ELECTRICITY PORTFOLIO TRANSITION IN BRAZIL: IS IT POSSIBLE TO MEET THE CHALLENGE OF SECURITY OF SUPPLY WITHOUT CARBONIZING THE ELECTRICITY PORTFOLIO?

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(1) Introduction

The Brazilian electricity sector has suffered a series of physical and institutional transformations over the past few years. Traditionally characterized by the predominance of hydroelectricity from large reservoirs with a capacity of multiple year's regularization, the sector has experienced a rapid change in the profile of its installed capacity. The Ten Year Expansion Plan 2021 (MME, EPE, 2012:98) reveals that the installed capacity of hydroelectric power from the current 84 GW will attain 117 GW in 2021, which is the equivalent to a reduction from 72% to 64% of the system's total installed capacity. At the same time, the wind power generation installed capacity will increase from 1 GW to 16 GW, which is equivalent to an increase of its share in the installed capacity of the system from 1% to 9% in 10 years. Thus, the continuous increase in electricity demand has been accompanied by an expansion of supply largely dominated by intermittent generation power sources. However, to compensate due to shortage in supply of hydropower with the worsening drought the country experienced last year, the thermal plants began to operate at full capacity. In November and December of 2012, 11 GW and 11.5 GW of thermal energy had to be generated, respectively, a volume 215% greater than that produced in the same period of 2011. Recently, minor institutional changes have been introduced in order to limit price impacts or the fast growth, and announced continued integration, of fossil fuel power generation.

Germany and England have adopted in the last ten years ambitious goals to enlarge the amount of renewable generation in their electricity generation and are now facing a number of challenges related mostly to the intermittency of these sources. Their experiences show that the large scale integration of electricity generation from renewables has important impacts on the level of system reliability of the system as well as on market prices. Ultimately, recent studies (Green and Vasilakos, 2010; Newberry, 2012) have shown that the need for extra backup to compensate for the interruption of wind or photovoltaic power has provided strong market power to fossil fuels electricity generation, causing major distortions on the price levels. Thus, policies to encourage renewable energy, if poorly implemented, can therefore end up favouring thermal based generation. Furthermore, in a system where reserve margins are decreasing fast, more intermittency requires further increases in the reserve capacity, which is costly. We investigate the impact of adequate reserve requirements due to large amounts of wind power integration on the final generation costs and theirs impacts on the security of supply of the Brazilian electricity sector.

(2) Methodology

We present an extensive analysis of the German and British experiences with respect to the integration of large amounts of intermittent power generation. We give special attention to the regulatory mechanisms implemented to encourage renewables generation, as well as to the costs and results of the policies adopted. Moreover, we expose and discuss the problems those countries have faced with the entry of a large amount of intermittent generation, in a short time, in their electricity portfolios. In a second moment, we analyse the Brazilian electricity sector, providing a picture of the location and rhythm of the entry of the integration of wind power generation. This allows us to foresee the biggest challenges the country will face in terms of the necessity of backup flexible generation, and extra transport and distribution capacity to allow exchanges of power between different regions in Brazil, to compensate for possible generation interruptions from wind of photovoltaic power generation.

(3) Awaited Results

In the light of the European experience, we realise an extensive analysis of the risks and opportunities related to the introduction of large amounts of intermittent generation in Brazil.

Most of all, we bring up the challenges the Brazilian electricity sector will have to overcome in order to integrate those large amount of intermittent generation. We present the most adequate regulatory incentives that can be implemented in order attain these goals. It is crucial that policy makers address adequately these questions in order to avoid compromising the security of supply and the increase of

electricity prices and tariffs to guarantee that the integration of intermittent renewable generation will be done in a successful way.

(4) Conclusions

Our work shows that the Brazilian's institutional framework is obsolete. It does not deal properly with the evolution the country's electricity demand and installed generation capacity. Our work proposes a new institutional framework were new renewable generation and carbon emission receive adequate price signals so that the expansion of the electricity sector is Brazil is not based on a massive carbonization of it's electricity portfolio.

References

Brasil, Ministério de Minas e Energia, Empresa de Pesquisa Energética, "Plano Decenal de Expansão de Energia 2021", Brasília: MME/EPE, 2012, available on http://www.epe.gov.br/PDEE/20120924_1.pdf

Grau, T., « Targetted support for new photovoltaic installations requires flexible and regular adjustments », DIW Berlin, Vol.2, N°6, June 1st 2012.

Green, R., Vasilakos, N., 2010, « Market behavior with large amounts of intermittent generation », *Energy Policy*, vol. 30 : 3111-3220.

Gross et al., 2006, The Costs and Impacts of Intermittency : An assessment of the evidence on the costs and impacts of intermittent generation on the British electricity network. UK Energy Research Centre, London.

Newberry, 2012, 12th IAEE European Conference "Energy Challenge and Environmental Sustainability", 9-12 Setembro, Veneza, Itália. Presentation available on http://www.iaeeu2012.it/pages/program_monday_10.html .