

# ***SOLAR FEED-IN TARIFFS IN A POST-GRID PARITY WORLD: A RISK-RETURN PERSPECTIVE***

Yuliya Karneyeva, University of St. Gallen, +41-71-2242599, yuliya.karneyeva@unisg.ch  
Rolf Wüstenhagen, University of St. Gallen, +41-71-2242587, rolf.wuestenhagen@unisg.ch

## **Overview**

Feed-in tariffs have proven to be an effective policy tool in Germany and many other countries, buying down the technology learning curve for solar photovoltaics and creating attractive returns for private investors. With recent cost trends in the industry, however, more and more countries are moving towards grid parity, which is a new reality that is only starting to be reflected in the energy policy literature. While believers in perfect economic rationality might conclude that reaching grid parity simply makes policy redundant, recent experience in key European solar markets shows that with the advent of grid parity and the reduction of feed-in tariffs investment in new solar capacity has decreased rather than increased, making it questionable whether low-carbon energy policy targets will be reached. We argue that this trend cannot be explained by lower returns alone, but is strongly driven by increased levels of risk, especially exposure to revenue risk. Post-grid parity solar policies, therefore, need to be informed by careful analysis of risk-return preferences of relevant investor segments. Relatively frugal but stable policy environments may be conducive to further growth of investment in photovoltaics, and minimize cost to society.

## **Methods**

The main objective of this paper is to evaluate how policy's role changes along three stages of solar PV diffusion – pre-grid parity, near grid parity and post-grid parity – and to find out what the role of policy is for the latter two stages of diffusion. In order to fulfill this objective, we conducted case studies of Germany, Italy and Switzerland for the years 2000-2014. Germany and Italy have been the two leading European PV markets for several years, while Switzerland is a late entrant but has seen significant growth in recent years. Looking at these three adjacent countries is also of particular interest as their electricity systems are highly interconnected. As an alpine country with a high share of hydropower and storage capacity, Switzerland could complement the strong growth of intermittent renewable energy capacity in its two neighbor countries.

The case studies are structured along the three stages of PV market development identified in the conceptual model described above. Particular emphasis is placed on an analysis of the changing investor landscape and on policy risk. The data presented in the case studies is drawn from a variety of mostly publicly available sources in each of the countries, which often had to be translated from the original national languages. A review of policy documents and reports published by the International Energy Agency and Solar Industry Associations was done to ensure consistency of the data across countries. Finally, a cross-case study analysis discusses the implications for post-grid parity policies.

## **Results**

While the relative cost of PV declines from one stage to another, the role of policy changes, too. The initial purpose of feed-in tariffs to buy down the technology learning curve has been successfully achieved in the first stage (pre-grid parity) and can therefore no longer be the main rationale for policies in the later stages. In the near grid parity stage, there may be a case for policy to smoothen the revenue stream, by using feed-in tariffs (or feed-in premiums) to offer solar investors a (partial) hedge against revenue risk. In the long run, with technology cost declining further, policy's role may be limited to creating a level playing field, such as internalizing environmental externalities and securing non-discriminatory grid access.

As for the most common players, the investor landscape is changing along the three stages. In the early part, a large share of solar PV investments has been done by new players from outside the energy industry, including homeowners, farmers and owners of commercial roofs. The near grid parity phase is characterized by widespread hesitation on behalf of both old and new investors, whereby some actors express policy fatigue and start experimenting with purely market-based business models. It is too early to tell who will be the most common players in the post-grid parity phase, but policy choices made today will shape that investor landscape – either

towards a distributed generation model, which may be dominated by residential and commercial roof owners, or towards more centralized model with utilities and institutional investors playing a stronger role.

Finally, the risk-return profile of solar policies also goes through a transition. While in the early days of solar market development, feed-in tariffs used to be rather generous in order to kick-start the market, this has been followed by a phase of generous but increasingly risky regulatory environments as in Italy in 2013 or Switzerland today. Existing or approaching caps for the level of policy support have been a prominent cause of such uncertainties. In the near grid parity phase, it is also apparent that controversial debates about future policy directions intensify, with grid operators and solar producers fighting for their views of the right framework conditions for shaping future markets, and incumbent power generation firms often playing a role in making their interests heard, too. Again, it is difficult to predict what the future will bring with regard to the policy risk-return profile, but our suggestion is that moving to what we call “frugal & stable” policies could be beneficial for all parties involved.

## Conclusions

This paper explores the role of solar feed-in tariffs in a post-grid parity world. As the cost of solar photovoltaic technology has come down, buying down the learning curve can no longer be the primary objective for solar policies. By conceptualizing the current transition as consisting of three distinct stages, we have shown how the role of policy changes, and presented the risk of a *Policy Valley of Death* that may occur when policymakers phase out existing support schemes while some market failures remain. Empirical case studies of solar market development in Germany, Italy and Switzerland have shown that the risk of such a policy valley of death is real. Both Germany and Italy have seen significant declines in solar investment as feed-in tariffs have been reduced or eliminated. The situation in Switzerland is different, as feed-in tariffs on paper still look quite generous, but an extensive waiting list has created a high level of policy risk for investors. These recent developments illustrate that an approach to energy policymaking that rests on pure assumptions of economic rationality may fall short of creating effective regulatory frameworks. Instead, policymakers would be well advised to appreciate the current diversity of solar energy investors, many of which are looking for a different risk-return profile than traditional energy investors. New investors in this space, such as retail investors and institutional investors, may be satisfied with relatively lower returns but react particularly sensitive to rising levels of exposure to revenue risk, which is a direct consequence of eliminating feed-in tariffs. Thus, in the next phase of solar market development, keeping at least a partial hedge against revenue risk may be crucial if policymakers want these investors to continue providing private capital to financing the energy transition. In the long run, moving towards a full-fledged post-grid parity world, the risk exposure can be gradually increased as long as a level playing field is warranted.

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