Investing in Clean Energy

How to maximize clean energy deployment from international climate investments

Global Climate Network discussion paper no. 4 November 2010

The Global Climate Network

The Global Climate Network (GCN) is a collaboration of independent, influential and progressive research and policy organisations in countries key to tackling climate change. Together, members of GCN are committed to addressing the constraints faced by sovereign governments in agreeing international action.

The GCN aims to help governments clear a pathway towards an effective and fair international agreement for avoiding dangerous climate change by proposing bold low-carbon policies and using data and analysis to persuade policymakers that climate change mitigation is in their interest.

GCN is working to:

- **Address** the political (economic, social and cultural) constraints barring the way to action by bridging the divide between domestic and international policy
- **Promote** equitable solutions that take into account the huge development, financial and energy challenges countries face
- **Champion** ideas and innovations to help construct a new political narrative that links action on climate change with enhanced economic and social well-being.

Alone, each GCN member has significant credibility and influence. By producing joint research, staging events together and seeking to influence policy, GCN can help bridge the dangerous divide that exists and is currently widening between international negotiations and national politics.

GCN members are:

ippr, London, also acting as the secretariat for the Network: The UK's leading progressive think tank with a strong track record on research and policy.

Center for American Progress, USA: Founded by John Podesta, former Chief of Staff to President Clinton.

Research Centre for Sustainable Development, China: An institute of the Chinese Academy of Social Sciences. Dr Pan Jiahua, its director, is one of 12 members of the Chinese Experts Committee for Climate Change.

The Energy and Resources Institute, India: The country's leading climate and energy research institute whose director-general, Dr Rajendra Pachauri, chairs the UN's Intergovernmental Panel on Climate Change and is a close adviser to the Indian government.

Bellona Foundation, Norway: Bellona is renowned internationally for its groundbreaking work on carbon capture and storage and other important low carbon technologies.

International Centre for Energy, Environment and Development, Nigeria: ICEED has expertise in climate change and energy policy. Ewah Eleri, its director, is lead author of Nigeria's Renewable Energy Master Plan.

The Climate Institute, Australia. Set up in 2005, the Institute is a leading voice in climate research and advocacy, pioneering clean technology and investment solutions with government and business.

IMBEWU Sustainability Legal Specialists, South Africa: An influential Johannesburg based legal consultancy specialising in sustainability law with a strong climate change focus.

Dr Rajendra Pachauri (see above) and Lord Chris Patten of Barnes, former European Commissioner for External Affairs, are GCN's first patrons.

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Executive summary

Finance is central to international negotiations on climate change. The 1992 United Nations Framework Convention on Climate Change (UNFCCC) obliges industrialised countries to help the developing world meet the costs of reducing greenhouse gas emissions. However, no agreement has yet been reached concerning the overall sum of developing country climate costs or how finance should be raised and spent.

The Copenhagen Accord, supported now by more than 120 countries, states that, 'developed countries commit to a goal of mobilizing jointly $100 billion a year by 2020 to address the needs of developing countries'. While this sum falls short of credible estimates of 2020 developing country costs and the Accord does not state how the finance will be raised, it is now taken by many to represent an international climate financing target.

Perhaps because of existing obligations under the UNFCCC, the debate about how and how much climate finance will flow from developed to developing countries has always been highly politically charged. The direct and wider economic impacts of the 2008/09 financial crisis have left many developed country governments with higher levels of public indebtedness than in recent years. The United States, for example, is projected to have a likely debt-to-GDP ratio of 72.6 per cent in 2011, compared with a pre-crisis ratio of 42.2 per cent in 2007. Consequently, many OECD governments are cutting public expenditure and thus face constraints when committing funds to meeting international climate finance obligations.

Beneath the high estimates of global costs and current pledges of finance, what price tags should we attach to particular actions in particular countries? What is the best way for some of the ambitious plans already published by developing countries to be financed, through what mechanism and from what sources? These are the questions that many within the community that follows climate change negotiations, policymakers and financiers are now asking.

The Global Climate Network (GCN) set out to answer these questions in a two-stage study of climate change financing, focused on mitigation and specifically clean energy. Stage one examined in detail the costs of installing clean energy capacity in GCN member developing countries, according to existing or anticipated government plans, and proposed a range of mechanisms to help ensure the required levels of investment are available. Stage two engaged policymakers, affected firms, banks and finance professionals and other experts in a series of national dialogues. Participants were asked for their views on real-world barriers to financing and to respond to the outcomes and proposals from stage one of the study.

Identifying climate mitigation needs in developing countries

This paper summarises four separate, national studies, examining and making estimates of the costs of installing renewable and low-carbon electricity generation capacity in China, India, Nigeria and South Africa. Specific sectors examined are: hydro, wind and solar in China; solar in India; gas and small-scale hydro in Nigeria, and solar and wind in South Africa. These have been identified as priority sectors for each nation by the respective governments.

GCN estimated the average annual cost in each national sector between 2010 and 2020 and compared these costs with 2009 levels of actual investment. We find that capital expenditure across the sectors and countries must almost double from around $34 billion in 2009 to an average of $63.6 billion between 2010 and 2020. Excluding China, for which 2009 investment in its wind sector exceeded estimated average costs for 2010–20, the average annual investment needed is $15.93 billion but the current gap is around $15.73 billion. India, South Africa and Nigeria are currently only investing $0.2 billion, a tiny fraction of what would be required to fulfil existing government ambitions.

In the case of many clean energy technologies and especially those included in this study, the high per-unit energy generation costs compared with incumbent technologies – known as incremental costs – largely result from capital costs: they are cheap to run but very expensive to install. Thus the investment challenge is twofold. Developing countries need help in gaining access to capital, because they are seen as riskier jurisdictions in which to invest (and the technologies themselves as riskier investments). Furthermore, anything that can reduce the investment costs, by making the technologies or the capital cheaper, will reduce the incremental cost.

A solution to the capital problem is fast becoming the holy grail of clean energy financing. The United Nations Advisory Group on Finance – charged by Secretary-General Ban Ki-moon with analysing how $100 billion of climate finance might be raised – will report within the next few days. It examines a range of proposals and options, but is expected to argue that 'careful and wise use of public funds in combination with private funds can generate truly transformational investments' and calls for further work in this area.

Applying itself to this challenge, GCN has looked in detail at how governments can intervene to help increase the sum and reduce the cost of clean energy investments in developing countries. While we acknowledge in this paper that the issue of how to finance developing country incremental costs remains open and highly contentious, it is increasingly clear that governments should commit a proportion of a future climate funds to help provide incentives and reduce risks for private investors, thereby reducing the costs of capital and sparking a rapid deployment of clean energy.

Mechanisms to leverage private finance

GCN proposes five mechanisms that could be used by individual developed country govern-ments or an international climate fund to help developing countries access private capital. These are:

1. **Loan guarantees.** Governments agree to underwrite loans to clean energy projects with taxpayers' money to safeguard the private investor against defaults.

2. **Policy insurance.** Governments could insure investors against the risk of policy uncertainty. They could do this through standard insurance or by issuing 'put' options that they would buy back if policies changed.

3. **Foreign exchange liquidity facility.** Governments can offer credit to help guard against risks associated with currency exchange fluctuations.

4. **Pledge fund.** A developed country government-backed fund that would identify and analyse smaller, relatively low-risk clean energy projects and offer these to investors that would pledge to invest a set amount of equity capital up front.

5. **Subordinated equity fund.** For higher risk clean energy projects, a government-backed fund would invest a proportion of the equity but receive returns last.

GCN estimates that for every US$1 of public finance invested, between US$2 and US$10 could be leveraged from the private sector by using these mechanisms. A GCN–Center for American Progress paper containing a greater level of detail on these mechanisms is published alongside this summary.

Findings from GCN national dialogues

The purpose of the national dialogues, which in some cases took the form of workshops and in others the form of face-to-face interviews, was to explore the barriers to private sector investment in low-carbon energy technologies, projects and programmes, and the potential policy solutions and instruments that could leverage private investment. Researchers from each GCN member organisation followed a common format that was agreed collectively beforehand. The following major themes emerged.

A. Barriers to private sector investment in low-carbon energy
A lack of policy instruments to guide investment; the relatively high costs of renewable energy technologies; high risks and relatively low returns; potential financers' limited experience of clean energy technologies and lack of technical expertise to appraise investments in low-carbon sectors; and poor competition in energy markets, were all cited as barriers to private investment.

B. Performance of existing financial instruments and mechanisms
Subsidies for clean energy, such as feed-in tariffs, were viewed as important, alongside measures to incentivise banks to reduce lending to fossil fuel-based projects, existing international funds for climate mitigation, and use of the Clean Development Mechanism.

C. Role of the public sector
Public funds have a role in helping to make clean energy technologies commercially viable, especially by supporting research, development and demonstration, supporting deployment and commercialisation, and creating infrastructure to support low-carbon energy projects.

D. Views on GCN-proposed leveraging mechanisms

Loan guarantees and policy insurance mechanisms were seen as being the most useful of the five mechanisms proposed by GCN. A subordinated equity fund was viewed favourably in developing countries, but not in developed countries. A foreign exchange liquidity facility was also considered important in the context of investments in developing countries in general.

Conclusions

GCN's study, along with supporting literature, points to the need for an investment partnership between public and private sectors with three equally important key elements, all of which are critical in the development of an international climate change fund that is consistent with the UNFCCC.

1. **Using developed country public funds strategically**: Governments collectively should allocate a proportion of the proposed $100 billion fund to foster an investment partnership with the private sector. This will help lower the costs of capital and, if successful, drive innovation, which will also make clean energy cheaper and so reduce the resulting incremental costs.

2. **Ensuring stable long-term policy is in place in developing countries**: A second key element in a clean energy investment public–private partnership is the use of deployment mechanisms and other public policy tools in developing countries to create the environment for private sector investment.

3. **Addressing incremental costs**: Finally, it is GCN's view that there is a critical role for clean energy investment public–private partnerships in dealing with incremental costs. GCN's study has primarily examined capital costs and investment barriers. As those challenges are met, however, the resulting deployment of clean energy will in most cases lead to a per-unit energy cost that is higher than that offered by incumbent sources. Any international fund must be capable of assisting with incremental costs too, ensuring that they do not fall on the shoulders of poorer consumers in developing countries with limited ability to pay.

Financing climate change mitigation

What can unequivocally be concluded about climate finance is that significant amounts of additional funds will be necessary to achieve a successful, global low-carbon transition and for long-term climate protection. It is also the case that developed nations have made clear commitments to help developing nations meet these costs.

In article 4.3 of the United Nations Framework Convention on Climate Change (UNFCCC 1992), developed countries listed in Annex II (those that were members of the OECD in 1992) are obliged to support 'agreed full incremental costs' of actions to tackle climate change in developing countries. This is in line with the principles outlined in article 3.1 of the Convention, which states that countries should take steps to protect the climate system 'in accordance with their common but differentiated responsibilities and respective capabilities'.

Numerous economic models, while differing significantly in their quantification of costs, agree that capital expenditure above 'business as usual' will be required for climate mitigation (IEA 2009). In addition, some approaches to climate mitigation, such as the fitting of carbon capture technology to existing plants, will incur higher running costs. These two areas of increased expenditure are known as incremental cost and lead to a loss of economic welfare at the level of the household, the nation state and globally.[1]

This loss of welfare appears small by comparison with the size of economies and expected improvements in welfare over time (Stern 2006, McKinsey and Company 2009) and when compared with the likely economic costs of a profoundly altered global climate. However, as has been well noted, while the economic task appears relatively trivial, difficulty lies in the political economy.

1 For instance, see Stern (2006), IPCC (2007), UNFCCC (2008a), Stern (2009), McKinsey and Company (2009) and European Commission (2009).

Persuading individuals and nations to accept higher energy, transport and other costs in the short term in order to fund investments to protect economies and the global climate in the long term is a crucial political conundrum (Aldy et al 2003: 85–110, Giddens 2009). It is a profound challenge in the industrialised world, especially against a backdrop of fiscal austerity, and in developing countries, where per capita GDP is still significantly lower.

Since the UNFCCC places the liability for 'agreed' developing country incremental costs on the shoulders of developed countries, finance has tended to be viewed not only as the issue that lies at the heart of the current global impasse but also as a proxy for the global reduction of greenhouse gas emissions (Baer et al 2009).

While arguably weak in terms of mitigation commitments,[2] the Copenhagen Accord (UNFCCC 2009) makes a clear financial commitment that is consistent with the UNFCCC. It states that 'developed countries commit to a goal of mobilizing jointly $100 billion dollars per annum by 2020 to address the needs of developing countries'. However, it stops short of determining the ratio of funds that will be spent on mitigation and adaptation respectively, and of identifying any specific mechanisms or sources of finance other than 'public and private, bilateral and multilateral, including alternative sources'.

Developing country costs

The Accord's 2020 finance commitment – which includes mitigation and adaptation costs – may also fall short of some of the more recent estimates of incremental costs in developing countries. A report by the World Bank (2010a) finds that developing country mitigation costs could range between $140–175 billion[3] per annum by 2030, while adaptation costs could average $30–100 billion per annum over the period 2010–2050.

Alternatively, Project Catalyst (2009) estimates that incremental developing country mitigation and adaptation costs will average between $85–120 billion per annum during the period 2012–2020, with the annually ramped-up total reaching $120–160 billion in 2020.[4] It could therefore be argued that the Accord's $100 bil-

2 See for instance www.climateactiontracker.org
3 Unless otherwise noted, all dollar figures are in US dollars.
4 This includes 13–26 billion per annum for adaptation. The mitigation cost reflects the incremental cost for the cost-positive elements of the marginal abatement cost curve in developing countries at a 10 per cent discount rate by 2020 needed to achieve a 450 ppm pathway and assuming developed countries implement all domestic reductions costing less than $78 billion.

lion target falls within the low end of cost estimates, but only if this was an average annual total between 2012 and 2020 rather than an 'end goal' for 2020.

The Copenhagen Accord does not specify how the $100 billion finance commitment will be raised. The UN Secretary General's Advisory Group on Finance, an informal but high-level group of heads of state, experts and finance ministers, has been charged (although not by the Conference of the Parties to the UNFCCC) with examining all available options for finance sources (UN 2010). It is expected to report in early November 2010 and is considering how public funds may interact with private finance to leverage higher levels of investment in reducing emissions.

Private finance is undoubtedly needed, since additional annual capital costs for mitigation in developing countries range between $265 billion and $565 billion by 2030, according to the World Bank (2010a). The results of this study support the high capital expenditure estimates that populate climate finance literature.

In the case of renewable energy technologies, where running costs are generally low, it is the investment costs that will comprise the bulk of the *incremental* cost identified above. In developed countries, incremental costs are generally passed on to consumers via carbon or energy pricing mechanisms. But if developed countries adhere to the letter of the UNFCCC's article 4, then they would be liable for these costs in developing countries also, and much of the $100 billion would therefore need to come from public and other so-called innovative sources.

Developed country governments are more highly indebted now than in recent years. OECD countries are likely to post a collective debt stock that exceeds $28 trillion.[5] The United States, for example, is projected to have a likely debt-to-GDP ratio of 72.6 per cent in 2011, compared with a pre-crisis ratio of 42.2 per cent in 2007.[6] Consequently, many OECD governments are cutting public expenditure and thus face constraints when committing funds to meeting international climate finance obligations.

Sources of finance

Developing countries will need help from developed countries to access capital finance and to fund incremental costs. A number of sources and instruments –

5 See http://stats.oecd.org/Index.aspx?DataSetCode=GOV_DEBT. In 2009, according to data gathered hitherto, total OECD debt stock was $19.8 trillion, however this excludes data for Japan, whose debt stock in 2008 was $8.6 trillion.
6 See OECD 'General government net financial liabilities', available at: www.oecd.org/dataoecd/5/51/2483816.xls

either already in operation or newly proposed – may play a part in meeting developing country financing needs.

Carbon market transfers, through instruments such as the Clean Development Mechanism (CDM), are currently the primary means by which consumers in developed countries finance developing country mitigation.[7]

In 2008, project-based carbon market transactions – including those in the CDM, the voluntary market and Joint Implementation projects – were worth almost $7.3 billion. In 2009, with energy demand in Europe – the main market for carbon credits – weakened and confidence in the carbon market undermined by the lack of certainty as to what may happen post-2012, the value of project-based transactions halved to less than $3.4 billion (World Bank 2010b).

The recovery and growth of the carbon market is largely dependent on the policy environment set by governments. The failure of Kyoto Protocol countries to commit to a further period of emissions reductions post-2012 and of the United States to pass comprehensive legislation to cap its emissions suggests that the future of the CDM and other mechanisms remains uncertain and, therefore, that flows of carbon market finance to developing countries are likely to remain low.

Revenues derived from the **auctioning of emissions permits** within developed country carbon trading mechanisms could also be used to help fund developing country incremental costs. Government auctions of emissions permits would effectively transfer money from consumers, who would incur the purchasing costs passed on by companies, to national treasuries where, in theory, the additional revenue could be used to increase expenditure on low-carbon initiatives, including to meet international obligations.

According to the European Commission, if by 2020 all sectors capped in the EU Emissions Trading Scheme (EUETS) were required to purchase permits at auction and did so at an average price of €40 per tonne, some €75 billion per year would be raised (European Commission 2008). However, the actual figure may be much lower: the Commission's estimates for the 2013–2020 period suggest that only around 50 per cent of permits will be auctioned[8] and EUETS carbon prices

7 Evidence from Europe, which currently operates the world's largest emissions trading scheme, suggests that even when all company permits were given to capped industries for free, companies still passed costs to consumers. See ECN (2008).
8 See Europa (2010).

have been fluctuating around the €15 per tonne mark for much of 2010,[9] although changes in energy prices may precipitate a steep increase by 2013, according to some analysts.[10]

The UK and Germany are currently the only two EU member states that are engaged in permit auctions to disclose comprehensively the amount of revenue they raise. Since the first auctions in 2008, these two governments have together raised more than €2.5 billion,[11] although this revenue flows directly into the budgets of the respective central governments and it is unclear whether it leads to increases in spending even on domestic, let alone international, low-carbon initiatives.

In UN negotiations, developing countries favour a commitment on the part of developed country governments to sacrifice an agreed proportion of national wealth, in addition to their existing commitments to give 0.7 per cent of GNI in overseas development assistance.

At the international level, a variety of proposals have been made for new, innovative sources of finance to help developing countries meet incremental mitigation, as well as adaptation, costs. These are summarised briefly below:

- **Upstream auction of carbon permits**: Countries participating in the Kyoto Protocol receive a national, tradable allocation of assigned amount units (AAUs). Norway has proposed that 2 per cent of these are retained by an international fund and auctioned to raise an estimated $15–25 billion per year (UNFCCC 2007).

- **ETS levies**: There is currently a levy of 2 per cent on the sale of permits in the CDM, which is used to finance the Adaptation Fund. Various countries have proposed extending this levy or adding levies to all new emissions trading schemes as they are established.

- **Carbon taxation**: France's attempts to introduce a €17 per tonne tax on carbon fell foul of the governing party's poor performance in regional elections early in 2010, but Norway, Sweden and other countries already tax carbon to raise

9 On 24 September 2010, the EUETS (EUA) spot price was €15.21 according to Vertis Environmental Finance. See: www.vertisfinance.com/index.php?page=202&l=1

10 According to UBS as reported by Bloomberg on 23 September 2010. See: www.reuters.com/article/idUSTRE68L3LX20100923

11 See: www.dmo.gov.uk/index.aspx?page=ETS/AuctionInfo for the UK and www.dehst.de/SharedDocs/Downloads/EN/Auctioning/Auctioning__report__07,templateId=raw,property=publicationFile.pdf/Auctioning_report_07.pdf for Germany's most recent auction.

revenue.[12] Switzerland has proposed a levy of $2 per tonne of CO2-equivalent at the national level in all countries with per capita carbon emission levels above 1.5 tonnes, with countries to retain different proportions of the funds depending on their level of development: 40 per cent in the case of developed countries and 85 per cent for the poorest.

- **Aviation and maritime levies**: Least developed countries (LDCs) have proposed an international levy on aviation (IATAL), which could raise $4–10 billion annually (UNFCCC 2008b). Tuvalu has proposed that permits for the emissions of international aviation and shipping are auctioned, raising $28 billion per year (UNFCCC 2008b).

- **Levies on bunker fuels**: LDCs have also proposed an upstream levy on bunker fuels for aviation and shipping, which could raise $4–15 billion annually (UNFCCC 2008b).

- **Taxation of financial or currency transactio**n: Other funding sources, such as a tax on currency transactions (Tobin Tax) or on financial transactions (Robin Hood Tax) have been mooted as possible sources of climate mitigation finance. These sources are popular with some leaders, notably President Sarkozy of France, but were they to be implemented it is likely that climate expenditure would be just one of many demands on the revenues raised. According to its proponents, a tax on transactions in stocks set at 0.5 per cent and a tax on currency transactions at 0.005 per cent would raise as much as $400 billion per annum.[13]

- **Fossil fuel subsidies**: G20 nations have committed to phasing out fossil fuel subsidies.[14] Annual subsidies to fossil fuels in developed countries alone have been estimated at $67 billion (Oil Change International 2009). The money saved could potentially be redirected to climate change solutions, including allocations to an international climate fund.

- **Climate or green bonds**: Several financial institutions, including the World Bank and the European Investment Bank, have already used bonds to raise finance for climate mitigation (WBT). Since 2008, the World Bank has raised around

12 Interestingly, several developing countries, including India and Costa Rica, have already introduced carbon taxation. South Africa has introduced a flat-rate CO_2 tax on new motor vehicles, which came into effect in September 2010.
13 See Robin Hood Tax campaign (2010) 'What is the Robin Hood Tax?', available at: http://robinhoodtax.org.uk/faq/what-is-the-robin-hood-tax/
14 Reuters (2009) 'G20 to agree phase-out of fossil fuel subsidies: draft', 25 September 2009. www.reuters.com/article/idUS-TRE58O18U20090925

$1.5 billion for climate-related projects in developing countries through bonds. Others are calling for more widespread use by developed country governments of bonds to raise finance for climate-related capital expenditure.[15] Duncan Foley (2007) argues that long-term government borrowing (that is, through the use of gilts) is the most appropriate means of financing climate change mitigation, as by helping to safeguard the atmospheric public good it will boost the welfare of future generations, who will in turn be more able to repay the debts incurred.

- **Special Drawing Rights**: At Copenhagen, the George Soros Foundation proposed that the IMF Special Drawing Rights (SDRs) facility could be used to finance a green fund, although this proposal appears already to have been rejected by IMF board members.[16] The European Climate Foundation (ECF 2009) estimates that issuing $100 billion of SDRs for monetization could generate approximately $7 billion in grants, loan and equity financing each year between now and 2050. Factoring in inflation, the currency value of these assets could increase to $10 billion in 2020 and $13 billion in 2030 in real terms.

- **Sovereign Wealth Funds**: In September 2010, sovereign wealth funds were valued at $3.94 trillion worldwide (SWF Institute 2010). Derived from earnings from natural resource extraction, the transferral of foreign exchange reserves and sovereign debt disbursement, these funds could be subject to a modest tax of 1 per cent with the proceeds going towards international climate action (Pendleton and Retallack 2009), raising as much as $39 billion.

Leveraging private finance

With carbon markets faltering and climate-related revenue streams (permit auctions, carbon taxes, climate levies, fuel taxes and so on) limited by a lack of policy ambition and open to capture by national treasuries, the focus of the climate finance debate is turning to private finance. Policymakers are increasingly asking how public finance and policy can be used to leverage private finance into low-carbon initiatives.

Private finance might more properly be termed 'investment'.[17] The debate about barriers to investment in low-carbon technology is an intractable one: a clear,

15 For instance the Climate Bonds Initiative: http://climatebonds.net/
16 Reuters (2010) 'IMF member countries reject green fund plan', 25 March 2010. www.alertnet.org/thenews/newsdesk/N24143408.htm
17 See for instance the report by IISD (2010) of the recent Geneva Climate Finance Dialogue.

long-term international policy framework and carbon price would doubtless give confidence to investors and remove some of the uncertainty and risks they face, but is currently unlikely. Thus, 'investment grade' policy (Hamilton 2009) at the national level will be essential if private finance is to flow into key sectors.[18]

Public–private cooperation

Subsidising South Africa's Renewable Energy Feed-in Tariff

The South African government's South Africa Renewables Initiative (SARI) provides an example of how public policy can be used to attract private sector investment. Led by the Department of Public Enterprise, the initiative is exploring options for financing South Africa's Renewable Energy Feed-in Tariff (REFIT), a policy mechanism identified by the government as critical to stimulating the development of the country's renewables industry and attracting the private investment necessary to achieve rapid and scaled-up deployment of clean energy technologies. However, modelling by SARI (2010) suggests that if the REFIT scheme is to work – and if investors are thereby to be drawn in – then the costs of running the REFIT may have to be part-subsidised by foreign donors or an international fund, at least for an initial period.

The modelling finds that there will be a financing gap between the business-as-usual energy tariff and the REFIT of an estimated 25 per cent in 2020 (where the REFIT is set at an average rate of $107/MWh) (SARI 2010). According to SARI, this financing gap could be filled from three different sources: domestic consumers, through a gradual increase in electricity tariffs; a green purchase obligation for energy-intensive industry; or international public finance (including grants, concessional finance and guarantees). Because neither domestic consumers nor energy-intensive industry can be expected to contribute significantly early on, the international financing requirement is large to begin with: perhaps around $40 per MWh in 2012, equivalent to $6.24 per tonne of CO2 saved (SARI 2010).

While the contribution of international financing has to be from public sources, it can be argued that this *leverages in* private sector investment, in that meeting the incremental costs in this way makes renewable energy in South Africa a commercially viable option. Given the limited government funds available and the difficulties in placing extra costs on South Africa's electricity consumers, it seems that unless developed country governments help meet this gap, the private sector will not invest sufficiently to enable the scaling-up of renewable energy.

SARI argues that the funding gap reduces over time because of 'learning' (that is, because innovation in renewable energy brings down its cost) but that the financing requirements start high. On the strength of this example, a feed-in-tariff in a developing country could be supported by international funders with a strong interest in the development of RE markets and, over time, could help ensure the necessary private sector investment takes place.

If policy is a precursor to investment – at least in sectors in which low-carbon technology is more expensive than carbon-intensive equivalents – then one essential part of the public-private partnership model is to introduce robust, long-term incentives to level the playing field (see the example of South Africa's REFIT above). Much of the literature on finance and climate change supports this important maxim (eg World Economic Forum 2009).

18 Hamilton (2009) stresses the importance of confidence in policy for investors, who will weigh up investment decisions based on the commercial profitability of a project versus the level of risk. See also UNEP et al (2009).

However, government's role in such a partnership can extend beyond merely putting incentives and regulations in place (Stern 2009, Ward 2010). The risks faced by private investors when investing in low-carbon initiatives in developing countries can be reduced using a variety of mechanisms and facilities, which involve using public finance – sometimes in the form of guarantees rather than cash funds – to leverage more significant sums of private finance.

Global Climate Network (GCN) research[19] identifies five mechanisms that developed country governments could deploy within a new or existing international green fund to leverage private investment in this way (see Table 1.1 on the following page).[20,21] In subsequent dialogues in each GCN member country, participants from private finance and investment, government and the research community were asked to comment on and rank these five proposed mechanisms (see Section 3).

19 See the GCN–CAP memorandum published alongside this report (www.globalclimatenetwork.info).
20 Several of these mechanisms are explored further by UNEP and SEFI (2005) in their report *Public Finance Mechanisms to Catalyze Sustainable Energy Sector Growth*.
21 NB: Although GCN's research focuses primarily on leveraging private sector investment in clean energy, the proposed tools could equally be relevant to leveraging funds for projects and technologies in other low-carbon sectors, such as transport.

TABLE 1.1

Five mechanisms that could be used by developed countries acting alone or together to help leverage private finance into low-carbon initiatives in developing countries

Mechanism	Risk addressed and leverage ratio
1. Loan guarantees. Governments agree to underwrite loans to clean energy projects with taxpayers' money to safeguard the private investor against defaults.	The cost of capital in many developing countries is higher because of the perception of higher political or economic risk. Some investors may not be prepared to accept these risks at all and others may demand higher returns for doing so. But with underwriting from developed countries, more investors may be attracted to clean energy in developing countries and the costs of borrowing may be lowered.[22] *Estimated leverage ratio: 6x–10x*
2. Policy insurance. Governments could insure investors against the risk of policy uncertainty. They could do this through standard insurance or by issuing 'put' options that they would buy back if policies changed.	Many clean energy projects are made profitable by policy, such as a feed-in-tariff. But changes in government or other political or economic circumstances can bring policy changes. Developed country governments can eliminate this risk by providing insurance that pays out if returns are reduced by policy changes. *Estimated leverage ratio: 10x*
3. Foreign exchange liquidity facility. Governments can offer credit to help guard against risks associated with currency exchange fluctuations.[23]	Clean energy project revenues may be paid in local currency, but debt is likely to have to be paid in foreign currency. Exchange rate fluctuations can make projects uneconomical and hence more risky. *Estimates of leverage ratios are hard to make due to a lack of literature in this area.*
4. Pledge fund. A developed country government-backed fund that would identify and analyse smaller, relatively low-risk clean energy projects and offer these to investors that would pledge to invest a set amount of equity capital up-front.	Many relatively low-risk clean energy projects in developing countries face two hurdles: they do not have sufficient access to equity, and the projects are too small for many equity investors to consider. A government-backed pledge fund could help bring equity investors and projects together. *Estimated leverage ratio: 10x*
5. Subordinated equity fund. For higher-risk clean energy projects, a govern-ment-backed fund would invest a proportion of the equity but receive returns last.	Equity investors may judge clean energy projects in developing countries as too risky, but with developed countries taking a subordinated equity stake, the risk would be significantly reduced. *Estimated leverage ratio: 2x*

Identifying climate mitigation financing needs

This study estimates the capital costs of installing electricity generating capacity in clean energy sectors that have been identified as a priority by national policymakers. More detail on each country's policy on renewable and low-carbon energy, its current ambition, a breakdown of costs and business-as-usual investment in renewable energy is contained in the four national case studies beginning on page 17.

Table 2.1 shows that estimates vary from country to country and across the six sectors: large- and small-scale hydro, solar PV and CSP, and wind and gas turbines. Total capital requirement between 2010 and 2020 is estimated at $636.3 billion, an average of $63.6 billion per year.

TABLE 2.1

Estimated costs of installing renewable energy

Country / sector	Installed capacity to be added (GW)*	Total investment funds needed ($bn)
China / hydro	130	134
China / solar PV	19	140
China / wind	138	203
India / solar PV	20	108
Nigeria / gas turbines	21	32
Nigeria / hydro	2	3
South Africa / wind*	5	12.2
South Africa / solar CSP	4.5	4.1
Total	339.5	636.3

Note: by 2020 in all cases except Nigeria hydro (2025) and India solar (2022)
*South African data assumes wind and solar shares in a 15 per cent renewable energy mix by 2020

Table 2.2 (on the next page) summarises the actual levels of investment renewable electricity generation sectors have received in the four focus countries in recent years. It shows that investment in the highlighted sectors across the four countries reached an estimated total of almost $34 billion, but with the overwhelming majority occurring in China.[22]

The average annual 2010–2020 investment gap in the highlighted sectors at 2009 levels is therefore $29.6 billion, if data for China is included (China's investment gap in hydro, wind and solar is currently $14.81 billion). Investments in the sectors and countries highlighted in this study must therefore double if current government ambition for renewable energy expansion is to be achieved. Excluding China, the average annual investment needed is $15.93 billion and the gap around $15.73; India, South Africa and Nigeria are currently only investing a tiny fraction of what would be required.

22 In 2009, $30.5 billion was spent on solar and wind and $2.39 billion on hydro in China; by contrast, $0.1 billion was invested in solar in India and $0.1 billion in renewable energy in general in South Africa. Public finance is not counted separately in these numbers, as we assume it is largely captured in the overall investment data. See the case studies in Section 3 and UNEP et al (2010).

TABLE 2.2

Most recent, actual funds for renewable energy projects from public and private sectors raised or promised.

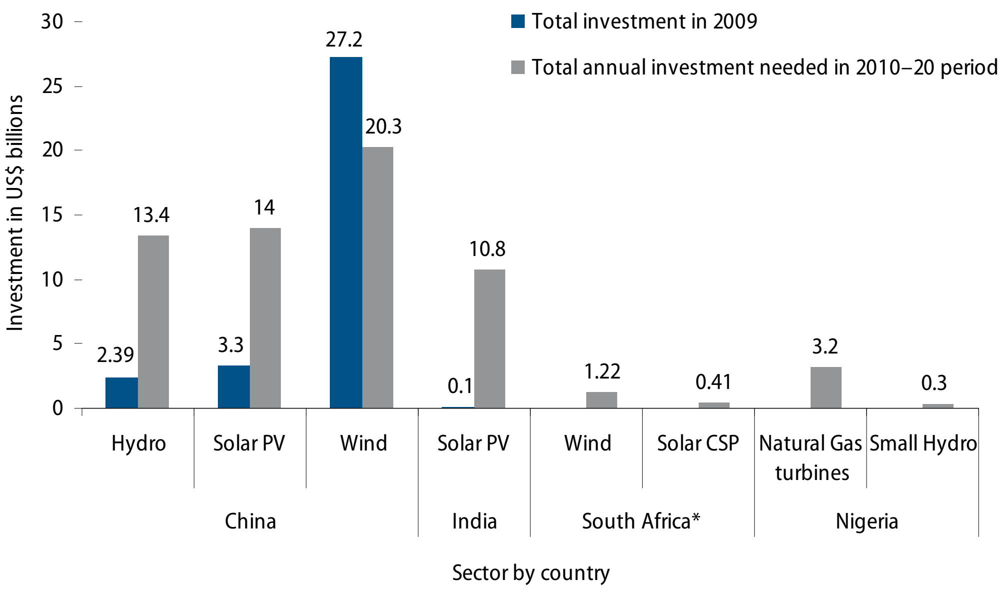
Country	Public finance ($bn)	Total investment ($bn)
China	3.1 in 'special funds' in 2008 and 46.9 in stimulus over two years (2009–10)	32.89 in 2009 (27.2 in wind, 3.3 in solar, 2.39 in hydro)
India	0.8525 by 2012 to install 15GW	2.7 in renewable energy finance in 2009 (down from 3.7 in 2008) including 0.1 in solar
Nigeria	3.3 loans for 'emergency power projects'; 0.042 for hydro and gas in 2010	Negligible
South Africa	0.037 in 2009, expected to increase to 0.063 by 2011/12	0.1 in 2009

Sources: UNEP et al (2010), government sources, other sources – see Section 3 for more details[23]

Significantly, China has already stated its intention to finance its climate investments without relying on an international fund. India has also made similar allusions and is planning to set up a new tariff structure to reward private energy firms that make investments in solar power plants. It is as yet unclear whether India will fund the solar tariff from the public purse, pass costs on to electricity consumers through bills, or ask for assistance from an international fund or donors.

FIGURE 2.1

Clean energy investment needs by sector in GCN member countries



*Total investment funds in South Africa in 2009 were US$0.1 billion across all clean energy sectors (no breakdown is available for wind and CSP respectively)

23 The Indian government estimates resulting leveraged private financing of $9.5–12.7 billion, at a leveraging ratio of up to 15x.

National case studies

China

Overview

China's plans to decouple economic growth from carbon emissions are well documented.[24] The Chinese government considers clean energy to be particularly important to China's energy security and low-carbon agenda, and investment in the renewable energy sector has soared in recent years. In 2007, approximately $8.86 billion (60 billion RMB) was invested in renewables and this increased to $11.23 billion (76 billion RMB) in 2008 (CCID 2009). Recent figures suggest that China has overtaken the United States to become the world's leader in clean energy investment, registering $33.7 billion in 2009 (see UNEP et al 2010).

Sustaining this level of investment will be crucial if China is to meet its ambitions for renewable energy generation, yet this will not be without its challenges. Many low-carbon technologies remain costly and yield relatively low returns, which make them difficult to finance and deploy at scale. For China, new and innovative finance and investment tools are required at both the domestic and global levels to leverage the funds necessary to realise the country's low-carbon energy potential.

Policy assumptions

The Chinese government has set itself a target of 15 per cent of final energy consumption to come from low-carbon energy sources, including nuclear power, by 2020.[25] A number of policies geared to achieving this objective are already in place

24 At Copenhagen, the Chinese government confirmed its commitment to reduce carbon intensity by 40–45 per cent by 2020 compared to 2005 levels, to be achieved by a number of policies – from restructuring the economy towards high-tech services to ambitious energy efficiency and afforestation programmes, and scaling up the contribution of renewables to China's energy mix.

25 This target replaces an earlier target, set out in 2006, for a 15 per cent share of primary energy to come from renewable sources by 2020. Typically, a 15 per cent final energy target implies a larger quantity of renewables than a 15 per cent primary energy target, yet the share of renewables is likely to be diluted by the inclusion of nuclear in this target (Martinot and Li 2010).

– many of which date back to the Renewable Energy Law of 2005 – including renewable portfolio standards, tax breaks for clean energy developers and feed-in tariffs for wind and biomass. The government has recently introduced obligations on electricity providers to purchase all surplus renewable power generated.

Under current – albeit unofficial – plans, a total of 500GW of installed renewable energy capacity is expected by 2020.[26] In this report we estimate of the total capital and incremental funds required to increase installed capacity, in line with the anticipated plans, in the following three sectors:

- Hydro: from 170GW in 2008 to 300GW in 2020
- Wind: from 12GW in 2008 to 150GW in 2020
- Solar PV: from 0.4 GW in 2008 to 20GW in 2020

Estimated costs: hydro, wind and solar PV

If the existing plans are approved and implemented, an additional 287.6 GW of capacity will be installed across the hydro, wind and solar PV sectors by 2020 (130GW, 138GW and 19.6GW respectively).

The GCN finds that installing an extra:

- 130GW of hydropower, at a unit cost of 7000 RMB per KW, will require approximately $134 billion (0.91 trillion RMB)
- 138GW of wind power, at a unit cost of 10,000 RMB per KW, will require approximately $203 billion (1.38 trillion RMB)
- 19.6GW of solar PV power, at a unit cost of 50,000 RMB per KW, will require approximately $140 billion (0.95 trillion RMB).

If one factors in the additional investment required in the nuclear power and biomass sectors (approximately $118 billion or 0.8 trillion RMB), it is anticipated that more than $597 billion (4.04 trillion RMB) in funds will be needed to finance China's clean energy plans between 2008 and 2020.

26 This amounts to a doubling of total installed renewable energy capacity in 2009, which was 226 GW (Pew Charitable Trusts 2010).

On top of this, installing desulphurisation equipment to improve the generation efficiency of coal-fired thermal plants will cost approximately $17 billion (116 billion RMB) between 2009 and 2020, while 4 trillion RMB will need to be invested in upgrading the electricity grid in the same time period.

Sources of finance

China has witnessed a surge in investment in renewable energy sectors in recent years. According to UNEP et al (2010), the country attracted $33.6 billion of new investment in solar, wind, biomass and energy-smart technologies alone in 2009. The majority ($27.2 billion) of this sum was channelled into wind energy projects and was derived from asset-based finance. Investments in solar and biomass totalled $3.3 billion and $3.0 billion respectively. In addition, the Chinese Ministry of Water Resources[27] estimates that $2.39 billion (16 billion RMB) was invested in hydro in 2009.

Hitherto, the domestic banking and finance sectors have been the most important sources of funding for renewable energy projects in China. In 2007, bank credit accounted for almost 45 per cent of total investment in renewable sectors and capital investment from the domestic finance sector has grown substantially. By the end of 2008, there were 59 IPO-listed companies operating in renewable energy sectors in China, while approximately $37.8 billion (256 billion RMB) in short-term funds was raised from the bond market in the period 2005–08.[28] Venture capital and private equity investment in clean energy sectors in China totalled $0.79 billion (5.3 billion RMB) in 2008, yet fell to $0.2 billion (1.3 billion RMB) in 2009 (UNEP et al 2010).

Public finance has been an important source of funds. In 2008, the Chinese government invested $3.1 billion (21 billion RMB) of 'special public funds' in renewable energy sectors (NDRC 2007). In the economic stimulus of the following year, it allocated $46.9 billion (317 billion RMB) to clean energy technology, energy efficiency and grid infrastructure development (Pew Charitable Trusts 2010: 20).

International sources, including direct foreign investment, are also important to the realisation of China's clean energy objectives. To date, the majority of external funding has been channelled through the CDM, under which China has the larg-

27 Figures cited in a 2009 communiqué by the Chinese Ministry of Water Resources. Available in Mandarin on request.
28 This figure has been calculated using data from various editions of the *China Securities and Futures Statistical Yearbook* published annually by China Securities Regulatory Commission. www.csrc.gov.cn/pub/csrc_en/

est number of registered projects (770 in mid-March 2010).[29] However, the proportion of foreign funds remains relatively low and amounted to only 1 per cent of overall funds invested in renewable energy sectors in 2007 (NDRC 2009).

Conclusions

China's ambitious plans to expand renewable sources energy between now and 2020 require significant levels of upfront finance and sustained investment. While recent investment figures clearly suggest that China's plans are on track, the challenge will be to ensure that the current high levels of investment are sustained year on year.

With this in mind, it is crucial that existing funds are used in the most efficient and cost-effective way. The GCN recommends that in order to strengthen China's clean energy technology market, domestic public funds should be targeted primarily at R&D, infrastructure development and reducing investment risks (through such measures as credit assurance, technology certification and guarantees against bad debts).

China would benefit from reform of existing international finance mechanisms and the establishment of a global bank under the UNFCCC, which would finance low-carbon technology development and handle transfers in and between developed and developing countries. The bank would be funded by annex I and non-annex I countries. Regional carbon banks could also be established.

In order to make effective use of international funds, GCN suggests that global public-private funding partnerships should be explored as a means to better protect against market uncertainty for renewables, reduce capital costs and establish a 'virtuous circle' of funding in priority technologies and sectors.

29 For example, Jia (2010).

India

Overview

India is the world's fifth-largest consumer of energy (EIA 2008) and faces the challenge of meeting escalating demand for energy as it attempts to fulfil its economic and development goals. A net energy importer, India is heavily dependent on fossil fuels, with 64.6 per cent of total installed capacity generated by thermal power, of which coal constitutes 53.3 per cent (Central Electricity Authority 2010). Since the energy sector is the biggest contributor of greenhouse gas emissions in India, with 58 per cent of net emissions coming from this sector (Ministry of Environment and Forest 2010), the Indian government has deemed it in the country's economic and environmental interest to aggressively pursue clean sources of energy.

Policy assumptions

The Indian government's Eleventh Five Year Plan includes a renewable energy target of 10 per cent of total power generation capacity and 4–5 per cent of final electricity mix to be achieved by 2012. Should these goals be met, renewables would account for approximately 20 per cent of the total added energy capacity planned in the 2007–2012 period. Towards the same goal, India expects to install 15GW of additional renewable power capacity by 2012.

Beyond this, the National Action Plan for Climate Change (NAPCC) puts forth ambitious plans for energy efficiency and the deployment of solar energy (Government of India 2008). In this paper we provide estimates of the capital and generation costs of renewables in India and, specifically, solar power technology, which has been identified in previous GCN studies as vital to India's clean energy future (Global Climate Network 2009, 2010).

Estimated costs: renewable energy technologies

The Indian government has allocated $850 million (Rs 3,925 crore) of public finance to support renewable energy under the Eleventh Five Year Plan, including $16.2 million (Rs 75 crore) for wind power demonstration projects and $43.3 million (Rs 200 crore) in subsidies to support grid-interactive solar PV.

However, the total capital investments required to achieve the plan's target of 15GW of installed renewable electricity by 2012 are likely to be significantly higher. Using estimates of capital and generation costs calculated by the Indian government's Integrated Energy Policy-Expert Committee (Planning Commission of India 2006), we find that $9.5–12.7 billion (Rs 43,850–58,600 crore) will be required between 2007 and 2012. Hence, if the 2012 target is to be met, this will require leveraging as much as 15 times the budgetary support currently provided by the Indian government.

According to official estimates of the potential of the renewable sectors in the medium term (to 2032; Ministry of New and Renewable Energy 2007), the total capital investments required for wind, small hydro, co-generation and biomass alone could range from $57.5 billion to $71.8 billion (Rs 265,524–331,524 crore).

Estimated costs: solar

The 2009 National Solar Mission (NSM) sets a target of achieving 1GW of installed capacity by 2013, 4GW by 2017 and 20GW by 2022. According to estimates by the Energy and Resources Institute (TERI), $14 billion will be required over the period to 2021 to implement the key provisions outlined by the NSM. These are summarised and individually costed below.

- $10.02 million for generation-based incentives
- $187 million for rural electrification and lighting
- $88 million for solar thermal systems
- $2.2 billion for interest subsidies
- $1.32 billion for R&D
- $77 million of grants for demonstration projects

Although the NSM envisages its 2022 target to be met through a combination of solar PV and less-expensive concentrated solar power (CSP) and that capacity will be supplied by grid-connected and decentralised installations, there is nonetheless reason to believe that the government's own cost estimates are conservative. We estimate that installing 20GW of solar PV in India could cost $68–108 billion.[30] Furthermore, since existing solar PVs are only 20–40 per cent efficient, as much as

30 This figure is calculated using a range of bottom-up feasibility studies, based on the experience in the United States and Europe, which estimate the capital costs of solar PV technologies to range from $3.8–5.4 million per MW.

50–100GW of installed capacity may be needed to supply 20GW of actual generation. As a result, this could increase capital costs by a factor of 2.5–5.[31]

If India achieves the NSM target of installing 20 million square metres of CSP collectors by 2022, the costs of purchasing collectors and other parts alone will total at least $533 million.[32] Given the likelihood that more-costly medium-to-high temperature collectors will need to be deployed to function effectively in India's hot temperatures, a minimum of $2 billion could be expected to be spent on equipment alone (excluding installation costs).

One of the main policy mechanisms envisaged to stimulate market growth will be a preferential feed-in tariff for solar generated electricity to be set, according to existing policy guidelines, at Rs 17.90 ($0.397) per kWh for solar PV projects and Rs 15.40 ($0.342) per kWh for solar thermal installations. According to earlier estimates calculated using a flat-rate solar feed-in tariff of Rs 17.50 per kWh – with utilities subsidising Rs 5.50 per kWh and central government the remainder – 20GW of subsidised solar generated electricity could cost the government as much as $54 billion over 20 years (*Times of India* 2010).

Sources of finance

Investment in India's renewable energy market fell by 21 per cent in 2009 to $2.7 billion, compared to $3.4 billion in 2008 (UNEP et al 2010). The main reason for this decline has been caution on the part of banks to lend to renewable energy developments in the wake of the global economic recession. Of this total, asset finance accounted for $1.9 billion, while venture capital and private equity provided a relatively modest $100 million worth of combined investments. The wind sector was by far the largest beneficiary of new investment in 2009, attracting approximately $1.6 billion, followed by $100 million in solar, $200 million in small hydro and $200 million in biofuels.

The CDM has generated considerable economic dynamism in India towards mobilising finance for renewable energy projects. As of May 2010, validated or

31 The variations in these estimates are due to variations in the average plant size envisaged in the studies. The larger the plant size, the lower the per-MW capital cost. Thus, considering that the NSM anticipates a larger proportion of small plants (25–50MW) in the initial stages and as demonstration projects, it is likely that capital costs will be higher, at least in the short term.

32 This calculation uses the lowest average price recorded in the United States between 1999 and 2008 ($2.40 per square foot in year 2004) and assumes this as the average price for collectors over the next 10–12 years. See for instance EIA (2010).

registered CDM projects in the biomass, solar, wind and hydro sectors in India totalled an estimated $13.4 billion in investment.[33] Arguably, the incremental costs of these projects will be paid off over time through the sale of Certified Emissions Reductions (CERs).

Prior to the financial crisis, international equity markets were also targeted by Indian companies as a way to generate funds for clean energy projects – in 2007, this source raised $756 million, compared to $646 million from domestic exchanges. However, the onset of the crisis saw international funds dry up in 2008, while only $74 million was raised on Indian exchanges.

The Indian government has allocated $850 million (Rs 3,925 crore) towards renewable energy programmes under the Eleventh Five Year Plan and has stated that the NSM will not require international financing, but instead will be funded unilaterally by India. Thus, government expenditure will remain an important funding source and, in particular, will be important in financing market creation policies (such as the feed-in tariff, or at least a proportion of it), supporting nascent technologies through the development cycle and ensuring a stable supply of low-interest credit for project developers.

Conclusions

Given the large scale investments required to meet India's ambitious renewable energy targets, supportive government policies, regulations and a catalogue of fiscal incentives are required to attract and mobilise large sums of finance from the private sector, both domestic and foreign. Existing policies, such as the NSM, are geared towards providing a stable and attractive environment for investment in the Indian market and it is anticipated that private funds will flow more rapidly as that programme progresses. This will be crucial if the Indian government is to achieve large-scale deployment and meet its anticipated installed capacity target in 2022.

As emphasised by other national case studies in this report, public-private partnerships will be key in the Indian context. It is also important that government money is spent wisely to stimulate private sector investment, such as on specific market generation policies, fiscal incentives and support for infrastructure for clean energy sectors.

33 Information accessed from the UNEP-Riso Centre 'Capacity Building for the CDM' website, available at: http://cdmpipeline.org/cdm-projects-region.htm

South Africa

Overview

South Africa is the largest emitter of greenhouse gas emissions on the African continent and its per-capita emissions are among the highest in the developing world. In 2008, the country released 337 million tonnes of CO2 into the atmosphere (IEA 2010)[34] with the greatest proportion of emissions coming from the energy sector.[35] Such levels are hardly surprising given that the South African economy centres on energy-intensive mineral extraction industries and the country is heavily dependent on coal as its primary source of energy.

Despite substantial coal reserves, South Africa's demand for energy recently outstripped supply – in 2008, periodic blackouts occurred as the state-owned utility Eskom was forced to 'load-shed' in the face of ageing and inefficient thermal plants. As energy demand continues to grow, the supply crisis has strengthened the case for South Africa to diversify its energy mix and invest in alternative energy sources. In the case of renewable electricity, solar – especially concentrated solar power (CSP) – and wind technologies offer the greatest potential in South Africa (Global Climate Network 2009), but finding the necessary capital and investment for large-scale deployment remains a significant hurdle to the country's clean energy aspirations.

Policy assumptions

The South African government's 2008 Vision and Strategy for Climate Change sets out an overall framework for future low-carbon policy and is grounded in a long-term vision of the country shifting to a competitive, low-carbon economy and sustainable energy mix. The document is based on findings from the government's Long-Term Mitigation Scenarios (DEAT 2007) process, which outlines several strategic options to stabilise greenhouse gas emissions.[36] The LTMS in turn appears to have informed South Africa's conditional pledge at COP-15 to reduce

34 The IEA's figure counts CO_2 emissions from fuel combustion only.
35 The latest official figures, dating back to 1994, suggest that the energy sector accounts for 78.3 per cent of South Africa's emissions (DEAT 2009).
36 The 'preferred' emissions path under the LTMS consists of South Africa limiting its emissions to 30–40 per cent below 2003 levels by 2050, and sets out four potential mitigation scenarios, of varying degrees of ambition, to achieve this. These range from a 'Start Now' scenario, in which emissions are reduced by approximately 9000 tonnes by 2050, achieving 45 per cent of the ultimate target, to 'Reaching the Goal', which is the most ambitious strategy requiring a wide range of government policy interventions.

domestic emissions by 34 per cent by 2020 and 42 per cent by 2025 compared to projected business-as-usual emissions growth trajectories.

While the Copenhagen pledge does not specify that the emissions reductions will be made in the energy sector or that renewable energy will play a part in achieving the stated targets, the South African government has previously set several aspirational targets for renewable energy. Most notably, the 2003 white paper on renewable energy sets a non-mandatory target of installing 10,000 GWh of renewable energy by 2013, which equates to approximately 4 per cent of total electricity generation capacity.[37] As of September 2010, the white paper was being reviewed, with an update due to be published in March 2011.

Furthermore, incorporated into the various LTMS strategies are notional targets which foresee renewables accounting for at least 27 per cent of generated electricity by 2030 and 50 per cent by 2050. In both cases, it is envisaged that CSP primarily, in addition to wind power, would – if the targets were to be made statutory – provide the bulk of renewable energy generating capacity.

Estimated costs: concentrated solar power and wind

The LTMS estimates the annual incremental costs of achieving the aforementioned targets for the expansion of renewable electricity. A 27 per cent renewable electricity supply target by 2030 could, according to the modelling, cost between $165.5 million (R1241 million) per annum at a 15 per cent discount rate and $556.9 million (R4177 million) per annum at a 3 per cent discount rate, between now and 2030. If renewables were to account for 50 per cent of electricity in 2050, $2703.5 million (R20,276 million) may be required each year until then, based on a 3 per cent discount rate. However, global clean technology learning could reduce these costs substantially to US$70.3 million (R527 million) per annum.

In this report we combine existing data on technology costs with new analysis to calculate that if renewable energy technologies were to account for 15 per cent[38] of South Africa's electricity generation capacity in 2020, this could require installing:

37 The Department of Energy has not decided on the exact composition of the electricity mix in the longer run, or the contribution of renewables. Eskom has stated that in order to power the South African economy and ensure an adequate reserve margin, 20GW of additional generation capacity (fossil and non-fossil sources) is required by 2020 and up to 40GW by 2030 (Eskom 2010).

38 The target of 15 per cent of electricity from renewable energy technologies by 2020 was selected by the GCN as it conforms to LTMS projections and is a realistic target within this timeframe.

- 5GW of additional wind power capacity, which would require approximately $12.2 billion (R91.5 billion) of investment

- 4.5GW of additional CSP capacity – primarily in the form of parabolic troughs and solar towers – which would require approximately $4.1 billion (R30.75 billion) of investment.[39]

Raising the level of ambition to 22 per cent of total electricity generation capacity by 2020 could require:

- 7GW of wind power at a total investment cost of US$17.1 billion (R128.25 billion)

- 7GW of CSP at a total investment cost of US $6.4 billion (R480 billion).

In the case of CSP, local production of hardware is estimated to bring down incremental investment costs by 5 per cent per year, as will the learning gained as deployment increases.

Sources of finance

In 2009, the South African government allocated $37.12 million (R278.4 million) in public funds to support clean energy projects, a 41.5 per cent increase on the 2008 budget outlay (R196.7 million). Spending in this area is projected to increase to $49.96 million (R374.7 million) in 2010/11 and $63.48 million (R476.1 million) in 2011/12, before falling to $10.68 million (R 80.1 million) in 2012/13.[40] This decline would suggest that the government foresees an increasing role for the private sector – including local and international banks and investors – in providing upfront capital, credit and equity for clean technology deployment in the medium to long term.[41] In 2009, total investment (private and public) in clean energy projects in South Africa was relatively modest, totalling approximately $0.1 billion (UNEP et al 2010).

39 Wind costs were calculated based on modelling used by Mainstream Renewable Power South Africa and Genesis Eco-Energy (2009). CSP costs were calculated using modelling by the Energy Research Centre (2009).
40 National Treasury (2010).
41 The Mainstream Renewable Power South Africa / Genesis Eco-Energy report (2009) suggests that the private sector is preparing to build at least 5GW of wind energy in South Africa, if the right regulatory environment is in place. It also claims that to achieve a notional target of 30GW of installed wind capacity by 2025, R140 billion of the R550 billion required would come from international investors, while the balance of R410 billion would come from debt provided by local and international banks and financiers. This amounts to a 25:75 split between private sector equity and debt.

Nevertheless, the government has indicated that it may introduce an escalating price for carbon, either through a carbon tax or another regulatory mechanism, which could generate public funds to spend on renewable projects or fund subsidies, such as the new REFIT scheme (see boxed text on page 10). This would supplement the existing fossil-fuel derived electricity levy, currently set at $0.02 per kwh, which is estimated to have generated $453 million (R3.4 billion) in 2009/10, and could generate as much as $693 million (R5.2 billion) in 2010/11 (SARS 2010).

In order to meet the ambitions of the LTMS, the government has stated that adequate and predictable finance and technological assistance from developed countries will be critical (indeed, South Africa's COP-15 emissions reduction pledge was conditional on the provision of international climate finance). Currently, a number of international investment routes are available, including the Clean Technology Fund (CTF), which under its Draft Technology Investment Fund Plan has channelled $500 million to date into renewable energy projects in South Africa. In contrast, carbon market finance has played a more limited role, due to the small number of South African CDM-registered and voluntary emissions reductions projects. It is also important to note that carbon finance will in most cases only represent a relatively small portion of the capital required to develop a bankable renewable energy project.

Conclusions

Financing South Africa's energy transition away from coal-powered generation towards clean, low-carbon alternatives will require substantial levels of upfront capital and incremental investment. In many policy circles, it is felt that the majority of finance for renewable energy projects should flow from international – and mainly public – sources, including the CTF, bilateral and multilateral donors, development banks and Official Development Assistance. We suggest that both international and domestic sources, public and private, have a role to play. We also suggest that donors and investors could fund specific policy interventions in South Africa (for example, to cover the costs of the REFIT scheme), in order to create the necessary policy and regulatory environment to make the clean energy transition possible.

Nigeria

Overview

In 2009, the federal government of Nigeria published its Vision 2020 economic strategy, setting out a medium-term growth and development plan. The country seeks to become one of the world's top 20 economies by the year 2020, with $900 billion in GDP and a per-capita income of no less than $4000 per annum. Today's per capita GDP is barely $1000. This ambitious growth target is built on several pillars, among them, a massive expansion in power supply.[42]

As identified in previous Global Climate Network papers (GCN 2009, 2010), accelerating the deployment of small hydropower and natural gas technologies is critical to alleviating the country's worsening energy crisis and meeting Nigeria's future energy needs. And yet, filling the finance gap remains one of the principal barriers to Nigeria's transition to cleaner and lower-carbon sources of energy.

Policy assumptions

The Nigerian government has announced a number of ambitious targets and policies aimed at stimulating the market for low-carbon energy. The Renewable Energy Master Plan (REMP)(ECN 2005), released in 2005, projects that renewable energy will account for approximately 10 per cent of total energy demand in Nigeria by 2025, with small hydropower constituting 66 per cent of the total renewable energy mix. Under the REMP, small hydro utilisation will grow from 50MW in 2007 to 600MW in 2015 and 2GW in 2025. The Renewable Electricity Policy and Regulatory Guidelines seek to expand the renewable energy market to a minimum of 5 TWh of electricity power production by 2016 (Federal Ministry of Power and Steel 2006).

The government's plans to develop the domestic gas market are set out in the 2008 National Gas Master Plan. In line with the Electric Power Sector Reform Act 2005, the plan envisages a wholesale transition to private sector and decentralised ownership of electricity generating gas plants from the erstwhile public power

42 The Vision 2020 document envisages an electricity demand of 35GW by 2020. Currently, electricity demand is about 9GW for loads connected to the national grid, but the national utility delivers below 3GW for a population of about 150 million. By 2030, the government has estimated that with higher projected GDP growth electricity demand could increase to 192GW (Sambo 2008).

utility. According to a recent report, demand for gas is expected to grow from 700 million cubic feet per day to 2.5 billion cubic feet per day by 2014.[43]

There are also a number of policies the government is pursuing to establish long-term favourable pricing mechanisms. Among these is the Clean Energy Bill which, when passed into law, will grant a mandate to the government to implement renewable energy and energy efficiency market creation strategies.

Estimated costs: small hydro and gas

The REMP estimates that small hydropower will supply a total cumulative generation of 2GW by 2025 from an existing capacity of approximately 70MW. We calculate that, based on an estimated cost of $1.5 million per MW of installed hydro power, an investment of approximately $2.94 billion (N 441 billion) will be needed for generation alone by 2020.

By 2020, it is estimated that about 21GW of gas-fired plants will have been built in Nigeria, which will require over $31.5 billion (N 4725 billion) for generation alone.

Generation costs across both sectors are therefore approximately $34.4 billion (N 5160 billion), yet the total costs are likely to be substantially higher, since these figures do not incorporate installation, distribution and transmission costs, or the incremental capital costs of operation and maintenance. The table below summarises the financial requirements for scaling up Nigeria's electricity supply from small hydropower and gas in the short, medium and long term.

TABLE 3.1

Estimated financial projections for scaling up electricity generation from small hydropower and gas in Nigeria

Small hydro				Gas			
Period	Capacity (MW)	Cost per MW ($)	Total cost ($)	Period	Capacity (MW)	Cost per MW ($)	Total cost ($ bn)
Short term (2010)	50	1.5 million	75 million	Short term (2010)	6600	Between 800,000 and 1.5 million depending on location (distance from gas source)	5.3–9.9
Medium term (2015)	500		750 million	Medium term (2015)	15,600		12.5–23.4
Long term (2025)	2000		2.9 billion	Long term (2025)	21,000		16.8–31.5

Sources: Federal Government of Nigeria (2009), Federal Government of Nigeria (2005), ECN (2005)

43 Reuters (2010), 'Nigeria to pay gas firms more to boost investment', 27 May 2010, available at: http://in.reuters.com/article/idINLDE64Q2EP20100527

Sources of finance

The domestic financial sector is the primary source of funding for long-term infrastructure projects in Nigeria. However, unlocking private sector investment for clean-energy projects is constrained by a number of barriers. These include a failure by the government (or lack of capacity) to implement much-needed power sector reforms;[44] weak regulatory frameworks, including discouraging tariffs set by the power sector regulator, which stifle the market for cleaner energy alternatives; and a lack of capacity among project developers, who are often unable to provide clear and convincing business plans to banks. The drying-up of available credit for capital-intensive infrastructure projects, triggered by the onset of the global financial crisis has also played a significant role.

In acknowledgement of some of these barriers, the Central Bank of Nigeria is taking steps to revitalise the power sector with the injection of $3.3 billion (N 500 billion) for investment in emergency power projects. The funds are to be channelled through the Bank of Industry as credit to banks at a maximum interest rate of 7 per cent for loan disbursement with a tenor of 10–15 years.[45]

Public investment of this kind is not new, and has hitherto provided the most important source of funding for energy projects in Nigeria. In 2010, government appropriation for the power sector[46] was $1.05 billion (N 156.8 billion), which included $30 million (N 4.5 billion) for small hydropower development[47] and $11.6 million (N 1.75 billion) for the rehabilitation of three gas plants.[48] However, the availability of public money in Nigeria is highly dependent on international crude oil prices, and as such suffers from inherent and recurring instability.

International sources of finance are deemed to have a significant role to play, particularly in buying down investment risks and enabling capacity building. A good example is the $400 million World Bank partial risk guarantee in the power sector to support Gas Supply Agreements.[49] Increased access to carbon markets, particularly the CDM, will also be important in terms of obtaining finance for gas-flaring reduction initiatives in the petroleum industry.

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44 One such example is the Electric Power Sector Reform Act 2005, which sought to privatise state-owned generation and distribution companies and to create a competitive power market.
45 Afrique en ligne, 'Nigeria's Apex Bank boost power sector with N 500 billion', 4 March 2010.
46 Federal Ministry of Finance (2010).
47 Through this funding, the government envisages total small hydropower generation capacity to increase to 150MW.
48 There were no provisions for the construction of new gas power plants in the 2010 budget.
49 World Bank (2009) 'World Bank assist in improving Nigeria's power and gas sector and Human Development Outcome', press release 2009/411/AFR, available at: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/0,,contentMDK:22214484~menuPK:2246551~pagePK:2865106~piPK:2865128~theSitePK:258644,00.html?cid=ISG_E_WBWeekly-Update_NL

Conclusions

A number of policies are needed to unlock the finance required for the massive expansion in small hydropower and gas power generation envisaged in Nigeria. In particular, swift implementation of the Electric Power Sector Reform Act 2005 is essential, as are incentives for investors, a clear climate change policy and regulatory framework, and exploration of generation incentives for investment in small hydro and gas projects, such as a preferential feed-in tariff for grid-connected projects. Further reform of the financial sector to increase liquidity, lower the cost of money and increase confidence among investors is also necessary.

In order to identify priority areas of investment in low-carbon technologies, it is recommended that the Nigerian government surveys existing sources of financing and financial management strategies and, in partnership with key stakeholders, undertakes a comprehensive assessment of climate change finance needs. This would provide a platform for engagement between government, the private sector and international institutions and would strengthen the position of Nigeria as a destination for low-carbon investments.

Findings from Global Climate Network dialogues

The GCN conducted a series of dialogues in each member country with selected experts from relevant government departments (including treasuries and business or economic planning departments), private investor groups, national public and private banks, regional development and international banks, multilateral agencies and non-governmental organisations.

The purpose of the dialogues was to explore the barriers to private sector investment in low-carbon energy technologies, projects and programmes and the potential policy solutions and instruments that could leverage private investment. Researchers from each of the eight GCN member organisations followed a common format that was agreed collectively beforehand. In some cases the dialogues took the form of workshops and in others the form of face-to-face interviews. The brief summary of findings below is grouped into five areas of inquiry.

Barriers to private sector investment in low-carbon energy

In most countries, the majority of participants suggested that the primary barrier to private sector low-carbon investment was the **absence of clear and stable national policies**. Inadequate regulation and standards (South Africa, China, Australia), lack of incentive policies (South Africa,[50] United States), the absence of market mechanisms and a price on carbon (China) and failure to implement existing policies (Nigeria)[51] were all cited.

Participants elsewhere suggested that the main obstacle to engaging financial institutions is that most low-carbon technologies are currently **not commercially**

50 In South Africa, most participants suggested that the current delays with and uncertainties surrounding the proposed preferential tariff scheme for grid-connected renewable energy (REFIT) are the most immediate barriers. In particular, the proposed eligibility criteria are seen as too restrictive to enable the effective deployment of low-carbon energy technologies.

51 It was felt by participants in Nigeria that the government has largely failed to implement the Electric Power Sector Reform Act 2005 which foresees liberalisation of the power market and a competitive pricing system.

viable (India). High upfront and import costs were typically cited by respondents as a problem (China, United States), although several participants in India pointed out that higher lifetime costs for a unit of output compared to base prices also make renewable energy technologies relatively unattractive. Potential foreign investors often consider clean energy markets in many developing countries to be too small to deliver worthwhile returns (Australia).

Low-carbon energy technologies and projects are often perceived as **high risk investments with uncertain returns**. In the United States, renewable energy project developers tend to have low credit ratings or no rating at all. Banks have to hold higher reserves for lower-rated investments, which has the effect of bringing down the return on investment. In China, many low-carbon project developers struggle to provide qualified collateral (collateral which is acceptable to lenders) to cover their risk and hence struggle to find financial institutions to act as guarantor. Participants in Australia suggested that, on top of the sector-specific risks in low-carbon technologies, developing countries were hampered by regulatory and sovereign risk and that this, coupled with the relative absence of credit-rated corporations, undermined their ability to attract private investment from overseas.

In almost all countries, participants noted that financial institutions often have **limited experience of low-carbon investments** and limited awareness of the opportunities available (United States, Australia, South Africa, Nigeria, India), although this is changing (Australia, India). In the United States, variable energy resources like wind are foreign to financiers, who lack experience of evaluating projects and consequently tend to use pessimistic 'worst-case' scenarios when estimating revenue returns, which in turn affects the bankability of the project. In India, most commercial lenders still tend to rely on the track record of project owners, particularly their balance sheets – an approach which does not particularly favour new and emerging renewable energy developers.[52] Often, small-scale projects run the risk of not even being considered, because the cost of appraisal is relatively high and most commercial lenders are so risk-averse (India).

Furthermore, that many financial institutions **lack the technical capacity** to appraise low-carbon projects was cited as a key factor inhibiting private investment flows in several countries (India, China, Nigeria). On the other side, project developers often lack the technical skills to draw up comprehensive and convinc-

52 According to Surya P Sethi, former Principal Advisor (Energy) to India's Planning Commission, this is due to the fact that financing or seeking to promote new technologies is simply not the primary business of commercial lenders.

ing business plans in order to secure credit for new projects from lenders (South Africa, Nigeria). In South Africa, several participants noted that local developers experience severe difficulties in marketing their projects to banks and investors.

In developing countries, **market imperfections** and **a lack of competition** in the power sector were cited by a number of participants as an underlying obstacle to investment (India, China, South Africa, Nigeria). In South Africa, state-owned Eskom is still the single buyer of generated energy and it was noted that this, alongside the government's failure to draw up independent power purchase agreements with renewable project developers, is not conducive to attracting private investors. Participants in Nigeria stressed that the present tariff structure locks in high-carbon energy and does not guarantee investment returns in alternative energy, including natural gas or small hydropower.

Poor infrastructure is a problem in several developing countries, particularly the limited capacity of electricity distribution and transmission networks (India, Nigeria). In Nigeria, a lack of public investment in gas infrastructure, planning and pipeline security has hindered finance flows. However, several participants noted that building the appropriate infrastructure to address market imperfections would require huge financial and technical resources (India).

Finally, a small number of participants suggested that **uncertainty at the international level** translates into a more difficult investment environment for the private sector at the national level (Australia).

Performance of existing financial instruments and mechanisms

Participants in several countries (India, China, United States) suggested that financial instruments deployed by governments at the **national level** to date have been quite effective in stimulating private investment in low-carbon energy projects, although most expressed caveats.

In India, nearly all participants agreed that feed-in tariffs for renewable-sourced energy have been important, although one participant questioned whether limited public subsidies are being deployed appropriately (see 4.3 below). Participants in China had a positive view of requirements on banks to phase out loans to high-emissions sectors, although most suggested that finance for low-carbon energy would remain relatively limited in the absence of a price on carbon. Participants in the United States felt that the soon-to-expire cash grants for clean energy projects have been 'hugely important' (and therefore should be extended) and that export credit agency assistance has been valuable in supporting US firms in international clean energy markets.

Elsewhere, participants pointed to a limited and hence inadequate number of domestic financing instruments to stimulate investment in clean energy technologies (Nigeria and South Africa). In South Africa, it was felt that Eskom does not have the resources to finance the envisaged expansion of domestic power supply and thus requires either an inflow of Treasury funds or adjustments in the tariff structure to allow for adequate capitalization.

At the **international level**, participants pointed to grants and loans administered by multilateral institutions (World Bank and Global Environment Facility) and regional development agencies, and through bilateral aid agreements. Participants in several countries (Australia, India) considered those that resulted in net resource transfer to have been quite effective in supporting the deployment of low-carbon technologies, particularly in rural areas (India) and high-risk countries (Australia).

However, several participants pointed out that the overall effectiveness of such funds is restricted by their low total volume compared to the financial needs of their respective countries, as well as by the extent to which they meet (or fail to meet) the incremental costs of a given project (India, China). Similarly in South Africa, most participants felt that although international instruments could assist in the initial development of low-carbon projects, they were insufficient to ensure the long-term sustainability of the local renewable energy industry and might even harm domestic competition.[53] Participants in Nigeria suggested that awareness of international climate funds is very weak among Nigerian business leaders.

At the same time, several participants believed that reforms to international institutions are necessary, including the need for harmonized procedures and guidelines, and better coordination and accountability frameworks (Australia, South Africa). Interestingly, participating American financiers do not appear to look to the World Bank for low-carbon investment opportunities – instead, there is a general impression that better returns can be made elsewhere, for example via the US Export-Import bank and traditional banks.

53 Several of those interviewed in South Africa felt that international instruments might impact in a negative way on the market and could distort competition between private developers, depending on whether they had access to international funds or not.

Opinions regarding the usefulness of the **Clean Development Mechanism** (CDM) in generating private capital were varied but generally less positive. Participants in India felt that the CDM has created awareness of the financial potential of alternative energy projects, yet been ineffective in terms of facilitating technology transfer and in its impact on total emissions. Similarly, participants in South Africa did not consider the CDM as 'a financial mechanism per se' – and were hence sceptical – while in Nigeria only three low-carbon energy projects have managed to secure CDM funding. One interviewee in Australia suggested that carbon markets have been important in helping transfer technological know-how, but have not led to additional capital transfers, above those provided through the offset.

The role of public sector finance

The majority of participants in most countries were of the opinion that public funds should be spent where commercial investors are not initially expected to come forward and that such funds were best utilised **to make low-carbon technologies commercially viable** (India, China, Australia). It was widely envisaged that public funds should be utilised strategically at different stages of the technology development and diffusion process in order to leverage and 'crowd in' private investment in low-carbon energy sectors (India, South Africa, United States, China, Australia).

Many participants suggested that public money should be used **to support research, development and demonstration** (RD&D) so as to bring down the cost of new technologies (India, Australia, United States, China) and enable the development of domestic technological capabilities (India, South Africa). While not excluding private investment, it was recognised by participants that the private sector is often less inclined to invest at the earlier stages in the technological cycle and that public funds have a key role to play in covering risk, for example through public–private partnerships and public equity in RD&D (China, Australia).

The use of public money **to support and facilitate deployment and market breakthrough** was also favoured by several participants (South Africa, China, India, Nigeria, Australia). Several participants in Australia suggested that limited government funds could be used to provide concessional loans to start-up firms and support the feasibility studies and business case development necessary to attract private investors. In India, participants suggested that public money should also be used to promote those technologies which are commercially viable but as-yet inadequately diffused, due to institutional, infrastructural and capacity- and demand-related barriers.

Elsewhere, several participants suggested a role for government funds **to spear-head investment in low-carbon energy infrastructure**, whether physical – as in the case of distribution and transmission networks (China, Nigeria, India, South Africa) – or human, as in skills development and jobs training (South Africa). Participants in China recommended that government funds be used to mitigate negative economic and societal impacts resulting from a change in the development pathway from high- to low-carbon, for example by establishing a new social security safety-net to support at-risk employees in high-carbon firms.

While participants in all countries specified a number of areas where public funds should be spent, **views differed as to the appropriate source for public financing**. In India, some supported levies on coal power plants to help cover the cost of generation-based incentives (GBI) under the National Solar Mission, yet others felt this to be an 'ill-advised' subsidy. Since solar energy is not yet commercially viable in India and has a very high import requirement and consequent cost, several suggested that the cost of a solar GBI was an 'incremental cost' and therefore should be undertaken only if it is paid for by the developed countries as per their obligations under the UNFCCC. None of the participants in India particularly opposed the idea of developed countries paying for the cost of GBI.

In Australia, it was noted that increasing budget allocations in developed countries for climate finance will be very tricky given the debt situation, but one interviewee suggested that **current fast-start commitments should be locked in** as a baseline figure for future transfers of public funds to developing countries.

Proposed debt- and equity-based mechanisms for leveraging private investment

In GCN member countries, the proposed tools (see Table 1.1) were met with positive responses on the whole and, taken together, were deemed likely to be useful in addressing the different types of real or perceived risks preventing private investment in low-carbon energy technologies.

Loan guarantees were considered to be the most important mechanism by participants in nearly all countries, being well-known to financiers and relatively straightforward to implement (United States, South Africa) and an effective means of mitigating risk (China, South Africa, United States, Nigeria, Australia). Such guarantees are already being used by the International Finance Corporation as a means of generating confidence among commercial lenders to support renewable energy and energy efficiency projects in Sri Lanka (India).

In countries where renewable energy and energy efficiency policies are driven by significant subsidy support, many participants felt that a **policy insurance** tool could be very useful to guarantee the availability of promised subsidies over the lifetime of a project (India) but noted that a greater understanding of how it would work in practice would be needed (South Africa). Elsewhere, where government policies are often not implemented or where the regulatory environment is shifting, participants felt that policy insurance could provide some comfort for investors, especially international financiers (Nigeria). However, others expressed reservations as to whether such a tool could reasonably insure against the consequences of any particular change in policy, given that multiple policies interact within the clean energy sector (United States).

Establishing a **low-carbon fund with subordinated equity** at the international level was viewed favourably in several countries (India, China), particularly as a means of supporting the development of the domestic financial market in clean energy (China). Participants in the United States suggested that such a tool could be a cost-effective way of raising equity funding but noted that the terms and conditions would be very important to investors.

From the point of view of reassuring international creditors that developers are able to pay back loans for low-carbon energy projects, several participants (United States, Nigeria) considered a **foreign exchange liquidity facility** to be critical, especially in countries where currency rates are prone to high levels of fluctuation. What is more, it was felt to be a proven and straightforward instrument (United States). Others acknowledged that the importance of such a tool would depend on the volume of projects involving international credit arrangements (India, China), but elsewhere participants suggested that such projects typically involved a one-off debt payment by developers and therefore such a facility may not be necessary (South Africa).

In most countries, **pledge funds** were considered the least relevant of the five proposals (South Africa, United States, Nigeria), although several participants in China suggested such instruments could have a role in the future as the domestic finance market for clean energy expands.[54] In the United States, investors are attracted to large deals, and a pledge fund would mostly bring in smaller projects. As a potential alternative, it was suggested that an international climate fund could act as a cornerstone for the securitization of smaller projects into bigger assets which banks could then buy (United States).

Among established mechanisms, **credit lines from multilateral banks** received a mixed response. The principle was welcomed in several countries, although some participants felt that the contractual terms of multilateral banks were often unfavourable and very burdensome for project developers and independent power producers (South Africa). Elsewhere, credit lines were not thought to be particularly useful (China). Operating costs, which appear to be the biggest reason to draw on a credit line, are not as important in clean energy projects as in many other project finance structures (United States).

Similarly, many felt that the potential of **carbon funds** to scale-up renewable energy projects was limited (South Africa, United States) and that the process for allocating such funds was not always transparent or objectively based on a project's merits (South Africa). However, others noted that there was some potential in linking international carbon funds into future domestic carbon-trading schemes (China).

Ultimately, it was argued that while the proposed tools would help with access to capital, most are unlikely to address the incremental costs of low-carbon technologies (India). As such, it was felt that their ability to leverage significant private capital into clean energy in the near future could be expected to be limited to commercial or near-commercial technologies.

Required policy changes

Participants in each GCN member country recommended a number of key policy changes, both at the national and international level, that were deemed necessary to stimulate private sector investment in low-carbon energy technologies, industries and projects.

54 Although participants in China suggested that much would depend on the terms and conditions governing pledge funds and the level of guaranteed return on investment.

In **India**, participants felt that, first and foremost, greater public expenditure on RD&D and greater transfer of technological resources are needed to reduce the costs of new and emerging technologies as well as to scale-up markets in high-priority clean energy sectors. Cultivating greater market diffusion of renewable energy technologies will also depend on a sufficiently developed credit market alongside appropriate financial instruments and support for developers to draw up business models suited to local needs and conditions.

Participants in **China** agreed that greater levels of private sector investment could be spurred if the right market signals for renewables were established and, to this end, they supported calls for the government to establish a carbon price and domestic trading exchange. They also advocated the establishment of a new domestic public equity fund, similar to the proposed subordinated equity fund, to share risk associated with low-carbon projects in targeted sectors.

In the **United States**, participants suggested that extension of the existing cash grant programme for clean energy projects and the introduction of a renewable energy standard are key priorities that could revive the industry and send a clear signal to private investors. Establishing a price on carbon was viewed as being of secondary importance, since in the current circumstances – and notwithstanding the unlikelihood of the Senate agreeing to necessary legislation any time soon – it would was likely to be high enough only to encourage fuel switching from coal to natural gas.

Participants in **South Africa** called for clear, legislative targets and standards for renewable energy and energy efficiency as part of an integrated energy and electricity policy framework. Several suggested that significant private capital could only flow if reforms to the power sector were achieved, including unbundling of the energy and electricity sectors and consequent introduction of greater competition to the market.[55] The implementation of REFIT and signed power purchase agreements were considered as the critical first steps towards persuading national and international banks to finance renewable energy projects in South Africa.

In **Nigeria**, participants suggested that, in order to stimulate demand for lower-carbon energy technologies, greater government efforts were needed to implement existing policies and regulation. It was felt that stronger tariff incentives for natural gas and small hydro-derived energy would help channel greater investment and

55 Participants in South Africa agreed that Eskom should not be the single buyer, owner of the national grid *and* most important generator of electricity.

encourage financial institutions to build capacities to service these sectors. New policies aimed at leveraging finance for infrastructure development – via public–private partnerships – were also recommended.

In terms of policy developments at the international level, several participants stressed that, contrary to popular opinion, there is no shortage of capital globally but that the challenge is to draw this capital to low-carbon investments (Australia). To this end, many participants supported enhanced international cooperation through various multilateral and bilateral agreements on finance and technological cooperation (India).

Others suggested that, rather than seeking simply to raise large sums to pay for the transition to low-carbon technologies, the international community should be focusing its attention on improving the risk–return ratio for private capital and that any new financing mechanisms should aim to improve the commercial settings for private sector players (Australia).

Conclusions and recommendations

Without clean energy investment, it is hard to envisage the shift to low-carbon economies ever moving from rhetoric to reality. This study looks in detail at specific technologies and their capital costs in four developing countries, and finds that 2009 levels of investment must, on average, double between 2010 and 2020 if the clean energy ambitions of the governments of those countries are to be met.

From country to country, the investment challenge varies significantly in magnitude. In China, to where the bulk of developing country clean energy investment currently flows, the gap is smaller in percentage terms (although larger in absolute terms) than in other countries, where exponential increases are required. While this suggests that different approaches will be needed in different countries – as it indicates the level of risk that investors believe they face in each market – it should also be noted that China has injected large sums of public investment into clean energy through its own stimulus initiative. It should also be stated that China has indicated it would not look to receive monies from an international climate fund.

From where will clean energy investment come? If the balance of risk and return is acceptable, then the private sector will invest – indeed, participants in the national dialogues held by GCN members suggested there is no lack of enthusiasm or available capital for clean energy. However, the unequivocal finding of this study is that government intervention will be needed to ensure the private sector's perception of risk does not exceed its expectation of return. In effect, clean energy investment requires a public–private partnership, with government using policy measures and relatively small sums of public money to help reduce the perception of risk, and consequently actual risk, among private sector investors.

GCN research, along with supporting literature, suggests there are three key elements to this kind of partnership.

1. Using developed country public funds strategically: Governments should allocate a proportion of the proposed $100 billion fund to foster an investment partnership with the private sector. This is important because the transition to a clean energy economy is a key means of achieving climate protection and a developed country government-backed or guaranteed partnership with private investors will help lower costs in two ways.

- **Lowering the cost of capital will bring down incremental costs**
  Developed country government-sourced subsidies and guarantees to help private investors finance clean energy in developing countries will reduce the costs of borrowing: cheaper money in most clean energy sectors means lower incremental costs generally.

- **Deployment on a large scale will drive down technology costs**
  A public–private partnership for clean energy investment should lead to a rapid increase in the pace and scale of deployment, which would lead to technological, technical and business innovation – learning by doing – and so bring down the currently high relative unit costs of clean energy.

Developed countries have an obligation under the UNFCCC to support climate mitigation and adaptation in developing countries. But through a public–private clean energy investment partnership, climate protection could be made cheaper and be accelerated, thereby enhancing the global public good and benefitting developed countries domestically, as well as fulfilling international obligations. Indeed, even though China has stated its intention not to be a recipient of international climate funds, the costs of investment in China could still be reduced through the use of some of the mechanisms highlighted above.

The literature on capital costs suggests that at least an additional $265 billion needs to be found by 2030 for climate mitigation. As this study illustrates, every $1 of public funds invested through the proposed mechanisms (see Table 1.1) could attract between $2 and $10 of private sector finance. As costs and risks associated with clean energy investment are reduced, these ratios may improve, with less public money required to leverage more private finance.

GCN's national dialogues with business leaders, financiers and policymakers support this view, with participants arguing in most cases that the role of government funds was to help 'crowd in' private investment in clean energy. Our five proposed mechanisms received a warm reception from participants who, in general, felt that loan guarantees would be the simplest to implement and of the greatest value.

There are other, non-financial roles for governments to play in this first element of the partnership. For instance, participants identified the pledge fund proposal or a more comprehensive cornerstone fund model as important in providing investors with greater confidence in unfamiliar markets. Also, many identified a lack of technical capacity among investors, who are yet to develop a thorough understanding and reliable analysis of clean energy technologies – this may increase the perception of risk, and governments have a role in filling this information gap.

2. Ensuring stable long-term policy is in place in developing countries: A second key element in a public–private clean energy investment partnership is the use of deployment mechanisms and other public policy tools in developing countries to create the environment for private sector investment.

GCN's national dialogues drew out some important observations on barriers to clean energy investment. The most significant of these is that clean energy technologies are not yet commercially competitive and so require clear, stable policy frameworks that can support deployment by boosting returns and reducing risk. The sorts of policies mentioned ranged from energy market reforms in general and tariff reforms in particular to provide incentives for clean energy technologies to the establishment of carbon pricing mechanisms.

The value of developed country government incentives for clean energy investment in developing countries will only be realized if those countries put in place long-term deployment policies. As this study and the supporting literature shows, the task of forming policies has already begun in some of the key developing countries, such as China, India and South Africa. In other countries, where policies exist but have not yet been implemented, such as Nigeria, greater political will is needed.

The promise of investment supported by developed country government actions should help provide incentives for governments to take deployment policies seriously.

3. Addressing incremental costs: Finally, it is GCN's view that there is a critical role for public–private clean energy investment partnerships in dealing with incremental costs. This study has primarily examined capital costs and investment barriers. As those challenges are met, however, the resulting deployment of clean energy will in most cases lead to a per-unit energy cost that is higher than that offered by incumbent sources.[56]

56 There are notable exceptions to this, for instance in countries such as Nigeria where there is a very high reliance on diesel generators to supply electricity to households and businesses. Clean or cleaner alternatives, such as those examined in this study, may well deliver electricity at a lower per-unit cost.

As noted earlier (see page 8), clean energy pricing mechanisms in developed countries impose costs on energy companies who then pass these costs on to consumers. In developing countries, the willingness and ability of consumers to pay the incremental costs is lower. So, at the same time as supporting governments to reduce incremental costs as rapidly as possible by assisting with access to cheap capital and driving innovation, GCN proposes that a proportion of the $100 billion fund should be used to provide assistance with incremental costs.

This could be done by forming agreements around specific policy mechanisms in developing countries, as is envisaged in the Nationally Appropriate Mitigation Actions (NAMA) process under the UNFCCC, or through new or existing bilateral agreements.[57]

Because incremental cost is an issue that underlies and undermines the political sustainability of climate change policy in all countries, it is important that governments adopt a pragmatic approach; one which stresses the inter-related benefits of clean energy investment, such as tackling energy poverty, improving health through better air quality, and meeting national economic and energy security objectives.

57 In Fast Start Finance, there is evidence that this is already a burgeoning area (Project Catalyst 2010).

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About the Global Climate Network

The Global Climate Network is a collaboration of independent, influential and progressive research and policy organisations in countries key to tackling climate change. Together, members of the Network are committed to addressing the constraints faced by sovereign governments in agreeing international action.

The Network aims to help governments clear a pathway towards an effective and fair international agreement for avoiding dangerous climate change by proposing bold low-carbon policies and using data and analysis to persuade policymakers that climate change mitigation is in their interest.

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