Assessing renewable energy policy integration cost, emissions and affordability the Argentine case

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Overview

As a result of the growing threat of climate change, international organisations and governments have together prompted agreements on strategies to reduce the amount of greenhouse gases (GHGs) in the atmosphere (World Energy Council, 2013). Such emission reduction commitments bear profound implications for the electricity industry, the largest GHG emitter of today (IPCC, 2014).

The renewable energy industries have boomed since 2008, with wind and solar displaying the highest growth rates. Installed wind energy worldwide swiftly grew from 6.1 GW in 1996 to 539 GW in 2017, an annual-average growth rate to 17% and solar has grown from 8 GW in 2008 to 402 GW in 2017, an annual growth rate of 48% (REN21, 2018). Owing to the fact that new generation is therefore increasingly subject to intermittency, renewable energies could pose new challenges in the stability, reliability and operation of electricity grids. In accordance with this, capacity mechanisms have been required in order to guarantee SoS, in the long term this may be achieved through an additional flexible plant that can be called up at short notice if wind falls or sunshine fades (Oelz et al., 2007; Palzer & Henning, 2014).

The Argentine Government promulgated Law 27.191 in 2015, which targets 8% of total generation from renewables by 2017, with this target increasing to 20% by 2025. Hydropower is a renewable energy source, however large hydroelectric plants are not included in that targeted cluster of energy sources as there are numerous social and environmental impacts that may result from its exploitation; moreover, such a technology working under the economy of scale criterion is excluded from receiving financial incentives. Thus, renewable sources include: wind, solar, biomass, geothermal, wave power, and small hydro >50 MW (Ruiz-Mendoza & Sheinbaum-Pardo, 2010; Senado y Camara de diputados de Argentina, 2015). There is much uncertainty concerning the implementation of this law, principally regarding its effect on affordability and on security of supply issues in the Argentine electricity market.
This paper focuses on the Argentine electricity sector, which is seeking increase renewable energy penetration (Senado y Camara de diputados de Argentina, 2015). Argentina was one of the first countries that liberalized electricity market in 1993, a competitive market was organized, Argentina was one of the first countries in the world to implement a comprehensive reform of its electricity sector, and among developing countries only Chile has had a comparably comprehensive and successful reform (Brunekreeft, 2004). Recently, Argentine government has promulgated law 27.191, which favours renewables, by exploiting the potential in hydro, wind, solar and biomass, that Argentina has not effectively developed, which favours renewables to reduce CO2 emissions and energy fossil dependence by exploiting the potential in hydro, wind, solar and biomass resources that Argentina has not yet effectively developed (REN21, 2018).

For a better understanding of the focus of this research, this section briefly describes the Argentine electricity market and its renewables potential. Out of the total installed capacity, hydropower currently accounts for 30.2%, while small hydro, wind and solar represent 0.5 %. Thermal electricity generation, comprising CCGT and carbon plant accounts for 65.1% of capacity and nuclear power represents 4.2%. The existing renewable-energy installed capacity in Argentina is 195MW, of which 187 MW comes from wind energy, 11,243 MW from large hydropower plants, 458 MW from small hydropower plants <50 MW, and 8MW from photovoltaic solar systems (CAMMESA, 2018). Argentina has a great potential for renewables; the estimated hydropower potential is 40,000 MW, and the potential of wind power in Patagonia region is 20,000 MW (World Energy Council, 2013).

This research assesses how current policies investment and integration of renewable energy sources might affect security of supply, environmental sustainability and affordable prices for Argentine consumers.

Methods

For policy analysis in Argentine electricity market a computational model was developed, in the model is oriented in the expansion, the following technologies were include: wind, solar, small hydro, large hydropower, gas, coal. Capacity mechanism and renewable policies were taken into in place.

Results

This study provides insights into the potential of renewable energy sources in the Argentine electricity supply industry. It examines the likely benefits of promoting renewable energies in the energy matrix, and discusses the possibility of blackouts if the right policies are not in place. This provides an objective rated capacity margin, which explains increases in both pool prices as well as in CO_2 emissions. In this case, renewable energies are not significantly diffused, despite the great Argentine potential in this sector. The removal of the capacity mechanism and the implementation of a stand-alone renewables policy is unwise due to its predisposition the system to blackouts, generation of high emission levels, and induction of higher prices in the system. Under these conditions, Argentina needs to go slow in renewables promotion, and maintain its focus on other policies to increase conventional capacity and guarantee the highest quality in electricity supply.

Although the capacity mechanism provides the capacity margin that is proposed in the BAU scenario, the system attains an unbalanced solution as it does not take sufficient advantage of the renewables and energy dependence reduction of gas and oil imports. In conclusion when policy is carefully set, a high renewable energies scenario is a good option in the mid-long term.

Conclusions

This study provides insights into the potential of renewable energy sources in the Argentine electricity supply industry. It examines the likely benefits of promoting renewable energies in the energy matrix, and discusses the possibility of blackouts if the right policies are not in place. Under the BAU scenario, the expansion of the electricity industry is primarily promoted by the capacity mechanism currently in place. This provides an objective rated capacity margin, which explains increases in both pool prices as well as in CO_2 emissions. In this case, renewable energies are not significantly diffused, despite the great Argentine potential in this sector. The removal of the capacity mechanism and the implementation of a stand-alone renewables policy is unwise due to its predisposition the system to blackouts, generation of high emission levels, and induction of higher prices in the system. Under these conditions, Argentina needs to go slow in renewables promotion, and maintain its focus on other policies to increase conventional capacity and guarantee the highest quality in electricity supply.

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