

The government's role in mobilising investment and innovation in renewable energy



Mobilising investment and innovation in low-carbon technologies, especially in renewable energy generation, is central to keeping the global average surface temperature increase well below 2°C. Successfully attracting investment and innovation in renewable energy requires not only core climate policies, such as pricing carbon, but also a focus on the broader investment environment.

The well below 2°C goal of the Paris Agreement implies a 29% increase in low-carbon energy investments in the next 15 years compared to business as usual (OECD, 2017). Steep decreases in the cost of some critical renewable energy technologies suggest that investors could profitably cater to these additional investment needs in the energy sector. Thanks to technology innovation, the capital cost of utility-scale solar photovoltaic fell by 20% in 2016 alone. That of onshore wind has decreased by 20% since 2010.

Despite these recently decreasing costs, investments in renewable energy in the power sector are not scaling up fast enough to keep the “well below 2°C” goal within reach. The International Energy Agency (IEA) estimates that cumulative investments in renewable power of more than USD 6 trillion until 2040 will be needed to meet this goal. Even with the significant progress of the past decade (Figure 1), USD 6 trillion in investment will not be attained if current investment levels persist. So, what is needed to further increase investment and innovation?

Figure 1. Trends in investment flows in renewable-power sources in OECD and G20 countries



To shed light on this question, the OECD report “The Empirics of Enabling Investment and Innovation in Renewable Energy” examines:

- the climate policy drivers of investment in renewable power;
- the importance of a sound broader investment policy environment, and
- the policy drivers of innovation in renewable energy.

The report gathered and tested data on more than 70 factors that could impact renewable energy investments in the electricity sector in OECD and G20 countries. These factors include climate mitigation policies, investment environment factors, and innovation environment factors. Based on this data, the analysis tests the hypotheses that stronger, more coherent climate mitigation policies, and the quality of the investment and innovation environment, have an impact on investments – by themselves and in interaction with each other. The report provides evidence reinforcing main policy messages in previous OECD analysis regarding drivers, barriers and misalignments affecting investment in renewable energy (OECD, 2015a; 2015b). This policy brief summarises the report's empirical results.

The climate policy drivers of investment in renewable power



Targeted incentives remain important drivers of investments in renewable energy, adding to the positive effect of carbon prices. Using a combination of climate policies can enhance results; in contrast, providing support for fossil fuel use undermines efforts to deploy renewable power technology.

Renewables investment in OECD and G20 countries between 2000 and 2014 was driven primarily by targeted investment incentives – feed-in tariffs (FiTs), tradeable renewable energy certificates and public tenders. While all three were used in both advanced and emerging economies, renewable energy certificates have positive effects only in advanced countries, while public tenders have a positive impact only in emerging economies. The differing impact is due to the ways in which policy design may or may not compensate for other country-specific factors. For example, explicit carbon prices (including carbon taxes and emissions trading schemes) have driven investment for both solar and wind in the EU as well as emerging economies.

Other climate policies show positive effects for investment in specific geographic or technology sub-samples as well. For example, explicit carbon prices (including carbon taxes and emissions trading schemes) have driven investment for both solar and wind in both the EU and in emerging economies. For solar power, both carbon prices and energy tax rates in the power sector have driven investment across all OECD and G20 countries. Conversely, fossil fuel subsidies for power generation seem to deter renewable investment in emerging economies, where these subsidies are highest.

Mitigation policies can produce enhanced results when they are combined. In emerging economies, for example, the impact of explicit carbon prices and of renewable certificates is amplified by public RD&D spending in the renewable energy sector. This suggests that aligning incentives can result in greater impact.

What is Basel III?

Basel III is a comprehensive set of reform measures aimed at strengthening the regulation, supervision and risk management of banks in the aftermath of the global financial crisis. The new set of regulations, implemented as early as 2012 in some Basel Committee member countries, establishes higher levels for capital requirements than the previous Basel I and Basel II regulations, and introduces a new global liquidity framework.

These regulations improve banks' ability to absorb financial and economic shocks, improve their risk management and governance, and strengthen their transparency. As results from this OECD study suggest, Basel III regulations may have unintentionally constrained investments in capital-intensive renewables infrastructure projects.

The importance of the investment environment



To meet renewable energy deployment goals, it is not sufficient to strengthen core climate policies. Specific policy incentives and climate policies should not be considered in isolation from the broader environment for investment and innovation in renewable energy. For instance, the implementation of Basel III banking regulations may have unintentionally decreased investments.

Many aspects of investment policy and facilitation play an important role. As a specific example, the ease of registering property like land and buildings plays an important role throughout OECD and G20 countries. Among more general indicators, the overall ease of doing business shows a strong impact on investment in the group of emerging countries.

The influence of SOEs on investment in renewables is ambiguous overall. Strong SOE influence is commonly assumed to inhibit market entry, including for the predominantly small investors in renewable technologies. However, greater levels of direct control of the state over enterprises throughout the economy were found to have a positive effect on investment in renewables across OECD and G20 countries. One possible explanation for this positive effect could be the direct influence of green political agendas on decision-making in SOEs – i.e. to invest in renewables. Results show that Basel III financial regulations may unintentionally have constrained the ability of banks to provide long-tenor debt financing for renewable power infrastructure projects. These projects are capital intensive, both in terms of absolute amount of capital needed and capital expenditure compared to operational expenditure throughout the projects' lifecycle.

Beyond their direct effect, investment conditions also seem to have an indirect effect on investments. The effect of carbon prices on investment in capital-intensive renewable projects can be hampered by a lack of long-term debt financing associated with a banking system trying to meet more stringent banking regulations. Likewise, the effect of public tenders on investment in advanced economies is reduced when there is greater direct control of the state over enterprises. This result may be due to dominant SOEs deterring investment from independent renewable power producers entering a market through tendering programmes.

The policy drivers of innovation in renewable energy



While feed-in tariffs and public RD&D spending are strong drivers of innovation in the renewables sector, the broader investment environment also has an impact on innovation. Innovation patterns show in particular the importance of ease of doing business as well as the role the state has to play.

Results from the innovation model developed for the empirical study suggest that feed-in tariffs and public RD&D spending in the renewable energy sector have stimulated patenting activity across OECD and G20 countries. Renewable certificates only show a positive effect in emerging economies. Public RD&D spending encourages patenting in renewable energy technologies across OECD and G20 countries and especially in emerging economies. However, neither public tenders nor explicit carbon prices appear to stimulate patenting. Further analysis could clarify the effect of an explicit carbon price on both investment and innovation.

While public tenders impact investment, they do not appear to influence innovation. Tenders incentivise bidders to cover costs but not more, while feed-in tariffs or other support schemes potentially leave profit margins. Accordingly, companies financing themselves through contracts won via a tender programme will not have as much budget left to spend on RD&D, which will decrease their capacity for innovation.

Just as the broader investment environment impacts investments in renewable power, it also impacts innovation. Among the relevant factors for innovation are the ease of doing business inside the country and with outside partners as well as the role of state-owned or state-led enterprises. In particular, while tenders in themselves do not show an impact on innovation, when they are combined with increasing direct control of the state over enterprises, tenders even show a negative effect on stimulating patent activity across OECD and G20 countries, perhaps due to their tendency to decrease capacity for innovation. Increasing direct control of the state over enterprises also reduces the effect of explicit carbon prices in stimulating patent activity in emerging economies.

In addition, factors with an influence on innovation more broadly also affect patenting activity for renewables. For example, increasing the number of universities and the knowledge stock of a country, as measured by the accumulated patents in the renewables sector, has a positive impact.

Policy implications



To promote investment and innovation in renewable energy, policy makers need to focus not just on core climate policies but on broader investment conditions and wide-ranging policies, from investment and competition to trade and financial markets.

Widening the focus is particularly relevant in the context of on-going reforms of incentive schemes for renewable energy in the EU and other OECD as well as emerging economies. If policies for the broader investment environment do not improve investment conditions relevant to the renewables sector, deployment and innovation of renewables technologies will be hampered, along with the effectiveness of climate policies.

The empirical research reported here points to concrete and achievable policy reforms that can boost investment and innovation in renewable energy. It also highlights an opportunity to bring about mutually reinforcing positive effects by combining particular climate mitigation policies. Moving forward, the OECD's new Centre on Green Finance and Investment will be leveraging a broad range of evidence-based analysis, including econometric analysis, to inform smart policy making among governments and across the whole of government.

More information about **OECD work on mobilising investment in clean energy infrastructure** can be found at: www.oecd.org/investment/clean-energy-infrastructure.htm.

Discover the **OECD Centre on Green Finance and Investment**: www.oecd.org/cgfi.

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