The Option Value of Capacity Remuneration Mechanism: a Comparison of Different Technologies

Bonaldo Cinzia*; Fulvio Fontini†; Michele Moretto‡

May 18, 2021

Abstract

In the literature, Capacity Remuneration Mechanism (CRM) have been advocates as tools to overtake market failures to deliver *security of supply*. The theory claims that optimal load shedding occurs when the NPV of the loss-of-load equals the discount cost of investment in new capacity (energy-only markets). However, investment in capacity is a dynamic process: the value of the investment depends on the evolution of prices and costs that are uncertain. Even if the investment in capacity allows obtaining security of supply it fixes the technology that a given system relies on (investments are stranded costs) and foregoes technological improvements. The analytical framework to evaluate the value of investments that includes the value of flexibility is the Real Option analysis.

An investor who invest in capacity under a CRM sells a bundle of call options to the SO. The seller obtains *ex ante* a remuneration, but foregoes the possibility to gain the difference between the VOLL and its own marginal cost whenever it is the marginal plant and the system is short of capacity. This latter effect is a *de facto* price cap, induced by the CRM, which is made apparent by some types of CRM (e.g., when the CRM assumes the form of Reliability options), but that in any case affects the revenue profile of the capacity under a CRM scheme.

The investor in capacity remunerated by a CRM thus needs to take into account two types of technological uncertainty: uncertainty due to the evolution of electricity prices and its own costs, that might alter the profitability of the investment and therefore its option value; the uncertainty about the relative costs of the electricity system that can alter the merit order and the price cap effect in the power market.

In this paper we investigate the option value of the investments in capacity financed by a CRM considering both sources of uncertainty. We evaluate if the investment value rises or lowers when including the Option

*Department of Economics and Management & Department of Civil Environmental and Architectural Engineering, University of Padua, Italy

†Department of Economics and Management, University of Padua, Italy

‡Department of Economics and Management, University of Padua, Italy

Value, with respect to the the NPV. Moreover, we compare the value (including the OV) of different types of investments in capacity, namely: (1) storage capacity fuelled by off-grid RES; (2) efficient gas-fired plants; (3) large baseload plant with no technological evolution and (4) capacity provided by the demand side, e.g., interruptibility contracts. We show that the OV can take both a positive or negative value, depending on the possible evolution of power prices, marginal costs, and on the identification of the marginal technology.