



Technology Executive Committee

29 August 2017

Fifteenth meeting

Bonn, Germany, 12–15 September 2017

Draft TEC Brief on innovation

Cover note

I. Background

1. As per activity 1 of its 2016-2018 workplan,¹ the Technology Executive Committee decided to analyse how innovation can support the implementation of nationally determined contributions and mid-century strategies. As part of this work, the committee held a special event on innovation and climate change during the United Nations Bonn Climate Change Conference in May 2017.² As per activity 4 of its workplan, in May 2017 the committee published a working paper on enhancing the financing of the research, development and demonstration of climate technologies.³

2. As per activity 1 of its workplan, at its 14th meeting the Technology Executive Committee requested its task force on innovation and research, development and demonstration to prepare a draft TEC Brief based on the special event and the working paper.

II. Scope of the note

3. The annex to this note contains the draft TEC Brief on innovation.

III. Expected action by the Technology Executive Committee

4. The Technology Executive Committee will be invited to provide comment on the draft TEC Brief, with a view to finalizing it after TEC 15.

¹ <https://goo.gl/EuR6f8>.

² http://unfccc.int/ttclear/events/2017_event2.

³ http://unfccc.int/ttclear/docs/TEC_RDD%20finance_FINAL.pdf.

Annex

Technological innovation for the Paris Agreement

Implementing nationally determined contributions, national adaptation plans and mid-century strategies

Why this TEC Brief?

In 2015, countries adopted the Paris Agreement and the 2030 Agenda for Sustainable Development. These are two major, inter-connected global milestones, defining goals for a low carbon, climate-resilient and sustainable future for all. There is an urgent need to achieve the objectives of these groundbreaking agreements. 2016 was the hottest year on record and the rising global temperature is now almost 1°C above pre-industrial levels. Climate change effects are being observed with greater frequency and intensity in all corners of the world, threatening other aspects of sustainable development. As part of global efforts to achieve the Paris Agreement's objectives, countries have developed nationally determined contributions (NDCs), national adaptation plans and mid-century strategies. Now, countries and the international community are focused on implementing them.

Technological innovation, as the driver of technological change, is a critical activity to accelerate and enhance the implementation of national climate actions and the achievement of these global objectives. And it is recognized as such. The Paris Agreement explicitly refers to innovation in its article 10, paragraph 5. In the 2030 Agenda for Sustainable Development, technological innovation is referred to in various sustainable development goals, particularly 7 (affordable clean energy), 8 (decent work and economic growth), 9 (industry, innovation and infrastructure) and 17 (partnerships for the goals).

The UNFCCC Technology Executive Committee recognizes the important role that technological innovation plays in achieving a climate-friendly future. It has prepared this policy brief to provide insights into the power of technological innovation for accelerating and scaling up the implementation of national climate actions. It also highlights the key elements of successful technological innovation. By considering the brief's messages, the Committee hopes that national and international actors may identify ways to enable innovation to empower countries to realize their goals of low emissions, climate resilience and prosperity.

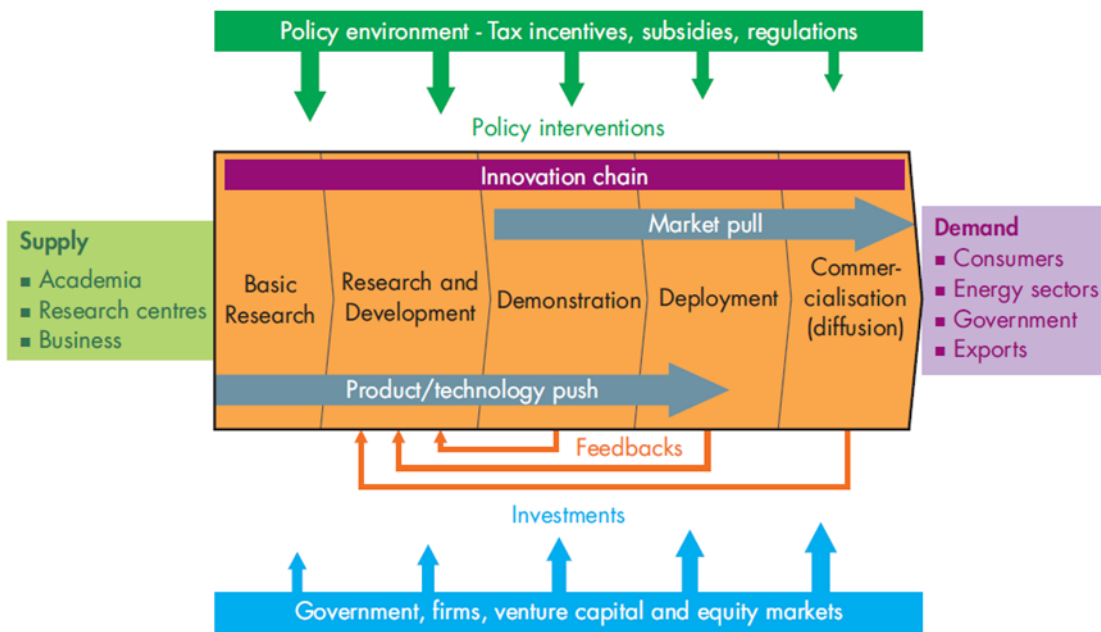
Highlights

(To be completed. TEC15 key messages and recommendations on innovation to be inserted here.)

What is technological innovation?

Technological change has been fundamental to economic and social development since ancient times. But the process through which this takes place has undergone a transformation in recent years, becoming more organized and systematized. This process, termed technological innovation, is now seen as consisting broadly of research, development, demonstration, deployment, and diffusion of a technology (see diagram below). It is through these steps that we develop a technology (i.e. a technique, skill, method or process), refine it, and then take to usage on a large scale. Innovation happens everywhere, in the formal and the informal economy, in private or public institutions, and in households and communities (Charmes et al., 2016). Notably, innovation is a complex process. It involves multiple actors interacting in various ways and with multiple feedback loops between and across the various stages. In part this interaction may be due to trial and error, as actors experiment with a technology to identify how it may solve the problem they have before them. During the innovation process a technology may also be modified to suit local conditions. Furthermore, it may be redesigned to have better performance or more features, or altered to provide new functions different from those originally intended, based on user feedback.

Innovation cycle (Diagram to be created by the graphic designer. To be based on IEA, 2008 as per below)



Nationally determined contributions and mid-century strategies

Harnessing technological innovation is a critical pre-requisite for countries to smoothly implement their NDCs, national adaptation plans and mid-century strategies. These are central elements of the Paris Agreement. NDCs are national climate plans which highlight climate actions, including targets, policies and measures that governments aim to implement in response to climate change and as a contribution to global climate action. Key to the contributions is the concept of national determination, i.e., the objectives and actions of the countries are derived from their national context, needs, and preferences. Another important element is the Paris Agreement's mid-century strategies. The Conference of the Parties invited countries to communicate their mid-century, long-term low greenhouse gas emission development strategies by 2020. In addition, many developing countries also develop national adaptation plans, as a means of identifying medium- and long-term adaptation needs and implementing strategies to address them.

A review of the 190 contributions submitted prior to the 21st session of the Conference of the Parties found that nearly 140 developing countries highlighted the importance of climate technologies. Furthermore, almost 50 percent of all developing countries specifically referred to the importance of technological innovation or research and development for achieving their climate objectives.

Ten key elements of technological innovation for climate change

The Technology Executive Committee highlights the following ten key elements for enhancing technological innovation to achieve climate and development objectives. The committee hopes that countries and other actors may find these useful as they seek to advance national, regional and global climate efforts.

1. Technological innovation is central to climate action

It will be extremely difficult, if not impossible, for countries to fully implement their NDCs, national adaptation plans and mid-century strategies without technological innovation. It is only through innovation that countries can develop, modify, and deploy technologies that can reduce greenhouse gas emissions and build resilience to the adverse effects of climate change. This is not to say that all countries will undertake innovation in the same way. They will engage in accordance with their needs, priorities and capacities.

The different timeframes of NDCs, national adaptation plans and mid-century strategies suggest the need for different but complementary technological innovation approaches. These approaches will need to balance short- and long-term imperatives. NDCs generally refer to shorter targets up to 2030. In this context, there may need to be an emphasis on the later stages of technological innovation. That is to say, how to intensify the deployment and diffusion of technologies for responding to immediate mitigation and adaptation needs. A key focus will also be on modifying existing technologies to different local circumstances and usage requirements. This shorter-term focus may also be entwined with other pressing concerns, such as those related to reducing poverty, providing access to clean drinking water, or improving health.

The priorities for technological innovation may be different for implementing mid-century strategies, which have a longer-term horizon to 2050 and beyond. Here, countries may focus on undertaking research on and developing a new generation of innovative technologies that can enable deep or full decarbonization, or jumpstart low carbon development strategy, provide protection against climate change, and respond to societal needs not yet fully conceptualized. This long-term focus will also interweave with long-term developmental aspirations in a sustainable manner. For many countries, this may relate to factors such as achieving energy access for all, eliminating poverty, developing a skilled workforce and enhancing competitiveness. In addition, national adaptation plans generally have medium to long-term perspectives. Viewing the short- and long-term together, our challenge is to harness technological innovation to respond to short-term goals effectively without compromising progression towards long-term aspirations.

Fiji's vision on innovation

Fiji, the President of the 23rd session of the UNFCCC Conference of the Parties, highlights the importance of innovation in its vision for the conference. Its vision is for the conference, inter alia:

“To harness innovation, enterprise and investment to fast track the development and deployment of climate solutions that will build future economies with net zero greenhouse gas emissions, in an effort to limit the rise of global temperatures to 1.5 degrees Celsius above pre-industrial levels.”

Find out more: <https://cop23.com.fj/fijis-vision-cop23/>




2. The journey has just begun

The world has begun to ramp up its response to the climate challenge. Climate technologies are being deployed on an unprecedented scale around the globe. For instance, in 2016 the world added more renewable power capacity (161 gigawatts) than it added from all net fossil fuels combined, with most new renewable energy capacity being installed in developing countries (REN21, 2017). In parallel, the costs of such technologies are falling significantly and in many countries are now competitive with fossil fuel options (World Economic Forum, 2017; Bloomberg, 2017).

While recent developments are promising, much more needs to be done. For many countries economic growth may no longer be closely tied to emission increases, but global greenhouse gas emissions continue to rise with a lower carbon intensity. Science clearly indicated that the window of opportunity to achieve Paris Agreement objectives is rapidly closing. Low-emission technology development and deployment is not at the speed or scale that is needed to achieve the Paris Agreement’s objectives (IEA, 2017). Progress is also varied across countries. To respond to these urgent climate challenges, there is a pressing need to accelerate and strengthen climate technology innovation, to deliver cheaper and better performing climate technologies on a larger and more widespread scale than ever seen before. Countries are aware of this and new initiatives are emerging. For instance, through Mission Innovation, 22 countries and the European Union have committed to accelerate clean energy innovation in the long-term, and agreed to seek to double their public clean energy research and development investment over the next five years. These actions are stimulating the action of other actors. Through the Breakthrough Energy Coalition, private sector actors have committed to accelerate private sector innovation of energy technologies. But more needs to be done, especially for other mitigation sectors and for adaptation. And countries facing other critical development challenges may struggle to find additional resources to adequately respond to climate change.

Considering the urgency we have, a key question pertains to how we can stimulate technological innovation to drive the low-carbon and climate resilient transformation required to deliver on climate objectives. Such transformational change may be needed to break chains of incremental improvements to technologies linked to a fossil-fuel-path dependency (OECD, 2017). While incremental improvements may deliver important short-term benefits, transformational change will be needed to achieve carbon neutrality in the second half of the twenty-first century. Breaking this path dependency will provide opportunities for new sustainable paths to develop and flourish. We have come a long way, but the journey is just beginning.


<p>Uruguay: generating almost all electricity through renewables</p>	
<p>In 2015, Uruguay generated more than 90 per cent of its electricity through renewable energy sources. Based on a long-term policy framework to 2030 (La Política Energética 2005-2030), the country has implemented policies and financial incentives to encourage the development of the wind turbine industry.</p>	
<p>Find out more: http://www.uruguayxxi.gub.uy/inversiones/uruguay-a-la-vanguardia-en-la-generacion-de-energia-en-base-a-fuentes-renovables/</p>	

3. There is no “one size fits all” approach

One of the key challenges with enhancing technological innovation efforts is that there is no “one size fits all” approach. This is due to several reasons. Firstly, no two countries are alike. All countries have different political, economic, social, cultural and environmental compositions and/or nuances. They also have different national priorities, needs, capabilities, renewable energy resources and stages of development. This means that each country will have unique innovation needs and will have to develop its own approach to stimulating innovation efforts. Secondly, countries themselves are not homogeneous. There can be as much diversity within a country as that observed between them. Thirdly, each stage of the technological innovation process may require a combination of different actors, institutions, networks and financing models. Fourthly, the innovation approach required for different sectors may be different, and the approach required for different technologies within a sector may also be different. The technological innovation process for climate change mitigation and adaptation may also be different! In sum, *different innovation approaches will be needed to identify solutions to address different problems in different contexts.*

This complexity makes it difficult for a country to immediately identify how it may improve its innovation performance to achieve its NDCs and mid-century strategy. Unfortunately, there is no simple answer. But this does not mean that we can shy away from the challenge. As noted above, enhancing technological innovation plays a key role in addressing climate change and driving sustainable development. Thus, we have no choice but to face this challenge and explore what we can do to achieve our goals. In fact, although there is no “one size fits all” approach, there are key principles

that can guide effective technological innovation efforts. The following elements (4 to 9) highlight these principles and provide indications of where one can focus their greater attention, depending on their country's specific circumstances and priorities.

Innovation: how diverse are countries?	
The Global Innovation Index explores the innovation performance of 121 countries using 81 indicators. The indicators cover a broad vision of innovation, including political environment, education, infrastructure, and business sophistication. Such indicators highlight the diverse elements that relate to innovation. The index is produced annually by Cornell University, INSEAD and the World Intellectual Property Organization.	
Find out more: https://www.globalinnovationindex.org/	

4. It's all about a systematic approach


Irrespective of the different challenges and circumstances that a country face, successful innovation interventions depend on a sound national system of innovation. A national system of innovation is defined as the combination of actors, institutions (both organizations and policies/laws) and networks that interplay to undertake and drive the innovation process in a national setting. As the Technology Executive Committee highlighted in its 2015 policy brief, building a strong system of innovation requires focusing on strengthening each of these three elements (TEC, 2015). There is a need to develop a strong education system (developing human capacity), strong institutions (developing organizations that design, implement and monitor effective policies, regulations and standards, thus creating a strong enabling environment), and strong networks (facilitating collaboration and interaction between the different actors and organizations). In addition, there is a need for clear political leadership that can motivate and help coordinate the technological innovation process and suitably guide the national system of innovation in the direction of priority areas (in our context, those related to low-carbon and climate resilience). While it may be relatively straight-forward to identify the steps to strengthen a national system of innovation, the reality is that many countries face coordination, resource and capacity challenges. These make it difficult to put in place measures that effect positive change. Also, conflicting priorities and urgent short-term needs lead to challenges in maintaining measures in place that, while crucial for developing the innovation system, take many years to show results. Faced with these difficulties, a country may tailor its intervention to focus limited resources on a particular climate and developmental challenge. The following elements highlight ways to achieve this.

5. The right push

How do we create new and improved climate technologies, or modify technologies to different local conditions? The earlier stages of the innovation process, namely research, development and demonstration (RD&D), collectively constituting the "technology push" stages, are those in which we achieve those aims. The government plays a key role in encouraging both public and private actors to focus their RD&D efforts on bringing climate technology options to commercial viability. But its support for these efforts can be especially important in developing countries where RD&D activities may be more often undertaken by public actors. Governments can also play a particularly important role for technologies where a market might not exist (e.g. large climate infrastructure projects or some adaptation technologies), is not as well developed or is informal. To facilitate effective climate technology push, governments can undertake a mission-oriented approach (Mazzucato, 2015). This involves strategically combining financing and a policy and regulatory framework to encourage actors to focus on a portfolio of options directed towards a specific public climate aim (Stern et al., 2007).

It has recently been noted that "current RD&D investment falls well short of the levels required to meet this long-term climate goal" (IEA, 2016). In this context, the Technology Executive Committee recently published a working paper on enhancing *Enhancing financing for the research, development and demonstration of climate technologies*. It notes that governments may accelerate efforts to meet climate challenges by increasing public expenditure for climate technology RD&D (TEC, 2017a). To stimulate private RD&D spending for climate technologies, governments can provide a clear


policy signal of a long-term national commitment to reduce greenhouse gases and build resilience to climate change. They can furthermore strengthen enabling environments that accelerate private investment (TEC, 2017a). Another important element of successful technology push is for a government to clearly understand its national needs and priorities for meeting climate and development objectives. Such a need-driven approach may help to ensure that investments in national technological innovation activities are directed in alignment with national priorities and effective in the context of broader economic and social development (Kholosa, et. al., 2017). UNFCCC technology needs assessments and technology action plans can play a helpful role in this regard (see element 10).

Cutting edge energy technology innovation	
The United States of America's Advanced Research Projects Agency-Energy advances high-potential, high-impact energy technologies that are too early for private-sector investment. It focuses on transformational energy projects that can be meaningfully advanced with a small investment over a defined period.	
Find out more: https://arpa-e.energy.gov/	

6. Pull a boat over a mountain

A significant problem that governments face in implementing their climate plans is facilitating the transformation of a viable technology into a product that is used at a scale which contributes to national climate objectives. Often, a key question here is on how to create market demand (pull) for the technology. Here the focus is on the later stages of the technological innovation process, related to the deployment and diffusion of climate technologies. In many countries such activities will be undertaken by the private sector (Stern et al., 2007), but the government will also play a key role in fostering their involvement by facilitating market creation and even its expansion. It may achieve this by designing and implementing policies, regulations and standards that create enabling environments and favorable market conditions for climate technologies (e.g. through feed-in tariffs, auctions) and remove disincentives such as high-carbon subsidies (OECD, 2017). It should also avoid implementing market incentives which lock-in high-emission technologies or infrastructure that is ill-prepared for adapting to the changing climate. As well as incentives, governments can also stimulate a stable long-term market pull through instruments that seek to capture the negative externality of greenhouse gas emissions, by, for instance, putting a price on carbon (OECD, 2017).


In addition to market creation, there are other ways to support 'demand pull' for climate technologies, especially for settings where markets might not be well functioning or for technologies that might not be well suited to a market. Public programmes that increase awareness about the value of technologies can help to educate and inform users, leading to informed selection and increased demand. The government can also create programmes that specifically support entrepreneurs and small and medium-sized enterprises to transform their prototypes into market ready technologies (such as innovation incubators). In addition, innovative financing and business models, often developed and implemented by a combination of public, private and non-for-profit sector actors, can play important roles in supporting market development and technology uptake (see also element 7). Finally, the national government can explore how to stimulate demand pull through global trade in climate technology goods and services, while also considering how to harmonize this with its chosen developmental pathway.

Kenya Climate Innovation Centre	
The Kenyan Climate Innovation Centre provides holistic, country-driven support to accelerate the development, deployment and transfer of locally relevant climate technologies. It provides incubation, capacity building services and financing to Kenyan entrepreneurs and new ventures that are developing innovative solutions in energy, water and agribusiness to address climate change challenges.	
Find out more: https://www.kenyacic.org	

7. Innovation is more than technology

The ever-evolving technological landscape and changing user behavior means that we can only fully leverage the opportunities that climate technologies present us with by also undertaking innovation in other areas, such as on financing, business models and policy mechanisms. Positively, we are not short of exciting examples (for example, see box below) observed in all countries. And these may serve as the basis for the design of similar or related approaches suitable to other local environments.


On finance, venture capital and angel investors are growing alternative funding sources for supporting the development of climate technology prototypes into market-ready ones. Green bonds are beginning to provide significant financing for technological innovation, especially for diffusing mature technologies at large scale. Innovation in business models is also growing. For instance, innovative pay-as-you-go models are revolutionizing the use of pico-solar photovoltaic technologies in the developing world, especially in Africa. And new policy mechanisms such as feed-in tariffs or auctions are innovative ways to build markets and create demand. Finally, potentially revolutionary technologies, such as blockchains, the internet-of-things, nanotechnology and information communication technologies, have the potential to drastically alter the way we live our lives. For example, information communication technologies can facilitate the transfer of knowledge and ideas as they extend reach to remote locations and marginalized people (OECD, 2012). Perhaps these technologies will allow us to grasp the full potential of climate technologies to respond to our climate and development challenges.

Off-Grid Electric innovative business model for Africa	
Off-Grid Electric provides solar home systems to homes and businesses in rural Africa communities through an innovative financial product. They developed a modular pay-as-you-go solar photovoltaic product that is being used in Cote d'Ivoire, Rwanda and Tanzania.	
Find out more: http://offgrid-electric.com	

8. It's all about people and process

To have impact, technological innovation must be inclusive. An inclusive process is one that ensures that diverse and relevant expertise, knowledge and views are incorporated. Such a process may ensure that all key stakeholders are involved in the design, development, demonstration, deployment and diffusion of a given technology. By having contributed to the process, they will more likely support the technology's introduction and interruption of existing behavioral patterns. Such stakeholders may include governments, the public, civil society groups, non-governmental organizations, the private sector, academia, local communities, technology users, beneficiaries, and financiers. An inclusive process may also facilitate the incorporation of indigenous knowledge into the innovation process. By integrating indigenous knowledge, the innovation process may increase the technology's performance and adaptation to local settings, and its incorporation into traditional practices. An inclusiveness process will also ensure that stakeholders develop awareness of the technology's potential benefits, impacts and usages. Inclusive innovation may also facilitate grassroots entrepreneurship and help integrate marginalized groups into circuits of economic activity (OECD, 2012).

Through an inclusive process, the innovation process can also maximize its effectiveness as a builder of human capacity. In undertaking technological innovation, a country provides involved actors with opportunities to build their knowledge base and analytical capabilities. The building of this endogenous capacity supports the continuing development of the local workforce and the development of the endogenous skills required to drive a national low-emission and climate resilient transformation. Through such education, countries will develop the learning capacities that allow technological and developmental 'catch-up' to happen (OECD, 2012). The Technology Executive Committee recognizes the importance of endogenous capacities for successful technological innovation interventions. It will continue to work on related issues in 2018 and beyond, in response to a mandate of the Conference of the Parties.

Europe's Climate Knowledge and Innovation Community	
The Climate Knowledge and Innovation Community is Europe's largest public-private innovation partnership focused on climate change, consisting of companies, academic institutions and the public sector. Its mission is to bring together, inspire and empower a dynamic community to build a zero-carbon economy and climate resilient society.	
Find out more: http://www.climate-kic.org	

9. To go far we must go together

In the interconnected world within which we live, it is impossible to think of the innovation process as a purely national activity. Global value chains, information and communications technology and the global workforce highlight advanced interconnectivity and modalities that the innovation process can draw upon in undertaking technological innovation. Collaboration across frontiers (whether they be national, institutional or otherwise) allows participating partners (public, private, academic, non-governmental organizations, etc.) to share expertise, experiences, good practices and lessons learned, and draw on the comparative strengths of each other. Failure to collaborate may lead to duplication, inefficient resource allocation or ineffectual innovation outcomes.

The Paris Agreement acknowledges the importance of collaboration on innovation in its Article 10, paragraph 5. Notably, international collaborative efforts on technological innovation in the energy and agriculture sectors have existed for some time. For over forty years, for example, the International Energy Agency Technology Collaboration Programmes (TCPs, formerly implementing agreements) and the Consultative Group on International Agricultural Research have been responding to technology challenges in these areas. Another example is the Clean Energy Ministerial, which promotes policies and programs to advance the transition to a global clean energy economy. However, participation in these initiatives often is limited to major economies (TEC, 2017a), although the CGIAR is an example where developing country needs are the central focus of the international effort. Furthermore, the level of international collaboration on innovation in adaptation sectors (such as water and infrastructure) and in other mitigation sectors (such as industry or transport) is mostly unknown (TEC, 2017a). There are also on-going regional efforts (for instance the European Union Horizon 2020 programme, which provides opportunities for developing country participation) and bilateral efforts (such as agreements between the United States of America and India).

Moving forward, the challenge is to enhance these initiatives and build new ones in other sectors. Efforts that increase the participation of more countries may enhance their relevance, reach and impact in terms of contributing to global climate action, and build their ability to meet their Paris Agreement and sustainable development goals. Enhancing such efforts may play important roles in facilitating large-scale deployment of low-emission and climate-resilient technologies in these sectors. South-south cooperation can also play a complementary role, helping countries to build capacity and transfer knowledge on undertaking innovation processes in similar contexts (TEC, 2017b).

10. UNFCCC bodies: building coherence and synergies

The United Nations Framework Convention on Climate Change and its bodies can play important roles in coordinating and enhancing the coherence of innovation efforts. The Technology Mechanism, which aims to enhance the development and transfer of climate technologies, may play a key role. The mechanism's Technology Executive Committee can identify (as it is doing through this brief) ways that countries may be able to strengthen their technological innovation interventions both nationally and internationally for addressing climate change. As noted in its current workplan, the committee will continue its work on innovation and research, development and demonstration of climate technologies. Its aforementioned working paper and special event identify issues that may benefit from further examination. For example, it may further explore how countries can implement the technologies of their NDCs and national adaptation plans to 2030, to address the urgent need for immediate climate actions. This may include by identifying new collaborative arrangements for technology research, development and demonstration, including public-private partnerships (TEC, 2017a). It may also involve exploring how countries can create market pull which facilitates large-scale deployment of successfully demonstrated technologies. The committee may also explore how to facilitate further support to developing countries for building their broader innovation capabilities, crucial for implementing national mid-century strategies.

The Climate Technology Centre and Network (CTCN) will continue to play a key role in providing climate technology and policy assistance. The CTCN can respond to developing country requests for technical assistance on technological innovation issues, including by drawing on the expertise of over 300 network members. Indeed, recently the CTCN received requests related to developing national innovation centres. UNFCCC technology needs assessments may also play a role by helping developing countries to identify and prioritize their technological innovation needs and priorities. Outcomes of the assessment process, such as technology action plans, may facilitate strategic planning and implementation of innovation processes. Low-carbon development strategies may also support countries to strategically guide their climate technology innovation processes.

The UNFCCC Financial Mechanism's operating entities may also play important roles in supporting technological innovation activities. For over 25 years the Global Environment Facility has supported climate technology demonstration and deployment, including through its Poznan strategic programme on technology transfer. More recently the Green Climate Fund has emerged, and is providing dedicated funding to climate change activities, including for technological innovation. Currently, the Fund is exploring how it may support collaborative efforts at the earlier stages of the technological innovation process. To facilitate the Technology Executive Committee's further work on technological innovation, the Fund could annually share information with the committee on projects it has approved that support the scaling-up of climate technologies.

Finally, the bodies mentioned above are also building linkages with each other to facilitate collaboration for effective delivery of support to countries. And accredited entities and national focal points to these bodies are sharing experiences with each other on channeling such support. The wealth of technological and financial knowledge that these bodies hold creates huge potential for collaboration that can affect transformational climate action. And this includes on technological innovation. For instance, by bringing together their complementary sets of knowledge and experiences, these bodies could collaborate to identify policies and instruments that support efforts to enhance technological innovation (TEC, 2017a).

Effective UNFCCC collaboration on climate finance and technology

In 2017 it was announced that Ghana and Tonga will receive readiness and preparatory support from the Green Climate Fund for climate technology assistance delivered by the Climate Technology Centre and Network (CTCN). Tonga requested the CTCN's assistance to develop a national energy efficiency plan. This will assist it in meeting its nationally determined contribution. For Ghana, the CTCN will provide technology transfer and capacity building to national organizations and government agencies for dry season management and planning.

Find out more: <https://www.ctc-n.org/>, <http://www.greenclimate.fund>



Way forward

Technological innovation is a key part of the climate solution. Without scaling up and speeding up climate technology innovation, it will be difficult, if not impossible, for the world to achieve the Paris Agreement objectives and sustainable development goals. NDCs, national adaptation plans and mid-century strategies also present us with challenges of different time horizons. NDCs are focused on short term goals up to 2030, while mid-century strategies on a longer-term perspective to 2050 and beyond. In addition, national adaptation plans generally have medium to long-term perspectives. Stimulating innovation to address all three without compromising any, while also addressing urgent development concerns, present significant challenges. But the challenges are not insurmountable – and certainly worth addressing.

How do we scale up and speed up technological innovation? There are no simple answers. But tailored efforts can have an immediate and significant impact, and put countries on the path to low-carbon and climate resilient development. Ongoing efforts throughout the world highlight that change is possible, and not necessarily at a high cost. The Technology Executive Committee, through this brief, has highlighted key elements that can help to scale up and speed

up innovation efforts. It hopes that together these efforts can lead us to achieving our vision of a low-emission, climate resilient, and prosperous world.

Recent work of the Technology Executive Committee

Since its establishment in 2010, the Technology Executive Committee has undertaken significant work on technological innovation. Notably, in 2015 it produced a policy brief and key messages to the Conference of the Parties on national systems of innovation. That same year, the Conference of the Parties requested the committee to undertake further work on the research, development and demonstration of climate technologies. Since then, the committee has worked to respond to this request and continued related work on technological innovation. In 2017 the committee produced a working paper on enhancing the financing of the research, development and demonstration of climate technologies. It also held a major special event on technological innovation and climate change, bringing together more than 100 innovation experts from around the world. This policy brief is based on the working paper and workshop.

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