ENERGY INNOVATION NEEDED BEYOND ELECTRIC POWER

The world needs an accelerated energy transition to ensure that the limits to global temperature rise set out in the Paris Agreement can be met.

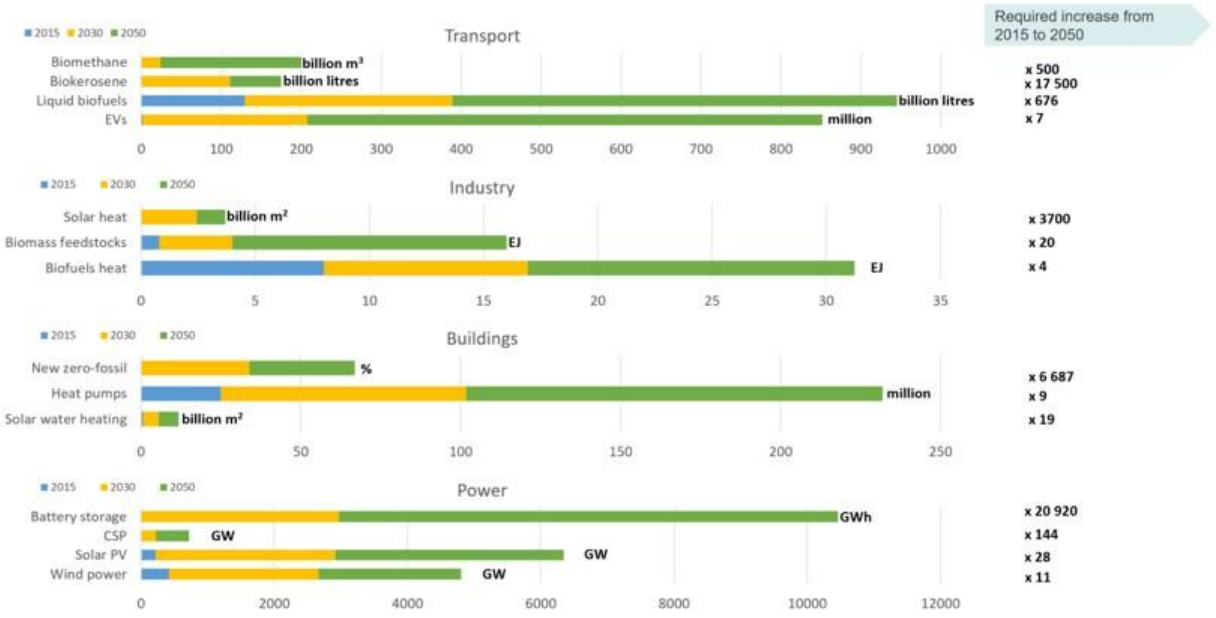
This transition requires innovation based on new technology and new operating practices. Given the time needed for successful innovation, greater effort is essential now to decarbonise the energy sector by 2050. Innovation is called for most in end-use sectors, including transport and industry. Governments should primarily set the stage for private-sector innovation through credible long-term policy signals and assist innovation in areas where the private sector lacks specific capacity or reach, such as certain enabling infrastructure.

Breakthroughs are needed in end-use sectors.

Innovation will continue to play a crucial role in decarbonising the energy sector. While technical solutions for the power sector already exist today, continued innovation will enhance their performance, reduce their costs and help scale up the deployment of the best available technologies. In end-use sectors, however, such as transport and industry, addressing the innovation challenge is more urgent than in the power sector.

Most research and development (R&D) investment flows into power sector technologies (such as solar photovoltaics [PV] and wind) rather than in technologies for end-use sectors (such as biofuels and biomass). The transition of the power and end-use sectors will require the continued improvement of existing renewable energy technologies; but in certain cases the emergence of breakthrough technologies or a major shift in production processes will be vital (Figure 1).

Figure 1: Technology deployment needs by sector and application, 2015-2050



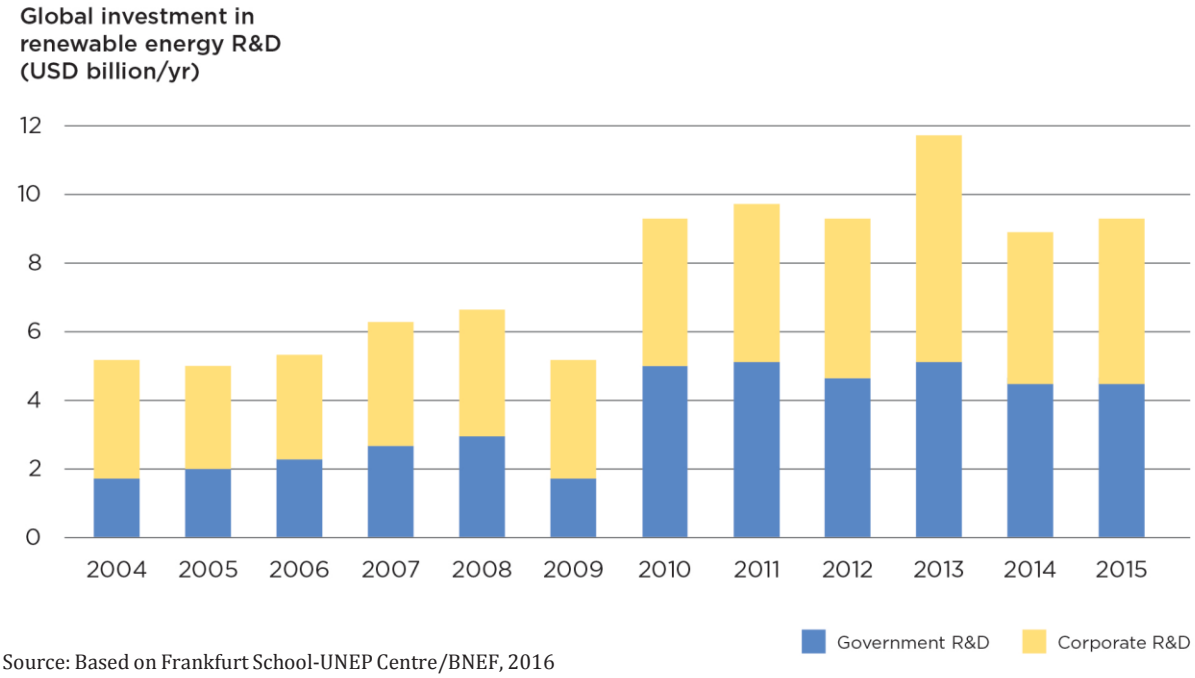
Note: CSP = concentrated solar power; EVs = electric vehicles; SWH = solar water heating; GW = gigawatt; m2 = square metre; m3 = cubic metre;

Renewables for transport, industry and other end uses

To achieve 90% CO_2 emission reduction by 2050, deployment needs go substantially beyond the power sector.

Transformative innovation must target not only the development of technology, but also innovative businesses, which may create jobs and additional economic opportunities in the process. Innovation, however, requires funding and over the past seven years government and corporate investment in renewable energy R&D has been stagnant (Figure 2).

Figure 2: Global R&D spending on renewable energy, 2004-2015



Source: Based on Frankfurt School-UNEP Centre/BNEF, 2016

While investment volumes have risen to around USD 300 billion per year, R&D expenditures amount to USD 10 billion per year. This 3% R&D investment share is well below that seen in other innovative sectors, such as information and communication technology and vehicle manufacturing.

Additional R&D efforts in renewables will further bring down the cost of zero-carbon technologies and decrease the overall cost of decarbonisation. To accelerate the energy transition, governments must increase investment in R&D to identify technology solutions for sectors where greater innovation is required.

Accelerated innovation requires a combination of various policy instruments across the whole technology lifecycle, from R&D to market scale-up.

Innovation requires a systematic approach, encompassing technical, policy, business model and regulatory considerations.

Concentrating all efforts solely on a narrow suite of measures, such as R&D spending or market signals, will not bring the expected results. Innovation policy frameworks must be target-oriented, deploy different policy measures across the technology

Renewable energy research and development

Investment in R&D for renewables has been stagnant over the past seven years and urgently needs to increase.

life cycle – from technology push to market pull – and define monitoring and performance indicators to ensure that progress takes place within an acceptable timeframe to dramatically reduce carbon emissions.

At the early stages of technology development, high-risk investments and limited commercial application make major government R&D investment essential, until breakthroughs reach the deployment stage. Governments should also actively support the development of other key pillars of the innovation ecosystem. In more advanced stages of technology development, R&D must be complemented by the development of business models tailored to the commercialisation of novel technologies. Governments can also guide the market by setting regulations linked to macroeconomic objectives, without being technology prescriptive. Therefore, as innovative technologies near the commercialisation stage, governments should avoid trying to pick winners and simply let the market decide. The guided market approach may foster the crucial role of the private sector in leading applied R&D for the energy sector. Governments must create the enabling environment for the private sector to innovate, and profit from their innovations, while transforming the energy sector.

Strong action is needed today to decarbonise the global energy sector.

Accelerating innovation is a pressing issue, considering that the time required to bring a technology from market niche to wide deployment may be longer than five decades. The magnitude of the decarbonisation challenge means that international collaboration is required to increase investment and accelerate the energy transition. Innovations should ideally be shared, developed and widely replicated by others.

Governments must anticipate and design mechanisms to finance the fundamental infrastructure that innovative technologies will require for integration.

The energy infrastructure that governments could facilitate include, for example: charging networks for EVs; new cross-border electricity interconnections; ultra-high-voltage transmission lines – possibly underground – to dispatch massive amounts of power from areas with abundant wind or solar resources to demand centres; district heating networks; and biomass feedstock management strategies. Such infrastructure will enable the commercialisation and mass deployment of emerging technologies needed to decarbonise the global economy.

The technology to push a global renewable energy transition in the next two decades is already here, but more innovation is urgently needed to scale up deployment, particularly in end-use sectors and in enabling infrastructure, system operation and business models.

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