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# Modeling the effects of the new Russian capacity mechanism on renewable energy investments

Mariia Kozlova *, Mikael Collan

*School of Business and Management, Lappeenranta University of Technology, Skinnarilankatu 34, 53851 Lappeenranta, Finland*

## HIGHLIGHTS

- New Russian RE investment incentive mechanism is presented in detail.
- Effect of the mechanism on RE investment profitability is numerically illustrated.
- Sensitivity of project profitability to selected variables is studied.
- Sensitivity results are compared to results under a generic feed-in premium.
- The mechanism is shown to reduce market-related risks of RE investments.

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## ABSTRACT

Russian renewable energy policy, introduced in May 2013, is a capacity mechanism-based approach to support wind, solar, and small hydro power development in Russia. This paper explores the effect of the new mechanism on the profitability of new renewable energy investments with a numerical example. The sensitivity of project profitability to selected factors is studied and the results are compared ceteris paribus to results from a generic feed-in premium case. Furthermore, the paper gives a complete and detailed presentation of the capacity price calculation procedure tied to the support mechanism.

The results show that the new Russian renewable energy capacity mechanism offers a significant risk reduction to the investor in the form of dampening the sensitivity to external market factors. At the same time it shields the energy market system from excessive burden of renewable energy support. Even if the complexity of the method is a clear drawback to the detailed understanding of how the mechanism works, the design of the incentive policy could be an appealing alternative also for other emerging economies.



## 1. Introduction

This paper studies the effect that the recently introduced Russian renewable energy (RE) incentive policy for the wholesale electricity market has on new renewable energy project investment profitability. This policy is an extension of the Russian pre-existing capacity trade mechanism and it is considerably different from other renewable energy support schemes implemented worldwide. We present the Russian RE incentive policy in detail, show how it affects RE investment profitability, and analyze the importance of the main variables of the policy mechanism on investment profitability.

The Russian RE investment support policy has been launched based on the background of the threat of global warming and the exhaustion of non-renewable energy resources that have caused the Russian government, in unison with many other governments around the world, to act in favor of RE investments. Renewable energy adoption and its diffusion that is taking place worldwide owes partly to the introduction of RE supporting mechanisms and this is why support mechanism design is a key factor in determining how much new RE power generation investments are started, i. e., the support mechanisms are an important determinant in how well RE supporting policies fair in terms of efficiency (del Río and Cerdá, 2014). It is important to note in this vein that

*Abbreviations:* ATS - Administrator of Trading System; CAPEX - Capital expenditures; CIA - Central Intelligence Agency; CPI - Consumer price index; DPM - Agreements for the delivery of capacity; FiT - Feed-in tariffs; NPV - Net present value; OJSC - Open joint-stock company; OPEX - Operational expenditures; RAO UES - Unified Energy System of Russia; RE - Renewable energy; RPS - Renewable portfolio standard; SO - System Operator

* Corresponding author.
*E-mail address:* mariia.kozlova@lut.fi (M. Kozlova).

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RE policy designs differ from country to country (International Energy Agency and International Renewable Energy Agency, 2014). Most of the RE support schemes used can be grouped into three system design types that are feed-in tariffs (FIT), tender- or auction-based term-based tariff systems, and renewable energy portfolio standards (RPS), or quota systems (REN21, 2015). The feed-in-tariff designs introduce a guaranteed (often fixed) special price, or a price premium, for generated RE electricity and there is evidence to suggest that these have been successful in incentivizing RE deployment (Fais et al., 2014; Lund, 2007; Maurer and Barroso, 2011). There is evidence to suggest that feed-in-tariffs may be a more expensive policy alternative for the "tax payer", than renewable energy portfolio standards, where pricing of generated RE electricity is typically set by the markets (Maurer and Barroso, 2011; Azuela and Barroso, 2012). Auction-based schemes attempt to find a balance between set (fixed) and the market pricing, by creating a market-based price for term contracts that then provide a fixed term price (del Río and Linares, 2014; Maurer and Barroso, 2011).

Developed countries have played a pioneering role in RE deployment, but for the last years, emerging economies show higher growth in new RE investments (Frankfurt School UNEP Collaborating Centre and Bloomberg New Energy Finance, 2015). Indeed, recent studies report empirical evidence of positive causality between RE consumption and economic growth in different parts of the world (Apergis and Payne, 2010; Apergis and Payne, 2011; Salim and Rafiq, 2012). Designing RE support policies in emerging economies seems to be a task that is challenged by many potential obstacles, e. g., including political and regulatory risks, typically higher market sensitivity to shocks, and a limited access to financing (Timilsina et al., 2012; Pegels, 2010; Beck and Martinot, 2004). Furthermore, difficulty to recruit human resources with the needed know-how and poor information and documentation availability may also cause hardship for RE support system design projects in emerging economies (International Finance Corporation, 2011). Under these circumstances, emerging economies have most often resorted to adopting RE support schemes that are already in place elsewhere, by perhaps slightly adapting them for the local circumstances and/or by integrating components from different already-existing schemes to the local pre-existing systems (REN21, 2015).

Feed-in tariffs have been the "system of choice" for the majority of developing countries that have adopted a RE support system and they have spread particularly to Asian and to African countries. Some emerging economies have adopted auction-based RE support schemes, especially countries in Latin and in Central America. Renewable energy portfolio standards that typically allocate more risks to the investors, appear not to have become very popular among the developing countries (International Energy Agency and International Renewable Energy Agency, 2014; REN21, 2015). In response to policy failures and deficiencies in local circumstances, many developing countries have moved from one type of RE supporting mechanism to another, sometimes leaving the first initiated system in force for specific RE segments. Examples of such "policy migration" include, e. g., Brazil's shift from feed-in-tariffs to an auction-based system, China's move from auctions to FIT followed by a focused re-introduction of auctions for particular technology types, and the Indian launch of auctions on top of a pre-existing FIT system and RE certificate markets (Azuela and Barroso, 2012).

Contrary to the strategy of many other developing countries to adopt pre-existing RE policy instruments, Russia has recently introduced a new and unique design for a RE support system that is based on capacity remuneration. The foundation of the new RE capacity mechanism is the pre-existing Russian capacity trade mechanism for conventional electricity production that tries to ensure the sustainability and smooth functioning of the Russian energy system. Adopted now for renewable energy support, the Russian RE support mechanism neither guarantees a particular price, nor allows the price to be fully formed by the markets. Instead the Russian mechanism is a set of specific remuneration calculation procedures that try to ensure a set fixed return on RE investments that is able to adapt to changing market conditions throughout a (support) contract term. The contracts are auctioned. Capacity remuneration approaches have also been implemented elsewhere in the world to enhance the reliability of electricity markets (Tennbakk et al., 2013; Hobbs et al., 2007; Held and Voss, 2013), but never before have they been adopted to support renewable energy investment.

Information available about the Russian renewable energy policy is rather limited on the international arena, because the original legislative procedures and capacity pricing instructions are publicly available only in the Russian language (Government of Russian Federation, 2013a; Government of Russian Federation, 2013b; Government of Russian Federation, 2015). The policy has been previously descriptively analyzed in English by the International Finance Corporation (IFC) (International Finance Corporation, 2013) in a way that is sufficient for obtaining a preliminary perception of the RE support mechanism, but not detailed enough for a full understanding of its effects on renewable energy investment deployment. In the academic literature, Russian renewable energy policy in general has received some attention prior to the introduction of the capacity mechanism, e.g., see (Martinot, 1998; Martinot, 1999; Zhang et al., 2011). In addition, the prospects of renewable energy development on the regional level and in the remote areas of Russia have been previously studied (Boute, 2013, 2016).

Literature that concentrates on the capacity mechanism, which is the main scheme to support RE in Russia and the only scheme available within the wholesale market of electricity is very limited. Anatole Boute of the IFC (Boute, 2012) studies the mechanism based of a legislative act draft available at the time of his writing, the paper is positive about the ability of the Russian (then planned) scheme to create appropriate incentives for new RE investments. The final details and a detailed presentation of the final remuneration calculations are not included for the obvious reasons. Vasileva and others Vasileva et al. (2015) have analyzed the RE capacity mechanism from a different perspective, modeling its possible impact on the electricity and the capacity prices on the Russian energy market, their results suggest only minor influence. Existing business and academic literature in English on the Russian RE support mechanism is fragmentary and does not fully present the remuneration logic of the said mechanism, the effects of the mechanism on RE investment profitability, and any consecutive implications for investors and policymakers have so far not been comprehensively analyzed.

In this vein, and in order to fill the observed research gap with regards to the Russian RE support system, this paper: i) describes the Russian RE support system and puts it in an international context; ii) numerically illustrates and analyzes the effect of how the said system affects the profitability of RE investments in Russia - the results shed new light on how the key policy features of the mechanism affect RE investment profitability, and iii) uncovers insights on policy implications for investors and for the Russian energy market system as a whole.

Furthermore, the paper presents, as an appendix, a detailed description of the Russian capacity pricing mechanism for the wholesale market RE in English – this is to clarify in fine grain the underlying Russian system, and while the presentation is a close reproduction of the relevant Russian laws in English and as such are not a scientific contribution at all, it is to the best of our knowledge among the first such presentations in English.