

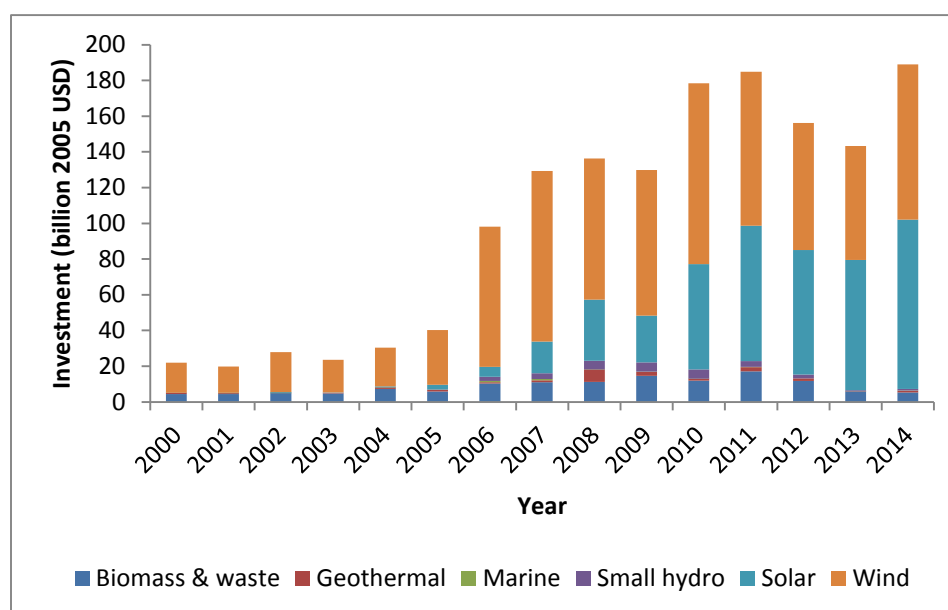
THE GOVERNMENT ROLE IN MOBILISING INVESTMENT AND INNOVATION IN RENEWABLE ENERGY

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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 total investment volumes in low-carbon energy infrastructure in the next 15 years (OECD, 2017). Steep decreases in the cost of some critical renewable energy technologies suggest that investors could profitably cater to investment needs in this 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. Yet, 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 significant progress in 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



New OECD research shows that misalignments in policies and electricity markets as well as cumbersome and unpredictable investment conditions are among the main factors holding back investment and innovation in renewable energy in advanced and emerging countries. For example, while public tenders generally attract renewables investments, they are less effective when independent power producers are forced to compete against a mostly state-controlled incumbent. In addition, research, development and deployment (RD&D) expenditures have played an important role in stimulating patenting in renewable energy technologies in the past. However, this innovation may soon taper off unless governments take action to increase spending in RD&D for low-carbon technologies, which is at historically low levels.

Policy reforms can play an important role in fixing these problems. *The Empirics of Enabling Investment and Innovation in Renewable Energy* fills a research gap by shedding light on:

- 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 climate policy drivers of investment in renewable power

Research shows that renewables investment in OECD and G20 countries between 2000 and 2014 was driven primarily by targeted investment incentives – feed-in tariffs (FiTs), tradeable renewable certificates and public tenders. While all three were used in both advanced and emerging economies, results show positive effects of FiTs and renewable certificates only in advanced countries, while public tenders show a positive impact only in 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 in both the EU and in emerging economies. Both carbon prices and energy tax rates in the power sector have driven investment in solar power across all OECD and G20 countries. Conversely, fossil fuel subsidies for power generation seem to deter renewable investment in emerging economies.

In addition, 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 shows that incentives have greater impact if they are aligned across a number of different areas.

The importance of the investment environment

To meet renewable energy deployment goals, policy makers also need to strengthen investment conditions, from investment policy to competition, trade and financial market policy. Most importantly, 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 had the unintended consequence of constraining access to debt financing for capital-intensive investments such as renewable projects.

Additionally, 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 in the group of emerging countries.

The influence of state-owned enterprises (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, increasing levels of direct control of the state over enterprises throughout the economy has a positive effect on investment in renewables across OECD and G20 countries. One possible explanation could be the direct influence of green political agendas on decision-making in SOEs.

Investment conditions also seem to have an indirect effect on investments, beyond their direct effect. The effect of carbon prices on investment in capital-intensive renewable projects can be hampered by the lack of long-term debt financing from a banking system trying to meet more stringent banking regulations. Likewise, the effect of public tenders coupled with direct control of the state over enterprises in advanced countries can deter investment. This interaction could result from dominant SOEs deterring investment from independent renewable power producers entering a market through tendering programmes.

The policy drivers of innovation in renewable energy

The innovation model suggests that feed-in tariffs and public RD&D spending in the renewable energy sector stimulate 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. Similar to the investment model, the results relating to carbon prices could be due to modelling and data issues. Additional analysis and better data could bring out the effect of an explicit carbon price more clearly.

Unlike investment, public tenders do not seem 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 capability for innovation.

Similar to investments in renewable power generation, the broader investment environment also has an impact on innovations in renewable power. The list of relevant factors shows the importance of the ease of doing business inside the country and with outside partners as well as the relevance of state-owned or state-led enterprises for innovation. 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 actually have a negative effect on stimulating patent activity across OECD and G20 countries. Increasing direct control of the state over enterprises also reduces the effect of explicit carbon prices in stimulating patent activity in emerging economies.

Similar to the investment environment, factors with a specific influence on innovation also affect renewable patenting activity. 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.

Initial 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. This 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 broader investment environment do not improve investment conditions relevant to the renewables sector, deployment and innovation of renewables technologies as well as the effectiveness of climate policies will be hampered. 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.

Meeting climate and sustainable development goals is the challenge of our generation, and policy makers need to be armed with approaches that have been proven to work. The OECD's econometric analysis suggests that well-aligned climate policies and broader investment conditions can make a real difference. Moving forward, the OECD's new Centre on Green Finance and Investment will be leveraging a broad range of evidence-based analysis to inform smart policy making across and among governments.

References and links

This article is based on "The Empirics of Enabling Investment and Innovation in Renewable Energy" by Geraldine Ang, Dirk Röttgers and Pralhad Burli, <http://dx.doi.org/10.1787/67d221b8-en>. Geraldine Ang and Dirk Röttgers are policy analysts at the OECD. Pralhad Burli is a researcher at Montclair State University.

More information about OECD work on mobilising investment in clean energy infrastructure can be found at www.oecd.org/investment/clean-energy-infrastructure.htm. The **OECD Centre on Green Finance and Investment** helps catalysing and supporting the transition to a green, low-emissions and climate-resilient economy through the development of effective policies, institutions and instruments for green finance and investment www.oecd.org/cgfi.

OECD (2017), Investing in Climate, Investing in Growth, <http://dx.doi.org/10.1787/9789264273528-en>

IEA (2017), World Energy Investment 2017, <http://dx.doi.org/10.1787/9789264277854-en>

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