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Policy Monitoring and Research Centre

ENERGY POLICY REFORM

THE IMPACT OF REMOVAL OF ELECTRICITY SUBSIDIES ON SMALL, MEDIUM SIZED ENTERPRISES AND POOR HOUSEHOLDS

POLICY BRIEF

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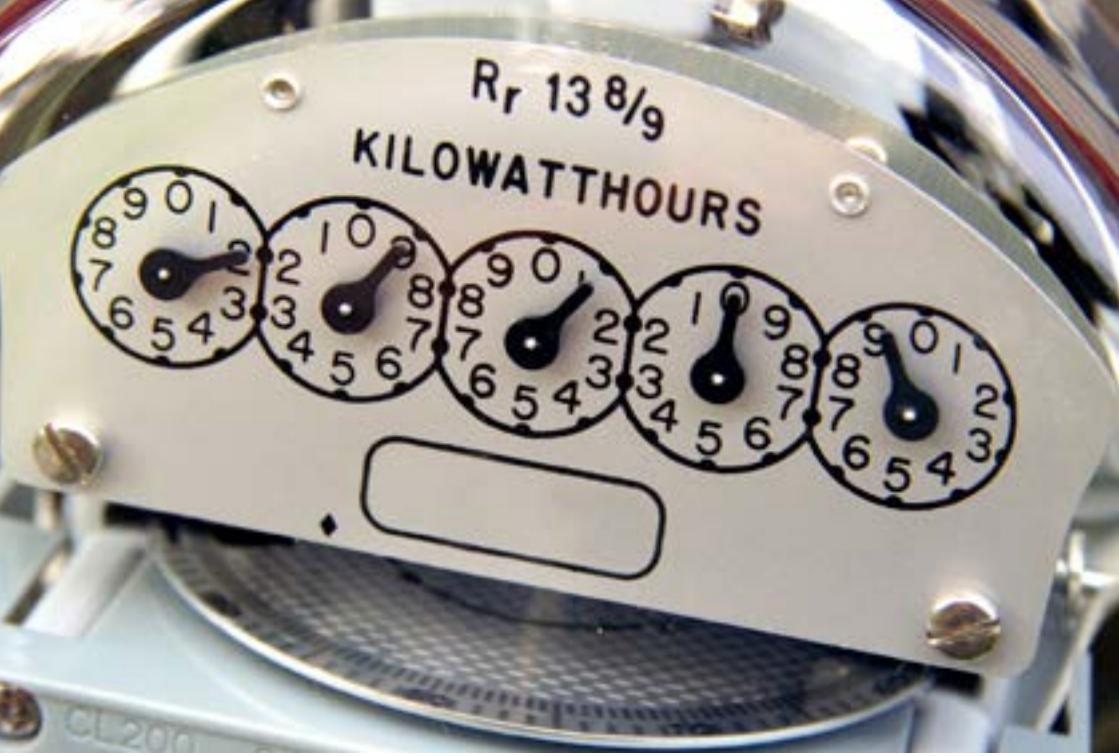
CONTENTS

PAGE

ABBREVIATIONS

CEC	Copperbelt Energy Corporation
CSO	Central Statistical Office
ERB	ERB Energy Regulation Board
FDI	FDI Foreign Direct Investment
GDP	GDP Gross Domestic Product
IFC	IFC International Finance Corporation
IMF	IMF International Monetary Fund
IO	IO Input Output
IPP	IPP Independent Power Producer
kWh	kWh Kilowatt hour
LCMS	LCMS Living Conditions and Monitoring Survey
MEWD	MEWD Ministry of Energy and Water Development
MSME	MSME Micro Small and Medium-Sized Enterprise
OECD	OECD Organisation for Economic Co-operation and Development
PMRC	PMRC Policy Monitoring and Research Centre
SME	SME Small and Medium-Sized Enterprise
SOE	SOE State Owned Enterprise
WB	WB World Bank
ZESCO	ZESCO Zambia Electricity Supply Corporation



1. EXECUTIVE SUMMARY

In the ***2017 National Budget***, the government of Zambia announced a plan to introduce *'cost-reflective tariffs'* for electricity by the end of 2017. This means removing the subsidies which currently allow ZESCO to charge consumers less than the cost of producing and distributing the electricity. In the current economic context, and faced with a large budget deficit and looming economic recovery programme, this is a welcome ambition. Removal of subsidies has the potential to crowd in investment in the energy sector, creating additional generation capacity and boosting growth.

Despite these benefits, policy questions do remain to ensure any withdrawal of subsidies is done effectively. For example, the Government needs to consider how cost reflective tariffs can be introduced while adequately protecting the poorest Zambians and Small and Medium Sized Enterprises (SMEs), as well as how to ensure price increases are sustainable and don't end up being reversed in the future.

PMRC have undertaken a project to explore these questions in detail. The project has assessed international experiences, predominantly from other African countries and brought this together with analysis of the impact of electricity tariff changes on households, the energy needs of SME's and analysis of the key stakeholder interests to form policy recommendations on how to implement cost reflective energy tariffs sustainably.

Setting a framework for success

In March PRMC published their interim report for this project that considered international experience of energy price reforms. The report highlights the relatively successful case studies of Kenya and Uganda. While reform has not been complete, there has been some success. But it also looks at examples of where reforms have not been successful. Mexico, where there was a clear policy failure, is explored in detail.

The policy recommendations that flowed from this analysis can be seen as a framework for successful withdrawal of electricity tariff subsidies. In short, successful programmes will

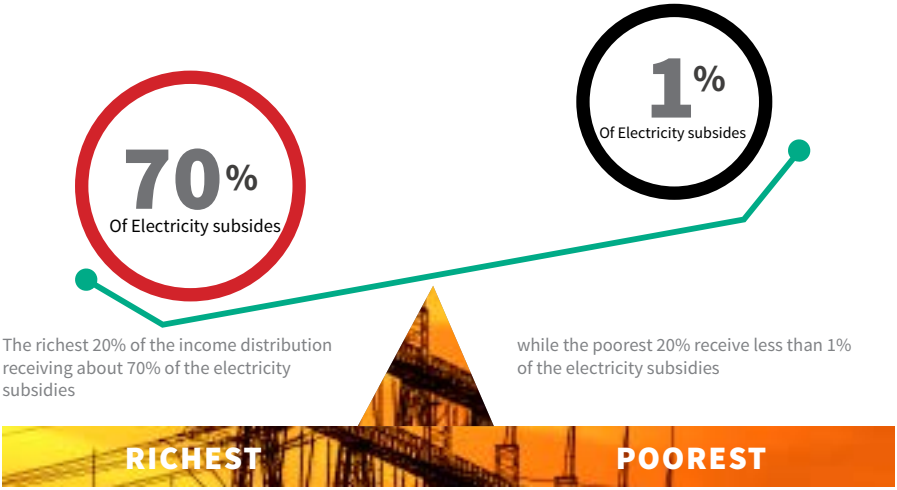
1. Make tariff reform part of a comprehensive reform plan, that includes a clear commitment to improve generation.
2. Ensure a clear communications strategy, with transparent access to information.
3. Phase in energy price increases.
4. Combine tariff reform with improvements in the efficiency of State Owned Enterprises (SOEs).
5. Target mitigating measures to protect the poor from price increases.
6. Depoliticise energy pricing, by granting price setting powers to an independent board.

Learning lessons from other countries will be key to delivering successful reforms, and avoiding the pitfalls that have prevented electricity tariff increases in the past. Out of all applications for tariff adjustments made by ZESCO to the ERB between 1998 and 2014, only 25% of the applications were granted full price increments. A comprehensive strategy addressing each of the points in ZESCO's proposed increases is important if increases are to be accepted this time round.

The case for reform - why subsidies are ineffective

Building on the interim report, this report completes PMRC project by examining the case for moving to cost reflective tariffs. Key to this is a robust analysis of the beneficiaries of the current subsidy regime and an analysis of the impacts of withdrawing these subsidies.

The results of this analysis clearly show that electricity subsidies are highly regressive and are not an efficient use of scarce Government resources. In Zambia PMRC's modelling shows that ***the richest 20% of households receive about 70% of the electricity subsidies while the poorest 20% of households receive less than 1% of the electricity subsidies.***



The reason for this skewed distribution of benefits is down to the design of ZESCO tariff bands – all households receive the first 300kWh of usage at subsidised rates, and whilst the poorest households do benefit from this they typically consume far less than 300kWh, whilst wealthier households consume far more – benefiting disproportionately from the subsidies. This is clearly an inefficient use of Government resource – more support is going to those households who need the least support.

ZESCO's proposed tariff increase[1] marginally improves the targeting of lower pricing, but the structure of tariff bands remains regressive. Under ZESCO's proposals the wealthiest 20% would receive about 64% of the subsidies while the poorest 20% would still receive less than 1% of the subsidies. This is largely attributable to the low levels of access to electricity by the poor.

However, despite the overwhelming amount of benefits in cash terms accruing to the wealthiest households the impact of electricity tariff increases will be felt most keenly by the poorest households. To estimate the impact on household spending PMRC modelled the estimated indirect impacts of energy price increases (for example the increased cost of buying food) as well as the direct impact of price increases. This analysis showed that a 75% electricity tariff increase has the largest impact on the poorest whose real, or disposable, income is likely to be eroded by 13%, compared to a 6% reduction in the incomes of the richest. The direct effect on real incomes for the poorest households is 9%, compared to only about 3% for the richest.

1. Note modelling was completed before the ERB confirmed the increase in ZESCO rates. The initial ZESCO proposals – including a lifeline tariff for up to 300kWh of usage was modelled.

The difference in the patterns of the direct effects is driven by differences in budget shares across the income distribution. Poorer households are likely to spend a larger budget share on electricity compared to richer households who typically have larger incomes and expenditures.

This analysis suggests two things, firstly that there is a strong case for withdrawing energy subsidies since they overwhelmingly benefit the wealthiest households, and that in withdrawing subsidies some effort must be taken to protect the poorest households who don't have sufficient levels of disposable income to manage tariff increases.

The case for reform – supporting improved productivity

Building on the household impact analysis PMRC considered the energy usage habits of SMEs, the challenges uncertain supply posed and the likely reaction of SMEs to any electricity tariff increases. This qualitative study showed that the current power outages experienced in Zambia had significant impact on the SMEs in several ways.

In the first instance, it's important to note that SME's in sub-Saharan Africa face the largest cost (as a percentage of income per capita) to gain access to mains electricity - a staggering 4,737% compared to 80% in High Income countries according to the World Bank. This is perhaps reflected in the fact that only 36% of SME's across sub-Saharan Africa have access to electricity. The same survey also suggests that 49.3% of firms in sub-Saharan Africa identified electricity as a major constraint to business compared to 26% in High Income countries.

PMRC's SME survey confirmed that access to reliable power remains an issue for SME's in Zambia. In particular, the findings showed 70% of SME's experienced fluctuations in power daily whiles 20% experienced fluctuations once a week –SME's overwhelmingly reported that this led to losses either due to low productivity or damage to stock or sales. Whilst there was wide knowledge of alternative sources – only 40% of SME's had access to a generator and all SME's indicated the cost of using alternative supplies of power was expensive.

Whilst this suggests that there could be large efficiency and productivity gains from a reliable supply of electricity, 80% of SME's surveyed indicated they would be likely to pass on the cost of any increases to consumers.

The SME survey makes it clear there is a strong case to improve the supply of electricity in Zambia, and this could result in large productivity gains. However, increased supply will need a combination of increased investment in generation and increased purchases of power from Independent Power Producers. It will be important to ensure this trade-off is made clearly by the Government to enable SME's to plan effectively and capitalise on potential productivity gains.

Delivering reforms

There are multiple stakeholders active in the energy sector in Zambia. The final piece of analysis PMRC conducted looks at their roles in delivering cost reflective tariffs and improved energy supply in Zambia.

It is clear that reforms can only happen if the Zambian Government, ZESCO and the ERB have their interests aligned. It is also clear from international examples that all of these players have a role in ensuring change is sustainable – the Government and ZESCO must set out clear plans for whole system reform, including generation capacity increases, whilst the ERB must represent consumers and ensure any price increases are implemented fairly.

Our analysis concludes all three of these key players need to act together to set out phased plans for reform, including using Independent Power Producers to increase supply in the short term.

Conclusion and Policy recommendations

There is a clear case for moving to cost reflective tariffs. Current subsidies are inefficient and poorly targeted. They direct Government resources to protecting the wealthiest households.

However, price increases need to be matched by improved energy supply. Neither businesses nor consumers should not, and will not, accept paying a higher price for an unreliable product.

The gains from improved supply could be significant. So, to ensure that changes are implemented sustainably, PMRC have the following recommendations for Government and are pleased to note that the ERB has implemented some of these in its recent ruling on ZESCO's electricity tariff increases.

1. **Do more to target reduced rates on those who need them most. Specifically;**

    a. Re-designing the proposed electricity tariff increases, replacing the current universal lifeline policy with a targeted usage and hardship based lifeline tariff policy and re-evaluating the level the lifeline band is set at (setting it lower than 300kWhs).

    b. Considering cross-subsidisation of household electricity consumption, i.e. asking the wealthiest households to pay more than cost of production to support lower rates for the poorest households.

    c. Encouraging ZESCO to partner with other parts of Government to target lifeline rates and support effectively.

    d. Removing the "fixed monthly charge" tariff, considering the fact that the fixed charge disproportionately raises the effective tariff rates for the marginal electricity users.

2. **Provide some certainty to business to enable them to plan for, and manage price increases. Including:**
   a. Providing a clear 3-year plan for phasing in any price increases for SMEs
   b. Guaranteeing price increases will result in increased security of supply.
   c. Considering subsidies for alternative supply as a temporary mitigation measure.
3. **Create the conditions for successful reforms, by:**
   a. Setting clear remit for the ERB to consider the importance of energy supply in their deliberations on electricity pricing.
   b. Providing a road map for Government investment in new energy generation capacity
   c. Providing an open and transparent case for change, with a clear offer to consumers

2. INTRODUCTION

Since 2008 electricity supply in Zambia has lagged behind the country's rapidly growing demand, leading to a widening electricity deficit and increased frequency of blackouts in the recent past. The economic impact of the crisis has been severe, with key economic sectors such as mining, manufacturing and agricultural sectors scaling down production and employment as the intensity of the blackouts increased and imported energy became expensive. Households on the other hand endured up to 12 hours of daily load-shedding at the peak of the crisis in July 2016.

12 Hrs
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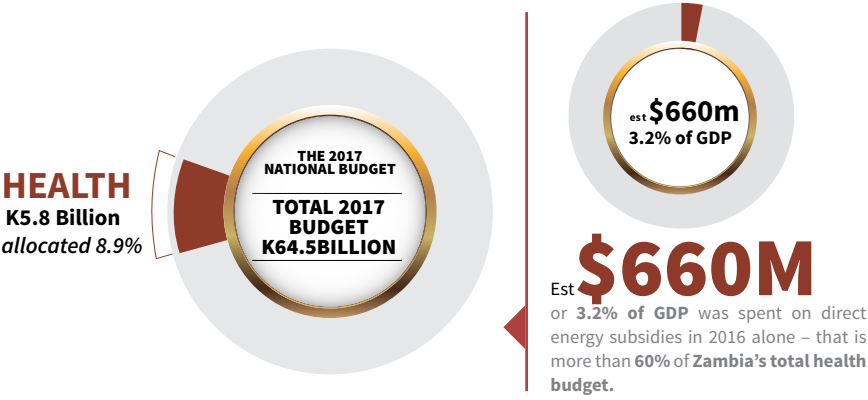
From a long-term perspective, insufficient capital investment in generation, transmission and distribution has been the fundamental cause of the current electricity deficit. In particular, the current below cost pricing of electricity has eroded the electricity sector's capability to rehabilitate and expand electricity generation over the years. While the applauded justification for energy subsidies is that they protect the real incomes of poor households, subsidies could cause fiscal deficits and macroeconomic inefficiencies especially in poor countries. A recent study by Coady et al (2015) estimates that nearly 5% of GDP in sub-Saharan Africa is spent on energy subsidies. Energy subsidies do not only impose huge fiscal costs, but could also crowd-out important social services such as health and education. Moreover, energy subsidies have been found to be poorly targeted and regressive, with top income quintiles receiving on average 5 times more benefits than the poorest quintiles in sub-Saharan Africa (Coady et. 2015).

Like most sub-Saharan Countries, Zambia spends a significant budget on energy subsidies. An estimated $660million, or 3.2% of GDP was spent on direct energy subsidies in 2016 alone – that is more than 60% of Zambia's total health budget for 2017. While a larger share of the direct subsidies has traditionally gone to the fuel sub-sector, the share of electricity subsidy expenditure has been rising since mid 2015 when the power crisis worsened. The World Bank estimates that at least $300million was spent on direct electricity subsidies in 2016 to cover the cost of electricity imports from the region (World Bank, 2016)



Given the huge energy subsidy expenditure that has contributed to the rising budget deficit and debt levels, and in response to the energy crisis that has threatened to derail macroeconomic stability and growth, the Zambian government has committed to implementing broader economic and energy sector reforms. Key among the reforms is cost-reflective tariff pricing aimed at attracting private investments in the electricity sector. Full cost pricing would also help reduce energy subsidy expenditures and the associated budget deficit currently at 10% of GDP. Following the August 2016 elections, the government revised fuel prices upwards by between 25% - 40% for various fuel products. This has been seen by many observers as a first step to full cost pricing in the energy sector. The government is also currently negotiating a **$1.6 billion IMF loan** and has indicated that energy and other subsidies will be removed as part of the required fiscal consolidation.

$1.6Billion

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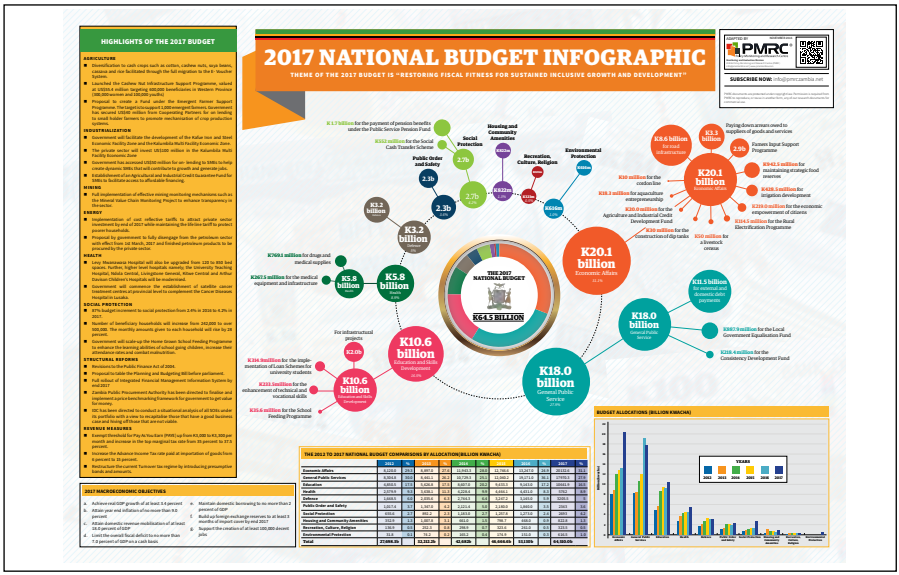
With IMF negotiations currently ongoing, the removal of all energy subsidies, including electricity subsidies now appears imminent. Indeed, this was confirmed in the *2017 National Budget*, which announced the Zambian Government's plans to remove electricity

subsidies and move to full cost reflective tariffs by the end of 2017. Most recently, ZESCO have initiated a price increase – which the Energy Regulation Board has approved with some changes to the original application.



PMRC are clear that the government should be commended for deciding to reform tariffs in this way. The benefits are numerous there's potential to reduce inefficient government spending, increase Foreign Direct Investment (FDI) in the energy sector and support job creation, as more capital projects will emanate from the changes. Ultimately electricity supply may be more reliable and this will provide significant support for growth and continued industrialisation.

However, tariff reform raises important questions. We all use electricity, both directly and through consumption of manufactured goods. Retailers rely on electricity for storage and payment processing, and businesses need electricity to operate on a day to day basis. Simply increasing prices could have adverse consequences for growth and poverty.

As part of our ongoing work on electricity subsidy reform PMRC are considering how these reforms can be successfully introduced. This report builds on the interim report that looked at international examples of subsidy reform and specifically considers the implications for the poorest households and Small and Medium Sized Enterprises (SMEs).

The report presents findings from a household distributional analysis, a survey of SME's and a stakeholder analysis and uses this evidence as a basis to make recommendations to policy makers on how to balance the need for reform with the need to minimise the impact of reforms on vulnerable groups of society.

3. RECAP: LESSONS FOR REFORM FROM INTERNATIONAL BEST PRACTICE

In March PMRC published a report that assessed the international experiences, predominantly from other African countries, that sought to introduce cost-reflective tariffs. The report highlighted some key lessons that Zambia should be aware of before starting the process of moving to cost reflective tariffs. In particular, the report highlights the relatively successful case studies of *Kenya and Uganda*.


KENYA & UGANDA

Source: Map of modern day East Africa

The report concluded that there were six key lessons Zambia should observe:

1. **Tariff reform should be part of a comprehensive reform plan:** For example, in Uganda tariff increases were accompanied by increases in generation capacity, with the opening of a large new hydroelectric plant.
2. **A communications strategy, with transparent access to information, is vital:** The Ugandan government and local newspapers made clear the regressive nature of electricity subsidies, with the rich benefiting the most.
3. **Energy price increases need to be phased in:** In Kenya reform was only possible over 5-10 years. On average countries that successfully implement changes appear to need at least 5 years.

4. **Tariff reform needs to be accompanied by improvements in the efficiency of State Owned Enterprises (SOEs):** Country experiences suggest the importance of strengthening SOE governance, improving demand management and revenue collection, and better exploiting scale economies to offset costs associated with inefficiencies. The Zambian government plans to conduct a situational analysis of all SOEs under its portfolio with a view to recapitalise those that have a good business case and hiving of those that are not viable.

5. **Targeted mitigating measures to protect the poor are necessary:** It is essential to provide support for the poorest consumers. This can take the form of life-line tariffs (the Zambian government plans to maintain and adjust the life-line tariff, a tariff measure that covers all households regardless of income status) or, for example, more generous Social Cash Transfers.

6. **Energy pricing should be depoliticised:** Responsibility for deciding on electricity prices can be given to an independent body to increase the chances of success and avoid political interference (as happened in Kenya, the Philippines, and Turkey).

These are powerful lessons and in this report PMRC seek to build on them and provide some clear specific recommendations for the key players on the move to cost reflective tariffs and ensure Zambia follows these lessons to complete this reform successfully.

4. THE IMPACT OF COST REFLECTIVE TARIFFS ON HOUSEHOLD INCOME

Households are key users of electricity, directly through supply to their homes and indirectly via consumption of goods. Moving to cost reflective electricity tariffs needs to be done with this in mind. Electricity can be a lifeline to escaping poverty and making it unaffordable could have hugely negative impacts for society.

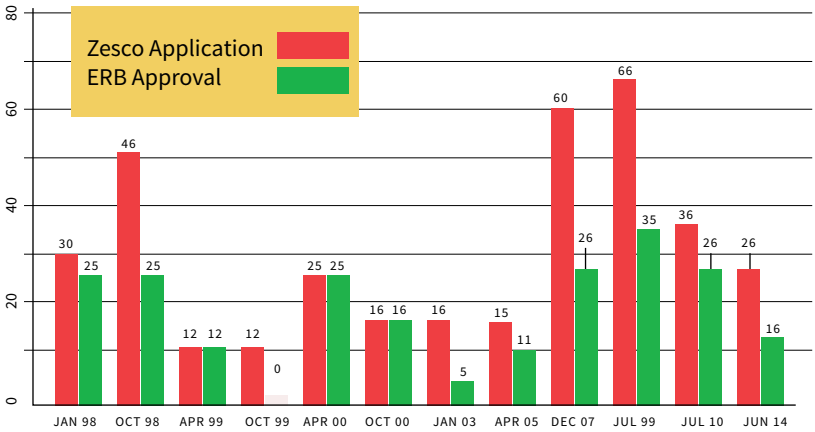
In this section the report presents findings from household impact modelling undertaken using the 2015 Living Conditions and Monitoring Survey to understand who benefits from current subsidies and who would benefit or suffer from any changes.

How to measure a subsidy?

To date full tariff adjustments have rarely been granted in Zambia. Out of about 12 applications for upward price adjustments made by ZESCO to the ERB between 1998 and 2014, only 25% of the applications were granted full price increments, this is set out in Figure 1 below. The rest of the price adjustment applications were either partially implemented or declined by the ERB.

So, it is safe to say that electricity tariffs are not adjusted to reflect the cost of service provision and electricity consumption is subsidised. However, estimating the value of any household subsidy is incredibly difficult in Zambia. Theoretically the value of this subsidy is the difference between the higher cost-reflective rates they ought to pay and the lower discounted tariff rates they actually pay. In notational form, the size of electricity subsidies per kWh could be defined as $\mathbf{S = P^m - P^s}$, where Pm and Ps are the market and discounted prices of electricity per kWh respectively. While there are no official up-to-date estimates of the total size of electricity subsidies in Zambia, estimates from Alleyne & Hussain (2013) indicate that total quasi fiscal deficits of power utilities, or the sum of all explicit and implicit subsidies, could be as high as 3.4% of GDP. Given that Zambia does not provide explicit subsidies to the power sectors, subsidisation has mainly occurred indirectly through the under-pricing[2]. The ERB in collaboration with the African Development Bank has recently funded a study to estimate the average cost of service for electricity supply in Zambia. The results of the study will enable up-to-date and accurate estimation of electricity subsidies and optimal tariff rates in Zambia.

Figure 1: Average Tariff Adjustment 1998 -2014



Source: Adapted from PMRC (2014)

2. Other sources of implicit losses include; power losses through distributional inefficiencies and power thefts from illegal connections

So, estimating the value of electricity subsidies at household level is a real challenge. To overcome this, the model we have used chooses to look at consumption as a proxy for subsidy. This is easier to model given the wider availability of data.

Electricity supply to residential consumers is billed using the inverted block tariff structure, where incremental blocks of electricity usage are charged higher rates. The current residential tariff schedule has **3 tariff blocks.** Electricity consumption from 0 - 100 kWh per month is charged at K0.15 per kWh while the next 101-300 kWh per month is charged at K0.31 per kWh. Consumption above 301 kWh per month is charged at K0.51. The main justification for inverted block tariff billing is to protect low income residential customers – this is in line with the ERB electricity pricing policy guidelines. Table 1 below shows the current tariff schedule for residential customers. The table also shows the August 2015 tariff rates which were reversed immediately after implementation. The last two columns show the recently announced tariff rates proposed to take effect in May and September 2017

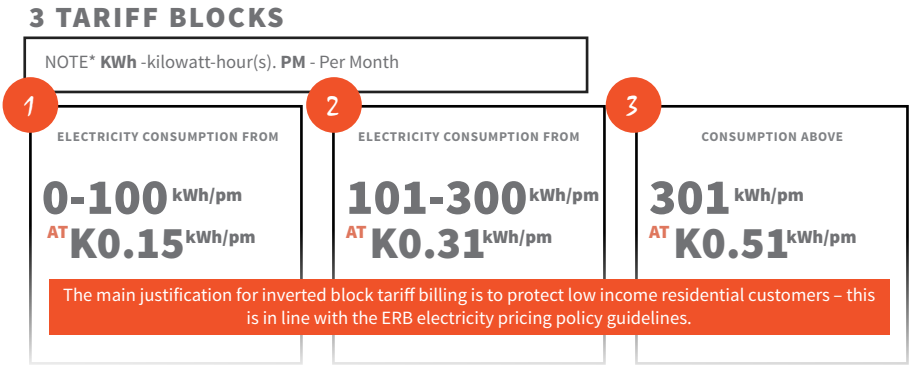


Table 1: Residential Tariff Structures

Current Tariff Rates		Rversed 2015 Tariff Rates[(a)]	Proposed Tariff Rates – 1st May 2017	Proposed Tariff Rates – 1st Sept 2017
kWh/month	(K/kWh)	(K/kWh)	(K/kWh)	(K/kWh)
0 -100	0.15	0.15	0.15	0.15
101-300	0.31	0.15	0.15	0.15
301 + above	0.51	1.54	0.77	0.89
Fixed Charge	18.23	18.23	27.35	31.90

Source: ZESCO. (a) Note that on 2nd December 2015, ZESCO announced adjustment to electricity tariffs. However, this was almost immediately reversed.

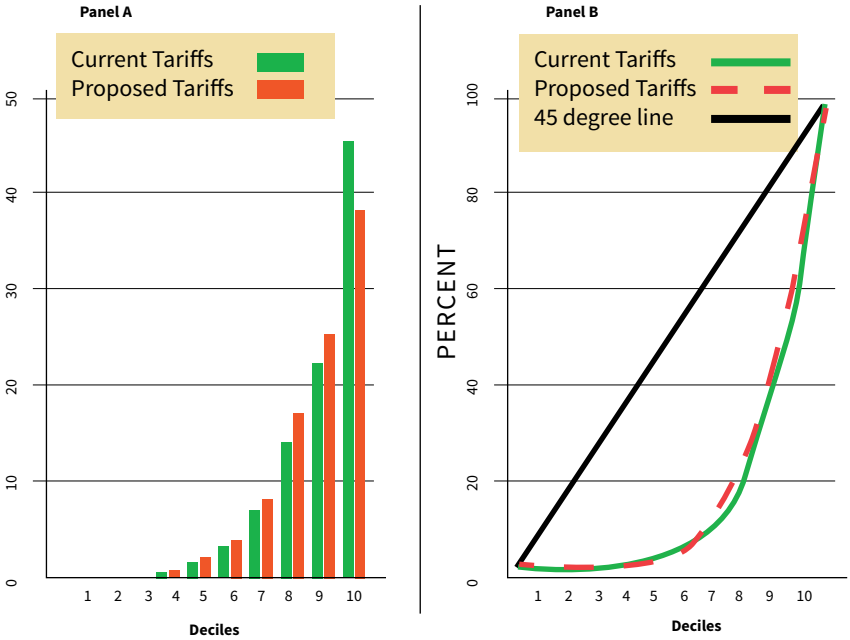
Who benefits from subsidies

Table 1 suggests electricity subsidies in Zambia are typically provided based on making the services accessible and affordable to low-income households. But international evidence suggests that subsidies are generally regressive – providing more benefit to the wealthiest households than the poorest.

Using the model PMRC have developed, it is possible to assess the extent to which subsidies are poorly targeted and suggest where government may undertake reforms to more efficiently protect the incomes of the poor while ensuring sustained accessibility to electricity services for the poor.

Figure 3 below presents the distribution of electricity subsidies across household consumption deciles in Zambia. Panel A shows the share of subsidies that accrue to each decile, while panel B shows the cumulative shares of subsidies that accrue to the cumulative population deciles

Figure 3: Distribution of electricity subsides



Source: Own estimates based on the 2015 LCMS.

The results show that electricity subsidies are highly regressive, with the richest 20% of the income distribution receiving about 70% of the electricity subsidies while the poorest 20% receive less than 1% of the electricity subsidies. A look at the entire distribution shows a particularly striking pattern – nearly all the electricity subsidies accrue to the richest 50% of the population, with less than 4% of the benefits received by the bottom 50% of the population.

The report has also modelled ZESCO's proposed tariff rates. These are shown in orange in Figure 3 and are slightly less regressive than the current tariffs, the overall picture does not change much – the richest 20% would receive about 64% of the subsidies while the poorest 20% would still receive less than 1% of the subsidies. A quick comparison with other sub-Saharan African countries indicates that Zambia's electricity subsidy distribution is not particularly the most regressive. Banerjee et al (2008) for example has shown that the poorest 40% of the population in Rwanda and Uganda received about 0.4% and 0.8% of the electricity subsidies, respectively.

Why don't poor households benefit from subsidies?

Table 2 below highlights the relationship between household electricity connection, household electricity consumption and household receipt of electricity subsidies. As can be observed, electricity connection rates are heavily skewed towards higher income deciles. Table 2 shows that while over 90% of the households in the richest decile have access to an electricity connection, less than 1% percent of the poorest households have access to the electricity grid. ***Effectively the poorest households don't directly benefit from subsidies because they don't use electricity.***

Table 2: Household Electricity Access, Consumption & Per Capital Subsidy Rates

	Household electricity connection rates	Average household electricity consumption (kWh)	Average per capita electricity consumption (kWh/person)	Average per capita electricity expenditure (K)	Average electricity subsidies per capita (K)
Poorest Decile	**0.33%**	**133.01**	**18.26**	**5.97**	**4.81**
2	0.54%	178.12	20.8	6.74	5.53
3	1.53%	204.17	24.51	9.39	5.07
4	2.87%	218.91	32.93	10.95	8.37
5	7.83%	237.76	34.59	11.77	8.5
6	15.31%	237.83	36.22	11.66	9.09
7	30.38%	252.34	39.37	13.41	9.63
8	52.86%	280.74	52.16	18.45	12.26
9	72.67%	329.73	64.6	23.6	14.43
Richest Decile	**91.00%**	**459.04**	**111.49**	**43.84**	**21.88**
Overall	31.43%	354.43	70.29	26.22	15.08

Source: Own estimates based on the 2015 LCMS.

These findings suggests that low income levels and poverty among the poor could be a barrier to access to electricity and electricity services. Given that ZESCO charges a connection fee for households to access the grid it seems likely that the poor cannot afford electricity connection charges in the first place, regardless of the price of consumption.

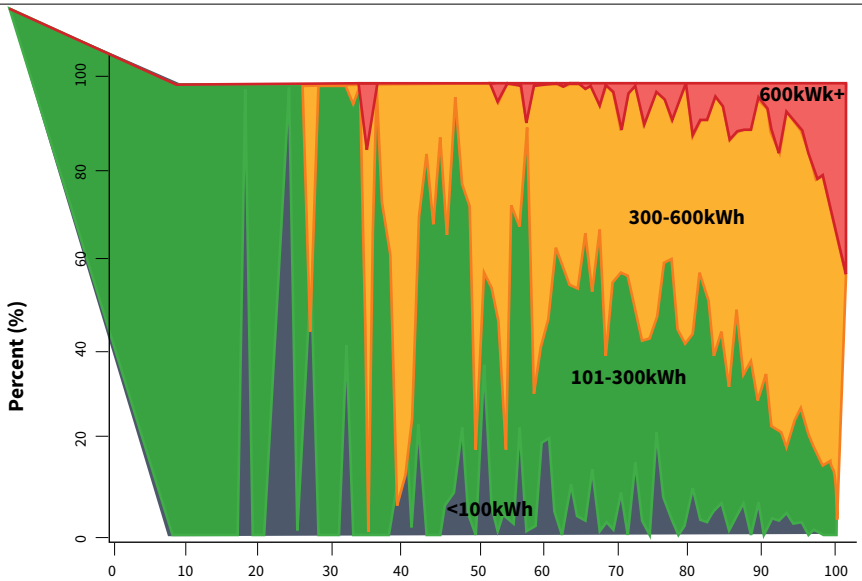
And why do the wealthiest households benefit the most?

Whilst the poorest households are rarely connected to the electricity grid, an overwhelming majority of the wealthiest households are. So more wealthy households use electricity, and as column 4 of Table 2 sets out, the wealthiest households consume nearly 5 times as much electricity per household as the poorest (when they are connected to the grid).

While this is expected, ***the structure of tariffs in Zambia means those consuming most electricity receive the greatest subsidy***, as every kWh supplied is effectively subsidised. The fact that the higher income deciles receive multiple times higher per capital subsidies than the poorer deciles is therefore not surprising.

This poor targeting of electricity subsidies is a direct result of the current Inverted Block Tariff billing system. The tariff schedule currently provides the first 100 kWh highly discounted units (the "R1" Lifeline) to all households regardless of usage and income status[3]. Given that there is some degree of subsidisation across all residential tariff bands, it is clear that the current system provides more subsidies to households that consume higher electricity units. Figure 4 below shows the patterns of levels of electricity consumption in kWh as household income increases.

Figure 4: Household Electricity Consumption by Percentile



Source: Own estimate from the 2015 LCMS

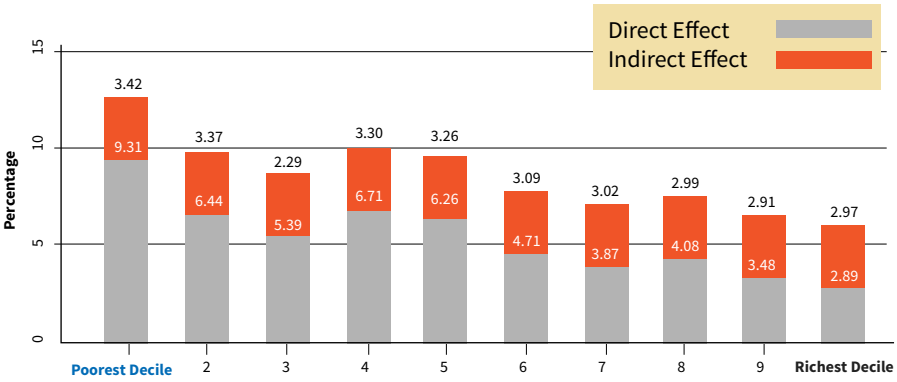
3. Based on the estimated long run marginal cost of electricity used in this paper, the lifeline tariff rate has an estimated 75% discount

Will Moving to Cost Reflective Tariffs Help? The Distributional Impact of Removing Electricity Subsidies

The increase in electricity tariffs arising from the removal of subsidies is likely to impact real household income both directly and indirectly. The direct effect arises from the increase in electricity expenditure due to electricity price increases, while the indirect effects arise from the increases in the price of goods and services that use electricity as intermediate inputs. The total real income thus shows the total reduction in real incomes as a result of electricity price increases. To estimate the direct and indirect effects of removing electricity subsidies, we simulate a 75% electricity tariff price increase. This is the suggested average increase in tariffs required to make the electricity tariffs cost reflective (Mundende, 2017).

Figure 5 below shows the estimated direct and indirect effects of electricity subsidy removal on real household incomes.

Figure 5: Direct and Indirect Effects of Effects of Electricity Subsidy Removal



Source: Own estimate based on the 2015 LCMS and the 2007 Input-Output Table

The results indicate that the removal of electricity subsidies and corresponding price adjustments have the biggest impact on the poorest households on a % of income basis. The total effect is largest on the poorest decile households who experience an average 13% reduction in their real incomes or consumable income, compared to a 6% reduction in the incomes of the richest decile. The direct effects are on average larger than the indirect effects for all but the richest decile. The direct effect on real incomes for the poorest households is 9%, compared to only about 3% for the richest decile.

This might seem counterintuitive – we have shown that the wealthiest households receive the largest benefit from electricity subsidies in Zambia, yet removing them will have a larger impact on the poorest households?

The reason for this is how we measure the impact. Table 3 below shows electricity budget shares, the direct and indirect effects and total income effects by consumption decile. This shows that poorer households spend more than 12% of their household consumption budgets on electricity alone. This is more than 3 times the share of the richest decile. Given that the income effects of price changes are directly proportional to the budget shares (and price changes), the direct welfare impact on poorer households is much stronger than it is for richer households.

In short ***poorer households are likely to spend a larger budget share on electricity compared to richer households who typically have larger incomes and expenditures thereby spending a higher proportion of their income if costs increase.***

Table 3: Direct, Indirect and Total Effects of Subsidy Removal

	Budget Share Electricity Expenditure	Direct Effect	Indirect Effect	Total Effect
Poorest Decile	**12.42**	**-9.31**	**-3.42**	**-12.74**
2	8.58	-6.44	-3.37	-9.81
3	7.19	-5.39	-3.29	-8.68
4	8.94	-6.71	-3.3	-10
5	8.34	-6.26	-3.26	-9.52
6	6.27	-4.71	-3.09	-7.8
7	5.16	-3.87	-3.02	-6.89
8	5.44	-4.08	-2.99	-7.07
9	4.63	-3.48	-2.91	-6.38
Richest Decile	**3.85**	**-2.89**	**-2.97**	**-5.86**
TOTAL	**4.77**	**-3.58**	**-2.98**	**-6.56**

Source: Own calculations based on the 2015 LCMS.

Will moving to cost reflective tariffs increase poverty?

An important issue of policy concern is whether the removal of electricity subsidies would impact poverty and inequality significantly. To provide some insight, we perform a comparative analysis of likely changes in poverty and inequality if electricity subsidies were removed. For poverty and inequality analysis, we used the Foster, Greer and Thorbecke (FGT) class of poverty measures and the popular Gini coefficient to measure poverty and inequality respectively. As indicated earlier, we measure poverty using household consumption per adult equivalent while the Gini measure uses household per capita income. This is to benchmark our analysis to the official poverty and inequality estimates reported by the Central Statistical Office (CSO, 2016)[4].

4. Our simulation of the initial poverty and inequality estimates using the 2015 LCMS dataset yields estimates very similar to the officially published statistics. Refer to CSO (2016) for comparisons with our results in Table

Table 4: Poverty and Inequality Effects of Electricity Subsidy Reform

	Poverty Headcount	Poverty Depth	Poverty Severity	Gini Coefficient
Before Reforms	54.9	27.3	16.9	0.67
After Reforms	56.2	28.1	17.4	0.66
Impact	1.28***	0.8***	0.6***	-0.01***

Source: Own Estimates based on the 2015 LCMS. *** denotes that differences are statistically significant at the 1% level.

Table 4 shows the differences in poverty and inequality following the removal of electricity subsidies. In particular, our findings suggest that the removal of electricity subsidies leads to a 1.3 percentage point increase in national poverty. Ceteris paribus, an estimated 198,000 individuals would be pushed into poverty by the removal of the electricity subsidies. We also find that the poverty gap or poverty depth worsens after the removal of subsidies. The intensity of poverty has basically increased implying that on average the incomes of the poor drop farther below the poverty line. This may suggest that government may need to put in more resources and concerted efforts to fight the increased poverty. Finally, we see that the poverty severity or poverty gap squared index has also increased, at least statistically. This suggests that the inequality or severity of poverty among the poor has increased. The removal of electricity subsidies therefore negatively impacts poverty in all its various forms.

Table 4 also shows changes in income inequality. We find that inequality reduces marginally, from a Gini coefficient of 0.67 to about 0.66. The difference in the Gini coefficient is statistically significant at the 1% level. The reduction in inequality is expected, since the reforms would remove the highly regressive subsidies, and thereby make the income distribution slightly more progressive (less regressive).

What should the Government do? – Policy Recommendations to Minimise Household Impacts

The household analysis demonstrates that subsidies benefit the wealthiest households the most, but also that removing subsidies has a greater income impact on the poorest households. Our analysis also shows that even after ZESCO's proposed increases, any remaining subsidies continue to benefit the wealthiest households the most.

This creates a dilemma – subsidies support households that don't need them more than those that do, but removing them could cause more poverty especially amongst the poorest households.

Policy makers, ZESCO and the Government need to think creatively about this dilemma in designing new tariffs. The use of lifeline tariff reforms as a policy instrument to mitigate

the adverse impact of electricity price increases on the poor is quite blunt and contributes to a disproportionate benefit going to the wealthiest households. According to the ERB (2016), the stated objective of the lifeline tariff policy is to protect the incomes of the poor. However, this policy provides lifeline benefits to all electricity consumers regardless of income status. In its current form, the universal lifeline tariff policy could end up increasing the energy deficit gap and income inequality between the rich and the poor because it is regressive. It is clearly failing in its core policy objective.

So, to ensure cost reflective tariffs are introduced in a way that limits the impact on poor households, poverty and target subsidies where they are most needed PMRC recommend:

- **Replacing the current universal lifeline policy with a targeted usage and hardship based lifeline tariff policy:** The current lifeline policy which extends subsidies to all electricity users regardless of income status is clearly regressive. The policy is poorly targeted, and by extension quite wasteful because the majority of the benefits accrue to the wealthiest households who are not the intended targets of the lifeline policy. To minimise leakages and inefficiency and to save on the scarce subsidy resources, the lifeline policy must be targeted to only the indigent or needy households to efficiently achieve the stated objectives of the "R1 Lifeline" tariff policy.

- **Re-evaluating the lifeline band setting.** ZESCO has recently proposed to increase the current lifeline band from 100kWh to 300kWh following the tariff adjustments. The proposal is based on the fact that the average household consumption is about 312 kWhs. Given that the wealthier households typically dominate access to the grid and enjoy substantially higher electricity consumption than the poorer households, the average electricity consumption is in effect heavily influenced and skewed toward the average consumption of the richer households. Given that the average consumption of the poorest 50% is only about 226 kWh per month, it is clear that lifeline should be based on the average consumption of the poor, rather than the overall average of the entire country as proposed by ZESCO. In this regard therefore, ZESCO must consider reducing the proposed lifeline tariffs to a lower level that takes into account the actual electricity consumption of the poor households. An overly generous lifeline not only encourages wasteful consumption of energy, but also poses significant budgetary pressure on the utility's financial position.

- **Revising the "fixed monthly charge"** to take into account the fact that the fixed charge disproportionately raises the effective tariff rates for the marginal electricity users. Given that the marginal user is likely to be the low-income user, it is clear that the fixed monthly charge adversely affects poor families. As has been shown, the "fixed monthly charge" could mean about 100kWh units of electricity is forgone. In this regard, we propose that the fixed monthly charge be waived completely for qualifying lifeline users. Alternatively, the fixed charged could be charged in proportion to electricity usage, to reflect the added cost imposed on the grid by high energy users.

- **Consider cross-subsidisation of household electricity consumption to**;

  1. Encourage electricity conservation among high-intensity residential users;
  2. Facilitate discounted or free electricity connection fees for the poor, and
  3. To potentially fund subsidised electricity tariffs for poorer families. The current tariff structure, including the proposed tariff rates do not provide for differential billing of high energy consumers. Given that wealthier households consume typically higher energy, including the fact that virtually all high-energy consumption is concentrated in the wealthiest deciles, cross-subsidisations could be particularly progressive. Differential and high price billing for high energy consumers could present an opportunity for ZESCO to not only encourage conservation by penalising excessive consumption, but could provide funds to support lower prices for poor electricity consumers and as well subsidise connection fees for poor households wishing to connect for the grid.

- ZESCO should partner with other parts of Government and utilise the already existing social welfare mechanisms and policies to identify and target the provision of subsidised lifeline electricity benefits and discounted grid connection fees for the needy households.

5. THE IMPACT OF ELECTRICITY

REFORMS SMALL AND MEDIUM SIZED ENTERPRISES IN ZAMBIA

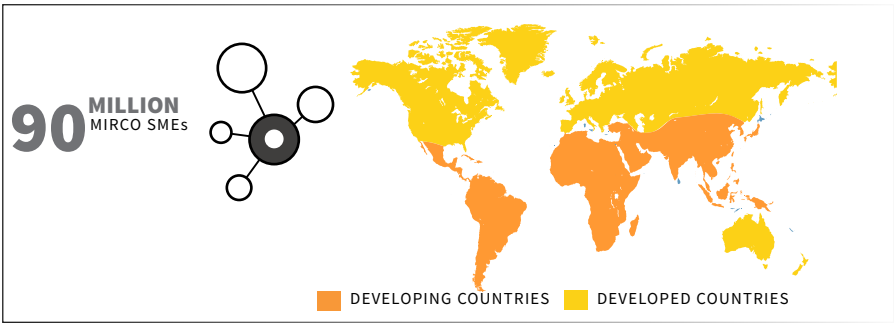
The previous section examines the impact of cost reflective tariffs and removal of subsidies on household consumers, drawing out some key recommendations. However individual households are only one set of electricity users. In this section we investigate the potential impact of changes on SMEs.

SMEs play a key role in driving the economy, and need a well-managed energy supply to support production. Understanding SME's usage, behaviour and likely response to price changes is necessary to inform the government how to sustainably introduce cost reflective pricing into the SME sector.

To aid this PMRC have undertaken new research, using in-depth interviews, to understand the constraints and opportunities for introducing cost reflective tariffs into the SME sector. A sample of 20 Zambian SMEs, who all use electricity in their business operations, was identified and data was collected with an interviewer-administered semi-structured questionnaire which focused on the effects of power outages on the operations of SMEs, especially on the use of alternative sources of energy and its resulting effect on the firms' competitiveness

Characteristics of SMEs in developing countries

There are around ***90 million Micro***, ***Small and Medium Sized Enterprises (MSMEs)*** in developing countries and emerging markets, and the density of formal MSMEs in low and middle income countries is rising (Kushnir et al., 2010). Formal MSMEs generate 35% of employment in upper middle-income countries, 42% in lower middle- income and 34% in low-income countries (IFC MSME Country Indicators).



Data on the proportion of GDP for which MSMEs are responsible are limited for developing countries. According to Ayyagari et al. (2003), the proportion of GDP generated by SMEs is smaller in developing countries than it is for high income countries.

Quantifying SME activity in developing countries is a challenge. Besides data availability, there are two main reasons for this

1. Lack of consistency across data sets, particularly in the use of different definitions of small, medium sized enterprises; and
2. A significant proportion of entrepreneurial activity in developing countries takes place outside the formal sector, and is not captured by enterprise surveys.

Manufacturing SMEs

Excluding micro-enterprises, manufacturing sector SMEs represent 17%, 21% and 29% of all SMEs in upper middle-, lower middle- and low-income countries, respectively (IFC MSME Country Indicators). Manufacturing enterprises, which are the focus of this study, therefore account for approximately a quarter to one third of formal SMEs in developing countries.

Table 5: Electricity Access in Sub-Saharan Africa and South Asia 2014

	Sub-Saharan Africa	South Asia	High Income Countries
Cost to get electricity (as a percentage of income per capita)	4,737%	1,895%	80%
Days to gain access	133	148	89
People with access to electricity	36%	62%	99.7%
Electricity losses as a percentage of output	10.8%	20.3%	6.2%
Electricity consumption (Kwh per capita)	534.9	605.2	8,905.4
Hours for an average outage	5.3	2.4	0.99
Percentage of firms identifying electricity as major constraint to business	49.3%	53.2%	26.0%

Source: World Bank 2014, OECD

Amongst manufacturing SMEs, the largest sub-sectors are the production of food and beverages, and textiles and clothing. Chemical products, wood products, fabricated metal products and furniture also account for significant proportions.

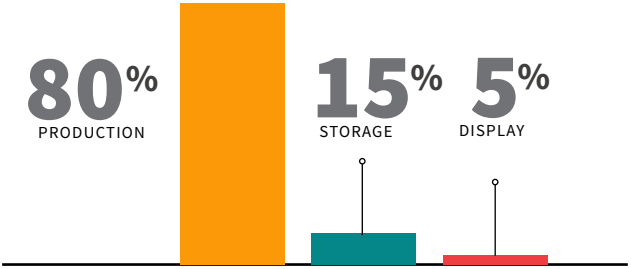
SME use of electricity – what we learnt

20 SMEs were surveyed, 14 were involved in manufacturing representing 70%, 4 of them were retailers representing 20% and the remaining 10% were distributors. Respondents were asked to indicate the area of their business they use electricity. The results are shown in table 6.

Table 6: Electricity Usage

	Number	Percent %
Production	16	80
Storage	3	15
Display	1	5
Total	**20**	**100.0**

Table 6 above indicates that without exception, all the research subjects rely heavily on electricity to provide goods and services to their clients. ***80% used electricity for production*** purposes, ***15% used it for storage*** and **5% used it to facilitate the display** of their products and services to attract potential customers.



As a non-representative sample of the wider SME population, the effects of fluctuations in power supply implies analogous effects on all SMEs and therefore the effect of power outages on SMEs will have colossal negative synergic effect on the nation's development and sustenance because a country's economic growth is largely dependent on the aggregate of small businesses within its markets.

Despite these limitations, the survey confirmed the following:

SMEs face significant cost barriers to accessing electricity. This is not only in Zambia but in sub-Saharan Africa. World Bank and OECD data (2014) shows that sub-Saharan Africa cost to access electricity as a percentage of income per capita stood at 4,737% compared to 89% in high income countries.

That power outages made significant impact on SMEs. The study investigated the frequency of power outages experienced by the subjects in the study. The findings showed 70% experienced fluctuations daily whiles 20% experienced fluctuations once a week. The businesses that incurred losses because of electricity outages are in the majority.

Almost all respondents indicated a loss in production due to power outages. Confirming that power shortages are restricting growth. Ceteris paribus, sales should result in profit

and where sales are diminished, then profits are diminished. Overall, a fall in production results in decreased sales and consequently reduced profit margins for a firm.

SMEs respond to shortages by finding alternative power sources. The study found that generator energy sources constituted the largest proportion (90%) of the preferred alternative sources of power. This is followed by solar panels (10%). But alternative sources are not always available or affordable. Only 40% of the respondents surveyed indicated owning a generator that was actively used as an alternative source of electricity. The findings indicated that a total of 100% of respondents were of the view that, these alternative sources of electricity (especially running a generator) though necessary to keep their business running are generally very expensive because of the high cost of fuel.

90%
ALTERNATIVE SOURCE OF POWER

10%
USE SOLAR PANELS

40%
OWNING A GENERATOR

SMEs want to see tariff adjustments phased in. The study also showed that 70% of the respondents were of the view that electricity tariff adjustments must be phased over a long period of time.

SMEs will pass increased costs onto consumers. Past experiences of tariff adjustment often resulted in SMEs adjusting the cost of their products upwards and 80% of those interviewed indicated they would raise the cost of their products to cover the increased cost of electricity.

These findings highlight the importance of modelling indirect impacts within the household survey, the SME survey confirms that businesses are likely to pass energy cost increases onto consumers (and increasing price inflation in the process). But the survey also reveals that this might be a price worth paying the results suggest shortages result in either a significant loss of production or increased cost of production via use of backup energy sources – there is a clearly an opportunity to make significant productivity gains (and perhaps operational savings) if Zambia can increase the reliability of the electricity supply to SMEs.

What should the Government do – policy recommendations to support SMEs

The study found that without reliable energy supply, SMEs are unable to produce in increased quantities and quality leading to poor sales and low levels of profitability. Consequently, if the level of profitability is high, it is expected that the rate of return on investment is high. With high profits, SMEs can increase their competitiveness and contribute significantly to the development of the Zambian Economy through increased

tax contributions and job creation. Energy supply to SME's needs to be part of a holistic growth strategy, investing in reliable energy could yield dividends in terms of increased productivity.

However, there are risks – higher costs will mean increased prices and this will squeeze incomes and could force some businesses to close. The Government's strategy needs to reflect this.

Based on the survey findings PMRC recommend that the Government consider:

1. **Providing a clear 3 year plan for phasing in any price increases for SMEs.** This will limit any inflationary impact on prices whilst providing certainty for SMEs to make business decisions and find productivity gains.

2. **Price increases must result in increased security of supply.** Without this productivity gains will be unachievable. Government should consider investing in supply before increasing prices.

3. **Government should consider subsidising alternative supplies as a temporary solution.** The survey shows SMEs rely on generators as an alternative power source. Fuel for these is expensive. The Government could consider moving away from direct subsidies to indirect subsidies of alternative power sources – for example discounted solar generators for SMEs.

4. **Government should reduce the cost of connection for SMEs**. Zambia and sub-Saharan Africa has the lowest access levels and highest costs to access electricity. This impedes business development and raises the costs of doing business by SMEs

These measures are all relatively small, but have a shared ambition – increasing the reliability of electricity supply. This supports some of the findings in PMRC's interim report that there is an obligation on the Zambian Government to deliver increased generating capacity in return for higher electricity prices.

6. STAKEHOLDER ANALYSIS

DELIVERING CHANGE IN ZAMBIA'S REGULATORY FRAMEWORK

The previous sections have highlighted that Zambia's electricity subsidies are both inefficient (the greatest subsidy goes to the wealthiest households) and act as a barrier to growth (based on the argument subsidies constrain supply and the SME survey shows supply constraint hamper productivity). Reforms are needed, but as our interim report set out sustainable shifts toward cost reflective electricity prices need to take account of the regulatory framework and create conditions to improve sustainability of supply.

It is in this context we need to understand the energy market in Zambia and ensure that the regulatory framework works to support increased production and reflects consumer interests. To aid this PMRC have undertaken a stakeholder analysis of the sector, setting out the key players but also highlighting where conflicts of interest may occur when taking forward reforms. Evidence suggests that failure to understand this limits the success of reforms. (MacArthur, J. 1997).

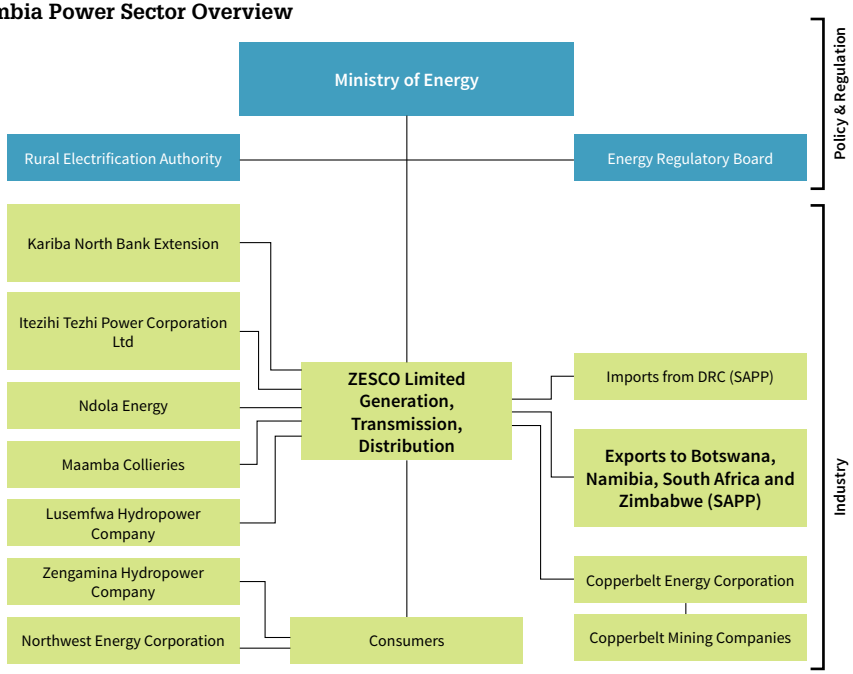
Table 7. Stakeholders in Electricity Tariff Reform

KEY STAKEHOLDERS – Those who can significantly influence reform programme or are important to the success of a project or a programme (according to the major policy objectives and purpose of the respective programme).
The Ministry of Energy Zambia Electricity Supply Corporation Limited (ZESCO) Energy Regulation Board International Finance Institutions (International Monetary Fund and World Bank) The Ruling Political Party
PRIMARY STAKEHOLDERS – Comprises individuals, groups of individuals or institutions that are affected either positively (beneficiaries) or negatively by a project or a programme which has impact on them.
❖ Energy Consumers (Electricity) ❖ Shareholders of private companies (Electricity Sector)
SECONDARY STAKEHOLDERS – are different intermediary entities in the process of delivering the activities comprising the project or programme, who can/cannot take part in the decision-making process and are influenced positively or negatively.
❖ Private Zambian Electricity Suppliers ❖ Employees of companies in the electricity sector ❖ Trade Unions of companies in the electricity sector ❖ Employers in the electricity sector ❖ Electricity generation equipment suppliers and investment developers

Stakeholder Analysis

This part of the study analysed the legislative and regulatory environment that that governs the electricity sector in Zambia. Specifically, it focuses on key institutions and stakeholders that will need to act for tariff reforms to be a success.

Zambia Power Sector Overview



Source: Adapted from Joseph Kapika and Anton Eberhard (2013)

If the Government is going to increase electricity tariffs this paper makes the argument this must be done in return for improvements in the security and sustainability of supply. There are currently seven notable domestic players in the electricity supply industry in Zambia. These include Zambia Electricity Supply Corporation (ZESCO), Copperbelt Energy Corporation (CEC), Maamba Collieries Limited, Ndola Energy, Itezhi Tezhi Power Corporation Limited, Kariba North Bank Extension and Lunsemfwa Hydro-Power. All these are regulated by the Energy Regulation Board of Zambia, however not all of these producers sell energy into the grid at subsidised rates, Independent Power Producers operate as commercial businesses but remain critical to ensuring Zambia has a reliable and secure electricity supply.

For example, in 2017 ZESCO plans to purchase about 4,543 GWh of energy from Independent Power Producers (IPPs) at a cost of US$ 502 million. The purchase of power from IPPs can only be supported by an upward adjustment to electricity tariffs given that the average cost of these purchases is US$ cents 11.04/kWh while the selling price is US$ cents 3.3/kWh. Government took the decision to support these purchases in 2015 and 2016 but not increase the ZESCO rates. Going forward, with spending reductions necessary, this is no longer affordable.

Moving to cost reflective tariffs will enable the Government to more readily access power from IPPs and so stimulate growth from commercial suppliers to complement ZESCO production.

Table: Planned Cost of Purchasing Power from Independent Power Producers

Electricity Source	MW	GWh	Cost US$ million
Maamba Collieries Limited	270	2,365	232
Ndola Energy	100	876	123
Itezhi Tezhi Power Corporation Limited	72	631	58
Kariba North Bank Extension	51	444	71
Lunsemfwa Hydro Power	26	228	18
Total Purchase	**519**	**4,543**	**502**

Source: ZESCO Media Brief on Retail Tariff Application

Policy makers and regulators

There are ***three key bodies*** involved in creating and regulating electricity supply and production in Zambia:

1. **The Ministry of Energy** - is intended to improve co-ordination and implementation of sector programmes in accordance with the ruling Party manifesto.

2. **ZESCO Limited** - is a vertically integrated electricity utility, which generates, transmits, distributes and supplies electricity in Zambia. It is a public utility, with the Government of the Republic of Zambia being a sole shareholder.

3. **Energy Regulation Board (ERB)** - is an autonomous statutory body established under the Energy Regulation Act of 1995, Chapter 436 of the Laws of Zambia, to regulate the energy sector in Zambia. The ERB is responsible, amongst other things, for promoting competition in the energy sector, issuing supply licences and regulating consumer price adjustments.

These ***three bodies*** clearly have different interests that may conflict with each other or with community interests. Balancing these interests will be critical in delivering cost reflective tariffs, and importantly increases in supply that must accompany these.

Reform will require a sustained effort, the leadership of the Ministry of Energy will be required to ensure coordination between ZESCO, IPPs and the ERB, as well as balance the political imperatives of driving growth and fiscal consolidation.

The ERB will need to balance the need for price increases, with the need to ensure that electricity remains affordable to all parts of Zambian society, and equally importantly price increases don't lead to significant price inflation.

ZESCO will need to demonstrate that increased revenues will enable them to increase energy supply, either via increasing their capacity or via purchases form IPPs. ZESCO will need to develop an informed strategy for this that reflects plans of IPPs, so as to not generate significant levels of surplus supply (and so deterring private investment).

Item	Stakeholder	Interest for Energy Sector Reform[1]	Power over Energy Sector Reform[2]	Available resources for Energy Sector Reform[3]
(a)	*(b)*	*(c)*	*(d)*	*(e)*
A	The Ministry of Energy	(+5)	(+5)	-Financial (+4) -Coercion (+5)
B	Zambia Electricity Supply Corporation	(+5)	(+3)	-Financial (+2)
C	Energy Regulation Board	(+4)	(+4)	(+2)
D	IMF and World bank	(+5)	(+5)	-Financial (+5) -Coercion (+5)
E	Energy Consumers	(+4)	(+2)	-Financial(+1)
F	Private Electricity Supply Companies	(+4)	(+2)	-Financial(+1)
G	Employers (Electricity Sector)	(+2)	(+2)	(+1)
H	Employees (Electricity Sector)	(+1)	(+3)	(+1)
I	Trade Unions (Electricity Sector)	(+1)	(+3)	(+1)

1. Interest of Stakeholder in tariff reform programme. Ranging from very high (+5) to very low (-5) or U-Unknown.
2. Power of Stakeholder in tariff reform programme. Ranging from strong (+5) to no influence (0).
3. Resources for tariff reform programme. Ranging from high (+5) to no resources (0).
4. Capacity to mobilise resources for tariff reform programme. Ranging from very high (+5) to very low (-5).
5. Pro tariff reform programme (+5) to contra tariff reform programme (-5)
6. Positive (+5), Negative (-5)

Capacity to Mobilise Resources for Energy Sector Reform[4]	Position of Stakeholder towards Energy Sector Reform[5]	Impact/Effect of Energy Sector Reform on Stakeholder[6]
(f)	*(g)*	*(h)*
(+4)	(+5)	(+5)
(+3)	(+5)	(+5)
(+1)	(+3)	(+3)
(+5)	(+5)	(+5)
(+1)	(+3)	(+4)
(+1)	(+3)	(+4)
(+1)	(+2)	(+3)
(0)	(+1)	(+2)
(+1)	(+1)	(+4)

What should the Government do – policy implications of the stakeholder analysis

In conclusion to the above analysis, striking the right balance between stakeholders' interests when considering policy proposals is a challenge. However there seems to be a clear mutual interest in increasing energy prices, but how this is done and how to ensure this results in increased long-term energy supply is a challenge.

There is a clear risk that without necessary social protection the Government bows to social pressure to pursue a policy of low prices, but in the long run, this policy of low prices cannot be sustained, because it discourages investment in the energy sector and has disastrous fiscal effects on the energy companies.

To mitigate these risks and balance various stakeholder interests PMRC recommend the Government consider:

- Setting clear remit for the ERB to consider the importance of energy supply in their deliberations on electricity pricing. This may require amendments to the SI that sets their remit.
- Providing a road map for Government investment in new energy generating capacity. This will reassure consumers that higher prices are resulting in new supply but also send a clear message to IPPs over the level of supply ZESCO may purchase from them in the coming years.
- Provide an open and transparent case for change, with a clear offer to consumers. This will involve setting out a compelling case for increasing prices but also making a clear political commitment to improve services in return for higher prices. For example, the Government and ZESCO could commit to end load shedding by 2020 if cost reflective tariffs are in place by the end of 2018.

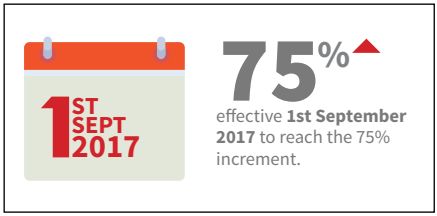
7. THE POLICY CONTEXT

SUMMARY OF RECOMMENDATIONS FOR GOVERNMENT

As this research has been conducted ZESCO have brought forward proposals for tariff reform in Zambia. Specifically ZESCO have submitted an application to the ERB for a 75% tariff increase in 2017 to be implemented in two phases namely;

FIRST PHASE

SECOND PHASE



As set out in the document PMRC are broadly supportive of the principle of increasing tariffs, but are clear the increase needs to draw on the lessons set out in our interim report that looked at international examples.

This means the move to cost reflective tariffs needs to be part of a compact with consumers that it will lead to increased energy supply and a more reliable service, and be accompanied by systems improvements and efficiencies from ZESCO.

To this extent, we think there is a case for the ZESCO to revisit their proposals, and if the Government is committed to the move away from subsidies and take action in this space. Specifically, the Government and ZESCO should consider a series of steps to ensure price increases can be introduced successfully.

1. Do more to target reduced rates on those who need them most. Specifically;

b. Re-designing the proposed price increase, replacing the current universal lifeline policy with a targeted usage and hardship based lifeline tariff policy and re-evaluating the level the lifeline band is set at (setting it lower than 300kWhs).

c. Considering cross-subsidisation of household electricity consumption, i.e. asking the wealthiest households to pay more than cost of production to support lower rates for the poorest households.

d. Encouraging ZESCO to partner with other parts of Government to target lifeline rates and support effectively.

e. Removing the “fixed monthly charge” tariff, to consider the fact that the fixed charge disproportionately raises the effective tariff rates for the marginal electricity users.

2. **Provide some certainty to business to enable them to plan for, and manage price increases. Including:**

   a. Providing a clear 3-year plan for phasing in any price increases for SMEs

   b. Guaranteeing price increases will result in increased security of supply

   c. Considering subsidies for alternative supply as a temporary mitigation measure

4. **Create the conditions for successful reforms, by:**

   a. Setting clear remit for the ERB to consider the importance of energy supply in their deliberations on electricity pricing

   b. Providing a road map for Government investment in new energy generating capacity

   c. Provide an open and transparent case for change, with a clear offer to consumers

8. CONCLUSIONS

This report covers a diverse range of issues surrounding the debate on electricity tariff reform. The report sets out the comprehensive case for overhauling the current subsidy regime, demonstrating that this is both ineffective and a potential barrier to increased energy supply, and so economic growth. The report recognises the urgent need to move to cost reflective tariffs to support the Government's economic recovery plan, and the conclusions of the report should be seen in this context.

The household impact study clearly sets out that while low-income households do certainly benefit from the current ZESCO electricity tariff schedules, the striking majority of the benefits actually accrue to the wealthy households in the country. Extremely low levels of access to the grid among the poor effectively bars the transfer of any subsidies to the poor. For the very few lucky ones – the less than 1% of the poorest decile who have access to electricity for example – the benefit they receive is proportionately lower than the benefit that accrue to the richest decile.

So the case for reforming the current pricing system is strong, but any new pricing system needs to be designed to deliver effective and efficient protection of the incomes of the low income electricity users. This is particularly crucial, especially at this point where government is faced with tightening fiscal space with little room to accommodate such budget lines as significant expansion in social cash transfers is necessary. We conclude that such an approach is possible but will need careful design, as set out in our policy recommendations.

Building on the household impact assessment the SME survey highlights the problems created by a subsidy regime that does not allow cost reflective tariffs. The results from the survey show that SMEs in Zambia, suffer from frequent electricity outages (planned and

unplanned), and these outages have adverse effects on their production processes leading to losses in profit.

The study further reveals that SME's incur additional costs sourcing alternate sources of electricity as well as costs associated with repairs and cancelled orders associated with electricity supply failures. This research agrees however with Wang (2002) and several other researchers that both intermittent and frequent power outages cause severe harm on SMEs profitability.

So, SME's need a reliable electricity supply to be competitive and to contribute to economic growth and development of the country. This electricity needs to be affordable because electricity is a necessity to their operations and productive capacity, and our survey concludes that whilst productivity gains, and loss reductions, may offset increased costs, SMEs will ultimately pass higher electricity prices onto consumers.

To ensure price reforms are sustainable for SMEs and consumers, a clear roadmap is needed from both the Government and ZESCO. Our stakeholder analysis shows that there is already a private sector in Zambia suggesting that with the right commitments from the Government electricity supply could be increased. However, reforms will require a careful balance between key stakeholders – individual consumers, business, regulators and suppliers.

Our stakeholder analysis suggests that there is scope to align the interests of this key group, but Government needs to take a lead for this to happen. Without a clear policy direction that offers a quid pro quo to consumers for price increases and a clear roadmap for increasing energy supply in the coming years' reforms, the challenge of balancing these interests will not be met.

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APPENDIX I: METHODOLOGICAL APPENDIX

DIRECT EFFECTS OF THE FUEL PRICE INCREASE

Let $wi = \frac{p_i q_i}{y}$ be the share of expenditure devoted to good ***i (i=1,…,k)*** in the total budget y, and *pi* and *qi* represent price and quantity consumed of good i respectively. The budget share provides the direct impact of any price changes on household welfare. This is a "first-order" estimate of the direct real income effect of a price increase. It is also a "short-run" estimate since it is assumed that households do not switch from fuel consumption to the consumption of other products. Alternatively, it provides the upper bound for the impact on the households in the long-run (see for instance, ArzedelGranado et al, 2010). The budget share is expressed as:

$$w_i = \frac{\partial logy}{\partial logp_i}$$

The above relationship shows the budget share as the price elasticity of real income or total consumption given that, the volume of demand is constant. The direct effect is expressed below as:

Direct Effect (DE)=budget Share x %age increase in price X 100

For example, suppose fuel prices increase by 10% and a household's budget share of fuel in their total budget is 15%, then the direct effect leads to a decline in household welfare equivalent to a 1.5% fall in real household income. Alternatively, if prices increased by 100% then real incomes decline by 5%. This can be aggregated across the petroleum products,

$$DE = \sum_{i=1}^{k} w_i x \partial log P_i$$

Where k is the number of fuel products consumed by the household.

Indirect Effects of the Fuel Price Increase: Input-Output Price Shifting Model

The calculation of the price changes is more complicated than shown above for the direct effect. Indirect effects on household welfare are estimated using the price-shifting approach of Coady and Newhouse (2006):

$$IE = \sum_{j=1}^{k} w_j x \partial log P_j$$

where K is the number of non--petroleum goods consumed by the household, and $\partial \log p_i$ is the relative price change resulting from the increase in fuel prices. This requires

information on the production structure of the economy that is easily obtained from input-output tables. The price-shifting approach implicitly assumes that goods are non-traded, that there are constant returns to scale in domestic production and that demand is price inelastic. The sum of the direct and indirect impacts then provides the total impact of the increase in fuel prices.

Price-Shifting Approach to Calculate the Indirect Effects

Coady and Newhouse (2006) suggest the following three broad categories of commodities according to the relationship between higher production costs and output prices:

- **Cost-Push Sectors:** These consist of sectors where higher input costs are passed on to the final prices paid by households. These consist of nontraded commodities such as government services, public utilities, construction, trade and transportation, as well as retail and wholesale trade. The relationship between consumer and producer prices is given by:

$$p_{cp}^{u} = p_{cp}^{p} + t_{cp}$$

where, p_{cp}^{u} the price paid by consumers, p_{cp}^{u} is the price received by producers and t_{cp} is the tax imposed by the government.

- **Traded Sectors:** The trade sectors compete with internally traded goods and output prices are determined by prices on the world market as well as the import or export tax regimes prevailing in the country. Since prices are determined in the world market, higher input costs are not transferred onto output prices.

$$p_{ts}^{u} = p^{world} + t_{ts}$$

- **Controlled Sectors:** These include industries that are controlled by government and thus government fixes the prices. Any price changes in this sector largely depend on whether government adjusts prices. In the absence of price adjustments, any higher input costs are borne by factor prices, profits or government revenue. To keep the analysis simple, taxes are set to zero.

$$p_{c}^{u} = p^{*}$$

The subscripts cp, ts and c denote cost--push, traded and controlled sectors respectively.

The changes in consumer prices in the traded and controlled sectors can be computed as:

$$\Delta p_{ts}^{u} = \Delta p^{world} + \Delta t_{ts}$$

$$\Delta p_{c}^{u} = \Delta p^{*}$$

Any changes in Δp_c^u re exogenous and depend largely on price adjustments announced by government. Similarly, Δp_{ts}^u exogenously determined through changes in trade taxes and world prices.

The changes for the cost-push sectors are relatively more involved. The changes in the cost-push sector can be computed as:

$$\Delta p_{cp}^u = \Delta p_{cp}^p + \Delta t_{cp}$$

The term Δp_{cp}^u depends on factor prices of all intermediate goods and can be written as Δp_{cp}^u =f(p), where P denotes the price vector of all goods and services.

According to Coady and Newhouse (2006), the aggregate commodity categories are produced with a share of each of the above sectors; that is, cost-push, traded and controlled sectors. These shares are given by **α, β, and γ,** respectively, and the sum of the shares are equal to one for each sector(a_s+a_s+a_s=1;s=1,…S). An input-output coefficient matrix (A) with unit costs of producing one unit of output j given by $\mathbf{a_{ij}}$ for input **i** can be used in capturing the production technology of domestic firms. Given the input-output coefficient matrix and fixed factor prices the change in price of output j can be written as:

$$\Delta p_{cp}^u = \sum_{i=1}^{s} \alpha_i a_{ij} \Delta p_{cp}^j + \Delta t_{cp} + \sum_{i=1}^{s} \beta_i a_{ij} \Delta p_{ts}^j + \sum_{i=1}^{s} \gamma_i a_{ij} \Delta p_c^j$$

In a more compact form using matrix notation, equation (8) can be written as:

$$\Delta p_{cp}^p = \Delta p_{cp}^p \cdot \alpha \cdot A + \Delta p_{ts} \cdot \beta \cdot A + \Delta p_c \cdot \gamma \cdot A$$

where the "." operator signifies multiplication, A is an n x n input-output coefficient matrix, p is a vector of prices and **α, β, γ** are **n x 1** diagonal matrices. The indirect effect can now be calculated by substituting equation (9) into (7) and using the resulting change in prices in (2) above.

The fuel products are mostly consumed within the non-traded goods and transport sectors. Thus, the effect on traded goods is most likely to occur through rising transport prices (Coady and Newhouse, 2006). The following assumptions are assumed to hold in our analysis, (a) all fuel products are in the controlled sector (b) all other products are in the cost-push sector and (c) there is no substitution away from fuel by households. The assumptions are not very restrictive. Given that the interpretation of the estimates here are short-run effects, no major adjustments to consumption of the fuels are expected within the short-run. Despite the limitations of input-output analysis – homogeneous output, fixed production technology, absence of scale economies, exogenous inputs and final demand – the approach is easier to implement and requires a lower level of information and data compared to more data and modelling intensive approaches such as computable general equilibrium frameworks.

Appendix II: Hedonic Regression Model Used To Impute Missing Electricity Expenses

VARIABLES	Coef.	Std.Error
Log of income	0.054***	(0.007)
Log of rent	0.263***	(0.014)
Household size	0.019***	(0.004)
Number of rooms	0.054***	(0.006)
Type of Wall Material		
Mud bricks	-0.100*	(0.057)
Compressed Mud	-0.057	(0.153)
Compressed Cement/Bricks	0.116***	(0.034)
Concrete blocks/slab	0.006	(0.032)
Cement blocks	0.014	(0.026)
Stone	-0.625**	(0.302)
Iron sheets	0.155	(0.176)
Asbestos /hardboard/wood	-0.083	(0.218)
Pole and dagga/mud	-0.140	(0.210)
Grass	-0.361	(0.369)
Type of Floor Material		
Cement	-0.003	(0.023)
Brick	-0.171	(0.185)
Tiles	0.102***	(0.032)
Mud	-0.163	(0.104)
Wood (not wooden tiles)	0.766	(0.520)
Marble	-0.101	(0.302)
Terrazzo	0.109	(0.199)
Province		
Copperbelt	0.076*	(0.040)
Eastern	-0.055	(0.048)
Luapula	-0.113**	(0.047)
Lusaka	0.053	(0.041)
Muchinga	0.019	(0.047)
Northern	-0.132***	(0.048)
North Western	0.014	(0.047)
Southern	0.025	(0.045)
Western	0.067	(0.053)
Urban	0.144**	(0.062)

Stratum		
Medium Scale	0.404***	(0.102)
Large Scale	1.007***	(0.123)
Non-Agric	0.067	(0.093)
Low Cost	-0.170***	(0.028)
Medium Cost	-0.092***	(0.024)
High Cost	—	
Constant	2.206***	(0.106)
Observations	3,287	
R-squared	0.438	

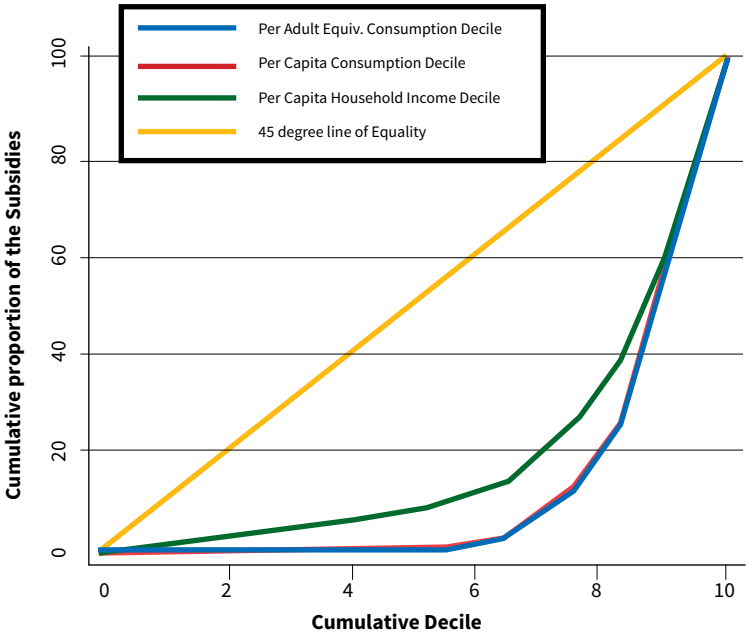
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NOTE: The dependent variable is log of electricity expenditure, the reference household has walls made of burnt bricks, concrete floors, is located in a small strata rural area in central province.

Source: Own computations based on the 2015 LCMS.

Appendix III: Sensitivity of Incidence of Subsidies

Ranking by 3 definition of house deciles



Source: Own estimate based on the 2015 LCMS

As can be seen in the figure above, the distribution of subsidies remains highly regressive, regardless of the welfare measure used to rank the household deciles. The Richest 20% of the households continue to receive at least 64% of the electricity subsidies, while the poorest 20% of the households continue to receive less than 7% of the electricity subsidies regardless of decile ranking measure.

Our findings that electricity subsidies in Zambia are regressive are therefore robust and hold across all measures of household welfare.

Appendix IV: Impact of targeting the first 100kWh free to Indigent Households

Decile	Average per capital expenditure (k/month)	Mean Subsidies per capita – current scenario	Mean Subsidies per capita – After Targeting	% Change in Per capita subsidy amounts
1	49.48	4.81	4.81	0.00%
2	72.15	5.53	5.92	7.05%
3	96.67	5.07	5.14	1.38%
4	124.65	8.37	8.51	1.67%
5	167.99	8.5	8.62	1.41%
Total	**144.08**	**7.93**	**8.06**	**1.64%**

Appendix V: Methodology SME SURVEY

Methodology

This study used an exploratory approach that deployed a mixed method approach for collecting and analysing data. A total of 20 Small to Medium Sized Enterprises involved in manufacturing were purposively sampled after stratifying them into categories of low, medium and high income groups. The underlying assumption and rationale for selecting manufacturing SMEs is because they rely on electric power as a key resource for their business. To ensure a higher success rate the questionnaires were interviewer administered. Secondly a one on one key stakeholder's engagement was conducted method to solicit and develop mechanisms that will cushion effects of energy reforms on SMEs. This analysis was useful for knowing who the key actors are, their knowledge, interests, positions, alliances, and importance related to the policy with the potential to increase support for electricity reform. A policy or program will more likely succeed if a stakeholder analysis, along with other key tools, is used to guide its implementation. The study also carried out a comparative analysis of 3 countries that have implemented electricity sector reforms to draw lessons categorized as follows; successful, failed and a mixture of both. The aim of this was to draw policy lessons that will guide proposals aimed at achieving a higher success rate for the Zambian case. Lessons were drawn from electricity sector reforms in Sub-Saharan Africa and Mexico. Given the urgent need for Zambia's economy to diversify away from copper, efforts to grow the manufacturing sector and foster job creation are imperative. Qualitative research is a popular approach in the sphere of social research because it is an approach that has dominant strategies that best enables researchers' understanding of the human subject. Therefore, it is most likely that researchers who aim to capture the essence of human behaviour and social interaction will employ this approach to get first-hand information from the insiders' perspectives (Greenstein, Roberts & Sitas, 2003).

The study focused on the analysis of 20 purposively selected SMEs, for qualitative information, the importance of reliable electricity (number and frequency of outages, alternative electricity costs, perceptions of electricity subsidy reform as a major constraint and recommendations to mitigate the impact of electricity tariff reform). Using these criteria, the study identified 3 districts initially with a view to analyse the operations of SMEs and how electricity tariff reform will affect them as well as assess the implications of using alternative electricity sources. The three selected districts were: Kitwe, Kafue and Lusaka. The terms of reference for the study specified a focus on manufacturing SMEs, largely because 'The most significant impacts to productivity can be due to forced stoppage of the manufacturing processes.' The share of total manufacturing employment accounted for by SMEs has been associated with higher rates of per capita GDP growth, Beck et al. (2005) meaning that 'a large SME sector in manufacturing is a characteristic of successful economies.' Therefore, improved knowledge on the impact of electricity tariff reform on the performance and growth of manufacturing SMEs is of significant interest to policy-makers.

Definitions

The study adopts the World Bank Enterprise Surveys' definition of small-scale enterprises as those with 19 or fewer workers, and medium-scale enterprises as those with between 20 and 99 workers. This is consistent with some Zambia's country-specific definition. Unreliable electricity supply is defined as the regular or irregular experience of interrupted electricity supplies, and is measured in terms of the frequency of interruptions (or outages) and their duration.

The definition of a small business enterprise in Zambia, as defined by the Small Enterprises Development Act of 1996 is any business enterprise;

- whose amount of total investment, excluding land and buildings, does not exceed in the case of manufacturing and processing enterprises, fifty million Kwacha (K50 million) or (US$ 25,000) in plant and machinery; and in the case of trading and service providing enterprises, ten million Kwacha (K10 million)or (US$ 5,000);
- whose annual turnover does not exceed eighty million Kwacha (K80 million) or (US$ 40,000); and employing up to thirty (30) persons;

provided that the values under cited in the above paragraphs be varied by the Minister, by statutory instrument.

Literature review

The literature review identified published literature from previous reviews of literature on electricity and SMEs and through online searches (using Google, J-stor and IMF online resources. Search terms used included: "reliable electricity and developing countries" "electricity tariff reform" "electricity deficits and manufacturing" "electricity and manufacturing" "electricity reliability and manufacturing" "SMEs and use of electricity"
This review of published literature focused on research questions on how electricity tariff reform will affect manufacturing SME productivity. The literature review also covered literature on alternative electricity sources for SMEs. This approach was expected to reveal literature about how SMEs cope with electricity deficits, their mitigation actions and how this affects production processes and productivity.

Some literature combines both approaches, using a combination of survey data and qualitative interviews for example.

This literature review sought to identify literature which looks explicitly at SMEs in the manufacturing sector and how electricity reform affects their operation. However, given that this literature is limited and that there is significant relevant literature which is not necessarily sector specific, the review also considered literature that covers SMEs in general, and manufacturing sector enterprises of all sizes, where evidence and lessons seem to hold value for manufacturing sector SMEs.

The literature on access to reliable electricity provides insight into how having electricity supply can affect SME performance and how unreliable access impacts SMEs. This may be relevant for understanding how the frequent temporary absence electricity supply, will affect SMEs and the coping mechanisms that are available.

The study focused on SMEs with up to 100 employees. The literature reviewed suggests that disaggregation not only between sector, but also on size, is important to understanding the impact of electricity supply and cost on productivity and the use of alternative sources of electricity.

Interviews

Key informant interviews were undertaken in three selected districts. The number of SMEs selected districts was determined by the resources available for the study and the timescale provided for its completion. In each of the four districts PMRC staff worked with a local affiliate of Zambia Chamber of Small Business Association to identify key informants and conduct interviews. A semi-structured interview technique was employed, with questions guided by findings from the literature review and statistical analysis.

To identify key informants, a mapping of stakeholders in the SME manufacturing sector of each country was prepared. Informants were identified purposively to ensure a range of perspectives (e.g. business associations). The study set out to interview 20 informants representing 20SMEs and 6SME stakeholders. A total of 20 interviews were actually conducted.

Unlocking Zambia's Potential

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