The feasibility of competitive electricity transmission in South Africa

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Abstract

The paper investigates whether competitive transmission of electricity is realisable in South Africa by adapting the Delphi research process to survey the opinions of expert panellists drawn from the relevant disciplines. The research propositions revolve around the roles that customers, generators and technology suppliers, among others, could play in providing competitive transmission services. Given that competition in electricity generation is generally accepted, the paper examines the extent to which sunk costs, fixed costs and scale economies are sufficient to block entry into the transmission services sector. The experts were unambiguously convinced that economies of scale in transmission were significant enough to block entry into the industry. Consequently, neither the successful introduction of competition in generation nor Eskom's successful experiment in power transmission and telecommunications joint ventures provides sufficient grounds to believe that it is feasible to implement a competitive electricity transmission industry in South Africa.

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1 Introduction

South Africa cannot implement a competitive electricity power transmission industry in the foreseeable future particularly because economies of scale and to a lesser extent, fixed costs and sunk costs collectively pose a formidable entry barrier. This is in spite of Eskom's current "successful" trial that institutionally disengages power generation from transmission.

These are the conclusions of the present study that seeks to reveal the conditions under which competitive electricity transmission will be feasible in South Africa. The study is justified on the ground that the current state of monopolistic power transmission is inefficient – costly and hardly meets consumer needs. Thus, scale economies, fixed costs and sunk costs – the potential entry barriers are analysed from the theoretical and experiential perspectives.

This paper examines this problem against the backdrop of three recent developments in the industry. First, Eskom has, since 1996, been simulating on electricity market through the 'Eskom Power Pool'. Second, in 1998, the South African government specified in its energy white paper its intention to implement and promote successful electricity industry by: permitting customers to choose their suppliers; introducing competition into industry; providing non-discriminatory access to the transmission system; and encouraging private sector participation (Republic of South Africa, 1998). Most recently in 2002, the government commissioned a project to investigate, among other things, ownership structures that would prevent participants from exercising monopoly power and ways of managing transmission congestion and ancillary services.

Ancillary services are provided by generators to ensure that the transmission system is stable and reliable. These services include frequency regulation, and the reactive power support to ensure that the maximum amount of electricity can be transferred across a particular connection (Hunt, 2000).

Two transmission models have, so far, evolved from international experience – the "Transco" and the "ISO" (Hunt, 2000). Transco refers to an integrated transmission company which owns and operates the transmission network, an example being the UK's National Grid Company (NGC). In the ISO model, an independent system operator (ISO) operates the network while another or more companies own it and are therefore responsible for maintenance and expansion (Ibid). This is the model used in the US, an example being the California Independent System Operator (CAISO) which operates three privately-owned transmission networks (Joskow, 2000).

Section two of the paper explores the literature and develops propositions for the study. Section three describes the methodological procedure, while sections four and five respectively analyse and interpret the research data. Section six concludes the paper, draws practical implications and recommends a short-term policy and action for introducing competition into electricity power transmission.

2 Literature review and research propositions

The most compelling case against attempts to introduce competitive forces in electricity power transmission is the contention that the industry is a natural monopoly characterised by scale economies. In other words, production at any level is lower when one firm produces all the output than when two or more firms produce the total. However, other authors have advanced alternative views, as well as additional means and instruments of competitive market formation including demand-side participation and transmission risk management.

2.1 Traditional views on natural monopoly

Hunt (2002) represents the traditional view in arguing that although it is appropriate to allow market forces to create adequate generation capacity, the competitive mechanism does not apply to transmission.

In justifying this stance, the author defines transmission as comprising four distinct areas, namely: maintenance (which is carried out by transmission owners); transmission operations (which involve the physical switching in and out of transmission components and is carried out by a system operator); system control (which includes decision making about transmission operations as well as giving operating instructions to generators); and system expansion and upgrade (which includes evaluating the need for new transmission assets, decisions about where and when to build new assets, and dealing with various economic and environmental approval processes that accompany new projects). This definition excludes ancillary services and takes the view that they are by-products of power generation.

2.2 Alternative views

Gordon (2001) suggests that if efficiency is the sole purpose of competition, a regulated transmission system can achieve a similar objective. In a review of the incentive regulation system in the UK, Merchant, Vass and Williams (2002) argue, however, that it is difficult to improve allocative, productive and dynamic efficiencies through regulation for three reasons. To begin with, information asymmetry exists between regulators and market participants. Furthermore, the benchmarks used to provide incentive to market participants are inadequate. Finally, there is no guarantee that risk taking will be efficient. Hunt (2002) has attempted to harmonise his own view with these views by proposing a system in which the operator is a regulated monopoly, while other areas of transmission, such as reliability services and transmission expansion, are contestable (Klein, 1996). This solution appears not to have addressed the core problem of scale economies.

According to Nelson and Primeaux (1988) the presence of scale economies at all output levels in transmission and distribution does not imply that natural monopoly exists. They cited a study that showed that economies of scale only existed if a monopolist's output was increased to existing customers. If, however, the output was to serve new customers or new customer requirement, a different utility should be set up to eliminate x-inefficiency. This conclusion supports the contention that focusing on scale economies alone can be misleading, because they are hardly a sufficient condition for the existence of natural monopoly (Brock, 1983). One such condition is the existence of sunk costs.

Baumol, Panzar and Willig (1982) assert that although sufficiently large fixed costs lead to natural monopoly cost conditions, such costs do not necessarily constitute barriers to entry unless they are sunk. In other words, fixed costs may be considered to be sunk and a barrier to entry only if they are irrecoverable and higher than the potential profits. Citing the example of an airliner, they demonstrate that despite the large fixed costs of operating a commercial aircraft, these costs are not necessarily sunk since the operator has the option to recover the costs by moving to other routes if a targeted market becomes unprofitable. Therefore, the alternative to redeploy assets in other markets provides the means of spreading sunk costs, of lowering potential entry barriers and thereby promoting multi-firm participation in the supply of transmission services; the problem, though, is whether to own or rent the asset.

A rental market provides the opportunity to transfer financial commitment from the user of the rented asset to its owner. At the same time, the use of futures contracts ensure that an entrant's initial investment has value, especially if well-functioning secondary markets exist to price such contracts. Another option is to take advantage of diversification. Roseman (2001) suggests a model in which transmission companies diversify into fibre-optics, telecommunications, gas or water markets. Such combinations of complementary businesses allow companies originally set up to provide electricity transmission services to recover costs that would otherwise have been sunk. Furthermore, as Burnovski & Zang (1999) suggest, a natural monopoly regulator may actively encourage competition by offering subsidies to potential entrants.

Thus, it is possible to improve efficiency in electricity power transmission in spite of its natural monopoly cost conditions by applying regulation and similar powerful instruments.

2.3 Demand-side participation

Contributors to the debate on competition in electricity transmission have rarely acknowledged the value of customer participation in the market. Joskow (2000) observes that in the US state of California, the absence of customer participation enabled power generators to abuse the market, resulting in sharp price hikes and frequent power failures. In some instances, a 50 000 MW system experienced power failures when customers could have provided an additional 300 MW required to ensure stability, had they had the opportunity to participate directly in the electricity market (Joskow, 2000).

Fraser (2001) suggests, against this background, that demand-side bidding in electricity markets should be considered as a way of fostering customer participation because it enables customers to express future demand at any given price. Indeed, their participation informs them how much energy they have consumed at any given time, and thereby facilitates independent purchasing and consumption decision making. Feasibility of demand-side participation will, however, require addressing the challenges of developing appropriate metering systems, customer ignorance, as well as regulatory and political reservations.

With regard to the required commercial arrangements, a range of instruments, including day-ahead bidding, bilateral contracts, futures contracts, and contracts for differences (CFDs), are available to customers. Other instruments available are those employed for managing the risks incurred during participation in the transmission market. These are called transmission rights.

2.4 Transmission risk management

Transmission rights occur in two forms – financial transmission rights (FTRs) and physical transmission rights (PTR). FTRs are financial instruments used to hedge congestion costs associated with the transportation of energy from points of injection (generators) to points of withdrawal (customers) through a transmission system. The holder of the rights is entitled to financial compensation for the use of part of the system. The holder may also trade the rights in a secondary market. Physical transmission rights, on the other hand, represent a contractual entitlement to the capacity of a transmission between agreed upon points in a schedule normally produced by an independent system operator (ISO). The holder of the right may decide to use such rights for the actual transmission of electricity, hoard them and thereby create congestions, or sell to a party that will use them for physical delivery (Fraser, Lyons & Parmesano, 2000).

Fraser, Lyons & Parmesano (2000) and Hunt (2002) argue that FTRs are superior to PTRs, especially where prices are geographically differentiated. A primary reason for this is that PTRs create the potential for market power if the holder decides to withhold capacity. However, an active market in PTRs can eliminate the problem of withholding capacity. But, such a market is not practicable because the time it takes to trade physical transmission rights is longer than the time required to make decisions necessary for a stable and efficient operation of the power network. Contrarily, the use of FTRs prevents this problem altogether, since they have no impact on scheduling and dispatch (Hogan, 1999).

Fraser, Lyons & Parmesano (2000) explain further, that FTRs are reliable instruments because they define property rights that transfer to their owners the benefits of using a transmission system by reserving capacity for their exclusive use, or providing them with the financial benefits of the line. In this view, FTRs encourage transmission investment since they have value and are therefore tradable. In addition, they are useful as a hedge mechanism against congestion-induced price spikes and thereby facilitate efficiency in electricity markets. This means, that ownership of FTRs has the same effect as ownership of a physical line, except for one important difference: the tradable rights of FTRs are "automatically assigned to those who provide the system with the highest value" (Fraser, Lyons & Parmesoano, 2000: 33).

2.5 Propositions

From this review of the literature, the following four propositions (further divided into 17 sub-propositions) were constructed for the field study:

Proposition 1: Redefining the transmission model to include competitive mechanisms is one way of improving transmission efficiency.

Sub-propositions

1 Traditional transmission activities include: maintenance; transmission operations, systems control; centralised transmission expansion and upgrading.

2 Emergent transmission activities include: land use; maintenance; transmission operations; systems control; generator reliability services; customer reliability services; technology-driven reliability services; wholesale energy metering; convergent services; commercial congestion; management; decentralised transmission expansion and upgrading; power quality management and, customer interface management.

3 Among the various transmission activities mentioned above, only transmission operations and system control are contestable.

4 The regulatory regime must ensure freedom of entry and exit even in activities not considered as contestable.

5 Dynamic locational transmission pricing improves congestion management by signalling to customers the cost of network congestion.

6 By reflecting the value of additional transmission capacity, dynamic locational transmission pricing facilitates decentralised system expansion.

7 Financial transmission rights are effective instruments for hedging transmission price risks.

8 Emerging innovative technologies can be used to provide specialised transmission services regardless of scale economies.

9 The institutional separation of network ownership from operation is necessary for efficient management of transmission activities.

Proposition 2: Where markets for ancillary services exist, it is possible to create a multi-firm power transmission system consisting of customers, generators and other service providers.

Sub-propositions

10 Ancillary services can be considered as part of the transmission system as long as they contribute to the creation of short-term transmission capacity.

11 Generators can be considered as transmission service providers as long as they provide ancillary services.

12 Customers can be considered as short-term transmission capacity providers to the extent that they relieve network congestion whenever they cut back demand.

Proposition 3: The successful introduction of competition in electricity generation despite high fixed costs, economies of scale and sunk costs suggests that it is equally possible to introduce competition in transmission.

Sub-propositions

13 Sunk costs and not fixed costs are the real barriers to entry into transmission markets.

14 The convergence of power transmission and telecommunication services can spread sunk costs and lower entry barriers.

15 If economies of scale do not fully account for monopoly in generation, they should similarly not fully account for monopoly in transmission.

Proposition 4: Eskom's successful experiment in power and telecommunications joint ventures suggests that competitive power transmission is feasible in South Africa.

Sub-propositions

16 The existence of an independent transmission entity such as Motraco, suggests that competition in long-term power transmission capacity provision is feasible in South Africa.

17 The use of power transmission facilities to support the Second Network Operator (SNO) can spread the sunk costs of transmission and lower entry barriers.

3 Methodological procedures

3.1 The Delphi process

The field study followed a variation of the Delphi process as described by Clayton (1997), the variation being that the researchers did not use the first round of the process to sketch scenarios with the panellists. Instead, the researchers designed a questionnaire based on the four propositions and administered it in the first round of the Delphi process. The process ended after two rounds instead of three.

This approach made it quicker to assess the degree of agreement or disagreement among the panellists and therefore avoided the possibility of attrition, which tends to occur the longer the research process (Critcher & Gladstone, 1998). Prior to this, the researchers made initial contact with potential panellists by telephone and email to brief them about the project and seek their willingness to participate. Consequently, the researchers dispatched the questionnaire to each panellist together with an electronic follow-up letter which detailed the process to be followed, and the extent of involvement. In the few cases where the researchers received no response after one week, they made further telephonic enquiry and allowed for five weeks to follow-up telephonic contacts before excluding a potential panellist from participating in the study.

Round one

The questionnaire required panellists to indicate the degree of their agreement or disagreement with the propositions rated on a five-point Likert scale which ranged between positive and negative numbers, with zero indicating a neutral response (Clayton, 1997). Rescaling was necessary to convert the data from ordinal to interval values. The rescaled values provided concrete data for calculating group means and standard deviations for each proposition. The researchers compared each panellist's response with the group standard deviation to determine whether it was extreme or not. Extreme responses were those that were either lower or higher than one standard deviation from the group mean. Whenever panellists gave such responses in this round, they were given the opportunity to review or maintain their positions in Round Two during which each panellist received a summary of the responses.

Round two

This round consisted of three steps:

Step 1
The researchers analysed the ratings for central tendency and dispersion as described above and subjected open-ended responses to content analysis in order to uncover underlying themes or patterns (Leedy & Ormrod, 2001). This made it possible to condense the responses into seven statements that the panellists later ranked in order of importance.

Step 2
The researchers further analysed for central tendency and dispersion, the open-ended responses ranked in Step 1 and the panellists reconsidered their ratings as in step 1. As before, the researchers assessed each ranked statement for possible biases but this time specifically in regard to the reasons for maintaining that the existence of economies of scale in electricity transmission was the major ground for considering the sub-sector as a natural monopoly.

Step 3
A summary of all the responses was sent to the panellists and the open-ended responses were subjected to further content analysis.

3.2 Population and sample

The initially targeted population of emerging entrepreneurs, journalists and local experts in energy economics, corporate strategy, electricity markets, transmission pricing, industry regulation, power transmission technology and finance was 90. However, 79 respondents took part in the first round, the number dropping to 63 in the second. This purposive sample, therefore, consisted of participants who may be described as "disinterested experts on the topic' (Critcher & Gladstone, 1998 :435) and those whose expertise was the result of "their participant involvement as leaders of special interest groups" (Critcher & Gladstone, 1998: 435).

3.3 Validity and reliability

To achieve internal validity, the researchers ensured that each participant's contribution derived from his or her expert knowledge. The option for panellists to reconsider views defined as extreme added considerably to encouraging uninhibited contribution.

4 Analysis of data

This section presents an analysis of the raw data obtained from the research process.

4.1 Rescaling

The rescaled values of the Likert scale for round one and round two are shown in tables 1 and 2 respectively.

Table 1
Rescaled values of Likert scale – Round one

Scale point	Nominal value	Rescaled value
Strongly disagree	-2	–1.908
Disagree	-1	–0.862
Neither agree nor disagree	0	–0.862
Agree	1	0.218
Strongly agree	2	0.687

Table 2
Rescaled values of Likert scale – Round two

Scale point	Nominal value	Rescaled value
Strongly disagree	–2	–1.945
Disagree	–1	–1.469
Neither agree nor disagree	0	–0.340
Agree	1	0.148
Strongly agree	2	1.013

4.2 Descriptive statistics

The group mean and standard deviation for each rated statement in the two rounds appear in tables 3 and 4.

Table 3
Group statistics based on rescaled Likert values – Round one

Rating statement	Group mean	Group standard deviation	Upper limit	Lower limit
1	0.507	0.231	0.738	0.275
2	0.195	0.358	0.553	–0.163
3	–0.170	0.491	0.321	–0.661
4	–0.137	0.606	0.469	–0.744
5	0.355	0.305	0.660	0.049
6	–0.043	0.456	0.413	–0.500
7	–0.088	0.287	0.199	–0.376
8	0.127	0.356	0.483	–0.229
9	–0.500	0.639	0.139	–1.139
10	0.239	0.321	0.559	–0.082
11	–0.043	0.456	0.413	–0.500
12	0.272	0.449	0.720	–0.177
13	–0.043	0.456	0.413	–0.500
14	–0.004	0.401	0.397	–0.405
16	–0.539	0.644	0.105	–1.183
17	–0.126	0.499	0.372	–0.625

Table 4
Group statistics based on rescaled Likert values – Round two

Rating statement	Group mean	Group standard deviation	Upper limit	Lower limit
1	1.013	0.000	1.013	1.013
2	0.340	0.442	0.781	–0.102
3	–0.895	0.763	–0.132	–1.657
4	–0.019	0.528	0.509	–0.548
5	–0.808	0.752	–0.056	–1.560
6	0.261	0.387	0.648	–0.126
7	–0.156	0.714	0.558	–0.870
8	0.418	0.477	0.895	–0.059
9	0.261	0.387	0.648	–0.126
10	0.174	0.151	0.325	0.024
11	0.108	0.358	0.466	–0.250
12	0.466	0.552	1.018	–0.086
13	–0.083	0.419	0.336	–0.502
14	–0.015	0.234	0.219	–0.248
16	–0.996	0.777	–0.219	–1.772
17	–0.068	0.418	0.350	–0.486

4.3 Distribution of responses

The distribution of responses in rounds one and two are shown in tables 5 and 6 respectively.

Round one

Table 5 shows that only propositions 9 and 16 received the "strongly disagree" response. It was also for the same propositions that the combined proportion of panellists who "strongly disagreed" and "disagreed" was higher than those who 'agreed' and 'strongly agreed'.

For the rest, the combined proportion of responses in the affirmative was higher than the corresponding proportion in the negative. A higher proportion of non-committal responses were given to statement 7.

Table 5
Distribution of responses to research statements – Round one

	–1.908 (Strongly disagree)	–0.862 (Disagree)	–0.351 (Neutral)	0.218 (Agree)	0.687 (Strongly agree)
Q1	0%	0%	0%	38%	62%
Q2	0%	0%	23%	54%	23%
Q3	0%	23%	31%	38%	8%
Q4	0%	31%	23%	23%	23%

Q5	0%	0%	8%	54%	38%
Q6	0%	15%	23%	54%	8%
Q7	0%	0%	54%	46%	0%
Q8	0%	8%	8%	77%	8%
Q9	8%	38%	31%	15%	8%
Q10	0%	0%	15%	62%	23%
Q11	0%	15%	23%	54%	8%
Q12	0%	8%	8%	46%	38%
Q13	0%	15%	23%	54%	8%
Q14	0%	8%	31%	54%	8%
Q16	8%	46%	23%	15%	8%
Q17	0%	23%	23%	46%	8%

Round two

Proposition 16 (Table 6) again received a "strongly disagree" response, while the same proposition together with propositions 3 and 5 received more responses in the negative than in the affirmative. For the rest, the combined proportion of responses in the affirmative was higher than the corresponding proportion in the negative.

Table 6

Distribution of responses to research statements – Round two

	–1.945 (Strongly disagree)	**–1.469 (Disagree)**	**–0.34 (Neutral)**	**0.148 (Agree)**	**1.013 (Strongly agree)**
Q1	0%	0%	0%	0%	100%
Q2	0%	0%	9%	64%	27%
Q3	0%	61%	18%	18%	3%
Q4	0%	6%	30%	55%	9%
Q5	0%	55%	15%	30%	0%
Q6	0%	0%	9%	73%	18%
Q7	0%	18%	18%	55%	9%
Q8	0%	0%	9%	55%	36%
Q9	0%	0%	9%	73%	18%
Q10	0%	0%	0%	97%	3%
Q11	0%	0%	24%	67%	9%
Q12	0%	3%	0%	55%	42%
Q13	0%	6%	27%	67%	0%

Q14	0%	0%	33%	67%	0%
Q16	3%	64%	21%	6%	6%
Q17	0%	6%	24%	70%	0%

4.4 Ranking the open-ended responses

The panellists' responses were overwhelmingly biased towards maintaining monopoly in transmission despite the liberalisation that had taken place in generation. Their reasons are condensed in the seven ranking statements in Table 7; the distribution appears in Table 8.

Table 7
Ranking reasons for stance on monopoly in transmission

Ranking statement	Ranking statement description
S1	Transmission is capital intensive and integrated.
S2	The complexity of transmission services renders unbundling impractical and uneconomical.
S3	Competitive transmission in a given geographical area is not possible.
S4	With regard to transmission, financing options such as BOOT (build-own-operate-transfer) are successful in only a limited number of instances.
S5	The monopoly arrangement is successful since customers receive fair value in terms of price, quality and service.
S6	Duplicating systems would result in the requirement to build-in "redundancy" for each system in order to meet quality standards.
S7	Multiple "wires" providers can exist – but only regionally (e.g. Southern Africa) and not nationally (e.g. South Africa).

With a ranking of 1 indicating the least preferred reason and 7 indicating the most preferred, the majority of panellists ranked statement S1, that is, "transmission is capital intensive and integrated" as the reason for preferring a monopolistic transmission system.

Table 8
Distribution of panellists' preferred reasons

Scale point	S1	S2	S3	S4	S5	S6	S7
1	0	9%	9%	36%	18%	0	18%
2	9%	9%	18%	0	27%	0	27%
3	0	9%	27%	27%	18%	9%	0
4	18%	9%	0	18%	18%	27%	27%
5	0	27%	27%	9%	0	36%	9%
6	0%	18%	9%	–	18%	18%	9%
7	64%	18%	9%	9%	0	9%	9%

(Note: 1 = least preferred, 7 = most preferred)

5 Interpretation of data

Interpretation of the data derives from the scale point description of the rescaled values of the Lickert scale for the two rounds of the Delphi process, including rankings of the open-ended responses.

5.1 Round one

During this round, the panellists agreed unanimously with the definition of the traditional transmission business model, as well as the alternative definition which combined the traditional model with unbundled services. These services include service maintenance, reliability services provided by customers, generators and dedicated systems devices. The panellists insisted, however, that the system operator should not necessarily own any transmission assets, but could use financial contracts such as financial transmission rights to manage the risk associated with the supply and use transmission capacity. Notably, they were sceptical of two suggestions – that only transmission operations and system control could be considered as contestable and that the use of new systems to provide dedicated transmission services as well as creating a regulatory regime promote freedom of entry and exit. More emphatically, they dismissed the view that dynamic locational transmission pricing facilitates decentralisation of system expansion.

These responses suggest that with regard to the proposition that refining the transmission model to include competitive mechanisms could improve transmission efficiency, the panellists were convinced that there were limits to the extent to which transmission could be unbundled. Furthermore, long lead times associated with the creation of transmission infrastructure made freedom entry and exit impractical. Besides, the requirements for economies of scale rendered emerging, stand-alone transmission technologies impractical.

Consistent with their agreement on the relevance of the expanded transmission model, the panellists concurred that customers, generators and other service providers could be considered as transmission service providers to enable them to participate in the short-term market for electricity transmission. However, they insisted that the successful introduction of competition in generation did not suggest a successful introduction of competition in transmission because of high fixed costs, sunk costs and economies of scale. Indeed, economies of scale and fixed cost, rather than sunk cost, were their overriding reason for considering unbundling of transmission impractical and hence a natural monopoly. In fact, they made no attempt to distinguish between fixed costs and sunk costs or acknowledge the relative importance of the two types of costs in arriving at their viewpoint. As a logical sequence of this stance, the panellists felt that a viable, independent transmission entity was not possible in South Africa because over capacity in telecommunications would make it uneasy to redeploy transmission assets in that sector.

5.2 Round two

The panellists had the opportunity to clarify their rejection of the suggestion that an expanded transmission model to include competitive mechanisms would improve transmission efficiency. Although they accepted the expanded model in principle, they argued that its usefulness depended on whether separating network ownership from network operations would increase efficiencies – a notion which they had dismissed. This explanation rendered merely academic their agreement with the proposition that the existence of markets for ancillary services facilitates the creation of a multi-firm power transmission system because entry and exit would have been blocked by economies of scale, in the first place. On the basis of this, the panellists were more confident in maintaining their disagreement over the feasibility of introducing competition transmission and in eventually dismissing the possibility of replicating the success of Motraco at the national level in South Africa.

6 Conclusions, implications and recommendations

To fall in line with the global trend towards electricity market liberation, the South African government is determined to restructure the electricity power industry which is considered as a natural monopoly, by separating generation from transmission and introducing competitive forces in both segments of the market. This, it is expected, will improve efficiency in terms of increased outputs and falling prices. It is against this background that the paper has investigated the conditions that will provide for competitive electricity power transmission and the extent to which South Africa is able to meet these conditions. In other words, the focus of this paper has been to discover how far it is possible to spread economies of scale, fixed costs and sunk costs in order to permit multi-firm entry into the industry.

To find answers to this problem, the researchers sought the opinions of experts through the Delphi research methodological technique. At the end of the process, the experts were insistent that the current state of the industry will not conduce a competitive electricity power transmission sector in South Africa. In arriving at this position, they made no distinction between sunk costs and fixed costs, neither did they consider either to be higher than the other. In fact, they considered neither fixed costs nor sunk costs to be significant. On the other hand, they reckoned the existence of economies of scale as sufficient to block new entrants. This viewpoint contradicts the findings of Baumol, Panzar and Willig (1982) that scale economies are neither necessary nor sufficient to prevent entry of new participants into an industry. Even so, the panellists were indifferent to the assertion by Nelson and Primeaux (1998) that economies of scale only exist as long as a utility's output to current consumers increases.

Consequently, the panellists dismissed the suggestion that Eskom's single case success in power transmission and telecommunication joint ventures implied that competitive power transmission would be feasible in South Africa. Their reason was two-fold – doubts that it can be replicated and the concern that redeploying transmission assets in the telecommunication sector is unprofitable where overcapacity problems exist. This means, they overlooked the fact that it is the developed countries, not developing countries which usually experience over-capacity problems.

In all seriousness, the government must be prepared to employ a wide range of instruments simultaneously. These include subsidy against losses to private firms, locational transmission pricing, financial transmission rights and price discrimination. When properly implemented, this will reduce dominance by one firm, and create opportunities for small business entrepreneurship development. In the meantime, a quantitative study to provide information about the key features of the South African industry's demand and cost curves will verify the panellists' opinion about the relative importance of the various types of costs as entry barriers.

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