

Belgian blackout? Estimations of the reserve margin during the nuclear phase-out



Ruben Laleman^{a,*}, Johan Albrecht^{b,1}

^a Ghent University, Faculty of Economics and Business Administration, Tweeckerkenstraat 2, 9000 Ghent, Belgium

^b Ghent University, Faculty of Economics and Business Administration, Belgium

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ABSTRACT

The outlook of the Belgian electricity system is increasingly unpredictable and challenging. Belgium is confronted with a nuclear phase out in a liberalized European electricity market which is strongly impacted by climate and renewable energy policies. The investment climate for controllable, non-intermittent assets is very problematic. We present estimates of the evolution of the reserve margin between 2014 and 2030, based on the events which took place at the end of 2015 regarding the availability of nuclear assets in Belgium. In the short term, until 2017, we expect the reserve margin to decrease from +1% to around –10%, taking into account the extension of the lifetime of the two oldest nuclear reactors in Belgium with ten years. Without this lifetime extension the reserve margin would have dropped to –17% by 2017. In the longer term, we find very negative and unsustainable reserve margins. In 2026, one year after the phase out of all the nuclear assets in Belgium, without new investments, the reserve margin could drop to –60%. In order to keep the reserve margin in Belgium at 5%, which can be considered as the lowest margin for secure supply, investments in gas and biomass assets in the range of € 11–13 billion would be required in the period 2014–2030.

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Introduction

Nuclear energy in Belgium

At the beginning of 2016, more than half of the electricity in Belgium originated from nuclear power. The share of nuclear in total installed capacity in Belgium is as high as 32%. With this share, Belgium is second on the global list of “share of nuclear capacity in the electricity mix” behind France with a share of 51% [1]. In total, there are 7 nuclear reactors in Belgium, with a combined total capacity of 5927 MW (Table 1). The 7 reactors are located in 2 power plants, one in Doel (near Antwerp) and one in Tihange (in Wallonia). All nuclear reactors were built in the

1970s and 1980s and are therefore reaching their “end of life” in the next decades.

A detailed review on the political decision to phase-out nuclear capacity in Belgium is provided by Aviel Verbruggen [3]. One of his conclusions is that “...little work and resources were spent on conceiving, developing and implementing a full alternative for the nuclear plants. A country heavily tied to the nuclear path cannot be expected to change course overnight.” [3]. This lack of a back-up plan is somehow surprising in the uncertain context of the ongoing liberalization and integration of European electricity markets. As nobody can or could predict the new electricity landscape after the liberalization a close observation of market dynamics and investment patterns is no luxury for a country with ambitious phase-out plans. Most of the recent policy interventions in Belgium were directed to the promotion of (mainly intermittent) renewable energy sources. In addition, there has been very little investments into research in the EU to improve the technical and financial competitiveness of non-intermittent renewable technologies such as biomass and biogas [4]. Making it difficult to subsidize the uptake in the electricity market of these technologies. Overall, it is clear that the impact of the nuclear phase out and the resulting drop in non-intermittent capacity has been underestimated by previous governments.

Abbreviations: RES, Renewable Energy Sources; RM, Reserve Margin; RAC, Reliably Available Capacity; PD, Peak Demand; TSO, Transmission System Operator; BM, Biomass; FIT, Feed-In-Tariff; CREG, Commission for the Regulation of the Electricity and Gas markets (in Belgium); FANC, Federal Agency for Nuclear Control (in Belgium); PW, Plan Wathelet; PEP, Platts' European Power (index); CWE, Central West European; CEE, Central East European.

* Corresponding author. Tel.: +32 9264 4209.

E-mail addresses: Ruben.Laleman@ugent.be (R. Laleman), Johan.Albrecht@ugent.be (J. Albrecht).

¹ Tel.: +32 9264 3510.

Table 1
Nuclear Assets in Belgium [2].

Power plant	Reactor	Reactor size (MW)	Start up year	Lifetime in 2015
Doel	Doel 1	433	1975	40
	Doel 2	433	1975	40
	Doel 3	1006	1982	33
	Doel 4	1039	1985	30
Tihange	Tihange 1	962	1975	40
	Tihange 2	1008	1983	32
	Tihange 3	1046	1985	30
Total	7 Reactors	5927		

Renewable electricity production in Belgium

In 1997, the share of renewable electricity in Belgium was among the lowest in the European Union [5]. Since the introduction of ambitious renewable policies in Belgium in 2005–2006 the share of renewable electricity production increased rapidly. The share of RES (Renewable Energy Sources) in the electricity mix has increased from only 1.7% in 2004 to a remarkable 11.1% in 2012. Belgium has thus reached the same share of renewables as the Netherlands or the United Kingdom. Compared to its neigh-

boring countries, Belgium has been quite successful at promoting renewables, only Germany’s share of RES has grown at a faster pace than that of Belgium in the period 2004–2012 (Fig. 1).

The most important technologies to have contributed to the rapid pace of renewables’ growth are wind, biomass and PV-systems. Especially the share of PV has grown markedly in the years 2008–2012 in the region of Flanders, due to a subsidy scheme that was similar to the FIT-system in Germany. According to Solar Power Europe [7] the share of PV electricity in Belgium reached about 3.4% in 2013 (Fig. 2). This is similar to the EU average of 3.5% but still much lower than the shares of PV electricity in Italy, Greece and Germany (>7%). However, we should not forget that the output of a solar panel in Belgium is much lower compared to Italy or Greece [8].

The nuclear phase out in Belgium

In the summer of 2012, the federal government approved a nuclear phase out plan to clarify its vision on the energy mix of the future [9]. This “plan Wathélet” contains not only the sequence of the phasing out of nuclear assets, but also some measures to cope with the resulting lack in controllable capacity, namely a tender for 800 MW of gas fired capacity [10]. In this plan the lifetime

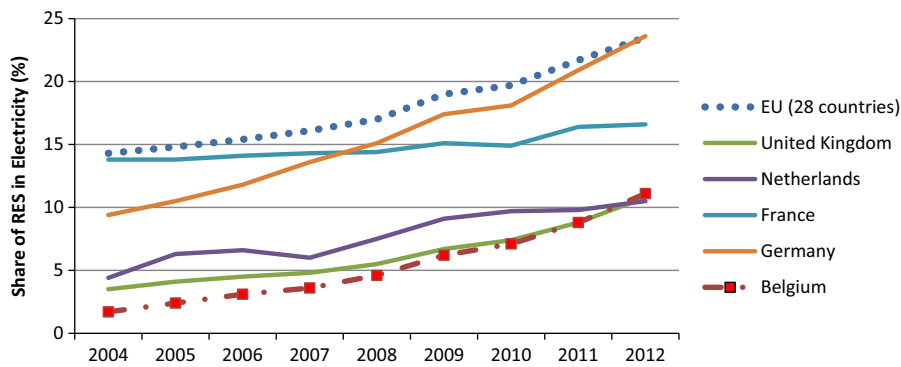


Fig. 1. Evolution of the share of RES in the electricity mix 2004–2012 (data from [6]).

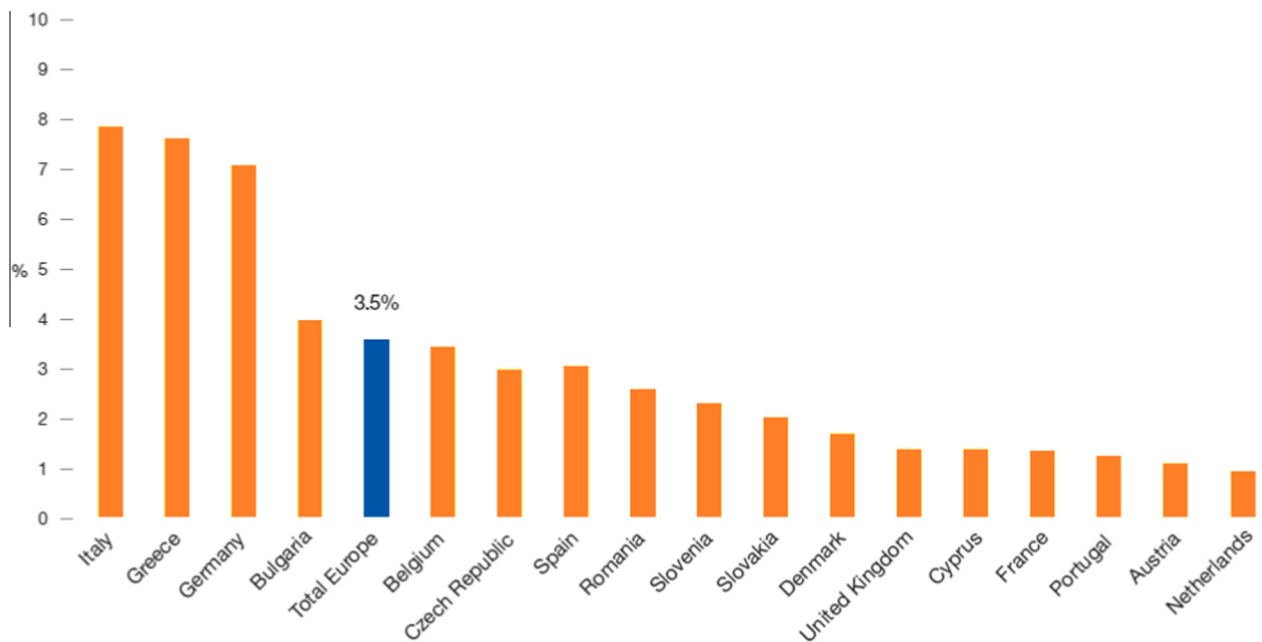


Fig. 2. Share of PV in EU member states in 2013 [7].

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