

ASSESSING THE DYNAMICS OF ENERGY MARKETS UNDER LIBERALISATION PROCESSES

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Abstract

The new liberalisation and privatisation trends now taking place world-wide have influenced government policies on electricity utility management. Some countries in the Latin American region are moving away from central planning, vertically integrated regional monopolies and heavily biased hydroelectricity generation schemes towards more liberalised set ups. The specific structure chosen in the Colombian case have important variations with respect to those advocated by main stream economic thinking.

Recent technology developments for power generation and extensive gas use in the household sector have stretch further relationships between electricity and gas industries. In this paper we present a System Dynamics model specially built as part of larger project to study and assess the effect of market forces into the power generation sector, at the light of a large scale plan which intends to supply natural gas to an important portion of the household sector and the power generation industry. With the aid of the model, we examine a number of economic signals to induce capacity investments to secure appropriate reserve margins for the Colombian electricity system.

1. INTRODUCTION

After years of crisis in the power supply sector, the Colombian energy policy gears towards the creation of appropriate measures leading to a) the financial recovery of the electricity utility industry and b) the provision of economic signals for adequate capacity investment. To this respect, three major factors have had an important effect on the system: tariffs only cover about 80% of the operational costs, unacceptable non-technical losses (almost 12%) and overall management inefficiencies. However, new legislation has been introduced to create a British-style market pool, stimulating competition between regional generation utilities and eliminating entry barriers to private investors. This possess questions with respect to the system ability to deliver appropriate signals to capacity building. This papers builds upon ideas expounded in Bunn et al (1992a, 1992b, 1993, 1994), Garcia and Dyner (1996), Ku (1995) and Smith (1995).

2. MODELLING THE ELECTRICITY SUPPLY INDUSTRY

In Colombia there are over 20 public generation companies, five of which account for about 90% of the system net capacity. Although the supply industry is heavily hydroelectric based (almost 80%), it also includes gas, coal, firewood and oil power plants. It is important to note that almost 10% of the total capacity will be private by early 1997, as new gas fuelled plants being built in the Caribbean and Southwest regions of the country, and no less than 15% should be privately owned by the end of this decade (even if no national assets are sold).

The supply model, Figure 1, considers linkages between six large modules, that allow interesting feedback effects in a way that investment decisions in economic markets go hand in hand with regulation mechanisms.

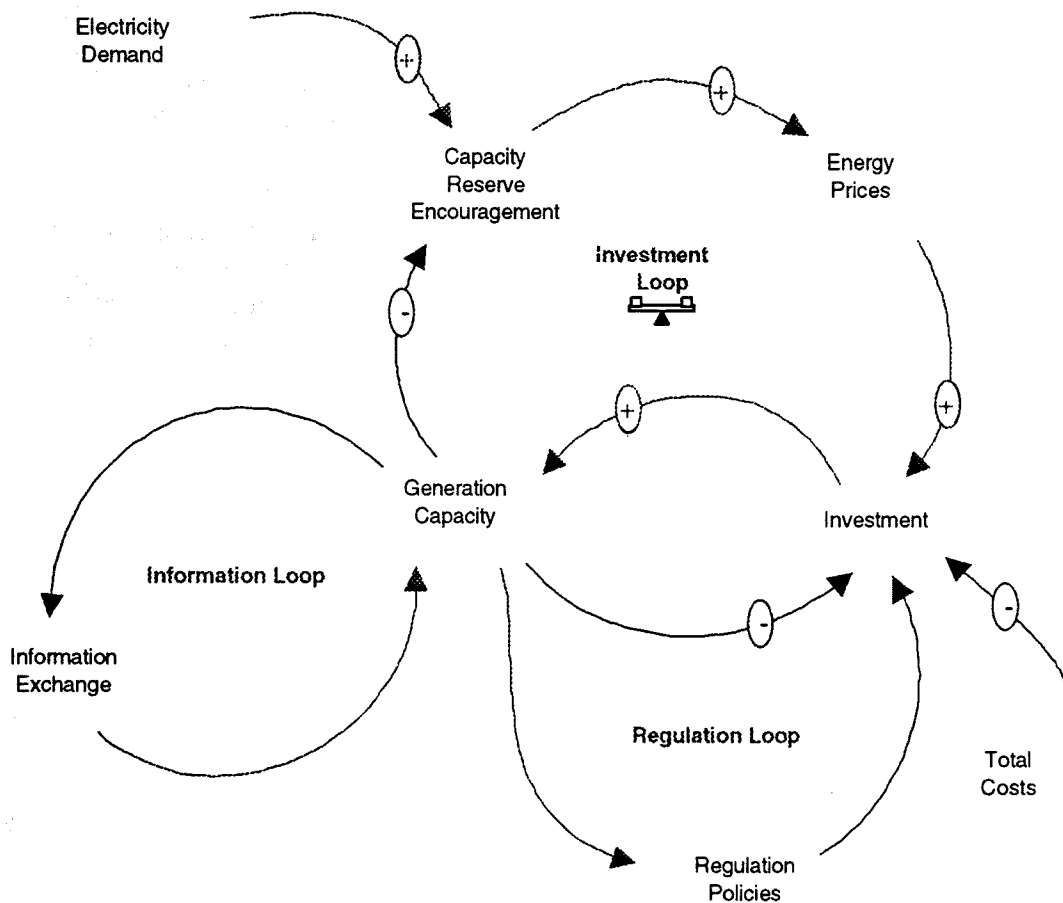


Figure 1 General causal loop diagram

The system aim is to provide clear signals of the margin gap between total system capacity and electricity demand, in a way that energy availability is guaranteed. The relationship between regulation, information and investment is suppose to provide here the appropriate system balance.

In this model we represent explicitly the major electricity utilities ISAGEN, EEB, EPM, CORELCA and EPSA, with some of their important characteristics, specially with respect to cash flows, broad financial figures and credit possibilities.

3. RESULTS

Present electricity tariffs will undoubtedly produce underinvestment and rationing. With better prices, the system margin should fluctuate around slightly safer values as illustrated in Figures 2a and 2b. Other simulations results, not exhibited, here show that ISAGEN and EPM preserve a high market share, because of their present solid performance, while EEB y CORELCA, at the moment with no financial capacity, loose market share as they are only financially capable of building few small plants (unless projects are undertaken with associates).

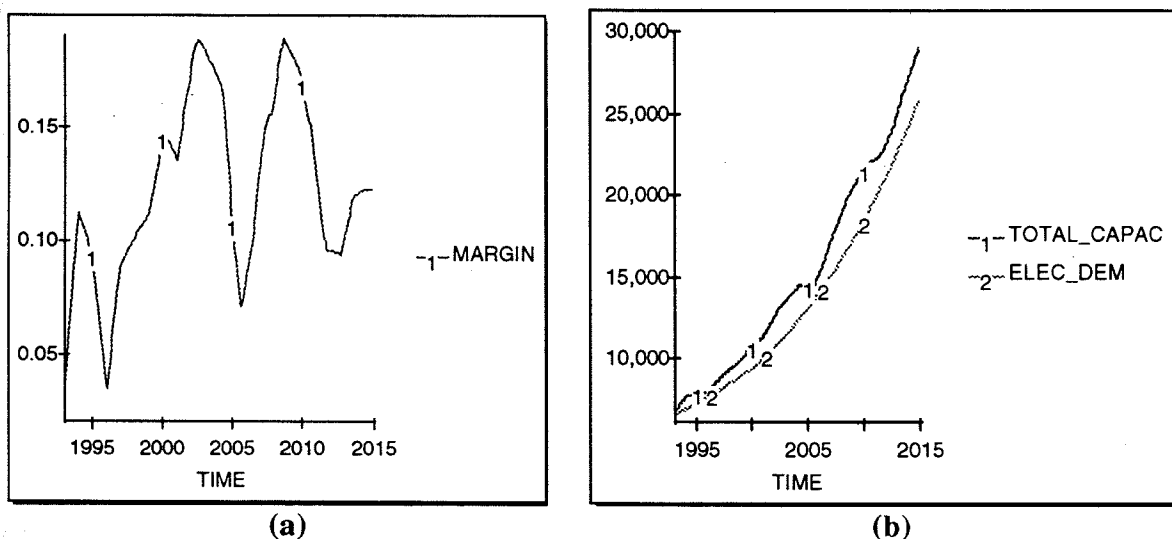


Figure 2. Simulation of a) system margin, and b) total capacity and electricity demand.

4. CONCLUSIONS

Currently, the electricity market need adjusting its regulation mechanism. Simulations suggest that modifications need to be implemented in the area of payments for capacity availability. This model may support policies to this end. Furthermore, new legislation is also required to facilitate substitution of both new and conventional energy sources.

The incursion of private investors will provably bring benefits to the gas-base power generation technologies, making the system more competitive and reliable, and less vulnerable to power blackouts. This is shown in an extended version of this paper.

Finally, the difficulties involved in finding adequate information for better modelling purposes, has been partially overcome by making parallels with other similar situations elsewhere. SD has been helpful to this respect.

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