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Belgian nuclear power life extension and fuss about nuclear rents

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HIGHLIGHTS

- Nuclear phase-out is only successful when alternative supplies are deployed.
- Politicians cannot bind their successors by words or by lawgiving.
- The phase-out law exemplifies the disruption of a strong nuclear lock-in.
- Life extension exemplifies the disruption of the phase-out law.
- The impact of imprecise nuclear rents on life extension could not be tested.

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ABSTRACT

Nuclear decision-making is embedded in slowly evolving political, economic and financial institutions. Belgium houses extended nuclear activities, mostly under French control, for example: SUEZ-GDF and EDF own all Belgian nuclear power plants. But a 2003 law mandates the closure of Belgium's nuclear power plants at a service age of 40 years; only force majeure could lift the strict obligation. Opposition to the law argued with climate change danger, financial losses, and loss-of-load risks. The financial issue got interwoven with a fuzzy debate on the definition, height and appropriation of "nuclear rents". As plausible hypothesis is adopted: the prospected transfer of hundreds millions of euro from power companies to the public interest will create public support for life extension. But the nuclear rents discussion had faded in July 2012 when the Belgian government admitted a 10-year life extension for TIHANGE I (962 MW) and imposed the closure of the 2×433 MW DOEL I and II. Loss-of-load risk was the government's only public argument. The opacity of the decision process and its "fifty–fifty" outcome do not allow proper testing of the hypothesis. The case illustrates that politicians cannot bind their followers except through the deployment of alternative power sources.

1. Introduction

In 2003 the Belgian parliament enacted a nuclear phase-out law imposing the closure at 40 years of operational service of power generation reactors sited in Belgium (www.ejustice.fgov.be). Ever since, the law and its implementation have been under debate. Studies were ordered to affirm the important role of nuclear power in Belgium (GEMIX, 2009). In Annex 8 of the GEMIX report, Percebois (2009) brought up the case of "nuclear rents", what he also called: "windfall profits", "fixed cost compensation", and "scarcity rents". The conspicuous cash flows are the result of operating largely depreciated nuclear plants, built at low historical outlays. He proposed the creation of a broad commission to assess the size of "nuclear rents", and to decide on how collecting and on how allocating the money. But established public institutes (the federal regulator CREG, the study department of the National Bank of Belgium) delivered separate and deviating assessments of the rents volume and diverged in opinions about allocation.

The first goal of this article is informing an international readership about decision-making in Belgium on investing and de-investing in power plants, i.e., nuclear phase-out and nuclear plant life extension. As second goal I wanted to test the plausible hypothesis that (eventual) transfer of (voluminous) "nuclear rents" to the treasury or to electricity consumers would create a strong incentive for politicians and the public to approve life extension beyond 40 years operation. Investigating this hypothesis requires clear evidence about steps in the policy processes. However, in actual policy-making, many important issues are not publicly documented and the applied logic does not obey formal scientific rules. Processes are partly based on trust, rules

Abbreviations: CCEG, Control Committee for Electricity and Gas, 1955–2003; CGEE-BCEO, Managerial Board of the Electricity Companies; CREG, Commission for Regulating Electricity and Gas, since 2000; EDF, Electricité de France, French state power company; ELECTRABEL, Major power producer in Belgium; FANC, Federal Agency for Nuclear Control, since 1957 - reformed in 2007; GDF, Gaz de France; SPE, small public power producer in Belgium; SUEZ-GDF, French conglomerate, owning ELECTRABEL.

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and conventions are not detailed on paper, and interests exert hidden pressure, e.g., via almost invisible lobbying. Testing the hypothesis failed, excluding both its acceptance and rejection.

Ancillary findings emerged, meriting additional assessment. First, politicians cannot bind their followers by approving regulations, neither by enacting laws. Breaching predecessors' vows is partly related to partisan agendas. Changing course is, in principle, a valid practice because time-sequential decision-making includes regular evaluation of the past course, and re-optimizing the use of resources. Decision-making science recommends regular review above rigid obedience to inferior solutions decided in the past (Raiffa, 1970; Dixit and Pindyck, 1994). A nuclear phase-out decision is a breaching example in case, as is life extension breaching the phase-out decision. Second, the only guarantee for committing the future is the development and deployment of superior substitutes, creating a variety of lock-ins. Therefore, the article zooms in on two important failures of boosting power supply options as alternatives for nuclear power: independent cogeneration and renewable power.

There are six more sections after this introduction. Section 2 describes the evolving structure of the electricity sector in Belgium. Over time, the cooperation with France nuclear companies intensified, and is sealed by the take-over of the major Belgian power generators ELECTRABEL and SPE, including their nuclear plants, respectively by SUEZ-GDF since 1989 and by EDF in 2008. In Section 3 the growth and actual state of the nuclear power generation sector in Belgium is documented. More than half of power generated in Belgium over the last 25 years was nuclear. Resolving this dependency requires well conceived and managed alternatives, a course of deliberate policy, not evident in Belgium (Section 4). Building upon the previous sections, it is argued why life extension is the only option for commercial nuclear plants (Section 5). Section 6 sheds more light on profits in the Belgian electricity sector and on what "nuclear rents" could be. In 2010–2011 political parties, the federal regulator and the National Bank mulled the height and appropriation of "nuclear rents". It seemed the outcome of this debate could have a significant impact on the life extension chances of the eldest nuclear plants. However, the rents debate stranded in fuss and the interest in "nuclear rents" plunged before life extension was decided. The new Belgian government vested in December 2011, decided on extending the lifetime of TIHANGE I with 10 years beyond its 40 years operational life (Section 7). All public argument was based on concerns about the loss-of-load[1] risks in Belgium over the years 2012–2017, and the hypothesis could not be verified, a fortiori: not be accepted or rejected. Conclusions are summarized in Section 8.

2. Evolving structure of the electricity sector in Belgium

In the 1950–70s the Belgian super-holding Société Générale controls hundreds of industrial plants in all main sectors, most power generation plants, and the contracting-engineering firms Electrobel and Traction & Electricité, merged to TRACTEBEL in 1986 (Brion and Moreau, 1995). The latter design and supervise the managerial and physical structures of Belgium's post-war electricity sector. During the 1950/70s this means merging tens of small producers to three geographically franchised producers (EBES, INTERCOM, UNERG), unified to ELECTRABEL in 1990. Investment economies of scale at the plant, station, and system level are realized (Joskow and Schmalensee, 1985), while running costs are minimized by internal competition among the plants. Soaring productivity increases create high financial surpluses. The optimized structure of the Belgian power sector, and its direct links with banks via the mother holding, are the foundations for a successful nuclear construction program over the period 1965–1985.

Although the Société-Générale is sponging on the power sector, the holding crumbles during the 1980s. In 1989, the French holding SUEZ acquires 51% of the shares. The ultimate control over the private Belgian electricity and gas interests (mainly TRACTEBEL and ELECTRABEL and dependent companies such as FABRICOM) is moved to Paris. During the following 15 years the interesting parts – mostly the electricity supply activities – are step-by-step integrated.

The public producer SPE, structurally integrated with the private companies since 1981, generates about 8% of the national production. In 2005, CENTRICA (UK) and GDF (F) form a joint venture, acquiring 51% of SPE; in January 2009, GDF had to cede its part to CENTRICA; in May 2009, CENTRICA transferred its 51% share in SPE to EDF for acquiring a 20% interest in British Energy (UK nuclear power).

The control by French companies over Belgium's power generation is highly relevant for future nuclear activities in Belgium. Lacking suitable locations to install nuclear plants, and facing strong public opposition (Laes et al., 2007), Belgium will rather import nuclear power from France. When new plants would be constructed, they will be located in France rather than in Belgium, with the corollary that life extension is Belgium's only left over commercial nuclear option.

3. Nuclear power generation in Belgium

Except for a small but growing share of renewable power (wind, solar, hydro) all electricity generated in Belgium is thermal with 50–55% delivered by nuclear reactors since the mid 1980s. In the aftermath of World War II Belgium is treated as a privileged partner by the USA in return for Congolese uranium deliveries to the Manhattan project. In 1952, the nuclear research centre SCK-CEN in Mol is founded. During the 1950–60s Belgium covers the entire nuclear cycle from mining (Congo), fuel rod fabrication, reactor development (three research reactors, one being the first PWR in Europe), to waste treatment and reprocessing (EUROCHEMIC), and geological storage in clay seams (HADES) (Laes et al., 2007; Eggermont and Hugé, 2011).

Table 1 shows Belgium's involvement in atomic power, with several ties to France. CHOOZ A and TIHANGE I are joint venture power plants, as well as CHOOZ B1 and B2. TRICASTIN I–IV supplies power to enrichment activities. The breeder SUPERPHENIX was not a success, but neither was KALKAR (a common project with Germany and The Netherlands). Not shown are the links between France and Belgium in the nuclear fuel cycle such as enrichment, fuel rod fabrication and spent fuel reprocessing, substituting for the shut-down of Belgian industrial activities. The Paris-based corporations SUEZ-GDF and EDF control all nuclear power generation plants in Belgium.

Nuclear lock-in is strong by the long and deep involvement of the Belgian electricity sector in nuclear power. In the decades following World War II nuclear power enjoys the full support of private and public interests, industry, science, politics, mass media, the general public. The lion share of public funding on energy research is assigned to nuclear. Universities and research centers educate and train qualified professionals. Plant construction time and budget overruns stay within acceptable limits (Verbruggen et al., 1988), and operational availability is high. No major incidents or accidents occur. The sector runs mainly on self-control (La Revue Nouvelle, 1975).

But in 1986, TRANSNUCLEAR reveals irregularities in waste processing activities at SCK-CEN. Along the clean up of this waste

[1] Loss-of-load is faced in a power system when the available generation capacity supplying power to the grid falls short of the demand for power. Because electricity is not storable and is transported all over a continent in seconds of time, sufficient capacity is needed at every moment of the year. With probabilistic methods the risks of supply shortages are estimated. When the assessed risks are too high, the power system is said to be unreliable, and add or retain generation capacity is recommended.