



**From Global to Local: Exploring the effects of the
global energy policy paradigm in Zambia**

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Abstract

Sub-Saharan Africa lags behind the rest of the world in electricity access and consumption. Infrastructure deficiencies are framed in terms of a “financing gap”, with policy oriented around attracting global private capital. This paper provides a critical assessment of such policies, in light of the experiences of the electricity sector in Zambia, drawing on the system of provision (SoP) approach.

The paper shows that in the case of Zambia, electricity production suffered greatly from a short-term crisis in hydropower in 2015/16. The state utility, Zesco, became loss-making in 2016 due both to high cost of emergency measures to compensate for the loss of hydro capacity, and to declining currency value increasing the relative cost of dollar-denominated debts. Rather than addressing the causes of this short-term issue directly, the response has been to adopt the global paradigm and sign up to long-term high-cost fossil fuel generation contracts with global investors. Additional renewable energy projects sponsored by donors are also with international private companies. Tariffs have escalated to compensate for so-called large state subsidies even though these have only emerged since the hydro crisis.

The case of Zambia shows that the standard paradigm for the provisioning of electricity through global private capital is problematic when the full workings of the electricity SoP are considered. Tariff increases are funding payments to international investors in regressive structures. Private generation projects create additional dollar-denominated liabilities, which threaten to weaken the financial position of Zesco. Meanwhile, the wealthy mining sector, which consumes over half of the electricity produced, negotiates private deals in secret. These findings indicate that the global paradigm prioritises the needs of global capital rather than social development objectives. The potential for more bespoke localised interventions are overlooked.

Key words: Zambia; electricity; IPPs; hydropower; global energy policy

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1 Introduction

The electricity sector in sub-Saharan Africa (SSA) continues to lag behind other regions. In 2016, 60% of the global population without electricity was located in SSA, compared with 28% in 1990, with nearly 600m people still lacking access (World Bank, 2018). Deficiencies in the energy sector are framed, both by donors and governments, in terms of a “financing gap” which is estimated to be around US\$40.8bn a year for the region (Eberhard et al., 2016). Numerous donor-sponsored initiatives have been developed to facilitate the flow of global private finance to sectors in need, such as the Global Infrastructure Facility and the G20 Infrastructure Hub. Countries are encouraged to create an appropriate “enabling environment” to attract investment, including tariff reform (Avila et al., 2017; Huenteler et al., 2017; AfDB, 2018).

However, while, undoubtedly, more finance is needed for energy infrastructure, simply chasing funds without closer regard to the specifics of the underlying political, economic and social structures within which financial flows are directed, creates a narrow framing of both the problems and the solutions. Collective grouping of electricity consumers, producers and private investors obscures the diversity within these categories, including how these agents interact. This in turn conceals the specifics of distributional outcomes from interventions to promote private investment.

This paper reviews the application of the mainstream paradigm to the specific context of Zambia through the lens of the “systems of provision” (SoP) approach. This approach contends that consumption outcomes are inherently linked to production, rooted in local context and emerge from the tensions among agents in the chain of provisioning. The paper shows that efforts to boost (foreign) private investment in electricity in Zambia have been stepped up following a crisis in hydropower generation resulting from low rainfall in 2015/16. Tariffs have increased substantially, in line with prescribed practice. Rural electrification has also been boosted by donor-sponsored private solar generation projects. However, closer examination of the nature and impact of these developments reveals underlying contestations and contradictions. Private investment in electricity generation is underpinned by long-term commitments from the state utility, Zesco, to buy fixed amounts of power at a set price via power purchase agreements (PPAs). These are often at a high cost and the agreements are underpinned by government and donor guarantees. These contracts create potentially extensive dollar-denominated public liabilities. Private infrastructure investments are ultimately repaid (with a profit) by consumers and taxpayers. In addition, electricity consumption is dominated by the mining sector, yet this sits separately from residential and other non-mining consumers, with mines negotiating Bulk Supply Agreements (BSAs) in secret. Furthermore, increases in electricity tariffs have brought the energy regulator into conflict with the mining industry, which is revealing of the power dynamics in the electricity sector.

This paper shows that the traditional policy package is not neutral but incorporates inherent inconsistencies and biases. An ostensibly straightforward policy measure such as cost-recovery pricing in this context raises questions of what costs should be recovered, and from whom, which in turn links to fundamental questions of equity. The mainstream policy paradigm adopts a remarkable tolerance for returns to capital (via interest and dividend payments) compared with a censorious approach to returns to

labour, with heavy criticism of overstaffing of the state utility. Similarly, there is concern for the fiscal impact of subsidised electricity tariffs, particularly to Zambian households, but less so for the fiscal costs of payments and other transfers to private investors via investment incentives and agreements. Furthermore, it is far from clear that the policies adopted will, in the short to medium term, necessarily alleviate the challenges facing the sector more broadly and Zesco in particular, specifically where private investment in power generation creates long-term liabilities for the state. The findings from this study indicate that standard policies to raise tariffs and attract private investment pay little attention to the specific needs of the sector in terms of the agents within it or to economy-wide social and distributional outcomes. Policies are based on an interpretation of fairness that risks benefitting international private capital rather than the Zambian population.

The following section sets the context for the study, starting with an overview of the conventional narrative shaping electricity policy, followed by an outline of the SoP approach and the specific Zambian context. Section 3 examines the Zambian electricity SoP in detail from the perspectives of three key agents: Zesco, (foreign) private producers and electricity consumers, including the mining sector. The paper concludes with a critical confrontation of the conventional discourse dominating the intellectual and policy space.

2 Background and approach: From global to local via Systems of Provision

There is an undisputed need for finance for investment in the electricity sector in SSA, both to increase generation capacity and raise access levels. The way in which this is to be achieved has consolidated into a conventional narrative over the past decade, adopted by donors and governments. First, the amount of investment needed is considered to be on a scale that cannot be raised by governments alone and so (foreign) private finance, especially to support infrastructure investment in generation, is required. Second, as a result, public funds including donor finance are required to be used to “catalyse” private finance (UNDP and UN Environment 2018, p.3; Eberhard et al., 2016). Third, governments need to create an attractive environment for private investors (UNDP and UN Environment 2018, p.2; Avila et al., 2017: 31; Eberhard et al., 2016).

Fourth, an important element in attracting private finance is the financial viability of (typically) state utilities (Huenteler et al., 2017). This in turn requires attention to transmission and distribution losses, tariff structures and billing and collection. “Underpricing” or subsidising of electricity tariffs is deemed to be particularly problematic (Flochel & Gooptu 2017, p.6), creating a drain on fiscal resources, incentivising over-consumption, crowding out public spending on health, education and investment. They are also considered regressive because only the wealthy have access to electricity (Huenteler et al., 2017, p. 5). This policy paradigm has led governments across SSA to endeavour to make their energy sectors more attractive to private investors (Avila et al., 2017: 31).

This study explores the effects of this paradigm in the context of Zambia drawing on the Systems of Provision (SoP) approach, as set out in Fine et al. (2018), which is based on

the premise that consumption is not simply the result of individual preferences but is integrally connected to the way in which services are provided. For the SoP approach, agents in the chain of provisioning, including consumers and producers as well as the state, have competing and complex priorities. A SoP analysis requires a context-specific, system-wide framing of the sector. The approach locates and unpacks relations across the spectrum of agents to include different types of producers and consumers, and their interaction with the state in its different guises. Outcomes emerge from intersections between these agents, rooted in context. In contrast to more traditional methods and approaches, SoP is immersed in real world messiness and is attuned to the contradictions and power relations that underpin policy outcomes in practice. The SoP approach was originally devised in relation to consumption studies (Fine & Leopold, 1992) and has been applied in diverse contexts including in the UK in relation to housing (Robertson, 2014) and water (Bayliss, 2014).

As such, SoP provides a suitable framework for analysing the ways in which global policy paradigms play out in specific locations. The approach recognises the diversity of agents. For example in the energy sector, categories of consumers range from rural households to international businesses and industry. Producers consist of state utilities, small off-grid systems as well as private producers. The energy policies advocated by international financial institutions (IFIs) can be expected to have variegated impacts within and across countries and according to types of producer and consumer.

Turning to the context of Zambia, the economy is dominated by copper production which accounts for around 77% of the country's exports (World Bank, 2017a). Hence, fluctuations in commodity prices have a strong effect on the economy, and the mining sector is highly influential. Zambia experienced rapid economic growth in the 2000s attributed in large part to the boom in commodity prices, as well as favourable weather that supported agricultural production, and sustained macroeconomic stability (Bhorat et al., 2017). However, income distribution remains highly unequal (Bhorat et al., 2017; IGC, 2017). Despite average annual economic growth of around 5%, an estimated 41% of Zambians live in extreme poverty (World Bank, 2017b). Rural poverty was around 78% in 2015 and this proportion has changed little since the 1990s. More recently, the economy has faced major challenges with a decline in the world copper price in 2015/16 which was partly responsible for a fall in currency value, with the Kwacha losing 41% of its value against the USD (World Bank, 2017b). This has had fiscal repercussions. Public debt is rising due to the rapid exchange rate depreciation and increased borrowing, particularly for Chinese-funded projects including for electricity generation (Jubilee Debt Campaign, 2018). In the short period from 2015 to 2017, Zambia's risk of debt distress shifted from low, to moderate, to high (IMF, 2017).

The country has an exceptionally high dependence on hydropower for electricity, deriving from the development of the copper sector during colonial times. Specifically, during the Federation of Rhodesia and Nyasaland between 1953 and 1963, accumulation in the copper sector was underpinned by the creation and subsequent dependence upon hydroelectricity. More recently, a heavy drought in 2015/16 caused a severe depletion of water levels in the country's main reservoirs, triggering a hydro crisis. In 2016, national electricity generation fell by 13% from the previous year. The

drought left the country with a power deficit at the peak of the crisis equivalent to almost half of total generating capacity (GCF, 2018), resulting in load-shedding and major interruptions in supply. Power shortages were associated with substantial economic, social and welfare costs. Initially the burden of load shedding was only imposed on households, businesses and industry excluding the mining sector. However, in July 2015, the power supply to the mines was cut by 30% as the severity of the crisis created what was deemed to be a case of force majeure (World Bank, 2015). Ad hoc crisis management compelled Zesco to source power from high cost imports and emergency power providers. In addition, the financial position of the utility was exacerbated by the fall in the value of the local currency.

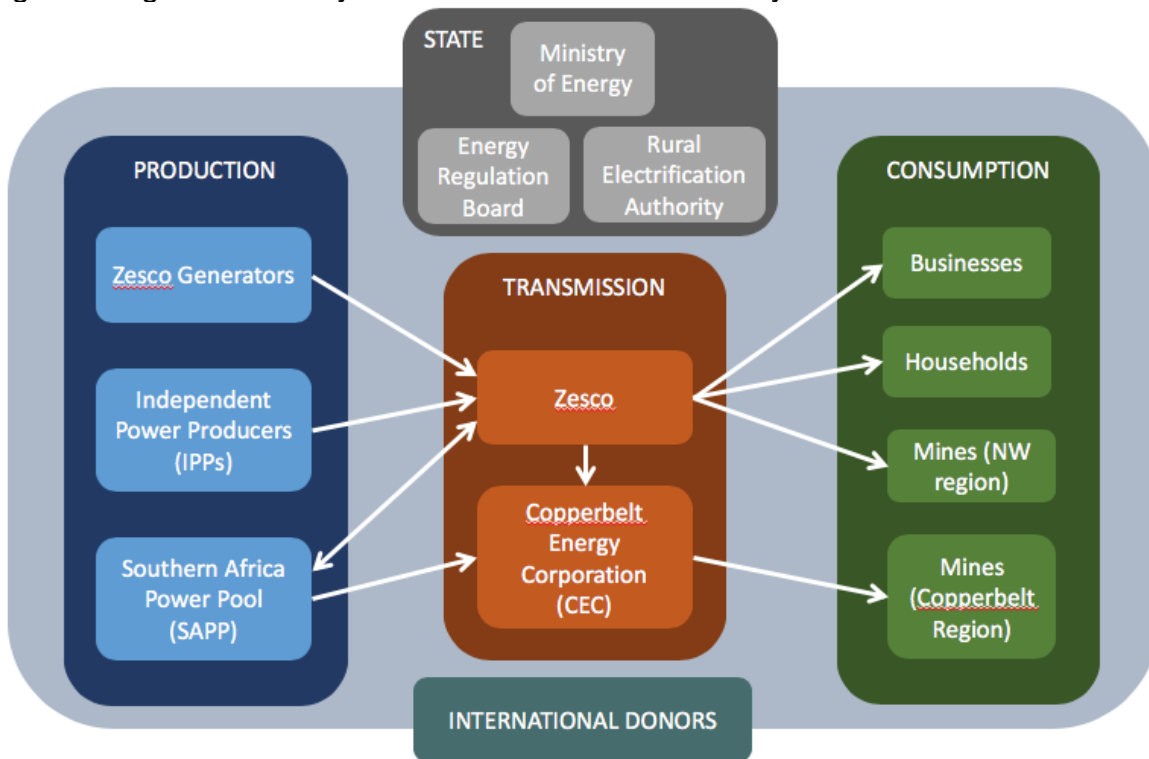
In common with other countries in the region, Zambia has low levels of electrification, particularly in rural areas, and access is less than one per cent for the poorest 20% of the country (PMRC, 2017). At the same time, demand for electricity has been rising due to growth in tourism, mining, construction and agriculture (Johnson et al., 2017). Investment in generation stalled from the 1970s with no new plants commissioned between 1977 and 2014 due to a period of excess capacity that lasted until the early 2000s (World Bank, 2017b). Overall, then, as with much of the region, investment is needed to boost generation and to increase access as well as to drive broader industrial development goals. Zesco has signed contracts with a number of Independent Power Producers (IPPs) since 2016 and the regulator is attempting to create an environment responsive to private sector needs. Accordingly, tariffs have increased substantially, although differentially across consumers.

While this study is ambitious in scope, not all areas of the electricity SoP could be covered in detail and we faced limitations in availability of information. Hence the elements of the SoP are reviewed selectively, relating mainly to infrastructure financing, with particular attention to distributional outcomes. Drawing on analysis of existing data, grey literature and interviews with key informants, the study is largely qualitative and far from exhaustive but our aim is to highlight key areas of concern and to point to the importance of challenging the application of global narratives to the local context.

3 The Zambian electricity SoP

Figure 1 provides an overview of the main agents in the SoP for electricity in Zambia. The sector is dominated by the state-owned, vertically integrated utility, Zesco Ltd. Zesco generates power, buys power from Independent Power Producers (IPPs) and trades with the Southern Africa Power Pool (SAPP) (see the left side of Fig 1). There are also some small off-grid mini-hydro generators such as the Zengamina Hydro Project set up by a charity, the North West Development Trust.

Figure 1: Agents in the System of Provision for electricity in Zambia



Zesco is responsible for transmission and distribution of electricity throughout the country, owning about 92% of the total grid-connected installed capacity, with the notable exception of mines in the Copperbelt region; these networks are operated by the private company, Copperbelt Energy Corporation (CEC). Zesco sells to a diverse range of end users (see the right of Figure 1) including residential, business and mining customers. These also include CEC which purchases power from Zesco and then supplies the mines in the Copperbelt region (see below). During the electricity crisis, in addition to power sourced from Zesco, CEC imported power directly for the Copperbelt mines from the SAPP.

The state is active in the sector in different ways, in policy-making through the Ministry of Energy (MoE) and through various state agencies, including Zesco itself. Specifically, the Energy Regulation Board (ERB) is responsible for implementing aspects of energy policy, notably licensing, tariff-setting and regulating quality of supply, in accordance with the provisions of the 1995 Energy Regulation Act. However, in practice ERB regulates Zesco only, using a series of key performance indicators (KPIs). For the rest of the sector, ERB provides technical oversight. The ERB sets electricity tariffs for all consumers, again with the notable exception of the mining industry and other large consumers. The tariffs paid by mines and CEC are outside the remit of ERB, set in long term BSAs, negotiated privately. Details of these are not in the public domain. In addition to the ERB, the Rural Electrification Agency (REA) is mandated to provide electricity infrastructure in rural areas of Zambia. Numerous donors are also active in the sector. Although not directly involved in policy, the ethos and the areas that attract donor

support give these institutions strong influence in directing developments. For example, of late, owing to the climate change framework, donors have promoted renewable electricity generation.

3.1 Zesco

Zesco was formed in 1970 under the Zambia Electricity Supply Act and brought together the electricity undertakings that had been previously managed by local authorities.¹ The company operates across the electricity SoP (Fig 1). Almost all residential customers are on prepaid meters. As a result, Zesco had a bill collection rate of 96% in 2014, one of the highest in SSA (Trimble et al., 2016). However, while revenue collection may have improved, Zesco's financial performance has been adversely affected since 2015 (see Table 1) by the decline in the value of the Kwacha and a surge in costs due to emergency power imports in 2015/16 to compensate for the decline in hydro power (World Bank, 2017b; IMF, 2017, p.49).

During the hydro crisis, Zesco had to purchase additional power at a significant premium, importing from electricity utilities in South Africa (Eskom) and Mozambique (EDM) and using emergency supplies from UK firm Aggreko and Karpower Ship. Much of this was at a cost considerably higher than the selling price. In 2016 the average price of imports was US\$0.15/kWh. However, the average selling price charged by Zesco was just US\$0.06/kWh (Zesco, 2016; Siliya, 2015).

Table 1 shows selected financial indicators for Zesco. The company had a marked increase in revenue in 2016, despite the fall in power production but much of this increase relates to an increase in mining tariffs that did not materialise into cashflow due to a dispute over the tariff (see below). The operating profit margin appears healthy from 2012 to 2014, ranging between 11% and 16%, but falls drastically in 2015 and in 2016 due to an increase in operational costs due to the crisis. In 2016, Zesco made an operating loss of over US\$13m compared with a profit of US\$98m three years earlier. Net profit margins are boosted by government tax credits.

Table 1: Zesco Selected performance indicators, 2013-2016 (US\$ 000).²

	Mar-12	Mar-13	9 months to 31 Dec	Dec-2014	Dec 2015	Dec 2016
Revenue	496,038	558,099	427,195	675,696	746,311	798,239
Operating profit	81,464	98,104	46,941	89,614	2,276	(13,234)
Income tax/ (credit)	(23,301)	(40,622)	34,587	(39,025)	98,593	140,040
Net profit after tax	58,162	57,482	81,527	50,590	100,868	126,806
Operating profit margin %	16.42	17.58	10.99	13.26	0.30	-1.66
Net profit margin %	11.73	10.30	19.08	7.49	13.52	15.89

Long term loans	400,208	558,163	692,593	926,845	1,284,243	1,220,198
Finance costs	2,026	2,892	2,925	7,763	5,832	31,437
Finance costs % Revenue	0.41	0.52	0.68	1.15	0.78	3.94
Gearing ratio (debt:equity)	41	45	50	58	64	62

Source: Authors' compilation from Zesco Annual Reports 2014-2016

Zesco has borrowed heavily recently. The lower part of Table 1 shows a sharp increase in Zesco borrowings in 2016 and a related increase in finance costs. As a share of revenue these have increased from less than 1% to almost 4%. This is all the more concerning as the revenue figure is overstated by an increase in mining tariffs that did not materialise. While gearing has not changed much since 2015, the level in 2016 is considerably higher than 2012, indicating higher borrowings. A substantial portion of the debt has been spent on increasing Zesco assets, investing mainly in property, plant and equipment (Zesco, 2016). Meanwhile, Zesco's electricity generation sent out in 2017 was still 11% below the 2015 level. Put differently, despite good rainfall and restoration of water levels, capital accumulation in Zesco was yet to translate into substantial gains in terms of generation capacity.

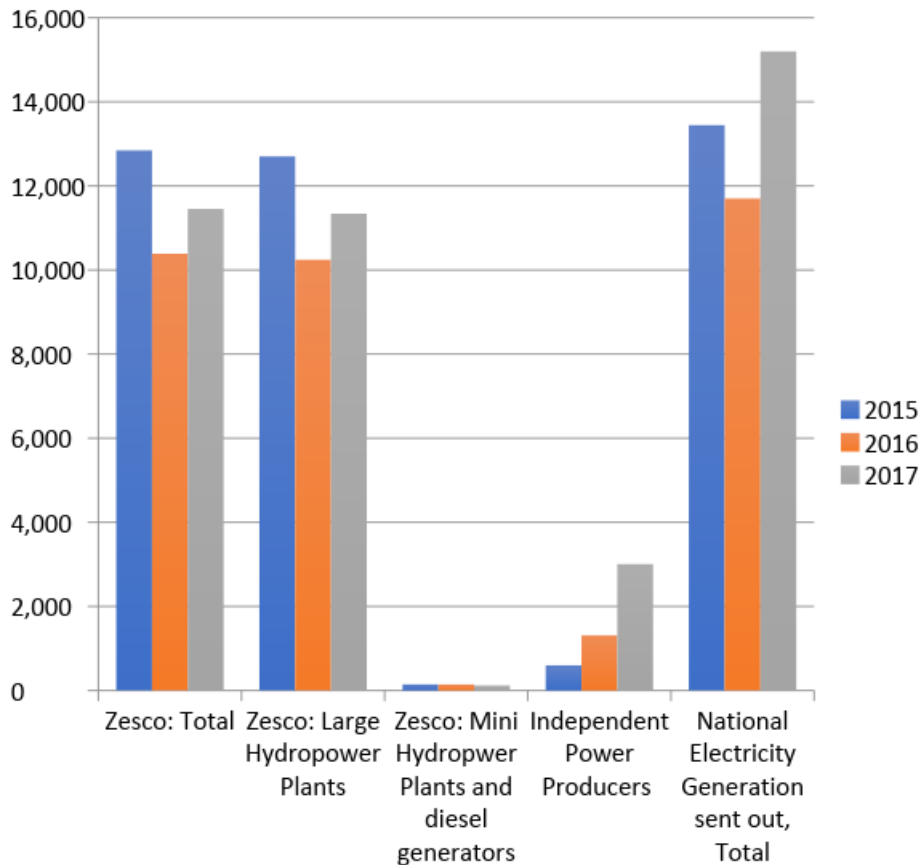
Zesco's financial situation, then, deteriorated dramatically in 2015 and 2016. However, until then, the company's financial position was reasonably stable. There have been suggestions that Zesco is "inefficient", in particular, due to over-staffing. A comparison of electricity utilities in SSA concluded that Zesco was overstaffed by over 70% (Trimble et al., 2016). This finding has had a significant impact on sector narratives. For example, in the financing appraisal of the West Lunga Scaling Solar Energy project, the World Bank (2017c: 28) relies upon the Trimble et al. study, which it in fact commissioned, to note that "that ZESCO's staffing ratio is one of the highest in power utilities in sub-Saharan Africa". In addition, the mining sector rejected electricity tariff increases in part because of the alleged "inefficiencies" of Zesco. However, the Trimble study is based on superficial indicators, notably the number of connections per employee. With the majority of electricity consumed by the mining sector, Zambia has some very large-scale customers. It is difficult to draw conclusions, as the World Bank does, concerning overstaffing. This is not to say that Zesco is not over-staffed but that this kind of rhetoric needs more careful analysis with an objective case-specific standard by which to assess staffing levels across functions within the institution.

3.2 Electricity production - IPPs

Figure 2 shows the sources of total generation sent out in Zambia from 2015 to 2016. Generation capacity is dominated by two large state-owned hydro plants, Kafue Gorge and Kariba North. These accounted for over half of production in 2017. The rainfall crisis led to a reduction in national electricity generation from 13,440 GWh in 2015 to 11,696 GWh in 2016. However, generation rose to 15,195 GWh in 2017 due mainly to improved rainfall in the 2016/2017 season and generation from private power plants (ERB, 2018). Generation from IPPs rose from 598 GWh in 2015 to 3,006.3 GWh in 2017. In 2017, IPPs accounted for nearly 20% of total electricity generated compared with just over 4%

in 2015. The public/private mix is likely to change in the coming years as new plant comes on stream on both sides.

Figure 2: National Electricity Generation sent out, GWh



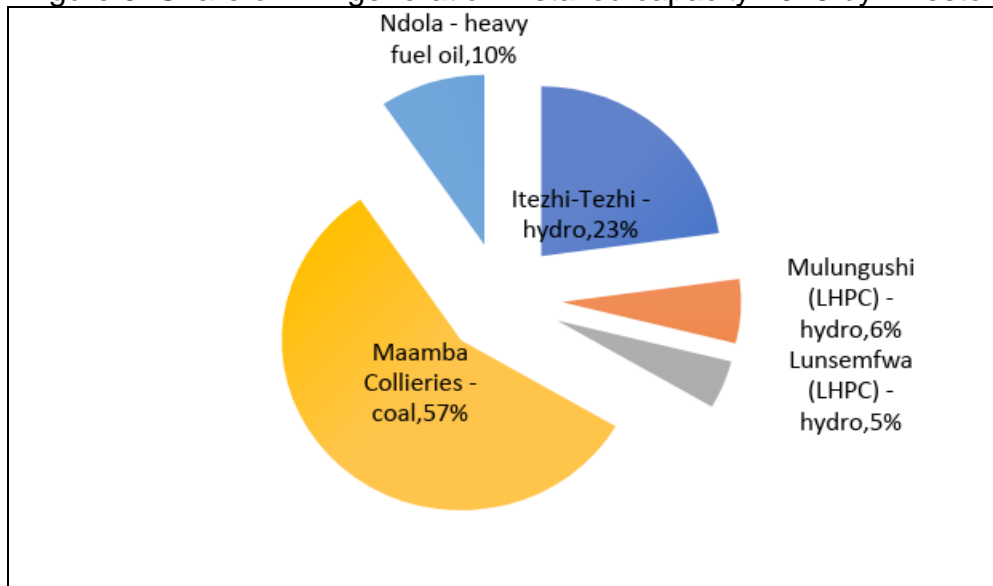
Source: Compiled by authors from ERB (2018)

Following the electricity crisis there has been a deliberate policy to diversify energy sources. In 2017 around 85% of electricity came from hydro-power. Three per cent was from small diesel plants operated by Zesco and CEC. Two recent IPPs have contributed to an increase in fossil fuel generation. Since 2013 a heavy fuel oil (HFO) IPP owned by Ndola Energy Company Ltd (NECL) has been operational, contributing just over three per cent of total generation capacity. In 2016, Maamba Collieries, a large coal powered plant, began operation accounting for over 10% of capacity that year. Some small solar plants such as the Samfya solar mini-grid have had a marginal impact on generation. Two new solar plants were due to come on stream in 2018 as part of the World Bank Group’s Scaling Solar programme (see below). Thus, despite the rhetoric around promoting renewables, there has also been a significant shift towards greater use of fossil fuels, ironically in the wake of a climate change-induced break in renewable supplies. National installed power capacity increased from 2,411 MW in 2015 to 2,827 MW in 2016 and more than two thirds of this increase came from coal power alone. With the Ndola IPP, the share of HFO in total national installed capacity doubled between

2016 and 2017, accounting for 85% of the increase of the national installed capacity during this period (ERB, 2017).

Figure 3 shows the shares of installed capacity for the four main IPPs in Zambia, in 2016 which between them account for almost all of the IPP share in generation (above).³

Figure 3: Share of IPP generation installed capacity 2016 by investor (2016)



Source: ERB 2017 and GCF 2018

Lunsemfwa Hydro Power Company (LPHC) was the first IPP in Zambia, emerging from the privatisation of the mining sector in the 1990s. Since 2011 it has been majority owned by Agua Imara, which is ultimately owned by Norfund, the Norwegian development financial institution (LHPC website).⁴ The other hydro IPP, Itezhi-Tezhi Power Corporation, owned 50:50 by Zesco and Indian company Tata Power, is also supported by donors with funding from FMO (Netherlands) and underwritten by World Bank guarantees via MIGA. The plant came on line in 2016 and there is a 25-year take off agreement with Zesco. The other two IPPs are owned by private investors. The terms of the contracts between the investor and Zesco are not made public. However, from the vantage point of Zambia’s public interest, there are concerns that these projects do not constitute good value for money. A Report by the Chamber of Mines (2017) cites research carried out by First Quantum Minerals, Zambia’s largest mining company, which found that the proposed electricity tariffs for Maamba Collieries and Itezhi-Tezhi were on average 23% higher than global benchmark costs. In addition, they are underpinned by long term PPAs with Zesco, so they are effectively dollar-denominated liabilities to which the company is contracted for decades. Some of the contractual arrangements are explored below.

NECL, which owns and operates the HFO 105MW⁵ power plant in the Zambia Copperbelt town of Ndola, is owned by Great Lakes Africa Energy Ltd (GLAE), a company registered in the UK. Extracts from the company accounts since operations began in 2014 are summarised in Table 2. The accounts state that the operation of the

PPA in Zambia is the only company activity with all revenue derived from the sale of electricity to Zesco, so a review of these company accounts provides insight into the profitability of the Ndola IPP, even though the terms of the 15-year PPA are not made public.⁶

Table 2: GL Africa (NECL) selected indicators (USD 000/ %)

	2014	2015	2016	2017
Revenue	26,561	29,793	28,742	99,885
Gross profit	19,426	23,393	22,664	53,295
Operating profit	12,631	18,895	16,533	40,282
Financial expenses	6,440	4,760	4,028	7,309
Profit before tax	6,191	14,135	12,505	32,973
Tax	60	0	0	0
Profit for the year	6,131	14,135	12,505	32,973
Operating profit margin (%)	48	63	58	40
Net profit margin (%)	23	47	44	33
Electricity generation (in GWh) sent out by NECL*	393.4	380.00	323.60	698.80

Source: GL Africa Energy Ltd Annual Report and Financial Statements, various years

*Source: ERB (2018; 2017)

Table 2 shows that company revenue increased substantially following an increase in plant capacity by over 116% between 2016 and 2017 from 323.60 GWh to 698.80 GWh, respectively. The table shows that the operation is remarkably profitable. While the net profit margin fell to 33% in 2017 from 44% in 2016, overall post tax profit increased by 160% to more than US\$33m. Yet, the company has paid almost no tax (aside from a payment of less than 1% of profit in 2014). In the UK the company has made use of a deferred tax asset and in Zambia, the company benefits from investment incentives offered by the Zambia Development Agency (ZDA) which provides full tax exemption until 2019 and partial exemptions until 2024. The company has liabilities of over US\$100m which consists mostly of loans from companies in the same corporate group, some of which attract interest at 15%. The company paid finance charges of over US\$7m in 2017 mostly to these group companies.

The company's risks have been mitigated mainly by ensuring that these lie with the state. For example, the contract price to Zesco is linked to the US Producer Price Index. The cost of HFO has been incorporated into an agreement with the Zambian state so that under a Fuel Supply Agreement between GLAE and the Ministry of Energy the company is liable to pay for HFO only once this amount has been recovered from Zesco (GL Africa Energy Ltd, 2017).

GLAE is controlled by Humphrey Kariuki, a Kenyan-based billionaire. The company finances the upfront costs of providing infrastructure but ultimately this is funded entirely by revenue from Zesco which in turn is financed through payment of user electricity bills

and Zambian taxpayers. Households and businesses are paying, via Zesco, into this opaque financing structure that results ultimately in high profits for one of the world's richest men.

Zambia's largest IPP, Maamba Collieries Ltd (MCL), the country's first coal-fired power plant, began operation in 2016 (GCF, 2018) during the electricity crisis. Originally established as a colliery in the 1970s, Maamba was set up as an IPP to use the existing coal stockpiles and consists of two 150MW coal-fired power plants as well as a transmission line to the national grid. MCL is majority owned (65%) by Nava Bharat (Singapore) (NBS), a wholly owned subsidiary of Nava Bharat Ventures, an Indian-listed business conglomerate. The Zambian state-owned ZCCM Investment Holdings owns 35% of the project company. The project is financed 70% debt and 30% equity from sponsors. Project borrowing of almost \$600m is funded by a group of lenders including Bank of China, Industrial and Commercial Bank of China, Standard Chartered Bank, Absa Bank Limited, Development Bank of Southern Africa, Industrial Development Corporation of South Africa, Barclays Bank Zambia and Africa Finance Corporation. The project is also supported by China's export credit agency, Sinosure, a Chinese state-funded export credit insurance company established to promote Chinese foreign investment (World Finance, 2016a).

This financing structure has been praised both for the high volume of finance raised from international banks including from Chinese finance institutions, and because the project is financed on a non-recourse, purely project finance basis. In addition, this was the first involvement of Sinosure in project finance in SSA. Previously Sinosure and Chinese state entities have only dealt directly with sovereign entities (World Finance, 2016a). This is described as a milestone for African infrastructure. The success is attributed to the robustness of the sponsor (NBS) and the strength of the project documents.⁷ For these reasons, the Maamba Collieries IPP was awarded "Project Finance Power Deal of the Year" by World Finance Magazine in 2016 (World Finance, 2016b). However, the ability of the project to raise finance successfully without recourse to the sponsors (the equity investors) stems from the conditions that have been taken on by the Government of Zambia. The project is strongly supported by the Zambian state, the state itself being minority shareholder (through ZCCM-IH). There is a 20-year, dollar denominated PPA with Zesco which is guaranteed by the Government of Zambia. In addition, the cost of power generated is high, with Zesco committing to pay MCL around US\$0.1035/kwh (GRZ, 2017). Again, as is the case for GLAE, the profitability and viability of emerging IPPs such as MCL is determined by the commitments of the Zambian state, in turn drawing on electricity customers and taxpayers.

The praise for the MCL deal from the international financial community contradicts the IMF's warnings regarding increasing public debt. While the IMF is concerned about government borrowing, raising private finance for infrastructure via IPPs is celebrated by financiers, despite creating substantial state liabilities. Thus, the potential risk exposure from IPPs is overlooked, if not properly understood, all in the name of encouraging private investment in the electricity sector. Similarly, despite global initiatives to divest from fossil fuels, Zambia's output from non-renewable sources is expanding rapidly (ERB, 2018). While, clearly, capacity expansion is required to deal with intermittency in

renewable sources, some kind of flexible back-up facility would better suit development objectives than long-term commitments to private providers for fossil fuel generation.

In addition to the fossil fuel plants, two IPPs for solar power generation are under construction as part of the World Bank’s Scaling Solar programme. This programme is intended to use public funds to “unlock” private investment in solar power in emerging markets.⁸ Details of the ownerships and the financing for these two projects are set out in Table 3.

Table 3: Financing and ownerships of Scaling Solar projects, Zambia

SPV name and date contract signed	Bangweulu Power Company (2017)	Ngonye Power Company Ltd (2018)
Owners of SPV	<ul style="list-style-type: none"> ○ Neoen (France) (55%) ○ First Solar (USA) (25%) ○ GRZ (20%) 	<ul style="list-style-type: none"> ○ Enel (Italy) (80%) ○ GRZ (20%)
Capacity	55MW	34MW
Total finance	US\$60.4m	US\$45m
Financing	<ul style="list-style-type: none"> ○ IFC A loan US\$13.3m ○ IFC Canada Climate Change Programme Loan US\$13.3m ○ OPIC⁹ Senior loan US\$13.3m ○ GRZ US\$4.09m ○ Neoen: US\$11.26m ○ First Solar: US\$5.12m 	<ul style="list-style-type: none"> ○ IFC A-loan US\$10m ○ IFC Canada Climate Change Programme Loan US\$12m ○ EIB loan US\$11.75m ○ GRZ US\$2.25m ○ Enel US\$9m
PPA duration	25 years	25 years
EPC contract	Sterling and Wilson (India)	Enel subsidiaries

Source: compiled from various sources including press releases from investors; IFC and IJ Global 2019a and 2019b; World Bank 2017c

Table 3 shows that while these projects are described as a means to “rapidly mobilise privately funded grid connected solar projects” (Scaling Solar 2018, p.2), a relatively small proportion of project funds comes from equity investors. The majority of project funds in both cases comes from concessional donor finance. Private sector investment comes to 27% of the project finance for Bangweulu and 20% for Ngonye. In addition these projects are underpinned by 25-year PPAs. These projects are then ultimately financed by Zambian electricity consumers and tax payers. While these projects bring benefits for Zambians through energy generation, and the cost of power is low compared with fossil fuel generation (the tariff for the Neoen contract is just US\$0.062/kWh (IFC, 2017).), they also generate secure profits for investors. Engineering, procurement and construction (EPC) is in the hands of international companies. The provision of renewable energy has clearly been cast as a global private investment activity.

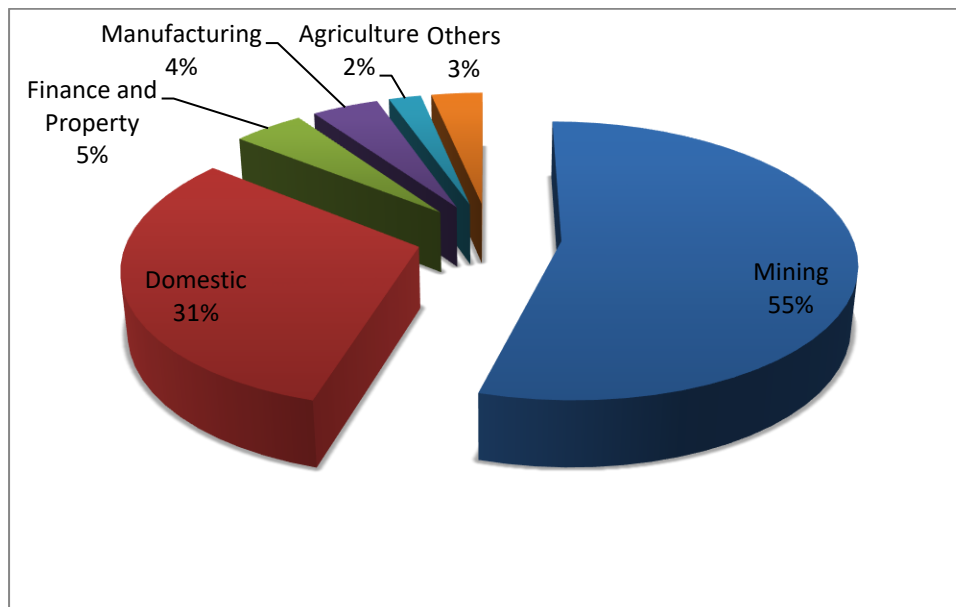
With infrastructure deficiencies consistently presented as a financing issue, private capital is seen as inherently desirable with insufficient regard to the details of the terms under which it is provided and the full distributional effects. Concessional finance is provided to create profitable business opportunities for global investors. In reality, although not readily visible, Zambian households and businesses become linked to global financial processes, via electricity consumption. The IPP is effectively a financial and operational intermediary.

It may be that IPPs bring advantages over public investment, such as speed and cost of construction, or predictability of financial flows, but providing funding is not one of them. The idea that private finance can contribute to the infrastructure financing gap is extremely misleading because contracts for private power generation, embedded in PPAs, create commitments for often high cost liabilities for decades. Private finance is only attainable if risks are allocated to the state and the payments of consumers and tax-payers are ring fenced for years into the future. This seems unlikely to ease the financial difficulties facing Zesco, or to fill the socially-acceptable investment gap necessary for a developing country electricity sector.

3.3 Electricity consumption

The mining sector consumes over half of electricity produced in Zambia (Fig 4). Residential users account for 31% with other categories, including manufacturing, accounting for less than 15% between them. In addition to existing consumers, the SoP is concerned with the millions in rural areas that still lack access to electricity.

Figure 4: Share of National Electricity Consumption by Economic Sector, 2016



Source: Compiled using data from ERB 2017

3.3.1 Access to electricity

According to the 2015 Living Conditions Survey Report (CSO 2016), at a national level, 31% of households stated that they were connected to electricity but there is considerable regional variation. Access has improved for urban households, in part supported by donors including the World Bank and the Swedish International Development Agency (SIDA) but rural electrification has lagged. In rural areas, home to about 57% of the population, about 4.4% of households has connection to electricity, compared with 67.3% of urban households (CSO 2016).

Increasing access is a core government policy¹⁰ and the GRZ has set electrification targets of 90% for urban areas and 51% for rural areas by 2030 (World Bank 2017b). The REA is supposed to be implementing the Rural Electrification Masterplan (REMP) described as a blueprint for electrification for the period 2008-2030. The plan has identified 1,217 target Rural Growth Centres (RGCs) in rural areas across the country which are targets for electrification. The approach is initially to target public activities in larger settlements such as health clinics and schools. The REMP is financed by the Rural Electrification Fund (REF) which comes from government and donor grants as well as a three percent levy on all retail electricity bills, although the levy funding travels via the ZRA and not all seems to reach the REF (World Bank, 2017b). Once the grid has been extended, these communities become customers of Zesco. Note that the mining sector does not contribute to this fund, according to publicly available information sources.

There are extensive challenges in extending access in rural areas. Almost 77% of the rural population in Zambia lives below the poverty line (World Bank, 2017b) and cannot afford to pay for power nor afford a connection fee. Electrification therefore relies on public funding. Low population density increases the cost of reaching scattered households. The REA is hopelessly underfunded to implement the REMP. The Authority has been spending about \$15m annually on rural electrification compared with an annual funding requirement of \$50m (Malambo, 2018). At the current rate, the 2030 targets will be missed by a significant margin (World Bank, 2017b). The assumption behind the REMP was that once electricity was made available at RGCs, then households would want to connect to the grid but take up has been far less than expected even in grid connected areas, in part deterred by the connection fee. And for the 60% of the rural population not located in the catchment areas of the RGCs, there is no electrification plan (World Bank, 2017b).

Donors are supporting investment in grid extension and off-grid generation activities in Zambia using renewable energy, including the Scaling Solar programme referenced above and the Beyond the Grid Fund for Zambia (BGFZ) under the Government of Sweden.¹¹ The GET FiT Zambia initiative is supported by the African Development Bank and KfW¹² and is designed to procure 200MW of renewable energy projects. As with the Scaling Solar projects, above, expanding rural access has been heavily constructed as a private sector activity. The GET FiT project consists of a number of components “designed to help create an attractive environment for private investors”,¹³ including “viability gap funding” which is effectively a subsidy to private firms to compensate for

the fact that rural consumers cannot afford a commercial tariff. The GETFIT website describes this as funding that “facilitates the entry of early movers from the private sector into the nascent renewable energy market in Zambia”.¹⁴ Yet, as the previous section demonstrated, private finance is reimbursed by the state with a substantial profit margin. Rather than a “market”, this is effectively a kind of wishful outsourcing of core development goals to the private sector.

3.3.2 Electricity prices

The electricity tariff has been the subject of considerable debate and contestation in Zambia. There has long been discussion about moving to cost-reflective pricing (World Bank, 2015; Kapika & Eberhard, 2013). Until the hydro crisis in 2015, Zambia had the lowest cost electricity in SSA and the lowest tariff, and Zesco was reasonably profitable. While, along with many other countries in the region, Zesco was deemed to be underpricing electricity, the amount of undercharging per kWh was regarded as comparatively small, calculated at \$0.02, less than Kenya (0.03) and Botswana (\$0.13) (Trimble et al., 2016).

However, pressure on prices increased substantially with the electricity crisis which pushed up costs for Zesco. The IMF (2017) considers what they term the “large and not well-targeted subsidies” (IMF, 2017, p.9) in energy to be one of the main sources of the country’s fiscal challenges (along with a large public sector wage bill and fuel and agriculture subsidies). For the IMF, a shift to cost reflective tariffs is required not just to ease pressure on the budget but also to “attract much needed investments into the energy sector” (IMF, 2017, p. 15).

In 2015 ERB approved a tariff increase of 180% for non-mining customers but this was reversed by the Government in 2016 following a public outcry. However, the removal of all energy subsidies including electricity subsidies was confirmed in the 2017 National Budget (PMRC 2017) and in that year tariffs were increased by 75% for non-mining customers in two stages. The average residential tariff increased from US\$0.347/kWh to US\$0.547/kWh (GRZ 2017). The lifeline volume increased from 100kWh to 200kWh. According to the IMF this means that the effective tariff increase was closer to 48% (IMF, 2017).

Such a high price increase was justified from an equity perspective on the basis that most households do not have access to electricity. The wealthiest households consume nearly five times as much electricity per household as the poorest (if they are connected to the grid) while the poorest 20% receive less than 1%. This narrative, that any electricity tariff below cost recovery is regressive because only the wealthy have access, is echoed widely in the development literature (see for example Huenteler et al., 2017), but closer examination of the case of Zambia raises questions regarding this conventional wisdom. First, while they may consume little electricity directly, poor households are expected to suffer from the indirect effects that put up prices for goods that use electricity as an input (Maboshe et al., 2019; PMRC, 2017).

Second, while a cost recovery tariff may improve liquidity for Zesco, passing the inflated production costs outlined above through to end users will contribute to a more regressive structure, with Zambian households financing the shareholder income of the world’s wealthiest via their consumption of electricity. Indeed, even if new developments in the electricity sector are initially undertaken by (foreign) private entities, it has been demonstrated above that the return on these investments is eventually extracted from Zambian taxpayers. Even then, the increased tariff is not sufficient to cover the US\$0.1035/kWh that Zesco is paying to Maamba Collieries Ltd, for example, so simply increasing tariffs is not sufficient to create financial viability.

Third, this notion of electricity subsidies has emerged relatively recently in Zambia. Table 3 below shows that on both budget commitments and cash disbursements bases, electricity sector subsidies were zero until 2015. Similarly, Zesco had a stable healthy operating profit up until 2015 when the electricity crisis began to impact on financial performance (Table 1). The notion of under-pricing seems then to be a phenomenon related to the electricity crisis rather than endemic to the sector.

Table 3: Cost of electricity sector subsidies (% of GDP)

	2012	2013	2014	2015	2016	2017
Cash	0.0	0.0	0.0	0.2	0.5	0.3
Commitment	0.0	0.0	0.0	0.3	0.9	0.1

Source: IMF 2017

Fourth, analysis of the distributional effects of tariffs (Maboshe et al., 2019) relate to non-mining customers. The tariffs paid by mining companies and by CEC are outside the remit of the ERB. They are set in long term privately negotiated PPAs and BSAs and the details, especially financial, are not in the public domain. According to press reports, however, an increase in the mining tariff was rejected by largest mines (Kansanshi, Kalumbila and Mopani Copper Mines) which withheld payment, discussed in more detail below. Revenue from mines is far more important to the financial viability of Zesco than that from households, since the mines collectively represent the largest consumer group. Increasing tariffs is not going to rectify the sector’s viability if the customers that dominate consumption are able to override (or negotiate in their favour) price-setting practices.

When electricity pricing is put in context, then the narrative of “inefficiency” caused by “under-pricing” becomes more nuanced. Far more detailed analysis of who pays what, and to whom, and for what is required. Furthermore, the definition of subsidy needs to be analysed, in particular with greater attention to the prices paid under BSAs and PPAs.¹⁵

3.4 Mines

The Zambian economy is dominated by copper mining. This is one of the most energy intensive industries in the world, accounting for about five per cent of electricity consumption globally (Chamber of Mines, 2017). In Zambia, the mining industry is the largest consumer category (Figure 4), operating mainly in two regions of the country.

Four mines account for 80% of Zambia's copper production (Chamber of Mines, undated). In North Western province, Barrick Lumwana is owned by Canadian investors and FQM Kansanshi, described as the largest copper mine in Africa,¹⁶ is owned by Canadian First Quantum Minerals. These mines in North-Western Province receive their electricity from Zesco. This mining region has emerged only since the early 2000s. Prior to this, mining was centred in the Copperbelt region. The main mines located here are Mopani Copper Mine (MCM), majority owned by Anglo-Swiss company Glencore Plc and Konkola Copper Mine (KCM), owned by UK registered, Vedanta Resources. Also, in the Copperbelt region is CNMC Luanshya Copper Mines Plc, owned by China Nonferrous Metal Mining (Group) Co. Ltd. The rest of Zambia's copper production comes from a handful of smaller Copperbelt mines (Chamber of Mines, undated).

The state-owned mining sector in the Copperbelt, Zambia Consolidated Copper Mines (ZCCM), was privatised in the late 1990s. This was a condition of structural adjustment and new loans from IFIs. At the time, the mining sector was in decline following a collapse in copper prices. While privatisation brought investment, it was associated with a devastating impact on local communities in loss of formal employment and the cessation of welfare services (including electricity) which had previously been supported by the mines (Nel et al., 2017; Fraser & Lungu, 2006). The terms of privatisation are widely regarded to have been extremely favourable to the mining sector, even by some of the mining companies themselves (Lungu, 2005).

Mines in the Copperbelt region are provided with power via CEC which transmits electricity purchased from ZESCO at high voltage and distributes it to mining operations (ZIPAR, 2015, and see Fig 1, above). CEC emerged from the privatisation of the mining sector and was formerly the Power Division of the state-owned ZCCM. While mines are supplied by CEC, non-mining (household and business) consumption in the Copperbelt area became the responsibility of Zesco after privatisation. Zesco now has to pay a fee to CEC for "wheeling" or use of CEC's supply and distribution network when it takes the power from the CEC network and sells it to communities in the Copperbelt.

CEC buys at least 30% of the electricity produced by Zesco. The terms, including the price, are part of a BSA, the terms of which are not public. CEC is also able to import power from other countries in the region and CEC has its own generators for emergency supplies. Since 2006, CEC has been owned by a consortium of Zambian investors. In 2017 the company was majority (52%) owned by Zambian Energy Corporation (Ireland) Ltd which is ultimately owned by Batoka Energy Holdings Limited (CEC 2017), a company registered off-shore in Ireland. The operation is highly profitable. CEC paid out dividends of over US\$50m over the three-year period from 2015 to 2017.¹⁷ The Chair of CEC, Hanson Sindowe, who orchestrated the 2006 takeover of CEC, is now one of the country's richest men (Forbes Africa 2014).

Mining companies have challenged efforts from the ERB to increase the price they pay for electricity. In 2014, an attempt by Zesco and CEC to raise prices for the mining sector, authorised by ERB, resulted in court action because the tariff increase failed to take due account of the power supply agreements previously negotiated privately between mines and suppliers on a case-by-case basis. Accordingly, the 2017 tariff did

not affect the mines initially. ERB is not able to unilaterally impose a tariff on the mines outside of these private agreements (according to a statement from Agnes Phiri of ERB, cited in Zambia Daily Mail 2017).¹⁸

In April 2017 a price increase for mines was proposed again, this time with a flat tariff of US\$ 0.093/kwh. The increase was to be backdated to January 2017 but mining companies opposed the plan and sought to continue to pay at their old tariffs. While individual contracts are not public, an IMF document put the average tariff paid by mines at \$0.067/kWh (IMF 2017). The dispute escalated, with Zesco and CEC reducing the power supply to mining customers that failed to pay the new electricity tariff (Lusaka Times 2017a). One of the largest mines, MCM, responded by deactivating mine access cards for more than 300 miners working for contractors and suppliers on the Copperbelt (Lusaka Times 2017b). The dispute was only resolved by the intervention by the President (Lusaka Times 2017c) although the terms that were settled are not publicly available.

This tariff dispute highlights the economic and political power of the mines. Mines are treated separately from the rest of the electricity consumers and this reflects a wider literature that shows that mining companies sit apart from the communities in which they operate, and from the country's socio-economic structure more broadly. For example, a 2016 World Bank study found that mineral revenues in Zambia were not shared with the local governments of communities where minerals are extracted, thereby undermining social and physical development. Any positive contributions were ad hoc and inconsistent (WBG, 2016). Zambian mines have been accused of a lack of regard for local communities in other ways, for example, contaminating local water and land (Vidal 2016; BBC 2015). Kesselring (2017) uses detailed ethnographic research in the mining towns of Solwezi and Kalumbila in North-Western Province to show the social divisions created and perpetuated in mining communities. She highlights how, during the electricity crisis, the protected enclaves of the mines and the living areas (including the golf course) for senior and junior management and expat workers continued to have almost unlimited access to electricity. Meanwhile the rest of the towns struggled to provide services to its residents. Mines were the last to be affected by load shedding and they barter for a better price. For Kesselring (2017, p.96) "The favoured treatment is an expression of the sector's economic power and unequal access to decision makers." The mines justify their preferential position on the basis of their economic significance: "Reducing power to the mines means reducing production, which negatively impacts employment, export earnings, government tax revenue and economic growth" (Chamber of Mines 2017, p.13).

The Chamber of Mines has been vocal in its criticism of Zesco, stating that mines should not have to pay for an inefficient utility, covering high staff costs, losses and leakages (Chamber of Mines 2017, p.21). The mines are strong supporters of a cost reflective tariff as this would likely result in a lower rate for mines relative to other consumers as their costs would be lower than for others (Chamber of Mines, 2017). It is much cheaper to provide electricity to mines than to households because they can receive it at high voltage and their consumption and payment is predictable. This highlights the need for

Careful analysis of the distributional effects of ostensibly neutral measures in the standard policy paradigm, such as a tariff that is reflective of costs.

The mining sector presents itself as a model electricity consumer seeking to promote efficiency but there is little regard to the importance of electricity access and affordability to the overall human and economic development of Zambia. Their interventions in the electricity sector are driven by the priorities of their shareholders. Mines have stronger links to global private capital than the communities in which they are located. Support for local infrastructure, once provided by the mines under state ownership, now takes the form of charity initiatives such as the Kansanshi Foundation. The sector could be called upon to play a much more significant and formal role in national economic development. The role of the mining sector demonstrates the tensions, contestations and power relations that influence sector outcomes and the way that these have evolved. The mining sector occupies a significant space in the overall electricity SoP, yet it positions itself as above and apart from the rest of the country and its economy, in a classic demonstration of resource-curse corporate behaviour.

4 Conclusion

This SoP analysis of the electricity sector in Zambia highlights some of the contradictions and inconsistencies in the mainstream policy paradigm. First, subsidies are heavily criticised by the IFIs because they benefit the wealthy. However, arguably, there is much about the current and proposed structure that is regressive, on which IFIs are largely silent. Cost-reflective tariffs are promoted on the grounds that a subsidy is inequitable as only the wealthy have access to electricity. Nevertheless, taken to its logical conclusion, a cost-reflective tariff in Zambia, in the absence of some form of welfare subsidy, would mean that the mining sector pays the lowest tariff and households in remote rural areas the highest, as mining customers are cheapest to serve. It is therefore unsurprising that the mining sector welcomes cost-reflective tariffs. Similarly, the need for tariffs to cover costs is often stated without scrutiny of what costs are covered, from and for whom. IPP contracts with offshore financiers are funded by Zambian households and tax-payers. Arguably an increase in residential tariffs to finance offshore returns to shareholders via these onerous contracts will have a regressive impact. Thus, the narrative of a drive for efficiency in electricity pricing is not necessarily neutral. There is a need to specify which costs are to be covered by the proposed cost-reflective tariffs, and to design and formulate appropriate tariff structures anchored on a mix of economic and social interests which will not penalise Zambian households or discourage business growth.

Second, it is far from clear that the measures introduced in recent reforms will address the main challenges facing the sector. Zesco has only recently run into financial difficulties, largely due to the depreciation of the currency and fall in rainfall. Support is needed to overcome these short-term issues. However, signing up to dollar-denominated, 25-year PPAs risks weakening the financial position of Zesco in the long-term. Outside the energy sector, Zambia has rapidly shifted to a situation of high risk of debt distress amid concerns about the fiscal effects of government borrowing. In the energy sector, a spotlight has been shone on Zesco borrowing for public power generation projects. At the same time, the financing for IPPs which create major public

liabilities is celebrated. The international community has a strong tolerance for liabilities from IPPs compared with government debt even though the private financing structures are potentially at higher cost and are inflexible and risk greater strain on public finances. In addition, these liabilities are ultimately funded by the nation. The focus has been on Zesco's efficiency and productivity as factors affecting the performance of the electricity utility, while a blind eye has been cast on the nature and effects of private investment in electricity.

Third, and related to the second, the focus of tariff reform is on residential and business consumers. The prevailing narrative is that customers are underpaying for electricity and this is a source of "inefficiency". But the mining sector which dominates consumption of electricity, sits outside the affected area on the grounds that contracts are negotiated separately. Arguably this is where attention to efficiency needs to be focused. Given that the mining share of electricity consumption is considerably higher than that of domestic households and that the mining consumers are the world's wealthiest, far more significant is any subsidy element in the tariffs paid by mines, and by CEC. Yet there is very little transparency regarding the electricity consumption of the mines. CEC is an intermediary, paying dividends to a parent company registered offshore. This could be seen as a source of inefficiency when looking at the sector as a whole, and in relation to the shortfall in rural electrification funding in particular. An argument to increase sector efficiency could rather call for the operations of CEC to be taken over by, or, as a compromise, run in collaboration with, Zesco with (part of the) revenue retained in-house rather than paid (entirely) to offshore shareholders. The international community looking to improve equity in the sector could also call on mining consumers to pay a levy to finance electrification.

Overall, there is a need to set the SoP in Zambia in both local and global context, with detailed attention not just to performance of sector utilities but also to distributional outcomes and the nature of interaction of agents. The sector-wide approach of the SoP calls into question the social and economic effects of mainstream narratives outlined at the start of this paper. Looking closely at developments in the Zambian electricity sector, it is difficult to avoid the conclusion that the ultimate beneficiary is global private capital in its different manifestations, from private equity investors in IPPs to shareholders in the mining industry.

This study is revealing of the messy realities and complex power relations that lead to sector outcomes. The simplistic assumptions that underpin the prevailing policy paradigm reflect inherent biases, and risk compromising development objectives. The international development community is quick to criticize supposed inefficiencies in state activities yet remarkably tolerant, and indeed supportive, of payments to international finance. A narrow focus on efficiency and financial flows has obscured wider priorities of equity, transparency, accountability and long-term sustainability. The SoP analysis shows that the particular configuration and operation of private capital in the electricity sector in Zambia must be read and understood within context. Rather than an off-the-peg policy package, attention is needed to the specific constraints and opportunities that the country faces, and to reflect the genuine challenges in providing a widely available, sustainable and equitable energy source. From a SoP perspective, it makes little sense

to resolve Zambia's electricity shortfalls with long-term, high-cost liabilities to global capital, particularly for fossil fuel generation. Continuing down this policy path is likely to undermine developmental goals, further entrenching rather than alleviating inequality.

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¹ <http://www.zesco.co.zm/aboutUs/briefHistory>

² All money values reported here are given in thousand USD, converted from Zambian Kwacha using the USD/Kwacha exchange rate adopted in the Zesco Annual Reports. Figures have not been adjusted for inflation. The US Dollar – Kwacha exchange rates used as official in Zesco Annual Reports were as follows:

	31 March 2012	31 March 2013	31 December 2013	31 December 2014	31 December 2015	31 December 2016
Exchange rate (Kwacha/US\$), average	5.27	5.42	5.53	6.39	8.61	10.32

³ An additional IPP, Zengamina, has been set up as an off-grid mini hydro scheme in the remote North West of the country. The project is small scale and just supplies the local community including schools and health clinics. The operation is owned by a charity, the North West Zambia Development Trust. There are other mini-hydro power stations being set up including Lusiwasi and Musonda Falls.

⁴ <https://www.hydropower.org/companies/lunsemfwa-hydro-power-company>

⁵ Phase one, a 50MW plant, was completed in 2013 and phase two, adding 55MW, was completed in 2017.

⁶ GL Africa Energy Ltd is incorporated, domiciled and registered in England (Company No. 08721406). The accounts state that “all of the Group’s revenue arose from the supply of electricity within Zambia” and “All of the Group’s revenue is earned from the supply of electricity within Zambia” Hence there is “one business segment in one geographical location” (GL Africa Energy Ltd Annual report and financial statements year ended 31 December 2016, p.23).

⁷ Transcript of World Finance Interview with Ashwin Devineni and PJV Sarma of NBS

⁸ <https://www.scalingsolar.org>, accessed 6 February 2019

⁹ OPIC is the US Government’s development finance agency which is designed to help American businesses invest in emerging markets and to advance US foreign policy and national security priorities

¹⁰ Note, however, that the definition of access is expected to change in light of technological developments, possibly taking the form of a solar panel for a hand-held device such as mobile phone or lighting appliance for a remote household which will require revision of the rural electrification approach (World Bank 2017b).

¹¹ See the BGFZ website - <https://www.bgfz.org/>

¹² See the GET-FiT website - www.getfit-zambia.org

¹³ See the webpage = <https://www.getfit-zambia.org/about/>

¹⁴ <https://www.getfit-zambia.org/about/>

¹⁵ Interviews with stakeholders indicated that through Bulk Supply Agreements CEC was capable of negotiating and buying power at a lower price than residential customers.

¹⁶ First Quantum website - <https://www.first-quantum.com/Our-Business/operating-mines/Kansanshi/>

¹⁷ Copperbelt Energy Corporation Company Accounts

¹⁸ This was confirmed in stakeholder interviews.