

Understanding the Clean Energy Investment Challenges

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Energy-sector investments involve both large sums of money and challenging uncertainties. Can the capital be raised affordably in today's economic context? How will current clean energy technologies perform over time? What will the legal and regulatory backdrop look like as climate-change negotiations advance?

A favourable policy environment enables investors to handle the complex drivers and uncertainties involved in modern investment decisions, which must determine not only choice of technology but also investment timing.

The IEA's [Project Transitions](#) was recently launched to focus on the factors driving investment choices and define new policy approaches to create the right investment incentives for meeting energy-security, climate-change and economic objectives.

Why this initiative?

There is no lack of challenges in the energy sector. Maintaining a stable and predictable price environment for energy resources seems more challenging by the day. The international structure of energy demand is changing significantly, in pace with the economic growth of emerging economies and those in the Middle East. But the global economic recession has also driven global demand down. Meanwhile, the structure of traditional markets is changing. To cite just one example, liquid natural gas delivery chains are now increasingly replacing pipelines as the primary



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¹ The IEA [OPEN Energy Technology Bulletin](#) is a free, web-based periodical newsletter published by the International Energy Agency (IEA).

transportation means for moving natural gas internationally.

Global climate change imposes additional constraints on the energy sector. The basic outline of the climate-change challenge is clear: by the end of this century, the energy sector must be generating nearly net zero emissions of carbon or we will not meet the declared goals of IEA member countries. A century seems like a long time, but is it?

The major capital investment projects that characterise much of energy supply and demand – from power-generation plants and steel mills to buildings and transportation infrastructure – all take time to plan and develop. More important, they last for decades. Fossil-fuelled electricity-generating plants constructed today will live on well into the latter half of this century, committing us to millions of tonnes of carbon emissions. Altering our currently projected path is entirely possible, but not trivial because changes are required throughout our economies, not in one single sector. The economic and geographic scale of the necessary transformation is unprecedented; and the time permitted by our goals is short rather than long, given this inertia in our capital structure.

The IEA has studied this challenge in the macro-scale analyses for its *World Energy Outlook* and *Energy Technology Perspectives* publications. Again, the rough outlines of what must occur in the energy sector are clear: the capital structure must change its emissions profile. What is less clear, however, is how best to do that when most of the energy infrastructure is so long-lived. The motivation behind the IEA's [Project Transitions](#) initiative is a need to focus on what public policy incentives should look like in light of more realistic formulations of investor incentives. This project complements the robust treatment of systemic interactions embodied in IEA's macro-scale analysis and provides more detailed investigations of the investment choices than is possible at that scale.

Getting into the investor's shoes

In its simplest formulation, the decision to invest is determined by comparing two streams - revenue to cost. When appropriately discounted, investment occurs when returns exceed cost. This is generally the decision rule for investment in macro-modelling. The investment decision is obviously more complex at a micro-level and literature demonstrates that investment drivers differ between sectors and industries, at least in their relative weighting. Some of these drivers are difficult to translate into monetary estimates of revenue and cost, and some of them involve different sorts of uncertainty. Technology performance characteristics, future fuel prices and the form and stringency of carbon constraints, for example, are significant

unknowns that investors must assess. In reality, investors will remain subject to various different regulatory structures, so that carbon constraints come in various different forms; and they come in parallel with incentives targeting other societal objectives. Electricity generators, for example, will be faced both with renewables incentives, delivered through either portfolio standards or feed-in tariffs, and with environmental standards for emissions other than carbon, in addition to a cost-of-carbon constraint.

Understanding these various drivers for investment choices, and the implications of the different uncertainties involved, are at the core of the [Project Transitions](#) initiative.

Stakeholder expertise

Clearly, it would be a waste of time to generate analysis that sat unread on the shelves of experts because it did not account for the significant drivers and uncertainties facing investors, or because it failed to facilitate the interaction of stakeholders and decision takers. Project Transitions will engage a group of the most representative stakeholders in its conception and implementation. An ad hoc advisory team of various types of stakeholder will help to ensure that the project is absolutely relevant to the issues we need to address. Participation in funding, project design and product review will give a broad set of stakeholders useful knowledge of a major IEA project and an opportunity to contribute to its findings and output, which will be provided to decision makers in both IEA member countries and major emerging economies.

Using the right analytical tools

Project Transitions complements and enriches IEA's macro-scale analysis by not only providing descriptive analysis of investors' decisions, but also quantitative analysis of the uncertainties faced in investment choices. The IEA Real Options Model (ROM) has been used in previous analysis to provide insight into the relative quantitative implications of the investment choice under different conditions. Since the decision to invest is not just a decision about technological alternatives but also a decision about when to invest, real options analysis is particularly suited to such questions.

In this project, ROM will again be part of the analytical tool kit. However, since the objective is to enrich our understanding of the investment choice implications of policies directed at energy-security and climate-change objectives, ROM will not be the only analytical technique used in the Project Transitions work. Case studies, conventional data development and analysis will also be part of the range of studies provided.

Timelines

Two of the initial studies are already under way. One study will use ROM to gain in-depth understanding of the nature of the refurbishment and greenfield development choice in electricity generation. A second is a scoping study to assess the extent to which sunk capital may influence the rate at which a technological transition can occur, and the policies that can empower it. Both of these studies are expected by mid-2009.

The entire Project Transitions programme is expected to cover nearly five years and provide multiple products reflecting its basic methodological orientation, namely that no single methodology can alone provide a complete picture of the full range of complex factors involved in the modern investment choice.

More information about the Project Transitions initiative can be found in our brochure [*Project Transitions - The Investment Challenge for Creating a Sustainable and Secure Energy Infrastructure*](#). Queries can be addressed by e-mail to Richard.Bradley@iea.org.