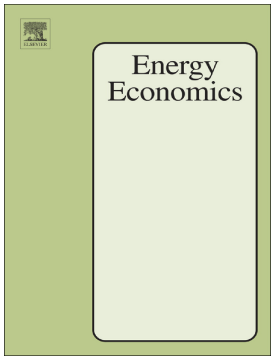

The second French nuclear bet

Quentin Perrier

PII: S0140-9883(18)30263-9
DOI: doi:10.1016/j.eneco.2018.07.014
Reference: ENEECO 4093

To appear in: *Energy Economics*

Received date: 15 February 2017
Revised date: 13 July 2018
Accepted date: 16 July 2018

Please cite this article as: Quentin Perrier , The second French nuclear bet. Eneeco (2018), doi:10.1016/j.eneco.2018.07.014

The second French nuclear bet

Quentin Perrier[a,b,*]

[a] *CIRED, 45 bis, avenue de la Belle Gabrielle, 94736 Nogent-sur-Marne Cedex, France*
[b] *ENGIE, 1 place Samuel de Champlain, Faubourg de l'Arche, 92930 Paris La Défense, France*

Abstract

Following the first oil crisis, France launched the worlds largest ever nuclear energy program, commissioning 58 new reactors. These reactors are now reaching 40 years of age, the end of their technological lifetime. This places France at an energy policy crossroads: should the reactors be retrofitted or should they be decommissioned? The cost-optimal decision depends on several factors going forward, in particular the expected costs of nuclear energy production, electricity demand levels and carbon prices, all of which are subject to significant uncertainty.

To deal with these uncertainties, we apply the Robust Decision Making framework to determine which reactors should be retrofitted. We build an investment and dispatch optimization model, calibrated for France. Then we use it to study 27 retrofit strategies for all combinations of uncertain parameters, with nearly 8,000 runs.

Our analysis indicates that robust strategies involve the early closure of 10 to 20 reactors, while extending the life of all other reactors. These strategies provide a hedge against the risks of unexpected increases in retrofit costs, low demand and low carbon prices.

Our work also highlights the vulnerabilities of the official French government scenarios, and complements them by suggesting new robust strategies. These results provide a timely contribution to the current debate on the lifetime extension of nuclear plants in France.

Keywords: Power system; Uncertainty; Nuclear costs; Robust Decision Making; Investment

JEL Classification: C6; D8; Q4

Highlights

- We estimate how many nuclear reactors should be retrofitted in France
- We identify key uncertainties and apply the framework of robust decision making
- Robust strategies imply closing 10 to 20 reactors and retrofit the others
- These results suggest a new strategy compared to the official French scenarios

*Corresponding author. E-mail address: perrier@centre-cired.fr
The opinions expressed in this paper are those of the author alone and might not represent the views of ENGIE.