New Member

Clément Leblanc

PhD in Economics from the École Nationale des Ponts et Chaussées

This year, we welcome a new member to the EnergyEcoLab team. Clément Leblanc joins us as a postdoctoral researcher to help with ongoing work, as well as to start new projects on energy and environmental economics. Last June, Clément received his PhD in Economics from the Ecole Nationale des Ponts et Chaussées (ENPC, Paris) in June 2023, after having completed it at CIRED (International Research Center for the Environment and Development). His Ph.D. research has focused on the design of support mechanisms for variable renewable electricity sources such as wind and solar power. He has experience in applied theoretical modeling and numerical power system modeling.

One main focus of his Ph.D. work was a comparison of the contract designs that different governments have used to support electricity production from solar and wind power. These include feed-in tariffs or contracts-for-differences, fixed feed-in premiums, and more sophisticated contracts such as the many variations of sliding feed-in premium contracts. To compare them, he focused on two desirable properties of such contracts: their ability to induce private investors to design and build the renewable power plants that are the most valuable to the power system, and their ability to limit the risk borne by those investors, which in turn allows for lower financing costs. While these two issues, taken separately, tend to lead to opposite conclusions, Clément treated them together so that the gains and losses associated with each could be compared. He developed a theoretical framework and a simulation-based quantitative strategy to achieve this goal. This strategy was based on a sample of wind and solar projects implemented in France, among which he assumed that an investor would have to choose while being supported through a specific contract design.

Clément simulated the discrepancy between the private revenue that the in-

vestor would receive from operating each wind or solar power project and the actual contribution of that project to the power system, from which he quantified the likelihood that the investor would choose a suboptimal project. He also estimated the additional cost of supporting these projects due to risk premia, and matched this with a welfare loss. His empirical implementation relied heavily on a numerical model of the French power system that he developed, allowing him to simulate hourly electricity prices based on a rough description of the power system (including total installed capacity and costs for each technology). This allowed him to base his quantitative strategy on price time series describing not only past situations but also alternative scenarios, e.g., regarding alternative fuel costs or the share of renewables in the mix. His results suggest that fixed feed-in premium contracts impose additional costs due to price exposure and that the excess costs may exceed the welfare gains from better incentives provided to investors. In addition, his results show that sliding feed-in premia are indeed an adequate contract design to address this risk/incentive trade-off: they allow to reduce risk premia while maintaining good incentives to select projects that are the most valuable to the power system. However, this is not true for all sliding feed-in premium designs.

As shown in the Figure 1, Clément found that **fixed feed-in premiums and sliding feed-in premia that hedge against the yearly average electricity price perform better in terms of incentivizing developers than those that hedge against the monthly average or feed-in tariffs**. This

Figure 1: Average welfare loss due to developers selecting a suboptimal renewable project, depending on the contract

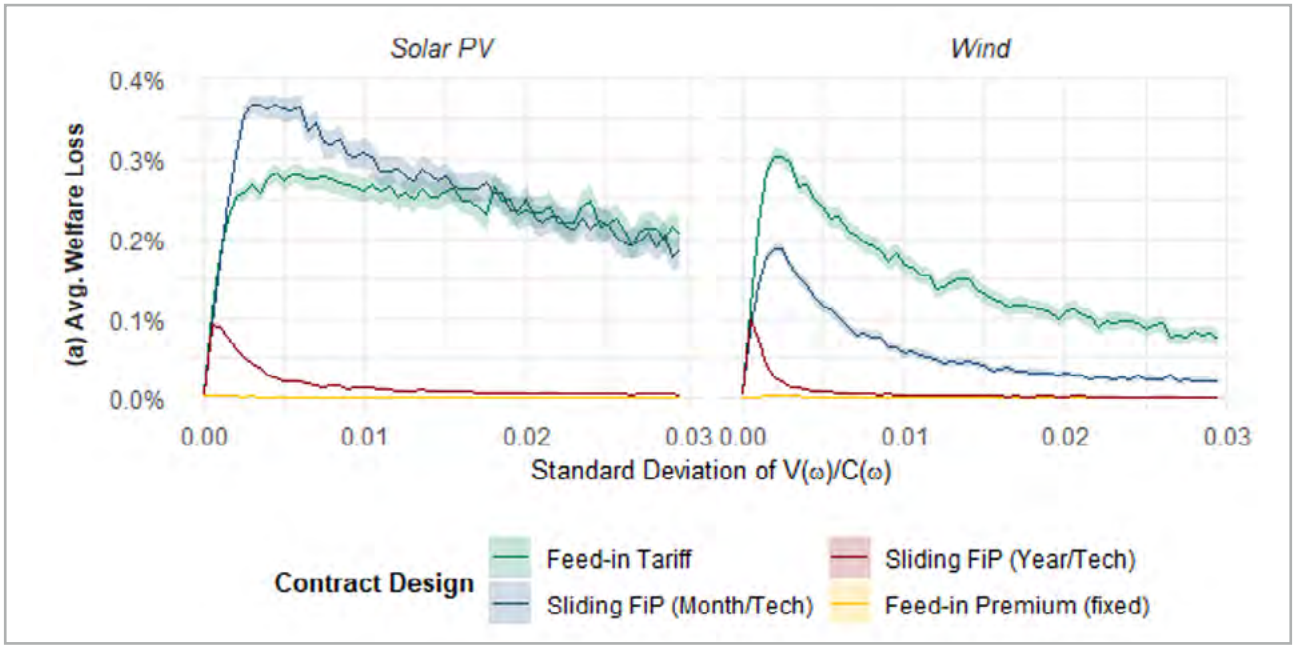

figure depicts the expected welfare loss due to developers selecting a suboptimal project, which depends on the assumed heterogeneity across projects: if all projects are equivalent (in terms of value-to-cost ratio), the selection of a suboptimal project does not affect welfare, and if the projects are very different from each other, it becomes unlikely that a firm would choose a suboptimal project due to the distortions imposed by the subsidy contract. In any case, monthly sliding feed-in premia do not appear to be a good design, which is all the more policy-relevant as they are currently used in France.

In another project, co-authored with Laurent Lamy, **Clément studied procurement contracts that provide insurance against production risk in a context where these contracts are awarded through auctions**. This project was inspired by a mechanism that the French government had in place for the award of its first set of subsidy contracts for offshore wind farms. Through this mechanism, the government would ensure that the yearly revenue of the firm operating the wind power plant would not change much in the event of a year with unfavorable weather. Clément and Laurent show that this particular mechanism, and any mechanism designed to provide this type of insurance, is vulnerable to manipulation by the subsidized firms. Firms would take advantage of a discrepancy between the production probability distribution assumed by the regulator and its actual distribution, a discrepancy that can be obtained either by shirking or by manipulating the information given to the auctioneer. Since these contracts are typically awarded through tender procedures, Clément and his co-author then studied the auction game and showed that this type of gaming could lead to excessive rents being captured by the winning firm. In a simulation-based case study of the offshore wind auctions held in France, they showed that these rents could have been up to 15 times larger than the benefits of insurance provision anticipated by a naive regulator.

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Looking ahead, **Clément will continue his research at EnergyEcoLab on topics related to electricity economics and, more broadly, energy and environmental economics** ·