

Review of proposals for practical power sector restructuring and reforms in a dynamic Electricity Supply Industry

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Abstract

South Africa's electricity supply industry (ESI) remains a vertically-integrated monopoly despite global trends towards restructuring. The monopolistic nature of the ESI could hinder the development of distributed power systems as penetration of renewable electricity increases. The research aims to rationalise South Africa's ESI evolution; propose practical power sector restructuring in the short-to-medium term; and to determine their potential impact. The research methodology included a single case study instrument, with embedded sub-units of analysis. Primary research data was gathered using semi-structured interviews with industry experts in addition to which secondary data from government documents and archival records were used for triangulation. Research results conclude that South Africa's ESI grew due to techno-economic industrialisation factors, while Apartheid-era policies influenced the ESI in only some specific respects. The vertically-integrated status quo was sustained in the post-transformation period due to government's focus on social imperatives; lack of regulatory & policy certainty; and conflicts in political ideology. South Africa didn't experience the pre-conditions that triggered global power sector reforms in the late 20th century but these pre-conditions are now becoming evident. Privatisation of Eskom Generation and introduction of wholesale and retail competition are not practical in the short-to-medium term, proving the infeasibility of the standard model of reform locally. The introduction of an Independent System and Market Operator (ISMO) using a single-buyer model is seen as the most favourable and practical option, with the ISMO owning transmission infrastructure. The research suggests that ESI changes will increase system efficiencies, economic performance and private sector involvement, but will not reduce electricity tariffs. The scenarios, challenges and proposals identified in this research are also applicable to other countries in Africa and other developing regions of the world, that have similar social and political backgrounds, ensuring sustainable supply of electricity.

Keywords: monopoly, unbundling, vertically-integrated utility, power sector reform, Eskom, Southern Africa

1. Introduction

Electricity is a fundamental enabler of economic development, social equity and modern life in general, the necessity of which spans across all industrial, commercial and residential sectors. Two aspects that underpin much of the public debate around electricity provision are cost and security of supply. Security of electricity supply is a general concern for all nation states [1]. However, this concern has grown significantly in South Africa ever since the severe and multiple power delivery failures from 2005 to 2008 when the state-owned electricity utility Eskom could not cope with load demand and had to resort to load-shedding across the country [2]. The utility has had to re-initiate scheduled load-shedding since the latter half of 2014 because of critical supply constraints resulting from maintenance backlogs and limited capacity [3].

The paper attempts to investigate why and how a historically vertically integrated ESI should consider restructuring while ensuring supply continuity and stability. The objective of the investigation is to review existing electricity restructuring research while analysing

the challenges and realities of electricity restructuring in South Africa and eventually linking the review with South African ESI restructuring propositions. The research aims to contribute to the field of electricity restructuring by proposing partial restructuring rather than complete restructuring for South Africa within the short to medium term, for the sustained stability of the ESI. The investigation is pertinent for utilities (and governments) trying to transition from centralised generation towards distributed generation in order to include a viable mix of renewable and distributed energy technologies. The lessons learnt from this paper can be useful in any country (or regions within a country) with significant electricity industry shifts. Restructuring will enable improved electricity transfer within the Southern Africa region via the Southern African power pool which includes twelve countries with a combined production of more than 300 TWh (with South Africa contributing to roughly 80% of production) [4].

Unbundling, privatising and restructuring of a country's ESI (i.e. electricity generation, transmission, distribution, and system operator) in some form or another, may lead to numerous benefits such as increased system efficiency [5], [6], increased competition, increased private investment, and ultimately increased security of supply, reduced electricity costs and increased economic growth within a country [7], [8], [9], [10]. This notion is widely supported in first-world countries and based largely on industrial economics models and global trends towards free and liberalised markets, as discussed by Knops [11] and the US Congress [12]. These notions are also built upon the "standard model of reform" which was developed to explain the evolutionary steps towards liberalisation of an ESI [9], as explained later. A liberalised energy market also aids the functioning of distributed generation when multiple sources of electricity technologies are available [13], [14]. Advanced reforms in electricity generation are consistent with more ambitious renewable energy policy, necessitating concessions to renewable energy constituencies with indications that the politics of power sector reform may encourage new renewable energy policies through the dynamic issue of linkage [15]. Evidence from the US shows that distribution network operators can promote cost-effective distributed generation by the means of competitive auction mechanisms [16]. However, a dynamic market with multiple fuel sources adds volatility [17].

Despite the popularity of the above views, they are still contested by others which call into question the claims of any proposed benefits, as discussed by Victor and Heller [18], Borenstein [19] and the US Congress [12]. To compound the problem, majority of research has focused on countries in Europe and North America [20] [21] [22] [23] with fewer studies conducted in Latin America [24] and Asia [25], and even fewer focused on the Sub-Saharan African context, despite the fact that many of the continent's countries are considering or have even commenced with steps towards restructuring and reforming their ESIs.

This research paper investigates the reasons behind the current long-standing vertically-integrated nature of Eskom in South Africa and analyses the current South African electricity supply industry restructuring measures being considered and on-going. This was done in relation to global trends already considered by both first-world and other developing nations. The paper also investigates the potential impact and implications that radical transformation along the entire power sector value chain (i.e. generation, transmission, distribution and system operator) would have on South Africa in the short-to-medium term.

The paper initially identifies a possible implementation model based on existing work. However weaknesses in the existing model are identified and augmented using qualitative analysis to reach emergent views. Based on the emergent views a revised structural

framework and roadmap that would best suit the South African ESI is proposed. The proposed model is envisaged to be applicable in other countries in Africa and developing regions of the world, which encounter similar socio-political backgrounds.

2. Background

Eskom is a vertically-integrated electricity utility that owns and operates the majority of South Africa's generation, transmission and distribution infrastructure making up the ESI. Following the electricity supply crises up to 2008, funding for Eskom's new generation-build programs (and subsequent cost escalations due to completion delays) have led to significant electricity tariff increases. These factors, coupled with the generally depressed global economic environment post-2008, has increased the debate around the structure, legislation, regulation, and management of the South African ESI, with the discussion coming into sharp focus within the country's governing, industrial, civil and private sectors, as well as within the general public discourse. For the past two decades, lobbyists have argued for changes to the ESI citing increased competition, private sector involvement, system efficiency and security of supply as key outcomes that would benefit the country at large [26] [27] [28]. To date, government has publicly acknowledged the above viewpoints and have claimed to be taking steps, citing planning, policy and regulatory efforts put in place to facilitate changes to the vertically-integrated and monopolistic nature of South Africa's ESI. However, it can be argued that not all efforts have been focused correctly or with the necessary vigour, while other areas have not been given the necessary amount of attention and urgency, whilst still other areas have been ignored completely.

Preliminary research investigations in this study uncovered that South Africa is no exception, and is at a pivotal point. There exists some government policy, legislation and leadership pronouncements that tend to support the call towards power sector reform in the country's ESI [29]. This is despite the fact that to date, there has not been any significant pace of action to fully address Eskom's controversially dominant position within the country's ESI. Unbundling, privatising and/or deregulation of a vertically integrated national utility has not always resulted in the promised benefits of low tariffs and security of supply [30]. On the other hand, some critics argue that in the past decade South African regulatory and policy frameworks have actually inhibited IPP (Independent Power Producer) investment and competition in the sector which are seen as the necessary factors in order to realise any benefits [31]. Preliminary investigations in this study further reveal that the current South African status quo with Eskom's vertically integrated position in all stages of the value chain does present some serious conflict of interest, and that there are indeed unclear and often overlapping roles of responsibilities between NERSA (National Energy Regulator of South Africa), the DOE (Department of Energy), NNR (National Nuclear Regulator) and Eskom. These include responsibilities over administrative functions such as ESI regulation, planning, procurement, contracting, and allocation as well as executable functions such as the role of the system operator, transmission and distribution in South Africa (as highlighted in Figure 2).

The scenario gets complicated because Eskom reports to the DPE (Department of Public Enterprises) which is the body responsible for the management of government owned companies [32]. Eskom being a government owned company reports to the DPE while the energy decisions have to be liaised with the DOE, whereas NERSA, IPPs and the NNR only work in collaboration with Eskom and the DOE and not directly with the DPE. Such kind of structuring further complicates the current local ESI.

The debate surrounding the ESI in South Africa is not a unique problem. First-world countries such as the USA and other European states had gone through this process in the 1990s [33], [34], [35], [36], while other developing nations such as China [37], India [38] [39] and Brazil [24] had also experienced similar ESI challenges in the past decade. A similar momentum in ESI restructuring can be observed in economies that transitioned from being closed economies to open economies, particularly in Eastern Europe [40], [41], [42], [43]. However, ESI restructuring initiatives have not always achieved positive consequences [44], [45].

There is no common model that encapsulates all the steps that each of these countries have followed, because each has addressed their ESI concerns differently. Pollitt [46] reviews a host of models used for ESI transmission restructuring in different regions of the world. Actions that have been successful in some countries have been failures in others, and it is fair to say that all models have both advantages and disadvantages [47]. Proposals for restructuring South Africa’s ESI have been initiated since the 1990s but never achieved the necessary momentum [26]. It is anticipated that South Africa will similarly have to find unique solutions to its own ESI challenges. Despite Eskom being the leading electricity utility on the African continent in terms of generation capacity, network expanse and technical expertise, South Africa is by no means a forerunner in terms of ESI reforms. However, it would be fair to state that South Africa has also not been lying completely idle and that steps have been initiated to bring about changes when periods of significant electricity market dynamics have occurred [27], [28]. Steyn [48], Steele et al [49] and Eberhard [27] all provide in-depth insight into the development of the South African ESI and the specific conditions that shaped it into its current form.

Hunt [50] and Littlechild [8] identified a series of 9 key milestones which are required for an ESI to move from a vertically-integrated utility to a liberalised power market. These steps collectively have come to be known as the “standard prescription” or the “standard model” of power sector reform and include steps in chronological order as depicted in Figure 1 below.

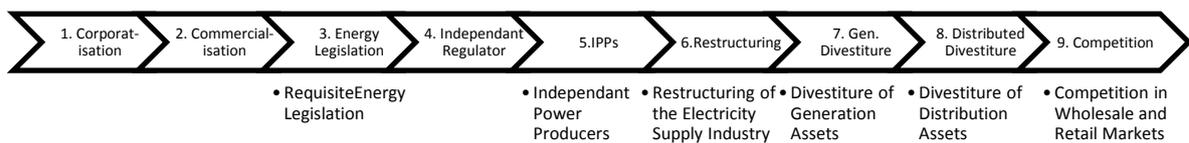


Figure 1: Standard Model of power sector reform [8], [50]

Gratwick et al [51] and Malgas et al [30] both firmly believe that it is now inappropriate, even futile, to retain the standard reform model or to measure power sector reform progress in terms of how many of the elements of the standard model have been obtained. Pollitt [52] observes the functioning of different types of operation practices based on regional preferences. Nepal and Jamasb [53] summarise the argument around the standard mode by mentioning that “state policymakers in favour of the standard reform model may generalise the progress of reforms in pioneer countries such as Chile to conclude that market-based reforms can be successful when implemented properly. In contrast, those critical of the reforms can generalise the outcomes of the slow and unstable market-based reforms in a number of countries in Eastern Europe, Asia, Latin America and Africa in concluding that the reforms have been costly and unsuccessful.”

Pickering [47] who has also done extensive research into power sector reform in South Africa offers a solution based on an all-inclusive role for a new Independent System Operator (ISO) or grid operator. His model suggests that a new ISO should take on all

functions of the ESI apart from generation and distribution, including all planning, system operation and transmission. There is merit in many of the suggestions put forward by Pickering [47], however there are possible enhancements that can be considered, and will be the focus of this research effort.

Proposed model

To address the question on how should South Africa consider power sector reform going forward into the next 5 to 7 years, an ESI structure was proposed based on the initial literature review and preliminary research analysis [47]. The intention was to use the proven and effective aspects of current global research conducted in this industry, and at the same time to develop a tailored model to meet the South Africa’s existing problems and future aspirations, while also building in best practices and lessons learnt from other developing Sub-Saharan countries. This conceptual model formed part of the propositions put forward and was incorporated into the research design. The intention was to rigorously test the feasibility of this model during the research data gathering and analysis processes. The South African ESI structure for the short-to-medium term proposed as part of the investigation is illustrated in Figure 2 below.

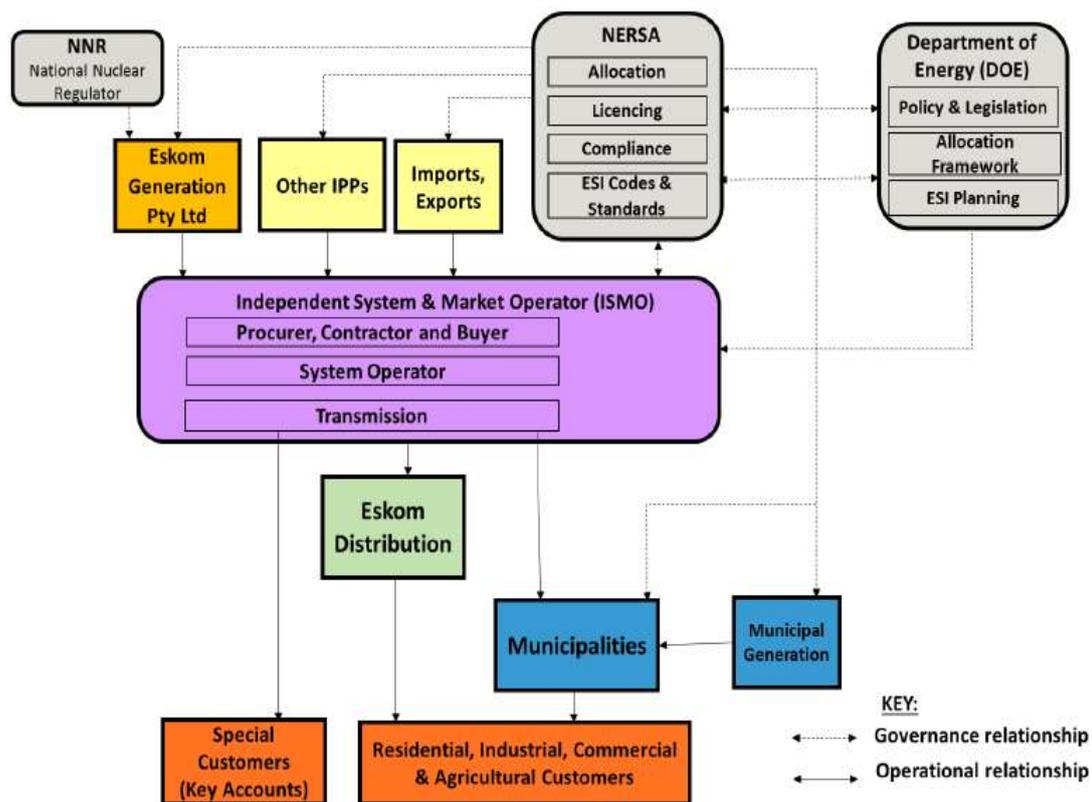


Figure 2: Proposed conceptual logic model for the South African ESI structure:
Adapted from Pickering [47]

Briefly commenting on the proposed model, it is suggested that power sector reform take the form of vertical unbundling of the state utility Eskom’s generation, transmission and system operator functions, with privatisation of Eskom Generation and Eskom Distribution as separate privatised entities. These measure are the expected steps towards full power sector liberalisation as discussed by Littlechild [8] and Hunt [50]. The role of an independent transmission system operator was proposed as a means to execute the

procurement, contracting and buying functions. Since the literature emphasised the need for uncoupled transmission and generation ownership, it was proposed that the new transmission system operator become responsible for all transmission assets in South Africa. From a technical perspective, this dovetails with the system operator role and should allow for effective and efficient operation of the grid. It was proposed that ESI Planning remain the accountability of the DOE, with an intention for this function to be participatory and inclusive, hence it is proposed that this be a tripartite responsibility between DOE, NERSA and Eskom owing to the great prominence placed on this function by researchers into Sub-Saharan hybrid power sectors like Gratwick et al [51].

It was felt that distribution should remain the sole responsibility of Eskom for a few reasons: the South African distribution network is extensive and Eskom has well established regional distribution structures, processes and skills; mass electrification programmes is still a key government policy that is best addressed using a state-owned model; and based on previous false-starts in unbundling Eskom’s distribution networks into regional electricity distributors (REDs), it would be wise to leave the system as is. Furthermore, an unambiguous responsibility for all procurement, contracting and buying functions is proposed for the independent transmission system operator, with an intention to leverage the common interface between generators (IPPs, Eskom, cross-border imports) and distributors (Eskom Distribution, municipalities) to eliminate any conflicts of interest, grey areas and disputes that could arise. It must be highlighted that this conceptual model was based on preliminary analysis of the literature and was intentioned to be rigorously tested during the data analysis process.

3. Research methodology

This research can be classified as qualitative empirical research specifically looking into explanatory policy issues. A case study was the all-encompassing research instrument through design, data collection and analysis. Specifically, a single case with embedded units was used which provided the ability to look at a single unit of analysis but from multiple perspectives. The unit of analysis considered was the South African electricity supply industry in its current state with all its key components i.e. Eskom Generation, Eskom Transmission, Eskom Distribution, IPPs, NERSA, DOE, municipal off-takers, industrial off-takers and residential off-takers. The research strategy relied on multiple sources of evidence aiming for convergence; and tried to use the prior development of theoretical propositions to guide data collection and analysis. (Yin, 2003) provides a development process for case study research design. This process is summarised in Figure 3 below and was utilised for this research.

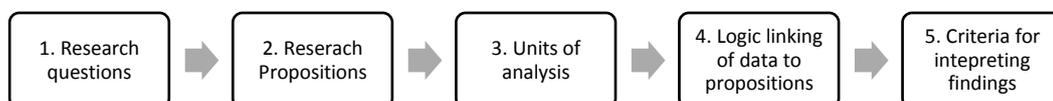


Figure 3: Case study research design process. Source from Yin [54]

Yin [54] also states that the development of case study explanatory research designs must focus on four conditions that relate directly to design quality i.e. construct validity, internal validity, external validity, and reliability. An attempt was made to ensure conformance with these conditions. Additionally, Yin [54] identifies six sources of evidence for case study research. This includes documents, archival records, interviews, direct observation, participant-observation and physical artefacts. It was decided that only the former three of the above list would be utilised for this research project, with interviews forming the primary data, and the other two functioning as secondary data. There are strengths and weaknesses to all sources of evidence, and none can be seen as better

than the others. The three sources of evidence were seen as complimentary to each other and a summary of their advantages and disadvantages are shown in Table 1 below and are discussed in greater detail within Figure 4 and Table 2.

Table 1: The three categories of evidence used (based on Yin [54])

Sources of Evidence	Advantages	Disadvantages
Semi-structured Interviews	<ul style="list-style-type: none"> Provides contextual information about a topic or a theme over a period that may otherwise lack from archival or written records Clearly conveys emotion which may be lacking from other sources of evidence <p>Interviewee most likely to be contactable thus providing opportunity for verification and providing additional information</p>	<ul style="list-style-type: none"> Interviewer's prodding and line of questioning may intentionally or unintentionally influence the interviewee's response <p>Biased and self-serving interests of the interviewee may dominate response towards this agenda</p>
Documents	<ul style="list-style-type: none"> Clear and direct purpose of the communication Can offer well illustrated and explained graphical content 	<ul style="list-style-type: none"> Potential to be biased as it can be penned by a biased author May be difficult to contact author to verify information e.g. non-updated contact details or passed away
Archival records	<ul style="list-style-type: none"> Allows researcher to attain a broader view of trends or outcomes due to being inclusive of long or older periods of time Provides a written historical form of evidence that cannot be influenced by participant behaviour which may affect the outcome of the study 	<ul style="list-style-type: none"> Researcher has no control over how data was collected when originally documenting the archived information The data may be incomplete or possibly fail to address certain key research questions or objectives

The tool used to evaluate the evidence for this study was ATLAS.ti, which is a tool used to extract patterns from complex and unstructured qualitative data [55]. Other examples of the use of the tool within the electricity sector include studies used to identify barriers in legislation for renewables [56]. The tool has also been used to assess the innovation impact emission trading system within the German power sector [57]. Similar approaches have been used to analyse governance and legislation in the nuclear power industry [58], [59].

South African Department of Energy legislative documents, NERSA regulatory publications and Eskom historical records were used as a source of evidence to corroborate and augment evidence from other sources. Archival records extracted from research papers and government records (from the 1980s) were considered to uncover the historical development of the South African ESI [60], [61]. Industry expert interviews (details of which are given in Table 2) were conducted as guided conversations along a semi-structured framework, rather than a rigidly structured inquiry. This strategy for conducting the interviews was to encourage in-depth insights by asking open-ended "why" and "how" questions rather than leading interviewees or making explicit queries. Data analysis consisted of examining, categorizing, tabulating, testing and recombining evidence to address the initial propositions of the study [54].

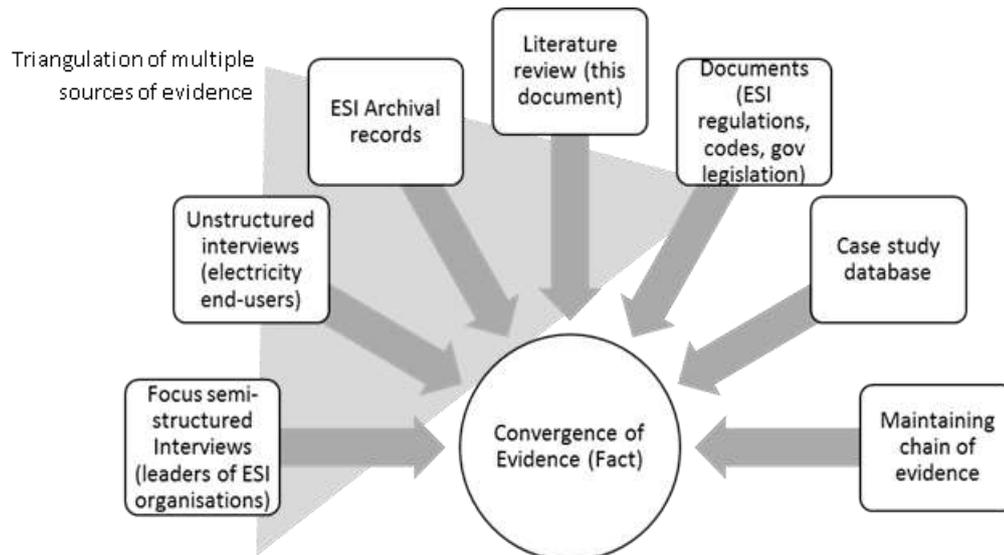


Figure 4: Summary of the data gathering techniques and sources used

Figure 4 above provides a summary of the data gathering techniques and sources for this research. The high-level research analysis strategy focus on trying to exhaust analysis of all evidence gathered, and then trying exhaust alternate or rival interpretations. Generally speaking, there are not many well-documented strategies and techniques for analysis of case study sources of evidence. However, there are a few specific techniques that were utilised in an attempt to generate high quality single-case study research which included pattern matching, explanation building, time-series analysis, and logic models [54]. A strict data coding process was utilised following guidelines as suggested by Saldana [62]. Manual coding was conducted first to generate high-level themes and data groupings, followed by detailed computer-assisted coding to generate code co-occurrences and linkages [55]. Table 2 presents a summary of the industry experts interviewed as part of the research.

Table 2: Industry Experts interviewed for semi-structured interviews

Interviewee	Role in Industry
Interviewee 1	Director of energy consulting firm in Southern Africa
Interviewee 2	Executive member of Industry body EIUG representing interests of intensive energy users in South Africa
Interviewee 3	Former member of South African parliamentary committee on energy
Interviewee 4	Eskom electrical utility general manager
Interviewee 5	Executive member of South African Independent Power Producers Association
Interviewee 6	Former Eskom general manager
Interviewee 7	South African civil society energy expert
Interviewee 8	Chief executive officer of an Independent Power Producer operating in Southern Africa

4. Results

During the initial manual coding process of the primary data sources, 6 dominant themes became apparent. These 6 broad themes developed naturally as the primary research data was analysed. In the secondary computer-coding step of analysis, the primary data was coded using computer-aided coding techniques. Emergent patterns and dominant views within individual themes arose out of the secondary coding step and the analysis of the 6 themes and their individual emergent views are presented below.

Theme 1 - Explaining the historic vertically-integrated nature of the South African ESI

- **Emergent view 1.a:** *Publicly owned vertically integrated ESIs were simply the natural choice of most early 20th century ESIs*
- **Emergent view 1.b:** *The vertically integrated nature of Eskom was coupled with a strong industrialisation strategy of the South African government in the 1920s to ensure cheap electricity for industry.*
- **Emergent view 1.c:** *Apartheid did not have severe influences on the South African ESI but it did have some specific impacts*

The vertically integrated structure of South Africa's ESI did not emerge as a direct result of any Apartheid policies. The ESI was established due to the techno-economic factors of the time which favoured large central coal power stations with transmission infrastructure that linked generation to load centres. This view is common with results from research conducted by Eberhard [31]. Aspects of the vertically integrated ESI, such as central operations and control did favour the Apartheid regime and hence the government of the day had no incentive to consider reforms. Despite this, three distinct influences that Apartheid had on the ESI were the aggressive coal power generation build program in the 1980s to ensure security of supply, which is also supported by Steyn [48] and Eberhard [31]; the increased disparity between excess electricity supply and subdued demand over the same period; and the neglectful attitude towards improving distribution infrastructure to previously "black" municipalities.

Theme 2 - Explaining the perceptions around the lack of reforms in the South African ESI post-Apartheid and up to the current day

- **Emergent view 2.a:** *Political issues and influence led to lack of reforms and restructuring*
- **Emergent view 2.b:** *Lack of appetite by government to relinquishing central control*
- **Emergent view 2.c:** *Lack of implementation and certainty in policy and regulations*
- **Emergent view 2.d:** *Eskom's low tariffs made it a natural barrier to entry for IPPs*
- **Emergent view 2.e:** *The immediate post-transformation Government focus was on mass electrification of previously disadvantaged communities*
- **Emergent view 2.f:** *Disorder in the Municipal Distribution Sector*
- **Emergent view 2.g:** *Shareholder conflicts of interest and resistance to change*

Politics has played an influencing role that has led to the lack of ESI reform and restructuring in South Africa in the post-apartheid period. This view of political influence on an ESI is shared by Pittman and Zhang [13] when commenting on the Chinese ESI. There has been a lack of incentives to relinquish central control by the government. Eskom

tariffs were too low in the latter part of the 1990s thus making it infeasible for IPPs to compete. This period also saw a lack of policy and regulatory certainty. This view is echoed in the literature by Pickering [42]. At the same time, there were conflicts of interest within Eskom due to their mandate to serve the social imperative of mass electrification vs. calls for self-sufficiency as a government SOE which required a profit maximisation strategy which has also been observed by Eberhard [31]. Eskom was also conflicted being the dominant generator, while also being the sole system operator, buyer of electricity and distributor. Historical marginalisation had also resulted in disorder within the municipal electricity sector, which was perpetuated in recent times due to inappropriate funding models and opposing stakeholder views. There were also conflicts of interest between NERSA and DOE in terms of planning and regulatory functions. These conflicts of interest have led to confusion, uncertainty, opposition and lack of commitment to change. Within Eskom, there's also been a strong resistance to change, resulting in them leveraging their market dominance to prevent change.

Theme 3 - Explaining the feasibility of the standard model of reform in South Africa

- **Emergent view 3.a:** *South Africa's ESI has different characteristics compared to other countries that embarked on the standard model*
- **Emergent view 3.b:** *Divestiture and privatising Eskom generation assets won't be practical in SA*
- **Emergent view 3.c:** *Wholesale and retail competition won't be effective in South Africa in the short to medium term*

If one considers where South Africa stands in relation to the standard model (as shown in Figure 1), it is clear that the country is currently at Step 5 of the 9 step model. Based on conducted analysis, the remaining 4 steps which include divestiture of generation and distribution assets and introduction of competitive markets may not be possible due to numerous reasons. Firstly, the strong internal resistance from Eskom opposing an unbundling of its assets (as discussed in previous theme), coupled with the strong political opposition to privatisation of the South Africa ESI form a powerful resistance force that oppose the latter steps of the standard model of reform. Secondly, the historical failure of the REDs is proof that divesting public-ownership of distribution will be difficult in South Africa in the short to medium term. Thirdly, the introduction of wholesale competition will be difficult due to the skewed distribution of large industrial users who could easily game the market. Fourthly, retail competition may be limited due to the generally poor condition of distribution infrastructure. Based on the above rationale and analysis, it is concluded that the standard model of reform cannot be implemented in South Africa, and alternative strategies need to be explored to bring about practical ESI reforms and restructuring. This is in line with findings of Bacon [10] who suggested that the chronology of the standard model may not necessarily hold true for countries with unique conditions.

Theme 4 - Restructuring proposals for the South African ESI

- **Emergent view 4.a:** *Views relating to establishment of an ISMO in South Africa*
- **Emergent view 4.b:** *Feasibility of Eskom Transmission being integrated into the ISMO by being carved out of Eskom*
- **Emergent view 4.c:** *Various Concerns with the ISMO*
- **Emergent view 4.d:** *A Single buyer model within the ISMO should be implemented*
- **Emergent view 4.e:** *Views on the practical Timelines for restructuring the ESI*
- **Emergent view 4.f:** *Addressing Municipal and Distribution Issues in South Africa*

Based on earlier thematic analysis, the South African political status quo has proved it unpalatable to consider any forms of privatisation to the South African ESI in the short to medium term. South Africa's ESI currently functions as a hybrid electricity market. Restructuring the ESI by implementing the ISMO as a government owned entity, with a single-buyer model provides a considerable opportunity to open up generation opportunities to IPPs in the future without privatisation of existing state-owned assets, thus proving that restructuring is possible without privatisation. The majority of industry experts support the call for a state-owned ISMO, and there is consensus that it is achievable in the short to medium term. This viewpoint is supported by Pollitt [52] who states that ISOs (in the form of regional transmission operators) showcase the ability to develop sophisticated markets on top of the basic system operation function. This conforms with the South African model to introduce an ISMO to manage both the systems and market operator functions independently from the transmission-asset owner; with evidence that this structure can be initiated successfully [12]. There are obviously some concerns that must be addressed before broad acceptance of the ISMO will prevail, and these must be addressed immediately to ensure that any second parliamentary bid to instate the ISMO does not fail in the future. With respect to restructuring the distribution sector, no definitive solution emerges from the research. Core municipal issues have been identified such as the dysfunctional municipal electricity cross-subsidising funding model, lack of firm regulation of municipalities by NERSA, lack of technical skills, enormous maintenance and refurbishment backlogs, and constitutional protectionism. Despite this, further research is required to arrive at practical ways to address these municipal issues.

Theme 5 – South African ESI Reform proposals to address conflicts and overlapping responsibilities with regard to planning, procurement, regulation and control amongst key South African ESI stakeholders

- **Emergent view 5.a:** *Reform propositions put forward to address the many conflicting and overlapping responsibilities between NERSA and the DOE*
- **Emergent view 5.b:** *Reforms needed to address the many Eskom conflicts of interest*
- **Emergent view 5.c:** *Reforms needed to address regulatory and policy uncertainty*

There are currently conflicts of interest in the perceived deferment of authority by NERSA to the DOE with respect to the granting generation licences. These observations are in line with the finding shown by Eberhard [31]. There are also areas of conflicts and overlapping responsibilities within Eskom that have been uncovered. Policy and regulatory uncertainty in South Africa is strongly perceived to be hampering efforts to enhance the ESI. It is seen as having a negative impact on private sector investment into the generation and distribution sectors of the ESI. Steyn [48] observed the successes public-private partnerships had brought Eskom historically. This is backed by the evidence found by Nepal and Jamasb [53] when researching early success stories of power sector reform. They conclude that market-based reforms require the presence of appropriate institutions and effective governance mechanisms. It is believed that all the above issues can be resolved with the introduction of the ISMO and the accompanying regulatory and policy modifications that will accompany its establishment within NERSA and the DOE.

Theme 6 - Impact to the South African ESI if reforms and restructuring occurs

- **Emergent view 6.a** *Reform and restructuring won't decrease tariffs*
- **Emergent view 6.b** *Reform and restructuring will increase SA economic performance*

- **Emergent view 6.c:** *Reform and restructuring will increase ESI private sector involvement and system efficiencies*

Electricity tariffs are likely to increase in the short-to-medium term in a reformed and restructured South African ESI, under the assumption that the ISMO will be established under a single-buyer model. The South African economy will only grow with an available, reliable and secure supply of electricity, which reforms and restructuring of the ESI will provide. This is backed by research conducted by Sen & Jamasb [63] who conclude that industrial consumption has shown a tendency to increase with the implementation of a complete reform of the electricity sector. There is consensus that reforms and restructuring can bring about greater private sector involvement with enhanced total system efficiencies, which is a view that is also taken by Bacon [10].

The following table aims to summarise some of the key similarities and differences emanating from the findings within this paper compared to existing key literature sources related to electricity restructuring.

Table 3: Summarised analysis of previous relevant research compared to themes within this paper

Previous research	Research methodology and instrument	Key outcomes of previous research	Key differences/similarities with findings in this paper
Littlechild [8], Hunt [50]	Industry expert insight and experience in the industry over 30 years	9 steps forming the “Standard prescription for power sector reform” including divestiture of both generation and transmission/distribution assets from incumbent utility to private sector	Findings in this paper suggests restructuring not in sync with standard prescription, and that generation and transmission/distribution restructuring without privatisation is the most favourable option to attain greatest value for all ESI stakeholders. This emphasises the view that cognisance of specific local conditions is paramount
Pickering [47]	The research was based on interviews with informed individuals, a review of confidential draft policy documents and a limited review of international literature	The report examined the key functions that an ISO would need to perform in South Africa. Recommends a single buyer established as part of an ISO. Also recommends ownership of transmission assets out of Eskom and into the ISO i.e. a full Transmission System Operator (TSO)	Pickering’s work broadly aligns with the findings in this paper. However, no specific recommendation is made for a full ISMO model, and considers REDs viable. Current findings point that regional distributors will not be practical in the short-to-medium term due to political and economic factors
Sen & Jamasb [63]	Panel empirical data spanning 1991-2007, using dynamic panel data estimators and conducting an econometric analysis of set hypothesis	Results show that individual reform measures have affected key economic variables differently. Findings suggest that due to political economy factors, outcomes have tended to be adverse in initial stages of reform but may improve as reform progresses beyond “baseline” structural reforms	Findings in this paper reach similar conclusions that electricity tariffs are not foreseen to improve during the initial stages of ESI reforms and restructuring in the short-to-medium term
Pollitt [46]	Evidence-based literature assessment of various empirical econometric studies, case studies and industry publications	This research concludes that evidence points to ownership unbundling of transmission being a key part of energy market reform in the most successful reform jurisdictions	Findings in this paper agree and recommend a total unbundling of transmission assets from the incumbent vertically-integrated utility, thereby increasing system efficiency and non-discriminate access to the grid

5. Conclusions and recommendations

The historical vertically integrated ESI structure in South Africa grew out of the need to meet the demands of the emerging industrialisation phase of the 1920s, as was envisioned by its founders. This was achieved using the most favourable techno-economic solutions on offer at the time. This structure served its purpose well during the following decades of progress in the minerals-industrial complex of South Africa. During the Apartheid government's rule in the 1950s and 1960s, the vertically integrated model continued to be favoured as it provided benefits of central control and security of supply. During the 1970s and 1980s, the vertically integrated structure was emboldened when massive generation and transmission expansion projects were executed by the incumbent utility Eskom.

The post-transformational government in the early 1990s inherited the vertically-integrated ESI structure, and initially leveraged it for their social imperative strategy of mass electrification. At the same time, the prevailing pre-conditions that saw global reforms occur internationally such as the serious questions of the incumbent utility's financial viability and operational efficiency, were not that prevalent locally. There was however some calls for greater market participation and the need to attract foreign direct investment voiced by pro-liberalisation industry participants. At the same time, analysis reveals that there were however other more localised factors that discouraged reform and restructuring such as political opposition by the unions and communist influences in the ruling party; Eskom's low-tariff that served as barriers to entry for IPPs; policy and regulatory uncertainty; and severe conflicts of interest between Eskom, the government and NERSA. This was despite no absence in progressive and intellectual discourse which produced the likes of the 1998 White Paper on Energy.

Despite minor reform and restructuring measures being implemented, analysis of the entire post-transformation period to date reveals the greatest stumbling block has been the lack of political will and alignment between the key stakeholders that led to opposition and stalling of any meaningful reforms and restructuring. Analysis reveals that the discontinuation of the REDS initiative, defaulting to Eskom as the "supplier of last resort" in 2004, failure of meaningful implementation of the 1998 White Paper on Energy, and more recently the failure to promulgate the ISMO Bill in 2013 are major signs of failures in the ESI. The historical reasons that saw vertical integration being favoured during the pre-transformation government rule i.e. techno-economic favourability and need for heightened central control; and during the immediate post-transformation period i.e., social transformative imperative; can no longer serve as valid reasons to counter suggestions to ESI restructuring. It is also important to note that pre-conditions that spurred on ESI restructuring and reforms globally are starting to be apparent in South Africa i.e. poor utility performance and short-term financial needs, which further validate its need in locally.

Based on the research analysis, it is concluded that the standard model of reform cannot be implemented in South Africa i.e. wholesale and retail competition is not feasible in the short-to-medium term, and so is the divestiture of generation and distribution. Divestiture of Eskom Distribution is unlikely in the short-to-medium term based on historical issues with the REDs proposal i.e. both funding model concerns and constitutional protection.

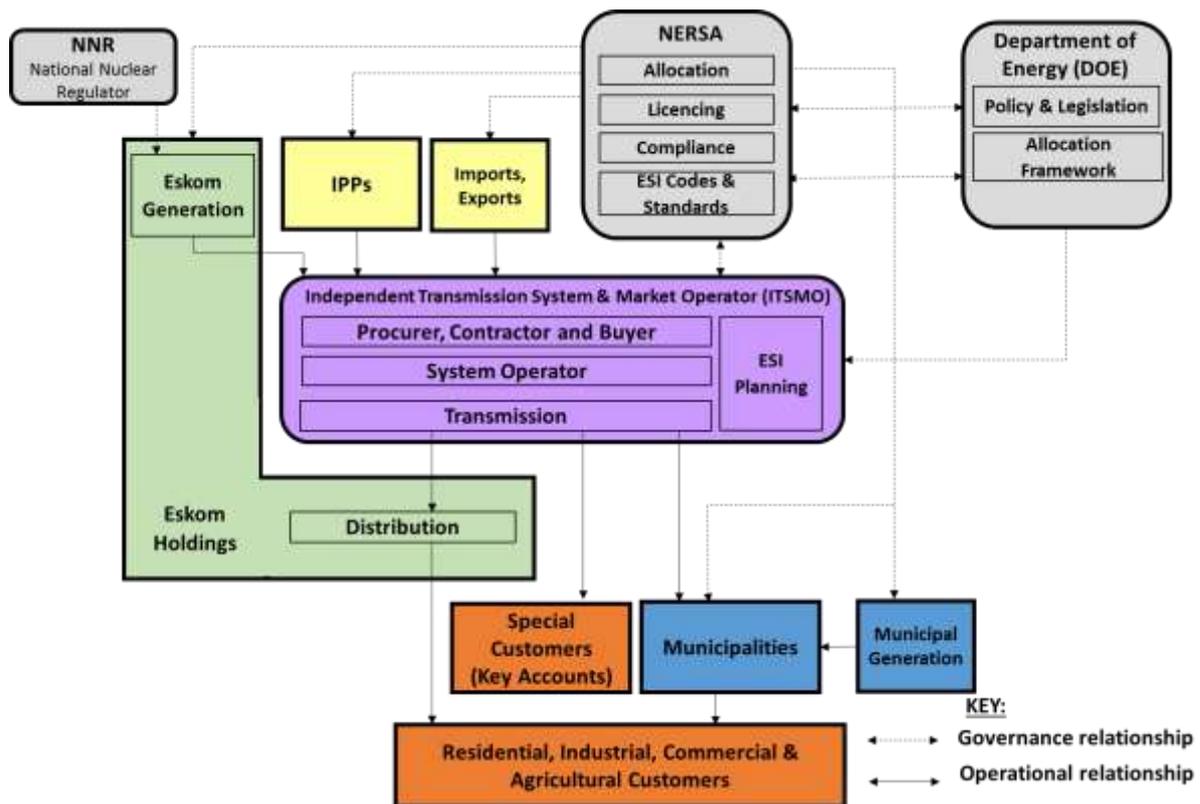


Figure 5: Recommended South African ESI structure based on research findings

Divestiture of Eskom Generation is unlikely in the short-to-medium term due to political opposition and financial viability concerns. It may be possible to divest Transmission, but only to another state entity such as an ISMO. South Africa's ESI currently functions as a hybrid electricity market with a questionable level of effectiveness in attracting new investments and security of supply. An alternative strategy needs to be explored to bring about practical ESI reforms and restructuring. The research points to a solution of restructuring by introducing a state-owned ISMO using a single buyer model in the short term, and which would be responsible for all the functions as per Figure 5 above.

Figure 5 above differs from the initial conceptual model (see Figure 2) in two respects i.e. research findings suggest that Eskom Generation should remain a state-owned entity (as opposed to the initial proposal for it to be privatised); and research findings point to ESI planning becoming an ISMO responsibility (as opposed to initial proposal that it remain a DOE responsibility). The model proposed in this research study is not dissimilar from propositions in the literature. There are however, South-African specific proposals that have been added to address local problems and leverage local conditions.

There are obviously some concerns that must be addressed before broad acceptance of the ISMO will prevail, and these must be addressed immediately (such as Eskom compensation for Transmission assets and Key Customer Account transfer of ownership) to ensure that any second parliamentary bid to instate the ISMO does not fail in the future. While the single buyer model has its disadvantages, the alternative wholesale and retail competition models pose significantly greater challenges in South Africa in the short term. An additional proposal is to establish a new Electricity Commission that involves industry stakeholders to rationalise the energy regulatory and policy environment.

The benefits of the proposals above allow for restructuring without privatisation, seen as a key requirement to earn favour from the powerful socialist lobby in South Africa. At the

same time, the ISMO is seen as a viable solution to remove all the identified conflicts of interest, overlapping responsibilities and policy and regulatory uncertainty within Eskom, NERSA and the government as detailed in the analysis section. Despite the suggestion for non-privatisation of existing Eskom Generation assets, given the financial concerns being experienced by Eskom currently, it is proposed that all future generation be obtained from the private sector, with Eskom Generation allowed to consolidate its existing operations and increase their system efficiencies.

Policy and regulatory reforms are also urgently required, and industry experts are of the opinion that their current uncertainty is leading to suppressed private sector involvement in the generation and distribution industries. Analysis reveals that most generation and IPP issues can be resolved with the introduction of the ISMO and the accompanying regulatory and policy modifications that will accompany its establishment. From a municipal electricity sector perspective, some core municipal issues have been identified such as the dysfunctional municipal electricity cross-subsidising funding model, lack of firm regulation of municipalities by NERSA, lack of technical skills, enormous maintenance and refurbishment backlogs, and constitutional protectionism. Despite this, further research is required to arrive at practical ways to address these municipal issues. It is also fundamental that the political will and buy-in be prevalent for any energy policy to be accepted and implemented in South Africa.

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