

# DISCUSSION PAPER

## Next steps towards a Climate Innovation Centre in Ghana

This discussion paper is part of the Technical Assistance to the Ghanaian National Climate Change Policy Framework (NCCPF). The analysis is supported by DFID.

### Abstract

A climate innovation centre is an institution aimed at enabling development through catalysing climate technology research, development, market creation and policy. This discussion paper discusses the possibilities, considerations and next steps for a Climate Innovation Centre (CIC) in Ghana based on new insights within the government of Ghana, a mapping of climate innovation in Ghana, new developments in the international climate negotiations and other multilateral processes, and analysis conducted by ECN.

The conclusion is that a Climate Innovation Centre can fill significant gaps in climate resilient development in Ghana. It seems important that a Ghana CIC does not become yet another institution that focuses on basic research in the area of climate change. Rather, it should connect the dots of the Ghanaian climate innovation system and act as a knowledge facilitator, also for the private sector.

Various models of climate innovation centres exist. Before choices are made for a model or a combination of models for Ghana, it is recommended to allow for a broad stakeholder process. The World Bank's infoDev programme could be a model for such a process. Such stakeholder engagement should be aligned with other policymaking processes on adaptation and low-carbon development, as well as related policy arenas, such as agriculture, transport, waste and energy.

## INTRODUCTION: A CLIMATE INNOVATION CENTRE IN GHANA?

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A climate innovation centre is an institution aimed at enabling development through catalysing climate technology research, development, market creation and policy. A Policy Brief published in October 2010 explains the considerations for a climate innovation centre in Ghana, going into the climate negotiations context, the practical choices for Ghana and examples of other countries. This discussion paper is the more in-depth follow-up of the earlier Policy Brief.

Ghana is a developing country with a fast-growing economy and population. This growth brings many benefits to development and general welfare. However, it also leads to problems that can inhibit development of the Ghanaian economy and reduce welfare in the longer term, for instance as a result of health problems due to air pollution, rising pressure on agricultural ecosystems that sustain livelihoods, deforestation and environmental degradation, depletion and waste of resources, and congestion and other transportation inefficiencies. From this perspective, addressing development and climate jointly can be beneficial for both issues.

To continue economic development in a sustainable way while resolving climate challenges as they emerge, it is essential that the country's innovation system is appropriately developed and that institutions function properly. Innovation is needed to develop national capabilities to face and resolve climate-related problems, particularly with regard to adaptation but also for the introduction of new energy and transport technologies that are needed for economic development. Sound institutions are needed to regulate technologies and for policymaking, but especially for implementation and policy compliance. For climate change-related matters, a climate innovation centre in Ghana could play an important role in fulfilling both innovation and institutional tasks.

This discussion paper will explore the role of a climate innovation centre by elaborating the following aspects:

- Rationale for a climate innovation centre in Ghana
- Embedding in the Ghanaian policy context
- Models of climate innovation centres
- Mapping climate change innovation in Ghana
- New developments on innovation centres at the international level
- Recommendations for next steps

## **RATIONALE FOR A CLIMATE INNOVATION CENTRE IN GHANA**

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Currently, the vast majority of global research and development (R&D) funding, for climate innovation and for other areas is spent in developed countries. However, it is becoming increasingly clear that innovation capabilities are key in developing countries, in order to be able to adopt, adapt and improve existing and new technologies in developing country markets. Without support of climate technology R&D in developing countries, these beneficial technologies are unlikely to be transferred (UNFCCC, 2010a).

Despite Ghana's relatively strong academic education base, many talented students move abroad for employment opportunities. There is a lack of innovation-intensive and intellectually challenging jobs in Ghana, which makes it hard to retain innovation capabilities in the country. A climate innovation centre can provide much-needed career opportunities for young scientists, engineers and entrepreneurs and is in line with national science and technology policies. International developments suggest that funding mechanisms for innovation centres could become available under the climate negotiations. Countries like India and Kenya are already responding to those in the context of the World Bank programme infoDev (see below). Ghana could be next in that programme and act as a lighthouse country for the instrument of innovation centres in the international climate negotiations.

In addition to the lack of R&D innovation capabilities, other barriers may occur once the technology has been demonstrated at scale and needs to be deployed routinely. Oftentimes, the investment climate for a new technology is unfavourable. There may be legal and regulatory barriers, the costs may be too high to compete with existing practices, and human capacity for operation and maintenance as well as low public awareness levels may inhibit the deployment of an otherwise beneficial technology. These challenges require a different approach to the innovation process, and different skills than for technology R&D. A climate innovation centre could also serve as a breeding ground for experts and as an enabler of climate technology markets.

## **THE GHANAIAN POLICY CONTEXT**

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The Government of Ghana recognises the social and economic impacts, and the development challenge arising from climate change. Following the 2008 elections and the resulting change in

government, the Ghana Ministry of Environment, Science and Technology (MEST) was reconstituted and endowed with greater responsibility for coordinating climate change activities across Ministries, Departments and Agencies (MDAs). In addition, the Ministry of Finance and Economic Planning (MoFEP) has become more strongly involved in overseeing climate related finance flows, and the National Climate Change Committee (NCCC) was strengthened and given the mandate to initiate the process of developing a National Climate Change Policy Framework (NCCPF), which aims to:

- raise awareness among decision makers about climate change impacts and their management
- create a policy framework for climate-resilient and low-carbon economic growth that is compatible with and integrated into national development plans and budgeting processes
- provide a mechanism for implementing and financing the policy framework,
- create the foundations for the development of detailed sector specific implementation plans
- link and harmonise existing climate change initiatives and opportunities

In November 2010, MEST published a discussion document (MEST, 2010), which is used as the basis for the detailed development of the policy framework. The document suggests an overall structure for Ghana's response to climate change based on three objectives, namely low-carbon growth, effective adaptation to climate change and social development, and seven supporting pillars, i.e. governance and coordination, capacity building, research and knowledge management, finance, international cooperation, communication, and monitoring and reporting. The NCCPF is expected to be a step forward towards improved coordination and harmonisation of initiatives, towards aligning climate change and development objectives, and towards mainstreaming climate change considerations into government decision making (MEST, 2010).

A group that is often forgotten in the policy context is the private sector. Only few climate change related initiatives in Ghana involve the private sector and attempt to suit their needs (Würtenberger et al, 2011). Similarly, there are no private sector representatives on the National Climate Change Committee, although it does include civil society representatives. This aspect is seen as lacking particularly in the climate innovation system in Ghana (STEPRI, 2010).

## **MODELS OF CLIMATE INNOVATION CENTRES**

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Climate innovation centres (CIC) can assume many different designs. Over the past years, various models of climate innovation centres have been proposed, and academic studies have been conducted to evaluate their effectiveness. Most studies agree that a climate innovation centre should lead to employment benefits and enhanced capacity in a country to address climate change – through adaptation to and mitigation of climate change. It should lead to education and training of professionals and collect the data and knowledge that can lay the basis for sustainable development. But apart from that, the models vary greatly.

The idea of climate innovation centres seems to originate from India, where Indian government officials, notably Dr. Ajay Mathur, currently director of the Bureau for Energy Efficiency in India, pushed for the concept of a network of innovation centres. Massive transfer of technologies, including deployment and R&D, he says, are essential for addressing climate change and achieving sustainable development. Dr. Mathur argues for product-focussed innovation centres, resulting in

concrete, problem-solving products that can be introduced to and further diffused by the market. The focus would be on products fulfilling unaddressed needs.

Prof. Ambuj Sagar, once a colleague of Dr. Mathur, sees climate innovation centres broadly as “institutional arrangements that can advance technology innovation to meet the energy and climate change needs of developing countries”. Sagar, with New Energy Finance, also worked on climate innovation centres with the World Bank funded organisation of infoDev (infoDev et al., 2010). Based on a review of capacities in existing innovation centres around the developing world, they arrive at five areas of gaps: access to finance, technology information, business support, market analysis and policy for innovation. In their “practical guide for designing a CIC”, the authors suggest functions for a CIC, such as:

- Technology information, assessment and applied R&D;
- Market analysis, training and other business advisory services;
- To help policymakers streamline the regulatory framework where it is inhibiting technology development and diffusion, and introduce standards where demand pull is appropriate;
- To increase and develop finance options, including innovative and locally appropriate ones, with investors and government;
- Keeping the overview of the climate innovation system.

The infoDev work on climate innovation centres is relatively business and private sector-oriented. Also in Ghana, a CIC could help to strengthen private sector engagement, educate developers on how to attract finance and develop businesses in climate-resilient and low-carbon technology.

The United Nations Environment Programme, the US National Renewable Energy Laboratory and the Energy research Centre of the Netherlands have also released an exploratory document on potential networks of climate innovation centres, under or outside of the UNFCCC (UNEP et al., 2010). Taking less of a bottom-up view than the infoDev work, the paper is also grounded in empirical evaluation of existing innovation centres and networks in developed and developing countries and worldwide. However, it does focus more on the network in which CICs could function, and broadly on different dimensions, choices and elements of a network of innovation centres.

UNEP et al. (2010) come up with five different models, which vary mainly in their focus on either RD&D or market diffusion, their national or regional aim and the degree to which they are centralised globally:

1. Network of climate technology research, development and demonstration (RD&D) centres
2. Network of national centres for market development, including a Variant A (with regional coordinating centres and national hubs) and a Variant B (only national centres with no regional coordination)
3. Network of hybrid RD&D and market development centres, combining Options 1 and 2 in regional centres. Variant A includes national hubs to the regional centres; Variant B does not.
4. Global technical centre working with multiple (external) networks of centres and experts.
5. Interlinked networks of separate RD&D centres and national market development centres, which are parallel networks of Options 1 and 2, linked by a strong secretariat/global technical centre.

Practically, the World Bank and infoDev are in the process of starting up various climate innovation centres around the world. The first two will be located in Kenya and India. Business plans have been

completed (infoDev, 2010a; infoDev, 2010b), based on an extensive stakeholder process. The CICs in Kenya and India have slightly different aims and focus as the two countries have different gaps and barriers. While Kenya has a broader capacity building need, India identifies this need in particular in small and medium sized enterprises. While Kenya aims at obtaining access to a variety of international mechanisms, India is looking specifically at financing options. In Kenya, technology information and market intelligence are envisaged in the CIC, whereas in India that is not considered an issue.

## MAPPING CLIMATE INNOVATION IN GHANA

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### Ghana and innovation

Evidence from a rich body of literature on innovation in the developing world suggests that science and innovation – i.e. the production and use of knowledge as well as the creation and adoption of new products, services and ways of doing things – are key to economic growth and improved standards of living, and in achieving the goals of sustainable development (Lall, 1992). Ghanaian policy-makers and politicians occasionally make reference to the roles that science, technology and innovation play in economic development, and why Ghana should invest more in its national innovation system. However, these statements are often not supported or followed by specific and coordinated actions.

The collective network of private and public actors involved in innovation is called the National Innovation System (Lundvall, 1992). Ghana's innovation system is relatively small and underdeveloped compared to those of middle-income countries such as India and Brazil. While Ghana's overall economic and political governance framework has been improved considerably over the past decade, policies and institutions for science, technology and innovation have not been modernised and aligned to economic growth, human development, and most importantly to environmental sustainability goals.

Ghana's overall research and innovation efforts are underfunded, thus affecting climate innovation. Ghana's expenditure on research and innovation has fluctuated between 0.3 and 0.5% of GDP. It does not compare well to other middle-income countries in Africa, such as South Africa (0.87%), although it does look better than least-developed countries. Most of Ghana's expenditure goes to salaries in the public research and innovation institutes. Even with the establishment of the Science and Technology Research Endowment Fund (STREFund) there is no indication that allocations for research and innovation activities will increase. Ghana does not have an institution dedicated to funding of research and innovation activities. Although Ghana's government recognises the role of knowledge and innovation in developing the economy and this recognition is reflected in various government statements such as Vision 2020, deliberate efforts to ensure that the national innovation system supports climate innovation and entrepreneurship or the establishment of a national climate innovation system within the national innovation system have not been pursued.

### Public institutions for climate innovation

The Science and Technology Policy Research Institute of the Council for Scientific and Industrial Research (CSIR-STEPRI) undertook an assessment of Ghana's capacity for climate innovation and

entrepreneurship in 2009. The investigation included public and private universities, public research institutes, government agencies and non-governmental organisations. Each of these institutions has a different role. Government and government agencies make and implement specific policies and are therefore indispensable for a functioning innovation system. Civil society organisations play a role in advocating issues that need to be put on the agenda and in implementing pilot studies. Universities and public research institutes implement research. Table 1 provides an overview of government institutions and civil society organisations that are active in climate innovation. Table 2 shows the institutions involved in research.

*Table 1 Overview of government and civil society institutions relevant to climate innovation in Ghana.*

<b>Name of Organisation</b>	<b>Type of Organisation</b>	<b>Area of Focus</b>
Concern Universal	Civil society organisation	Advocacy and adaptation measures
Council for Scientific and Industrial Research	Public research organisation	Research and technology development in renewable energy and policy*
Energy Commission	Government	Policy and Regulation
Energy Foundation	Civil society organisation	Assist industrial energy consumers to improve energy management
EnterpriseWorks VITA	Civil society organisation	Energy-saving cook stoves
KITE	Civil society organisation	Advocacy, enterprise development and research
Ministry of Energy	Government	Policy making
Ghana Standards Board (GSB)	Public agency	Quality tests and quality assurance certificates
Environmental Protection Agency (EPA)	Public agency	Environmental impact assessment of technologies and innovation activities, licensing
Ghana Investment Promotion Centre (GIPC)	Public agency	Coordination and monitoring of investment activities Register of technology transfer agreements
Registrar General's Department (RGD)	Public agency	Custodian of intellectual property law, register of companies, patent information, information source for technologies and innovation activities in Ghana
National Board for Small Scale Industry (NBSSI)	Public agency	Promoting the development of micro- and small-scale enterprises

\*For more details, see Table 2

Table 2 Overview of public research institutions relevant to climate innovation in Ghana.

Name of organisation	Type of organisation	Area of focus
Crops Research Institute	Council for Scientific and Industrial Research	Drought, food crops, climate change adaptation
Savannah Agricultural Research Institute	Council for Scientific and Industrial Research	Drought, food crops, climate change adaptation
Building and Roads Research Institute	Council for Scientific and Industrial Research	Cooling in residential buildings
Forestry Research Institute	Council for Scientific and Industrial Research	Ecosystem services, forestry, fire management
Institute of Industrial Research	Council for Scientific and Industrial Research	Renewable energy, particularly solar and wind
Water Research institute	Council for Scientific and Industrial Research	Climate change impacts, adaptation in water supply and harvesting
Ghana Atomic Energy Commission	Public research organisation	Research and development of nuclear energy
Science and Technology Policy Research Institute	Council for Scientific and Industrial Research	Climate innovation policy research
Kwame Nkrumah University of Science and Technology (KNUST)	Public university	Education and training Energy Centre: renewables Technology Consultancy Centre: Technology transfer
University of Ghana (Legon)	Public university	Education and training Impacts and adaptation
University of Cape Coast	Public university	Education and training

### Climate innovation activities in the private sector

Ghana has a relatively small manufacturing sector. In 2006 there were 25,931 companies active in manufacturing. 85 percent of these were small enterprises employing up to 9 persons. ‘Only 41 manufacturing firms employ more than 500 people.... It can be concluded, that the manufacturing industry is dominated by small and medium enterprises...’ (UNIDO and Government of Ghana, 2006). Approximately 65 percent of capital goods in Ghana is imported. High costs of raw material, lack of credit due to high interest rates and demand of financial institutions for collateral, lack of modern equipment and power outages are some of the causes of the underdeveloped manufacturing base. Given this situation, manufacturing companies are unable to establish in-house research, technology development and innovation departments.

Ghana has a variety of financial institutions. Most of them are commercial and development banks, such as Barclays Bank Ghana Ltd., Ecobank Ghana Ltd. and Ghana Commercial Bank Ltd. There are also a multitude of registered rural banks in the country. Traditionally, these financial institutions are not directly involved in financing research, technology development and innovation projects; however there are exceptions such as the Agricultural Development Bank and the National Investment Bank: In the past, the Agricultural Development Bank has contracted the CSIR to conduct

agricultural research while the National Investment Bank has contracted the Ghana Atomic Energy Commission (GAEC) to conduct research on the industrial use of atomic energy. There is also a growing number of commercial banks and non-bank financial institutions that are interested in providing finance for 'sustainable development projects', climate innovation projects and entering into carbon financing. These include Ecobank, Standard Chartered Bank, Stanbic, Barclays Bank and the investment company E+Co.

Table 3 lists some of the entrepreneurs in climate innovation activities. Most of them are found in the energy and power sectors.

*Table 3 A selection of private sector actors involved in climate innovation*

<b>Name of Organisation</b>	<b>Type of Organisation</b>	<b>Area of Focus</b>
Criterion Gold River Enterprise	Private sector	Photovoltaic system installations
Danafco Engineering Ltd	Private sector	Photovoltaic system installations
E and Co.	Private sector	Financing climate innovation
Ecobank Ghana Limited	Private sector	Financing 'sustainable' development projects
Environment Technology Limited	Private sector	Biogas technology
Kludjeson International Ltd	Private sector	Photovoltaic system installations
Pheebe's Company Limited	Private Sector	Biogas technology
Biogas Technologies West Africa Limited	Private Sector	Biogas technology
Solar Electric Power Company	Private sector	Photovoltaic system installations
Solar Electric Systems	Private sector	Photovoltaic system installations
Solar Light Company Limited	Private Sector	Photovoltaic system installations
Deng Limited	Private sector	Technology solutions provider and equipment supplier in renewable energy and water Filtration and Irrigation
TMT Energy	Private Sector	Wind energy
Tropical Energy Resources	Private Sector	Waste to energy
Volta River Authority	Public power company	Hydro electric power generator
Zoomlion Ghana Limited	Private sector	Waste to energy

### **Observations on climate innovation in Ghana**

In summary, it can be said that Ghana's climate innovation system has a multitude of actors: research, technological development and education institutions, including institutions of higher

learning and training, some technology support and regulatory agencies such as ministries, departments and agencies dedicated to public policy-making and coordination; some small and medium scale enterprises both locally owned and foreign companies, and a good number of banking and non-banking-financial institutions. However, the climate innovation system needs to be characterised as lacking coordination and interaction and therefore does not make use of the capacity present in the country.

Additional observations can be made. First of all, research should not be done in isolation. Pre-commercial and applied research should have strong links with market actors in the private sector, in order to assure that innovations reach the market and can be deployed. In a study of ICTs and development in Ghana, Zachary (2003) notes poor links between Ghanaian engineering institutions, particularly university faculties, and private companies. Stronger collaboration with the private sector for commercialisation and deployment is needed in all research institutions.

Second, although the human capabilities are relatively developed in Ghana, university departments and research institutions are often challenged in terms of availability of modern laboratories and equipments. That means that state-of-the-art analysis, for instance for adaptation and modification of technologies to suit local circumstances, consumer demands and markets, cannot be done in the country. Most small- and medium-scale enterprises largely rely on old technologies for production while foreign large corporations conduct R&D in their home countries.

Third, the innovation landscape is fragmented and characterised by weak links and absence of synergies between and among the many institutions in Ghana. Ghana's public R&D and higher education institutions also have weak relations and limited interactions. There are very few joint or collaborative projects between public research institutions such as the CSIR and universities. The few joint activities that are undertaken tend to be ad hoc and not necessarily focused on technological innovation.

## **NEW INTERNATIONAL DEVELOPMENTS ON INNOVATION CENTRES**

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In various international bodies, there is increasing attention for innovation activities in developing countries. At the United Nations Framework Convention on Climate Change meeting in Cancun of December 2010, a Technology Mechanism was established with the aim of supporting technologies for mitigation of and adaptation to climate change. The Technology Mechanism is particularly aimed at developing countries and so far contains two main elements: a Technology Executive Committee (TEC) and a Climate Technology Centre and Network (CTCN) (UNFCCC, 2010b).

Although it has only just been established and many of the modalities still need to be agreed upon, it is clear that the TEC will be responsible for the strategic guidance of the Technology Mechanism, including identification of issues and needs, and guidance on policies and measures.

The CTCN's focus is mostly on implementation and practical support. This can be training and capacity development, but also twinning arrangements for R&D collaboration and facilitation of partnerships of existing organisations (UNFCCC, 2010b). At the moment, it is unclear how the Technology Mechanism will be funded, but it is likely that the Green Climate Fund, also agreed on in Cancun, will contribute.

In conclusion, the new Technology Mechanism, including a climate technology centre and network, could be looking for countries to set up pilot activities in the near future. This could be an opportunity for advancing climate innovation in Ghana, through a centre, international R&D collaboration or other policies.

## CLIMATE INNOVATION CENTRES: NEXT STEPS FOR GHANA

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Ghana has expressed interest in establishing a national climate innovation centre. This paper concludes that there is a gap to be filled in the climate innovation system in Ghana, and outlines considerations and arguments for further pursuing a climate innovation centre. It seems important that a Ghana CIC does not become yet another facility where basic research is carried out. Rather, it should connect the existing dots of the Ghanaian climate innovation system and act as facilitator for knowledge exchange, including with entities in the private sector.

This paper has provided the narrative for a climate innovation centre in Ghana, consisting of three parts: first, Ghana, through its MEST discussion paper presented in Cancun, has expressed a clear commitment to and interest in climate-resilient and low-carbon development. Second, this paper has demonstrated that there are gaps to be filled in the climate innovation system, in particular regarding links with the private sector. Third, there is international interest in taking this further, from institutions such as infoDev and the United Nations Framework Convention on Climate Change. This interest can be materialised, as Kenya and India have already shown with the infoDev programme. What are the next steps that have to be taken?

Before choices are made about a design and function of a climate innovation centre, or a combination of functions, it is recommended to allow for a broad stakeholder process. The infoDev programme could be a model for such a process. Such stakeholder engagement should have a clear and well-defined role for the Government of Ghana, and be aligned with other policymaking processes on adaptation and low-carbon development, as well as related policy arenas, such as agriculture, transport, waste, and energy.

For international embedding, it is recommended that Ghana presents itself as a serious candidate for piloting a climate innovation centre. Starting a conversation with infoDev is a first step. Another option is to fortify its international influence by nominating and promoting a suitable candidate for the Technology Executive Committee in the Technology Mechanism.

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## AUTHORS AND CONTACT INFORMATION

This policy brief is written by

Heleen de Coninck (ECN)

Laura Würtenberger (ECN)

Gordon Akon-Yamga (STEPRI)

For more information, please contact:

Heleen de Coninck

Energy research Centre of the Netherlands

Email: [deconinck@ecn.nl](mailto:deconinck@ecn.nl); phone: +31 224 564316

Energy research Centre of the Netherlands (ECN)

Unit Policy Studies

Radarweg 60

1043 NT Amsterdam

The Netherlands

Phone: +31 224 564431

Fax: +31 224 568339

[www.ecn.nl/ps/iec](http://www.ecn.nl/ps/iec)