1. Introduction

The role of energy consumption in socio-economic development has been widely discussed from theoretical and empirical standpoints. According to some authors, energy constitutes a biophysical constraint to economic growth because every economic activity requires a minimum quantity of energy to be performed (Beaudreau, 2005; Georgescu-Roegen, 1971; Stern and Cleveland, 2004). Furthermore, different studies found empirical evidence for the link between GDP and energy consumption, for both developed and developing countries (Soytas and Sari, 2003; Sari and Soytas, 2007; Lee, 2005).

These days, in a context of instability of energy markets, the discussion about future evolution of energy systems has been highlighted (IEA, 2009). Debates focus on the contribution of energy to the development process. Different perspectives on this topic can be linked to the role that energy plays in a national or local economy: while in producer states, energy may be an economic driver, in other states it may be a constraint to growth, depending on the balance between local and foreign energy supply and demand. In most of the cases, this situation may require the use of energy policy, in order to enhance energy markets coordination and performance. The Argentinean case constitutes a hybrid one, in the sense that up to very recently it was a producer country, to which energy might have been a driver, but it seems to be turning into a consumer country, to which energy may hinder economic growth.

Indeed, since 2004 the Argentinean energy sector has gone through an important supply problem, highly related to economic growth and de-growth periods, which derived on shutdowns in energy supply. These supply interruptions, mainly of natural gas (NG) and electricity, have had a negative impact on the key productive sectors, particularly the industry sector. According to estimations of the Centro de Investigaciones de la Unión Industrial Argentina, in July 2010 the GDP inter annual rate of growth decreased 2.3%, as a result of shortages in NG and consequent use of more expensive substitute fuels.

To some extent the goals of the Argentinean energy problem are both NG and electricity. For NG the weak points are productivity of the most important fields, most of which seem to be in their peak, diminishing trend of reserves and reductions in the reserve margin of capacity of transport of the system, which decreased between the 2005 and 2009 period (Recalde, 2010a). For the latter the problems have been also power capacity and production. According to information of Compañía Administradora del Mercado Mayorista Eléctrico (CAMMESA), one of the main problems of the power system is the diminishing reserve margin, as the gap between total installed generation capacity and peak demand levels has decreased significantly since 2002. This situation worsens by restrictions in NG supply, since it constitutes 76% of the fuel consumption in power generation.

There have been different explanations to the Argentinean energy problem. On the one hand, some authors explain the situation through the analysis of current conditions in either NG
or electricity markets. They argue that the key factor to understand this situation is recent energy policy, or industry re-reforms as mentioned by Haselip and Potter (2010), which did not succeed on promoting investment. These authors also insist that economic growth experienced in Argentina from 2004 implied a boom in energy demand that could not be rapidly addressed by private producers (Cont and Navajas, 2004). On the other hand, others insist that the roots of the problem are the changes in the control of energy resources in the early 1990s, the erratic energy policy and private investment from then on. According to these authors, the interrelation between electricity, NG and oil chains, the unpredictable evolution of the institutions and regulation through all the periods, the behavior of private operators and their reintegration and concentration strategies have been crucial to this problem (Campodonico, 2004; Kozulj 2002, 2004; Pistonesi, 2001).

This paper analyzes the Argentinean energy system, and throughout some points of previous arguments can be found. However, a systemic approach is mainly adopted, using the energy chains framework, from a historical standpoint, to study the performance of the energy system. Along this paper, energy system is defined as “a group of activities which, from an endowment of natural resources, satisfy energy services, both for final consumption and productive demand which, consequently, may hinder economic development.

2. Argentinean energy system

In order to understand and discuss the current situation of the Argentinean energy system, some of its key characteristics, such as the composition of the energy mix and relevance of hydrocarbons; the performance of the key segments of the chains and their inter-coordination, the energy reforms, the recent reintegration of the energy chains and market concentration, should be studied. Most of the following discussions focus on NG and electricity markets as they are considered to be the issue of the current Argentinean energy problem.

2.1. Energy mix and chaining

One of the main characteristics of the Argentinean energy system is its high dependence on hydrocarbons, primary NG and Crude Oil. In 2009 hydrocarbons represented 86% of Total Primary Energy Supply (TPES), where NG accounted for 52%. As shown in Fig. 1 the share of NG in TPES increased since the discovery of the field of Loma La Lata in 1977. Power and industry are the main destinations of NG, each one accounting for 30% out of total in 2008. In the case of oil, refineries are the most important TPES destination; fuel oil products are primarily used in transport (40%), power generation (12.7%) and agro.

The relevance of NG in the Argentinean energy system is highly related to the evolution of power generation. In 2010, the generation mix was composed by 57% of thermal generation plants, 38% hydro technologies and 3% nuclear plants. Fig. 2 shows the evolution of the Wholesale Electricity Market (MEM) from 1992 onwards. During this period, power demand was supplied mainly by thermal plants, most of which are powered by the combustion of NG, that in 2010 represented 70.2% of total fuel consumption in power generation, followed by fuel oil (16%), gas oil (10.4%) and charcoal (3.4%). Power shortages in

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1 Argentinean most important Wholesale Electricity Market.
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