefits and co-benefits. Foreign backers will lower the risk of capital losses if guarantees can be structured, in addition to ensuring ample capital is available, to make LPG investments of that scale economically justifiable, and return capital appropriately given the country level and firm-level risks. This is a well-proven approach.

As mentioned previously, successful examples of this approach involving certain DFI, IFI, and MDB-linked coordinated funding that could be adapted to Cameroon include:

- a. FMO's lead funding ~\$16 million investment in the \$60 million Bangladesh-based LPG company Omera, in the form of debt and equity. This has since been up-sized.
- b. DANIDA's co-financing the establishment of GlocalGaz, a regional LPG marketer in Cameroon, including a filling plant and cylinder inventory.
- c. IFC's follow-on round of financing of \$20mm to Omera.

Additional cases are described in Annex Chapters 28 and 29.

The logic for targeting marquee leaders in the blended finance and risk mitigation mix is that they will enable the mobilization of financing at scale, provide TA grants and guarantee structures, and then be the catalyst for followers. Ideally, this approach could also lower the overall blended costs of funding, could be patient capital, and would be well matched to the potential repayment abilities of the LPG supply chain players that underlie the cash flows of the funding mechanisms. This packaging of lead institutions to provide grant funding, TA, capital, and guarantees is an approach similar to typical syndicate and other "book-building efforts" in project finance and other financings. Grants for TA and operational development of the resource-mobilizing entities envisioned in this report are not atypical and can play an important role.

7. Methodology

The approach to executing GLPGP's mandate has been an interdisciplinary one. Detailed studies have been undertaken regarding the market demand for LPG, technical investment needs, impact potential, and blended financing options to implement investments. GLPGP has based the Investment and Implementation Plan and the investment funding and risk mitigation recommendations on the fit – namely matching the investment funding needs of local value chain actors with requirements of blended finance and risk mitigation sources. We have analyzed both domestic and international sources of meeting the capitalization and risk mitigation needs in order to create both local and foreign based solutions to facilitate the implementation. The belief is that foreign capital will also catalyze what limited sources of interested capital may exist in the local market. We have then set out to create options to attract both local and foreign sources of capital. Importantly, Cameroon has approximately US \$12 billion in its institutional capital markets from banks, and investors ranging from pensions to insurance companies. While they are also familiar with complex structures, they are conservative and tend to aggregate into perceived “safe haven” instruments like treasuries and investments or loans to large corporations. This leaves SMEs and growing corporations limited in their access to capital. For a growing company like an LPG Marketer, these domestic funders are, in reality, non-concessional Funders. In the mix of blended capital, if these local sources are crowded-in, they will need risk mitigation to participate at scale.

The funding recommendations herein are anchored on an analysis of realistic options for implementing the Investment and Implementation Plan. GLPGP has utilized market-based analysis such as the needs of existing LPG Marketing companies that would need to be financed to drive the scale-up of Cameroon's LPG solution. Pension and insurance regulatory bodies have also been consulted. Finally, major institutional funders including DFI representatives, investment banks, commercial banks, insurance companies, mutual funds, pensions, private debt/equity, and others have been approached to understand their appetites for investing in various types of opportunities. Outside of Cameroon, the Clean Cooking for Africa/GLPGP expert team also discussed their potential interest with groups such as AfDB, DBSA, DFID/CDC, FMO, IFC, KfW, POPARCO, OPIC, and USAID among others. We have also discussed providing combinations of capital and risk mitigations with groups such as PIDG, GuarantCo and Africa Finance Corporation. On the private funding side, numerous funds have been approached on a confidential basis.

The firm-level funding recommendations herein are based on an analysis of realistic options for implementing the Investment and Implementation plan, reflecting a composite of the industry. This is based on LPG consumption forecasts, market-based pricing of key financial influencers of the LPG operators, government-allowed operator value chain margins in key areas like costs of LPG, refill prices, cylinder policy and availability, regulatory operating framework (strength of BCRM, for example) and investment needs to fill the demand potential and other components, as explained in this report and the Feasibility Study. This has enabled building the industry profile (operational and related financial composite) based on actual market information and Feasibility Study. This approach is referred to herein as the Strawman (composite) approach.

Ideally, GLPGP would have specific company disclosures available; however, in the absence of having access to this information from a largely privately-owned and fragmented supply chain, it was determined to use the next-best approach—namely, the Strawman (composite) approach. This approach weights the potential social impact, risk and return expectations of potential Cameroonian and international Funders, to assess the likelihood of satisfying the Investment Plan's financing needs against the potential to fund such needs.

An analysis was performed of the best mix of concessional and commercial capital – blended capitalization, risk mitigation through guarantees, and supplemental needs such as grants for ensuring that operating entities have the capacities to meet the requirements to attract capital and be sustainable. For example, TA grants could be used to enable LPG Marketing companies to analyze and reposition themselves in the changing industry, and to target better in underserved and unserved geographic areas (the “higher-hanging fruit” mentioned in the previous Chapter).

The recommended investments requires financing 4.3 million LPG cylinders of 12.5kg equivalence (kge); expansion of the bottling plant (BP) network with appropriate storage capacity; pallets for efficient movement of the cylinders; and cages to display the cylinders in retail locations (see Chapter 3 for details).

Recommended technical assistance measures and associated costs are set forth in Chapter 20 beginning on page 142.

Conclusion

This interdisciplinary approach has established that there is an underlying case for both owners and Funders to consider in terms of development impact, financial returns and social impact presented by investing in the LPG sector in Cameroon. To realize this potential, considerable investment must be attracted into the Bottling and Marketing modalities. Importantly, because the investment needs are over time, capital providers and proprietors can participate in stages and naturally hedge risks—that is, testing of stages of funding. These investments for the Bottlers and Marketers – namely for key investment areas as noted in cylinders and bottling plants/storage—have been modelled using the Strawman approach. We have also accessed the related funding options from 2019 to 2030. We then have determined that the best approach to driving capital and risk mitigation resources from interested parties is through a combination of direct and indirect channels. This enables institutions to deploy meaningful amounts of capital, thereby justifying their time and efforts. Direct Funding (grants, debt, equity, risk mitigation tools) are both non-domestic and domestic institutional resources structured through a TA supported initiative to groom and support pipeline recipients to meet the requirements of institutional resource providers. This should complement capital providers by enhancing the viability of various investment opportunities and options.

8. Structuring Cameroonian LPG Investment and Implementation

The approach to mobilizing blended financing around Cameroonian LPG value chain Marketer and Bottler modalities should be phased to identify and mobilize the best syndication of lead Funders and risk mitigation sources first. Because of the scale of funding needs and the risks, funding and risk mitigation sources should be tapped from outside Cameroon and then used to catalyze participation from institutions inside Cameroon such as banks, pensions, insurance companies and private investment institutions. This approach is a proven one and DFIs, for example, serve this lead role well. Their mandates and abilities, depending on the institution, are designed to provide some or all of the continuum of project development technical assistance monies and resources, capital ranging from working capital to longer-term hard asset financing – debt, equity, hybrid instruments, and pass-through or fund investments.

To be most effective as a way to stimulate the LPG sector, it is important to prioritize the firm level investees or recipients of capital by working first with the top tier players in terms of market share and impact potential. This will serve to stimulate interest from both sources of funding and risk mitigation and also from other sector followers. GLPGP has confidentially approached selected leading players, and the belief is that, while some have on-going smaller operational funding needs covered by local banks, the larger capital investments associated with bottling/storage and cylinder investments will require investment capital beyond their existing funding capabilities. This applies both to access to capital and the terms of that capital.

Their ability to fund at interest rates as attractive as that which can be mobilized utilizing global and domestic blended capital sources is doubtful, because the blended mixes will utilize risk and capitalization structures that can better minimize risk. They can incorporate syndicated scale with (i) pre-arranged tranches as per DFIs or IFIs – for example, using the IFC-sponsored MCA; (ii) instruments such as OPIC's private placement insurance for 144A debt placements – essentially providing a U.S. Government guarantee to investors in, for example, an SPV; (iii) first-loss tranches from impact investors and institutions with such offerings; (iv) investment structures that can be more accommodative to the structural needs of the companies – for example, using convertible instruments that can lower immediate coupons in exchange for future upside through royalties (structures domestic banks do not typically utilize to fund clients); (v) operational and political risk guarantees; (vi) FX guarantees; and other advantages. In addition, DFIs, MDBs, and IFIs can offer tenors out to fifteen years, thereby lowering the cash-flow burdens with debt servicing over shorter tenors. Domestic banks are limited by risk metrics, capital adequacy ratios and provisioning, and capital pricing constraints that understandably limit their ability to do these things. Unless an investee is a blue-chip client, it is even difficult to finance beyond three to five years. For these reasons, it makes sense for Cameroon's LPG companies to work to be part of the blended finance structured funding solutions, as recommended herein. Importantly, this approach can still incorporate their local bank funding, but in conjunction with funding through a blended capital initiative.

Cameroon's LPG Marketing companies will need to invest in the approximately 4.3 million incremental cylinders required to 2030, assuming the forecasted demand potential is fully realized. This represents a €120 million estimated capital cost. A Marketer SME with a 5% market share, for example, would incur a roughly €6 million investment cost to keep its relative market share, assuming market shares and cylinder rotation rates stay relatively constant in future. In a developing market where certain Marketers may soon be positioning for survival while others position for opportunities to grow, this can be a large investment amount, and interested outside Funders, whether domestic or foreign, will want risk mitigation.

9. Structuring Firm-Level Investments

To target and structure firm-level funding opportunities and assess their risks— “to pick potential winners” —it is key to note the sector’s evolving macro-operational dynamics. This makes firm-level risks a dynamic assessment. Funders will therefore price their capital at the sovereign, sector, and operator risk levels. These risks can be mitigated by risk guarantees and insurance from both private and public institutions, but they too have to have an appetite, and the pricing has to be affordable to the operators. As noted, Cameroon’s LPG sector is not yet mature, and which companies will become the private sector winners over the long term is not certain. From a funding and risk perspective, LPG Marketers may be perceived as a more-risky grouping, especially during the initial years. That means that only those firms that can currently demonstrate key operational, competitive, financial, and managerial capability (or strong potential) are likely to be bankable. Larger Marketers—especially those with their own bottling plants—can in theory be more appropriately assessed for their potential and their risks, both at this stage and going forward. Their smaller competitive pool could make these larger firms more attractive as a group. In addition, Marketers with bottling plants have a sizeable portion of their core assets as physically fixed assets, which provides more comfort to Funders. SCDP, being a special case as the national LPG bottling utility company, is entirely fixed asset-based.

Structuring the firm-level capitalization should therefore be based top-down—mainly regulatory/demand—and bottom-up—operational firm/industry-level. The view is that this approach will segment the LPG sector into two main tiers of targets:

- 1) *Tier 1 Entities* – Those that are well-positioned to accept and deploy capital for growth. These would have economic scale, strong operational outlooks, and sound management, and are most likely “bankable” in the immediate term, with some advisory services to prepare for outside resourcing; and
- 2) *Tier 2 Entities* – Those with a reasonable chance and interest in growing with the new market expansion, but are still smaller or uncertain. These are typically smaller scale SMEs and will need more time and assistance to be “bankable”.

For more conservative debt Funders, structuring funding around companies with bottling facilities may be easier than those without due to the fixed assets base. Outside of investment in cylinders, which are portable assets, they have € 86 million in plant and storage capacity that can stand as fixed asset collateral for Funders. Marketers without bottling operations, on the other hand, have only cylinder as the primary investment need. Investing directly in smaller Marketers whose assets are dominated by cylinders potentially riskier, and interested Funders will want to have risk diversification. This is analogous to carrying out a portfolio diversification strategy by owning a range of companies in a sector to mitigate competitive risks, or to a closed-end country fund.

In light of the mix across these two tiers, it is recommended is to take two paths to funding the recommended LPG investments:

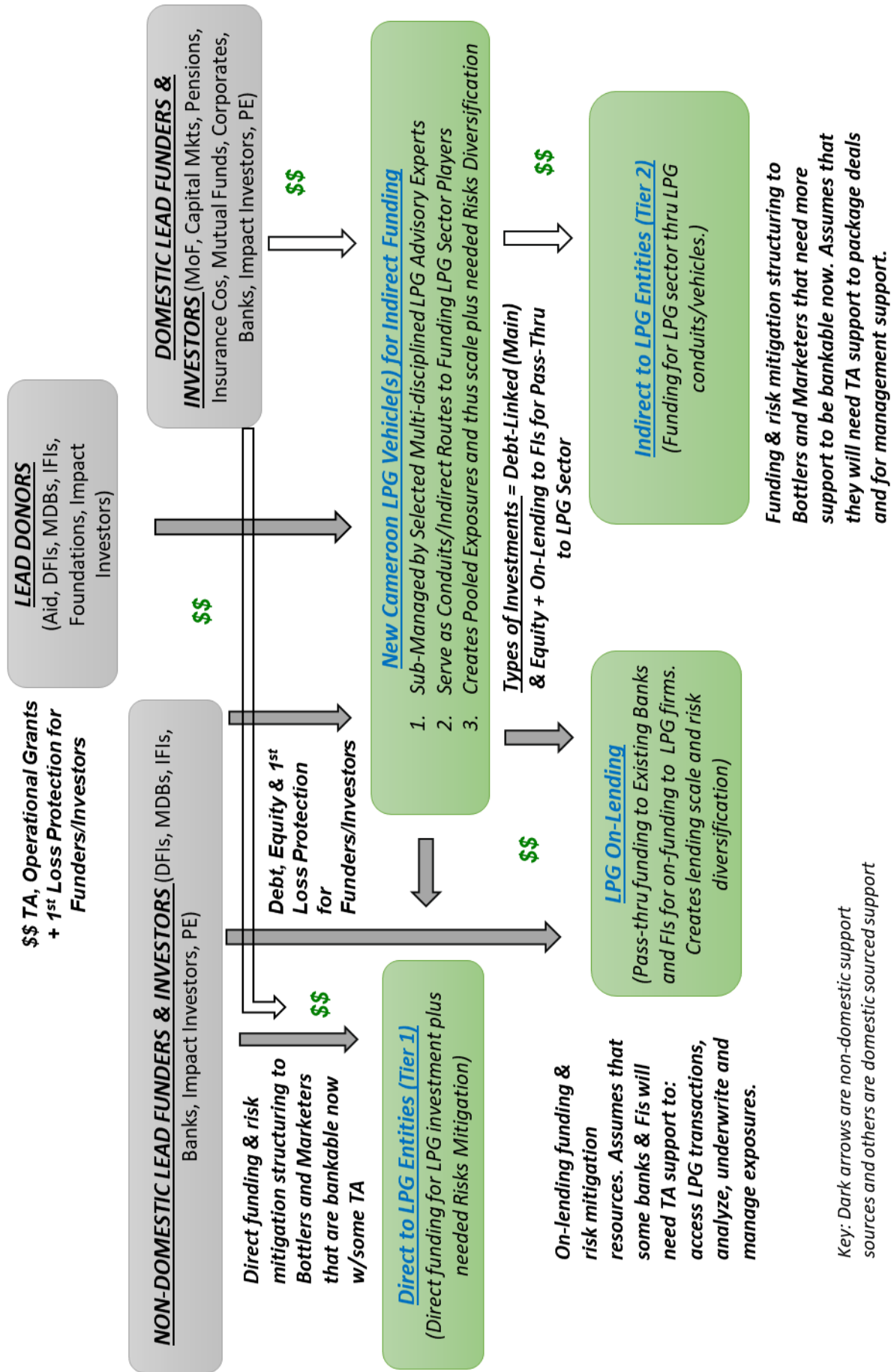
- a. **Direct Structured Funding** to LPG companies that are bankable or can be made bankable with the correct engagement or advisory work from Clean Cooking for Africa/GLPGP experts and other experts;
- b. **Indirect Funding** to other LPG companies, where justified.

Over time, with favorable development of the market led by the Tier 1 entities, the Tier 2 entities would be motivated to make the effort required to graduate to Tier 1. Tier 2 entities might also be supported in doing so by appropriate technical assistance measures (see Chapter 20 for details).

Investing with a portfolio diversification approach can be done effectively through direct and indirect conduit/surrogate investment structures which enable institutional players to build positions in the LPG sector in both lower risks areas (Tier 1) and in the evolving areas (Tier 2). In addition to advising LPG entities on positioning for direct funding and risk management sources, the recommendation therefore is to create LPG-targeted funding vehicle(s) that can serve as funding conduits. LPG-targeted institutional Funders and investors can use these vehicles to achieve larger-scale exposure to the LPG value chain. These vehicles could be in the form of public SPVs, private SPVs, an LPG focused Non-Bank Financial Institution, or investment funds. The choice would be determined primarily by the Funders themselves, based on their structural preferences and requirements. Figure 13 below presents these approaches and the role of the selected vehicle(s). The size of a given vehicle can be €100 million or more, which enables DFIs and other non-Cameroonian Funders, as well as important domestic Cameroonian Funders and investors (such as the pensions and banks) to put their required minimum quanta of capital to work. This would typically be in the range of €1 million (for Cameroonian entities) to €5 million to €25 million or more for non-Cameroonian institutional investors and Funders, such as DFIs, IFIs and MDBs, and impact-interested private sector investors and Funders, such as P/E firms (debt and equity funds), pensions, foundations, family offices, etc.

In reference to Figure 13 and its *Tier 1 Entities*, these will be funded directly, largely by non-domestic sources, followed by domestic banks and domestic institutional investors. The LPG Vehicles and LPG On-Lending through financial institutions, as shown in the figure, will be made available to invest in both *Tier 1 & 2 Entities*. The LPG Vehicles serve the purpose of providing a pooled solution to investment in *Tier 1 & 2 Entities* that, because of limited scale or other limitations, cannot draw the attention of capital sources directly.

Figure 13. Recommended approaches to funding and risk mitigation of at the firm level



10. Projecting the Performance of Firm-level Investments

To test the potential appeal for outside capital to fund the firm-level investments, GLPGP modeled the investment requirements, the timing, and the returns to Funders using the Strawman approach and has concluded that, through 2030, investments in cylinders, bottling and storage can generate hard currency equivalent returns of approximately 8% to 10% on debt and more than 30% on equity.

These returns are attractive compared to minimum return thresholds for emerging markets institutional investors of usually 20%. Funding the more sustainable Marketers, so that they can invest in new cylinders, is attractive in terms of equity IRR. Their issue, however, is whether the leading/larger Marketers can mobilize enough resources on their own to fund the required cylinder investment to drive overall sector growth.

To protect the returns associated with such exposures, guarantee structures from groups such as those noted below in Figure 14 are available. For DFIs (such as KfW or DEG, for example), there are potential roles for both lead funding and for risk mitigation. (For a more detailed discussion of DFI participation needs and opportunities, see Chapter 20, which begins on page 142.) Foreign backers will lower the risk of capital losses if guarantees can be structured in addition to the availability of ample capital to make LPG investments of the scale to be economically viable in order to return capital.

As can be seen from the representative cases in the Supplementary Annexes, partnerships of DFIs and the IFC have backed multiple loans to LPG operators across the value chain in LMIC markets. This makes the IFC a suitable target to approach for non-concessional capital while also serving as an organizer of co-funders, which IFC often does through its syndication services. Such co-funders can include concessional capital. Partners who are members of the IFC's MCA would create an efficient syndication club that could provide packages for LPG investment to modalities which are adequately prepared in terms of plans and capabilities, or which become so, whether on a large one-off basis or on an aggregated levels. Certain DFIs and MDBs still have reservations about investing in a modality associated with hydrocarbon fuels such as LPG. Fortunately, major groups like the IFC and FMO are comfortable with the LPG sector and can therefore serve as catalytic blended capital sources. In addition, larger private impact investment groups may also find the health, environmental, SME, infrastructure and economic inclusion developmental and impact results to be compelling.

Figure 14. Large providers of risk mitigation offerings, by category



The scenario in Table 37 is the Base Case capitalization blend for the LPG funding vehicles in Cameroon. Note the interest expense for the Marketer base case (as presented in Chapter 4), outsourcing filling to SCDP, is €4.3 million.

Table 38. Extreme case capitalization for LPG investment vehicles

IRR to all Equity Capital	
	57%
Revenue/t	16%
190.00 €/t	36%
210.50 €/t	57%
220.00 €/t	77%
230.00 €/t	97%

Debt Breakdown	%	Int Rates
Non-Concessional	100%	12.50%
Concessional	0%	8.00%

Overall Int Expense	5,946 €
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The scenario in Table 38 is the Extreme Case capitalization without any concessional capital for the LPG funding vehicles in Cameroon. The interest rate is averaged at 12.5% as explained above – the 12% to 13% range for riskier LPG corporates. Note the interest expense rises to €5.9 million. The IRRs to the equity backers fall only slightly relative to the blended Base Case.

A similar effect results for a Marketer which operates a hybrid filling model. Using, notionally, a mix of 50% in-house filling (and a corresponding need for financing its filling plant) and 50% outsourced to SCDP, the IRR to equity falls from 33% in the base case to 31% in the extreme case, while interest expenses rises from \$16.3 million to \$22.8 million.

Despite the mild (but non-trivial) effect of the concessional capital on interest expenses and on equity returns for the Marketer modalities, the reality is that, no matter how reasonable IRRs might still be, the size of the capitalization, and the risks of the underlying operating investments, would limit the exposures for a non-blended non-concessional capital stack. For that reason—i.e., in order to supplement as well as to crowd in non-concessional capital in order to complete the capital stack—concessional capital from DFIs and MDBs (among others) would be required.

Mobilizing up to €274 million to fund LPG investments to build out LPG penetration to serve projected demand through 2030 must be done in several phases that match the timing of deployments of investments by the various underlying LPG operators. It does not make sense to overcapitalize the SPVs, NBFIs, or LPG investment Funds if the demand for investment funding has not yet been timed by the operators, based on their needs for timing of outgoing capital cylinder and bottling plant investments.

In the case of Marketers making cylinder investments, this could be done indirectly through the arrangement of on-lending lines to partner financial institutions already engaged with some of these LPG operators, via the types of the SPV(s), or NBFIs envisioned in this analysis. Likewise, funding can also be made directly to the operators through tranches of debt commitments, from LPG investment vehicles such as the SPV(s) or LPG Investment Funds. Importantly, operators should be expected to provide equity to bolster outside capital commitments. The equity tranches are expected to be 25% of the overall funding or approximately €45 million (if 100% of cylinder deposits were usable as internal financing; €69 million if the deposits are excluded), in line with blended funding trends in capitalization. This most likely cannot be satisfied by operators by themselves, so this will likely have to be structured as preferred equity (or quasi-equity) with a predictable stream of cash returns for the outside investors (such as impact investors and DFIs). This is an area where the scale of the SPVs serves to aggregate streams of multiple operators' returns and dividend them out. Guarantees will also be important at these levels.

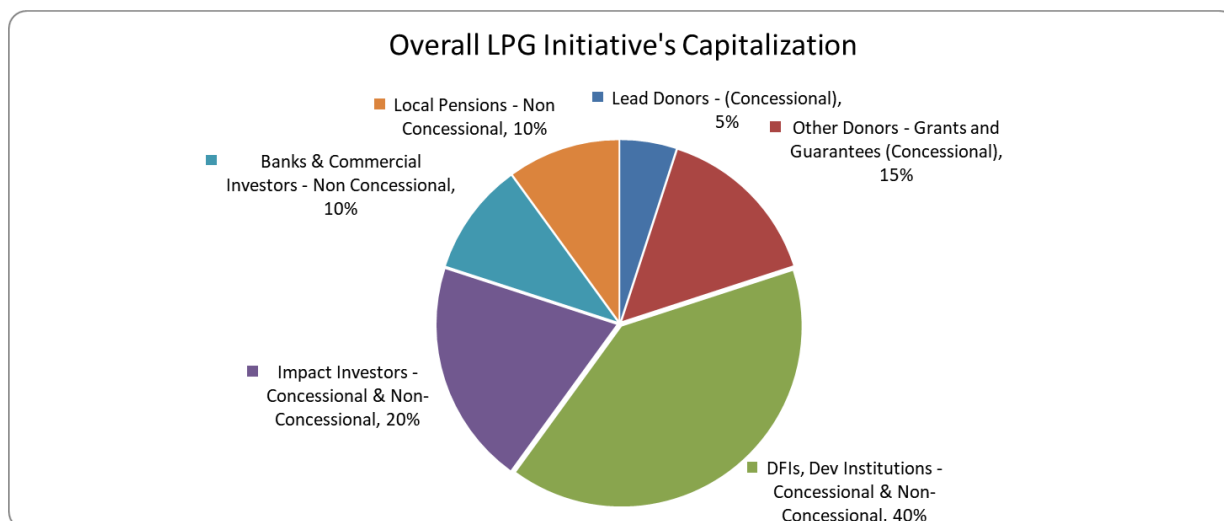
This discussion of the aggregate funding need for creating investment in €274 million of assets assumes that major state-owned energy entities like SCDP⁴¹ may participate in mobilizing some lower-cost capital for their share of funding via the LPG mechanisms. This may be particularly the case, given the tight fiscal situation in Cameroon as of this writing; for example, it has been publicly reported that the national pension fund is having difficulty paying pensioners.

⁴¹ As noted in the Feasibility Study, “Even though SCDP is projected to own and operate 79% of the total capacity of the sector, due to economies of scale and other factors, the SCDP share of investment requirement was costed at just €40 million, or 47% of the total €86 million” – in incremental filling-related capacity.

12. Operationalization of the Investment and Implementation Process

The LPG financing mechanisms' costs (Figure 13, page 101) would be funded by a 2% to 3% management fee charged to the investors. In the early years, it is envisioned that lead donors will need to provide working capital grants and loans until the Vehicles get to assets under management that can cover expenses each year. This will include design grants and other grants. The expected size of such funding will be discussed with prospective grant and support sources. In later years, higher costs of a larger staff will be offset by the management fee being applied to a larger capital base. Figure 15 shows that the LPG vehicles will be financed through multiple tranches to mobilize as much capital as possible. The high and low range of quantum is shown, which frames the zone of actual financing transactions based on the extent to which customer cylinder deposits are able to be applied. In reality, the timing of tranches will pick up momentum but after the first tranche is closed. GLPGP has based its estimations of the composition of the capital stack from team experience, knowledge of market trends, and research including sources like the OECD and Convergence. What actually occurs will be based on the marketplace when funding happens.

Figure 15. Overall target capitalization of LPG investment projects - 2019 to 2030



Overall Funding - Gross Assets

274,278 €

(Euros 000s)

Overall	Assumed Capitalization	Capitalization
	5% Lead Donors - (Concessional)	13,714 €
	15% Other Donors - Grants and Guarantees (Concessional)	41,142 €
	40% DFIs, Dev Institutions - Concessional & Non-Concessional	109,711 €
	20% Impact Investors - Concessional & Non-Concessional	54,856 €
	10% Banks & Commercial Investors - Non Concessional	27,428 €
	10% Local Pensions - Non Concessional	27,428 €
100%	Size of Vehicle Funding	274,278 €

Overall Funding - Net of All Cylinder Deposits 178,237 €

<i>(Euros 000s)</i>		
Overall	Assumed Capitalization	Capitalization
	5% Lead Donors - (Concessional)	8,912 €
	15% Other Donors - Grants and Guarantees (Concessional)	26,736 €
	40% DFIs, Dev Institutions - Concessional & Non-Concessional	71,295 €
	20% Impact Investors - Concessional & Non-Concessional	35,647 €
	10% Banks & Commercial Investors - Non Concessional	17,824 €
	10% Local Pensions - Non Concessional	17,824 €
100%	Size of Vehicle Funding	178,237 €

The LPG capitalization targets are based on:

- **Investment Needs:** The projected investment needs of the Cameroon plan;
- **Availability of Scalable Capital:** The availability of resources of scale at each Funder category to participate;
- **Probability of Success:** The potential to successfully access such resources based on past investment and funding records and to blend them into a capital stack;
- **Add-On Impact:** The additionality/multiplier effect that can be facilitated by mixing catalytic donor grants and capital with other concessional and non-concessional sources;
- **Returns and Risks:** The return expectations and risk tolerance of capital sources and LPG's ability to meet these; and
- **Benchmarking:** Market benchmarks for such funding, by targeted groups.

The sector investment needs the ability for operators to stretch them out, and the size of capital commitment assumed by each Bottler or Marketer involved going forward are captured in the table below.

Table 39. Overall target capitalization of LPG investment projects - 2019 to 2030

<i>(Euros 000s)</i>	2019-22	2023-26	2027-30	Totals
Total Cylinders	53,709 €	46,563 €	19,780 €	120,052 €
SCDP Bottling Plants & Storage	24,847 €	15,448 €	231 €	40,526 €
Non-SCDP Bottling Plants & Storage	28,019 €	17,420 €	261 €	45,700 €
Terminal Expansion	20,000 €	34,000 €	0 €	54,000 €
Transportation Enhancements	3,818 €	5,091 €	5,091 €	14,000 €
Gross Capital Investment	130,393 €	118,523 €	25,362 €	274,278 €
<i>Max. Potential Funding from Cylinder Deposits</i>	42,967 €	37,250 €	15,824 €	96,042 €
Potential Net Capital Investment (Floor)	87,426 €	81,272 €	9,538 €	178,237 €

Table 40. Target capitalization by prospective capital source - 2019 to 2030
(prior to any borrowing against, or internal use of, cylinder deposit funds)

(Euros 000s)		Target Capitalization of			
% of Cap	Sponsored Vehicle - Gross Capital Amounts	2019-22	2023-26	2027-30	Totals
5.0%	Lead Donors - (Concessional)	6,520 €	5,926 €	1,268 €	13,714 €
15.0%	Other Donors - Grants and Guarantees (Concessional)	19,559 €	17,778 €	3,804 €	41,142 €
21.2%	DFIs, Dev Institutions - Concessional	27,643 €	25,127 €	5,377 €	58,147 €
18.8%	DFIs, Dev Institutions - Non-Concessional	24,514 €	22,282 €	4,768 €	51,564 €
10.6%	Impact Investors - Concessional	13,822 €	12,563 €	2,688 €	29,074 €
9.4%	Impact Investors - Non-Concessional	12,257 €	11,141 €	2,384 €	25,782 €
10.0%	Banks & Commercial Investors - Non-Concessional	13,039 €	11,852 €	2,536 €	27,428 €
10.0%	Local Pensions - Non-Concessional	13,039 €	11,852 €	2,536 €	27,428 €
100.0%	Size of Vehicle Funding	130,393 €	118,523 €	25,362 €	274,278 €

(with 100% borrowing against, or internal use of, cylinder deposit funds)

(Euros 000s)		Target Capitalization of			
% of Cap	Sponsored Vehicle - Net of Consumer Deposits	2019-22	2023-26	2027-30	Totals
5.0%	Lead Donors - (Concessional)	4,371 €	4,064 €	477 €	8,912 €
15.0%	Other Donors - Grants and Guarantees (Concessional)	13,114 €	12,191 €	1,431 €	26,736 €
21.2%	DFIs, Dev Institutions - Concessional	18,534 €	17,230 €	2,022 €	37,786 €
18.8%	DFIs, Dev Institutions - Non-Concessional	16,436 €	15,279 €	1,793 €	33,509 €
10.6%	Impact Investors - Concessional	9,267 €	8,615 €	1,011 €	18,893 €
9.4%	Impact Investors - Non-Concessional	8,218 €	7,640 €	897 €	16,754 €
10.0%	Banks & Commercial Investors - Non-Concessional	8,743 €	8,127 €	954 €	17,824 €
10.0%	Local Pensions - Non-Concessional	8,743 €	8,127 €	954 €	17,824 €
100.0%	Size of Vehicle Funding	87,426 €	81,272 €	9,538 €	178,237 €

Given that there is the probability that all the steps to be taken starting in 2019, set forth in this report dated December 2018, and in the immediate following years, will not be accomplished on such a timely basis, and that this might jeopardize the timeline of the recommended investment projects and their financing, it would be worthwhile for the reader to consider the 2019-2030 target years of activity to be Years 1-12.

Marketers in Cameroon may borrow internally against the cylinder deposits obtained from their end-customers. Under law, the cylinder deposit amount in Cameroon is set to 80% of the cost of the cylinder to its Marketer. In Cameroon, the Marketer must treat these funds on its books as a liability of the Marketer to the depositor. (In some other BCRM countries, a portion of the deposit amount must be treated as taxable income instead.) The funds provided by the customer are to be returned to the customer when s/he cancels service and returns the cylinder to the Marketer. The internal reuse of these deposit funds makes the consumer, in effect, a major financing source for Marketers. As presented in the tables above, this effect causes the net amount needed by Marketers for financing of new cylinders to be closer to 20% of the capital cost of the cylinders than 100%. The actual percentage will depend on the rate of cylinder inventory growth year over year, deposit liability reserve levels, cylinder losses and scrap rates, and other factors, and is not possible to determine in advance.

Thus, the financing requirement for cylinders, in practice, will fall somewhere between the hypothetical net (representing a floor value) of € 24 million of capital and the gross requirement of € 120 million.

The scenarios below show the potential average capital burden to the 12 LPG Marketers at the two ends of that range. The full investments for larger players may be partly self-fundable but, for smaller operators, the quantum, as referenced in Table 41 as the "Average Size of Investments", could be difficult without the existence of LPG-related funding mechanisms. Importantly, equity of approximately 25% should be part of the funding equation of the LPG operators so that foreign Funders of investment needs can get

comfortable. The LPG funding mechanisms can serve the purpose of aggregating the project level investments into a pool that can then be efficiently funded and de-risked. Since these levels will require interest payments, it is important to utilize the least costly funding on the debt component.

Table 41. Investment quanta by type, by LPG Marketer - 2019 to 2030

Company	LPG Market Share	Share of Gross Cylinder Investment (000)	GoC Mandated Consumer Costs	Net Cylinder Investment Costs afer Consumer Pmts	Share of Bottling Plant Investments	Total Investment (000)*	Investment after Consumer Deposits (000)*
SCTM	26.9%	32,280 €	25,824 €	6,456 €	12,261 €	44,541 €	18,717 €
AZA Afrigaz	15.3%	18,360 €	14,688 €	3,672 €	6,974 €	25,334 €	10,646 €
Tradex	13.4%	16,080 €	12,864 €	3,216 €	6,108 €	22,188 €	9,324 €
Total	13.3%	15,960 €	12,768 €	3,192 €	6,062 €	22,022 €	9,254 €
Camgaz	10.7%	12,840 €	10,272 €	2,568 €	4,877 €	17,717 €	7,445 €
Oil Libya/Mobil	6.8%	8,160 €	6,528 €	1,632 €	3,099 €	11,259 €	4,731 €
Glocal Gaz	4.9%	5,880 €	4,704 €	1,176 €	2,233 €	8,113 €	3,409 €
Green Oil	2.9%	3,480 €	2,784 €	696 €	1,322 €	4,802 €	2,018 €
Bocom	2.5%	3,000 €	2,400 €	600 €	1,140 €	4,140 €	1,740 €
Infotech	1.5%	1,800 €	1,440 €	360 €	684 €	2,484 €	1,044 €
Stargas	1.0%	1,200 €	960 €	240 €	456 €	1,656 €	696 €
Corlay	0.8%	960 €	768 €	192 €	365 €	1,325 €	557 €
Sector Investment	100.0%	120,000 €	96,000 €	24,000 €	45,580 €	165,580 €	69,580 €

* Assumes that SCDP takes a 47% share of new Bottling Plant Investments. Excludes EU54M and EU14M in Terminal and Distribution Investments

Operationally, the IFC has an active syndication process which brings in other qualified funding partners. This Funders' group is a highly capital and resource intensive club of IFIs and DFIs some of which like FMO and the IFC, are themselves involved in LPG-related projects. The MCA syndicate grouping below is facilitated through the members' respective capital markets teams – an area in which the IFC is very active and is therefore a good target for GLPGP's funding approaches. This process was further institutionalized in October 2009, when the IFC created along with DEG, FMO, and PROPARCO, the MCA syndication format shown in Table 42. The MCA details how the IFIs and DFIs will work in a pre-arranged standardized manner, to co-finance projects when the IFC is the mandated lead arranger. This is done through the IFC's Parallel Loans Program whereby the IFC is the lead arranger for loans, and can also act as administrative agent. In this situation, participants (DFIs, IFIs, etc.) benefit from the IFC using its syndication platform, deal-structuring team, origination expertise, due diligence, loan documentation and closing for its own exposures, and those of its fellow Parallel Loan syndication members. When appropriate, this could create blended funding-related efficiencies in terms of scale of funding (larger pools raised), time (close more investors/Funders faster), and costs of funding. In the case of the MCA, many of the targets that could be approached for the various blended capital funding structures and associated risk mitigation instruments are signatories.

Table 42. IFC Master cooperation agreement syndicated/parallel loans signatories

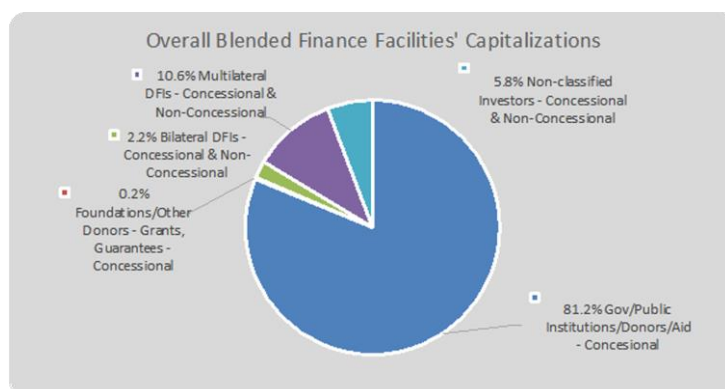
1. International Finance Corporation
2. France's Société Promotion et de Participation pour la Coopération Economique (Proparco)
3. Germany's Deutsche Investitions-und Entwicklungsgesellschaft mbH (DEG)
4. Netherlands' Nederlandse Financierings-Maatschappij Voor Ontwikkelingslanden NV (FMO)
5. Development Bank of Japan (DBJ)
6. Austria's The OPEC Fund for International Development (OFID)
7. Belgium's Societe Belge d'Investissement pour les Pays en Developpement SA/Investment Co. for Dev. Countries (BIO)
8. Black Sea Trade and Development Bank (BSTDB)
9. Oesterreichische Entwicklungsbank (OeDB) or Development Bank of Austria
10. Eurasian Development Bank
11. Arab Petroleum Investments Corp (APICORP)
12. United States' Overseas Private Investment Corporation (OPIC)
13. Islamic Corporation for the Development of the Private Sector (ICD)
14. Export Development Canada (EDC)
15. United Kingdom's Commonwealth Development Corporation (CDC)
16. Portugal's Sociedade para o Financiamento do Desenvolvimento (SOFID)
17. Banque Ouest-Africaine de Developpement (BOAD) or West African Development Bank
18. Swedfund
19. Compañia Española de Financiación del Desarrollo (COFIDES)
20. International Investment Bank (IIB)
21. Hungarian Export-Import Bank (HEIB)
22. Swiss Investment Fund for Emerging Markets (SIFEM)
23. Finnish Fund for Industrial Cooperation Ltd (Finnfund)
24. Instituto de Credito Oficial (ICO)
25. Japan International Cooperation Agency (JICA)
26. Cassa Depositi e Prestiti (CDP)
27. PTC India Financial Services Ltd (PFS)
28. Indian Renewable Energy Development Agency (IREDA)
29. Easter and Southern African Trade and Development Bank (PTA Bank)
30. Africa Finance Corporation (AFC)

13. Building the Blended Capital Stack

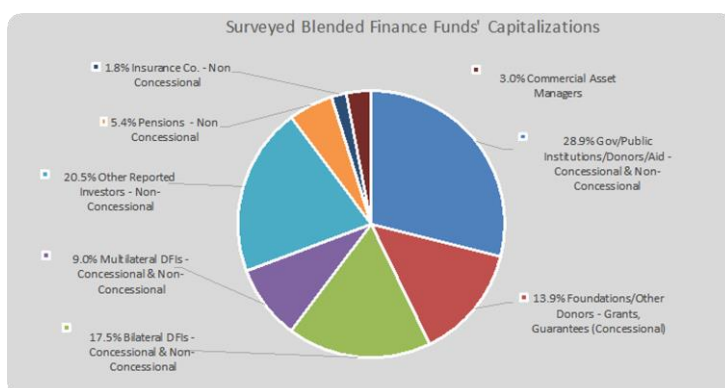
In addition to discussions with potential funding and risk mitigation providers, GLPGP has used research, such as the OECD's July 2019 report *Blended Finance Funds and Facilities – 2018 Survey Results*, to verify the trends in successfully capitalizing blended funding vehicles. This data is captured in the two charts below. This report provides an in-depth analysis of the collective investment vehicles used in blended finance structures. The SPVs, NBFIs and Fund structures recommended by GLPGP fit this classification. Specifically, of the estimated US \$60.2 billion in blended funding vehicles, broken down as investment funds (structured and non-structured) and special facilities (including funding mechanisms such as on-lending vehicles or SPV conduits), the concessional capital portion is larger than the non-concessional portion. This is consistent with this structuring recommendations of this report. GLPGP's view is that the non-Cameroonian institutions such as foreign government donors, MDBs and DFIs, and development-oriented institutions such as IFC or SIDA, can be instrumental in catalyzing both domestic and foreign capital. The OECD data proves this out.

Table 43. Blended capital sources - concessional vs. non-concessional shares (2018) (OECD 2019)

C/NC %s	Assumed Blended Capital Sources
100%	Lead Donors - (Concessional)
100%	Other Donors - Grants and Guarantees (Concessional)
53%	DFIs, Dev Institutions - Concessional
47%	DFIs, Dev Institutions - Non-Concessional
53%	Impact Investors - Concessional
47%	Impact Investors - Non-Concessional
100%	Banks & Commercial Investors - Non Concessional
100%	Local Pensions - Non Concessional



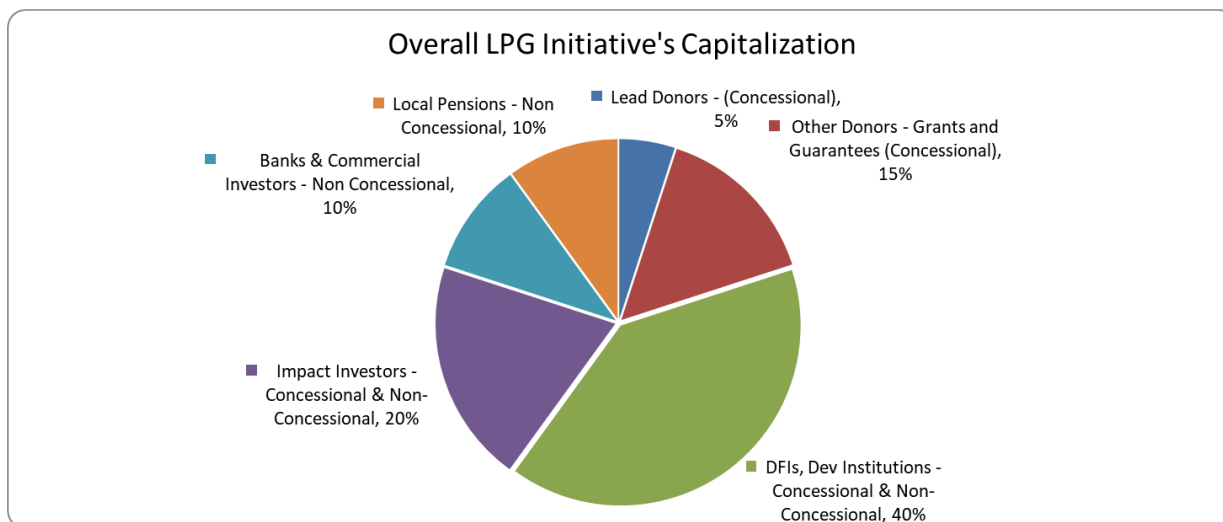
The adjacent two charts, recreated from the OECD report, demonstrate most of the types of institutions that GLPGP can approach for the proposed funding mechanisms. As GLPGP has proposed hybrid vehicles, SPVs, NBFIs, On-lending Facilities, and Investment Funds, as possible ways to efficiently fund the LPG sector, the information from the OECD report corroborates the appeal of such approaches for important blended finance sources.



The specific level of potential participation from various categories of capitalization partners, will vary from region to sectors being targeted by the blended funding vehicles. In Africa, DFIs, MDBs, and other development-oriented entities are key players in catalyzing both direct funding to entities (businesses and project), and also to large-scale funding mechanisms like facilities

and funds. GLPGP's capitalization mix therefore reflects this. This is reflected in Figure 16 below.

Figure 16. Capitalization of LPG investment in Cameroon - 2019 to 2030



Prospective targeting for backers of the LPG funding mechanism(s) include partners that are members of the IFC's MCA (see Table 42 above). This group has actively co-funded and provided concessional and non-concessional blended resources to transactions, with Africa being one of the top recipients, according to OECD analysis. Approaching members of the MCA and their sub-windows would create an efficient syndication club that could provide packages for LPG investment. Certain DFIs and MDBs still have reservations about fossil fuel sources. Fortunately, major groups like the IFC and FMO are comfortable with the LPG sector and can therefore serve as catalytic blended capital sources, as they did with Omera Petroleum in rounds of funding. In addition, larger private impact investment groups may also find the Clean Cooking for Africa Program's connections to the UN's SDGs covering areas such as health, environment, access to clean energy, SME, infrastructure and economic inclusion developmental and impact results to be compelling.

Specific roles for DFIs to increase impact and reduce risk

DFIs are active in areas that overlap with the LPG investments for Cameroon. This makes them likely to be lead Funders and risk mitigation providers for selected initiatives. The sectors such as SMEs and Financial Institutions/Innovations, Infrastructure, and Manufacturing could appeal to DFIs, especially when coupled with the positive social and environmental impacts from the investments. If, for example, SPVs are created to fund the build-out of the LPG sector and to fund related SMEs and MSEs, this will align well with certain DFI windows, because those are target areas. GLPGP recommends targeting DFIs and IFIs that are already active in Cameroon as a start. These include AfDB, CDC, DEG, FMO, IFC, Norfund, OPIC, and Swedfund. To go to the IBRD, the Government must make the approach and this then creates a semblance of Cameroon officially taking on more debt vis-à-vis its debt ceiling restrictions.

DFIs are well-positioned to help facilitate the national LPG build-out. Through their mandates, experienced teams, and range of tools, they can have a powerful effect on the success of LPG ecosystems and the projects and companies within them. Useful and effective DFI tools include grants, TA, direct or indirect (through investment funds) funding, debt/equity/hybrid funding, guarantees, risk mitigation structures, insurance, syndication with other DFIs and IFIs, SPVs, IFC-led MCA/parallel loans, and political advocacy and

influence including linkages (in which governmental undertakings regarding LPG are linked as performance requirements to a larger, broader portfolio of financing and financial cooperation).

The DFIs' critical anchor role as catalyst Funder and accommodative capital provider can be essential for moving the large quantum of capital needed for the country's investments.

DFIs can undertake some of the following key roles, discussed more fully in Part VIII beginning on page 142:

1. Provide large and diversified capital investment of their own;
2. Catalyze and crowd-in outside non-concessional, more risk-adverse co-funding;
3. Lower the cost of capital for various projects (where it makes sense to do so);
4. Introduce first-loss-protection for other investors (for example, Swedfund with SIDA taking a 50% first loss);
5. Provide risk mitigation tools, such as guarantees (range of DFIs, MIGA) and private bond 144A placement insurance (OPIC);
6. Provide hedging tools to help mitigate LPG price volatility and address currency risk;
7. Use financial influence in the country overall to ensure governmental performance of obligations;
8. Provide technical assistance funding to help the Government develop capacity to suppress black market activities and ensure BCRM compliance and the LPG sector to improve management capability and project bankability and prepare projects to sufficient investment readiness;
9. Provide technical assistance to educate and create awareness of LPG benefits among consumers;
10. Underwrite a country's initial LPG microfinance program on a concessional basis to demonstrate to local financial firms that microfinance can be a legitimate commercial activity for them;
11. Help secure international LPG supply on more favorable terms, through bringing their balance sheets to bear (e.g., AfDB offering letters of credit with concessional terms for use by LPG Marketers to acquire cylinders *en masse*);
12. Become a Funder to a locally listed or non-local stock exchange-listed SPVs and/or provide protections for other investors/Funders; and
13. Support further work by the Clean Cooking for Africa expert team.

The financial modelling of the investment parameters, economic performance, and financial returns of the key firm-level investments described in this report includes co-funding with concessional debt for approximately 40% of the capital stack of the projects sector-wide, both to ensure rates of return to equity investors are possible without risking over-leverage, and to moderate the cost of debt in order to reduce the debt service burden on the LPG sector's firms as they consume capital and defer full profitability for the sake of growth.

The thesis for the DFI role is that DFIs have interest in the large health, environmental, social and development impact that scaling up clean cooking can have on the target countries' populations. To achieve the desired impacts as efficiently as possible, DFIs welcome sizable, scalable, bankable funding

opportunities. Although the global LPG sector is over 100 years old, and LPG-for-impact has been the subject of study by UNDP, WHO, and other organizations for many years, it is only recently—such as through the efforts of the Clean Cooking for Africa program—that opportunities for LPG investment and lending at scale are being identified, prepared, and structured for addition to the global flow of projects suitable for DFI support. It is therefore recommended that DFIs include consideration of financial support to LPG initiatives where LPG investment and lending opportunities are demonstrated to be feasible—such as in Cameroon.

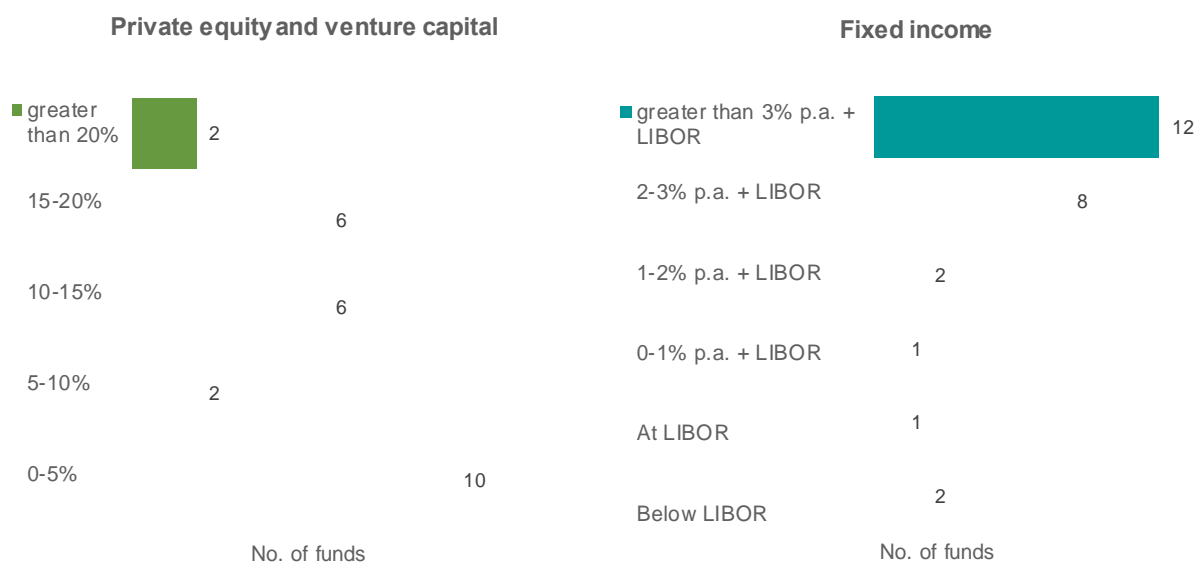
DFIs' development of LPG-specific investment funds

A second key role for DFIs is in contributing to indirect investment into such LPG opportunities, by participating in the establishment and funding of an LPG-specific impact-investing fund. Such a fund would aggregate and deploy LPG-focused global capital, including DFI capital, to high-impact, high-need LMICs for prudent and justified LPG expansions and utilize the particular, deep domain expertise of the Clean Cooking for Africa/GLPGP expert team in so doing. GLPGP and KfW have collaborated to design two such funds for future implementation: the LPG Infrastructure and Distribution (LID) Fund and the First Costs Financing (FCF) Fund. They could be conduits through which interested DFIs could align capital for LPG impact-investing at scale with proven, impartial, dedicated LPG expertise. DFIs can potentially provide General Partnership operating launch capital, as well as provide anchor Limited Partner funding commitments. This can then facilitate additional funding sources joining the fund(s) alongside the DFI sponsors.

14. Pricing the Blended Capital Stack

In addition to evaluation of the level of participation in the blended finance, GLPGP also compared its cost of capitalization assumption against pricing trends (See *Relative Pricing of Types and Sources of Concessional and Non-Concessional Funding* in the Supplementary Annexes), case reviews and conversations with active funders like DFIs. This was supplemented with analysis of the OECD's report on returns. Equity and private debt for Cameroon are seeking minimum returns (hard currency) of 20% and upwards (equity) and 15% upwards (debt). The summary analysis from the OECD report, shown below in Figure 17, demonstrates that the 8% to 10% ranges for concessional and non-concessional debt, are good approximations for early analysis of the financial outlook for LPG modalities, once funded with blended capital. As of this report, this would put OPIC costs, before other fees, at roughly 5% to 8%. In addition, 46% (12 of 26) of fixed income players in blended capital are expecting greater than 3% per annum over Libor.

Figure 17. Financial return expectations



Note: Based on 22 private equity funds, 4 venture capital funds and 26 fixed income funds. In fixed income, percentages are per annum (p.a.). LIBOR is the London inter-bank offered rate, which represents a benchmark interest rate at which global banks borrow from one another.

15. Targeting Initial Investors and Risk Mitigation Sources

GLPGP has initiated exploratory discussions with AfDB, DFID/CDC, FMO, IFC, OPIC, PIDC, PROPARCO, SIDA, and USAID among others about new financial commitments in line with the scope of the envisioned funding mechanisms. The IFC and DFIs often work together as joint sponsors across investments from project grants, debt, equity, guarantees, first loss provisions etc. and therefore are a good starting point to marshal resources. They also have experience in using through similar structures such as the IFC's MCA platform of over 30 financial institutions globally – mainly DFIs, IFIs, and MDBs which have pre-packaged syndication agreements that sometimes facilitate faster transaction funding through a range of exposures at various levels of the capital structure. In the area of LPG, FMO and the IFC, two groups being explored, are active in sizable exposures in projects in developing markets.

The recommendation is to target marquee funding and risk mitigation leaders in GLPGP's blended finance and risk mitigation mix. They will enable GLPGP to mobilize scale and then serve as the catalyst for followers who ideally could lower the overall blended costs of funding, be patient capital, and be well matched to the potential repayment abilities of the LPG supply chain players that underlie the cash flows of the funding mechanisms (SPVs, NBFI, Investment Funds, etc.). This lead Funder approach is similar to typical syndicate and other "book-building efforts" in project and other finance efforts.

FMO's logic on the LPG funding, as captured below, matches well with the end ambitions of the goals of the GLPGP-led Cameroon LPG Master Plan in the evolution of the Cameroonian market. According to FMO, in additional press releases, they have up-sized their investment in Omera Petroleum Limited three times. This could make them an attractive target. Importantly, similar assets are being funded to those targeted in the technical plans by GLPGP.

For illustration, below is FMO's case excerpt describing the Omera Petroleum investment:

Figure 18. LPG DFI investment case: FMO in Bangladesh

Who is our client

Omera Petroleum Limited (OPL) in Bangladesh is developing an LPG project to import, store, bottle and distribute liquefied petroleum gas throughout Bangladesh. OPL sources its LPG on the global market. The company will mainly target domestic use as it is considered one of the safest, eco-friendly and healthy cooking fuels. OPL is one of the subsidiaries of a strong and reputable energy player in Bangladesh and benefits from its sector and market experience and an established brand.

Funding objective

FMO has financed and invested in the development and construction of 4 LPG plants with a local capacity of 100,000 tonnes/year. Total project costs amount to approximately US\$60 million. Through the Infrastructure Development Fund FMO is providing US\$9.5 million senior debt and approximately US\$5.5 million equity. The funding will be used for the construction of the main terminal, the three satellite plants and the distribution network. The main terminal is located in Mongla (close to one of the country's principal seaports) where the LPG is delivered and then redistributed to the three satellite bottling plants located in Dhaka, Bogra and Chittagong and further on to private and commercial users.

Why we fund this project

LPG can be used for cooking, heating, electricity generation, transportation (autogas), refrigerating and many other industrial and commercial applications. Given the lack of natural gas in rural and

urban areas in Bangladesh due to the fast growing economy, households are looking for alternatives for cooking. LPG is a more expensive alternative for cooking compared to charcoal and kerosene but the health and environmental benefits easily outweigh the cost, for those who can afford it. By engaging in this transaction, FMO contributes to the positive impact that LPG has on the health and productive time consumption on local Bangladeshis, especially women and children. OPL is expected to reach close to 250,000 households, representing 1.2 million people. The local banking sector was not able to meet the full financing needs of OPL and by doing this transaction FMO-IDF filled the gap. The additional equity will provide sufficient buffer to the debt providers. OPL is also able to benefit from FMO's name and experience as an international finance institution, which may help in attract potential future investors and financiers.

In addition to FMO's involvement, the IFC has also been actively involved in LPG including an August 2018 \$20M loan to Omera Petroleum. As with GLPGP's suggested LPG investments for Cameroon's Master Plan targets, this loan is slated for capital expenditures including cylinders, transport barges, storage tanks, trucks, and filling machinery.

For additional cases, see Supplementary Annexes' Chapters 28 and 29, beginning on page 215.

16. Implementation Schedule

The following table lays out the major activities and milestones of the investment projects from 2019-2030, based on the LPG Master Plan (to the extent defined as of this writing) and based on industry norms for project completion.

In case of delay to the start of the activities, the timeline can be assumed to be pushed outward by the amount of the delay.

Table 44. Timeline of major financing and implementation events

Major Project / Program Activities	Tranche 1				Tranche 2				Tranche 3			
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bottling investment tranche												
Cylinder investment tranche												
Bottling plant capacity additions												
Import terminal expansion												
Deployment of cylinders												
Management/engineering/finance assistance activities												
Capacity-building activities												
Microfinance program												
Distribution training / women's SME empowerment												
Education and awareness program												
Follow-on studies for LPG ecosystem enhancement												

Lightly shaded cells indicate a transition (for microfinance), optional extension or recurrence (for training), or continuation of a study (for longitudinal studies) of the activity.

It should be noted that delays affecting implementation or financing could shift this schedule outward, and, therefore, it may be useful to view the schedule as covering years 1-12, rather than necessarily years 2019-2030, which are utilized here for consistency with the Feasibility Study data and findings.

⁴² Conceptually, a PPP approach would be carried out through a partnership with FEICOM as discussed in Chapter 25.

17. Summary of Main Project Risks, Mitigations and Mitigation Sources

Main risks and mitigations

Risks may be grouped into several categories, which include:

- Country risks (regulatory, political, other)
- Industry
- Economic
- Consumer demand
- Execution
- Financing / Fund structure and operation
- Investment process

Country risks

Regulatory Risks. The regulatory landscape in Cameroon applicable to LPG, for financing, and overall, is an important consideration. The regulatory scorecard presented in Chapter 6 of the Feasibility Study is a useful assessment tool regarding the supportiveness of the LPG regulatory environment and gaps to be diligenced and hedged against. As part of investing, legal stabilization clauses will be sought in contracts with Government. Risk mitigation products may also be utilized where justifiable, as described later in this Chapter.

Specific regulatory risks include:

1. Failure to reform the multibrand Wholesaler category of distributor, as recommended in the national LPG Master Plan, if the influence of Wholesalers were to increase (via increased distribution market share) over time. This can be mitigated by directing growth capital to those LPG companies whose strategies, operations and distribution networks do not include, or bypass, such Wholesalers, and by requiring compliance as a condition of the financing.
2. Failure to enforce safety requirements adequately for cylinders and cylinder handling. Historically, the Government has been adequate but not optimal in this task, and with a larger LPG sector--particularly one with growth in the more remote regions of the country—the task will become more challenging. This can be mitigated by a program of mandatory, regular safety audits of filling plants, primary transportation, and a sampling of the cylinder inventories and cylinder holding facilities of distributors and retailers. Funding for such a program could be a component of technical assistance provided by the development system (see Chapter 21). Additionally, industry self-auditing as well as undertakings by each modality to follow core safety practices and procedures may be mandated, as a condition of the financing of new cylinders.

3. **Weak enforcement.** A constant risk throughout most Sub-Saharan African LPG markets is weak enforcement of otherwise good regulation. There can be many reasons for enforcement to become lax, ranging from inadequacy of governmental capacity/resources to corruption. Mitigation can occur in three main ways: (i) cooperation and sharing of regulatory cost burdens between government and industry, out of industry self-interest, as has recently occurred in countries such as Kenya; (ii) changes to LPG companies' operational and distribution models to increase control over cylinder assets and their safety as they recirculate; and (iii) mobilization of increased political will to address the inadequacy within the relevant regulatory agencies. Increasing political will, while perhaps the slowest form of mitigation, becomes increasingly easy to do as LPG becomes important to more and more voter-consumers, particularly if LPG safety declines in consequence of lax regulatory enforcement and increased short-cutting of needed safety spending and processes by some industry players.

Additionally, diligence would be undertaken regarding the regulatory frameworks for business rights protection (including anti-counterfeiting), investment, and/or microlending being adequate. Use of qualified locally-familiar counsel and accountancies will facilitate such diligence.

Investing Environment Risks. Cameroon has an overall favorable and improving investment environment, as described earlier in this Part of the report. Country risk premiums may also be priced into the overall cost of blended capital, based on the blend and the needs of the Funder sources.

Nationalization/Expropriation Risks. Standard project and other insurance would be obtained where appropriate through bodies such as OPIC and MIGA; additional sources and products are noted later in this chapter.

Government Nonperformance/Default on Contractual Obligations. As a possible partner in certain levels of the LPG infrastructure and distribution chain, the Government may be contractually committed to funding or other obligations related to projects and consumer access. If the Government were to default, this could have numerous politically sensitive impacts on general voting public, once they are increasingly tied into the expanded LPG market. Performance guarantees by Government and other key partners and counterparties should be provided for project completion and operational finance commitments as conditions precedent to investment.

Subsidy Risks. Risks associated with the LPG subsidy in Cameroon are of the following types:

1. The Government is unable for budgetary reasons to increase the size of the subsidy to keep pace with LPG consumption (despite the countervailing taxes in the LPG price formula), or to deal with an unanticipated and long-lasting price shock in the international LPG markets, creating insolvency and performance risk in CSPH as the subsidy administrator and funds-manager.
2. Conversely, subsidized consumption grows far faster than projected, and faster than new LPG infrastructure can be funded and deployed, creating LPG shortages while raising the subsidy burden on government. Overshooting consumption projections could occur because of subsidy leakages as LPG becomes widely available—for example, LPG begins to be used as a primary automotive fuel (as happened in Ghana) or for the heating of

swimming pools by the wealthy (as happened in India before its LPG subsidies were targeted to the poor).

3. The Government, in responding to fiscal pressure from subsidy growth, seeks to restrict LPG consumption growth and/or LPG imports (creating shortages) in order to limit the size of the subsidy.
4. The Government, in responding to fiscal pressure from subsidy growth, cuts the amount of the subsidy per tonne, increasing the end-user price (and thus putting downward pressure on demand growth) and/or cutting margins for the LPG supply chain (thus putting financial pressure on the supply chain participants and limiting their ability to invest in growth and in safety).

In all of these cases, beyond the use of risk management products (in particular, those associated with governmental performance), Government should actively plan each year, on a multi-year basis, its anticipated subsidy volumes and cost in context of expected LPG market growth and achievement of national policy goals and milestones for LPG. As part of contingency planning, Government, working with LPG stakeholders, should also develop a transition plan to be able to shift the subsidy from a general subsidy to one that is directly targeted at the poor, who most need it, as other LMICs with large LPG penetration rates, such as India and Brazil, have very successfully done.

If the Government later decides to institute a targeted LPG subsidy aimed at the poor, the Clean Cooking for Africa/GLPGP advisory team can provide best practice knowledge and guidance to establish the new subsidy in a way which is minimally distortive to the market and minimizes the risk of the subsidy growing beyond the Government's capacity to honor it as LPG volume grows in the target population.

Pricing and Levy Risks. The LPG investments presented in this report are potentially viable under Cameroon's existing regulated LPG pricing and margin structure, with or without any form of cylinder discounting or other capital recovery levy added. If such a levy is instituted, it would accelerate the rate at which cylinders can be acquired and deployed by LPG Marketers to serve the projected unmet demand, and the rate of LPG adoption by consumers (due to the significantly lowered deposit cost for a residential cylinder, which the levy mechanism achieves). The key risk with respect to both pricing and any levy is the risk of a future adverse change. If viable investments are made based on current expectations about the pricing formula and its long term stability, and the pricing formula is changed in future in a way that materially reduces demand or margins, the investments may become unviable after the fact. If viable incremental investments are made, whose increased size and/or pace depend on the levy, and the levy in future is reduced or terminated prematurely, the incremental investments may become unviable after the fact. Guarantees by Government should be sought with respect to stability of the price formula and permissible adjustments to the formula over time, as conditions precedent to investment. Additionally, if the Government determines that it will institute a levy, guarantees should be sought about its longevity and its minimum and maximum permitted effects on prices and, if applicable, on margins.

Political Risks. Sufficient political and business support are integral to scaling up LPG. To reduce political risk, both local official and private sector partners must have a material stake in the success of the local projects. Political support can be developed by project sponsors and Funders, and through linkages by DFIs

(for example) to other lending activities in the country. Regarding a shift in future political/policy for LPG investments, various third party insurance products can be considered.

Industry risk

LPG Supply, Demand, and Price Movements. As a global commodity, LPG may be subject to price movements based on supply and demand dynamics outside of the internal market conditions of the country. This could impact the availability of product in target markets, if prices rise too high. In Cameroon, margins are fixed by regulation, which eliminates margin risk; the remaining market risk is to volume. (This is normal in commodity dependent businesses.) The projects' cost basis, through blended capital sources, will lower overall break-even margin points for infrastructure assets and companies. In addition, underlying companies and projects will be expected to implement appropriate contingency planning in their operations such as hedging of inputs, including LPG supply. Long-term supply contracts with diverse sources and buffer storage will serve as mitigants to these disequilibria. MIGA and USAID offer programs to insure commodity price risks and these may also be employed, where justifiable. To the extent that production of natural gas at Kribi will generate any LPG as a co-product, this LPG should be used as a hedge and buffer against any volatility in the international LPG market.

Consultancy IHS Markit has forecast that global LPG supply will be in surplus for approximately another 10 years, creating relative price stability during the expected investment horizon. See Supplementary Annex Chapter 32 (Note Regarding Long-Term LPG Pricing and Availability) beginning on page 223 for further discussion.

Additionally, commercial quantities of price-competitive bio-LPG have been introduced into the global market in 2018; by 2030, such quantities could become a significant hedge against potential LPG supply or price volatility.

Lastly, entering into long-term, price-capped contracts for LPG supply hedges further against LPG volume and price risk.

Energy Alternatives. Price differentials could create a risk regarding substitute fuels at the end of the value chain. Given the level of development of other fuel products, it is expected that the risk of substitution is limited, except among the poorest. While that creates a corresponding risk with respect to impacts connected with that population, the likely effect on investment results is expected to be small, based on the modelling performed and presented in this report. In addition, once businesses and consumers have invested in LPG equipment and adapted to them operationally and behaviorally, respectively, a switching barrier (whether economic or psychological or both) is created for abandoning LPG use. That is, LPG use is somewhat sticky, once begun.

Bankability of Certain LPG Companies. Some LPG companies, upon due diligence, may be deemed unbankable. This can be mitigated in several ways:

1. Technical assistance (TA) measures, which could be funded by international development resources, can strengthen management capability, business planning, transparency and reliability of reporting, and operational effectiveness.
2. If instituted, a cylinder discounting levy, such as presented in this report, would significantly improve LPG companies' bankability where the key issue is adequate cashflow to cover debt service and generate sufficient returns to equity investors.

3. Investing via a special purpose vehicle, or similar, that aggregates multiple capital recipients and provides an active oversight role, can help to mitigate the bankability risk of the weaker players by (i) pooling risk across both strong and weaker players, (ii) creating a de facto form of consolidation among the players, and (iii) allocating or reallocating capital to maximize impact sector-wide and minimize risk sector-wide.
4. Unbankable companies can be excluded from the investment program until they improve enough to become bankable. Access to significant expansion capital on favorable terms by competing, bankable companies should motivate those which do not qualify to make improvements, and to take advantage of TA resources which may become available.
5. Informally, unbankable companies can also be encouraged to merge with stronger, bankable companies on mutually acceptable terms.

It should be noted that it is not necessary for every LPG company to maintain its present market share in order for the investment program to be carried out to its full extent and for all addressable demand to be served.

If the combined growth capability of the bankable firms receiving investment capital turns out to be below the scale and pace of investment described in this report, then the scale and/or the pace of the investments would necessarily be adapted to their actual capability.

Microfinance scalability risks. Microfinance may prove to be important to unlocking an additional level of LPG demand, particularly among lower-income households that can afford LPG refills but not the up front costs of the LPG equipment. Scaling up LPG microfinance on a commercial basis requires that LPG microloans continue to demonstrate acceptable repayment characteristics to the participating lenders, as well as create long-lasting LPG customers for the participating LPG operating companies. Sensitization and education of prospective borrowers is also important, but beyond the scope of activities and availability of resources of most MFIs. Ongoing TA resources to support sensitization activities would address that gap. As microlending scales up, the average credit quality of consumers who have not yet taken LPG loans may also decline, due to the “low hanging fruit” being plucked in the beginning. That in turn would lead to a higher percentage of credit rejections (and higher average costs to originate each loan), or to worse loan performance, or both. If that occurs, further expansion of LPG microlending may slow or stop. Providing concessional capital and/or guarantees in the loan underwriting mix has proved important in MFIs undertaking LPG lending, and a bespoke funding vehicle for providing concessional capital or guarantees, such as the First Costs Fund described in the preceding Chapter, could help to address this.

If microfinance of consumer LPG equipment does not scale readily or widely, then the overall level of demand that can be served will likely be smaller (closer to the lower bound demand projections in this report), and the investment program’s scale may need to be adapted accordingly.

Economic risks

Interest Rate and Inflation Risks. Currency, interest rates, and inflation changes may impact LPG affordability and also the repayment performance of the LPG projects. Interest rate hedging and other approaches can be utilized to insulate from adversely expanding spreads. Inflation should be priced into contracts as appropriate, so as not to erode SPV/Fund performance. Cameroon has experienced very

modest price inflation in recent years. Currency hedging will be employed under both project level and SPV/Fund level risk management policies, as needed.

Currency and Exchange Rate Risks. The income received by the investment vehicle(s) will typically be denominated in the local currency of the project companies; however, the books and assets, capital contributions, and distributions will be conducted in U.S. Dollars or Euros, as appropriate. As long as the CFA is pegged to the Euro, currency risk remains relatively small, with U.S. Dollar/Euro exchange rate risk affecting only the portion of investments or purchases which are dollar-denominated. Dollar-Euro currency hedging and derivative products may be employed to mitigate these risks for both investors and operating companies.

Consumer-related risk

Lack of Demand. The amount of projected demand may not come into fruition for a variety of reasons, including lack of awareness by consumers, relative affordability of LPG equipment and fuel, and accessibility. These potential issues (except for cost of fuel) can be mitigated by the work that Clean Cooking for Africa/GLPGP will continue to do in Cameroon (subject to availability of resources), including working to create awareness of LPG benefits among consumers. Additionally, the investments are staged over time, and can be accelerated or delayed/reduced based on leading indicators (including those specified in this report) signaling additional pent-up demand or early saturation of the market. To the extent Government wishes to ensure maximal residential LPG demand for policy reasons, it should consider targeting and deepening its LPG subsidy specifically to lower income households, to create greater fuel affordability for that segment.

The separate risk of price changes is discussed in the *Industry risk* section above.

Consumer Repayment Risks (re: Microfinance Loans). Credit risk in large part will depend on both the selection of on-lending partners and consumer repayment behavior. The analysis of the extension of credit will include diligence of the MFIs and their underlying approaches to customer selection, credit policies, and the target market segments. As a practical matter, consumers will not want to be cut off from LPG once they are using LPG for cooking and have acquired the appliances for cooking and heating with LPG. Nevertheless, as a backstop, the use of blended capital that may be required to underwrite or guarantee or partially guarantee MFI lending will lower the costs of lending, and first loss arrangements with DFIs or other impact investors can protect the performance of the underlying lending portfolio.

New MFI lending for LPG adoption will be piloted in carefully expanding phases, applying lessons from each preceding phase to reduce the risks of later phases.

Ultimately, the aim of the Clean Cooking for Africa program is for LPG microlending to transition to an entirely local platform of partners with underwriting from one or more of them for the group's activities, thereby creating the option for early exit and monetization of microlending activities.

Execution risks

Execution Risks. Investment projects must be required to have competent, experienced management. The funding vehicles (e.g., SPVs) must do the same⁴³. Local partners that will be required, or are desired, where

⁴³ The Clean Cooking for Africa/GLPGP LPG expert team may play such a role in the latter.

they are competent and experienced will help address local execution risks at the operational and local co-investment level. Ultimately, a sound governance system with international-standard financial reporting at all levels will be among the most important tools for identifying execution risks and responding quickly and appropriately to eliminate or reduce them.

LPG Distribution Execution Risk. The inability to reach the ultimate end users of LPG will be a gating decision point regarding whether to invest in a particular geographic target area. This will also limit the success of the investment vehicles but will protect from over-stretching to serve untenable markets.

Counterfeiting and Issues Around Safety. Local LPG industry and the management of the investment vehicle(s) must address these issues to the extent they may arise. Good implementation of the BCRM model (as described in this report) will substantially derisk this issue. Part of the solution may also come from integrating fragmented operators in the distribution chain vertically and horizontally, offering shared benefits from economic scale and market power.

Risks of the Multibrand Wholesaler Distribution Model. See above under *Regulatory risks*.

Complexity of Coordination of Multiple Investment Projects. The quantity of parallel projects may introduce complexity which could cause delays, overruns in project preparations costs, and execution challenges in excess of projects taken individually. There can be no assurance that management and operation companies can successfully manage such complexity. Conversely, the fact that the projects are all linked through a master investment plan means that no one project will receive and deploy a quantum of growth capital without strong assurance that the linked projects in the supply chain receive proportional, and well-timed, quanta of growth capital, so that all projects are mutually reinforcing.

SPV/Fund/NBFI structural and operational risks and mitigants

No Operating History. These vehicle(s) are likely to be recently-formed entities, with no operating history. This may be mitigated by the operating experience and expertise of the Clean Cooking for Africa/GLPGP team, by experienced LPG operating managers on the ground, and by relevant in-country and international project partners.

Liquidity of Investment. The investments will be illiquid as with all private equity and long term debt investments. The investors will be provided with distributions as appropriate and the critical mass of projects created will make this an potential portfolio for an exchange listing (as discussed earlier in this Part of the report) or potential acquisition. To the extent possible, the investment project agreements will include terms that give options for forced monetizations or exit pathways under appropriate conditions.

Long Term Investment. An investment in the vehicles is a medium- to long-term investment. The aim of facilitating the creation of sustainable LPG platforms dictates a significant length of time between the initial investment and the return of investment or realization of gains, if any. “Patient capital” will therefore have a role to play in the capital stack.

Restrictions on Transfer and Withdrawal. There may be no market for the investment securities, absent an exchange listing. In addition, investments in the SPVs/Funds/NBFIs may not be transferable or withdrawable in the usual course of business.

Asset Valuations. Valuations of the LPG assets will be determined by the management of the investment vehicles working with outside valuation experts. The valuations will be based on audited financial

information to the extent possible, complemented by best-practice valuation methods and metrics used in the LPG sector globally.

Investment process-related risks

Finding Investments. The ability to prepare projects and execute the investment strategy in reasonable time frame given possible regulatory and other issues will be a major focus. Continuing diligence will permit walking away from projects which cease to offer the return and risk profile meeting investor requirements before significant amounts of capital have been deployed in them.

Ability to Realize Cash Returns and Exits. As with all investment vehicles, continued listings of the vehicles on liquid exchanges, as well as underlying assets, plus trade sales and dividends, are not certain in time or amount. The strategy of listing or shelf registration can mitigate these risks.

Country Development Risk. Part of the feasibility assessment in this report involved consideration of favorable national developmental trends such as: attractive demographics; rising per capita income; credit reach; urbanization; legal and political stability; progressive governmental policies for healthcare, environment and development; growing foreign investment; development of infrastructure (in particular, road networks), etc.

Environmental Hazards (Other Than LPG Accidents). The investments and projects will be implemented following ADR and other best practices and global regulatory standards. In addition, the funds and projects will take appropriate insurance policies against hazardous accidents and occurrences.

Wrong Investment Thesis. If the findings of, and conclusions from, this report and its companion *Cameroon LPG investment and Implementation* report are wrong, it will result in overinvestment in infrastructure, but there are nonetheless choices available to address this. For example, a) to run at lower capacity or b) to run at normal capacity but resell surplus LPG acquired into other markets (e.g., to regional traders, or to regional petrochemical producers) at a discount. Also, most LPG infrastructure can be scaled up in steps, rather than built all at once. Management and advisors must continue to conduct detailed studies in advance of major capital deployments to be maximally confident that the investment thesis is correct.

Risk mitigation sources for investors

DFIs, MDBs, IFIs, private companies and others provide the risk mitigation tools profiled below.

Risk mitigation tools include guarantees, insurance, and other credit enhancements that are often used in combination with impact or related funding to strengthen the creditworthiness of a funding recipient. According to Convergence's database as of July 2019, 35% of blended transactions have used a development guarantee, and these transactions represent a total capital flow of \$77 billion.,

Many providers of capital also provide risk mitigation tools which offer potential efficiency in lining up the right combinations of blended funding and risk mitigation for many products and services.

The following figure⁴⁴ provides several examples as points of reference:

⁴⁴ Self-reported institutional data analyzed by GLPGP.

Figure 19. Large providers of risk mitigation products, by category



One example of a good source of potential capital and risk products is the U.S. Overseas Private Investment Corporation (OPIC). Its risk/insurance products include enhancing Funders' investment positions by guaranteeing 144A bond placements which can be quite large and attract global pensions, insurance and other investors. This could be used by LPG-related vehicles to issue securities to international investors. This is because the 144A bond insurance essentially converts LPG-related risks into a U.S. Government-mitigated risk. This could also lower the costs of issuance to the backed entity.

IFC and AfDB are investors in, and also offer directly, numerous insurance and risk mitigation products. They are also on the top-tier of potential Funders for the financing team to approach.

18. Structuring Risk Mitigation with Guarantees on Investments

Guarantees will be important in mobilizing both domestic and non-domestic Funders into blended capital structures for the LPG sector. Guarantees would strengthen the comfort of parties to invest in the LPG Vehicles or directly into underlying LPG operating entities. According to the Convergence's database as of July 2019, approximately one third of blended finance transactions (35%) have used a development guarantee, and these transactions represent a total capital flow of \$77 billion. The guarantees LPG Investment Vehicles or operating companies will need fit this classification. As this Part references Convergence's database updates from July 2019, their characterization is consistent with GLPGP's: *"Credit guarantees cover all or a portion of scheduled repayments of private sector loans or bonds against the risk of default and are commonly used to mobilize private investment for project finance, financial intermediation and policy based finance. Political risk guarantees cover private lenders against the risk of a government, or a government owned agency, failing to perform its obligations vis à vis a private sector project. Risks may include currency inconvertibility, regulatory risks (adverse changes in law), and various forms of breach of contract. Guarantees may be full (i.e., cover the full value of scheduled repayments) or partial (i.e., cover a portion of the full value), although partial guarantees are considerably more common."*

Trade guarantee facilities can be used for the importation of cylinders and other vertical needs.

African-oriented cross-owned institutional financing, credit, and risk mitigation sources should also be leveraged. This could cover trade finance, working capital, capital investment, risk insurance (including re-insurance), and hedging. This cross-ownership is likely to enhance the strategic appeal to various partners, due to their joint focus on doing business in Africa. Examples GLPGP is exploring include the Africa Trade Insurance Agency (ATI), into which AfDB has invested, and the European Investment Bank, which has expressed initial interest.

Given that GLPGP and AfDB have established a working relationship through AfDB's grants window for LPG micro-finance, and are exploring larger funding for 2019 and thereafter, AfDB could be a logical partner for risk solutions as well. AfDB and ATI would be logical first partners to approach in terms of larger risk mitigation tools for Cameroon.

A two-tiered approach could be used, by accessing AfDB's various risk mitigation tools such as trade guarantees, insurance, and credit enhancements – either directly from AfDB or from proxies. Following one AfDB investment into ATI, a statement from the then Director of Private Sector and Microfinance at AfDB noted that "ATI uses innovative risk mitigation instruments to catalyze private sector financing into a range of critical sectors from core infrastructure to trade finance." This could be useful for Cameroon's LPG investments. Other active groups like Sweden's SIDA partner with USAID, IFC, DFIs and others to actively guarantee risks in development areas that compliment Sweden's international development agenda. GLPGP will approach SIDA as appropriate.

Another target might be the heavily DFI-backed AFC (although Cameroon itself is not a current shareholder member). This entitles member countries to risk and funding support from AFC, and issuing capital via AFC's enhanced credit rating if appropriate projects are brought forward. AFC is owned by numerous groups including very active DFIs such as AfDB, KfW, DEG, FMO, and PROPARCO. This could be a logical grouping to approach.

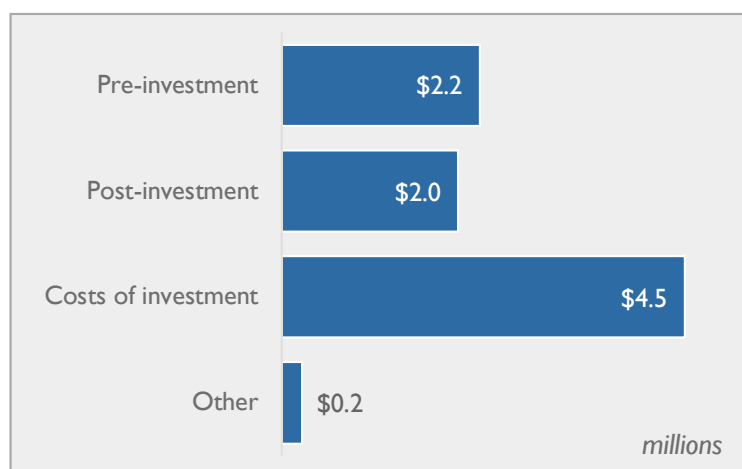
In addition, FMO and OeEB have been involved with LPG related activities (FMO in Bangladesh – invested; OeEB in Albania – commissioned studies). OeEB, while smaller among the European DFIs, is quite active across debt, equity, quasi-equity, and grants. In addition, like AfDB, FMO and other DFIs, it could be approached to provide credit lines for an NBFi.

19. Technical Assistance for Project Preparation and Financing

In the use of blended finance and risk mitigation tools for the Cameroonian LPG sector, TA can play an important facilitating and knowledge-deepening role in: 1) governmental level sector oversight and development; 2) project/company preparation for funding; 3) managerial and operational strengthening; 4) on-going budgetary support for the LPG advisory services; and 5) monitoring and reporting budgets as agreed for items such as impact measurements and reporting. According to Convergence Blended Finance's February 2019 analysis, 34% of all blended finance transactions have an associated technical facility. They have utilized TA as a concessional form of resources.

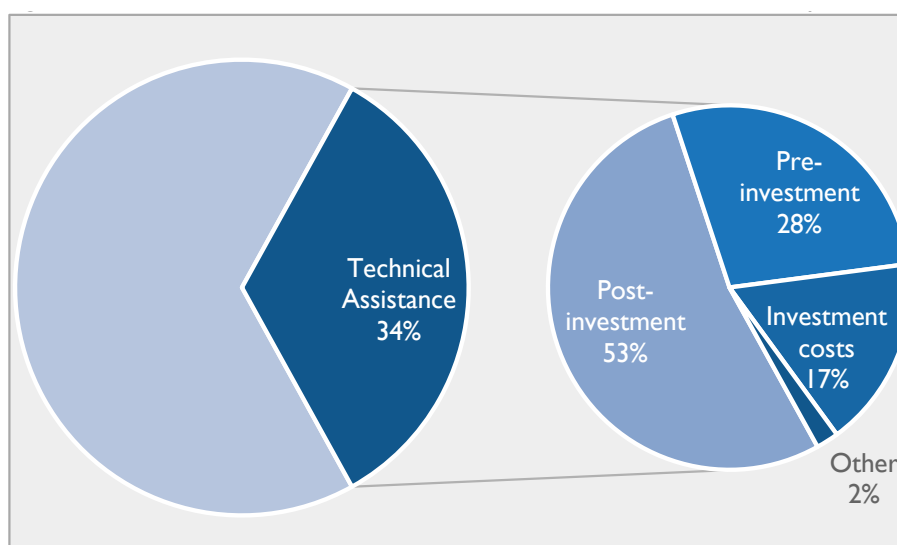
According to data in Convergence's 2019 brief, *Blending with Technical Assistance: "on average technical assistance facilities have been capitalized to 12% of deal size"*. Figure 20 below shows the average breakdown of this assistance. GLPGP has also interviewed select Funders and a common theme for those interested in possibly funding the opportunities in LPG is the readiness of the projects at the onset, and the ability of such entities/projects to perform to the expectations of backers in the future. The ongoing TA averages \$4.5 million for investments but this is less typical than pre-investment preparation and post-investment work. The IFC, by example, has indicated in an interview with GLPGP that it is often concerned with the management capabilities of the projects in sectors like LPG. TA can help alleviate some of this uncertainty.

Figure 20. Average size of technical assistance facility by type



Source: *Convergence Blended Finance February 2019*

Figure 21. Breakdown of blended finance deals with a technical assistance facility

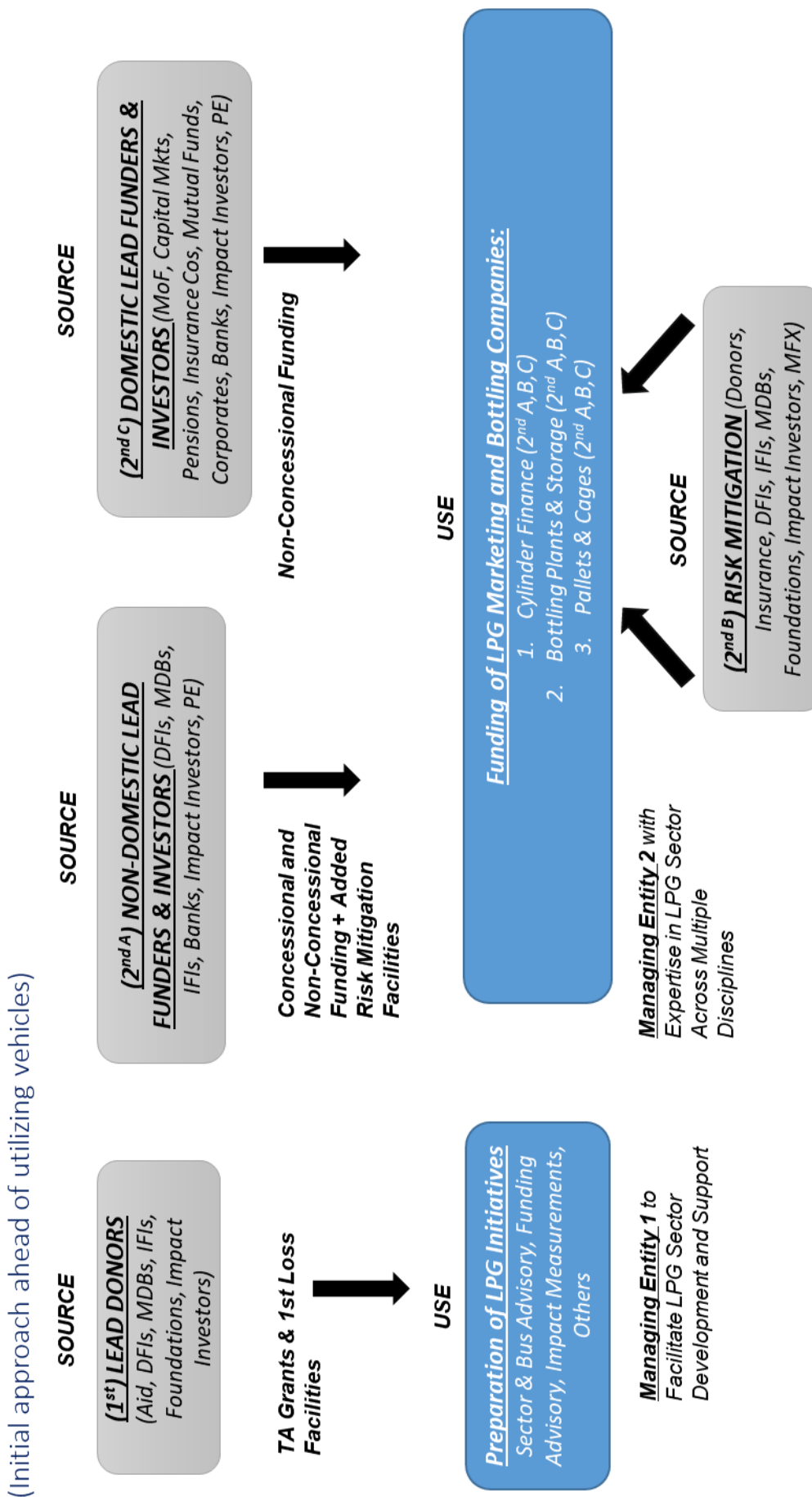


Source: *Convergence Blended Finance February 2019*

According to Convergence, “Technical assistance is one tool for accelerating commercial sustainability and deepening development impact for projects and social enterprises aligned to the SDGs in developing countries. Technical assistance can be as effective as concessional capital in managing risks and supporting returns in blended finance transactions to mobilize additional commercial capital.”

The Value Chain Capitalization Stages discussed in Figure 22 envision tapping into TA providers as a first step in the next stages of implementation. Institutions like the EU, KfW, AfDB, DFIs and others could jump start the next steps of implementation with grants. These are captured in the section Source 1st below in Figure 22 followed by parallel stages Source 2^{ndA}, 2^{ndB}, and 2^{ndC}.

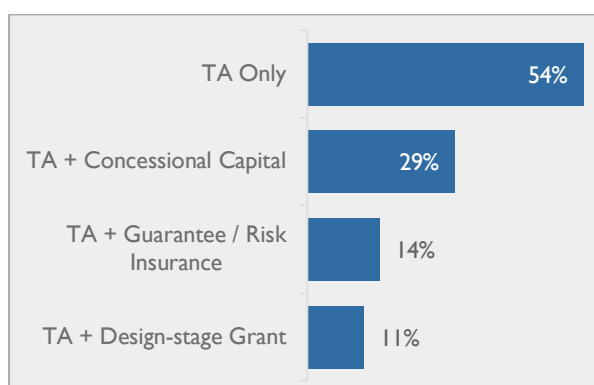
Figure 22. Value chain capitalization stages: grants, concessional and non-concessional



LPG sector development TA is an integral part of the blended capitalization initiatives proposed in the schematic above. If targeted efficiently, for example, to strengthen operations and management of a group of LPG Marketers targeted for funding, this component can de-risk projects from the perspective of both proprietors and outside financial backers. This is how it is envisioned in the Cameroonian context.

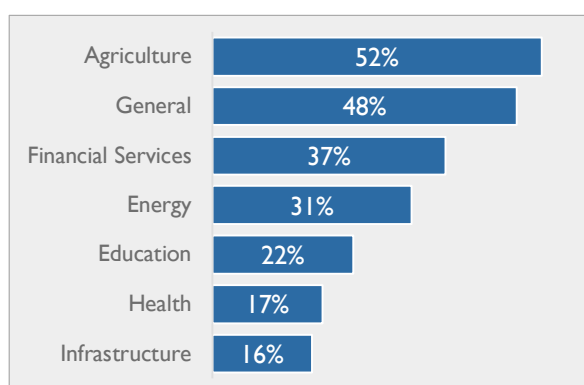
The blending of capitalization for Bottlers and Marketers has a range of uses for TA from pipeline development, preparation, and funding, to on-going sector support initiatives from contracted advisors and donors themselves. In the Cameroon context, EU market assessment, impact work, technical study, project identification and funding option grants have been provided. The next logical step is to engage LPG market design-stage grants and implementation grants – for example, to develop the funding mechanisms and pipeline candidates in the critical value chain verticals. This will ultimately be matched with both concessional capital and non-concessional capital. Groups that GLPGP would suggest approaching for finance such as the IFC, which has funded several LPG projects around the world, are noted by [Convergence](#) to be among the top providers of investment-related TA. This is done, as noted, to de-risk and also to make projects and investments more likely of achieving their expected impact and financial results. The two following Figures present a synopsis of the role of TA in the context of the 34% of all blended finance transactions where TA was used.

Figure 23. Percentage of deals with technical assistance



Source: *Convergence Blended Finance February 2019*

Figure 24. Percentage of deals with technical assistance, by sector

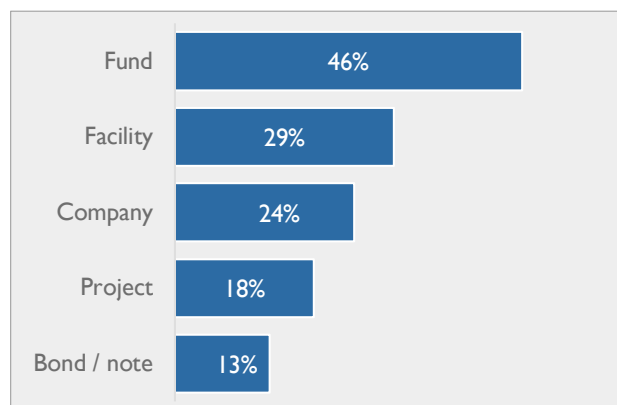


Source: *Convergence Blended Finance February 2019*

The conclusion from the Figures above is that, in terms of sector applicability, TA has been used in numerous blended funding initiatives across sectors to stimulate capitalization and sector development. This can be readily applied to LPG, as the IFC has done, for example. According to [Convergence](#), as of February 2019, 38% of TA has targeted Sub-Saharan Africa. This also bodes well for the LPG blended capital

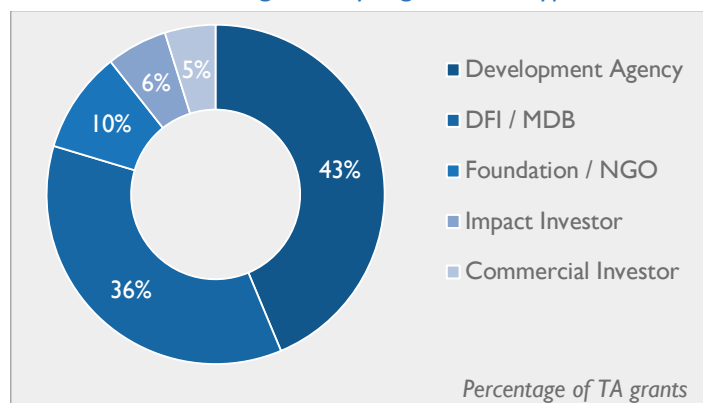
goals being proposed herein as the notion of TA support for both direct and indirect funding approaches should be well appreciated by the Funders that are being targeted. Importantly, the deal types using the blended finance, as broken down below in [Figure 25](#), match well to the capitalization staging and structures being recommended.

Figure 25. Percentage of deals with technical assistance



Source: Convergence Blended Finance February 2019

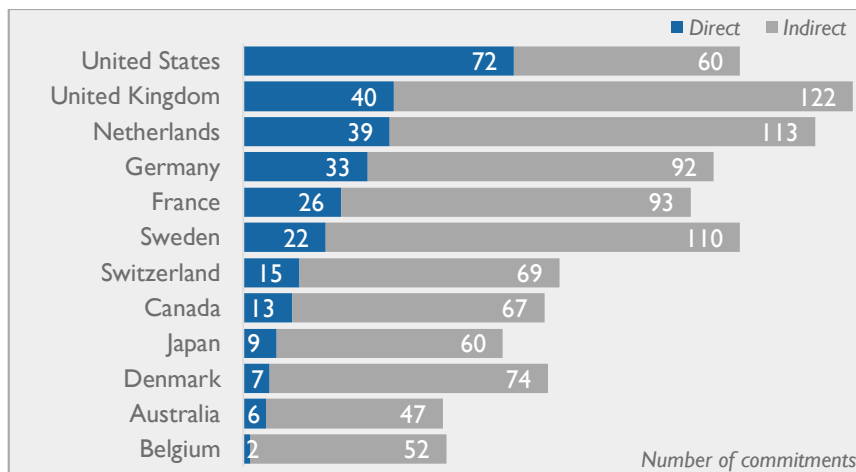
Figure 26. Percentage of technical assistance grants by organization type



Source: Convergence Blended Finance February 2019

TA is typically deployed through donor funds or aid agencies associated with the major pools of blended capital such as DFIs, MDBs and other like-minded institutions. GLPGP is targeting many of the groups. Figure 26 shows the types of parties that should be targeted in structuring TA grants for Cameroon. Importantly, many of these institutions are also active potential Funders. As such they are also targeted for investment in LPG in Cameroon. As an example, the IFC is active in LPG loans across the value chain and also a top TA provider.

Figure 27. Most active donor governments in blended finance



Source: Convergence Blended Finance May 2019

According to the Convergence database, donor governments have participated in approximately half (56%) of blended finance transactions captured – with the remaining transactions supported primarily by DFIs, development banks, and philanthropic organizations. Donor governments have committed various types of financial resources (e.g., grants, guarantees) to blended finance solutions, both directly and indirectly (e.g., indirectly through multilateral organizations or funds). Based on current data, the top donor governments, by number of commitments, have been the United States, the United Kingdom, the Netherlands, Germany, France, and Sweden.⁴⁵

⁴⁵ Convergence Blended Finance (2019)

VII. Environmental, Health, Social and Economic Impact Potential

This Part⁴⁶ provides an evidence base and estimation for use by investors, policymakers, industry and researchers to guide the development of LPG infrastructure and distribution systems in Cameroon.

Introduction: impact scenarios

The assessment utilizes the demand forecast scenarios presented in Part IV together with the investment scenarios presented in Part V to calculate the potential social, environmental and development impacts through 2030 from each scenario compared to the “business as usual” projection of LPG adoption and use from Part IV.

All of the scenario models take into account that improved biomass cookstoves (ICS) will seek to compete with LPG.

This impact assessment relies on two main sources of data for projecting future LPG adoption and use: (i) a survey commissioned by GLPGP and conducted by Dalberg Research in June 2018 (referred to as the GLPGP-Dalberg survey) and (ii) a household research survey conducted by the University of Liverpool between April and September 2017 as part of the LPG Adoption in Cameroon Evaluation (LACE studies). Although nationally representative data sets such as the Demographic and Health Survey (2012) and the NIS data (2014) exist, these data sets were not well suited for the assessment, being outdated and having meaningful data limitations regarding fuel use and fuel availability and affordability.

These data, alongside the demand scenarios, were used to analyze and model the environmental, health, gender, and macroeconomic impact from serving the potential demand for household cooking in Cameroon to 2030, taking into account the primary cooking fuel(s) previously used by new LPG users.

Each cooking fuel has its own characteristics in daily use with respect to health, environment, gender and economic impacts.

It is important to note that the impact assessment presented in this report is calculated for scenarios where LPG is made sufficiently available to serve the projected demand, relative to the base case projections. This approach helps estimate the incremental impact of the investment to be made to cause LPG to become available to Cameroon households that desire it over time, and are located in areas of Cameroon where LPG is feasible to be provided and used⁴⁷.

Environmental impacts

Cameroon has the second highest deforestation rate in the Congo Basin, losing approximately 220,000 hectares of forests annually. Although 48% (22.5 million hectares) of Cameroon is covered in forest, Cameroon has lost 4.4 million hectares of its forests (18.1% of its total forests) between 1990 and 2010.⁴⁸

⁴⁶ The contents of this Part were developed with Dalberg Global Development Advisors under engagement to GLPGP.

⁴⁷ For example, areas without good road access, or where most cooking fuel use is and will be from gathered wood, were not deemed to develop new LPG demand.

⁴⁸ FAO (2015)

The impact of households changing their primary fuel from charcoal and firewood to LPG can have many positive impacts on the environment and climate. For this analysis, the environmental impacts from increased LPG use and corresponding decreased charcoal and firewood use was calculated as follows:

- **Averted deforestation:** 35 to 54 million trees saved annually relative to base case projections in 2030 and over 300 million trees saved between 2020 and 2030.
- **Carbon dioxide equivalent (CO₂eq) emissions⁴⁹ averted:** 5.0 to 5.6 million MT of CO₂eq emissions reduced annually in 2030 and over 40 million MT of CO₂eq emissions averted cumulatively between 2020 and 2030.
- **Black Carbon equivalent (BCeq) emissions⁵⁰ averted:** 5.5 to 8.0 million MT of BCeq emissions averted annually in 2030 and over 46 million MT of BCeq emissions averted cumulatively between 2020 and 2030.
- **The economic value of averted CO₂eq emissions in terms of carbon financing:** € 45 – € 147 million cumulatively between 2020 and 2030, using the 2018 prevailing price of carbon.

Health impacts

Quantitative impacts

Transitioning from charcoal and firewood to LPG can have significant health impacts due to reduced exposure to household air pollution (HAP) from burning solid fuels to meet household energy needs. HAP is causally related to ischemic heart disease, stroke, chronic obstructive pulmonary disease, lung cancer in adults, and acute lower respiratory infection in children (based on Global Burden of Disease (GBD) data)⁵¹, plus several other conditions not included in GBD estimates (e.g. blindness in women). All these diseases can result in premature death or a disability. For this study, the health impacts from increased LPG use (and decreased charcoal and firewood use) were estimated by calculating (1) deaths averted, and (2) Disability-Adjusted Life Years (DALYs)⁵² saved due to reduced exposure to HAP from reparable fine particulate matter (PM_{2.5}).⁵³ Impacts on both adults and children were estimated.

Overall, relative to base case projections, 18,985 deaths could be averted cumulatively between 2020 and 2030 due to increased LPG usage under conditions of expanded availability and increased consumption. In addition, 926,484 DALYs could be saved relative to base case projections. This could result in a total economic value of labour of working age adults (from deaths averted and DALYs saved) of € 208 million, relative to base case projections. It is important to note that using indoor PM_{2.5} concentrations will overestimate health benefits of LPG. While outdoor cooking would result in lower exposure to PM_{2.5}, due to

⁴⁹ CO₂eq emissions include carbon dioxide equivalent emissions from carbon dioxide, methane, and nitrous oxide. These were calculated using IPCC conform standards. Further details are provided in section 2.2

⁵⁰ BCeq emissions includes black carbon equivalent emissions from black carbon, organic carbon, carbon monoxide, and total non-methane organic compounds. Further details are provided in section 2.3.

⁵¹ IMHE (2016)

⁵² The disability-adjusted life year (DALY) is a measure of the overall disease burden, expressed as the number of years lost due to ill-health, disability, or premature death.

⁵³ PM_{2.5} refers to Particulate Matter, 2.5 micrometers or less. These are air pollutants with a diameter of 2.5 micrometers or less, small enough to invade even the smallest airways and produce respiratory and cardiovascular illness.

increased ventilation, this analysis uses indoor PM_{2.5} exposure concentrations in the absence of reliable data on outdoor exposure.

Gender impacts

Qualitative impacts

Globally, it is estimated that women spend an average of 4.5 hours a day on unpaid work, more than double the amount of time spent by men.⁵⁴ Reducing the number of hours per day women spend on unpaid work could have numerous financial and social benefits including allowing women to find more paid work (including both farming activities and other income-generating labor which would vary by setting), pursue education and/or have more leisure time.⁵⁵ LPG may offer a time savings compared to charcoal and firewood (and other collected biomass), as it provides storage of LPG in cylinders within the home, and saves cooking and cleaning time.⁵⁶ In this analysis, the main gender impacts of transitioning to LPG resulted from time saved from not having to acquire fuel daily as households transition from firewood and charcoal to LPG, and secondarily from time saved from cooking faster with LPG (through better and instant-on heat delivery to pots), fire preparation time, and cleaning (for example, because pots are not blackened by LPG).

Cooking with LPG will result in an estimated total time saving of 38 minutes per person per day for former charcoal households, 34 minutes per person per day for former firewood households, and 24 minutes per person per day for former kerosene households. In a developed country, saving 38 minutes from a daily work commute, for example, would be deemed a very significant source of value. Its significance is less clear in the context of cooking in Cameroon. The value of this time as perceived by those who spend it was not evaluated as part of the survey scope, nor assessed in available datasets or studies. (It is, however, one of the benefits that users consider, at least qualitatively, when choosing to use LPG in place of another type of fuel.) The time savings for households that collect firewood and purchase charcoal are much smaller—10.2 and 4.4 minutes per person per day, respectively, from switching to LPG.

If the total saved time were possible to convert to gainful employment paid at the minimum wage, the combined time savings from fuel collection and cooking efficiencies could result in an annual economic value of € 52 million a year, relative to the base case. This is necessarily a hypothetical estimation, and further research would be required to assess the extent to which time savings translate into value as perceived by individuals and as measured by society.

While jobs will be created in the LPG sector, including for women, women are likely to experience reduced employment and income opportunities in the informal charcoal sector as charcoal use for cooking is displaced by LPG use. These effects may be significant, but were excluded from this analysis due to lack of available data on employment in the charcoal sector.

⁵⁴ Gates, Melinda (2016)

⁵⁵ Oxfam International (2017)

⁵⁶ Brooks N. et al. (2016); Nautiyal S. (2013)

Consumer household expenditure impacts

Quantitative impacts

Stove and fuel affordability are potential constraints to LPG initial adoption and sustained use, given income and liquidity levels of Cameroonian households.⁵⁷ Yet, LPG could save households costs in the long run, because LPG is more cost-efficient at delivering heat to pots than charcoal, kerosene and firewood in Cameroon.

In 2018, households in Cameroon spent € 2.2 billion on residential cooking fuel (7.6% of GDP)⁵⁸. Under conditions of expanded availability and increased consumption of LPG, the annual cost savings to consumers could exceed € 780 million in 2030, relative to the base case scenario. For the households switching to LPG, this equates to an annual per household cost savings of € 26 for former kerosene households and € 22 for former charcoal households.

The absolute savings are greater for urban households due to the higher price of charcoal and firewood in urban (and peri-urban) areas relative to rural areas. For households switching from purchased firewood, the annual cost savings are even greater. However, an estimate of the total saved among consumers switching from purchased firewood to LPG could not be reliably made due to limitations in the underlying data.

Macroeconomic impacts

Quantitative impacts

Increasing LPG usage within the country could affect the (1) tax revenue and (2) trade balance for the country's economy, as well as the (3) total number of jobs across various fuel value chains. Cameroon's LPG supply is imported in part, and LPG is taxed, and these are expected to continue in a reformed LPG market.

LPG, charcoal and firewood are all subject to tax in Cameroon. The total of LPG taxes (VAT on elements of the price build-up plus the stabilization tax) is approximately 14%, and firewood and charcoal are subject to VAT of 19%. Assuming that the taxes on these fuels remain unchanged over time, an increase in LPG consumption, combined with a decline in purchased firewood and charcoal consumption, will impact national tax revenue. The 80% of LPG supply to Cameroon which is imported is also subsidized⁵⁹; increased importation will increase the subsidy burden on Government, in addition to affecting the trade balance. There is no import tax on LPG and firewood and charcoal are not imported, so increasing or decreasing LPG imports will have no net impact on tax revenue.

For purposes of this analysis, production capacity of LPG, the pricing and price-formula of LPG, and the subsidy on LPG were assumed to be constant at 2018 values. Given the lack of price data on other fuels, the macroeconomic impact of change in firewood, kerosene and charcoal consumption was not possible to model; the results presented here should be interpreted accordingly.

⁵⁷ Maxwell et al. (2018); Asante et al. (2018)

⁵⁸ This was calculated using the total number of households, primary fuel use per household, the average consumption per household, and the average cost of each fuel, to obtain the total spent in 2018.

⁵⁹ The LPG subsidy amount fluctuates based on variations in the market price of imported LPG. For this analysis, an average subsidy amount equal to 367 CFA/kg has been assumed.

Increased LPG usage could decrease national tax revenue on an annual basis by € 150 to 220 million in 2030, relative to base case projections. This equates to a cumulative decrease in national tax revenue of € 1.25 to 2.0 billion between 2020 and 2030, relative to base case projections. (This calculation assumes effective tax collection within the charcoal and purchased firewood sectors, which may overstate the potential tax decrease due to the informality of those sectors.)

The subsidy cost could increase by CFA 36 to 48 billion per year in 2030, should sales price and import price stay constant at 2018 levels.

The national trade deficit in 2030 could enlarge by € 130 to 175 million relative to the base case.

Across the LPG value chain, an estimated 4,300 jobs existed in 2016. Serving the projected increased LPG consumption could create between 17,976 and 24,097 net new direct jobs in the LPG value chain by 2030, relative to base case projections, predominantly in LPG distribution and retail operations. It is important to note that a wide uptake of LPG will result in job losses in the charcoal and firewood value chains, particularly in the informal sector. It was not possible to estimate such losses from available data.

Unquantified and under-quantified impacts

Increasing the volume of LPG in the country will create additional formal economic activity (e.g., growth of LPG businesses, staff of bulk depots, staff of filling plants, and transporters) which could positively affect the tax revenue from corporate tax in the country. This effect was not captured/modelled in the analysis, because of the lack of data on the corporate tax of different levels of the LPG value chain.

The health analysis was restricted to the five GBD health outcomes while acknowledging that there is good quality and emerging evidence of other health outcomes associated with HAP (e.g. cataracts, adverse pregnancy outcomes, TB, etc.) and burns, which have not been included in this analysis.

Conclusion

The results summarized above demonstrate that successful scaling up LPG use has meaningful positive impacts on four of five socio-economic impacts assessed: environment, health, gender and consumer household expenditure.

VIII. Progressing the Clean Cooking for Africa Program in Cameroon

This Part summarizes recommendations and notional budgeting for a next major phase of engagement by the Clean Cooking for Africa Program in Cameroon, in connection with the investments, project implementation, and other supportive measures.

There are two main ways in which the Program should evolve:

1. Facilitating the mobilization and deployment of blended capital (including technical assistance (TA) funding) to those projects which require it or would be strengthened thereby;
2. Extending and expanding work with the Government, the LPG sector and other relevant stakeholders to improve the overall LPG ecosystem in Cameroon.

This Part presents an overview of Program development recommendations, including (i) potential DFI participation and (ii) technical assistance measures and follow-on studies to help improve and expand the LPG ecosystem further. DFI Investment Participation

20. DFI Investment Participation

DFIs are an important source of capital for LPG sector reform and expansion, not only by reducing the cost of capital, which may be desirable, but also by providing the needed reassurance to other Funders that crowds in adequate non-concessional capital and by providing TA resources, both of which may be vital and transformative.

As mentioned previously, DFI roles can include some or all of the following:

1. Provide large and diversified capital investment of their own;
2. Catalyze and crowd-in outside non-concessional, more risk-adverse co-funding;
3. Lower the cost of capital for various projects (where it makes sense to do so);
4. Introduce first-loss-protection for other investors;
5. Provide risk mitigation tools, such as guarantees and private bond placement insurance;
6. Provide hedging tools to help mitigate LPG price volatility and address currency risk;
7. Use financial influence in the country overall to ensure/support governmental performance of obligations;
8. Provide TA funding to help the Government develop capacity to improve its enforcement of LPG regulations and market rules, and the LPG sector to improve management capability and project bankability and prepare projects to sufficient investment readiness;
9. Provide TA to educate and create awareness of LPG benefits among consumers;

10. Underwrite the country's initial expansion of LPG microfinance programs on a concessional basis to demonstrate to local financial firms that microfinance can be a legitimate commercial activity for them at scale;
11. Help secure international LPG supply on more favorable terms, through bringing their balance sheets to bear (e.g., offering letters of credit with concessional terms for use by LPG Marketers or intermediary SPVs to acquire cylinders *en masse*);
12. Become a Funder to listed or non-local stock exchange-listed SPVs and/or provide protections for other investors/Funders.

Although DFIs may wish to consider co-funding of individual LPG projects, in order to achieve breakthrough impacts from large-scale LPG transition away from solid fuels for cooking, it is important that critical investments occur across the entire LPG supply chain, and across multiple operating and project entities, in a coordinated fashion. DFIs can take a lead, where the private sector has not yet been willing to do so, in the establishment of blended capital financing vehicles for aggregation of related LPG projects in a given country (or across multiple countries), as described in detail elsewhere in this report.

Quantum target and staging for concessional capital

In Cameroon, the recommended share of the total capital investment to 2030 attributed to concessional capital is 40%. On a gross asset cost basis, this represents financing of € 52.2 million in tranche one, € 47.4 million in tranche two, and € 10.1 million in tranche three. On a net basis, the hypothetical minimum required would be approximately 15% less, taking into account the potential effect of the consumer cylinder deposits: € 44.2 million in tranche one, € 42.6 million in tranche two, and € 5.7 million in tranche three.

Additionally, technical assistance (TA) and microfinance program funds of up to € 22.9 in tranche one, € 25.2 million in tranche two, and € 0.6 million in tranche three could be deployed to improve the odds of success and, thereby, expand (or de-risk) the impact potential of the investments.

Treating tranche one investments and TA/microfinance costs as a portfolio of interrelated investments for concessional capital sources, the financing requirement for tranche one would be:

Investments (net/floor – gross)	€ 44.2 – 52.2 million
Microfinance programs	up to € 8.6 million
Technical assistance measures	up to € 14.3 million
Total	€ 67.1 – 75.1 million

Of this, the investment portion (€ 44.2 – 52.2 million) would be repaid, with applicable interest, at the end of tranche one, and could then be recycled into tranche two, and then again into tranche three, both of which are smaller investment quanta than tranche one.

This allows concessional capital sources to treat tranche one as an immediate project portfolio for impact investing, with the opportunity to reinvest repaid funds into later tranches based on the results achieved with each prior tranche, and taking into account the conditions, gating factors, evolving risks, and new information available at the start of each later tranche.

What is critical overall is how the presence, and tools, of concessional capital sources in the capital stack improve the attractiveness and risk appearance of the LPG sector and its investments to non-concessional capital sources.

In combination with the following proposed microfinance and technical assistance programs and activities, a notional DFI led Clean Cooking Program for Cameroon program would comprise approximately € 70 million of investment and TA/microfinance funding for use in tranche one, as shown above. In time for tranche two, the program would determine whether, and how much, to re-deploy its repaid capital (plus usable interest payments) for the expansion projects and measures in that tranche. Of this, in case access to concessional funding is limited, priority (or preference) should be given to the near- and medium-term CapEx and TA requirements, because the first wave of new LPG demand that can be served will be pent-up, unmet demand that does not require microfinance to be unlocked. (See the Feasibility Study for a detailed discussion of the stages of demand.)

21. Microfinance and Technical Assistance Programs and Activities

The following tables describe a set of useful demand-stimulating and other technical assistance (TA) activities which emerged from the Feasibility Study, with recommended budgeting for each. The microfinance project is notionally planned to occur during tranches one and two (running through 2026), while each TA item is notionally planned to occur and conclude within 1-2 years, but any of them could optionally be extended beyond this with additional funding.

Descriptions of selected items are presented after the table.

Table 45. Recommended microfinance and consumer education program and indicative budget

Item	Indicative budget (€ 000)	By tranche (€ 000)		Prospective executing parties
LPG microfinance program expansion (including consumer sensitization)	25,700	1	8,600	GLPGP, FEICOM, MUFFA, MC2, Afriland Bank, LPG Marketers Other local partners to be added
		2	17,100	

See Project Annexes, Chapter 25 beginning on page 202, for details. The program objective would be to stimulate LPG switching and use by 500,000 households (with minimal cannibalization of households that would have switched without it) across tranches one and two. The main ramp-up would be in tranche two, to correspond with the expansion of the LPG sector into higher risk geographic and demographic parts of the population.

Table 46. Recommended technical assistance program and indicative budget

Item	Indicative budget (€ 000)	By tranche		Prospective executing parties
		(€ 000)		
Financial, management and technical/engineering project support and capability building (associated with the investments) (at 10% of non-cylinder CapEx)	15,400	1	7,700	GLPGP / Clean Cooking for Africa expert team, DFIs, IFC Selected financial and engineering consultancies
		2	7,200	
		3	500	
Public education and awareness campaign ⁶⁰	750	1	750	MINEE, GLPGP, communications consultancy
SME distributor training	200	1	200	GLPGP training team, selected LPGMCs/OMCs
Women's LPG entrepreneurship training and financing	3,600	1	3,600	GLPGP training team, selected LPGMCs/OMCs
Follow-on studies (see Feasibility Study, Part XII)	900	1	750	GLPGP / Clean Cooking for Africa expert team
		2	150	
Subtotal	20,850			
TA program management / overhead (10%)	2,085			
Total	22,935			

Table 47. Summary TA program budget per investment program tranche

	Tranche 1	Tranche 2	Tranche 3
	2019-2022	2023-2026	2027-2030
Management/finance/engineering assistance	7,700 €	7,200 €	500 €
Education and awareness	750 €		
SME distributor training	200 €		
Women's entrepreneurship	3,600 €		
Follow-on studies	750 €	150 €	
Subtotal	13,000 €	7,350 €	500 €
<i>Program management/overhead</i>	<i>1,300 €</i>	<i>735 €</i>	<i>50 €</i>
Total	14,300 €	8,085 €	550 €

Description of selected TA items

SME distributor training Training in good and safe LPG business and operating practices under BCRM. Per recent experience in Cameroon⁶¹, the cost would be US \$450 per distributor; target of 500 distributors).

⁶⁰ This element is separate and distinct from the targeted consumer education activities included in the microfinance program.

Women's entrepreneurship	Training and coverage of business start-up costs for women to become LPG distribution/depot entrepreneurs under BCRM. Per recent experience in Cameroon ⁶¹ , the cost (including inventory) would be US \$24,000 per woman, spent over two years; Cameroon target of 150 women).
Follow-on studies	<p>A set of recommended follow-on study topics is outlined in the Feasibility Study, Part XII, including:</p> <ul style="list-style-type: none"> • Development of pro-poor/pro-rural LPG interventions and programs; • Bulk Road Vehicles; • Alternatives for increasing domestic LPG production for Sonara; • Importation strategies and opportunities for regional coordination; • Pay-as-you-go business models in context of Cameroon price regulation; • Household surveying of an expanded population across a broader number of towns and villages to strengthen findings with respect to comparative fuel economics, and other drivers of fuel-switching and fuel-stacking; • Evaluating fuel-stacking behavior longitudinally; • The potential impacts of LPG expansion on the charcoal sector and of imposing limitations on charcoal activity, such as logging bans, charcoal export taxes, etc.; • Cost-benefit analysis to determine the role which credit screening should play in LPG microfinance programs; • Geographic targeting of cylinder exchange points and depots; • Potential for bio-LPG production and use.

⁶¹ Program conducted in Cameroon by GLPGP supported by a technical assistance grant from the African Development Bank.

22. Program Structure

A broadened and extended program would include establishing a managerial organization comprising the following key categories of expertise:

Category of expertise	Key responsibilities	Potential sources
LPG sector development, project planning and preparation	<p>Ongoing policy and regulatory reform/enhancement advisory</p> <p>Technical assistance delivery: ongoing national planning (where required), project preparation, management capability development, cross-project coordination, investment technical and economic evaluation / due diligence, engineering support, training programs / SME capacity building</p> <p>Research and M&E support</p>	GLPGP / Clean Cooking for Africa expert team ⁶²
Financing and investment	<p>Structuring of financial vehicles / funds</p> <p>Mobilization and deployment of capital</p> <p>Investment and credit decision-making</p> <p>Investment management and fund operation (as GP or similar), including compliance and reporting</p> <p>Monetizations / exits</p> <p>Financial TA to project entities</p>	<p>DFI</p> <p>Regional investment bank</p> <p>GLPGP finance team (for LPG-specific expertise)</p>
Communications and education	<p>Develop educational and awareness campaigns regarding LPG benefits, safe use, etc.</p> <p>Expand and extend SME training programs in LPG marketing, distribution, retailing</p>	<p>Communications consultancies</p> <p>GLPGP sensitization/training teams</p>
LPG microfinance / pro-poor programs	<p>Improvements to program design, including especially for commercial scalability</p> <p>Transition to pure commercial basis; transfer to 100% local/regional partners</p> <p>Supervision, M&E</p>	<p>DFI microfinance group</p> <p>GLPGP microfinance team</p> <p>Regional pro-poor commercial bank</p>

⁶² To be expanded as necessary or desired

Category of expertise	Key responsibilities	Potential sources
LPG/clean cooking M&E	Monitor and evaluate the program and its results, including social, economic, environmental and climate impacts	Independent evaluator, such as a university or research institute with staff having relevant experience

Ultimately, in Cameroon as well as any other LMIC, the government must take active responsibility for ensuring the LPG ecosystem remains sufficient with respect to safety and bankability, and the leading LPG companies (private as well as state-owned) must drive and execute major LPG projects and business expansions. The Clean Cooking for Africa Program, appropriately extended and expanded, could help both the public sector and the private sector identify and exploit opportunities to accomplish more, faster, in transitioning the national cooking fuel market to LPG from other, harmful fuels.

IX. Project Annexes: Information Memoranda

23. Project 1: Bottling Plants and Storage

The information in this subsection is reproduced for ease of reference from Chapter 3. The Chapter then continues with a presentation of the bottling plants (BPs) technical and other details.

Projected bottling capacity and number of bottling plants

Filling plants may be grouped into SCDP facilities and the in-house facilities of other LPG Marketers. These may be subdivided into expansion of existing facilities and construction of new facilities. Where existing facilities are in place, the investment plan builds up from the 2017 volume and capacity, ramping up capacity in stages to achieve the storage and throughput requirements for the facility's anticipated share of the total national LPG cylinder refilling volume, region by region and entity by entity. (SCDP provided its own forecast of the aggregate future volumes it would serve from Cameroon's LPG Marketers, taken together.)

In regions without existing facilities, it is assumed that operations from a new facility would commence during the second year of the investment program (notionally, 2020), after which it would be expanded, as necessary, in steps as its throughput requirements increase to serve the demand associated with that facility.

A Cameroon filling plant audit was conducted by the GLPGP/Clean Cooking for Africa engineering and construction experts in 2018 to review operations, potential improvements, and estimate near-term, medium-term, and long-term investments costs consistent with the Master Plan (as recalibrated to the demand projections described in this report).

The bottling capacity requirement is defined by the peak consumption in a year, increased by a safety factor. The peak of consumption is related to seasonality. There being no definitive information available on the consumption seasonality of the LPG in cylinder use in Cameroon, the bottling capacity has been calculated conservatively at 120% of the annual consumption target.

Total required bottling capacity was projected to be approximately 380 KT per year in 2030 nationwide, with one shift of operations (labor) depending on the region to serve the projected consumption (upper-bound scenario). This nameplate capacity allows for the intended 20% of flexibility to cover all peak needs throughout the year.

The following table shows the theoretical need of bottling in the different regions.

Table 48. Theoretical maximum bottling capacity required to 2030 (MT)

Region	2018a	2020e	2022e	2024e	2026e	2028e	2030e
Extreme-Nord (Maroua)	2.6	8.5	11.7	15.4	19.3	23.5	28.0
Nord (Garoua)	1.8	5.2	7.1	9.3	11.6	14.1	16.8
Adamaoua	3.3	7.9	8.6	9.3	10.0	10.6	11.1
Centre (Yaounde)	40.5	66.0	68.2	69.6	69.6	68.4	66.5
Sud (Kribi)	2.4	5.3	6.2	7.1	8.0	9.0	10.0
Est (Bertoua)	1.6	3.6	4.9	6.3	7.8	9.4	11.2

Region	2018a	2020e	2022e	2024e	2026e	2028e	2030e
Littoral (Douala)	49.8	83.5	86.0	87.4	87.2	85.3	82.5
Sud Ouest (Kumba)	2.6	7.7	10.4	13.4	16.8	20.3	24.1
Nord Ouest (Bamenda)	3.0	7.4	10.5	14.0	17.8	21.8	26.2
Ouest (Bafoussam)	5.5	10.9	13.6	16.6	19.8	23.1	26.6
Total	113	206	227	248	268	285	303

Overall filling and storage investments

The following two tables show the filling and storage capacity requirements by region:

Table 49. Filling plant capacity growth requirements by region to 2030 (KT)

Region	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Extreme-Nord (Maroua)	10		4		5				3	
Nord (Garoua)	7	2		3			3		2	
Adamaoua (Ngaoundere)	4	2			1					
Centre (Yaounde)	39									
Sud (Kribi)	7				2				2	2
Est (Bertoua)		3			1		2		3	
Littoral (Douala)	43									
Sud Ouest (Kumba)	10		3		4			4		
Nord Ouest (Bamenda)	11		4		4			4		6
Ouest (Bafoussam)	10			5				4		
Total	139	7	11	8	17	0	5	12	10	8

Table 50. Filling plant storage growth requirements by region to 2030 (MT)

Region	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Extreme-Nord (Maroua)		90		60		75				15	
Nord (Garoua)		105	30		45			45			
Adamaoua (Ngaoundere)		25	30			15					
Centre (Yaounde)	570	474									
Sud (Kribi)			7,500			6,000					
Est (Bertoua)								30		45	
Littoral (Douala)											
Sud Ouest (Kumba)		140		45		60			60		
Nord Ouest (Bamenda)		168		60		60			60		90
Ouest (Bafoussam)		70			75				60		
Total	570	1,072	7,560	165	120	6,210	0	75	180	60	90

The total incremental filling facility investment requirement for these capacities is estimated as follows:

Table 51. Filling facility investment requirements to 2030

(€ millions)

Category	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Storage capacity	2.6	4.9	34.8	0.8	0.6	28.6		0.3	0.8	0.3	0.4
Filling capacity		6.6	0.3	0.5	0.4	0.8		0.2	0.6	0.5	0.4
Cylinder maintenance units		0.5	0.5	0.5		0.3				0.3	

The investment cost through 2029 (with no further investment required in 2030) is € 74 million for expanded storage, € 10 million for added filling equipment (carousels, etc.), and € 2 million for added cylinder maintenance equipment, totaling € 86 million.

SCDP investments

Even though SCDP is projected to own and operate 79% of the total capacity of the sector, due to economies of scale and other factors, the SCDP share of the incremental investment requirement was costed at just € 40 million, or 47% of the total of € 86 million. (Additional SCDP investments to improve safety and infrastructural flexibility were identified at € 10.7 million.) This includes the following specific elements:

- Increased LPG storage and pipeline capacity at the Bonaberi facility, comprising three new spherical units of 1,300 tonnes each and a new 8" pipeline for unloading LPG vessels. This could also delay the time by which a new terminal at Kribi would be required to come on line.
- Expansion of the Yaounde facility to the level of 40 KT per year, which will entail a separate assessment of its integration with the Yaounde hydrocarbon depot.
- Consistent utilization of filling carousels, palletizers, on-line scales and cylinder running stock.

The SCDP investments are grouped into five main phases, as shown in the following table:

Table 52. SCDP filling investment requirements summary
(€ millions)

Category	Investment Amount
Security and safety enhancements*	0.7
"Quick win" improvements (very rapid financial payback)*	10.0
Near-term scale-up (through 2021)	23.2
Medium-term scale-up (2022-2025)	14.1
Long-term scale-up (after 2025)	3.5
Total	51.5

* These items increase safety and improve operations but do not increase capacity per se

Capacity would increase in the following steps:

Table 53. SCDP filling capacity and storage build-out steps (KT)

Year	Capacity	Storage
2019	60	3.0
2020	170	9.5
2024	255	13.0
2028	315	14.0

SCDP asset and operational enhancements

Based on GLPGP's audit of the SCDP filling facilities, the following are highlighted as existing areas to be addressed as part of the overall build out of SCDP capabilities:

1. Governance of the LPG branch at SCDP
2. General safety considerations for SCDP sites
3. Control of LPG fuel
4. Efficiency in bulk loading and unloading
5. CAMRAIL operations
6. Product quantity reconciliation
7. Maintenance of the sites
8. Cylinder maintenance
9. Road transport optimization

1. *Governance of the LPG branch at SCDP*

Handling of LPG in cylinders is an atypical activity within the downstream petroleum sector, requiring specialized know-how that, if absent or lost when new hires are insufficiently trained and experienced operators retire, risks deterioration in the safety of filling facilities and safety of the cylinder for the user.

The operating rules of LPG filling plants, as applied by the profession, require ongoing monitoring by competent persons; contrary to the common practice of petroleum depots to have interchangeable staff reassigned regularly from position to position.

Key responsibilities include:

- Controlling the cylinders on arrival
- Checking the tare of the cylinder
- Deciding not to fill a defective cylinder and informing the cylinder-owning Marketer
- Maintaining a running stock, on pallets, by brand
- Regularly checking the accuracy of cylinder filling (no over- or under-filling)
- Ensuring strong safety discipline, processes, and systems
- Checking trucks for safety compliance before admitting them to the depot

SCDP does not provide a dedicated, LPG-specific management and professional structure, either at the depot level nor the national coordination level. This may limit SCDP's ability to drive sustained operational improvements throughout the organization, including for example palletizing, effective management of cylinder running stock, and truck safety. It is recommended that SCDP institute such a structure as part of executing its program of expansion and improvements.

For the same reason, there is insufficient accountability for handling of LPG bulk stock and its supply. If SCDP's legal and contractual status does not allow it to own the LPG stock outright and sell the LPG ex-filling plant according to the national price structure, it is recommended that SCDP create a subsidiary (e.g., SCDP GPL), as proposed in the national LPG Master Plan, that can centralize LPG accountability for LPG management, operations, and fuel control.

2. General safety considerations for SCDP sites

The examination of the SCDP filling plants was not intended to verify SCDP's safety policy. This said, a number of technical areas merit improvements, as follows:

- Lack of flame arrestors on LPG trucks entering the filling center;
- At Bertoua, the automatic sprinkler valve of the storage facilities was not connected, and all fire safety valves were not mounted in the "failsafe" position (that is, in the absence of power they default to the open position). For all sites, it is important for SCDP to ensure on an ongoing basis that:
 - Automatic fire valves are in the open position in the absence of power;
 - Automatic gas valves are in the closed position in the absence of power;
- An absence of thermal expansion valves on certain sections of liquid piping taken with 2 valves;
- 2 out of 3 fire safety groups had broken down at the Bafoussam site; and
- There was only one fire safety group at the Ngaoudere site; two are needed in case of failure.

3. Control of LPG fuel

SCDP is not responsible for ensure adequate and timely supply of LPG fuel. It is the Marketers that own the LPG stock located in the SCDP filling plants and that make consumption forecasts and organize the purchase of LPG for the sector through Tradex.

Dispatch orders from Bonaberi to the filling plants (SCDP plants and independent plants) are given by the Marketers without coordination of the overall product movements. The orders are given to the bulk carrier and paid by the respective Marketer. This cost is subject to the equalization refund⁶³ applicable to the Marketer, but which may in fact apply to the filling center only. This process tends to restrict product supply, limiting the recovery of stock. The situation is exacerbated by the low product receiving capacity at Bonaberi.

As a result, all the satellite filling plants throughout the country that are totally or partially dependent on LPG supply from Bonaberi, are frequently in short support of LPG.

Because SCDP, cannot directly supply its own LPG to address this, SCDP obliged to quota the number of trucks of the Marketers which exit the SCDP plants, or to use the stock owned by some Marketers to serve the orders of others. This entails performing a complex monthly stock reconciliation, which could be avoided if SCDP (or an SCDP GPL subsidiary) had its own stock that it could sell to Marketers on a supplemental basis, in case of shortage, or which it could sell to Marketers as the primary supplier, on an open-access utility basis.

The site of Yaoundé depends on the supply from Kribi Perenco. Bonaberi is in a similar situation. Kribi Perenco has insufficient LPG production to supply Yaoundé in full. Bonaberi, which must make up the supply gap, is not usually able to satisfy the regional demand.

⁶³ See Chapter 10 (Pricing) of the Feasibility Study for details.

The context analysis provided by Bonaberi indicates that its product shortfalls are a consequence of a lack of storage. Bonaberi is supplied by sea:

- Firstly, by a mixed LPG 250MT and liquid products coaster (*caboteur* in French) coming from the Limbe refinery,
- Secondly, by an LPG ship (currently, one owned or chartered by Geogas) whereby LPG is imported from the Gulf of Guinea. This LPG ship is limited in tonnage because of the draft available in the supply channel of the port of Douala. The maximum draft at the port of Douala is -7 meters compared to 0 LAT (Lowest Astronomical Tide). At high tide, the draft can be improved by one or two meters. This draft of -7m would allow the passage of a 6,000 MT LPG ship, with which SCDP has had experience in the past.

The storage at Bonaberi is 2,500 MT for support of an import volume of more than 93,000 MT/year, meaning that the storage rotation is less than 10 days. This 10-day turnover rate is extremely high by industry standards: it leaves no room for maneuver in terms of shipping delays and hazards, such as storms or damage.

The unloading of the ships received in Bonaberi requires three days and generally comprises 3,000 MT per delivery—provided that 2,500 MT of unused capacity is present in the storage spheres. This means that it is necessary to evacuate Bonaberi of 500 MT of LPG by truck whenever unloading a vessel. 500 MT translated to approximately 25 trucks to be loaded during the three day ship-unloading cycle. The two existing truck loading stations have a maximum loading capacity of 20 trucks if work is performed for two shifts.

In summary, Bonaberi has inadequate storage and inadequate truck loading capacity.

4. Efficiency in bulk loading and unloading

At all SCDP sites, pumping equipment are undersized. Loading and unloading trucks or rail tankers takes a long time, sometimes more than four hours for a rail tanker and more than two hours for unloading a 20 MT truck.

There are no international standards regarding these product transfer times, but it would be advisable to achieve the following transfer times:

Type	Target for Loading	Target for Unloading
Tank truck 20-22 MT	40 minutes	60 minutes
Rail tank 33 MT	60 minutes	90 minutes

5. CAMRAIL operations

The use of rail could be optimized if CAMRAIL, Cameroon's national railway company, complied with its commitment to optimize rail tanker transfers. Presently, it may take more than 12 days for a Bonaberi-Ngaoudere return trip instead of the committed seven days.

CAMRAIL has available for SCDP use 4 LPG wagons of 33 MT and three rail platforms of 16 MT ISO containers. These are dedicated to supplying Ngaoudere. The Yaoundé depot, although connected by rail,

is served by Bonaberi and Kribi via truck. Were SCDP to have enough rail tanks available, Yaounde could also be supplied by rail, which is less costly than by truck.

By acquiring five new rail tankers, CAMRAIL could create a complete LPG train (12 cars) and thereby minimize transfer costs (in cooperation with CSPH, which manages the transport adjustment levies). It is recommended that SCDP, CAMRAIL, and CSPH jointly pursue such a plan.

Meanwhile, CAMRAIL should optimize its trains with the few LPG cars available to improve the delivery cycle for SCDP.

6. *Product quantity reconciliation*

The filling plant examinations revealed recurrent product quantity reconciliation problems. That is, the quantity of product received by road or rail does not correspond to the reception gauging. This problem is due to:

- Inaccuracy of gauging instruments; and
- A volume/weight conversion based on uncertainty in the product density.

From an accounting point of view, these differences in weight are put in a "coulage" accounting line item managed by CSPH. The only effective way to measure the LPG product coming out of a site is the mandatory use of a weighbridge for all bulk trucks and rail tank.

It is therefore recommended that the Bonaberi site be equipped with a weighbridge truck and wagon, and Ngaoudere, which handles product transfer to Maroua, must also be equipped with a truck weighbridge.

7. *Maintenance of the sites*

SCDP sites have suffered from a clear lack of maintenance, which has serious consequences with respect to under-maintained safety systems (e.g., fire engine pump unit down, automatic watering valves out of order).

Other examples included:

- Many machines were not operational in the filling halls (e.g., leak detectors, weight control, filling scales);
- Lack of spare parts in the satellite filling sites; and
- Some storage units required repainting, to limit their oxidation.

It was beyond the scope of the project to perform a deep analysis of the maintenance status and regime in the national filling network; these examples are presented as indicative of the overall need to improve the management of, and accountability for, maintenance, and to ensure sufficiency in future of maintenance activities and budgets.

8. *Cylinder maintenance*

The cylinder park is owned by the Marketers; SCDP has no responsibility with respect the quality of the cylinders except to scrap those which leak. Regrettably, the quality of the cylinder park present in the SCDP filling centers during the site audit process was very poor.

There should be recertification of all cylinders at ten years of age (or sooner), timely repair of damage to cylinder shrouds and feet (base), regular repainting in accordance with the cylinder brand, and washing of all cylinders passing through the facilities. All of these were lacking.

Figure 28. Examples of cylinder quality at SCDP facility (2018)



These cylinders are in very poor condition.

With respect to cylinder manufacturing quality, there is high variation across the different brands. Some cylinders made in China do not have tare markings (AZA), which is illegal. Cameroonian regulation on the specifications for gas cylinders exists, and it should be respected and enforced. Non-compliant cylinders should be scrapped upon arrival at SCDP.

This situation is largely due to the lack of cylinder inventory maintained by the Marketers at the filling plants. This forces the Marketers to push for very rapid turnaround of existing cylinders, without spending the time to remove cylinders to perform maintenance and for the mandatory decennial hydraulic test.

As discussed in Chapter 3, the investment plan presented in this report includes adequate cylinder buffer and working stock quantities to address these shortages, thereby permitting proper cylinder maintenance procedures to be followed without undue pressure from certain Marketers to skip them.

9. Road transport optimization

The bulk transport of LPG by road in Cameroon is generally done by truck with semi-trailers of 20-22 MT capacities. These semi trailers are equipped with double or triple axles.

Other countries in Africa and Europe use 56,000 liter (28 MT) tanks mounted on 3-axle semi-trailers with maximum axle loads of 10 tonnes. It was beyond the scope of the project to investigate the rationale for using smaller, 20-22 MT trucks in Cameroon, which move 20-25% less LPG per trip.

Geographic capacities and flows of Bottling Plants

In 2017, non-SCDP bottling plants were located as follows:

- Douala: BOCOM, SCTM, ASA, KC
- Yaoundé: DCTM, Green Oil, Star, ASA

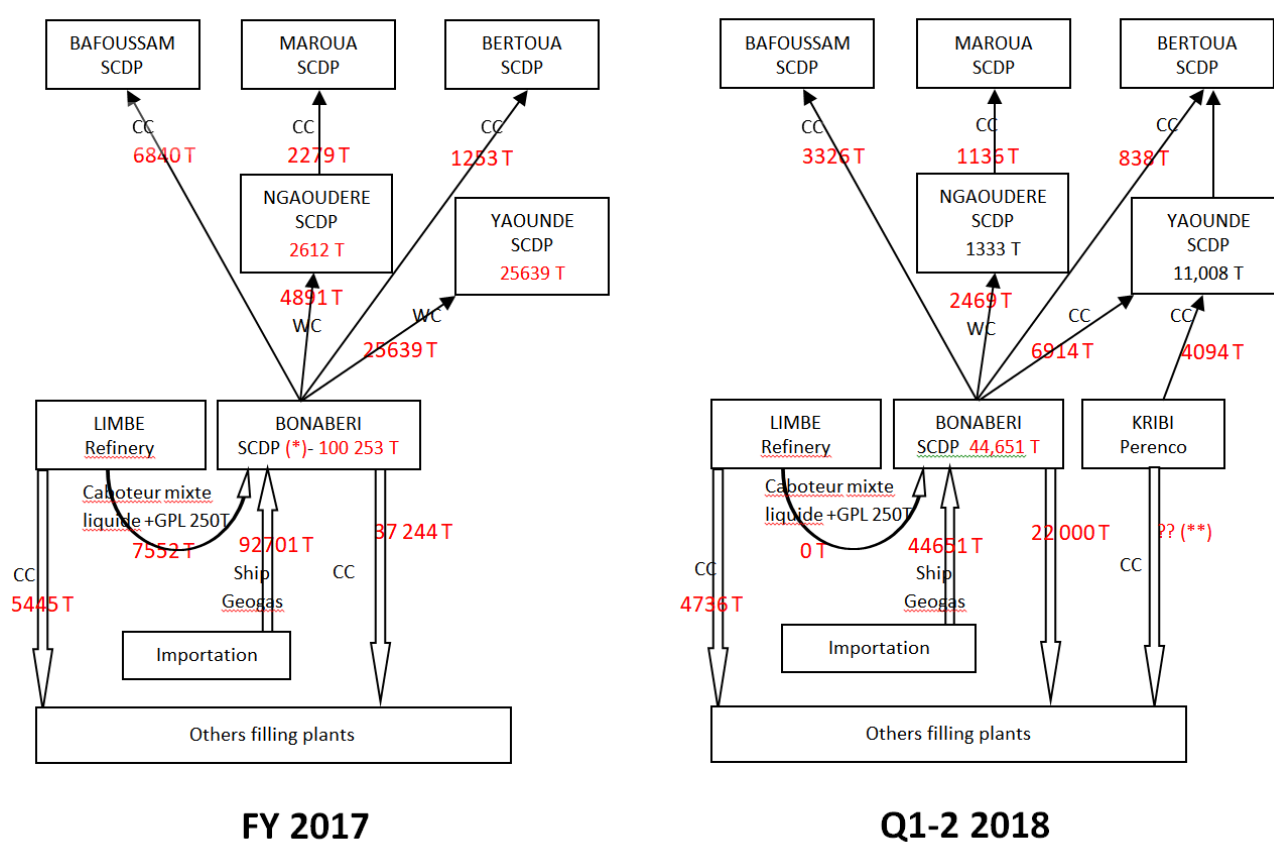
The capacities in recent years were as follows:

Table 54. Historical SCDP and non-SCDP filling plant capacities

	2016	2017	2017 as %
SCDP filling plants	56,336 MT	58,072 MT	56%
Other Marketer's filling plants	37,645 MT	45,287 MT	44%
TOTAL	93,981 MT	103,359 MT	100%

The following diagrams show the product flows and quantities as organized in 2017 and in Q1-Q3 2018:

Figure 29. Product flows (2017-2018 H1)



CC= Camion citernes (tank truck)

WC= Wagon citerne Rail tank)

(*) Emplissage bouteilles Bonaberi=19 449 T- Bonaberi cylinder filling 19 449 T

(**) Volumes KRIBI vers centres marketers inconnus mais très faibles en rapport avec les volumes du pays

The following two figures present the logistical schemes of SCDP plants and non-SCDP plants, respectively. Decisions about how to route LPG are taken by CSPH.

Figure 30. SCDP logistical scheme (2018)

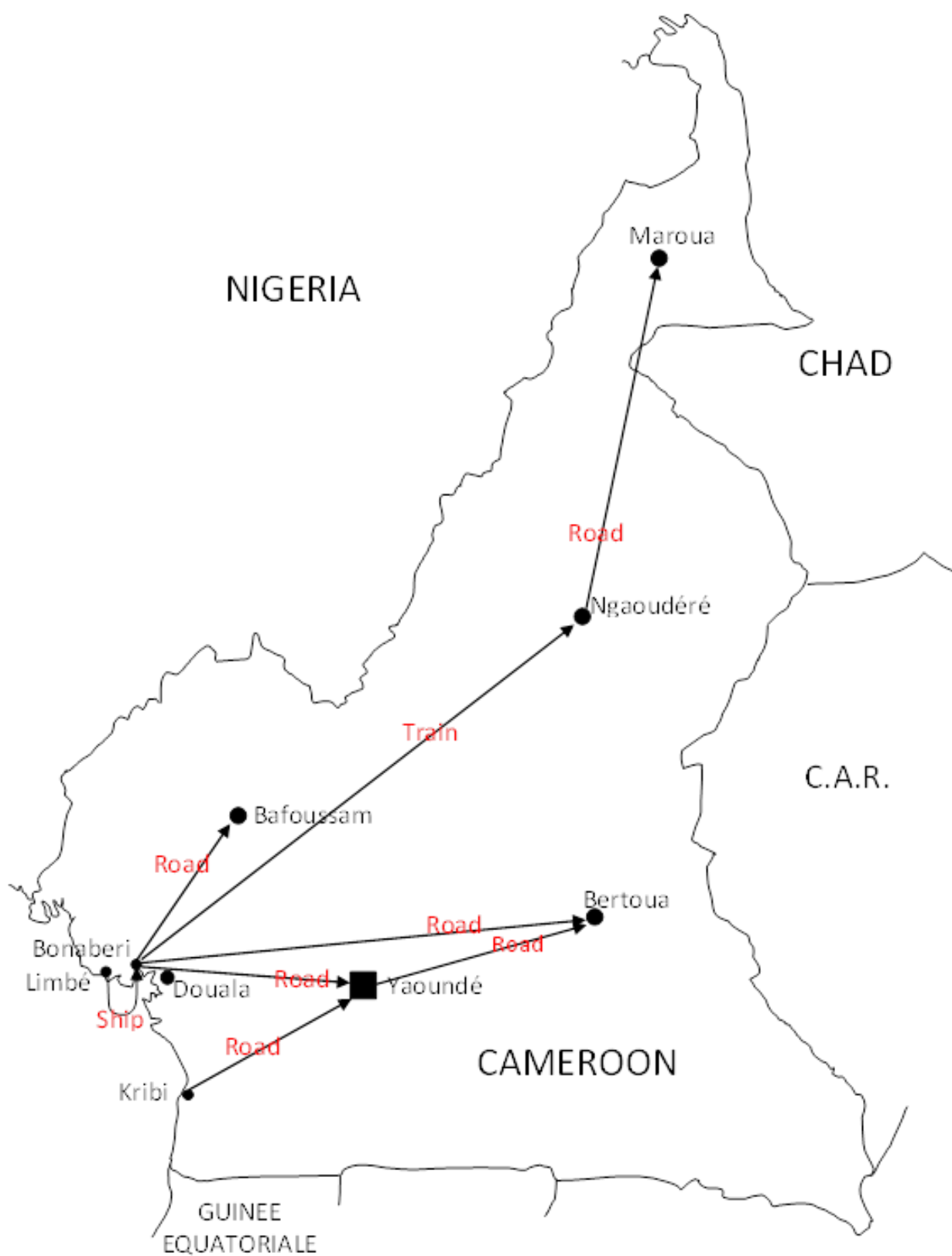
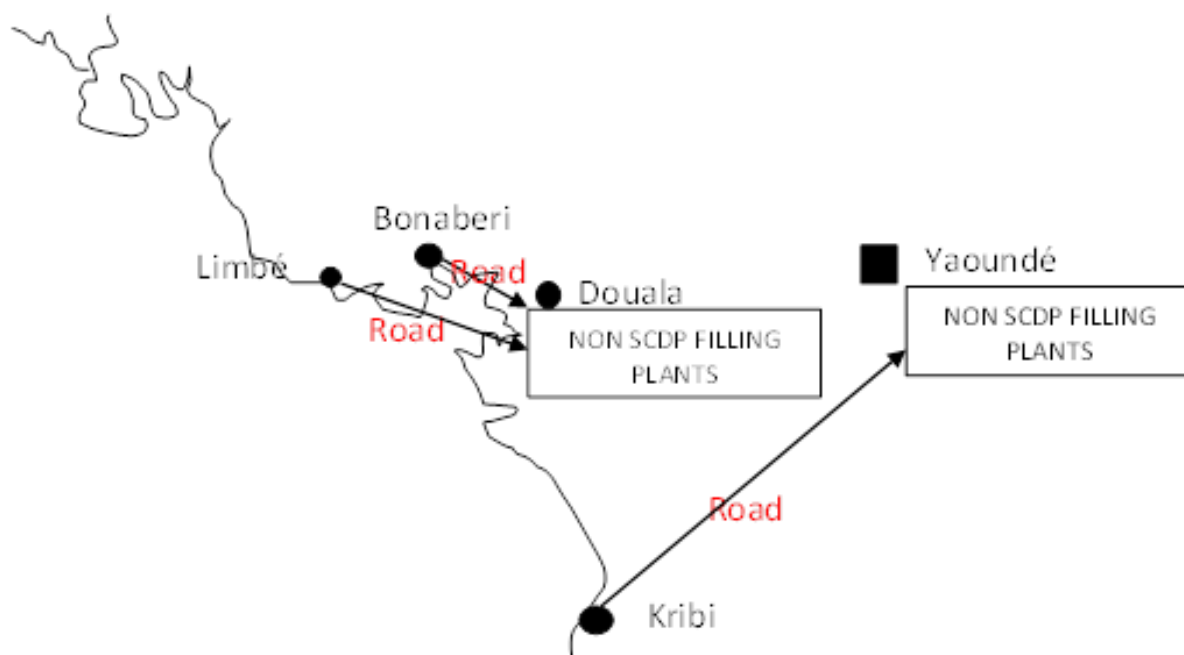


Figure 31. Non-SCDP logistical scheme (2018)



BP site characteristics

The following table summarizes the site characteristics:

Table 55. Bottling Plant site characteristics (2017)

Site	Storage	Tonnage 2017 B: Bulk C: Cylinder	Filling	Supply S:Sea T:Rail R:Road	Gas pumping (m ³ /h)	Fire water storage	Fire fighting Pumping	Environ- ment	Safety
Bonaberi	2 500T : 80 500 T B 5x 500T	19 500 T C	Carousel 18 stages (12 operational) 4 Scales	S T R	2x30 1x20	2500 m ³	900 m ³ /h	RAS	RAS 7l/m ² /min – 2.8h
Yaounde	1000T : 25 600 T C 2x 500T	25 600 T C	Carousel 23 stages 4 Scales	T R	2x35 1x40	3890 m ³	2250 m ³ /h	Domino	RAS 7l/m ² /min – 10h
Bafoussam	171T : 6 900 T C 1x150T 1x21T	6 900 T C	7 Scales	R	2x25	800 m ³	575 m ³ /h	Domino	7 l/m ² /min – 50h No gas detection Fire pump out of order
Bertoua	100T : 1 265 T C 4x 25T	1 265 T C	4 Scales	R	2x12	1000 m ³	400 m ³ /h	RAS	10 l/m ² /min-4h RAS
Ngaoundere	95 T : 2 300 T B 2x35T 1x25T	2 300 T B 2 600 T C	8 Scales	T R	3x25	250 m ³	225 m ³ /h	Domino	8.3 l/m ² /min-1.5h Fire water tank too small Only 1 Fire Pump
Maroua	105T : 2 200 T C 3x35T	2 200 T C	5 Scales	R	1x25	780 m ³	120 m ³ /h	RAS	5.6 l/m ² /min-6.5h No gas detection

SCDP bottling plant investments

The bottling plant portion of the investment plan covers three categories, as follows:

- **Safety:** investments recommended as essential to comply with the minimum safety requirements of international LPG industry standards.
- **Quick win:** Near-term Investments that immediately improve productivity.
- **Near-, medium- and long-term expansion:** based on volume growth as projected in the investment plan. Unless otherwise noted, near-term is in or around 2020, medium-term in or around 2024, and long-term in or around 2028.

Independent Marketers that do not utilize SCDP did not provide information on specific plans and sites for expanding their non-SCDP bottling footprints. Therefore, their investments in complementary in-house bottling plants, while included in the investment plan in terms of capacity and financing aspects, are not provided with technical descriptions in this Chapter.

The following three subsections provide general comments with respect to each SCDP BP investment category. Thereafter, the details for each plant (new and expansion) are provided.

Safety investments

Fire network: At all existing sites, bring the fire-fighting flow rate calculated for the storage greater than or equal to 7 liters / m² / minute, which corresponds to the average standard typically applied as of the 1980s. Modern international standards, API, NFPA 58, and European regulations are now based on flows of 10 litres / m² / minute for a duration of two hours.

The additional storage covered in this investment plan are specified with the modern international standard watering rate of 10L / m² / minute for two hours.

Gas and flame detection: Apart from Maroua, SCDP filling centers are equipped with at least gas detectors on the storage. For plants that are not equipped or are partially equipped, it is necessary to supplement these gas detectors with sensors on all hotspots where the presence of a gas leak is likely: the filling hall, gas pumping, and truck and wagon loading bays. For flame detection, it is necessary to apply this on all storage and all truck and wagon loading bays.

Automation: The gas and flame detections must be used to control the safety of the site and automatically start the fire groups.

Gas detection at 50% LEL or flame detection triggers safety measures for the overall safety of the installation: closing of the automatic valves, shutdown of the pumps and compressors, start of the fire groups.

Where this does not exist, emergency stop buttons should be positioned at strategic locations (gas pumps, loading bays), and with easy access in filling halls to secure the site (stop pumps and compressors, closing automatic storage valves and wagon-truck loading/unloading).

Automatic valves on loading/unloading bays: All truck and wagon loading stations must be equipped with automatic valves. Via a push-button, these valves and the pumping systems are automatically closed.

Storage investments

Turnover rates: For this study, the rotation rate of the storage according to the filling volumes was determined to be 36 (10 days of stock), except for Maroua and Garoua, which are specified to be 24 (15 days of stock) to account for distance and for potential transport difficulties.

Filling investments

Carousel: The filling carousel becomes necessary when the volume passes the threshold of about 10,000 MT.

Palletizer: A palletizer becomes necessary when the site is equipped with a filling carousel. For sites equipped with scales in lines and/or with low volumes would not be equipped with carousels but will nonetheless use pallets for storage of the cylinders and management of the cylinder working stock. Pallets and palletizers optimize productivity and prevent breakage.

Cylinder recertification: All filling plants, large or small, must be able to recertify the cylinders. This procedure is mandatory every ten years. The method to be used to verify up-to-date recertification of cylinders will have to be validated by all relevant stakeholders.

Cylinder washing and painting: SCDP should offer marketers the option of paying for washing of the cylinders and the application of fresh commercial paint as required. The investment linked to this service is outlined in more detail hereafter.

SCDP safety and quick-win investments

Table 56. SCDP safety and quick-win investment summary

Site	Safety	Quick win
Bonaberi	<ul style="list-style-type: none"> Gas detection: gas pumping, loading bays, filling hall Flame detection: the pumping station, loading / unloading bay Automation Automatic valves loading/unloading bay 	<ul style="list-style-type: none"> Weightbridge for rail and truck LPG pumping: loading/unloading bay – rail and truck 1 new truck loading bay Mounded stockage 3,900 T Pipe 8" to the port 3 new truck loading bays
Yaounde	<ul style="list-style-type: none"> Gas detection: gas pumping, loading bays, filling hall Flame detection: the pumping station, loading / unloading bay Automation Automatic valves loading/unloading bay 	<ul style="list-style-type: none"> LPG pumping on loading/unloading bay- rail and truck
Bafoussam	<ul style="list-style-type: none"> Gas detection: gas pumping, loading bays, filling hall Flame detection Automation Automatic valves unloading bay 	
Bertoua	<ul style="list-style-type: none"> Automation 	
Ngaoundere	<ul style="list-style-type: none"> Gas detection: gas pumping, loading bays, filling hall Flame detection Automation Automatic valves loading/unloading bay 2nd fire fighting group 225m³/h 	<ul style="list-style-type: none"> Weightbridge for truck LPG pumping: loading/unloading bay – rail and truck – 50m³/h pump and 691 compressor Additional stockage to supply Maroua

Site	Safety	Quick win
Maroua	<ul style="list-style-type: none"> Gas detection: gas pumping, loading bays, filling hall Flame detection Automating Automatic valves unloading bay 2nd fire fighting group 120m³/h 	<ul style="list-style-type: none"> Pump 30m³/h

Bonaberi site

Safety investments

- The Bonaberi site is equipped with gas detection on the storage; this gas detection to be extended to the loading stations for trucks and wagons, gas pumping, and the filling hall.
- The site is equipped with flame detection on the storage; this flame detection to be extended to truck and wagon loading stations and to gas pumping.
- Upon installation of this gas detection extension, review the servocontrols related to gas and flame detection.
- Installation of automatic valves on loading and unloading bays and servocontrol when activating a push button and DCMT when it exists.

Quick-win investments

- **Storage:**

Bonaberi is currently the only point of entry for imported LPG. (The Kribi import project has not yet been realized.)

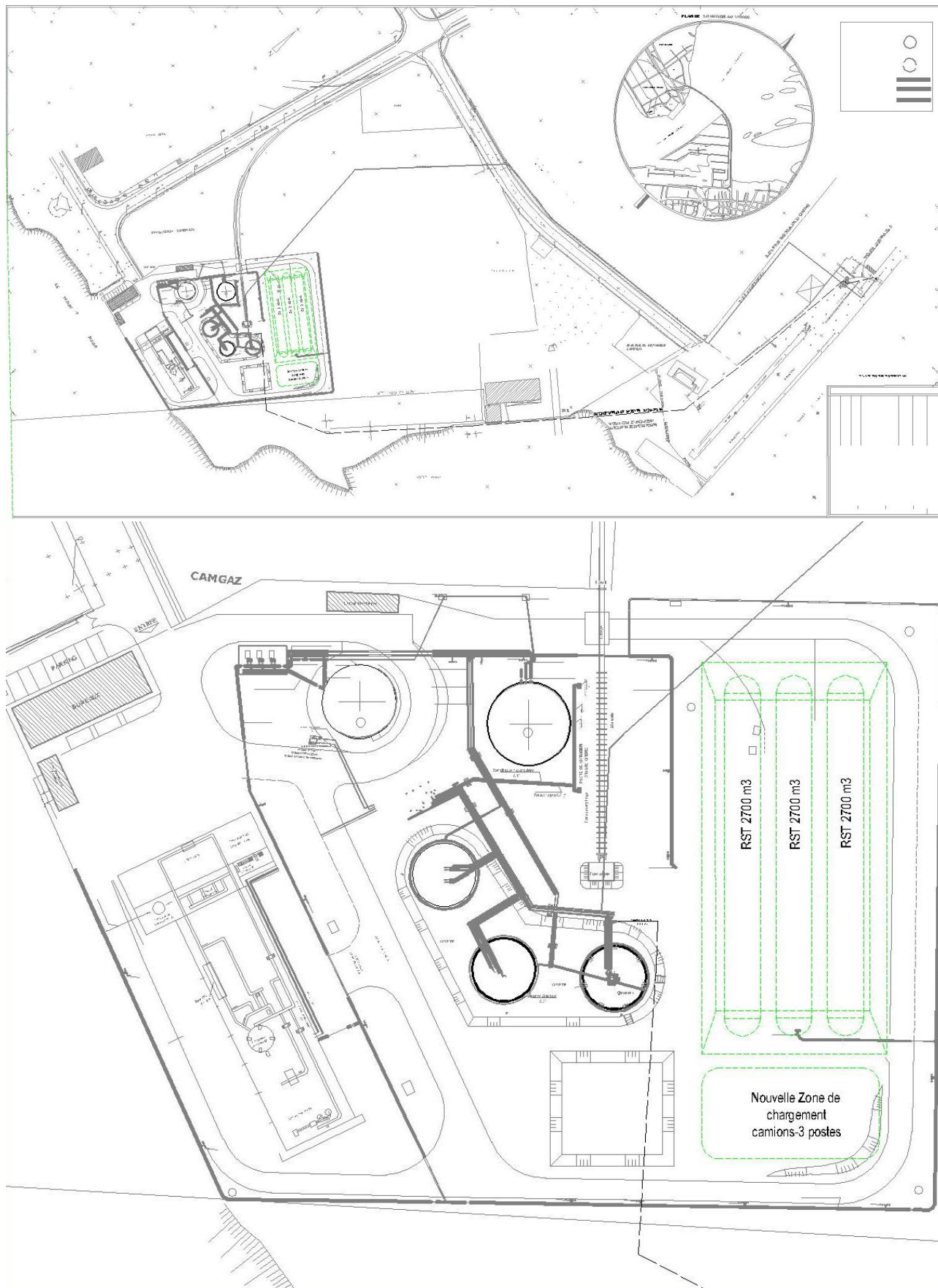
The turnover rate of Bonaberi storage (2.500 MT) is 40—that is, less than 10 days of national consumption stock. This turnover rate is very high and does not allow any buffer for disruption or delay of supplies by sea. Adverse weather conditions or an incident in the port would immediately affect the country's supply. In addition, the low storage capacity at Bonaberi limits importation to maximum 3,000 – 3,500 MT per ship discharge, while the available draft of the port of Douala (7m) would otherwise allow cargoes of 6,000 tons.

It is possible to implement three mounded tanks of 1,300 MT in place of the Marketers' hangar on the existing site. Mounded storage has the advantage of eliminating the risk of BLEVE⁶⁴. does not need additional fire protection, and allows set-up with lower regulatory distances from surrounding structures.

The following figure diagrams the site plan with respect to the recommended tanks:

⁶⁴ Boiling liquid expanding vapor explosion

Figure 32. Bonaberi site diagrams



The following are the additional quick-wins for Bonaberi:

- **Pipe 8 " 650m:** Installation of an 8 " pipe to improve the ship unloading time. The existing 4" pipe will be reused as a gas balance pipe and will drain the 8" pipe at the end of ship unloading.
- **New truck filling stations:** it will be necessary to take advantage of the installation of new storage facilities to set up a new truck loading area to make the evacuation of the product more fluid and functional- 3 loading bays.
- **Mass balance:** The Bonaberi site sends LPG by train or truck to SCDP filling plants and Marketers' plants. The quantities are always challenged upon receipt because the method of calculating the quantities shipped or received is done by converting volumes by weight via the density of the product:
 - The calculation of the volume has a margin of error, because it is done by level difference in the storage via a calibration table.
 - The density calculation is approximate because it is done by averaging the product densities received per shipment.

This results in deviations that are put in a "*coulage*" budget line.

To alleviate these uncertainties and limit the "*coulage*" accounting line, a weighbridge to weigh the trucks and rail wagons at the exit of the site will eliminate all future disputes.

- **Pumping:** Truck and railcar loading times are unnecessarily long—more than an hour to load a 20 MT truck and two hours to load a rail tanker. By means of a large pumping set (80m³ / h per loading station) and pipes adapted to the desired flow rates, it will be possible to load a 20 MT truck in 30 minutes and a rail tanker in one hour.
- **Loading station:** Bonaberi only has two truck loading bays. A third station will eliminate bottlenecks. (This item was already in SCDP's plans for future implementation.)

Expansion investments

Near term:

- 5 new rail tankers
- Palletizer
- 2 x 4 on line scales for 6 kg cylinders
- As the national investment program is implemented, Bonaberi will pass the milestone of 25,000 tons of filling within 2-3 years. The 18-stage carousel must be complemented by a second filling line with a 24-stage carousel (18 scales) to enable future throughput up to the level of 55,000-60 000 tpa. It will concurrently be necessary to widen the existing filling hall
- Re-testing set: 10 cylinder retesting machines and accessories (water test balloons, valve unscrewing/screwing machine, etc.)

Medium term:

- The required increase in throughput for filling 12.5 kg cylinders will be ensured by adding eight additional scales on the 24-stage carousel, while the increase of 6 kg cylinder volumes is ensured by adding an 8-stage carousel.

Long term:

- To add additional capacity, the facility may go from single shift to double shift or triple shift operations.

Impact on staff

The following table projects the staffing requirement associated with the increased throughput:

Table 57. Bonaberi BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	6	4	8	4
Additional staff for cylinder testing	0	3	6	9	9
Total	0	9	10	17	13
Cumulative	0	9	19	36	49

Note: The increase in Douala storage to 6,400 MT will ensure an annual supply of product for the country up to about 200 KT per year. Beyond these 200 KT, a new marine terminal (such as the planned Kribi terminal) must come on line to handle some of the Bonaberi volumes. Alternative importation solutions, such as floating storage facilities, could temporarily offset the need to realize the Kribi project.

Yaoundé site

Safety investments

- The Yaoundé site is equipped with gas detection on the storage; this gas detection to be extended to the loading stations for trucks and wagons, to gas pumping, and to the filling hall.
- The Yaoundé site is equipped with flame detection on the storage; this flame detection to be extended to truck and wagon loading stations and to gas pumping.
- Upon installation of the gas detection extension, review the servocontrols related to gas and flame detection.
- Installation of automatic valves on loading and unloading bays and push-button activated servocontrol and DCMT when it exists.

Quick-win investments

- Truck and railcar loading times are too long, more than an hour to load a 20 MT truck and two hours to load a rail tanker. By means of a large pumping set (80m³ / h per loading station) and pipes adapted to the desired flow rates, it will be possible to load a 20 MT truck in 30 minutes and a rail car in one hour.

Expansion investments

Near-term investments are recommended to be limited to safety investments at the absolute minimum level to ensure safe filling.

Palletizing and cylinder re-testing equipment will be installed in a new filling center to be built in Yaounde.

Near term:

- In the near term, awaiting relocation of the filling plant, an 18-stage carousel will ensure adequate throughput on 12.5 kg cylinders, and installation of four scales on lines on conveyor will adequately increase the filling capacity on 6kg cylinders (and could also be used to supplement 12.5 Kg cylinders when necessary).

Medium term:

- Given the immediate proximity of the hydrocarbon deposit and the positioning of the filling plant in its activity area, it is recommended to create another filling center at Yaoundé which will ensure total regional throughput (40 KT for the long term), upon which the existing Yaoundé site will be dismantled. This new filling center will be connected to the rail network.

New filling plant in Yaoundé:

- Long-term capacity of 40,000 MT, sized initially for 30,000 MT
- Storage of 1,000 MT
- 1 filling hall 20x35m ,700 m², carousel 24 stages equipped with 24 scales for 12.5 kg, 8 on line scales for 6kg cylinders, 2 stationary scales for 35 Kg cylinders, palletization
- Palletizer 11 cages
- Cylinder retesting set
- 1 railcar unloading bay
- 1 truck loading/unloading bay
- Gas pump room
- Fire fighting set; pump, fire network, water tank storage, etc.
- Buildings
- Truck and railcar weightbridge
- Gas and flame detection

Long term:

- Increase of storage capacity by 600 MT
- 8-stage carousel for 6 kg cylinders

Impact on staff

The following table projects the staffing requirement associated with the increased throughput:

Table 58. Yaoundé BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	6	0	4	0
Additional staff for cylinder testing	0	3	3	0	0
Total	0	3	3	4	0
Cumulative	0	3	6	10	10

Bafoussam site

Safety investments

- Gas detection on the loading stations for trucks and wagons, gas pumping, and the filling hall.
- Flame detection.
- Servocontrols related to gas and flame detection.
- Automatic valves on loading and unloading bays and servocontrol when activating a push button and DCMT when it exists.

Quick-win investments

- N/A

Expansion investments

Bafoussam had 7,000 MT production in 2017 on 171 MT of storage with 7 scales; rotation rate of 40.

Near term:

- N/A

Medium term:

- Carousel 24 stage - 18 scales 12.5 kg
- 4 Scales on line 6 kg
- Palletizer and pallets
- Forklift
- Cylinder requalification set - 10 stages
- 500 MT additional storage

Long term:

- 6 scales 12.5 kg
- Carousel 12 stage - 6 kg

Impact on staff

The following table projects the staffing requirement associated with the increased throughput:

Table 59. Bafoussam BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	2	4	2	0
Additional staff for cylinder testing	0	3	3	0	0
Total	0	5	7	2	0
Cumulative	0	5	12	14	14

Bertoua site

Safety investments

- As the site has been constructed relatively recently, there are only minor safety investments to be made: servocontrols for gas and flame detectors, automatic valves on loading and unloading bays and a push-button activated servocontrol and DCMT when it exists.

Quick-win investments

- N/A

Expansion investments

Bertoua has 1,400 MT throughput and 100 MT of storage with four scales.

Near term:

- 4 scales on a line - 12.5 kg
- 4 scales on a line – 6 kg
- Cylinder requalification set – 10 stages
- Additional 100 MT storage

Medium term:

- 4 scales on a line – 12.5 kg
- Additional 250 MT storage

Long term:

- Carousel 24 stage – 18 scales 12.5 kg
- Palletizer and pallets

Impact on staff

The following table projects the staffing requirement associated with the increased throughput:

Table 60. Bertoua BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	2	2	2	0
Additional staff for cylinder testing	0	3	3	0	0
Total	0	5	5	2	0
Cumulative	0	5	10	12	12

Ngaoudere site

Safety investments

- Gas detection on the loading stations for trucks and wagons, gas pumping, and the filling hall
- Flame detection
- Servocontrols related to gas and flame detection
- Automatic valves on loading and unloading bays and push-button servocontrol and DCMT when it exists
- 2nd fire fighting group
- Increase fire water storage to support a minimum of 2 hours of sprinkling on the tanks

Quick-win investments

- Weighbridge for trucks
- Pumping increase on truck and railcar loading/unloading bays: Pump 50 m³/h and 691 compressor and piping
- 150 MT storage increase, to supply Maroua

Expansion investments

Ngaoudere has 3,400 MT throughput and 95 MT storage with 8 scales.

Near term:

- 4 scales on line – 12.5 kg
- 4 scales on line – 6 kg
- Additional 150 MT of storage (as mentioned above under *Quick-win investments*)
- Cylinder requalification set – 10 stages

Medium term:

- 4 scales on line – 12.5 kg
- 4 scales on line – 6 kg
- Additional 150 MT of storage

Long term:

- Carousel 24 stages – 18 scales 12.5 kg
- Palletizer and pallets

Impact on staff

The following table projects the staffing requirement associated with the increased throughput:

Table 61. Ngaoudere BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	2	2	2	0
Additional staff for cylinder testing	0	3	3	0	0
Total	0	5	5	2	0
Cumulative	0	5	10	12	12

Maroua site

Safety investments

- Gas detection on storage, loading stations for trucks and wagons, gas pumping, and the filling hall
- Flame detection
- Servocontrols related to gas and flame detection
- Automatic valves on loading and unloading bays and push-button servocontrol and DCMT when it exists
- 2nd fire fighting group 120 m³/h

Quick-win investments

- 30m³/h pump

Expansion investments

Maroua has 4,800 MT throughput and 105 MT of storage with 5 scales.

Near term:

- Carousel 24 stages - 16 Scales 12.5 Kg
- 4 Scales on line - 6 kg
- Palletizer
- Forklift
- Cylinder requalification set - 10 stages
- Additional 500 MT of storage

Medium term:

- 8 scales on carousel - 12.5 kg
- 4 scales on line – 6 kg
- Additional 500 MT of storage

Long term:

- Carousel 8 stages – 6 kg
- Additional 500 MT of storage

Impact on staff

The following table projects the staffing requirement associated with the increased throughput:

Table 62. Maroua BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	6	2	4	0
Additional staff for cylinder testing	0	3	3	3	0
Total	0	9	5	7	0
Cumulative	0	9	14	21	21

Garoua site (new site)

New filling plant in 2020:

- Sized for 21,000 MT
- Initial storage of 400 MT, with a planned rotation rate of 24 to accommodate the challenges of transport
- The filling hall will be sized to accommodate a carousel and palletization.
- 4 scales on line – 12.5 kg
- 1 scale stationary – 35kg
- Cylinder requalification set – 10 stages

Medium term:

- Carousel 18 stages – 12.5 kg
- Palletizer and pallets
- Forklift
- Additional 400 MT of storage

Long term:

- Additional 800 MT of storage (2028)
- Additional 800 MT of storage (2030), if required

Staffing

The following table projects the staffing requirement associated with the plant and its expansion:

Table 63. Garoua BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	8	6	4	0
Additional staff for cylinder testing	0	2	1	3	0
Total	0	10	7	7	0
Cumulative	0	10	17	24	24

Kribi site (new site)

New filling plant in 2020:

- Sized for 13,000 MT
- Initial storage of 200 MT, with a planned rotation rate of 36
- The filling hall will be sized to accommodate a carousel and palletization
- 4 scales on line – 12.5 kg
- 4 scales on line – 6 kg
- 1 scale stationary – 35kg
- Cylinder requalification set – 10 stages

Medium term:

- Carousel 12 stages – 12.5 kg
- Palletizer and pallets
- Forklift
- Additional 200 MT of storage

Long term:

- N/A

Staffing

The following table projects the staffing requirement associated with the plant and its expansion:

Table 64. Kribi BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	8	6	2	0
Additional staff for cylinder testing	0	2	1	3	0
Total	0	10	7	5	0

Cumulative	0	10	17	22	22
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Kumba site (new site)

New filling plant in 2020:

- Sized for 30,000 MT
- Initial storage of 400 MT, with a planned rotation rate of 36
- The filling hall will be sized to accommodate two carousels and palletization
- 4 scales on line – 12.5 kg
- 4 scales on line – 6 kg
- 1 scale stationary – 35kg
- Cylinder requalification set – 10 stages

Medium term:

- Carousel 18 stages – 12.5 kg
- Palletizer and pallets
- Forklift
- Additional 500 MT of storage

Long term:

- Carousel 12 stages – 6 kg

Staffing

The following table projects the staffing requirement associated with the plant and its expansion:

Table 65. Kumba BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	8	6	6	0
Additional staff for cylinder testing	0	2	1	3	0
Total	0	10	7	9	0
Cumulative	0	10	17	26	26

Bamenda site (new site)

New filling plant in 2020:

- Sized for 33,000 MT
- Initial storage of 400 MT, with a planned rotation rate of 36

- The filling hall will be sized to accommodate two carousels and palletization
- 4 scales on line – 12.5 kg
- 4 scales on line – 6 kg
- 1 scale stationary – 35kg
- Cylinder requalification set – 10 stages

Medium term:

- Carousel 18 stages – 12.5 kg
- Palletizer and pallets
- Forklift
- Additional 500 MT of storage

Long term:

- Carousel 12 stages – 6 kg

Staffing

The following table projects the staffing requirement associated with the plant and its expansion:

Table 66. Bamenda BP staff ramp-up to 2030

	2018	2020	2024	2028	2030
Additional staff for filling	0	8	6	6	0
Additional staff for cylinder testing	0	2	1	3	0
Total	0	10	7	9	0
Cumulative	0	10	17	26	26

Summary of new and added SCDP BP capacities

The following tables summarize the capacity additions presented above.

Table 67. Summary of SCDP BP storage capacity additions to 2030

BP Site	2018	2020	2024	2028	2030
BONABERI	2,500 T	6,400 T	6,400 T	6,400 T	6,400 T
YAOUNDE			1,000 T	1,200 T	1,200 T
BAFOUSSAM	171 T	671 T	671 T	971 T	971 T
BERTOUA	100 T	200 T	450 T	450 T	450 T
NGAOUDERE	95 T	245 T	395 T	395 T	395 T
MAROUA	105 T	605 T	1,105 T	1,605 T	1,605 T
GAROUA		400 T	800 T	800 T	800 T
KRIBI		200 T	400 T	400 T	400 T
KUMBA		400 T	900 T	900 T	900 T

BP Site	2018	2020	2024	2028	2030
BAMENDA		400 T	900 T	900 T	900 T
TOTAL SCDP	2,971 T	9,521 T	13,021 T	14,021 T	14,021 T

Table 68. Summary of SCDP BP volume-storage ratios to 2030

	2018	2020	2024	2028	2030
Volume	70,752 T	97,875 T	179,772 T	259,233 T	296,604 T
Storage	2,971 T	9,521 T	13,021 T	14,021 T	14,021 T
Ratio volume/storage	23.8	10.3	13.8	18.5	21.2

Table 69. Summary of SCDP BP filling equipment capacity additions to 2030

BP Site	Number of Scales				
	2018	2020	2024	2028	2030
BONABERI	22 scales	54 scales	62 scales	62 scales	62 scales
YAOUNDE	27 scales	31 scales	34 scales	42 scales	42 scales
BAFOUSSAM	7 scales	29 scales	47 scales	47 scales	47 scales
BERTOUA	4 scales	12 scales	16 scales	34 scales	34 scales
NGAOUDERE	8 scales	16 scales	24 scales	42 scales	42 scales
MAROUA	5 scales	25 scales	37 scales	45 scales	45 scales
GAROUA	0 scales	9 scales	27 scales	27 scales	27 scales
KRIBI	0 scales	21 scales	21 scales	21 scales	21 scales
KUMBA	0 scales	9 scales	27 scales	39 scales	39 scales
BAMENDA	0 scales	9 scales	27 scales	39 scales	39 scales
TOTAL	73 scales	215 scales	322 scales	398 scales	398 scales

Table 70. Summary of SCDP BP staffing additions to 2030

BP Site	Increase in Staff (Cumulative)				
	2018	2020	2024	2028	2030
BONABERI	0	9	19	36	49
YAOUNDE	0	3	6	10	10
BAFOUSSAM	0	5	12	14	14
BERTOUA	0	5	10	12	12
NGAOUDERE	0	5	10	12	12
MAROUA	0	9	14	21	21
GAROUA	0	10	17	24	24
KRIBI	0	10	17	22	22
KUMBA	0	10	17	26	26
BAMENDA	0	10	17	26	26
TOTAL	0	76	139	203	216

BP costing

The following set of tables summarizes the costing estimates for the new and expanded BPs. The first of the set summarizes the details.

Table 71. Summary of BP costing by stage/type of investment, to 2030
(€ 000)

BP Site	Safety	Quick win	Near term	Middle term	Long term	Total
BONABERI	117	9,279	1,633	102	-	11,131
YAOUNDE	124	104	47	5,594	902	6,771
BAFOUSSAM	118	-	1,857	924	-	2,899
BERTOUA	40	-	694	547	210	1,491
NGAOUDERE	158	611	360	394	295	1,817
MAROUA	143	30	1,849	1,328	1,352	4,703
GAROUA	-	-	4,152	1,431	-	5,582
KRIBI	-	-	3,967	767	-	4,734
KUMBA	-	-	4,282	1,550	602	6,434
BAMENDA	-	-	4,282	1,550	102	5,934
TOTAL	700	10,024	23,123	14,187	3,463	51,496

Table 72. BP costing: Bonaberi

Site	Objet	Safety	Quick win	Near term	Middle term	Long term
BONABERI	Gas detection (central if necessary, sensors, cabling)	X	35,000 €			
	Flame detection (central if necessary, sensors, cabling)	X	36,000 €			
	Gas & Flame automation-wired logic- cabling and accessories	X	18,000 €			
	Automatic valves on loading/inloading bays and automation	X	28,000 €			
	Truck weightbridge			X	75,000 €	
	Wagon weightbridge			X	120,000 €	
	LPG pumping trucks and wagons loading bays			X	104,000 €	
	1 new truck loading bay			X	70,000 €	
	Mounded storage 3900T			X	7,880,000 €	
	Pipe 8" to the port			X	650,000 €	
	3 new truck loading bay			X	380,000 €	
	5 new tank wagons				X	900,000 €
	Paletization				X	165,000 €
	Forklift				X	50,000 €
	palets				X	80,500 €
	Cylinder Retesting machine -10 stages, emptying machine 3 & 12.5 Kg, pump, retesting balloon, valve screwing/unscrewing machine and accessories				X	135,000 €
	4 on line scales 6 Kg				X	47,000 €
	Filling hall extension (Civil works and metal structure, miscellaneous)				X	120,000 €
	Additional Carousel 18 stages -24 scales 12.5 Kg				X	135,000 €
	Carrousel 8 stages 6 Kg					X
TOTAL			117,000 €	9,279,000 €	1,632,500 €	102,000 €
					TOTAL	11,130,500 €

Bonaberi cost-benefit analysis

The following table shows the payback calculation applicable to the storage, pipe and carousel stage investments at Bonaberi:

Table 73. Bonaberi BP quick-win investment cost-benefit analysis for new storage, 8" pipe and loading bays

BONABERI	Storage + 8" pipe + loading bays	QYearité	P Unit €	Total
CAPEX	Engineering, supervision	1	400,000 €	400,000 €
	Destruction of the marketers building and preparation	1	150,000 €	150,000 €
	3 x 1300 Tons Buried tanks	3,900	1,700 €	6,630,000 €
	Electricity instrumentation	3	100,000 €	300,000 €
	Gas piping, pump room	1	400,000 €	400,000 €
	Pipe 8"	650	1,000 €	650,000 €
	3 loading bays area- civil works	1	200,000 €	200,000 €
	3 loading bays area - equipment-piping -pumping	3	60,000 €	180,000 €
				TOTAL
OPEX SAVINGS	Saving on the " passage en depot" (3900 T x 24)	93,600	20 €	- 1,872,000 €
	Saving of the unloading cost of the ship-avoidance of surestary	24	10,000 €	- 240,000 €
	Nomore waiting for the trucks to evacuate the 500 tons excess product during ship unloading : 15 trucks x 1 day x 600€ x 40 rotations	15	24,000 €	- 360,000 €
			TOTAL OPEX/ Year	- 2,472,000 €

The IRR of the above investment through 2030 is 24.7%, based on implementation by 2020 and counting the annual OpEx savings as commencing in 2021.

Table 74. BP costing: Yaoundé

Site	Objet	Safety	Quick win	Near term	Middle term	Long term		
YAOUNDE	Gas detection (central if necessary, sensors, cabling)	X	35,000 €					
	Flame detection (central if necessary, sensors, cabling)	X	43,000 €					
	Gas & Flame automation-wired logic- cabling and accessories	X	24,000 €					
	Automatic valves on loading/inloading bays and automation	X	22,000 €					
	Pompage GPL stage camions et wagons			X	104,000 €			
	4 on line scales 6 Kg				X	47,000 €		
	New filling center- 1000T storage -40 000 T capacity (details herebelow)					X	5,594,060 €	
	Storage Capacity increasing + 600 MT						X	800,000 €
	Carousel 8 stages 6 kg						X	102,000 €
	TOTAL		124,000 €	104,000 €	47,000 €	5,594,060 €	902,000 €	
TOTAL						6,771,060 €		

NEW FILLING PLANT YAOUNDE Storage 1000 T- Capacity 40KT	Quantity	Unit Price €	TOTAL PRICE
Design and engineering			150,000 €
Supervision			150,000 €
Civil works			866,500 €
Storage	1000 MT	1500 €/T	1,500,000 €
LPG NETWORK (2 postes CC+ 2 postes WC)			700,000 €
FIREFIGHTING NETWORK			450,000 €
COMPRESSED AIR NETWORK			80,000 €
ELECTRICITY (incl gas & flame detection)			450,000 €
FILLING MACHINE			
Filling 12.5 Kg			
Conveyors, weight control, gas leak detection, production monitoring			111,000 €
4 scales in line	1	153,000 €	153,000 €
Filling 6 Kg			
Conveyors, weight control, gas leak detection, production monitoring			68,000 €
8 scales in line			48,000 €
Filling 35Kg			
Roller conveyors 3m, Stationary filling scale, energy pole, Manual electronic gas leak detection			30,800 €
Palettiseur 11 casiers			165,000 €
Emptying machine 6-12.5Kg, Resteting machine, Retesting balloon, valve screw-unscrewing machine			
Emptying machine 6-12.5Kg, Resteting machine, Retesting balloon, valve screw-unscrewing machine	1	135,000 €	135,000 €
Construction Supervision : 6%			
Transport-Packaging 8%			24,648 €
Transport-Packaging 8%			32,864 €
Commissioning 8%			32,864 €
Hors foncier, frais de douane, TVA			
TRANSPORT	1	150,000 €	150,000 €
3rd party control	1	20,000 €	20,000 €
MISCELLANEOUS- UNFORSEEN	1	10,000 €	10,000 €
MISCELLANEOUS- UNFORSEEN	1	266,384 €	266,384 €
GRAND TOTAL Hors foncier, frais de douane, TVA			5,594,060 €

Table 75. BP costing: Bafoussam

Site	Objet	Safety	Quick win	Near term	Middle term	Long term
BAFOUSSAM	Gas detection (central if necessary, sensors, cabling)	X 35,000 €				
	Flame detection (central if necessary, sensors, cabling)	X 43,000 €				
	Gas & Flame automation-wired logic- cabling and accessories	X 18,000 €				
	Automatic valves on loading/inloading baysand automation	X 22,000 €				
	Additional storage 500 T			X 1,250,000 €		
	Carousel 24 stages- 18 scales 12.5 Kg			X 129,600 €		
	4 on line scale 6 kg			X 47,000 €		
	Paletization			X 165,000 €		
	Forklift			X 50,000 €		
	palets			X 80,500 €		
	Cylinder Retesting machine -10 stages, emptying machine 3 & 12.5 Kg, pump, retesting balloon, valve screwing/unscrewing machine and accessories			X 135,000 €		
	Additional storage 300 T				X 750,000 €	
	+6 scales 12.5Kg				X 39,000 €	
	Carrousel 12 stages 6kg				X 135,000 €	
TOTAL		118,000 €	- €	1,857,100 €	924,000 €	- €
TOTAL						2,899,100 €

Table 76. BP costing: Bertoua

Site	Objet	Safety	Quick win	Near term	Middle term	Long term	
BERTOUA	Gas & Flame automation-wired logic- cabling and accessories	X 18,000 €					
	Automatic valves on loading/inloading baysand automation	X 22,000 €					
	Additional storage 100 T			X 250,000 €			
	+4 on line scales 12.5Kg			X 47,000 €			
	+ 4 on line scale 6 kg			X 47,000 €			
	Additional storage 250 T				X 500,000 €		
	+4 on line scales 12.5Kg				X 47,000 €		
	Carrousel 24 stages 18 scales					X 129,600 €	
	Paletization			X 165,000 €			
	Forklift			X 50,000 €			
	palets					X 80,500 €	
	Cylinder Retesting machine -10 stages, emptying machine 3 & 12.5 Kg, pump, retesting balloon, valve screwing/unscrewing machine and accessories			X 135,000 €			
	TOTAL		40,000 €	- €	694,000 €	547,000 €	X 210,100 €
	TOTAL						1,491,100 €

Table 77. BP costing: Ngaouderei

Site	Objet	Safety	Quick win	Near term	Middle term	Long term
NGAOUDERE	Gas detection (central if necessary, sensors, cabling)	X 35,000 €				
	Flame detection (central if necessary, sensors, cabling)	X 43,000 €				
	Gas & Flame automation-wired logic- cabling and accessories	X 18,000 €				
	Automatic valves on loading/inloading baysand automation	X 22,000 €				
	2nd Fire pump 225m3/h	X 40,000 €				
	weightbridge CC		X 75,000 €			
	Pump 50m3/h & 691 compressor 691 + piping		X 86,000 €			
	Storage 150 T to supply Maroua		X 450,000 €			
	+4 on line scales 12.5Kg			X 47,000 €		
	+4 on line scales 6Kg			X 47,000 €		
	Additional storage 100 T				X 300,000 €	
	+4 on line scales 12.5Kg				X 47,000 €	
	+4 on line scales 6Kg				X 47,000 €	
	Carrousel 24 stages 18 scales					X 129,600 €
	Paletization					X 165,000 €
	Forklift				X 50,000 €	
	palets				X 80,500 €	
	Cylinder Retesting machine -10 stages, emptying machine 3 & 12.5 Kg, pump, retesting balloon, valve screwing/unscewing machine and accessories				X 135,000 €	
	TOTAL		158,000 €	611,000 €	359,500 €	394,000 €
TOTAL						1,817,100 €

Table 78. BP costing: Maroua

Site	Objet	Safety	Quick win	Near term	Middle term	Long term	
MAROUA	Gas detection (central if necessary, sensors, cabling)	X 35,000 €					
	Flame detection (central if necessary, sensors, cabling)	X 43,000 €					
	Gas & Flame automation-wired logic- cabling and accessories	X 18,000 €					
	Automatic valves on loading/inloading baysand automation	X 22,000 €					
	2nd fire pump 120m3/h	X 25,000 €					
	Pump 30m3/h		X 30,000 €				
	Additional storage 500 T			X 1,250,000 €			
	Carrousel 24 stages 16 scales			X 121,800 €			
	+4 on line scales 6Kg			X 47,000 €			
	Paletization			X 165,000 €			
	Forklift			X 50,000 €			
	palets			X 80,500 €			
	Cylinder Retesting machine -10 stages, emptying machine 3 & 12.5 Kg, pump, retesting balloon, valve screwing/unscewing machine and accessories			X 135,000 €			
	Additional storage 500 T				X 1,250,000 €		
	+8 scales 12.5 Kg				X 31,200 €		
	+4 on line scales 6Kg				X 47,000 €		
	Additional storage 500 T					X 1,250,000 €	
	Carrousel 8 stages 8 scales 6 Kg					X 102,000 €	
	TOTAL		143,000 €	30,000 €	1,849,300 €	1,328,200 €	X 1,352,000 €
	TOTAL						4,702,500 €

Table 79. BP costing: Garoua

Site	Objet	Safety	Quick win	Near term	Middle term	Long term
GAROUA	New filling pant sized from 7 à 21000T/an, Storage 400 T, 4 on line scale 12,5 Kg, 4 scale on line 6 Kg, Stationary scale 35 Kg, equipped for cylinder retesting details here below			X	4,151,780 €	
	Additional storage 400 T				X	1,000,000 €
	+ 1 carrousel 18 stages				X	135,000 €
	Paletization				X	165,000 €
	Forklift				X	50,000 €
	palets				X	80,500 €
	TOTAL		- €	- €	4,151,780 €	1,430,500 €
TOTAL						5,582,280 €

NEW FILLING PLANT GAROUA	Quantity	Unit Price €	TOTAL PRICE
Storage 400 T- Capacity 7 à 21KT			
Design and engineering			150,000 €
Supervision			150,000 €
Civil works			866,500 €
Storage	400 MT	1500 €/T	600,000 €
LPG NETWORK			600,000 €
FIREFIGHTING NETWORK			400,000 €
COMPRESSED AIR NETWORK			80,000 €
ELECTRICITY (incl gas & flame detection)			450,000 €
FILLING MACHINE			
Filling 12.5 Kg			
Conveyors, weight control, gas leak detection, production monitoring			111,000 €
4 scales in line	1	47,000 €	47,000 €
Filling 6 Kg			
Conveyors, weight control, gas leak detection, production monitoring			68,000 €
4 scales in line			24,000 €
Filling 35Kg			
Roller conveyors 3m, Stationary filling scale, energy pole, Manual electronic gas leak detection			30,800 €
Cylinders Maintenance			
Emptying machine 6-12.5Kg, Resteting machine, Retesting balloon, valve screw-unscrewing machine	1	135,000 €	135,000 €
Construction Supervision : 6%			16,848 €
Transport-Packaging 8%			22,464 €
Commissioning 8%			22,464 €
TRANSPORT	1	150,000 €	150,000 €
3rd party control	1	20,000 €	20,000 €
3rd party control	1	10,000 €	10,000 €
MISCELLANEOUS- UNFORSEEN	1	197,704 €	197,704 €
TOTAL			4,151,780 €

Table 80. BP costing: Kribi

Site	Objet	Safety	Quick win	Near term	Middle term	Long term
KRIBI	New filling pant sized from 3 à 13000T/an, Storage 200 T, 4 on line scale 12,5 Kg, 4 scale on line 6 Kg, Stationary scale 35 Kg, equipped for cylinder retesting details here below			X	3,836,780 €	
	Additional storage 200 T				X	500,000 €
	+ 1 carousel 12 stages				X	102,000 €
	Paletization				X	165,000 €
	Forklift			X	50,000 €	
	palets			X	80,500 €	
	TOTAL		- €	- €	3,967,280 €	767,000 €
TOTAL						4,734,280 €

NEW FILLING PLANT KRIBI	Quantity	Unit Price €	TOTAL PRICE
Storage 200 T- Capacity 3 à 13KT			
Design and engineering			150,000 €
Supervision			150,000 €
Civil works			866,500 €
Storage	200 MT	1500 €/T	300,000 €
LPG NETWORK			600,000 €
FIREFIGHTING NETWORK			400,000 €
COMPRESSED AIR NETWORK			80,000 €
ELECTRICITY (incl gas & flame detection)			450,000 €
FILLING MACHINE			
Filling 12.5 Kg			
Conveyors, weight control, gas leak detection, production monitoring			111,000 €
4 scales in line	1	47,000 €	47,000 €
Filling 6 Kg			
Conveyors, weight control, gas leak detection, production monitoring			68,000 €
4 scales in line			24,000 €
Filling 35Kg			
Roller conveyors 3m, Stationary filling scale, energy pole, Manual electronic gas leak detection			30,800 €
Cylinders Maintenance			
Emptying machine 6-12.5Kg, Resteting machine, Retesting balloon, valve screw-unscrewing machine	1	135,000 €	135,000 €
Construction Supervision : 6%			16,848 €
Transport-Packaging 8%			22,464 €
Commissioning 8%			22,464 €
TRANSPORT	1	150,000 €	150,000 €
3rd party control	1	20,000 €	20,000 €
3rd party control	1	10,000 €	10,000 €
MISCELLANEOUS- UNFORSEEN	1	182,704 €	182,704 €
TOTAL			3,836,780 €

Table 81. BP costing: Kumba

Site	Objet	Safety	Quick win	Near term	Middle term	Long term	
KUMBA	New filling plant sized from 3 à 13000T/an, Storage 400 T, 4 on line scale 12,5 Kg, 4 scale on line 6 Kg, Stationary scale 35 Kg, equipped for cylinder retesting details here below			X	4,151,780 €		
	Additional storage 500 T				X	1,250,000 €	
	+ 1 carousel 18 stages 12.5 Kg				X	135,000 €	
	Paletization				X	165,000 €	
	Forklift			X	50,000 €		
	palets			X	80,500 €		
	Additional storage 200 T					X	500,000 €
	+1 carousel 12 stages 6 Kg					X	102,000 €
	TOTAL		- €	- €	4,282,280 €	1,550,000 €	X 602,000 €
	TOTAL						6,434,280 €

NEW FILLING PLANT KUMBA Storage 400 T- Capacity 7 à 30KT	Quantity	Unit Price €	TOTAL PRICE
Design and engineering			150,000 €
Supervision			150,000 €
Civil works			866,500 €
Storage	400 MT	1500 €/T	600,000 €
LPG NETWORK			600,000 €
FIREFIGHTING NETWORK			400,000 €
COMPRESSED AIR NETWORK			80,000 €
ELECTRICITY (incl gas & flame detection)			450,000 €
FILLING MACHINE			
Filling 12.5 Kg			
Conveyors, weight control, gas leak detection, production monitoring			111,000 €
4 scales in line	1	47,000 €	47,000 €
Filling 6 Kg			
Conveyors, weight control, gas leak detection, production monitoring			68,000 €
4 scales in line			24,000 €
Filling 35Kg			
Roller conveyors 3m, Stationary filling scale, energy pole, Manual electronic gas leak detection			30,800 €
Cylinders Maintenance			
Emptying machine 6-12.5Kg, Resteting machine, Retesting balloon, valve screw-unscrewing machine	1	135,000 €	135,000 €
Construction Supervision : 6%			16,848 €
Transport-Packaging 8%			22,464 €
Commissioning 8%			22,464 €
TRANSPORT	1	150,000 €	150,000 €
3rd party control	1	20,000 €	20,000 €
3rd party control	1	10,000 €	10,000 €
MISCELLANEOUS- UNFORSEEN	1	197,704 €	197,704 €
TOTAL			4,151,780 €

Table 82. BP costing: Bamenda

Site	Objet	Safety	Quick win	Near term	Middle term	Long term	
BAMENDA	New filling pant sized from 7 à 33 000T/an, Storage 400 T, 4 on line scale 12,5 Kg, 4 scale on line 6 Kg, Stationary scale 35 Kg			X	4,151,780 €		
	Additional storage 500 T				X	1,250,000 €	
	+ 1 carousel 18 stages 12.5 Kg				X	135,000 €	
	Paletization				X	165,000 €	
	Forklift			X	50,000 €		
	palets			X	80,500 €		
	+1 carousel 8 stages 6 Kg					X	102,000 €
	TOTAL		- €	- €	4,282,280 €	1,550,000 €	X 102,000 €
					TOTAL	5,934,280 €	

NEW FILLING PLANT BAMENDA Storage 400 T- Capacity 7 à 33KT	Quantity	Unit Price €	TOTAL PRICE
Design and engineering			150,000 €
Supervision			150,000 €
Civil works			866,500 €
Storage	400 MT	1500 €/T	600,000 €
LPG NETWORK			600,000 €
FIREFIGHTING NETWORK			400,000 €
COMPRESSED AIR NETWORK			80,000 €
ELECTRICITY (incl gas & flame detection)			450,000 €
FILLING MACHINE			
Filling 12.5 Kg			
Conveyors, weight control, gas leak detection, production monitoring			111,000 €
4 scales in line	1	47,000 €	47,000 €
Filling 6 Kg			
Conveyors, weight control, gas leak detection, production monitoring			68,000 €
4 scales in line			24,000 €
Filling 35Kg			
Roller conveyors 3m, Stationary filling scale, energy pole, Manual electronic gas leak detection			30,800 €
Cylinders Maintenance			
Emptying machine 6-12.5Kg, Resteting machine, Retesting balloon, valve screw-unscrewing machine	1	135,000 €	135,000 €
Construction Supervision : 6%			16,848 €
Transport-Packaging 8%			22,464 €
Commissioning 8%			22,464 €
TRANSPORT	1	150,000 €	150,000 €
3rd party control	1	20,000 €	20,000 €
3rd party control	1	10,000 €	10,000 €
MISCELLANEOUS- UNFORSEEN	1	197,704 €	197,704 €
TOTAL			4,151,780 €

Descriptions of selected assets

Rail tanker

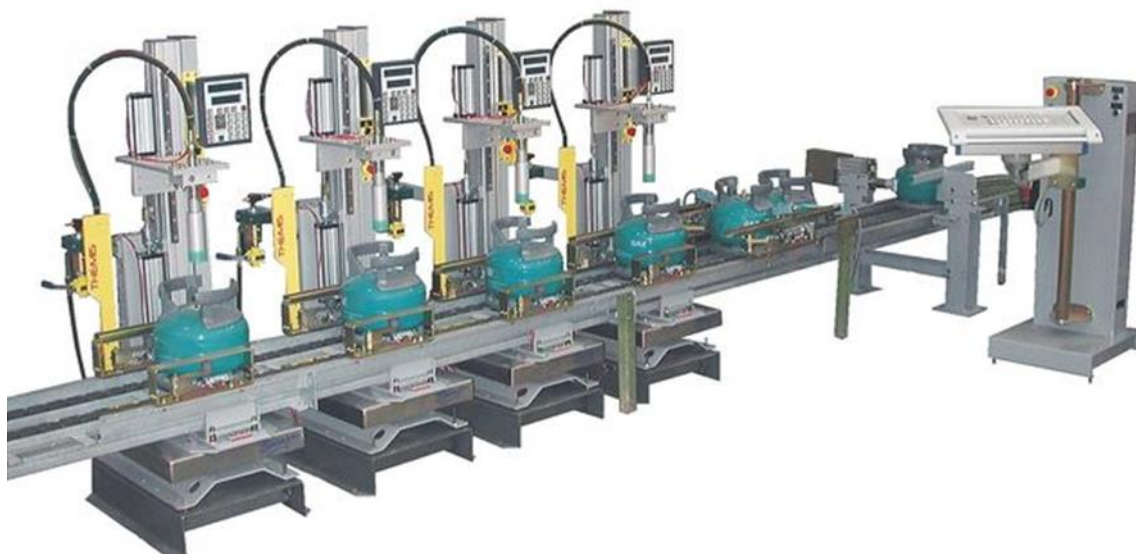
The transport cost ratio of rail versus road is approximately 30%. For example, if the average cost of road transport is € 30/MT, the transport cost per rail will be € 21 / MT. The depreciation of a tankwagon (costing about € 180,000) will thus be recovered after 25,000 km.

Figure 33. LPG rail tanker



On line scale

Figure 34. On line filling scales
(conceptual diagram and photo of an operating line in Cameroon)





Palletization equipment

Palletizing means loading, unloading and transporting cylinders in pallets (or cages) specially designed for handling by forklifts. For domestic cylinders with a diameter of 300/310 mm, the external dimensions of the base of 2200 mm x 1600 mm have become standard. The capacity is 7 rows of 5 cylinders, totalling 35 cylinders.

A closing bar made of steel or composite fibers with different locking modes closes each of the two open faces.

Cylinder safety is significantly improved, damage losses are significantly reduced, resulting filling line delays and interruptions are largely eliminated, and the loading and unloading time of trucks is considerably reduced as well. Only one operator and his forklift are sufficient to handle the pallets for a line of 1,200 cylinders / hour, vs. four operators working without pallets.

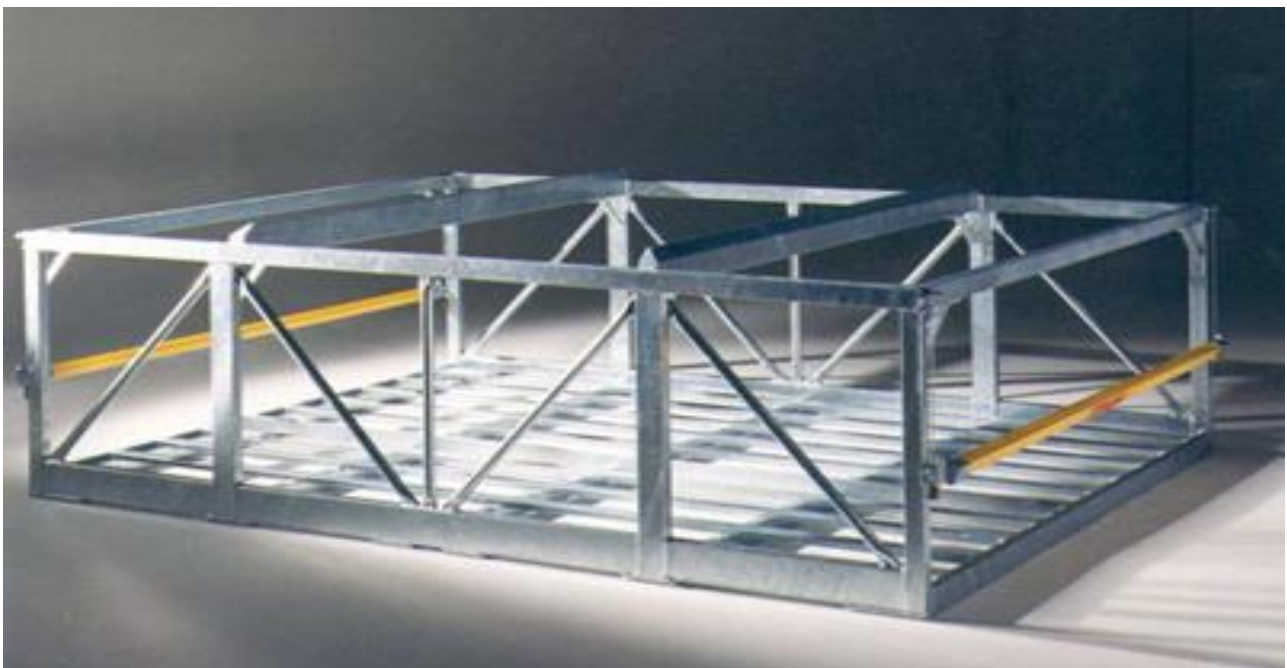
LPG cylinder trucks travelling with pallets are far safer as well. The cylinders are protected by the pallet until delivery to the retailer. In a traffic accident, falling cylinders can be catastrophic; use of the pallet prevents this.

At the bottling plant, the palletizer is the first and last machine in the filling chain. It can be equipped with various accessories. The loading / unloading operation can become fully automatic when the pallets are equipped with cable bars. Completed by a pallet stacker and unstacker, a palletizer is capable of producing

2,400 bt / hour with one or two forklifts, depending on the distances to be traveled between the filling hall and the storage areas.

The machine shown in the figure below is fully automatic. A set of four pallets is deposited by the driver at the furthest end in this view. The pallets are transferred by two parallel chains to different stations where the operations are carried out.

Figure 35. Palletization equipment



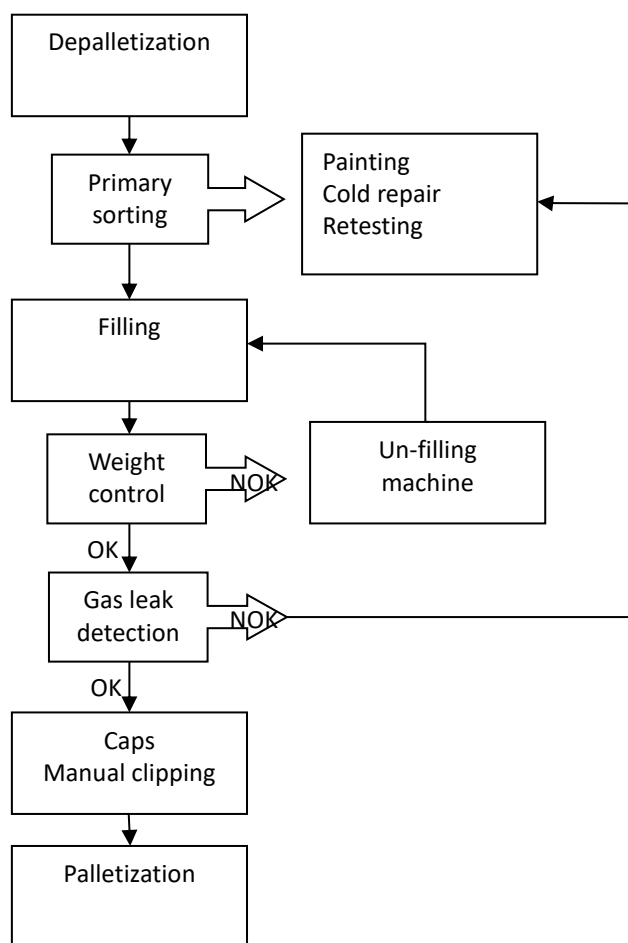
Mass balance equipment / weightbridge

Figure 36. Weightbridges



Bottling Plant process design

Figure 37. Bottling Plant process flow diagram



Technical specifications

For a new BP, the following are generalized specifications, adapted to the specific requirements of each plant as described earlier in this Chapter:

WORKS

The following works would be performed:

Civil works

- Earthworks and levelling
- Construction of administrative and technical buildings
- Construction of filling hall
- Construction of concrete blocks for piping, concrete slabs for pump room, unloading facilities
- Construction of internal road
- Construction of sewerage, drink water, electrical network system
- Fence height 2.5 meters and 2 gates
- The Power supply by National Electrical company (High voltage), construction will include transformer High voltage/low voltage

Storage

- Installation of storage including standard foundation (capacity depending of the type of bottling plant).
- Sprinkling system

Fire fighting

- Installation of fire water system, pumps, jockey pump, fire hydrant, water cannon, fire pipes and accessories based on sprinkling system at 10 liters/m²/minutes during 2 hours (capacity depending of capacity of the storage)
- Installation of fire water tank (capacity depending of capacity of the storage)

LPG network

- Installation of [2]x30m³/h LPG pumps (one spare)
- Installation of LPG compressor for bulk truck unloading
- Construction of 1 LPG bulk truck unloading bay and, where applicable, 1 LPG rail unloading bay
- Installation of air compressors, air dryers
- Installation of electrical diesel generator
- LPG pipes and accessories
- Installation of gas and flame detector system

Bottling hall equipment depending of the capacity of the bottling plant

- 12.5 Kg cylinder line(s) or carousel
- 6 kg cylinder line(s) or carousel
- Large cylinder capacity line
- Washing and painting line
- Maintenance line

CLIMATIC CONDITIONS

- To be adapted to location of the site
- Ambient temperature max: XX°C
- Ambient temperature mini: XX°C
- Average temperature: XX°C
- Relative humidity max: XX%
- Relative humidity mini: XX%
- Atmosphere: humid and very corrosive

PRODUCT

LPG with butane density of 580 kg/m³ (worst case to be considered for normal load calculations)

APPLICABLE RULES AND STANDARDS

- GUIDELINES APPLICABLE FOR THE CONSTRUCTION, THE OPERATING AND THE SAFETY OF LPG FILLING PLANTS - (Installations with Liquid LPG Transfer into Cylinders)
- ASME BPVC Section VIII Div 1 for pressure vessel (or equivalent)
- API5L last revision for pipes and accessories (or equivalent)
- NFPA 58 last revision for firefighting (or equivalent)
- NFPA 15 for fire pump installation (or equivalent)
- IS-5571 and IS-5572 (Part-I) for electrical area classification (or equivalent)
- NFPA 70 for electricity in unclassified area (or equivalent)
- NFPA 780, for Standard for the Installation of Lightning Protection (or equivalent)

DESIGN LIFE

The design life of the LPG plant including all mechanical, associated piping, electrical, instrumentation and civil/structural works shall be 30 years with due note taken of the operating and maintenance regime and environmental conditions.

SITE DETAILS

The bottling plant consists of the following, adapted to the specific specification for each plant:

Gas equipment

Installations of either [1] x XXXX MT LPG aboveground pressure vessel or underground storage tanks, based on the individual plant specification

LPG pumping station (LPG pumps and compressor)

Technical building (includes diesel or LPG power generator, fire water pumps, air compressor)

LPG unloading road/rail tankers facility equipped with loading arm

Filling hall

12.5 kg

- Chain conveyors (including derivation, stops, sorting post, walkway, etc.)
- Carousel XX stages including tangential entrance and exit
- X scales on carousel, equipped with automatic filling gun for 20 mm compact valve
Note that for smaller plants, on line scales are specified instead of carousels
- On line automatic weight control
- Manual refilling
- Electronic gas leak detection
- Sleeves shrinking machine
- Palletiser 9 stages, including stacker-unstacker in option
- Assistance management computer (in option)
- Pressure regulator set

6 kg

- Chain conveyors (including derivation, stops, sorting station, walkway, etc.)
- X scales in lines
 - or alternative Carousel XX stages including tangential entrance and exit
 - X Scales on carousel, equipped with automatic filling gun for 20 mm compact valve
Note that for smaller plants, on line scales are specified instead of carousels
- On line automatic weight control
- Manual refilling
- Electronic gas leak detection
- Sleeves shrinking machine
- Palletiser x stages (in option)
- Assistance management computer (in option)
- Pressure regulator set

Large cylinder size

- Stationary filling scales, equipped with manual clamps for shellgas valves
- Leak detection, type "water bell"

Washing-Painting-maintenance

- Chain conveyor (including branches, stops, walkway, sorting stations, etc.)
- Unfilling system 12.5 kg, including X-station and unfilling unit
- Unfilling system 6 kg, including X station
- 12.5 retesting machine, including X stages and test unit
- 6 Kg retesting machine, including X stations
- Paint booth online
- Washing tunnel
- Foot and shroud Straightener machine
- Valves Screw / unscrew machine
- Manual gasing
- Online tare scales

Utilities

- Gas and flame detection system
- Water fire fighting system
- Power, control and lighting distribution
- Industrial and potable water system
- Sewer and septic tank
- Compressed air network
- Lightning protection

Other facilities

- Guard house
- Administrative building containing offices, canteen, cloakroom, wash room,
- Trucks parking (outside the site)
- Comprehensive fire protection system complete with [X] m3 fire water storage, fire pumps (at least 2) to cool the storage at 10 l/m²/min during at least 2hours able to supply the entire fire fighting power +30% (If one of the pumps is out of order, the remaining pumps will ensure the entire fire fighting flow), fire water main ring, fire monitors, fire water spray system, fire hydrant, extinguishers
- Staff/visitors parking (outside the site)
- Fencing with 2 gates, driveways and drainage
- Associated civil works
- Electrical installation works inclusive of power supply, power and lighting distribution system, back-up power, voltage protection for key equipment

LPG STORAGE FACILITIES

The storage tanks will comply with ASME BPVC Section VIII Div 1, Rules for Construction of Pressure Vessels and the Engineering Equipment.

The LPG storage sphere(s) or bullet(s) should be constructed according to the following basic data:

- Design Pressure: 17 bar
- Test Pressure: 25 bar

- Design temperature (Maximum): +55°C
- Design temperature (minimum): -10°C
- Shell & Head steel material: ASTM SA516 G70 or P355NL1 or equivalent
- Steel Plates steel material: Normalized
- Corrosion allowance (minimum): 1.0mm
- Applicable heat treatment: ASME Section VIII division1
- Lifting lugs: Suitable for (un)loading
- Joint Efficiency: 1
- Nozzle of tank flange type: ANSI-Class 300 flange & neck

Each storage vessel(s) (sphere or bullet) shall be equipped with the following:

a. Tank Instruments

- Pressure gauge
- Temperature equipment,
- Level indicator with transmitter,
- High level switch (HL: 90% and HHL: 95%),
- Pressure relief valves: At least two pressure relief valves designed, sized and tested in accordance with API RP 520 (Part 1) and RP 521 to provide adequate flow capacity to protect the tank during fire exposure.

b. Shut-off valves (from the shell side)

Liquid Outlet Line:

- Internal safety valve (hydraulically operated with fusible plugs), Fail Closed or external automatic valve,
- Remotely Operated Ball Valve (pneumatically operated), Full Bore, Fail Closed
- Ball Valve Full Bore

Liquid Inlet Line and liquid return line:

- Check Valve
- Remotely Operated Ball Valve (pneumatically operated), Fail Closed
- Ball Valve manually operated

Vapour Balance Line:

- Excess Flow Valve
- Ball Valve manually operated, automatic recommended

Liquid drain line:

- Remotely Operated Ball Valve (pneumatically operated), Fail Closed
- Dead Man Ball Valve and Globe Valve manually operated connected by piping of sufficient volume to remove any accumulated water

LPG PUMPING STATION

The LPG pumping station is a shelter located in vicinity to the LPG storage tanks.

Pumping station includes:

- LPG filling hall pumps

Two (2) LPG pumps designed as duty pumps to transfer LPG from storage tanks to filling hall (1 working and 1 spare).

Each pump is has a nominal flow rate of $[30]m^3/h$ and shall have individual by-pass valve back to the tanks for over pressure protection.

The loading pumps may also used to transfer LPG from one tank to another (as back-up to the compressor).

Each pump will be provided with:

- LPG strainer installed in suction line
 - Check valve at pump outlet line
 - Isolation ball valves (full bore in suction line)
 - Delivery pressure gauge
 - Delivery flow switch
 - By-pass valve
 - LPG vapour/liquid purging system
- LPG Compressor

One (1) LPG compressor is used to transfer LPG from semi-trailer to the storage tanks (unloading). The flow rate of the compressor is $[75]m^3/h$.

The compressor will be provided with:

- LPG strainer intake line
 - Intake pressure gauge
 - Intake pressure switch
 - Outlet pressure gauge
 - Outlet pressure switch
 - Temperature gauge
 - Oil pressure switch and pressure indicator
 - Liquid trap with electric level switch
- Bulk truck unloading

The LPG plant will be equipped with [1] unloading bay for LPG road tankers or semi-trailer and where applicable rail tanker.

Each Loading / unloading operations shall be manually controlled.

Each bay should be equipped with:

- Double loading arm: One 3'' for liquid line provided with safety breakaway coupling, and one of 2'' for vapour line provided with safety breakaway coupling as well
- Opening/close of corresponding manual valves
- Check valves
- Road tankers grounding indicator and control relay to ensure safety during LPG transfer
- Control stations to start/stop LPG pumps or LPG compressor
- Dead-man push button station to make sure that the operation is focused on loading operations and to deal with the possibility of a consciousness lost
- Emergency push button to allow unloading local operator to stop the process

- Fire alarm manual activation
- Fire and gas detection
- ESD valve on the liquid line

UTILITY SYSTEMS

- Fire water system

Fire water system will be designed according to NFPA 58 and shall consist of below equipment:

- Fire water pumps with a least one equipped with thermal motor driven
- Jockey pumps with electrical motor driven
- Firewater network to cover fire protection to all plant facilities: main fire water pipe able to insure the entire flow of fire fighting water.
- Fire water storage tank: capacity in accordance of the requested fire fighting flow

The firewater network shall be permanently pressurized by means of a jockey pump alone.

In case of main power failure, jockey pumps shall be assisted by the emergency generator.

Pumps shall be basically started:

- Automatically in case of fire alarm or pressure lost in the firewater network
- Manually from control room or pumps room.

Firewater pumps shall be stopped manually only through the push button station located in pumps room.

The firewater network shall consist of:

- A pipe network
- Manual valves to split and isolate the network in sections
- Automatic spray system with double supply. One side by deluge valve, the other by manual valve
- Water monitors
- Hydrants
- Hose reels

A fixed water deluge system shall be installed over the LPG storage tanks, the truck, unloading areas, filling hall and the LPG pumps and compressor.

- Service water supply for industrial purpose

Service water shall be made available to the service water consumers within the plant.

Suitable system shall be to boost/reduce the water pressure as required to meet the water pressure requirements of the respective utilities.

- Potable water for building services

Potable water service shall be made available to the service water consumers within the plant.

Suitable system shall be to boost/reduce the water pressure as required to meet the water pressure requirements of the respective utilities. Water tanks located in the buildings roofs are allowed.

- Drainage

Drainage and sewerage shall be designed in accordance with the relevant requirements of the Environmental local Regulations and Standards. Industrial drainage is not applicable.

Drainage system shall be designed taking into consideration the type of effluents, the segregation and disposal. Clean storm water from roofs of buildings shall be directed to local soak ways through appropriate gravity lines. Roads and parking shall be sloped to provide run off to adjacent areas, without causing erosion.

Areas around buildings and unpaved areas shall be sloped away from paved areas, where applicable.

Storm water drainage of the entire plant shall be done through soak away pits, which shall be constructed along the drainage network.

INSTRUMENT/COMPRESSED AIR

The air requirement shall be designed with adequate provision and installed in the technical building.

- The air system shall consist of:
 - One (1) air compressors (including spare)
 - One (1) air tank (receiver)
 - Two (2) air dryer (including spare)
 - A plant wide instrument air/plant air distribution system consisting of distribution headers, instrument air manifolds and other accessories engineered to ensure availability of instrument air/plant air to all consumers within the plant.

ELECTRICAL DESIGN

- Power

Electric power required to feed the plant shall be provide by a new transformer. One Diesel generator shall be foreseen to feed the plant in case of power failure.

- Grounding

Grounding system shall be provided. It shall be designed as per the requirement of IEEE-80 standard (Guide for Safety in AC Substation Grounding or BS 7430, last edition-Code of practice for earthing) or equivalent.

For earthing of electrical systems, equipment and structures each installation shall have one common earth grid connected to at least two groups of earth electrodes. The earth grid shall comprise earthing conductors made up of wires of stranded copper.

- Lightning protection

Lightning protection for storage tank, building and structures shall be provided.

Design and installation shall be as per BS 62305-Protection against lightning or equivalent.

- Illumination of the plant

The plant lighting includes the normal lighting and the emergency lighting to selected areas of the plant during emergency condition. A multiplying factor of 0.8 shall be used in the calculation to allow for the fact that the luminaries become dirty.

The lighting distribution system of the plant shall consist of:

- Normal AC Lighting: It shall be ON at all times in indoors areas/as required

In outdoor area:

- Emergency AC Lighting: These lighting fixtures shall be normally ON along with normal AC system. In case of failure of main supply these lights will be automatically fed by the emergency generator.
- Critical Battery-Back-up Lighting: In case of the failure of main supply these lights shall be energized by battery back-up until emergency generator starts. These fixtures shall be located at strategic locations to enable safe movement of opening personnel and access to important control point failure of complete AC supply.

BUILDINGS

- Administrative building

The administrative building shall include the following services:

- Administrative rooms (4 offices including meeting room)
- Control room
- Lunch area
- Cloakroom
- wash room and toilets
- Guard room

- Technical building

The building shall include following services:

- Diesel generator room
- Fire fighting pumps rooms
- Air compressor set

Extinguishers for fire fighting, emergency lights, emergency exits, power supply, etc. are to foreseen.

- Guard house

A guard house will be built at the entrance of the bottling plant.

- Fence and gates

The depot must be enclosed with an industrial fence not less than 2.5 m in height.

The fence must have no less than two exits which are not next to each other and are always freely accessible. Two gates should be built, one used as safety gate. They should be outwards opening and has a width of 7m minimum.

DIESEL ELECTRIC GENERATOR

The electric generator should have below specifications:

- Engine
 - Cooling system: closed cooling system.
 - Governing type: electronic
 - Air filter type: replaceable element
 - Exhaust system: industrial type silencer (85DbA at 1 m).
 - Fuel system: Gas oil
- Electric Generator
 - Voltage: 400V Tri
 - Earthing system: TT
 - Frequency: 50Hz
 - Protection: IP23
 - Output rating: To be specified
- Control panel

It will be equipped with all the necessary generating set instrumentation and protection devices.

- Instrumentation
- Voltmeter and ammeter
- Combined frequency and tachometer
- Hours run counter
- Positions voltmeter and ammeter phase selector switch
- Led charging alternator failure
- Shutdowns with individual warning LEDs
- High coolant temperature
- Low coolant level
- Low lube oil pressure
- Emergency stop

Controls:

- Key switch (off – run – preheat – start)
- Lock down stop button
- Led test
- Automatic start
- Sound protection
- Sound attenuated Canopy: Yes

PRODUCT TRANSFER

The installation shall allow following product movements:

INDEPENDENT OPERATIONS

The installation permits the following operations independently:

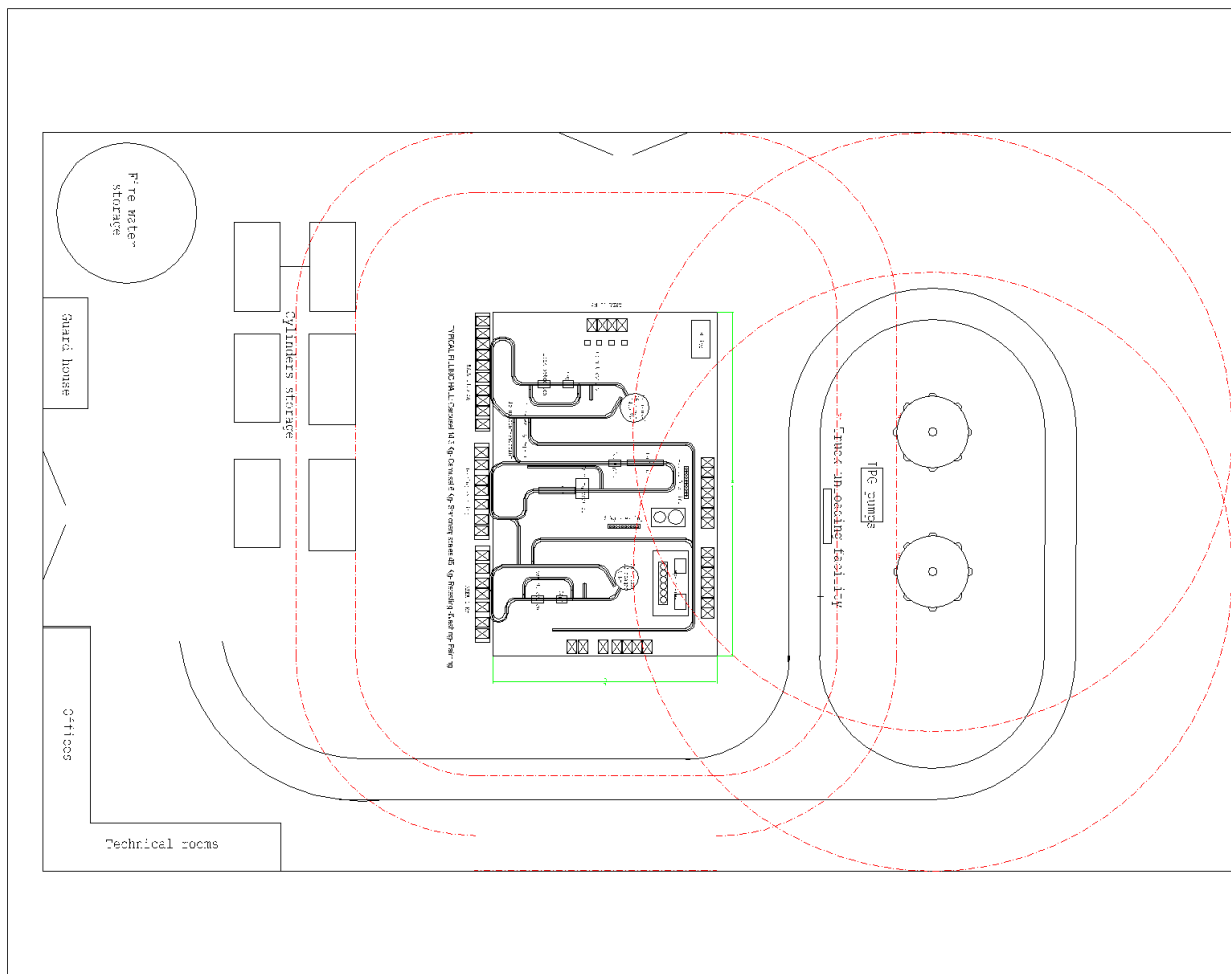
- Unload the bulk truck or rail tanker into the storage
- Make tank to tank transfer (in case of many tanks)
- Supply filling hall

SIMULTANEOUS OPERATIONS

The installation shall permit the following simultaneous operations:

- Unload the bulk truck or rail car in the tank(s) / supply filling hall
- Supply filling hall / transfer product from one tank to another if more than two tanks exist

Figure 38. Bottling Plant site generalized layout: new plant



Construction timing

An individual greenfield bottling plant can be constructed and made operational in a 12-18 month period from the time of the decision to proceed. Timing variabilities include permitting and necessary land and roadworks preparation specific to the plant.

The latest modular bottling plant designs from companies such as Maken Energy (the industry leader) bring the standard lead time down to 12 months and below.

Installation of expansion equipment can be accomplished in 6-12 months based on the nature and extent of the work to be performed.

24. Project 2: Cylinder Procurement

Implementation of the cylinder investment is a procurement project. Because LPG cylinders must comply with Cameroonian standards, it is possible to aggregate the cylinder purchasing requirements of the LPG Marketers to conduct procurements which minimize pricing and optimize terms for the sector as a whole.

Additionally, if the Government institutes the proposed cylinder discounting levy, recommended to be € 0.037 per kg of LPG consumed nationally, the Marketers can benefit from a discount of 40% on the cost to acquire each cylinder (which savings would also be passed on to the consumer).

The total new cylinder requirement to serve the projected demand in Cameroon is:

Table 83. Projected 12.5kge cylinder quantities required to 2030 (in two-year increments)

	2019-20	2021-22	2023-24	2025-26	2027-28	2029-30
New 12.5 kge cylinders	890	1,029	991	672	346	361

Investment in cylinders is an annual process, adjusted according to market trends. The pace of investment may be accelerated if consumption is greater than forecast, up to the sustainable growth rate of the firm, and decelerated if the market starts to saturate (that is, the demand for new cylinders stabilizes with respect to demographic trends).

An important driver and metric is the cylinder rotation rate in a given area, which increases as the distribution network becomes more efficient and productive, ensuring no cylinders remain idle, no scarcity or problems of refill supply, and no illegal cross-filling or diversion of cylinders by competitors.

Cylinder cost

Based on an indicative global procurement exercise, a blended cylinder cost of € 28 was achieved per 12.5kge unit.

25. Project 3: LPG Microfinance Scale-up

In the course of executing a first LPG microfinance program in Cameroon, as described in the Feasibility Study, it was evidenced that microfinance can be an effective financial tool for unlocking LPG demand among households which can afford LPG (compared to charcoal or purchased firewood, for example) but have difficulty affording the up front lump-sum costs of the consumer equipment required to be an LPG user.

The program was carried with local banking and MFI partners and local LPG Marketer partners (who sourced and distributed the LPG stoves along with the filled LPG cylinders and other required accessories).

GLPGP also identified certain barriers to scaling up LPG microlending via the local-partners approach, particularly with respect to MFI organizations:

1. Unwillingness of MFIs to underwrite loans using their own balance sheets, especially at smaller program scales.
2. Unwillingness of MFIs to obtain and keep records required for impact evaluation (e.g., detailed surveys).
3. Even when the MFI is willing to obtain records for impact evaluation, too many of the consumers may be unavailable or unwilling to take part in surveys after they have received their LPG equipment.
4. Marketing, sensitization and education of the consumer is a critical part of causing those who cannot afford up-front LPG equipment costs to consider adopting LPG by incurring what is, to them, a major loan obligation. However, neither the MFIs nor the LPG Marketers (which generally complain of having low margins in Cameroon's price-regulated LPG market) view such consumer marketing, sensitization and education activities to stimulate demand among prospective LPG customers as a justifiable part of their "business as usual" operations. Thus, they have been unwilling to take the lead in, or to contribute financially to, these important activities. This resulted in high additional human resources costs for marketing, sensitization and education which GLPGP and its donors bore.
5. Some MFI field locations expressed concern about storing LPG equipment in their offices in connection with the LPG lending program. (The MFIs were not asked nor obligated to do this, but made headquarters decisions to have some field locations take on this role, to supplement or complement the equipment distribution activities of the LPG Marketer partner.)
6. Some second-tier MFIs required government authorization before entering the LPG lending sector, it being a new business line for them.

Opportunity to scale up LPG microfinance with a new Government-supported fund

In Cameroon there is a new government ministry, the Ministry of Territorial Administration and Decentralization (MINATD). MINATD was created to organize the territorial administrative units, chiefdoms and external services; to organize national and local elections and referendums; to assure good

implementation law and regulation and the maintenance of public order; and to help guarantee public liberties. In so doing, MINATD acts to empower local populations through their local governments.

It has supervisory authority over the **Special Council Support Fund for Mutual Assistance (FEICOM)**. FEICOM is under the technical supervision of MINATD and the financial supervision of the MINFI. FEICOM's mission is to support municipal governments' development projects through technical and financial assistance.

Due to these new governmental developments, there is a new corresponding pathway for scaling up LPG microfinance in Cameroon, by leveraging the ability of FEICOM to reach out to urban and rural communities through the municipalities.

Just prior to this writing, MINEE recommended to the Clean Cooking for Africa/GLPGP team that GLPGP collaborate with FEICOM on an expansion of LPG microfinance in Cameroon.

MINEE and FEICOM are currently designing a pilot project for "municipal service stations", co-funded by FEICOM and the municipalities. This project will distribute hydrocarbon products, including LPG, with the objective of significantly expanding the geographic footprint of the retailing of such projects over the long term. These municipal service stations will be owned by the municipalities and leased to interested petroleum/LPG companies. By doing so, the project will increase availability and accessibility of LPG across the national territory by both removing financial and other barriers to SME retailing of LPG and by encouraging and supporting the development (and expansion) of SME LPG retailers.

These stations could also serve as access points for microfinance program participants to obtain their LPG equipment and refills, addressing the concern raised by some MFI field offices about storing LPG equipment at their offices.

As this possibility arose too late in the timeline of the Clean Cooking for Africa project (as presently funded) for further exploration with FEICOM, the approach outlined below is conceptualized based on an assumption that the FEICOM municipal service station project would be well suited as a substitute, complement, or source of synergy with traditional MFIs and LPG distributors.

Proposed national LPG microfinance program in partnership with FEICOM

Overview

The proposed program with FEICOM would expand the existing Cameroon LPG microfinance program to 500,000 participant households across the 10 regions of Cameroon through 2026, corresponding to the first two tranches of the supply-chain investment program. Because the sector expansion in tranche one (to 2022) will by default focus on existing, unmet demand nearly exclusively (as described in the Feasibility Study), the microfinance program is intended to operate at moderate scale during tranche one to build experience, capability, and learnings, and then ramp up to its full scale in concert with tranche two, in order to help broaden the market as its expansion transitions from serving only unmet demand to serving unmet demand while also creating and serving new demand.

FEICOM administers the loan disbursements and repayments through municipal staff. FEICOM and GLPGP are jointly responsible for carrying out marketing and sensitization activities, raising awareness at a national

level about the health and environmental benefits of cooking with LPG. (The LPG private sector does not normally emphasize this message in its marketing activities.)

Program costs would split between FEICOM and one or more providers of development capital, such as a DFI like KfW, AfDB, or others. Concessional funds would be used to fund the LPG equipment purchase, or as loan guarantees.

Given the fiscal constraints which the Cameroon Government faces, it is not clear to what extent FEICOM could participate in loan underwriting. However, even if it does not participate in the capitalization of the lending program, its physical footprint across the nation's municipalities, combined with its mission and objectives, is a potentially significant source of advantage for scaling up an effective LPG microlending program that is national in scope.

Indicative budget

Table 84. Microfinance expansion program indicative budget

Item	Number of households (HH):	
	XAF	Euro
	500,000	6 years
LPG equipment cost (per household)	48,000	72
Total equipment cost (500,000 households)	24,000,000,000	36,000,000
Loan capital required ⁶⁵	11,328,000,000	16,992,000
Marketing and sensitization (includes staff domestic travel)	3,312,500,000	4,968,750
Staffing		
2 growing to 5 project coordinators	97,200,000	145,800
3 growing to 10 project assistants	140,400,000	210,600
Program management and oversight/impact evaluation (2 P/T staff)	396,900,000	595,350
<i>Subtotal</i>	15,275,000,000	22,912,500
General, administrative and other overhead costs (10%)	1,833,000,000	2,749,500
Total	17,108,000,000	25,662,000

Contribution to national LPG demand

If these 500,000 households are all new LPG users who switch to LPG from other cooking fuels, then they would represent approximately 20% of the new user population projected to switch to LPG by 2030⁶⁶ in the Feasibility Study. If the program then possible to replicate and expand in tranche three, it would (hypothetically) contribute to the switching of about 60% of the projected new user population.

The magnitude of the impact of such a program is thus potentially large—but only if it proves scalable in practice.

⁶⁵ Assumes repaid loan capital is recycled annually into new loans.

⁶⁶ It should be noted that the Feasibility Study modelling of future demand forecasts that affordability measures are much more likely to increase per-user consumption of LPG than to create a significant population of new LPG users. Therefore, any LPG microfinance project

Advantages and potential concerns regarding FEICOM in the co-lead role

Advantages:

- **Loan servicing:** FEICOM can work through municipal staff to administer and service loans.
- **Easier product access:** The municipal service stations created by MINEE/FEICOM would serve as access points for microfinance program participants to obtain their LPG equipment and refills. Potentially, these sites could also be loan origination and servicing centers as well. Each service station serves one municipality, which comprises several communities/villages.
- **Lower loan cost:** Interest need not be charged on the loan. The interest component of 1.25% per month in the presently ongoing microfinance program was included as a financial incentive to the MFIs. If interest does continue to be charged, interest income could be used to cover the costs of marketing and sensitization activities, lowering the overall program cost outlay.
- **Scale up potential:** FEICOM has national reach and a mandate to advance development objectives in underserved areas.
- **Experience with development financial cooperation:** FEICOM has experience co-funding other development programs, such as with KfW⁶⁷, and is familiar with DFI funding modalities. (See for example www.kfw.de/KfW-Group/Newsroom/Latest-News/Pressemitteilungen-Details_495552.html.)

Potential concerns:

- The microfinance program becomes overly government-driven rather than private-sector driven, undermining the original intention of building a robust LPG microfinance sector led by financial institutions in Cameroon.
- FEICOM/municipal staff may not have adequate loan/credit assessment and administration capabilities, and would require appropriate up front and ongoing training to remedy this.

Proposed alternative national LPG microfinance program, in partnership with MFIs

If FEICOM cannot become, or is unwilling to become, a main partner as outlined in the previous section, then the microlending program could be expanded using its existing structure, by bringing in additional local MFI and LPG Marketer partners and by expanding the scale of activities performed by the existing local partners.

Overview

Under this alternative, the existing microfinance program would be expanded to 500,000 participant households across the 10 regions of Cameroon through 2026, corresponding to the first two tranches of the

⁶⁷ See for example https://www.kfw.de/KfW-Group/Newsroom/Latest-News/Pressemitteilungen-Details_495552.html

supply-chain investment program. It would be accomplished by expanding the scale and scope of the local partnerships and providing the necessary additional funding. MFIs would administer the loans.

The ramp-up approach for the program would be substantially similar to the FEICOM partnership approach mentioned previously. Because the sector expansion in tranche one (to 2022) will by default focus on existing, unmet demand nearly exclusively (as described in the Feasibility Study), the microfinance program is intended to operate at moderate scale during tranche one to build experience, capability, and learnings, and then ramp up to its full scale in concert with tranche two, in order to help broaden the market as its expansion transitions from serving only unmet demand to serving unmet demand while also creating and serving new demand.

FEICOM could still play a key role in this case, by helping to carry out the marketing, sensitization and educational activities that the MFIs and LPG Marketer partners have, to date, been reluctant to perform. FEICOM's municipal service stations could also serve as LPG fuel and equipment access points.

Program costs would be split between concessional development Funders and FEICOM (whose contributions might be done in kind instead of, or in addition to, in cash). For the loans, DFI funding could be used to underwrite loans for LPG equipment purchases, as low cost capital to the MFIs to on-lend, or as loan guarantees, or a mix of these.

To mitigate the risk of MFIs giving loans to consumers who do not have good enough credit⁶⁸, MFIs could be asked to pay the cost of marketing and sensitization (estimated at 20-25% of the equipment cost), and be reimbursed for that cost from the proceeds of the loan repayment stream. As a possible future add-on program component, microloans could also be provided for customers to purchase LPG refills, hence expanding the lifetime value of each customer to the MFI. This would provide a further reason for the MFI to fund the marketing and sensitization activities.

Advantages and potential concerns regarding MFIs in the co-lead role

Advantages:

- **Lending expertise:** MFIs handle credit screening, loan origination, and loan administration and servicing as routine parts of their “business as usual” activities.
- **Incentive to pursue full repayment:** MFIs have incentive to ensure full loan collection due to the income they received from repaid interest, and due to the risk they bear of non-collection.
- **Local capacity building:** The program would promote and benefit from continued capacity building of Cameroon's MFIs with respect to LPG microlending.

Potential concerns:

- **Higher loan cost:** MFIs will charge interest on the loans, increasing the consumer's loan amount relative to a low- or no-cost loan made via FEICOM.

⁶⁸ GLPGP has not encountered this problem thus far; the MFIs have been careful and proactive in assessing credit even though loan funding has been provided by GLPGP.

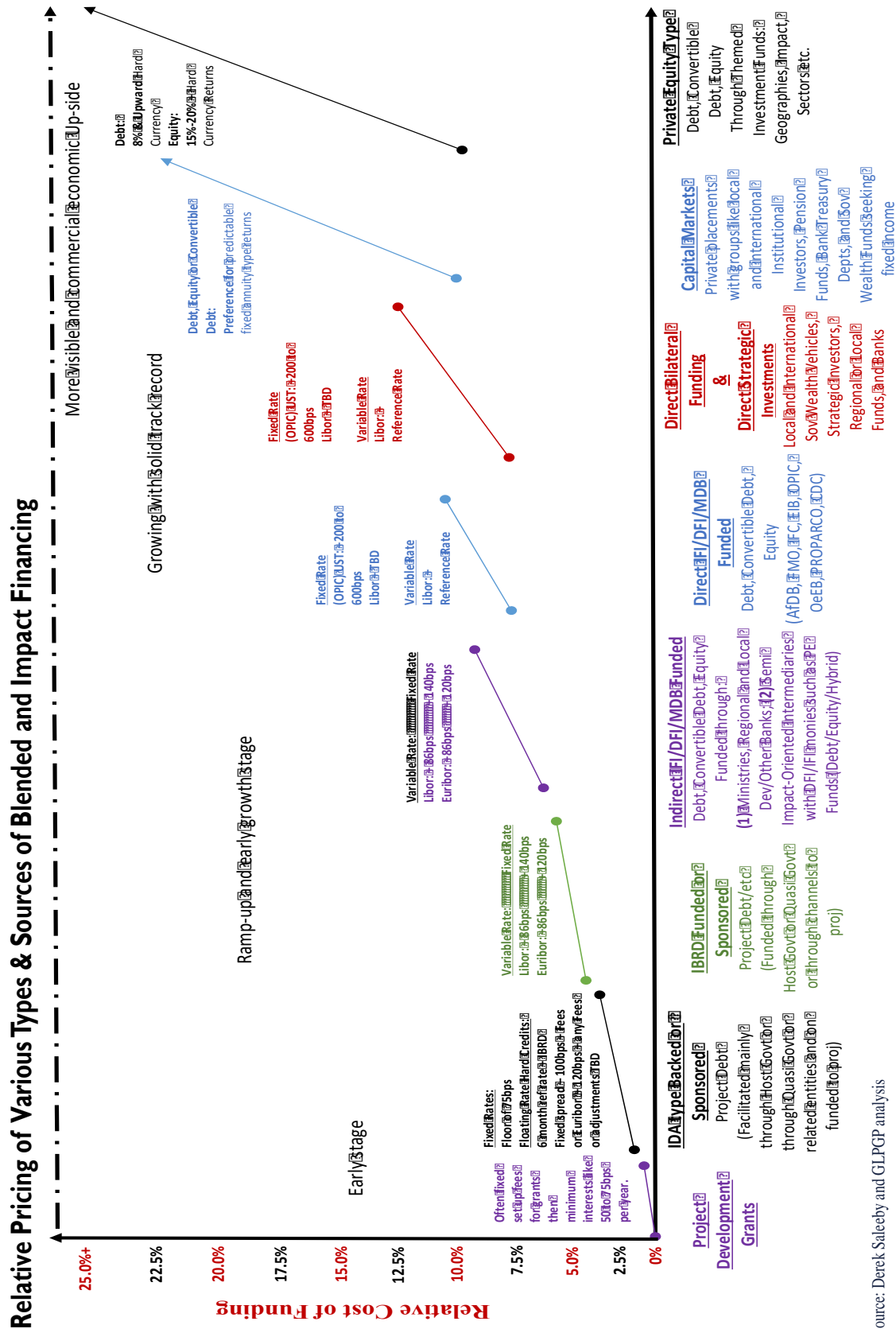
- **Uncertain geographic scale-up potential:** Whereas FEICOM already has national geographic presence through the municipalities, MFIs must be recruited at both the headquarters and field office levels across the country in order to create a similar volume and geographic scope of LPG lending activity, which will take additional time to accomplish.

Indicative budget

The program costs would be essentially the same under this scenario, except that the allocation of responsibilities and certain funds flows would be differently structured. The MFI recruitment cost would be treated as part of the G&A line item.

X. Supplementary Annexes

26. Pricing of Types and Sources of Concessional and Non-Concessional Funding

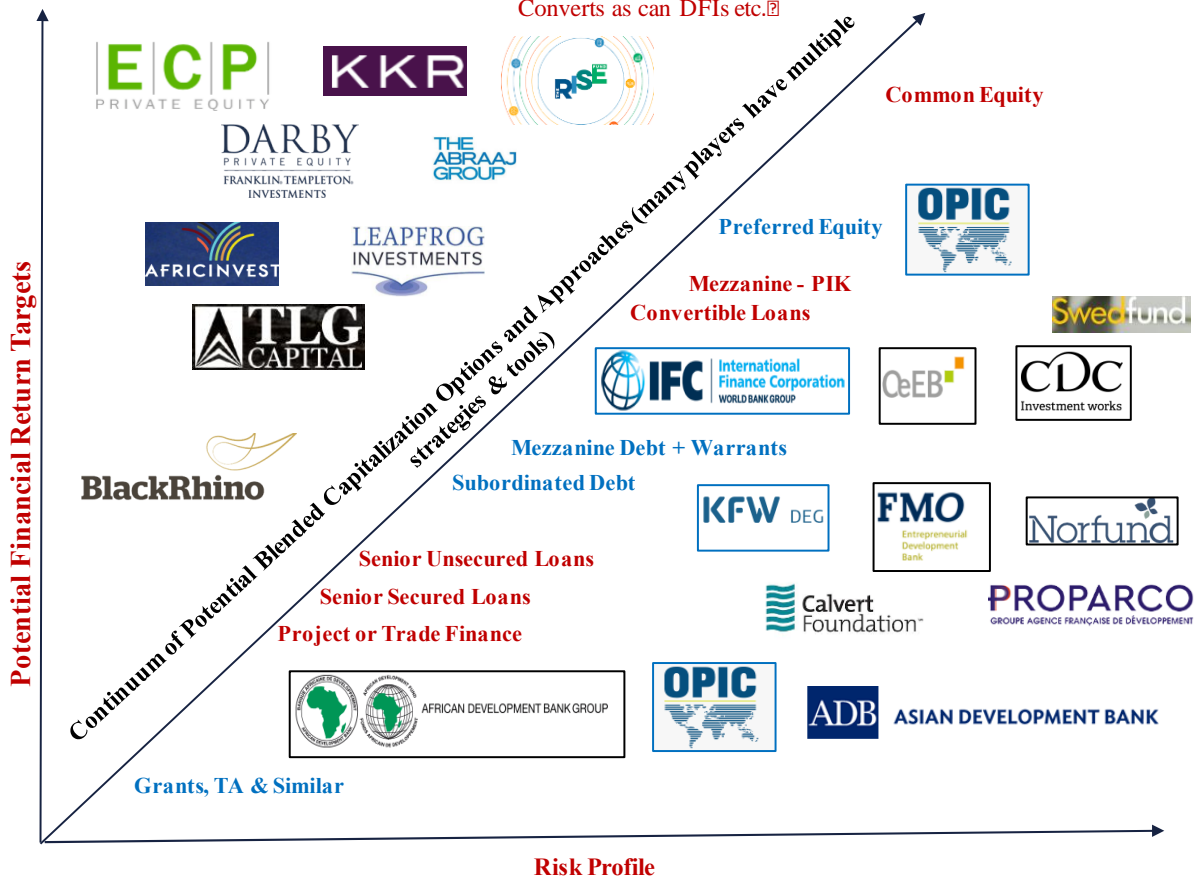


Source: Derek Saleeby and GLPGP analysis

Note: This analysis does not factor in the credit guarantees, insurance, export credit, trade finance, etc. It is based on the most current financing benchmarks presented by the entities mentioned in the market proxies/knowledge in the case of private equity and capital markets.

27. Risk / Return Expectations of Potential Blended Funding Sources

Note that many funders below use similar instruments to fund, but have differing relative return requirements. OPIC's preferred returns may be lower than Abraaj. TLG Africa can do Sr. Secured but also Mezzanine and Converts as can DFIs etc.



28. Finance Case Studies: DFIs, IFIs, MDBs, Guarantors and Other Funders

Backing LPG Related investments in Cameroon, Ghana, and Kenya

The purpose of mentioning the below cases is to demonstrate the combination of DFI and other blended funding sources that have worked in LPG and, therefore, could be approached by GLPGP. The first DFI-backed IPP project was the AES-SONEL LPG-fired power project in Limbe, Cameroon, which was built and commissioned in December 2003 and led by the Emerging Africa Infrastructure Fund (EAIF), a subsidiary of Private Infrastructure Development Group (PIDG). PIDG was established in 2002 by donor groups and members from Australia, Germany, IFC, Netherlands, Norway, Sweden, Switzerland and UK, and was the catalyst for funding the 4 case studies. The Clean Cooking for Africa/GLPGP financing team has approached PIDG and is seeking their willingness to engage in the recommended LPG initiatives. They can similarly crowd in some of their DFI backers.

These case studies represent three LPG-focused projects in Cameroon, Ghana, and Kenya which are power projects. However, they acted as catalysts in mobilizing foreign capital and expertise in each country, and established various forms of infrastructure for further development of the LPG sector in each country, such as import terminal and storage facilities.

Cameroon's LPG-Fired Power Project

In 2001, AES Corporation acquired and privatized 56% of SONEL, Cameroon's electric utility. Cameroon relies on hydro-electricity for 70% of its power generation, but the country has an eight-month dry season from November to June when river flows are greatly reduced. The project was designed to fill the electricity gap during the dry period. However, it is now fully utilized during the year and catalyzed investments in transmission and distribution.

To finance and commission the 85MW Limbe plant, adjacent to the SONARA refinery which supplies its fuel (the only domestic source of LPG), AES secured a \$554 million financing package from sources including EAIF, FMO and Finnfund, as well as \$168 million or 30% raised through domestic commercial equity. The Limbe project was the first project funded by DFIs followed by a larger capital expenditure program of \$293.3 million investment which was partly financed by FMO, Finnfund, Finnish Export Credit, PROPARCO, DEG, AfDB, IFC and EIB.

In 2003, EAIF committed \$30 million to the Limbe project and played the critical role in arranging the balance of the debt financing. For the larger financing program undertaken by AES in 2006, EAIF rolled over its existing facility, and increased its exposure by another \$5 million. This provided vital bridging and smoothed the way for other institutions to support AES-SONEL's new capital expenditure program. The refinancing was converted into Euro-based package. The development impact was:

Indicator	Development Impact
Private Sector Investment	\$554 million
Fiscal Benefits	Total taxes paid in 2005-12 were €166 million; increased economic activity had positive impact on indirect employment; and a more reliable electric source contributed to sustainable economic development
Job Creation	During construction, there were 508 workers which generated significant transfer of skills, knowhow and expertise to the local workforce
Additional Benefits	Limbe project increased available generating capacity by 10%; project supplies 820,000 people with improved power supply; significant improvement in electricity supply and reliability; and successful PPP model

Ghana's LPG Power Project and Import Storage Facility

Quantum Group Limited (QTL) is building an LPG-fueled power project in Tema, Ghana and essential import terminal and infrastructure for LPG and petroleum liquids. Sage Petroleum, a subsidiary of QTL, will import the LPG and petroleum liquids products and own 20% of the Bridge Power Project. The IFC has been a lender to Quantum-related entities, although now they are at odds.

Ghana's LPG storage company Quantum Terminals Group lists a bond on the London Stock Exchange

GuarantCo-backed London Listed Bond

On November 29th, 2018 Ghana's LPG storage company Quantum Terminals Group (also discussed below) listed a 75% partially guaranteed bond on the London Stock Exchange denominated in Ghanaian Cedis. This is part of a larger Cedis 140 million financing program. The initial placement of approximately Cedis 40 million is guaranteed 75% by GuarantCo – a PIDG entity. This guarantee enabled various investors to take positions in this placement.

Bridge Power

Sage to Supply LPG for the Bridge Power Project

The Bridge Power Project (sponsored by the Early Power Limited) is a greenfield development project in Ghana for the rapid deployment of a 400 MW (net at site conditions) generation facility to be fueled initially by LPG with diesel as the backup fuel. There is a 20-year power purchase agreement with the Electricity Company of Ghana. The project is owned 20% by Sage Petroleum, 20% by GE, and 60% by Endeavor Energy.

The Project will run on imported LPG as the primary fuel and diesel as a secondary fuel. It is estimated that by year 5 of operation natural gas will be available for the project and this will then become the primary fuel with LPG left in place as a secondary fuel.

As part of this project, Quantum, through its associated companies, will build storage spheres and construct a pipeline from the Tema Jetty to connect to the existing LPG storage and transportation infrastructure at the Tema Oil Refinery. This will ensure that in addition to supplying LPG to fuel the Power Plant, Sage will also be in the position to supply LPG to the local market.

Quantum LPG Terminal

Quantum to build LPG storage and associated infrastructure

The Quantum LPG Terminal Project is a greenfield development project in Atuabo, Ghana near the Jubilee Oil Fields. They are building three 500 cubic meter storage tanks, three loading gantries and associated infrastructure to increase the availability of LPG in Ghana. The cost of the tank farm was \$19 million, which required hard and local currency for the Project so Standard Chartered Bank provided the US\$10.8 million project loan (57%) which had a local currency guarantee for 50% of the proceeds by GuarantCo, a subsidiary of PIDG. The project completed in Nov-2014.

Quantum is building a 55,000 MT storage tank farm (100,000 MT expansion capability) at Tema which will serve the petroleum liquids storage requirements of Sage Petroleum, its trading subsidiary. The project is estimated to cost \$33 million (51.5% QTL equity and 48.5% banks). In addition, QTL is building a 23,000 cubic meter storage tank farm for LPG storage for the power project at a cost of \$65 million (~23% QTL equity and ~77% from power project). QTL will receive leasing fees from the power project for usage of storage tanks. The development impact was:

Indicators	Development Impact
Private Sector Investment	\$117 million (72% LPG)
Fiscal Benefits	Project increased government revenue through Corporate Tax, Withholding Taxes, Import and Stamp Duties

People Benefiting	2 million
Additional Benefits	Reducing reliability on wood and charcoal-fueled cooking, carbon dioxide emissions, slowing deforestation and contributing to Ghana's fuel security

Kenya's LPG-fired Power Project

Kenya Power and Lighting Company, the state electric utility, issued a tender for the first independent power producer in 2005, which was won by Danish BWSC and Aldwych international, a private equity fund manager focused on the power sector. Rabai heavy oil-fired power project is one of the most efficient and among the cleanest thermal fuel plants in East Africa, which was constructed and commissioned in May 2010. The Rabai project, located near Mombasa, involved the development, financing, construction, operation and maintenance of a 90MW heavy oil-fired power plant which was converted to run on LPG.

The total investment in the Rabai Project was €111.31 million. Of this, €26.67 million (24%) was funded through a combination of commercial equity (14%) and equity from DFIs (10%). The remainder of the financing was arranged through 15-year senior and subordinated loans from DFIs including EAIF, FMO, PROPRACO and DEG. EAIF was the lead arranger, and €22.57 million was their financing amount in the project. The development impact was:

Indicator	Development Impact
Private Sector Investment	€111.31 million
Fiscal Benefits	Project increased government revenue through Corporate Tax, Withholding Taxes, Import and Stamp Duties; government subsidies for expensive emergency power generation were slashed; and power supply improved
Job Creation	During construction and operations, there were 300 people and 70 people, respectively
Additional Benefits	Project provides 400,000 households with reliable power supply, met stringent international design standards, and is convertible into LPG

29. Finance Case Studies: IFC

Sampling of IFC's LPG-Related investments

Below are the excerpts from the IFC's public disclosures on select LPG investments. The importance is that these demonstrate that the IFC as a source of TAS and non-concessional debt (mainly) are active in the LPG value chain modalities from importation, storage, bottling, filling, cylinder finance, marketing/distribution, transportation, operation finance, and technical assistance. These are all areas relevant for improvement of the Cameroon market's LPG growth. In addition, these are instructive in that they demonstrate that the IFC is a logical target for funding and potential technical assistance.

Project Description

Approved: Jun 28, 2019

Engro Vopak Terminal Ltd.

"EVTL" or "the Company" owns and operates the largest terminal and storage facility for bulk liquid chemicals and Liquefied Petroleum Gas (LPG) in Pakistan. It is involved in the handling and storage of Para-Xylene, Acetic Acid, Ethylene Di Chloride (EDC), Vinyl Chloride Monomer, Ethylene, Mono Ethylene Glycol, Phosphoric Acid and LPG.

The proposed investment will support the Company to: i) expand LPG storage capacity by 6,000 tons; ii) expand EDC handling facility; iii) undertake 3-year terminal rehabilitation program and; iv) install solar panels (The "Project").

The total project cost is estimated at US\$40 million and IFC will provide an "A" Loan of up to US\$40 million to fund the project. The financing will provide the Company with access to critical long-term funding in an environment where such funding is scarce. IFC will also advise the Company on designing and implementing investments aimed at improving efficiency of the terminal and reducing its energy consumption and emissions.

Stated Expected Development Impact

The Project is expected to have the following development impacts: a) Environmental sustainability - the Project is expected to support energy transition in Pakistan towards cleaner fuels by increasing access to reliable supply of LPG, which has low indoor health hazards and greenhouse gas emissions relative to alternative conventional fuels like firewood, kerosene or charcoal. The Proposed Project will allow the Company to implement 3-year terminal rehabilitation capex program covering some high priority scheduled maintenance and terminal rehabilitation that is essential for its continued safe and efficient operations. b) Stakeholders Effects: The Project will have economy-wide effects by substantially alleviating current deficit of LPG in Pakistan and improving access to cleaner fuels for rural households, as well as automotive sector consumers. Extension of LPG capacity will also provide additional business opportunities for thousands of Small and Medium Enterprises operating in the downstream LPG distribution business, such as LPG cylinder distributors, fueling stations and others. c) Market creation: The Project will result in systemic changes to

the existing LPG market in Pakistan through implementation of infrastructure to import, store and market larger quantities of LPG which is expected to substantially increase the local availability of LPG.

Project Description

Date ESRS Disclosed

Apr 25, 2018

Mombasa Gas Terminal

(MGT or “the company”) is developing a greenfield liquefied petroleum gas (LPG) terminal, in the Port of Mombasa, Kenya that will import and market LPG within the country. The terminal will have direct mooring access for large-sized LPG carriers, a pipeline for the transfer of gas to an onshore storage facility which has a capacity of 22,000 metric tons (MT) that will be mounded. The aim of the project is to address issues of LPG supply and infrastructure in the Port of Mombasa to support the LPG master plan for Kenya. MGT currently operates a fleet of 20 dedicated LPG tank containers for import of LPG into Mombasa on-board container vessels.

Total Project Cost is US\$ 112 million, and IFC is considering supporting the Project by providing MGT with US\$48 million in a combination of loans for its own account and for other participating lenders. In addition to mobilizing long-term financing, IFC is providing guidance on the deal structure and in ensuring appropriate management capacity to operate the LPG terminal.

The project involves a loan of \$30 million to MGT to construct the gas terminal which will comprise; i) a private berth for unloading mid-size LPG carriers and an associated pipeline; ii) onshore mounded storage of 22,000 MT and associated infrastructure including multiple loading gantries for the transfer of G to transport vehicles; and iii) dedicated LPG transport vehicles equipment. The technology involved will enable vapour displacement from the storage tanks of the LPG carriers to feed back to the mounded storage tanks (and vice-versa) as a closed system to prevent major pressure changes between the LPG in storage at the mounded storage and the ships. The berth shall be equipped with an import system designed to receive pressurized imports at 1,000 m³/hr from Mid-Size Gas Carriers (MGC), Large Gas Carriers (LGC) or Very Large Gas Carriers (VLGC). The facility will have no blending facilities in that the LPG will be delivered with the appropriate specification from the point of origin.

The company will transport LPG using three routes: (i) LPG ISO tanks transported by truck to the Rift Valley Railways (RVR) yard in Kilindini and loaded onto flat wagons for transport to Nairobi and beyond; (ii) LPG ISO tanks transported by truck to the Standard Gauge Railway (SGR) yard in Port Reitz and loaded onto flat wagon for transport to Nairobi and elsewhere; and (iii) LPG loaded into LPG bullet trucks for transportation within Mombasa by accredited third party transporters contracted by the company or customers.

Stated Expected Development Impact

(i) Positive impact on LPG end-users who will have more access as a result of larger LPG volumes, more affordable price, and increased access to a cleaner, more efficient and safer fuel. (ii) Positive impact on distributors, as LPG will be more readily available, as a result of MGT's competitiveness arising from its scale, enabling distributors meet the growing demand and size of the market. (iii) Supports environmental

sustainability through diversification into more efficient and safer energy resources than currently available, and with potential linkages to domestic retail and distribution sector.

Project Description

Approved: Jun 25, 2018

Invested: Aug 13, 2018

Omera Petroleum Ltd.

“Omera” or “the company” is the second largest liquefied petroleum gas (LPG) player in Bangladesh, with a throughput capacity of 120,000 metric tonnes per annum (MTPA). The company has its main import storage terminal in Mongla, and three satellite storage / bottling stations in Ghorashal (Central region), Bogra (Northern region) and Chittagong (Southern region), respectively. Omera has a fleet of one river barge, road tankers, and contract distributors’ cylinder trucks to transport LPG from central terminal to satellite stations, and to customers. All storage terminals and filling stations are located along the rivers / main roads and inside industrial areas.

Total project cost over the next 2 years is estimated to be around US\$60 million including capital expenditures for cylinders, barges, storage tanks, trucks and filling machinery. IFC proposes an investment of up to US\$20 million to partially finance this capital expenditure.

Stated Expected Development Impact

1. Stakeholders Effects: a) Customers effects: Currently, about 90% of natural gas in Bangladesh is used to generate electricity, with demand from both domestic household and industrial segments expected to grow substantially. However, there is a daily shortage of natural gas of approximately 1,000 million cubic feet (mmcf/day) which might cause major disruptions to the economic activities if remain unaddressed. Due to the shortage of natural gas, LPG is even more needed now especially by the domestic households as natural gas is increasingly diverted for industrial and power sector use. The Project will help minimize the shortage gap and address the lack of storage facilities that have become the bottleneck in the distribution chain by increasing the storage capacity at various stages in the value chain. The other bottleneck is in the downstream logistic services, where certain locations are hard to reach or that the transport lead time is long, both due to the constraints in the transportation infrastructure. The Project will help smoothen the distribution of LPG to the end users by constructing capacity barges, cylinder carrying barges, and upgrading the LPG road tankers fleet. This will direct and indirectly increase the reliability of supply by shortening the delivery time and lowering the transportation costs, and to ensure end customers will have access to LPG when they need them. b) Distributors effects: OPL has established a strong distribution channel with more than 200 distributors across the country. OPL is now present in more than 22,000 retail points in the country, and has presence in all the administrative sub-districts of Bangladesh. The project will increase economic activity of these distributors and retailers, most of them MSMEs, due to the higher volume of LPGs and number of cylinders being distributed to the end users. By 2020, additional 2.1 million cylinders will have been distributed to the market and by 2018, additional 3,000 retailers will have been added to the distribution network.

2. Contribution to Market Creation: a) Resilience: The project will help create a more resilient energy system through promotion of supply diversification, by helping a private sector player such as OPL deliver LPG to the market. The Project also supports the Government of Bangladesh's policy to dedicate the natural gas production to power generation and industrial consumption, which are currently facing erratic and short supplies. Allocating more natural gas to power generation and fulfil the demand of the household segment with LPG will not only create a more resilient energy system but also lead to better manufacturing productivity and thus generate greater economic value from scarce natural gas resources. b) Sustainability: This project will support the promotion of LPG which has low greenhouse gas emission characteristics when compared to for example, conventional cooking fuels such as firewood, kerosene and charcoal. Usage of these conventional cooking fuels have reduced drastically in rural Bangladesh, but represent still around 75% of the consumption of cooking fuels, so there is a big potential for LPG to reduce greenhouse gas emissions. Inefficient cooking emits greenhouse gases such as carbon dioxide and methane, and aerosols such as black carbon. Better access to LPG in rural areas of Bangladesh through new distribution networks will provide a cleaner and efficient fuel than biomass, reducing overall emissions and thereby improving overall health of the local population. Unlike firewood and charcoal, LPG is easy and instantaneous to light, easy to control so that the required rate of heating can be obtained. LPG does not produce any smoke or soot therefore in overall is more environmentally friendly and sustainable compared to conventional cooking fuels.

Project Description

Approved : Apr 4, 2016

Invested: Nov 14, 2016

Private Enterprise Company Nadezhda

("Nadezhda") is based in eastern Ukraine and is a wholesale and retail distributor of liquefied petroleum gas (LPG), gasoline, and diesel fuel. The purpose of the project is to support the expansion of Nadezhda through a) increasing the number of retail stations, which would sell traditional fuels as well as LPG, and b) managing working capital risks by partially replacing short-term loans with long-term debt.

The total project cost is estimated at US\$22 million. The proposed IFC investment is a US\$10 million A loan and a US\$10 million C loan. The remainder of the financing will come from internal cash generation of Nadezhda. The IFC is providing: risk capital and long-term funds; guidance on environmental and social aspects of the project; and financial advice on improving the Company's debt repayment profile.

Stated Expected Development Impact

According to the IFC's disclosures, the development impacts expected include: Development of Ukraine's infrastructure based on modern and safe standards; Supporting the expansion of the distribution infrastructure for liquefied petroleum gas, which is a "cleaner" fuel; and Employment creation / preservation: The investment is expected to create 238 new, permanent jobs.

Project Description

Approved: Jun 18, 2015

Invested: Dec 29, 2015

Bulmarket DM

The company is headquartered in Ruse, a city located next to the Danube river in Bulgaria. In addition to its operations in Ruse, it owns LPG terminals in Byala, Plovdiv, Sofia and Kyustendil in Bulgaria as well as Galati and Giurgiu in Romania. Bulmarket DM is the Sponsor of the project. It is a regional trader and distributor of LPG, diesel and other fuels with a number of different divisions, including railway transportation, CNG retail stations, port and auto transport. LPG is the most important segment for Bulmarket, representing over half of its EBITDA. Assets relating to LPG import and distribution include two LPG transport ships, a port and railway trans-shipment terminal in Romania, six LPG storage terminals in Bulgaria and Romania, 150 rail tank cars and trucks.

The project will finance (i) the Company's core LPG business line through the development and expansion of three terminals in Ruse, Sofia and Plovdiv; (ii) the development of a new LNG business both for wholesale trade and business to business distribution; and (iii) the refinancing of short term debt. The total Project cost is estimated at EUR31 million. The IFC investment will be an A loan of up to EUR15 million. Provision of long-term financing: Longer tenors are not readily available in the current market environment and Bulmarket needs long-term financing for this project.

Stated Expected Development Impact

Among other stated impacts, the IFC states that the financing will help Bulmarket to become the first importer and distributor of liquefied natural gas (LNG) in Bulgaria. The Company will supply off-grid, industrial end-users with a cheaper, "cleaner" burning alternative to diesel or compressed natural gas (CNG). This Project will develop the LNG infrastructure in Bulgaria, which encourages greater use of the fuel, has a positive environmental impact, and supports the Bulgarian industrial base with more competitive energy costs. In addition, the enhancement of the company's distribution capacity for liquefied petroleum gas (LPG), a "cleaner" burning fuel primarily used in vehicles as a substitute for gasoline or diesel will also encourage greater use of the fuel resulting in a positive environmental impact.

30. LPG-Related Laws and Regulations

Law 090/031 of 10 August 1990

Governs business activity in Cameroon

Law 096/12 of 5 August 1996

Legal framework for environmental management

Law 098/015 of 14 July 1998

Establishments classified as dangerous, unhealthy and noxious, and instruments of application

Law 098/020 of 24 December 1998

Governs devices operating under gas and steam pressure

Law 11 099/031 of 22 December 1999

Institutes the national petroleum code

Law 10 0 2012/006 of 19 April 2012

Institutes the national gas code

Decree 0 77/528 of 23 December 1977

Regulates storage and distribution of petroleum products, modified by decrees 092/304/PM of 18 September 1992 and 0 95/135/PM of 3 March 1995

Decree 11 02011/408 and /410 of 9 December 2011

Reorganizes and forms the Government, respectively

Decree f 2012/501 of 7 November 2012

Organizes the Ministry of Water and Energy

Decree 99/818/PM of 9 November 1999

Defines modalities for setting up and operating establishments classified as dangerous, unhealthy or noxious

Decree 02000/935/PM of 13 November 2000

Specifies conditions for downstream petroleum sector activities

Decree 0 2014/3438/PM of 27 October 2014

Defines modalities of application of Decree f 2012/006 of 19 April 2012 to institute the gas code

Decree 0 2005/577/PM of 23 February 2005

Defines modalities to conduct environmental impact assessments

Order 0 006/PM of 12 January 2009

Defines modalities, technical and safety rules relating to the implementation, development and operation of storage depots and Liquefied Petroleum Gas (LPG) filling plants

Order 0016/MINMEE of 13 July 1995

Defines modalities and control procedures for petroleum products

Order 0 009/MINT/DTT of 23 February 1998

Sets regulations governing the transportation of hazardous materials

Order 0 22/MINMEE of 8 September 2001

Specifies certain petroleum sector operating conditions

Joint ministerial order 0 009/MINDIC/MINMEE of 21 February 2002

Enacts propane/butane LPG standard (NC 02 : 2000—08) for the national territory

Order 0 011/MINDIC/CSPH of 30 April 2003

Establishes and sets LPG cylinder deposit rate (at 80% of cost) for the national territory

31. Note Regarding LPG Accounting Treatments

In the presentation of financial models for the LPG sector and firms operating in the LPG sector, for sake of both conservatism and simplification, the following two financial statement/cashflow items have been omitted, with certain implications:

1. *LPG passthrough costs and arbitrage.* The financial performance of an LPG company, by industry convention, does not typically consider the asset value of the LPG fuel which it acquires and sells. In this report, the portion of turnover (revenue) and the cost of goods sold (COGS) associated with the LPG commodity itself are treated as equivalent and are disregarded. In Cameroon, because LPG costs and prices are fixed by regulation, and because CSPH hides the subsidy from the LPG companies, there is certainty about these two income statement items. That is, the LPG company creates gross profit from the unit margins applicable to its LPG volumes. Accordingly, what is presented in this report as “turnover” (or revenue) is in actuality the aggregate unit margins, and the cost to acquire the LPG commodity is disregarded. While is possible in principle for an LPG company to “buy low and sell high”, by having sufficient storage to exploit time-based arbitrage, in Cameroon, this is not feasible to exploit given the governmentally-fixed price structure downstream of CSPH.
2. *LPG gain.* LPG gain is an LPG industry term for the small quantity of LPG that remains in returned cylinders when customers return their “empty” cylinders to the cylinder recirculation system. This amount may run to 1-3%. It is normative in the LPG industry that the LPG Marketer does not provide a credit to the consumer for this leftover LPG quantity. This is a practical matter: it is not operationally or economically feasible to measure the leftover quantity accurately and efficiently across thousands of retail cylinder exchange points. Thus, the LPG Marketer gets a small head-start on the refill of every cylinder that passes safety inspection at the filling plant. This head-start is a potentially significant contributor to the profit stream of the Marketer, because it is effectively “free LPG” to the Marketer, the value of which passes directly through to the Marketer’s pretax net income. The notional value of the LPG gain has not been included in the financial modelling presented in this report, in part because it is not practical to assign a specific, reliable value, and in part in order to err on the side of conservative forecasting of firms’ financial performance. Therefore, the financial rate of return generated by an expansion investment in an LPG Marketer will, in practice, be somewhat higher than presented in this report’s financial models, and the cash flow and debt service risk will be slightly lower than suggested by those models.

32. Note Regarding Long-Term LPG Pricing and Availability

LPG pricing trends over spans of 10 years and beyond are not feasible to predict. Historically, global and regional LPG prices tracked directionally with the long-term movements in global and regionally-applicable crude oil price indices. Thus, price spikes of intermediate durations are possible. (The governments of some LPG-using countries protect their populations from such spikes through price-stabilization mechanisms.)

From the 2010s, LPG has increasingly tracked directionally with regional natural gas and LNG prices as natural gas / LNG pricing decoupled from crude oil pricing in international markets.

It should be noted that the LPG market clearing function performed by the petrochemical / plastics sector currently represents approximately 30-35% of total LPG global consumption. This segment is the most price-sensitive of all consuming segments. Therefore, petrochemicals/plastics consumption may provide a buffer that insulates LPG pricing to some degree for the other consuming sectors (residential, industrial, etc.), if global LPG supply tightens toward, and after, 2030.

This document assumes that LPG source pricing applicable to Cameroon will remain relatively stable toward and through 2030. To estimate the effect of significant LPG price change on adoption and consumption on an absolute basis, a sensitivity analysis has been included in the demand and impacts Parts of this report.

Across a 10+ year time scale, it was beyond the practical scope of the study and analysis presented in this report to attempt to assess how relative price changes among LPG and the main Cameroonian cooking energy and technology alternatives might affect adoption and consumption as of 2030 and beyond.

33. About the Global LPG Partnership

The Global LPG Partnership (GLPGP) is a United Nations (UN)-backed, non-profit Public-Private Partnership formed in 2012, under the UN Sustainable Energy for All initiative, to aggregate and deploy needed global resources to help developing countries transition large populations rapidly and sustainably to liquefied petroleum gas (LPG) for cooking.

GLPGP is evidenced-based and competition-neutral in its work.

GLPGP partners with host country governments at their invitation, and other relevant stakeholders, to create national plans for rapid, sustainable scale-up of LPG infrastructure, distribution and demand. GLPGP then assists with financing and implementation of key plan elements to transition the maximum viable population to LPG for cooking.

Developing countries request GLPGP's assistance to achieve the three main prerequisites for making LPG widely available and affordable:

- Plan and implement enhancements to government policies, regulations and regulatory enforcement to create the enabling environment for a viable, scalable, sustainable LPG sector;
- Provide knowledge and expansion capital to achieve critical mass of LPG supply, infrastructure and distribution systems quickly and sustainably; and
- Empower consumers, who can otherwise afford LPG fuel, to pay the upfront cost of appliances to use LPG and thereby unlock additional demand.

More information is available at www.glpgp.org.

34. Disclaimer and Safe-Harbor Statement

This document is not an investment prospectus nor a solicitation to buy or sell securities.

Certain portions of this document contain forward-looking statements that are based on expectations, estimates, projections and assumptions. Words such as “expect,” “anticipate,” “plan,” “believe,” “scheduled,” “estimate” and variations of these words and similar expressions are intended to identify forward-looking statements, which include, but are not limited to, projections of supply, demand, consumption, prices, policies, regulations, investment activity, economic and financial performance, business performance, cash flows, contracts and tenders, and other projections. These statements are not guarantees of future performance with respect to the parties associated with, or referred to in, such statements. These statements involve certain risks and uncertainties, which are difficult to predict. Therefore, actual future results and trends may differ materially from what is forecast in forward-looking statements due to a variety of factors, which include, but are not limited to, changes in (i) government policies and regulations, (ii) pricing, (iii) business strategies, (iv) the national and/or global economy, (v) exchange rates, (vi) project costs, (vii) consumer demand or preferences for energy products and services, (viii) competition conditions, (ix) market structures, (x) outcomes of litigations, (xi) outcomes of political and legislative processes, and others.

All forward-looking statements speak only as of the date shown on the front page of this document, or, in the case of any document incorporated by reference, the date of that document. The Clean Cooking for African Project and GLPGP do not undertake any obligation to update or publicly release any revisions to forward-looking statements to reflect events, circumstances or changes in expectations after the date of this report.